AGENDA
SHAWNEE MUNICIPAL AUTHORITY
May 17, 2021 AT 6:00 P.M.
COMMISSION CHAMBERS AT CITY HALL
16 WEST 9TH STREET
SHAWNEE, OKLAHOMA

CALL TO ORDER

DECLARATION OF A QUORUM

1. Consider approval of Consent Agenda:

   a. Minutes from the May 3, 2021 regular meeting.

2. Consider and take action with respect to a resolution of the Shawnee Municipal Authority (the "Authority") approving and authorizing a Drinking Water SRF Loan from the Oklahoma Water Resources Board in the total aggregate principal amount of not to exceed $20,625,000; approving the issuance of a promissory note in the total aggregate principal amount of not to exceed $20,625,000, secured by a pledge of revenues and authorizing its execution; approving and authorizing the execution of a loan agreement for Drinking Water SRF Loan; designating a local trustee and approving and authorizing the execution of a trust agreement; approving and authorizing the execution of a security agreement; ratifying and confirming a lease agreement and operation and maintenance contract, as amended; approving various covenants; approving and authorizing payment of fees and expenses; and containing other provisions relating thereto.

3. Consider and take action with respect to a resolution of the Shawnee Municipal Authority (the "Authority") replacing and superseding Resolution No. SMA 2020-04 dated December 7, 2020 and approving and authorizing a Clean Water SRF Loan from the Oklahoma Water Resources Board in the total aggregate principal amount of $13,500,000; approving the issuance of a promissory note in the total aggregate principal amount of $13,500,000, secured by a pledge of revenues and authorizing its execution; approving and authorizing the execution of a loan agreement for Clean Water SRF Loan; designating a local trustee and approving and authorizing the execution of a trust agreement; approving and authorizing the execution of a security agreement; ratifying and confirming a lease agreement and operation and maintenance contract, as amended; approving various covenants; approving and authorizing payment of fees and expenses; and containing other provisions relating thereto.

4. Consider Bids:

   a. Water System Improvements DWSRF Project No. P40-1020504-03 (Award)

5. New Business

(Any matter not known or which could not have been reasonably foreseen prior to the posting of the agenda)

6. Adjournment

Respectfully submitted,

Lisa Lasyone, CMC, City Clerk

Shawnee Municipal Authority **1. a.**

Meeting Date: 05/17/2021

Minutes

Submitted By: Kacie Eck, City Clerk

Department: City Clerk

Information

Title of Item for Agenda

Minutes from the May 3, 2021 regular meeting.

Fiscal Impact

Attachments

Minutes

THE TRUSTEES OF THE SHAWNEE MUNICIPAL AUTHORITY OF THE CITY OF SHAWNEE, COUNTY OF POTTAWATOMIE, STATE OF OKLAHOMA, MET IN REGULAR SCHEDULED SESSION, MONDAY, MAY 3, 2021, DURING THE BOARD OF CITY COMMISSIONER MEETING AT 6:00 P.M., PURSUANT TO NOTICE DULY POSTED AS PRESCRIBED BY LAW AT 2:33 P.M. ON APRIL 30, 2021. UPON ROLL CALL, A QUORUM WAS DECLARED WITH THE FOLLOWING MEMBERS IN ATTENDANCE:

PRESENT: Flood, Bolt, Rutherford, Sehorn, Salter
ABSENT: Matthews, Weaver

Call to Order
Declaration of a Quorum

AGENDA ITEM NO. 1: Consider approval of Consent Agenda:

a. Minutes from the April 19, 2021 regular meeting.

A motion was made by Trustee Rutherford, seconded by Trustee Flood, to approve Consent Agenda Item No. 1(a). Motion 5-0.

AYE: Rutherford, Flood, Bolt, Sehorn, Salter
NAY: None

AGENDA ITEM NO. 2: Consideration of a Clean Water State Revolving Fund (CWSRF) resolution.

Public Works Director Brad Schmidt explained the proposed resolution was a requirement for the Clean Water State Revolving Fund to move the Wastewater Improvement Project forward.

Resolution No. SMA-2021-2 was introduced.

THE SHAWNEE MUNICIPAL AUTHORITY, ACTING THROUGH THE CITY OF SHAWNEE, HEREBY ADOPTS THE PLANNING AND ENVIRONMENTAL INFORMATION DOCUMENT FOR THE PROPOSED WASTEWATER IMPROVEMENTS. SAID DOCUMENT IS DATED JANUARY 22ND, 2021 AND WAS PREPARED BY WALL ENGINEERING, CONSULTING ENGINEERS.

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A motion was made by Trustee Rutherford, seconded by Trustee Sehorn, to approve a Clean Water State Revolving Fund (CWSRF) resolution. Motion carried 5-0.

AYE: Rutherford, Sehorn, Salter, Flood, Bolt
NAY: None

AGENDA ITEM NO. 3: Consider Bids:

a. Water System Improvements DWSRF Project No. P40-1020504-03 (Open)

BIDDER	**AMOUNT**
BRB Contractors, Inc. Topeka, Kansas	$15,907,000.00
Downey Contracting, LLC Oklahoma City, Oklahoma	$14,594,000.00
Walters-Morgan Construction, Inc. Manhattan, Kansas	$15,387,000.00
Archer Western Construction, LLC Irving, Texas	$17,583,000.00
Wynn Construction Co., Inc. Oklahoma City, Oklahoma	$15,907,000.00

Public Works Director Brad Schmidt read five (5) bids into the record. Mr. Schmidt requested the bid award be deferred to a future City Commission meeting.

A motion was made by Trustee Rutherford, seconded by Trustee Flood, to defer the bid award to a future City Commission meeting. Motion carried 5-0.

AYE: Rutherford, Flood, Bolt, Sehorn, Salter
NAY: None

DRAFT

AGENDA ITEM NO. 4: New Business (Any matter not known, or which could not have been reasonably foreseen prior to the posting of the agenda)

There was no New Business.

AGENDA ITEM NO. 5: Adjournment

There being no further business to be considered, the meeting was adjourned by power of the Chair. (7:11 p.m.)

_____
ED BOLT, CHAIRMAN

ATTEST:

_____
LISA LASYONE, SECRETARY

DRAFT

Shawnee Municipal Authority **2.**

Meeting Date: 05/17/2021

Resolution

Submitted By: Kacie Eck, City Clerk

Department: City Clerk

Information

Title of Item for Agenda

Consider and take action with respect to a resolution of the Shawnee Municipal Authority (the “Authority”) approving and authorizing a Drinking Water SRF Loan from the Oklahoma Water Resources Board in the total aggregate principal amount of not to exceed $20,625,000; approving the issuance of a promissory note in the total aggregate principal amount of not to exceed $20,625,000, secured by a pledge of revenues and authorizing its execution; approving and authorizing the execution of a loan agreement for Drinking Water SRF Loan; designating a local trustee and approving and authorizing the execution of a trust agreement; approving and authorizing the execution of a security agreement; ratifying and confirming a lease agreement and operation and maintenance contract, as amended; approving various covenants; approving and authorizing payment of fees and expenses; and containing other provisions relating thereto.

Fiscal Impact

Attachments

Resolution

THE BOARD OF TRUSTEES OF THE SHAWNEE MUNICIPAL AUTHORITY, SHAWNEE, OKLAHOMA, MET IN REGULAR SESSION IN THE CITY COMMISSION CHAMBERS AT CITY HALL IN SHAWNEE, OKLAHOMA, ON THE 17TH DAY OF MAY, 2021, AT 6:00 O'CLOCK P. M.

PRESENT:

ABSENT:

Thereupon, the Chairman introduced a Resolution which was read by the City Attorney. Trustee _____, moved that the Resolution be adopted and Trustee _____, seconded the motion. The motion carrying with it the adoption of the Resolution prevailed by the following vote:

AYE:

NAY:

The Resolution as adopted is as follows:

RESOLUTION NO. SMA 2021-___

A RESOLUTION OF THE SHAWNEE MUNICIPAL AUTHORITY (THE "AUTHORITY") APPROVING AND AUTHORIZING A DRINKING WATER SRF LOAN FROM THE OKLAHOMA WATER RESOURCES BOARD IN THE TOTAL AGGREGATE PRINCIPAL AMOUNT OF NOT TO EXCEED $20,625,000; APPROVING THE ISSUANCE OF A PROMISSORY NOTE IN THE TOTAL AGGREGATE PRINCIPAL AMOUNT OF NOT TO EXCEED $20,625,000, SECURED BY A PLEDGE OF REVENUES AND AUTHORIZING ITS EXECUTION; APPROVING AND AUTHORIZING THE EXECUTION OF A LOAN AGREEMENT FOR DRINKING WATER SRF LOAN; DESIGNATING A LOCAL TRUSTEE AND APPROVING AND AUTHORIZING THE EXECUTION OF A TRUST AGREEMENT; APPROVING AND AUTHORIZING THE EXECUTION OF A SECURITY AGREEMENT; RATIFYING AND CONFIRMING A LEASE AGREEMENT AND OPERATION AND MAINTENANCE CONTRACT, AS AMENDED; APPROVING VARIOUS COVENANTS; APPROVING AND AUTHORIZING PAYMENT OF FEES AND EXPENSES; AND CONTAINING OTHER PROVISIONS RELATING THERETO.

WHEREAS, the Shawnee Municipal Authority, Pottawatomie County, Oklahoma (the "Borrower"), was organized under Title 60, Oklahoma Statutes 2011, Sections 176-180.4, as amended, for the purpose of furthering the public functions of the City of Shawnee, Oklahoma (the "City"); and

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WHEREAS, the Borrower is authorized and has determined to construct improvements to the Borrower's water treatment systems (the "Project") in order to better serve the customers of said Borrower and in payment of part of the cost thereof, to seek money in the form of a Drinking Water SRF Loan from the Oklahoma Water Resources Board (the "Board") in the amount of $_____; and

WHEREAS, the Board has under consideration a loan application of the Borrower and the Borrower has determined to borrow money from the Board to accomplish the Project and to evidence such loan by the issuance of the Borrower's Series 2021 Drinking Water SRF Promissory Note to Oklahoma Water Resources Board in the original principal amount of $_____ (the "Note"), said Note being secured by a pledge of revenue derived from Borrower's water and sanitary sewer systems (hereinafter collectively, the "System") provided, said pledge and lien shall be on a parity in all respects with the Borrower's (i) Series 2010A Drinking Water SRF Promissory Note to Oklahoma Water Resources Board dated October 14, 2010, issued in the original principal amount of $1,485,000; (ii) Series 2013 Promissory Note to Oklahoma Water Resources Board dated April 24, 2013, issued in the original principal amount of $12,070,000; (iii) Utility System Revenue Note, Series 2016 dated June 8, 2016, issued in the original principal amount of $5,410,000; (iv) Series 2019 Clean Water SRF Promissory Note to Oklahoma Water Resources Board dated May 28, 2019, issued in the original principal amount of $5,380,000; and (v) Series 2019A Clean Water SRF Promissory Note to Oklahoma Water Resources Board dated September 19, 2019, issued in the original principal amount of $37,920,000 (collectively, the "Existing Indebtedness"); and

WHEREAS, it is the desire of the Borrower to authorize the execution and delivery of any and all documents necessary or attendant to the issuance of the Note.

NOW, THEREFORE, BE IT RESOLVED BY THE TRUSTEES OF THE SHAWNEE MUNICIPAL AUTHORITY, POTTAWATOMIE COUNTY, OKLAHOMA:

Section 1. Issuance of Note. The Borrower is hereby authorized to accept said loan and issue its Note payable to the Board and secured by a pledge of revenue derived from the operation of the System. The officers of the Borrower are hereby authorized and directed to execute said Note and to do any and all lawful things to effect said loan and secure said loan from the Board, provided that the principal amount of the Note shall be $_____, and the rate of interest on the Note shall be a fixed rate of interest of _____ percent (____%) per annum inclusive of administrative fees of one half of one percent (1/2%).

Section 2. Execution of Loan Agreement for Drinking Water SRF Loan. The Loan Agreement for Drinking Water SRF Loan by and between the Borrower and the Board (the "Loan Agreement") is hereby approved and the Chairman or Vice Chairman and Secretary or Assistant Secretary of the Borrower are hereby authorized to execute same for and on behalf of the Borrower, and to do all other lawful things to carry out the terms and conditions of said Loan Agreement.

Section 3. Designation of Local Trustee and Execution of Trust Agreement. The Borrower hereby designates BancFirst, Oklahoma City, Oklahoma, to serve as local trustee (the "Local Trustee") of certain funds in relation to the Note. The Trust Agreement by and between the Borrower and the Local Trustee, pertaining to the Note (the "Trust Agreement") is hereby approved and the Chairman or Vice Chairman and Secretary or Assistant Secretary are hereby authorized to execute same for and on behalf of the Borrower, and to do all other lawful things to carry out the terms and conditions of said Trust Agreement.

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Section 4. Execution of Security Agreement. The Security Agreement by the Borrower in favor of the Board (the "Security Agreement"), whereby the Borrower gives a lien on the revenues of the System to the Board to secure payment of the Note is hereby approved and the Chairman or Vice Chairman and Secretary or Assistant Secretary are hereby authorized to execute same for and on behalf of the Borrower, and do all other lawful things to carry out the terms and conditions of said Security Agreement.

Section 5. Lease Agreement and Operation and Maintenance Contract. The Lease Agreement and Operation and Maintenance Contract dated as of January 12, 1971, as amended by an Amendment to Lease Agreement dated as of July 1, 1990, between the City and the Borrower (collectively, the "Lease Agreement"), whereby the City leased to the Borrower its presently existing and hereafter acquired water and sanitary sewer systems, is hereby ratified and confirmed and the term of said Lease Agreement shall extend until the Note is paid.

Section 6. Covenants of Borrower Until payment in full of the Note and performance of all obligations owing to the Board under the Loan Agreement and the instruments executed pursuant hereto, unless the Board shall otherwise consent in writing, the Borrower hereby represents its intent to abide by and carry out the covenants contained in the Loan Agreement, which covenants are incorporated herein in their entirety.

Section 7. Project Costs Disbursement Account; Fees and Expenses. The Borrower is authorized to establish an account or accounts as necessary to serve as the Project Costs Disbursement Account described in the Loan Agreement. Upon closing of the referenced loan, the officers of the Borrower are hereby authorized to disburse (from loan proceeds or other available funds of the Borrower) those fees and expenses set forth on Exhibit "A" hereto, together with such other fees and expenses as will be set forth on the Borrower's Closing Order to be executed in connection with the closing of the financing referenced herein.

Section 8. Necessary Action. The Chairman or Vice Chairman and Secretary or Assistant Secretary of the Borrower are hereby further authorized on behalf of the Borrower to accept, receive, execute, attest, seal and deliver the above mentioned documents and all additional documentation, certifications and instruments and to take such further actions as may be required in connection with the transactions contemplated hereby, and are further authorized to approve and make any changes to the documents approved by this Resolution, for and on behalf of the Borrower, the execution and delivery of such documents being conclusive as to the approval of any terms contained therein.

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ADOPTED AND APPROVED THIS 17TH DAY OF MAY, 2021.

SHAWNEE MUNICIPAL AUTHORITY

_____
Chairman

ATTEST:

_____
Secretary

(SEAL)

DRAFT

STATE OF OKLAHOMA)
)SS
COUNTY OF POTTAWATOMIE)

I, the undersigned, Secretary of the Shawnee Municipal Authority, Pottawatomie County, Oklahoma, an Oklahoma public trust, do hereby certify that the above and foregoing is a true, full and correct copy of an excerpt from the minutes of a meeting of the Board of Trustees of said public trust held on the date above stated, all as recorded in the official minutes of such meeting. I further certify that the "Open Meeting Law" was complied with for such meeting.

GIVEN UNDER MY HAND THIS 17TH DAY OF MAY, 2021.

(SEAL)

_____
Secretary

DRAFT

EXHIBIT "A"

Fees and Expenses Paid at Closing

The Public Finance Law Group PLLC	
Legal Fee and Reimbursement of Expenses	0.75% of the principal amount of the Note plus $2,500
BOK Financial Securities, Inc.	
Financial Advisory Fee and Expenses	0.75% of the principal amount of the Note plus $2,500
BancFirst	
Trustee Bank Acceptance Fee	$500.00

DRAFT

Shawnee Municipal Authority **3.**

Meeting Date: 05/17/2021

Resolution

Submitted By: Kacie Eck, City Clerk

Department: City Clerk

Information

Title of Item for Agenda

Consider and take action with respect to a resolution of the Shawnee Municipal Authority (the “Authority”) replacing and superseding Resolution No. SMA 2020-04 dated December 7, 2020 and approving and authorizing a Clean Water SRF Loan from the Oklahoma Water Resources Board in the total aggregate principal amount of $13,500,000; approving the issuance of a promissory note in the total aggregate principal amount of $13,500,000, secured by a pledge of revenues and authorizing its execution; approving and authorizing the execution of a loan agreement for Clean Water SRF Loan; designating a local trustee and approving and authorizing the execution of a trust agreement; approving and authorizing the execution of a security agreement; ratifying and confirming a lease agreement and operation and maintenance contract, as amended; approving various covenants; approving and authorizing payment of fees and expenses; and containing other provisions relating thereto.

Fiscal Impact

Attachments

Resolution

THE BOARD OF TRUSTEES OF THE SHAWNEE MUNICIPAL AUTHORITY, SHAWNEE, OKLAHOMA, MET IN REGULAR SESSION IN THE CITY COMMISSION CHAMBERS AT CITY HALL IN SHAWNEE, OKLAHOMA, ON THE 17TH DAY OF MAY, 2021, AT 6:00 O'CLOCK P. M.

PRESENT:

ABSENT:

Thereupon, the Chairman introduced a Resolution which was read by the City Attorney. Trustee _____, moved that the Resolution be adopted and Trustee _____, seconded the motion. The motion carrying with it the adoption of the Resolution prevailed by the following vote:

AYE:

NAY:

The Resolution as adopted is as follows:

RESOLUTION NO. SMA 2021-____

A RESOLUTION OF THE SHAWNEE MUNICIPAL AUTHORITY (THE "AUTHORITY") REPLACING AND SUPERSEDING RESOLUTION NO. SMA 2020-04 DATED DECEMBER 7, 2020 AND APPROVING AND AUTHORIZING A CLEAN WATER SRF LOAN FROM THE OKLAHOMA WATER RESOURCES BOARD IN THE TOTAL AGGREGATE PRINCIPAL AMOUNT OF $13,500,000; APPROVING THE ISSUANCE OF A PROMISSORY NOTE IN THE TOTAL AGGREGATE PRINCIPAL AMOUNT OF $13,500,000, SECURED BY A PLEDGE OF REVENUES AND AUTHORIZING ITS EXECUTION; APPROVING AND AUTHORIZING THE EXECUTION OF A LOAN AGREEMENT FOR CLEAN WATER SRF LOAN; DESIGNATING A LOCAL TRUSTEE AND APPROVING AND AUTHORIZING THE EXECUTION OF A TRUST AGREEMENT; APPROVING AND AUTHORIZING THE EXECUTION OF A SECURITY AGREEMENT; RATIFYING AND CONFIRMING A LEASE AGREEMENT AND OPERATION AND MAINTENANCE CONTRACT, AS AMENDED; APPROVING VARIOUS COVENANTS; APPROVING AND AUTHORIZING PAYMENT OF FEES AND EXPENSES; AND CONTAINING OTHER PROVISIONS RELATING THERETO.

WHEREAS, the Shawnee Municipal Authority, Pottawatomie County, Oklahoma (the "Borrower"), was organized under Title 60, Oklahoma Statutes 2011, Sections 176-180.4, as amended, for the purpose of furthering the public functions of the City of Shawnee, Oklahoma (the "City"); and

DRAFT

WHEREAS, the Borrower heretofore adopted Resolution No. SMA 2020-04 dated December 7, 2020 which is replaced and superseded by this Resolution; and

WHEREAS, the Borrower is authorized and has determined to (i) construct improvements to the Borrower's wastewater treatment systems and (ii) sponsor a non-point source wetlands project which will involve construction of a sedimentation basin to prevent sediment loading to Wes Watkins Reservoir and all related appurtenances (collectively, the "Project") in order to better serve the customers of said Borrower and in payment of part of the cost thereof, to seek money in the form of a Clean Water SRF Loan from the Oklahoma Water Resources Board (the "Board") in the amount of $13,500,000; and

WHEREAS, the Board has under consideration a loan application of the Borrower and the Borrower has determined to borrow money from the Board to accomplish the Project and to evidence such loan by the issuance of the Borrower's Series 2021 Clean Water SRF Promissory Note to Oklahoma Water Resources Board in the original principal amount of $13,500,000 (the "Note"), said Note being secured by a pledge of revenue derived from Borrower's water and sanitary sewer systems (hereinafter collectively, the "System") provided, said pledge and lien shall be on a parity in all respects with the Borrower's (i) Series 2010A Drinking Water SRF Promissory Note to Oklahoma Water Resources Board dated October 14, 2010, issued in the original principal amount of $1,485,000; (ii) Series 2013 Promissory Note to Oklahoma Water Resources Board dated April 24, 2013, issued in the original principal amount of $12,070,000; (iii) Utility System Revenue Note, Series 2016 dated June 8, 2016, issued in the original principal amount of $5,410,000; (iv) Series 2019 Clean Water SRF Promissory Note to Oklahoma Water Resources Board dated May 28, 2019, issued in the original principal amount of $5,380,000; (v) Series 2019A Clean Water SRF Promissory Note to Oklahoma Water Resources Board dated September 19, 2019, issued in the original principal amount of $37,920,000; and (vi) Series 2021 Drinking Water SRF Promissory Note to Oklahoma Water Resources Board approved by the Borrower on May 17, 2021 but not yet closed, to be issued in the original principal amount of $_____ (collectively, the "Existing Indebtedness"); and

WHEREAS, it is the desire of the Borrower to authorize the execution and delivery of any and all documents necessary or attendant to the issuance of the Note.

NOW, THEREFORE, BE IT RESOLVED BY THE TRUSTEES OF THE SHAWNEE MUNICIPAL AUTHORITY, POTTAWATOMIE COUNTY, OKLAHOMA:

Section 1. Issuance of Note. The Borrower is hereby authorized to accept said loan and issue its Note payable to the Board and secured by a pledge of revenue derived from the operation of the System. The officers of the Borrower are hereby authorized and directed to execute said Note and to do any and all lawful things to effect said loan and secure said loan from the Board, provided that the principal amount of the Note shall be $13,500,000, and the rate of interest on the Note shall be a fixed rate of interest of not to exceed one and sixty five hundredths of one percent (1.65%) per annum inclusive of administrative fees of one half of one percent (1/2%) with said rate to be determined pursuant to a Certificate of Determination to be executed by the Chairman or Vice Chairman of the Borrower.

Section 2. Execution of Loan Agreement for Clean Water SRF Loan. The Loan Agreement for Clean Water SRF Loan by and between the Borrower and the Board (the "Loan Agreement") is

hereby approved and the Chairman or Vice Chairman and Secretary or Assistant Secretary of the Borrower are hereby authorized to execute same for and on behalf of the Borrower, and to do all other lawful things to carry out the terms and conditions of said Loan Agreement.

Section 3. Designation of Local Trustee and Execution of Trust Agreement. The Borrower hereby designates BancFirst, Oklahoma City, Oklahoma, to serve as local trustee (the "Local Trustee") of certain funds in relation to the Note. The Trust Agreement by and between the Borrower and the Local Trustee, pertaining to the Note (the "Trust Agreement") is hereby approved and the Chairman or Vice Chairman and Secretary or Assistant Secretary are hereby authorized to execute same for and on behalf of the Borrower, and to do all other lawful things to carry out the terms and conditions of said Trust Agreement.

Section 4. Execution of Security Agreement. The Security Agreement by the Borrower in favor of the Board (the "Security Agreement"), whereby the Borrower gives a lien on the revenues of the System to the Board to secure payment of the Note is hereby approved and the Chairman or Vice Chairman and Secretary or Assistant Secretary are hereby authorized to execute same for and on behalf of the Borrower, and do all other lawful things to carry out the terms and conditions of said Security Agreement.

Section 5. Lease Agreement and Operation and Maintenance Contract. The Lease Agreement and Operation and Maintenance Contract dated as of January 12, 1971, as amended by an Amendment to Lease Agreement dated as of July 1, 1990, between the City and the Borrower (collectively, the "Lease Agreement"), whereby the City leased to the Borrower its presently existing and hereafter acquired water and sanitary sewer systems, is hereby ratified and confirmed and the term of said Lease Agreement shall extend until the Note is paid.

Section 6. Covenants of Borrower Until payment in full of the Note and performance of all obligations owing to the Board under the Loan Agreement and the instruments executed pursuant hereto, unless the Board shall otherwise consent in writing, the Borrower hereby represents its intent to abide by and carry out the covenants contained in the Loan Agreement, which covenants are incorporated herein in their entirety.

Section 7. Project Costs Disbursement Account; Fees and Expenses. The Borrower is authorized to establish an account or accounts as necessary to serve as the Project Costs Disbursement Account described in the Loan Agreement. Upon closing of the referenced loan, the officers of the Borrower are hereby authorized to disburse (from loan proceeds or other available funds of the Borrower) those fees and expenses set forth on Exhibit "A" hereto, together with such other fees and expenses as will be set forth on the Borrower's Closing Order to be executed in connection with the closing of the financing referenced herein.

Section 8. Necessary Action. The Chairman or Vice Chairman and Secretary or Assistant Secretary of the Borrower are hereby further authorized on behalf of the Borrower to accept, receive, execute, attest, seal and deliver the above mentioned documents and all additional documentation, certifications and instruments and to take such further actions as may be required in connection with the transactions contemplated hereby, and are further authorized to approve and make any changes to the documents approved by this Resolution, for and on behalf of the Borrower, the execution and delivery of such documents being conclusive as to the approval of any terms contained therein.

DRAFT

ADOPTED AND APPROVED THIS 17TH DAY OF MAY, 2021.

SHAWNEE MUNICIPAL AUTHORITY

_____
Chairman

ATTEST:

_____
Secretary

(SEAL)

DRAFT

STATE OF OKLAHOMA)
)SS
COUNTY OF POTTAWATOMIE)

I, the undersigned, Secretary of the Shawnee Municipal Authority, Pottawatomie County, Oklahoma, an Oklahoma public trust, do hereby certify that the above and foregoing is a true, full and correct copy of an excerpt from the minutes of a meeting of the Board of Trustees of said public trust held on the date above stated, all as recorded in the official minutes of such meeting. I further certify that the "Open Meeting Law" was complied with for such meeting.

GIVEN UNDER MY HAND THIS 17TH DAY OF MAY, 2021.

(SEAL)

_____
Secretary

DRAFT

EXHIBIT "A"

Fees and Expenses Paid at Closing

The Public Finance Law Group PLLC	
Legal Fee and Reimbursement of Expenses	0.75% of the principal amount of the Note plus $2,500
BOK Financial Securities, Inc.	
Financial Advisory Fee and Expenses	0.75% of the principal amount of the Note plus $2,500
BancFirst	
Trustee Bank Acceptance Fee	$500.00

DRAFT

Shawnee Municipal Authority **4. a.**

Meeting Date: 05/17/2021
Bid Award
Submitted By: Kacie Eck, City Clerk
Department: City Clerk

Information

Title of Item for Agenda
Water System Improvements DWSRF Project No. P40-1020504-03 (Award)

Fiscal Impact

Attachments

Memo
Bid Tabulation
Notice
Plan Holders List
Project Plans
Bid Specifications
Addendum No. 1
Addendum No. 2
Addendum No. 3

City of Shawnee
PUBLIC WORKS

MEMORANDUM

To: Honorable Mayor and City Commission
From: Brad Schmidt, Public Works Director
CC: Chance Allison, City Manager
Date: 5/10/2021
Re: Water Plant

Staff received bids for the water plant project at the May 3rd,2021 commission meeting. After an extensive review of the bids by staff and project engineers, staff recommends awarding the contract to Downey Contracting LLC, Oklahoma City, Oklahoma, in the amount of $14,594,000.00. This award is subject to successful closing of the Drinking Water State Revolving Fund loan.

BID TABULATION WATER SYSTEM IMPROVEMENTS WATER TREATMENT PLANT EXPANSION SHAWNEE MUNICIPAL AUTHORITY SHAWNEE, OKLAHOMA HUB PROJECT 19SHAWWTP May 3, 2021 4:00 P.M.			CONTRACTOR Downey Contracting, L.L.C. 3217 Northeast 63rd St. Oklahoma City, OK 73121		CONTRACTOR Walters-Morgan Construction, Inc. 2616 Tuttle Creek Blvd. Manhattan, KS 66502		CONTRACTOR BRB Contractors, Inc. 3805 NW 25th Street Topeka, KS 66618		CONTRACTOR Wynn Construction Co., Inc. 11901 N. Eastern Avenue Oklahoma City, OK 73131		CONTRACTOR Archer-Western Construction, LLC 1411 Greenway Drive Irving, TX 75038	
			TOTAL BID	**$14,594,000.00**	**TOTAL BID**	**$15,387,000.00**	**TOTAL BID**	**$15,907,000.00**	**TOTAL BID**	**$15,907,000.00**	**TOTAL BID**	**$17,583,000.00**
ITEM	DESCRIPTION	UNIT	UNIT PRICE	TOTAL BID	UNIT PRICE	TOTAL BID	UNIT PRICE	TOTAL BID	UNIT PRICE	TOTAL BID	UNIT PRICE	TOTAL BID
1	All work shown on the Plans and/or required by the Specifications.	LS	$14,374,000.00	$14,374,000.00	$15,127,000.00	$15,127,000.00	$15,654,000.00	$15,654,000.00	$15,607,000.00	$15,607,000.00	$17,319,000.00	$17,319,000.00
2	Undercut and backfill with aggregate base if needed	2000 CY	$50.00	$100,000.00	$70.00	$140,000.00	$66.50	$133,000.00	$90.00	$180,000.00	$72.00	$144,000.00
3	Changes in size of process lines due to unknown lines or structures.	ALLOWANCE	$120,000.00	$120,000.00	$120,000.00	$120,000.00	$120,000.00	$120,000.00	$120,000.00	$120,000.00	$120,000.00	$120,000.00

HOLLOWAY, UPDIKE AND BELLEN, INC.

ENGINEERS

818 East Side Boulevard
Post Office Box 1543
Muskogee, Oklahoma 74402
(918) 682-7811
(918) 682-4551 Fax

May 6, 2021

Chance Allison, City Manager
Shawnee Municipal Authority
PO Box 1448
Shawnee, OK 74802

Re: Water System Improvements
Water Treatment Plant Expansion

Dear Mr. Allison:

We have tabulated the bids received May 3, 2021 on the above referenced project. A copy of the tabulation is attached.

Downey Contracting, LLC, Oklahoma City, Oklahoma was the lowest bidder with a bid of $14,594,000.00.

To the best of our knowledge and based on our research, Downey Contracting, LLC is capable of performing the work and should be considered for award of the contract.

Sincerely,

HOLLOWAY, UPDIKE AND BELLEN, INC.

Jay Updike
Vice President

JU:mm 19SHAWWTP

Oklahoma Drinking Water State Revolving Fund
Advertisement for Bids
Notice to Bidders

Notice is hereby given that Shawnee Municipal Authority, hereinafter called the "Owner" will receive sealed bids at the City Clerk's office at the City of Shawnee located at 16 West 9th Street, Shawnee Oklahoma 74801, until 4:00 p.m. on the 3rd day of May, 2021. The bids will be opened by the staff after authorization of the City Commissioners/Shawnee Municipal Authority Trustees at their 6:00 p.m. meeting on May 3, 2021. The bids will be presented to the City Commissioners/Shawnee Municipal Authority Trustees at said meeting for consideration.

This project is in cooperation with the Oklahoma Department of Environmental Quality.

Water System Improvements
DWSRF Project No. P40-1020504-03

The project includes the following work:

Water Treatment Plant Expansion including process building with clarifiers and filters, demolition, sitework, site piping, electrical and instrumentation.

All bids received at said time shall be publicly opened and read aloud. All work shall be performed and all construction and material used and furnished shall be in accordance with the Plans and Specifications prepared by Holloway, Updike and Bellen, Inc., and on file at the Public Works Building located at 111 South Kickapoo, Shawnee, Oklahoma 74801.

The Notice to Bidders, Form of Bid, Form of Contract, Plans and Specifications, Forms of Bid Bond, Performance and Statutory Payment Bond, and other Contract Documents may be examined at the following:

1. Owner: Shawnee Municipal Authority
   111 South Kickapoo
   Shawnee, OK 74801

2. Engineer: Holloway, Updike and Bellen, Inc.
   818 Eastside Boulevard
   Muskogee, OK 74403

Plans and Specifications can be obtained online at http://www.hubengineers.com or at the Office of Holloway, Updike & Bellen Inc., 818 East Side Blvd, P.O. Box 1543, Muskogee, Oklahoma, 74402; (918) 682-7811. **Payment Options: Online Download $50.00 or ½ size Paper Set $100.00, *none*** of which are refundable. All checks shall be made payable to Holloway, Updike & Bellen. BIDDER must purchase plans and specifications from Holloway, Updike and Bellen, Inc. either directly for paper plans and specifications or through our website for download. BIDDER must be on plan holders list at Holloway, Updike and Bellen, Inc. in order to submit a bid.

Each bidder shall accompany his original bid, with a certified or Cashier's Check on a solvent bank located in Oklahoma or a Bidder's Bond, in the amount of five (5) percent of the amount bid, as a guarantee of his ability to perform the contract bid upon, and that he will enter into a written contract with the Owner to perform said work and/or furnish said materials in accordance with said plans and specifications and furnish the required bonds within ten (10) days after the acceptance of his bid.

The deposit will be retained by the Owner as, and for, liquidated damages in case the successful bidder fails to enter in said contract and furnish the required bonds provided for in the specifications within the time required. Deposit of the unsuccessful bidders will be returned upon the execution of the Contract and required bonds.

Each bidder shall accompany his bid with a DW- 412 Noncollusion Affidavit and a DW-413 Business Relationships Affidavit in writing displaying that the Bidder has not directly or indirectly entered into an agreement, express of implied, with any other bidder or the price or amount of such bid or any bids, the limiting of the bids or bidders, the paying to anyone any money for promotion expenses, the parceling or farming out to any bidder or bidders or other persons of any part of the contract or any part of the subject matter of the bid or of the profits thereof. Performance, Maintenance and Statutory Payment Bonds in the amount of 100% of the contract price with a Corporate Surety licensed in Oklahoma and approved by the Owner and Engineer, will be required for the faithful performance of the contract. A Maintenance Bond guaranteeing the repair of all damage due to improper materials or workmanship for a period of one (1) year, after the acceptance of the work by the Owner, will be required.

This project is to be financed by a loan from the Oklahoma Water Resources Board through the Department of Environmental Quality Drinking Water State Revolving Fund (DWSRF) and shall be referred to as DWSRF Project No. P40-1020504-03.

A. "Equal Opportunity in Employment: All qualified applicants will receive considerations for employment without regard to race, color, religion, sex, national origin, age or physical handicap. Bidders on this work will be required to comply with the President's Executive Order No. 11246, as amended. The requirements for bidders and contractors under this order are explained in the specifications."

B. "Each bidder must fully comply with the requirement, terms and conditions of the Department of Environmental Quality Small, Minority, Women's Businesses Requirements including affirmative steps to contract with small, minority and women's businesses during the performance of this contract. The bidder commits itself to the affirmative steps to contract with small, minority and women's businesses contained herein and all other requirements, terms and conditions of these bid conditions by submitting a properly signed bid. Requirements are contained in DEQ Guidance and Procedures, DW-700."

C. "All bidders must comply with the Anti-Kickback Act and the Contract Work Hours Standards Act."

D. "Davis Bacon Act wage rules shall apply. All laborers and mechanics employed by contractors and sub-contractors on projects funded directly by or assisted in whole or in part by and through the Federal Government shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of Chapter 31 of Title 40, United States Code. The Department of Labor provides all pertinent information related to compliance with labor standards, including prevailing wage rates and instructions for reporting. For more information please refer to http://www.wdol.gov/ and http://www.beta.SAM.gov."

E. American Iron and Steel provisions also apply to projects funded directly by or assisted in whole or in part by and through the Federal Government pursuant to the "Consolidated Appropriations Act, 2014". Sec. 436(a)(1) of the act states that "None of the funds made available by a State Water Pollution Control Revolving Fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C 1381 et seq.) or made available by a Drinking Water Treatment Revolving Loan Fund as authorized by Section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States."

A mandatory pre-bid conference will be held on this project at 2:00 p.m. on April 27, 2021 in the Commission Chambers at City Hall located at 16 West 9th Street, Shawnee, Oklahoma 74801.

The contract is to be awarded to the lowest responsive, responsible bidder. The Owner reserves the right to waive any informalities in the bidding and the right to reject any and all bids in accordance with the Oklahoma Competitive Bidding Act. Conditional bids shall not be accepted.

Brad Schmidt
Name

Utility Director
Title

March 31, 2021

Plan Holder Report as of 04/30/2021 10:17:02 AM CDT
Holloway, Updike & Bellen Inc
Shawnee Water Treatment Plant Expansion (eBidDoc #7709844)

Contact:	Jay Updike jupdike@hubengineers.com
Phone:	918-682-7811
E-mail:	mmetz@hubengineers.com
Bid Date:	05/03/2021 04:00 PM CDT

Help

Company	Contact	Designation	Bus. Types	Entry Date	Doc Type	Comments
Walters-Morgan Construction, Inc. 2616 Tuttle Creek Blvd. Manhattan, KS 66502	Nathan Galle Phone: 785-539-7513 Fax: 785-539-6521 Email: ngalle@waltersmorgan.com	Prime Bidder	SBE	03/25/2021	eBidDoc	
Dodge Data & Analytics Next Member Numbe 2860 S State Hwy 161 Ste. 160 #501 Grand Prairie, TX 75052	Adam Bouman Phone: 513.666.3354 Fax: 800-768-5594 Email: dodge.docs@construction.com	Plan Room	DBE	03/26/2021	eBidDoc	
Haynes Equipment Co. 117 NW 132nd St. Oklahoma City, OK 73114	Joe Mossauer Phone: 405-755-1357 Fax: 405-755-6493 Email: joemossauer@haynes-equipment.com	Supplier	SBE	03/26/2021	eBidDoc	
BRB Contractors Inc. 3805 NW 25th Street Topeka, KS 66618	Ken Johnson Phone: 785-290-1134 Fax: 785-235-8045 Email: ken.johnson@brbcontractors.com	Prime Bidder		03/26/2021	eBidDoc	
Crossland Heavy Contractors - Columbus 501 South East Ave Columbus, KS 66725	Kaylee Mann Phone: 620-429-1410 Fax: 620-429-2977 Email: kmann@heavycontractors.com	Prime Bidder		03/29/2021	eBidDoc	
Third Generation Electric 8620 S. 33rd West Avenue Tulsa, OK 74132	Daniel Stefanoff Phone: 918-446-6626 Fax: Email: tiffany@tgetulsa.com	Subcontractor		03/29/2021	eBidDoc	
Wynn Construction Co., Inc. 11901 N Eastern Avenue Oklahoma City, OK 73131	Madison Lankford Phone: 405-753-1120 Fax: 405-753-1159 Email: bid@wynnconstruction.com	Construction Manager	SBE	03/29/2021	eBidDoc	
ePlan 1400 Forum Blvd Ste 7B Suite 105 Columbia, MO 65203	Eplan Reporter Phone: 5734477130 Fax: 573-355-5404 Email: eplan@eplanbidding.com	Plan Room		03/29/2021	eBidDoc	
Bates Instrumentation, LLC PO BOX 371 Stigler, OK 74462	Kendrick Bates Phone: 918-441-7178 Fax: Email: office@batesinst.com	Unknown	SBE	03/29/2021	eBidDoc	
Libra Electric Company 4634 Enterprise Drive OKC, OK 73128	David Ware Phone: 405-949-9371 Fax: 405-949-9373 Email: sales@libraelectric.net	Prime Bidder	SBE	03/29/2021	eBidDoc	
Archer Western Construction - Texas Area 1411 Greenway Drive Irving, TX 75038	Rod Lunkwitz Phone: 972-457-8500 Fax: 972-457-8501 Email: rlunkwitz@walshgroup.com	Prime Bidder		03/30/2021	eBidDoc	
ConstructConnect 3825 Edwards Rd Cincinnati, OH 45209	Eric Mills Phone: 800-364-2059 Fax: 866-570-8187 Email: content@constructconnect.com	Plan Room		03/30/2021	eBidDoc	
Branco Enterprises, Inc. 12033 E. Hwy 86 Neosho, MO 64850	Estimating Phone: 417-451-5250 Fax: Email: estimating@branco.com	Prime Bidder		03/30/2021	eBidDoc	
velocity constructors inc 2107 West College Avenue Englewood,, CO 80110	Bob Rogstad Phone: 3039847800 Fax: 303-984-7802 Email: rrogstad@velocityci.com	Prime Bidder	SBE	03/30/2021	eBidDoc	
Downey Contracting, L.L.C. 3217 Northeast 63rd Stree Downey Contracting LLC Oklahoma City, OK 73121	Brandon Downey Phone: 4054785277 Fax: 405-478-5269 Email: dfuksa@downeycontracting.com	Unknown		03/31/2021	eBidDoc	
EFI-Solutions 1221 N. Elm St PO BOX 723 Centralia, IL 62801	Gina Foster Phone: 618-533-1351 Fax: 618-533-1459 Email: gfoster@efi-solutions.com	Supplier		03/31/2021	eBidDoc	
Ramsey Ward Electric Co. 114 4th Ave SW Ardmore, OK 73401	Rusty Gillispie Phone: 580-223-2221 Fax: 580-223-2302 Email: rustygillispie@ramseyward.com	Subcontractor		04/02/2021	eBidDoc	
Crossland Heavy Contractors - Tulsa 14149 E. Admiral Pl. Tulsa, OK 74116	Delissa Ford Phone: 918-438-2800 Fax: 918-438-2801 Email: dford@heavycontractors.com	Prime Bidder		04/21/2021	eBidDoc	
Holloway, Updike & Bellen Inc 818 East Side Blvd Muskogee, OK 74402	Tiffany Hilton Phone: 918-682-7811 Fax: Email: thilton@hubengineers.com	Project Solicitor		04/23/2021	eBidDoc	

Plans for

WATER SYSTEM IMPROVEMENTS
WATER TREATMENT PLANT EXPANSION

By The

SHAWNEE MUNICIPAL AUTHORITY
SHAWNEE, OKLAHOMA

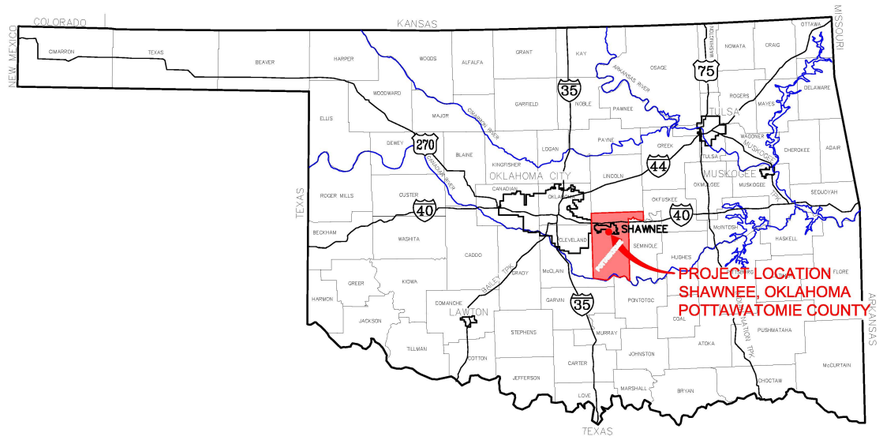
DWSRF PROJECT NO. P-40-1020504-03

Shawnee
MUNICIPAL AUTHORITY

ED BOLT _____ Chairman
DARREN RUTHERFORD _____ Vice Chairman

BOB WEAVER _____ Member
TRAVIS FLOOD _____ Member
DANIEL MATTHEWS _____ Member
MARK SEHORN _____ Member
BEN SALTER _____ Member

CHANCE ALLISON _____ Manager
BRAD SCHMIDT _____ Public Works Director
JACOB WICKWARE _____ Plant Supervisor



Project No. 19SHAWWTP
2021

HALF SIZE PLANS

REGISTERED PROFESSIONAL ENGINEER
JAY ROY UPDIKE
11252
OKLAHOMA

Jay Updike, P.E.
OK 11252

HOLLOWAY, UPDIKE AND BELLEN
Consulting Engineers
C.A. No 219 Expires 6/30/21

905-A South 9th Street
Broken Arrow, Oklahoma 74012
918.251.0717

818 East Side Boulevard
Muskogee, Oklahoma 74403
918.682.7811

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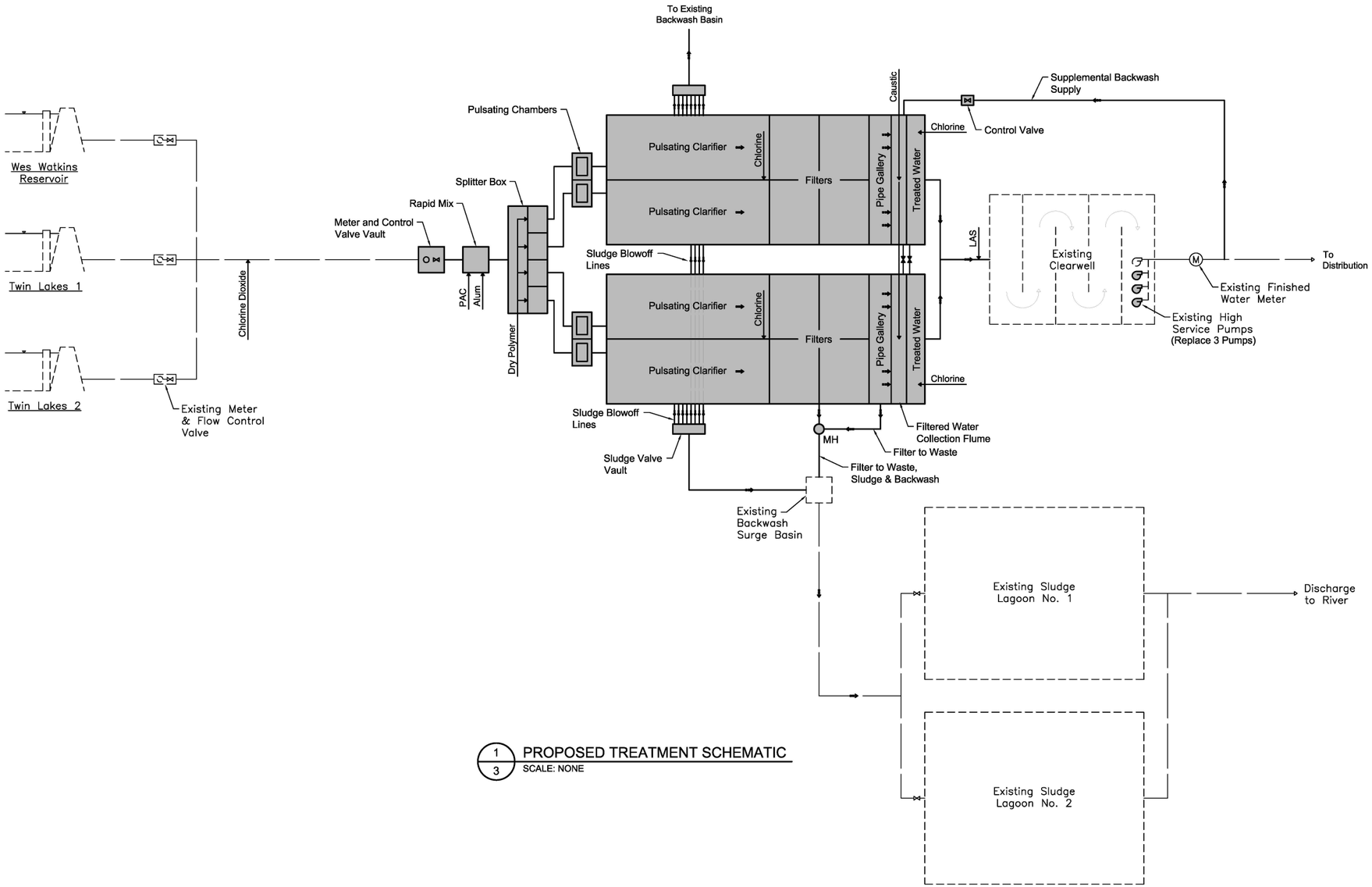
1/2 VICINITY MAP
SCALE: NONE

GENERAL NOTES

1. THE CONTRACTOR SHALL CALL "OKIE AT 1-800-522-6543" AND EACH UTILITY COMPANY PRIOR TO DIGGING TO DETERMINE THE LOCATION OF THEIR FACILITIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COST OF REPAIR OF UTILITIES DAMAGED BY THE CONSTRUCTION.
2. ALL BEDDING, BACKFILLING AND SPECIAL SURFACE CROSSINGS SHALL BE PERFORMED IN STRICT ACCORDANCE WITH THE DETAILS SHOWN ON THE PLANS.
3. THE ENGINEER WILL PROVIDE BENCHMARK AND HORIZONTAL CONTROL FOR THE PROJECT. CONTRACTOR SHALL BE RESPONSIBLE FOR CONSTRUCTION LAYOUT.
4. THE CONTRACTOR SHALL PREPARE A "STORM WATER PREVENTION PLAN" AND FURNISH EROSOIN CONTROL MEASURES PER THE SPECIFICATIONS. COST SHALL BE INCLUDED IN COST OF OTHER BID ITEMS.
5. ANY DAMAGE TO THE ROADWAY PAVEMENT, DRIVEWAYS, SIDEWALKS, YARDS OR FIELDS CAUSED BY THE CONTRACTORS OPERATION SHALL BE REPAIRED TO THE OWNERS SATISFACTION AT THE CONTRACTOR EXPENSE.
6. THE CONTRACTOR SHALL FIELD VERIFY ELEVATION OF ALL EXISTING LINES BY EXCAVATION IN ADVANCE OF CONSTRUCTION.
7. EXISTING VALVES SHALL BE OPERATED BY THE OWNER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FLUSHING, STERILIZING AND TESTING NEW LINES.
8. SEQUENCE OF CONSTRUCTION
   A. CONSTRUCT NEW FACILITIES INCLUDING PROCESS BUILDING, PAC BUILDING, AND CHEMICAL FEED LINES.
   B. TEST ALL EQUIPMENT AND LINES AND READY FOR SERVICE.
   C. MAKE TIE-INS TO ALL EXISTING AND NEW PLANT PROCESS (INCLUDING CHEMICAL FEED SYSTEMS) TO RUN NEW PROCESS IN PARALLEL WITH EXISTING PLANT. WASTE TREATED WATER FROM NEW PROCESS.
   D. AFTER NEW PROCESS IS IN SERVICE AND MEETING ALL WATER QUALITY STANDARDS ROUTE FINISHED WATER TO CLEARWELL.
   E. CAP OFF LINES AS REQUIRED FOR PERMANENT OPERATION OF NEW FACILITIES. DEMOLISH EXISTING FACILITIES AS SHOWN ON THE PLANS.
9. COORDINATE ALL PLANT SHUT-DOWNS AND TIE-INS TO EXISTING LINES WITH THE PLANT SUPERVISOR.
10. ALL FITTINGS ON PRESSURE LINES SHALL BE RESTRAINED BY THE INSTALLATION OF RESTRAINED JOINTS AT THE FITTINGS AND AS FOLLOWS:

FITTING:	RESTRAINT:
12" 90° BEND	FITTING AND 3 JOINTS EACH WAY
12" 45° BEND	FITTING AND 1 JOINT EACH WAY

11. SOLID SLAB SOD ALL DISTURBED AREAS AT WATER TREATMENT PLANT.
12. MAINTAIN 5' VERTICAL SEPARATION AND 2' VERTICAL SEPARATION BETWEEN FINISHED AND RAW WATER LINES.



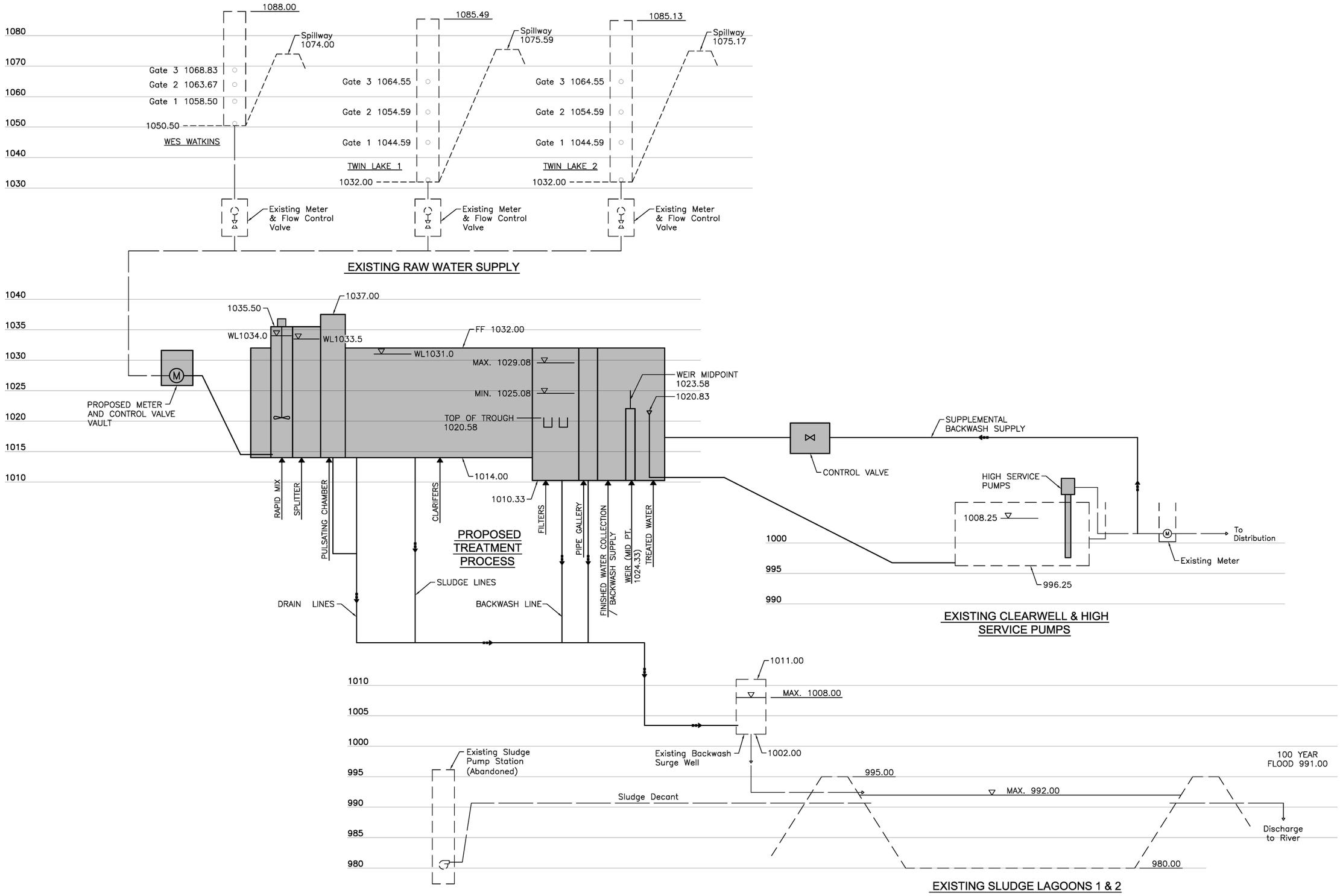
1/3 PROPOSED TREATMENT SCHEMATIC
SCALE: NONE

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/683-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: GPM	PROCESS SCHEMATIC	Proj. No. 19SHAWWTP
Date: 2020	Check: JRU	.	Sht. No. 3



BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Holloway, Updike and Bellen, Inc.
ENGINEERS
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: GPM
Date: 2020	Check: JRU

HYDRAULIC PROFILE
.

Proj. No. 19SHAWWTP
Sht. No. 4

SCALE: 1"=30'

Abandoned Ozone Building FF 1038.15
Elevated Backwash Tank (Abandoned)
30" Raw Water
RW (Abandoned)
20"
30" (Abandoned)
Abandoned Storage / Settling Basin
Abandoned Storage / Settling Basin
12" Drain (Abandoned)
24" Finished Water
14" Finished Water
Existing Meter and Flow Control Vault
30" Raw Water
Rapid Mix
CP2
24" Inlet
Existing Clarifier No. 1
Existing Clarifier No. 2
8" Sludge
Existing Control Structure
30" Settled Water
Flow Meter (Buried)
42" Storm Drain
24" Finished Water
Vault
Existing High Service Pumping
Existing Generator
Existing Filter, Admin and Lab Building FF 1017.31
6" Drain
Storm Drain
12" Sludge
UGE
TOS 1011.70
TOS 1012.59
Existing Clearwell TOS 1013.91
TOS 1011.99
TOS 1012.69
Existing LAS Feed Liine
30" Filtered Water
Abandoned Chemical Building FF 1028.81
Abandoned Coagulation Building (Below Grade)
Abandoned Coagulation Building (Below Grade)
CATV
OHE
14" Water
30" Raw Water
36" RW
20" RW
Backwash Recycle (Abandoned)
Abandoned Filters
Abandoned Filters FF 1026.83
Abandoned Filters
Abandoned High Service Pumping
24" Clearwell Connection (Abandoned)
12" Drain (Abandoned)
14" FW (Abandoned)
Drain
Existing Generator
MCC
30" Backwash / Waste
Abandoned Concrete Basin
Existing Surge Basin
20" Backwash
To Lagoons
To Lagoons
Existing Sludge Pump Station

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: 1"=30' | Detail: GPM
Date: 2020 | Check: JRU

WATER TREATMENT PLANT SITE
EXISTING SITE PLAN & SURVEY CONTROL

Proj. No. 19SHAWWTP
Sht. No. 5

SCALE: 1"=30'

LEGEND

ABANDONED LINE OR LINE TO BE ABANDONED, REMOVE AS REQUIRED.

STRUCTURE TO BE DEMOLISHED (2) TWO FEET BELOW FINAL GRADE OR AS REQUIRED FOR NEW STRUCTURES. BACKFILL, COMPACT AND GRADE TO DRAIN.

Abandoned Backwash Water Tank
Elevated Backwash Tank (Abandoned) (DEMOLISH)
CP1
30" Raw Water
RW (Abandoned)
Abandoned Ozone Building FF 1038.15 (TO REMAIN)
26" 30" (Abandoned)
Abandoned Storage / Settling Basin
Abandoned Storage / Settling Basin
Drain (Abandoned)
APPROX. LIMITS OF FLOOR REMOVAL
Abandoned Chemical Building FF 1028.85
Abandoned Coagulation Building (Below Grade)
EXCAVATE AND REMOVE AS REQUIRED FOR NEW PROCESS BUILDING
Abandoned Coagulation Building (Below, Grade)
Abandoned Filters FF 1026.83
Abandoned Filters
Abandoned High Service Pumping
Abandoned Concrete Basin
Backwash Recycle (Abandoned)
14" FW (Abandoned)
24" Clearwell Connection (Abandoned)
To Lagoons
Existing Meter and Flow Control Vault
24" Finished Water
Flow Meter (Buried)
REMOVE GRAVEL
REMOVE GRAVEL. ADD TOPSOIL AND SEED.
CP2
Existing Clarifier No. 1
DEMOLISH COVER AND REMOVE WALLS TO TWO FEET BELOW FINAL GRADE. BACK FILL TO FINAL GRADE.
Existing Clarifier No. 2
DEMOLISH COVER AND REMOVE WALLS TO TWO FEET BELOW FINAL GRADE. BACK FILL TO FINAL GRADE.
24" Inlet
8" Sludge
Existing Control Structure
30" Settled Water
42" Storm Drain
Vault
Existing High Service Pumping
Existing Generator
Existing Filter, Admin and Lab Building FF 1017.31
Existing Clearwell TOS 1013.91
TOS 1012.58
TOS 1011.70
TOS 1011.99
TOS 1012.69
30" Filtered Water
12" Sludge
6" Drain
Storm Drain
UGE
OHE
Existing Surge Basin
MCC
Existing Generator
30" Backwash Waste
6" Drain

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Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: 1"=30'	Detail: GPM
Date: 2020	Check: JRU

WATER TREATMENT PLANT SITE DEMOLITION PLAN

Proj. No. 19SHAWWTP
Sht. No. 6

SCALE: 1"=30'

CONSTRUCT CHEMICAL BUILDING ACCESS ROAD, ASPHALT WITH CURB AND GUTTER. INSTALL 40' DOUBLE GATE IN EXISTING FENCE

CONSTRUCT 18' ASPHALT DRIVE WITH CURB AND GUTTER

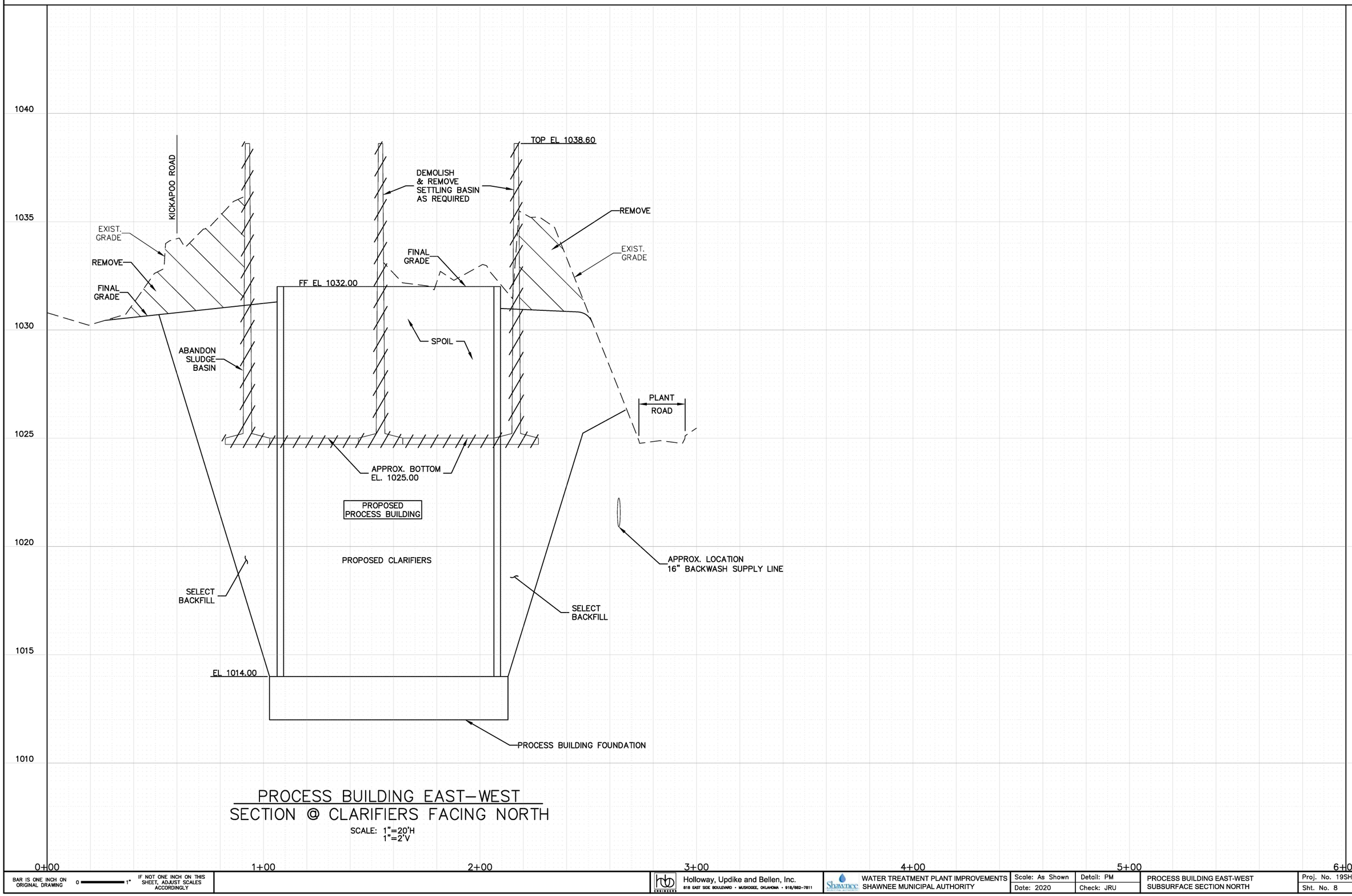
REPLACE EXISTING FENCE WITH 100 L.F. OF 6' CHAIN LINK FENCE WITH 3 STRANDS BARBED WIRE AND 18' DOUBLE GATE

MILL AND OVERLAY WITH 2" OF 24 ASPHALT (PG 64-22)

NOTE:
PLACE SOLID SLAB SOD ON ALL DISTURBED AREAS.

Existing Chemical Bldg.
16" Water
24" Finished Water
Abandoned Backwash Water Tank
Elevated Backwash Tank (Abandoned)
30" Raw Water
RW (Abandoned)
Abandoned Ozone Building FF 1038.15
20" 30" (Abandoned)
14" Finished Water
24" Finished Water
Existing Meter and Flow Control Vault
30" Raw Water
Abandoned Storage / Settling Basin
RAW WATER FLOW METER / CONTROL VAULT
Flow Meter (Buried)
Rapid Mix
CP2
Existing Clarifier No. 1
Existing Clarifier No. 2
PROCESS BUILDING F.F. 1032.00
SIDEWALK
PAC BUILDING F.F. 1020.50
6" OF TYPE 'A' AGGREGATE BASE
Abandoned Chemical Building FF 1028.81
30" Settled Water
Existing Control Structure
Vault
Existing High Service Pumping
Existing Generator
Existing Filter, Admin and Lab Building FF 1017.31
BW SUPPLY CONTROL VAULT
Existing Clearwell TOS 1013.91
TOS 1012.58
TOS 1011.70
TOS 1011.99
TOS 1012.69
30" Filtered Water
Backwash Recycle (Abandoned)
24" Clearwell Connection (Abandoned)
Abandoned Filters
Abandoned Filters FF 1026.83
Abandoned High Service Pumping
Drain (Abandoned)
BLOWERS
Storm Drain
42" Storm Drain
12" Sludge
UGE
OHE
CATV

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811	WATER TREATMENT PLANT IMPROVEMENTS SHAWNEE MUNICIPAL AUTHORITY	Scale: 1"=30'	Detail: GPM	WATER TREATMENT PLANT SITE GRADING & PAVING PLAN	Proj. No. 19SHAWWTP
			Date: 2020	Check: JRU		Sht. No. 7



PROCESS BUILDING EAST–WEST
SECTION @ CLARIFIERS FACING NORTH

SCALE: 1"=20'H
1"=2'V

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

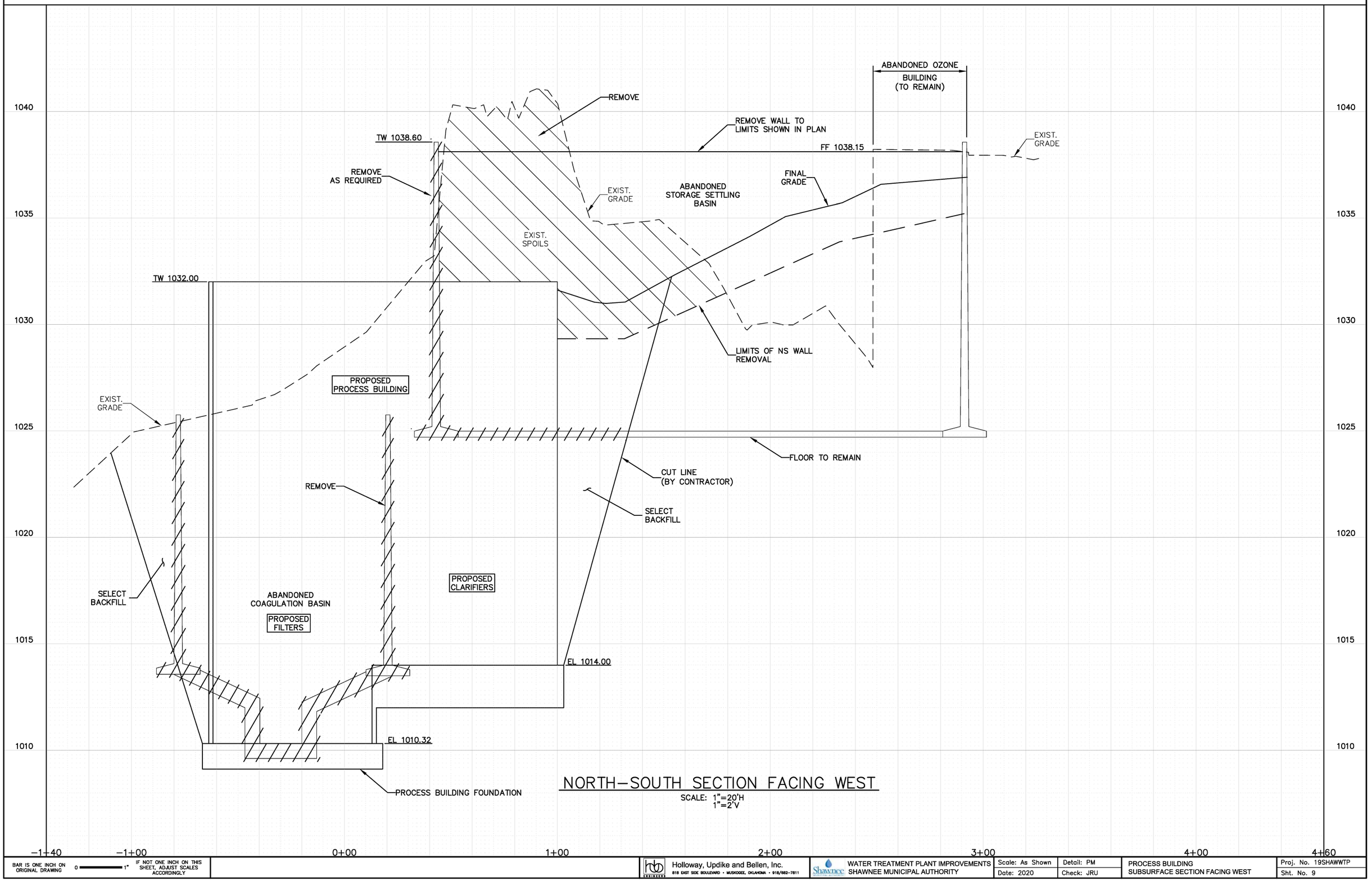
Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: PM
Date: 2020 | Check: JRU

PROCESS BUILDING EAST-WEST
SUBSURFACE SECTION NORTH

Proj. No. 19SHAWWTP
Sht. No. 8



NORTH–SOUTH SECTION FACING WEST

SCALE: 1"=20'H
1"=2'V

BAR IS ONE INCH ON ORIGINAL DRAWING — 0 — 1" — IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: PM
Date: 2020	Check: JRU

PROCESS BUILDING
SUBSURFACE SECTION FACING WEST

Proj. No. 19SHAWWTP
Sht. No. 9

SCALE: 1"=30'

Elevated Backwash Tank (Abandoned)
30" Raw Water
RW (Abandoned)
Abandoned Ozone Building FF 1038.15
Abandoned Storage / Settling Basin
Abandoned Storage / Settling Basin
RW (Abandoned)
30"x24" TEE w/ 30" B.F. VALVE SW
RAW WATER FLOW METER / CONTROL VAULT
30"x24" TEE w/ 30" B.F. VALVE NE
LINE A 30" RW
12" Drain (Abandoned)
24" BYPASS LINE WITH 24" B.F. VALVE
3/8" RAW WATER SAMPLE LINE
12" DRAIN
2-1/2" GAS LINE
PROCESS BUILDING F.F. 1032.00
Abandoned Chemical Building FF 1028.81
MH F
RW (Abandoned)
(8) 6" SLUDGE
RW (Abandoned)
12" DRAIN
MH A
(8) 6" SLUDGE
LINE 'C' 30"
2" WATER SUPPLY
2" AIR
GAS DRAIN
MH B
24" BW
12" Drain (Abandoned)
30"
MH C
10" FTW
12"
BW SUPPLY CONTROL VAULT
12" TEE w/ GATE VALVES WEST & SOUTH
30" B.F. VALVE
30" B.F. VALVE
LINE 'D' 12"
12" BACKWASH SUPPLEMENTAL SUPPLY
MH G
MH H
LINE 'B' 30" FW
LINE 'C' 30"
20"
24" Clearwell Connection (Abandoned)
MH D
12" Drain (Abandoned)
30" B.F. VALVE
LINE 'C' 30"
MH E
Abandoned Filters
Abandoned Filters
Abandoned Filters FF 1026.83
Abandoned High Service Pumping
14" FW (Abandoned)
Existing Generator
MCC
Abandoned Concrete Basin
12" Drain (Abandoned)
Existing Surge Basin
20" Backwash
To Lagoons
To Lagoons
Existing Sludge Pump Station
Backwash Recycle (Abandoned)
Existing Filter, Admin and Lab Building FF 1017.31
Flow Meter (Buried)
2-1/2" GATE VALVE
2-1/2" PAC WATER SUPPLY
PAC BUILDING F.F. 1020.50
12"x2" SERVICE CLAMP
12"x2" SERVICE CLAMP WITH 2" GATE VALVE
EXCAVATE TO DETERMINE ELEVATION AND FITTINGS NEEDED
INSTALL 30" TEE IN EXISTING LINE WITH 30" B.F. VALVES WEST & SOUTH
24" Finished Water
TIE-IN TO EXISTING LINE WITH 12" T.S.&V.
LINE 'F' 12"
20" Backwash Supply
24" Finished Water
30" Settled Water
3" DRAIN
BORE UNDER ROAD
30" Settled Water
6" Drain
Storm Drain
42" Storm Drain
Existing Meter and Flow Control Vault
30" Raw Water
30" Raw Water
Rapid Mix
CP2
24" Inlet
24" Inlet
Existing Clarifier No. 1
Existing Clarifier No. 2
8" Sludge
8" Sludge
Existing Control Structure
30" Settled Water
Vault
Existing High Service Pumping
Existing Generator
TOS 1012.58
TOS 1011.70
Existing Clearwell TOS 1013.91
TOS 1011.99
TOS 1012.69
12" Sludge
UGE
Existing LAS Feed Line
30" 90° BEND
30" Filtered Water
INSTALL 30" TEE IN EXISTING LINE WITH 30" B.F. VALVE WEST
30" Backwash Waste
12" Sludge
42" Storm Drain
OHE
GAS
CATV
14" Water
30" Raw Water
20" RW
36" RW

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

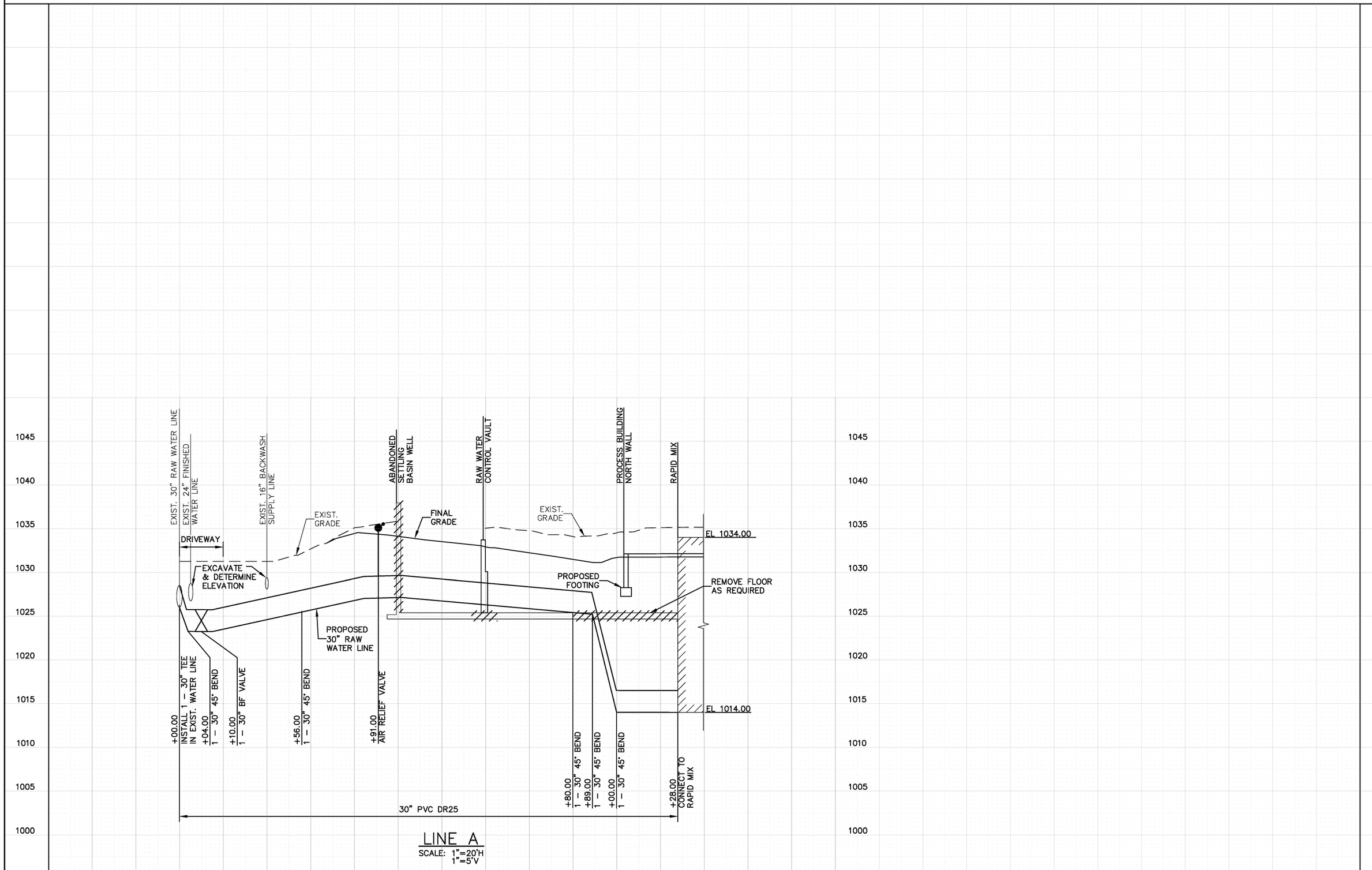
Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: 1"=30'	Detail: GPM
Date: 2020	Check: JRU

WATER TREATMENT PLANT SITE
SITE PIPING PLAN

Proj. No. 19SHAWWTP
Sht. No. 10



LINE A

SCALE: 1"=20'H
1"=5'V

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

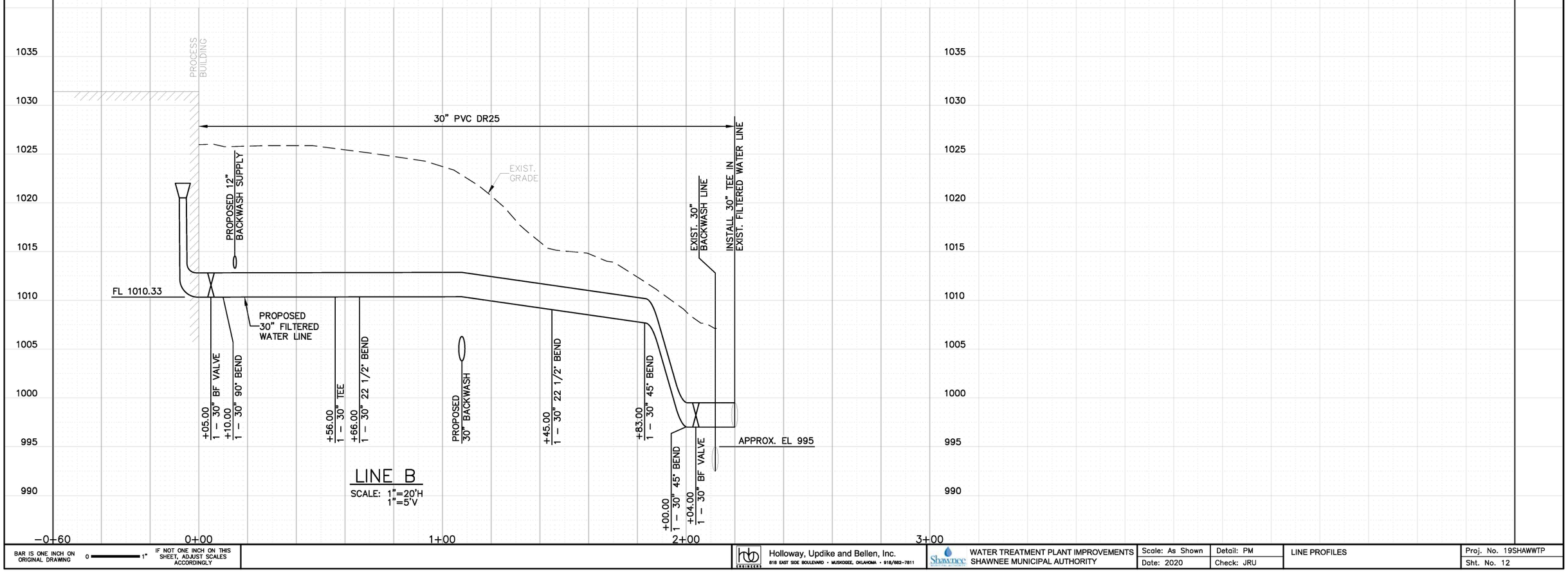
Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: PM
Date: 2020	Check: JRU

LINE PROFILES

Proj. No. 19SHAWWTP
Sht. No. 11



LINE B

SCALE: 1"=20'H
1"=5'V

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

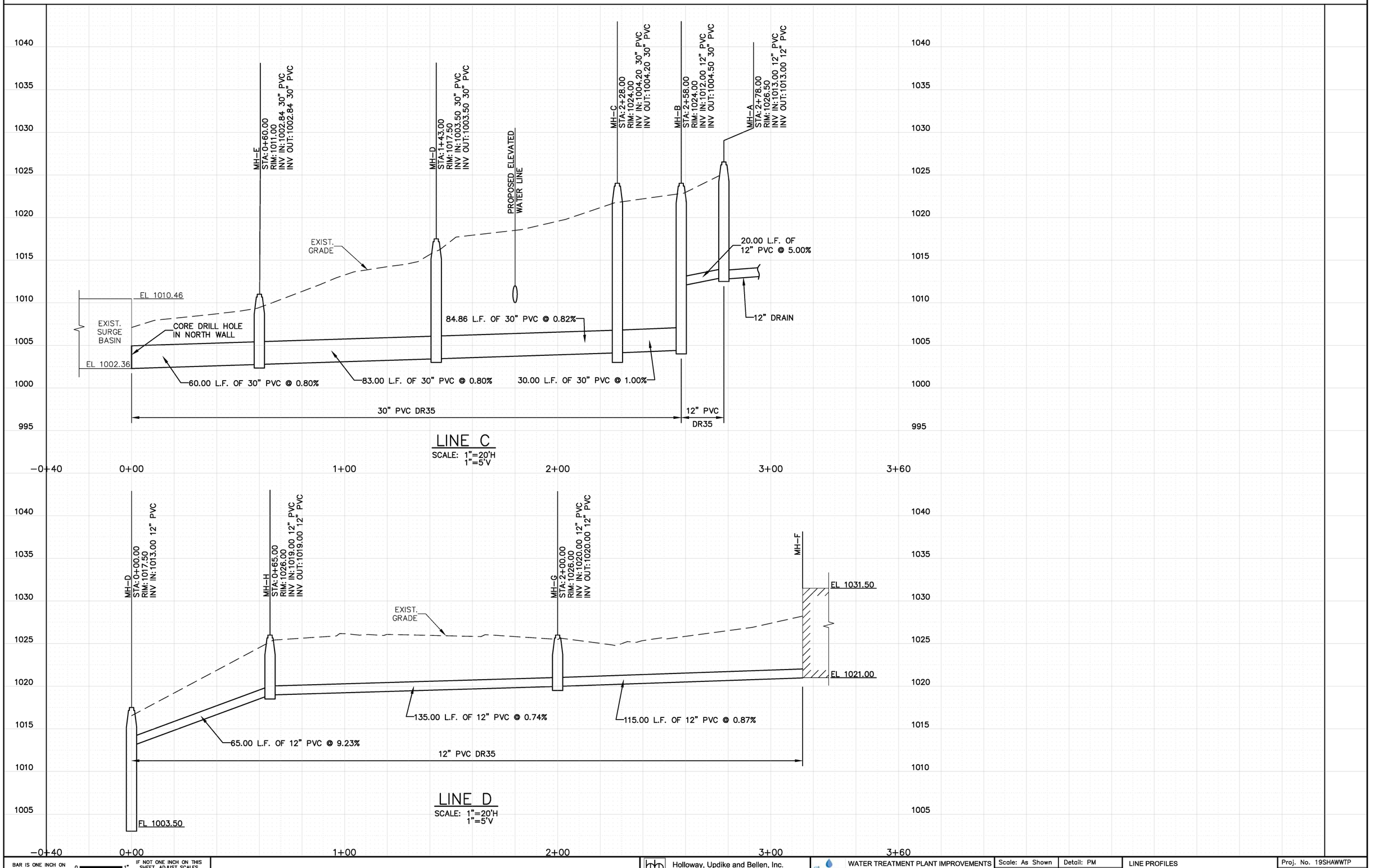
Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: PM
Date: 2020	Check: JRU

LINE PROFILES

Proj. No. 19SHAWWTP
Sht. No. 12

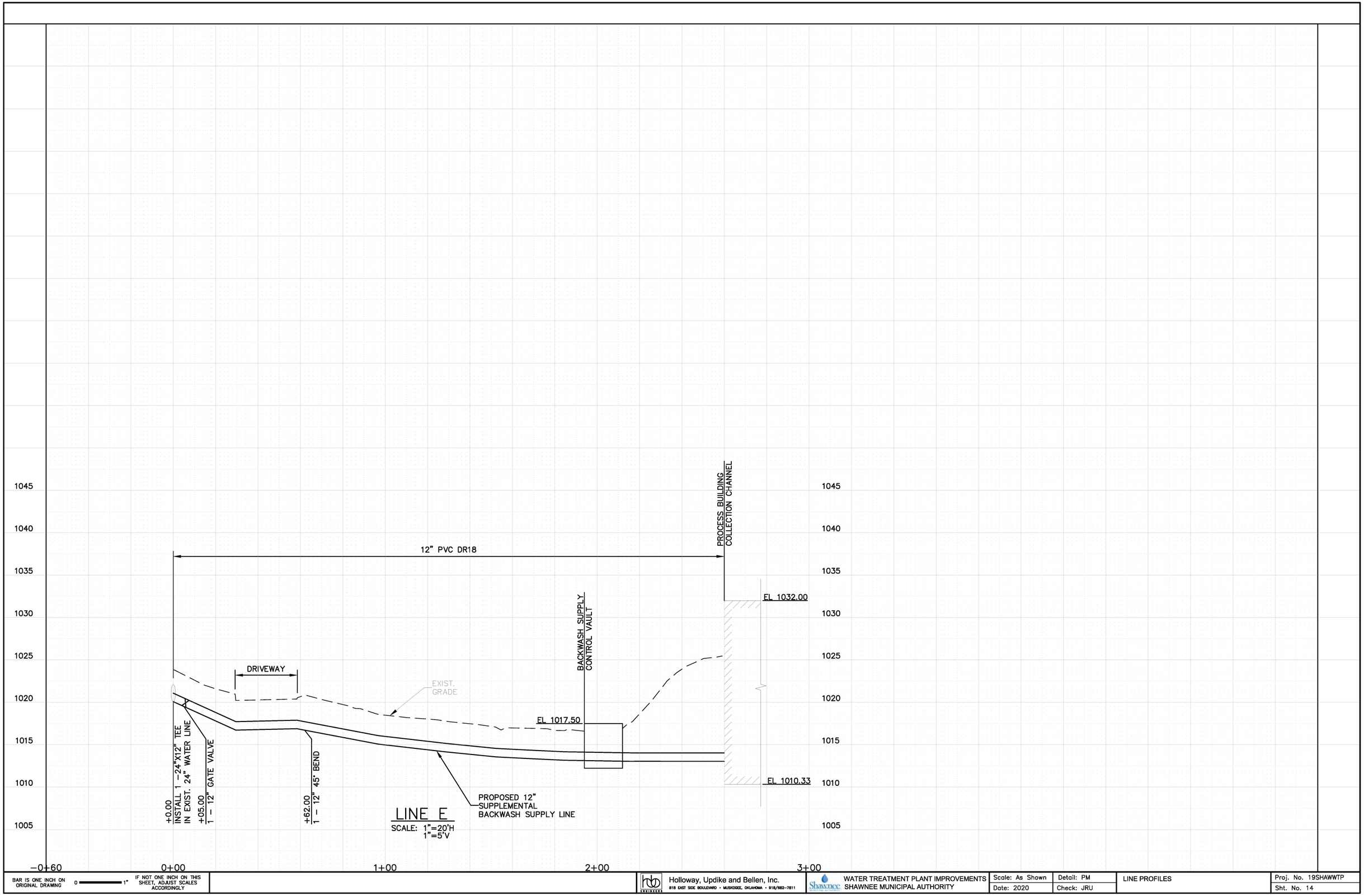


BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: PM	LINE PROFILES	Proj. No. 19SHAWWTP
Date: 2020	Check: JRU		Sht. No. 13

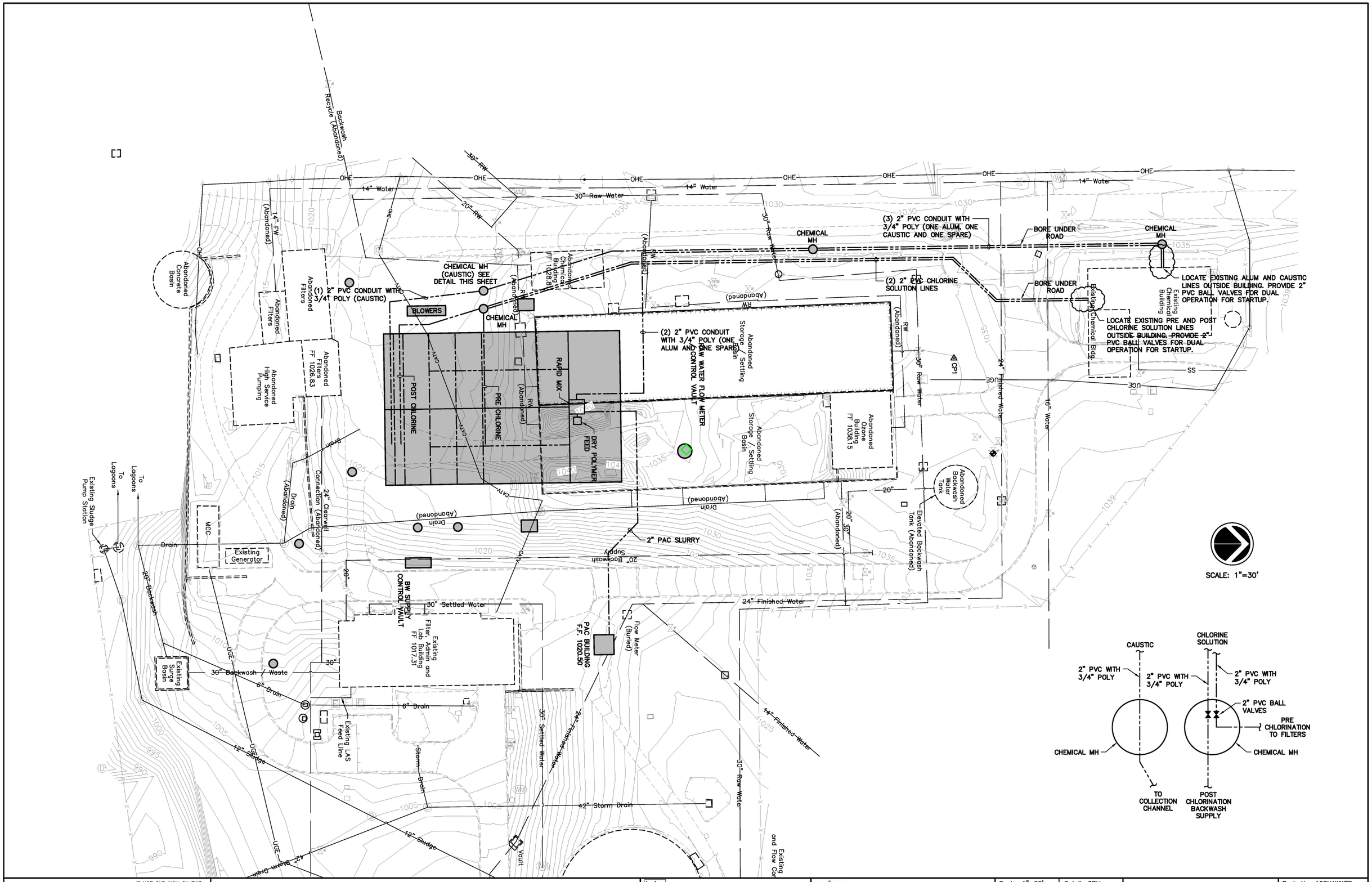


BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

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818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: PM	LINE PROFILES	Proj. No. 19SHAWWTP
Date: 2020	Check: JRU		Sht. No. 14

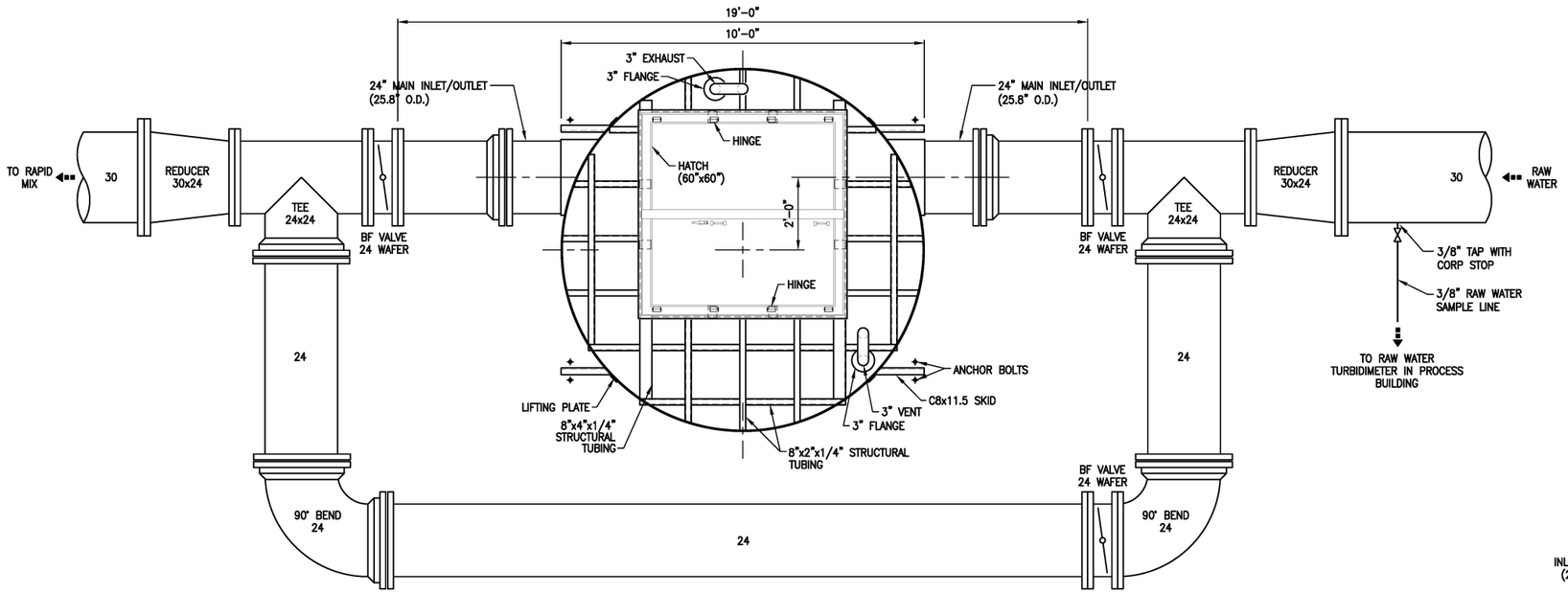


BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

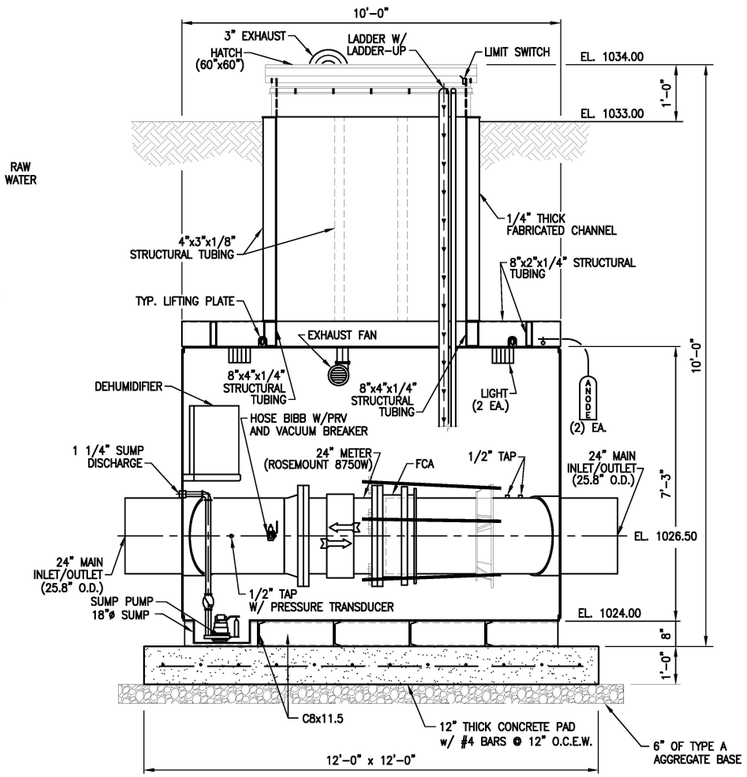
Holloway, Updike and Bellen, Inc.
810 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: 1"=30'	Detail: GPM	WATER TREATMENT PLANT SITE CHEMICAL LINE SITE PLAN	Proj. No. 19SHAWWTP
Date: 2020	Check: JRU		Sht. No. 15

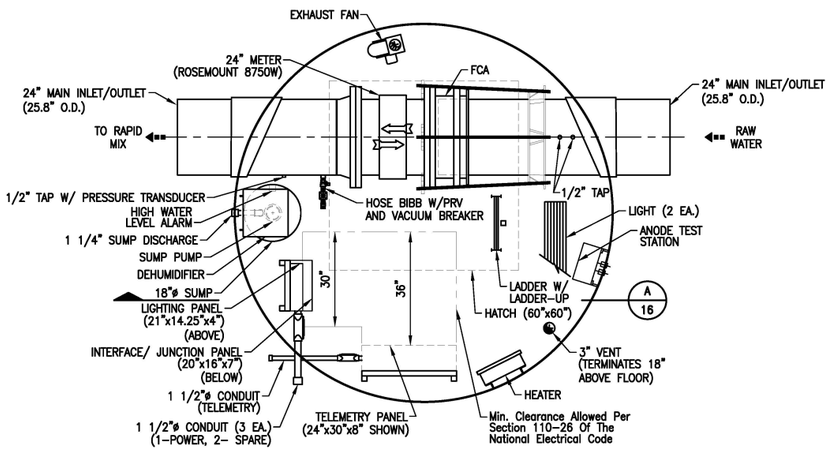


EXTERIOR PLAN

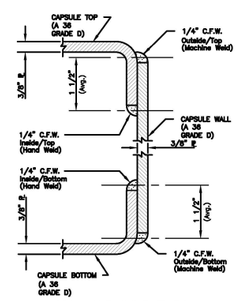


SECTION A–A

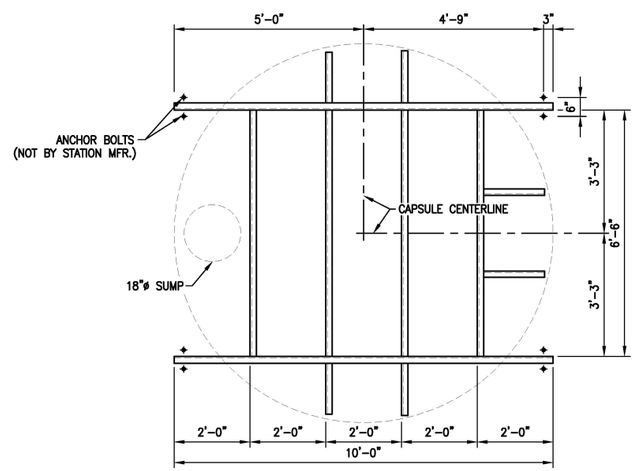
NOTE:
1. ALL PIPING TO BE CLASS 150 DIP RESTRAINED JOINT.
2. CONTRACTOR TO PROVIDE TRANSITION GASKETS AS REQUIRED.
3. ALL BURIED FITTINGS SHALL BE RESTRAINED MECHANICAL JOINT.



INTERIOR PLAN

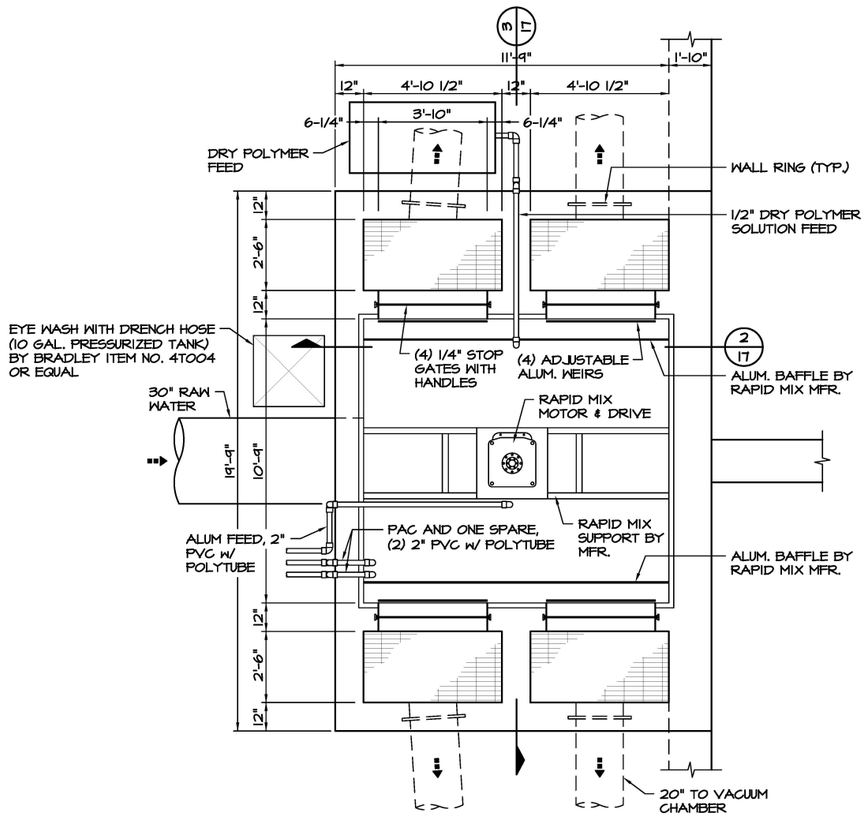


LAP JOINT CONNECTION OF CAPSULE WALL PLATE WITH FLANGE TOP AND BOTTOM



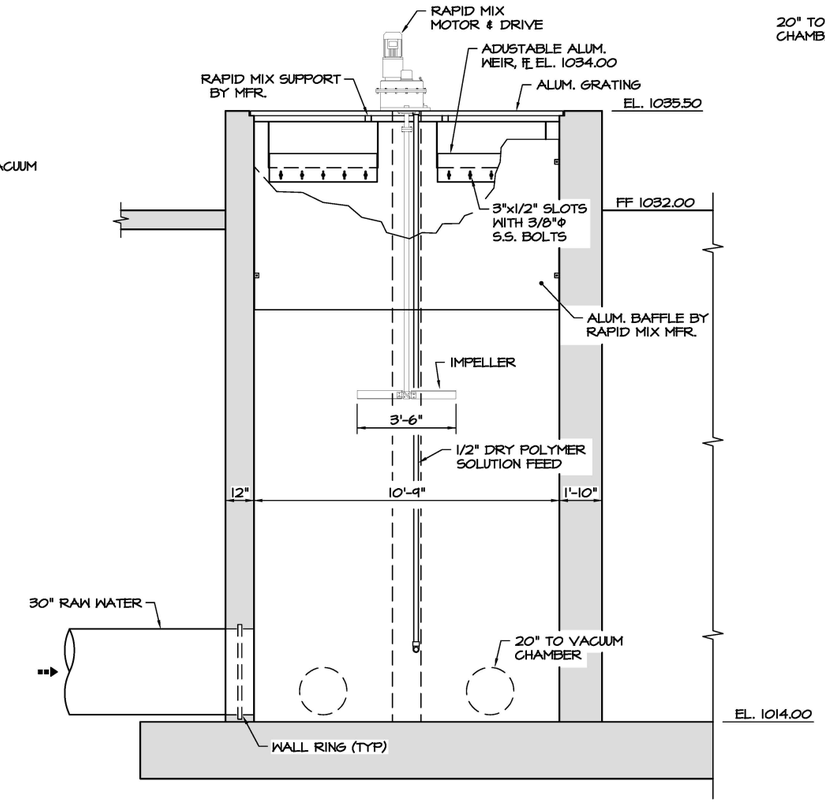
SKID PLAN

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811	WATER TREATMENT PLANT IMPROVEMENTS SHAWNEE MUNICIPAL AUTHORITY	Scale: As Shown Date: 2020	Detail: GPM Check: JRU	RAW WATER MASTER METER STATION .	Proj. No. 19SHAWWTP Sht. No. 16

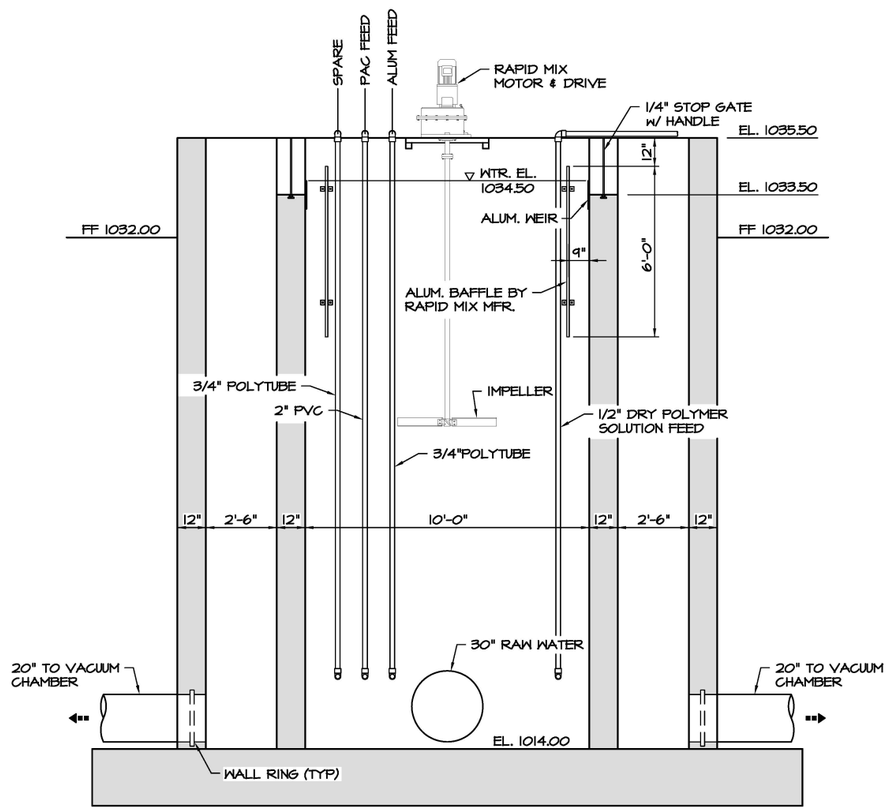


1/17 PLAN @ RAPID MIX BASIN
SCALE: 3/8" = 1'-0"

NOTE:
ATTACH FEED LINES TO RAPID MIX WALLS WITH S.S. HARDWARE



2/17 SECTION
SCALE: 3/8 1'-0"



3/17 SECTION
SCALE: 3/8" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Holloway, Updike and Bellen, Inc.
ENGINEERS
818 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

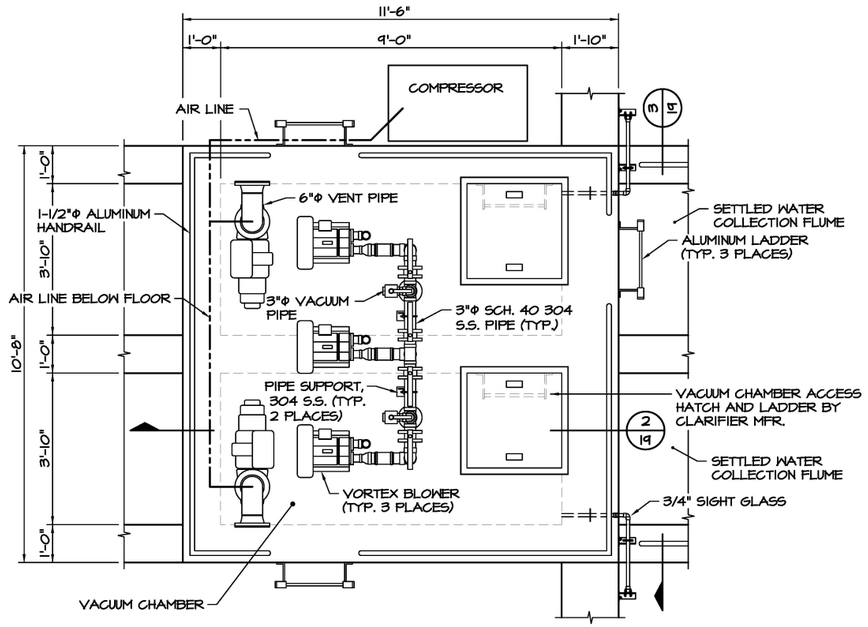
Shawnee MUNICIPAL AUTHORITY

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: GPM
Date: 2020 | Check: JRU

TREATMENT PROCESS BUILDING
RAPID MIX BASIN PLAN AND SECTIONS

Proj. No. 19SHAWWTP
Sht. No. 17

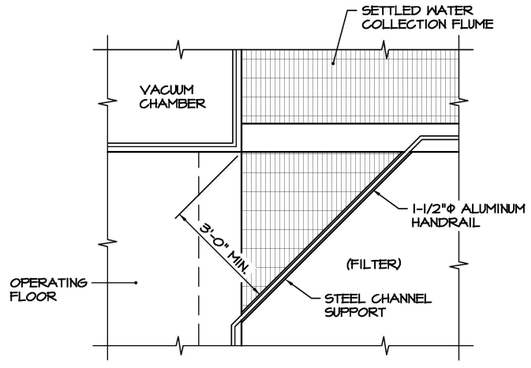


1/18 PLAN @ VACUUM CHAMBER (TYP. OF TWO)

SCALE: 1/2" = 1'-0"

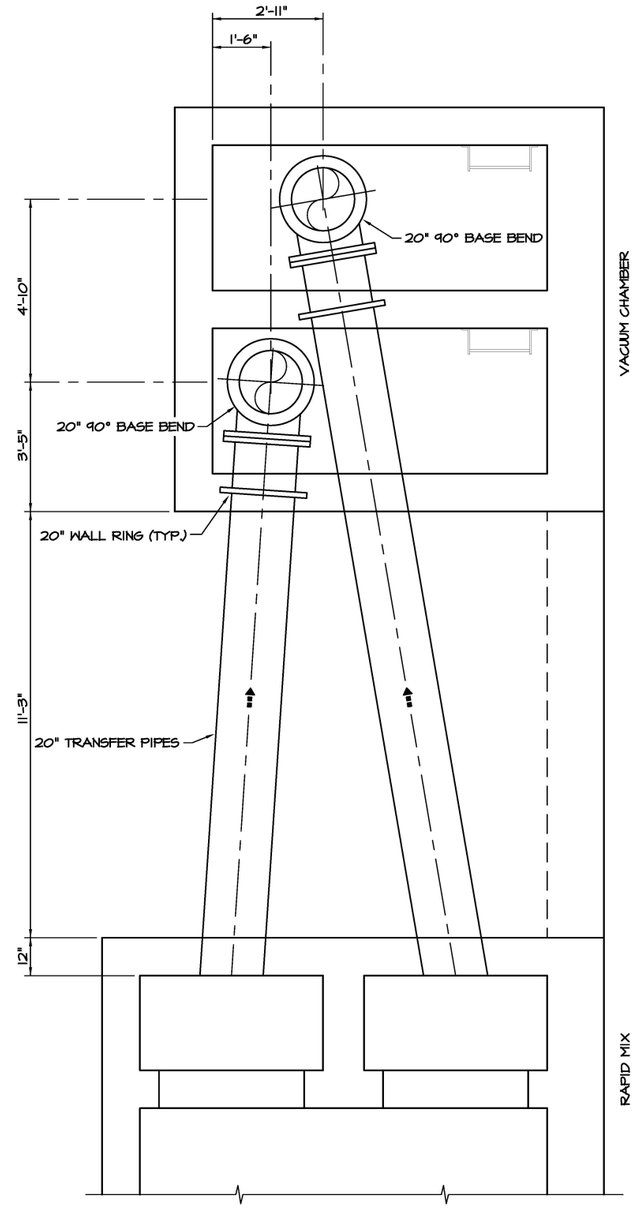
NOTE:

PIPING AND FITTINGS ARE INTENDED TO SHOW THE APPROXIMATE EQUIPMENT LAYOUT. FINAL LAYOUT BY CLARIFER MFR.



A/18 GRATED WALKWAY DETAIL (4 LOCATIONS)

SCALE: 3/8" = 1'-0"



2/18 20" TRANSFER PIPE LAYOUT (TYP. OF TWO)

SCALE: 1/2" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

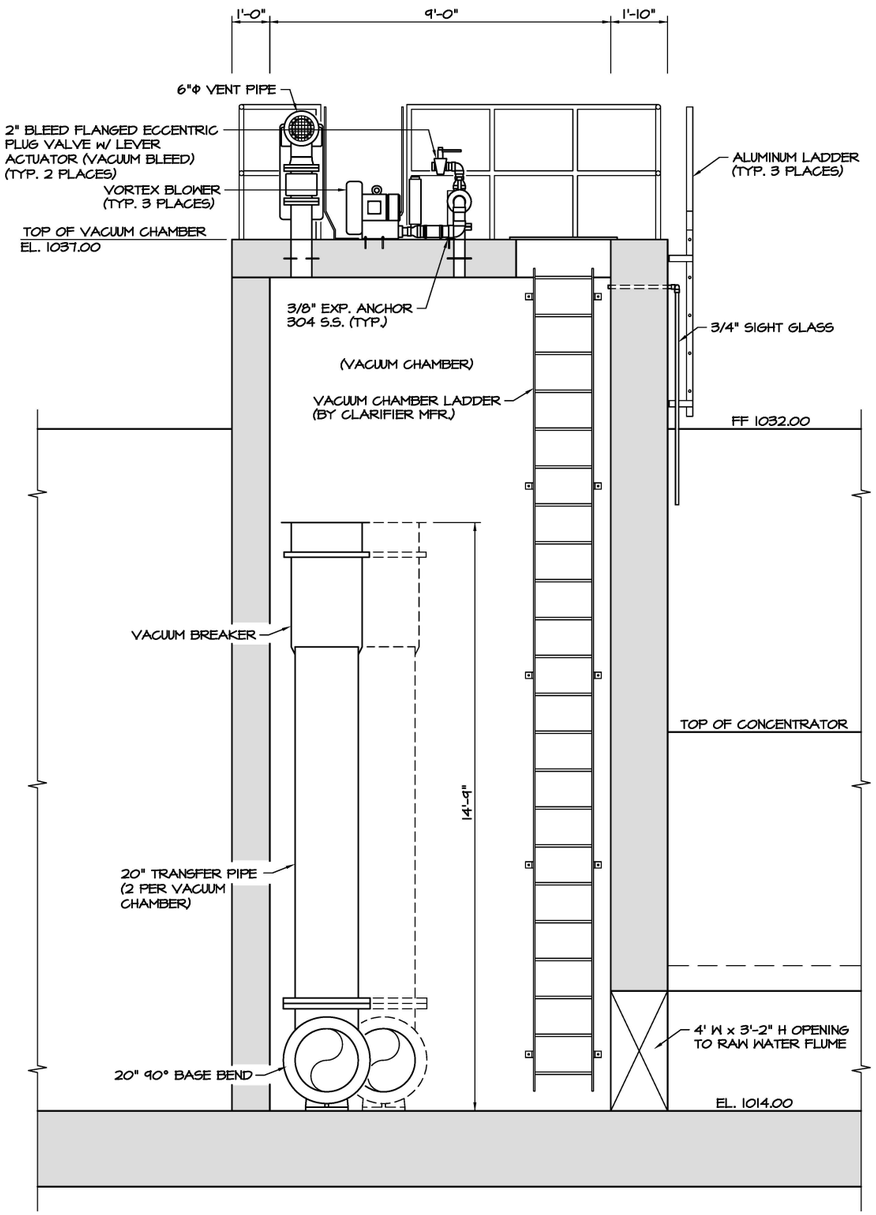
Holloway, Updike and Bellen, Inc.
ENGINEERS
818 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

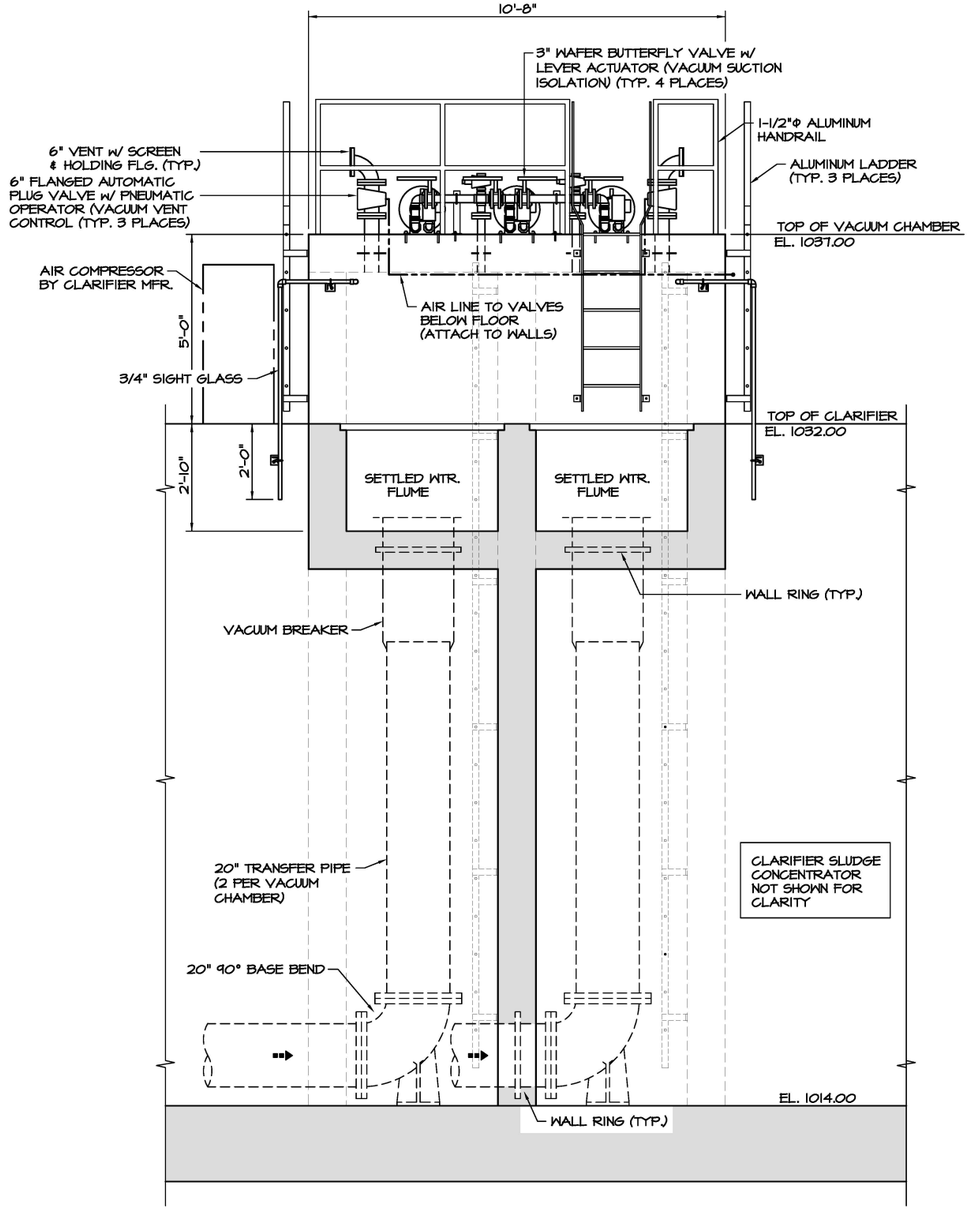
Scale: As Shown	Detail: GPM
Date: 2020	Check: JRU

TREATMENT PROCESS BUILDING
VACUUM CHAMBER PLAN AND SECTIONS

Proj. No. 19SHAWWTP
Sht. No. 18



2/19 SECTION
SCALE: 1/2" = 1'-0"



3/19 SECTION
SCALE: 1/2" = 1'-0"

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Holloway, Updike and Bellen, Inc.
515 EAST 3RD BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7851

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: GPM
Date: 2020 | Check: JRU

TREATMENT PROCESS BUILDING
VACUUM CHAMBER PLAN AND SECTIONS

Proj. No. 19SHAWWTP
Sht. No. 19

167'-2"
34'-6"
59'-10"
72'-10"
1'-10"
58'-0" (PULSATING CLARIFIERS)
3'-2"
18'-0" (DECLINING RATE FILTERS)
18'-0" (DECLINING RATE FILTERS)
16'-0" (PIPE GALLERY)
12'-0"
1'-6"
5'-0"
6'-0"
1'-4"
6" AIR GAP
1'-4"
1'-4"
1'-4"
1'-4"
1'-6"
12"
12" SUPPLEMENTAL BACKWASH SUPPLY
4' WIDE CONC. SIDEWALK
EL. 1032.00
4'-0" x 3'-3" CONC. PAD
(8) 6" BLOW OFF LINES TO MANHOLE "A"
METAL BUILDING
4" DRAIN TO MANHOLE "A"
24" BACKWASH TO MANHOLE "B"
10" FILTER TO WASTE LINE TO MANHOLE "C"
EL. 1024.50
4' WIDE CONC. SIDEWALK
TO EXISTING CLEARWELL
24"x18"x12" SUMP
4'-0" x 3'-3" CONC. PAD
12" G.V.'s
11'-10"
8"Ø CLEARWELL VENT
EL. 1025.00
MTL. STAIRWAY
EL. 1032.00
50'-8"
OPERATING FLR. 1032.00
ALUM. HANDRAIL (TYP.)
4'-0"W x 3'-10"L REMOVABLE TUBE SETTLERS (ONE EACH CLARIFIER)
PROVIDE KICK PLATE ON HANDRAIL ADJACENT TO FILTERS
OPEN
OPEN
PULSATING VACUUM CHAMBER
(SETTLED WATER FLUME)
ALUM. STOP GATE (2 REQ'D.)
(5' WIDE CATWALK)
30"x30" TEE
30" FILTERED WATER
30" B.F. VALVE
(SETTLED WATER FLUME)
20" CANAL GATE (2 REQ'D.)
OPEN
OPEN
(4) 20" TRANSFER PIPES
12"
10'-9"
18"
DRY POLYMER FEEDER
12"
12"
2'-6"
20" PVC INTERCONNECT LINE (NORMALLY CLOSSED)
12" SUPPLEMENTAL BACKWASH SUPPLY
(2) 30" B.F. VALVES WITH STEM AND VALVE BOX TO DECK LEVEL
EYE WASH WITH DRENCH HOSE (10 GAL. PRESSURIZED TANK)
RAPID MIX
10'-9"
WEIR (4 REQ'D.)
30" RAW WATER
18"
12"
2'-6"
12"
12" RAW WATER DISTRIBUTION TUBES TYP. BOTH SIDES
SETTLING PLATES TYP. BOTH SIDES
NOTE: SETTLING TUBE SYSTEM NOT SHOWN FOR CLARITY
24'-8"
12"
8'-10"
18"
FILTER INFLUENT VALVE
OPEN
OPEN
AIR SUPPLY
FILTER TO WASTE
TREATED WATER BACKWASH SUPPLY
TREATED WATER COLLECTION CHANNEL
EFFLUENT AND BACKWASH SUPPLY
BACKWASH FLOW CONTROL WEIR
VALVE BOX FOR WEIR ADJUSTMENT
12"
8'-6"
PULSATING VACUUM CHAMBER
ALUMINUM LADDER (TYP. 3 PLACES)
3'-10"
12"
(SETTLED WATER FLUME)
(2) LEVEL CONTROL WEIRS BY CLARIFIER MFR.
(SETTLED WATER FLUME)
3'-10"
12"
12"
12"
VACUUM CHAMBER
AIR COMPRESSOR PACKAGE BY CLARIFIER MFR. (2 REQ'D.)
GRATED WALKWAY (FOUR LOCATIONS)
FILTER INFLUENT FLUME
ALUM. HANDRAIL
OPEN
OPEN
(5' WIDE CATWALK)
30" 90° BEND
30" FILTERED WATER
30" B.F. VALVE
50'-8"
MTL. STAIRWAY
12" SETTLED WATER COLLECTION TUBES TYP. BOTH SIDES
CONRETE BAFFLE BELOW TYP. BOTH SIDES
48"x48" ALUM. WATERTIGHT HATCH w/ GASKET SEAL (4 REQUIRED)
4' SQ. LANDING
AIR VACUUM BREAKER
8"Ø CLEARWELL VENT
(CONC. SLAB AT GRADE)
ALUM. HANDRAIL
12' x 12' INSULATED COILED OVERHEAD DOOR
18' WIDE ASPHALT DRIVE
4'-0" x 3'-3" CONC. PAD
EL. 1032.00
(8) 6" BLOW OFF LINES TO MANHOLE "E"
METAL BUILDING
24"x18"x12" SUMP
6" AIR SUPPLY LINE
EL. 1024.50
4'-0" x 3'-3" CONC. PAD
1'-10"
101'-9"
1'-10"

1/20 PLAN @ EL. 1032.00
SCALE: 3/32"=1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

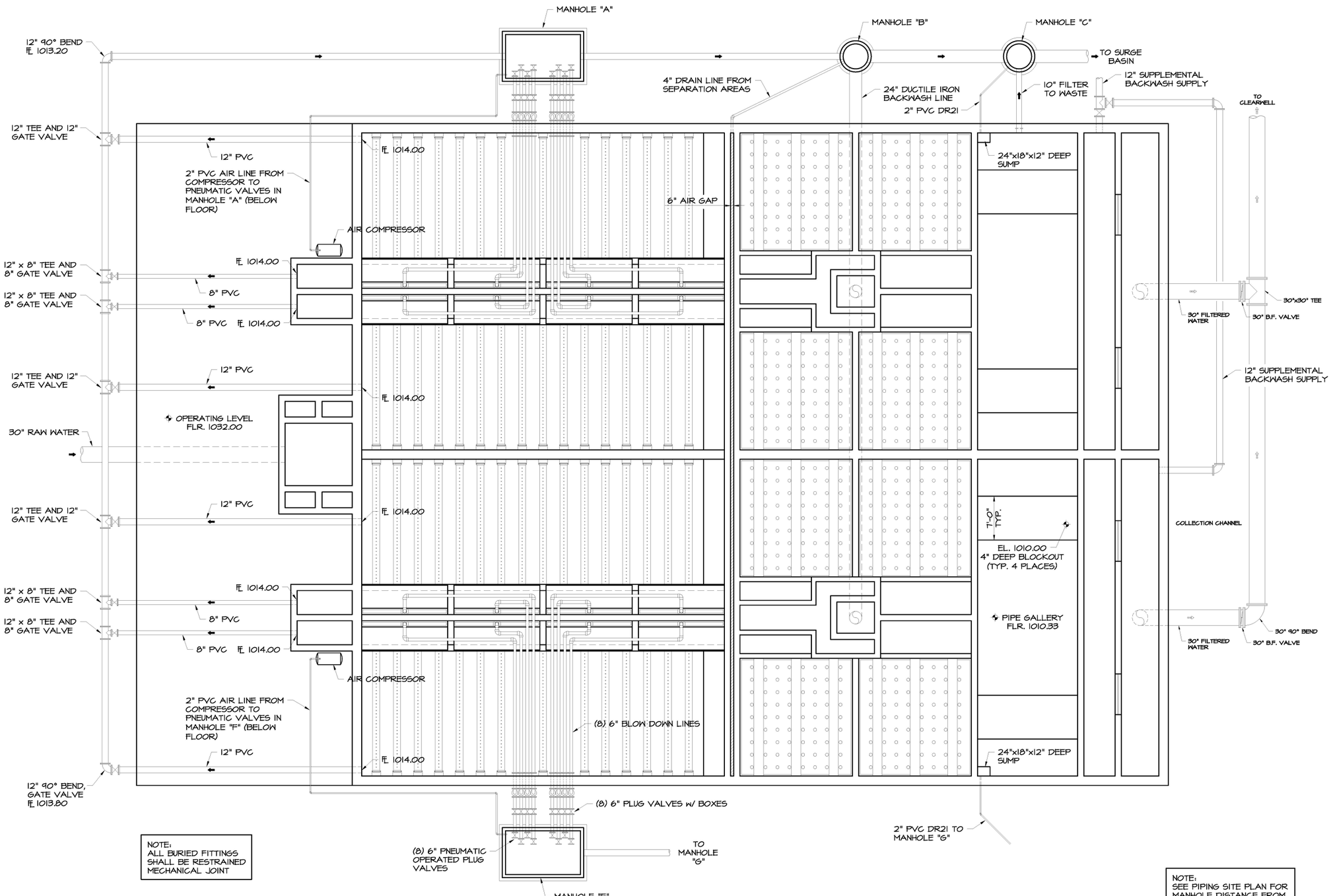
Holloway, Updike and Bellen, Inc.
515 EAST 3RD BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7851

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: GPM
Date: 2020 | Check: JRU

TREATMENT PROCESS BUILDING
FLOOR PLAN @ OPERATING LEVEL

Proj. No. 19SHAWWTP
Sht. No. 20



SCALE: 1/8"=1'-0"

NOTE:
ALL BURIED FITTINGS SHALL BE RESTRAINED MECHANICAL JOINT

NOTE:
SEE PIPING SITE PLAN FOR MANHOLE DISTANCE FROM BUILDING.

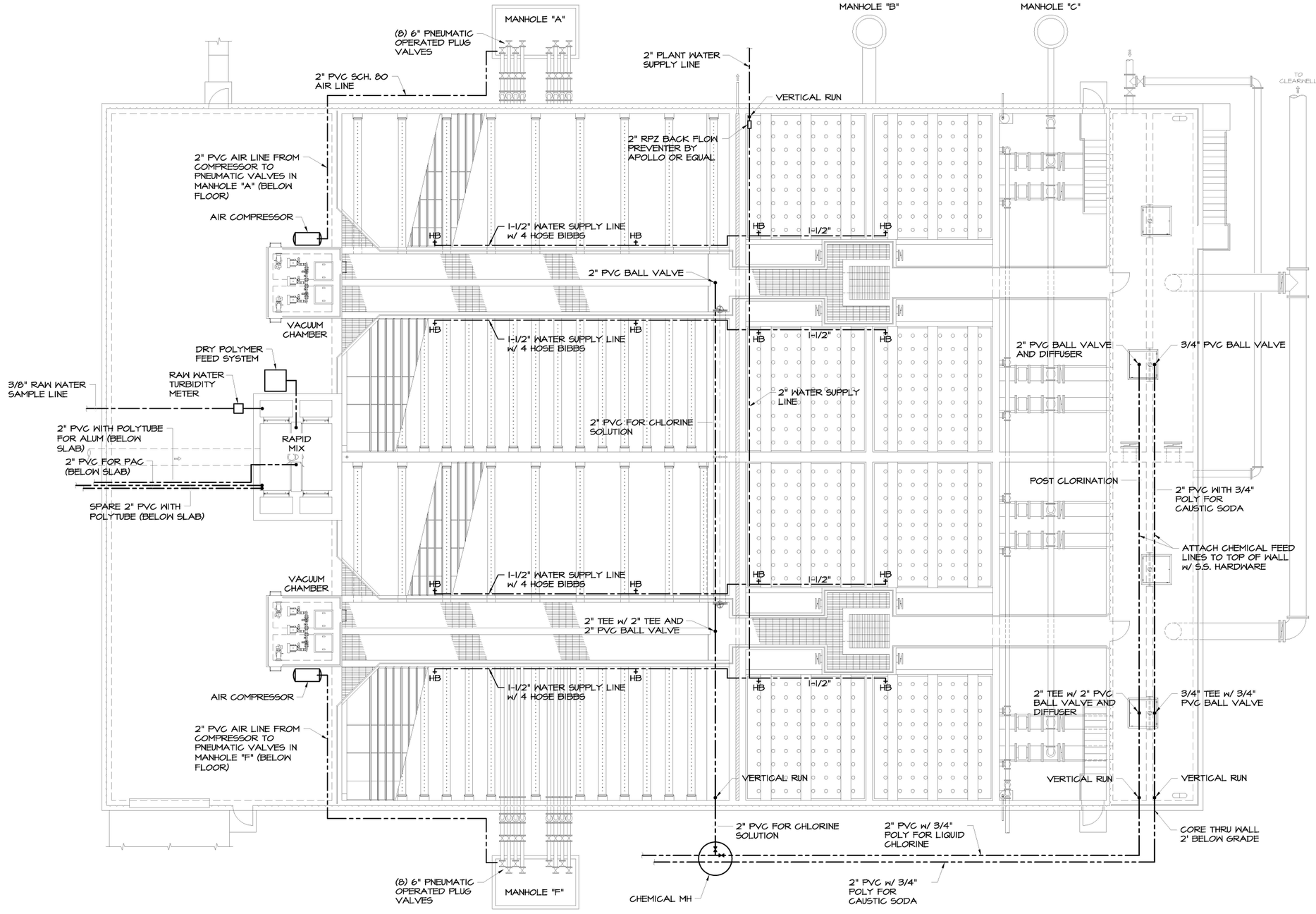
1/21 PLAN @ EL. 1028.00
SCALE: 1/8" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Holloway, Updike and Bellen, Inc.
ENGINEERS
815 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: GPM	TREATMENT PROCESS BUILDING PLAN @ EL. 1028.00
Date: 2020	Check: JRU	Proj. No. 19SHAWWTP Sht. No. 21



SCALE: 1/8"=1'-0"

1/22 CHEMICAL FEED, PLANT WATER & AIR PIPING PLAN

SCALE: 1/8"=1'-0"

NOTES:

1. WATER SUPPLY PIPING SHALL BE 2" GALVANIZED SCH. 80.
2. BURY ALL EXTERIOR LINES.
3. COLOR CODE EXPOSED PIPING OR CONDUITS AS FOLLOWS:
   A. CHLORINE SOLUTION (YELLOW)
   B. CAUSTIC SODA (BLACK)
   C. POLYMER (ORANGE)

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

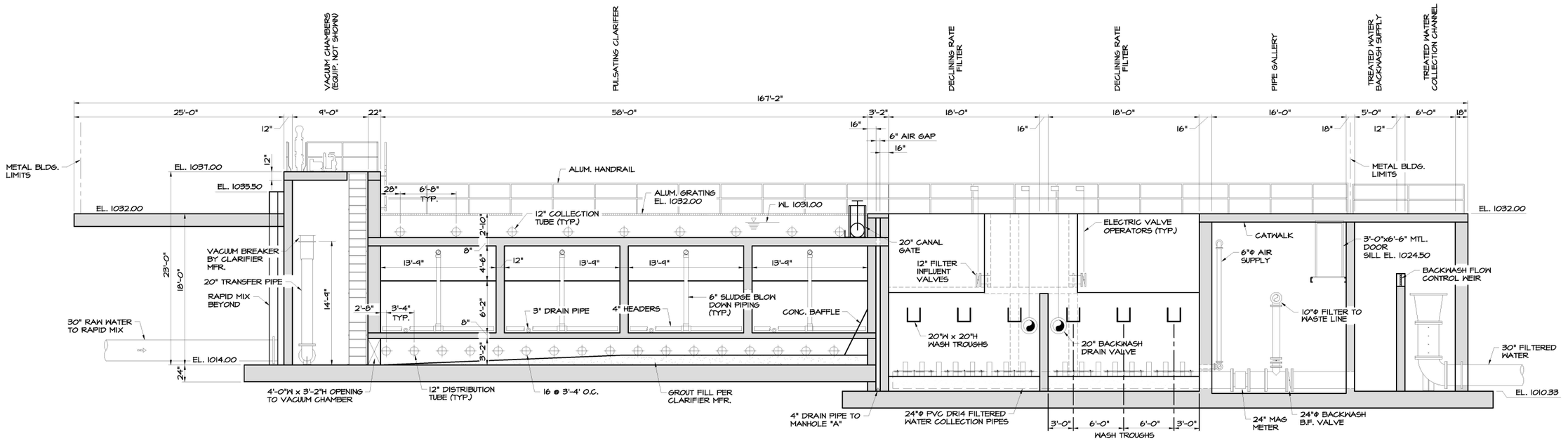
Holloway, Updike and Bellen, Inc.
816 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

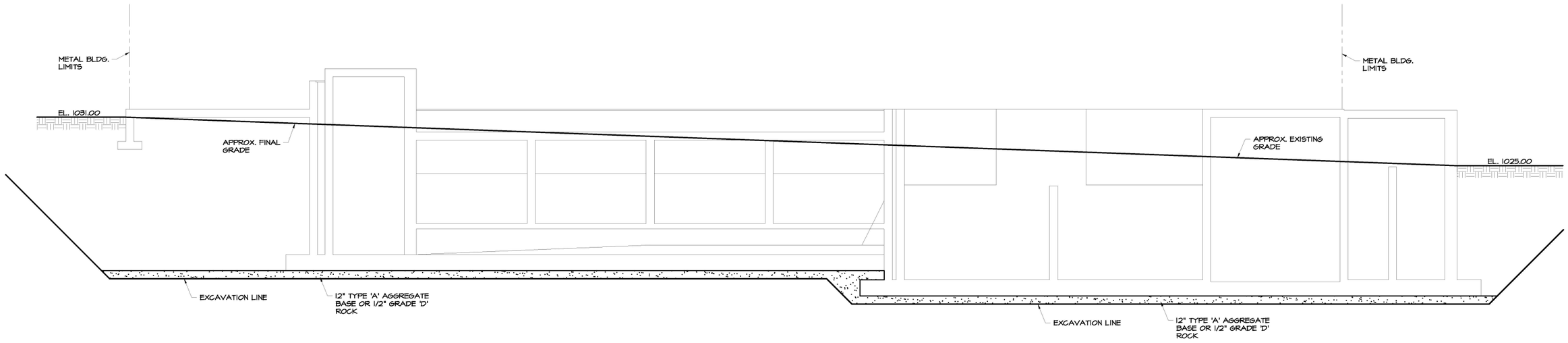
Scale: As Shown | Detail: GPM
Date: 2020 | Check: JRU

TREATMENT PROCESS BUILDING
CHEMICAL FEED, PLANT WATER & AIR PIPING PLAN

Proj. No. 19SHAWWTP
Sht. No. 22



1/23 LONGITUDINAL SECTION
SCALE: 5/32" = 1'-0"



2/23 EXCAVATION SECTION
SCALE: 5/32" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

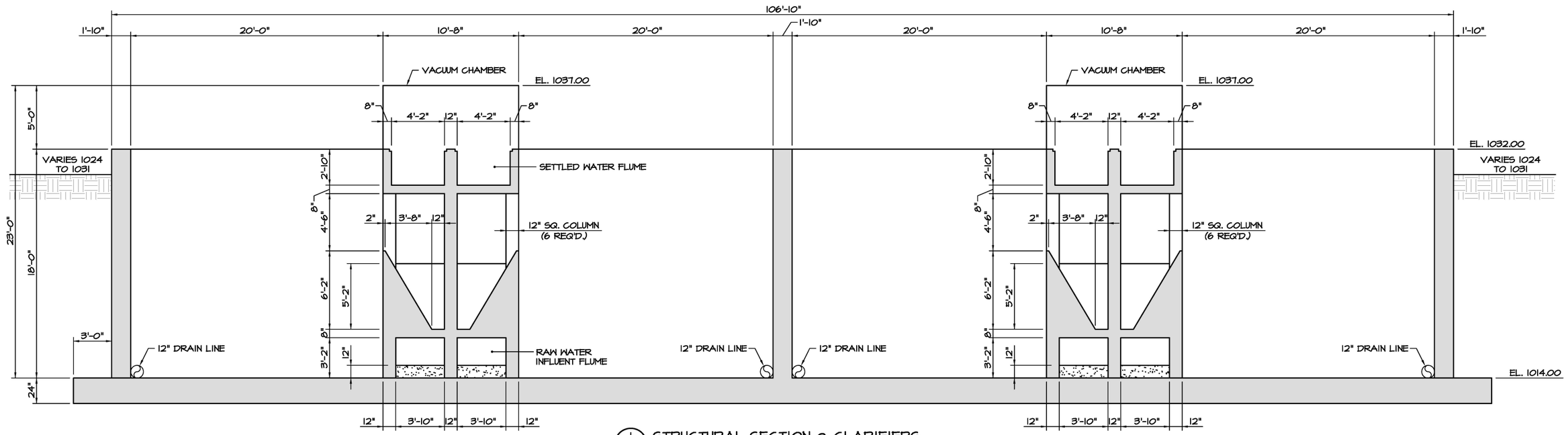
Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

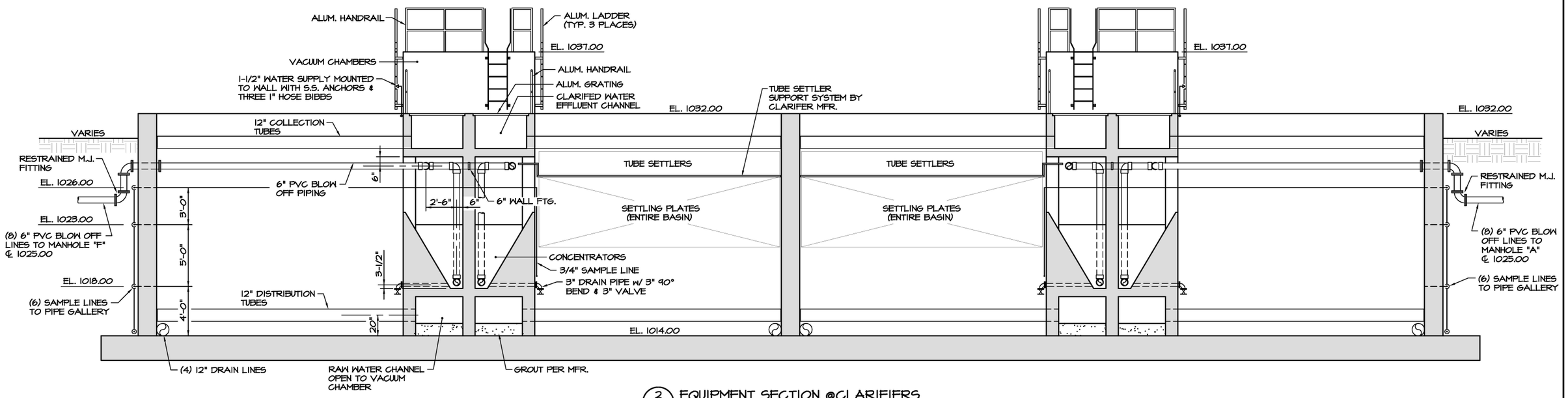
Scale: As Shown | Detail: GPM
Date: 2020 | Check: JRU

TREATMENT PROCESS BUILDING SECTIONS

Proj. No. 19SHAWWTP
Sht. No. 23



1/24 STRUCTURAL SECTION @ CLARIFIERS
SCALE: 1/4" = 1'-0"



2/24 EQUIPMENT SECTION @CLARIFIERS
SCALE: 1/4" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

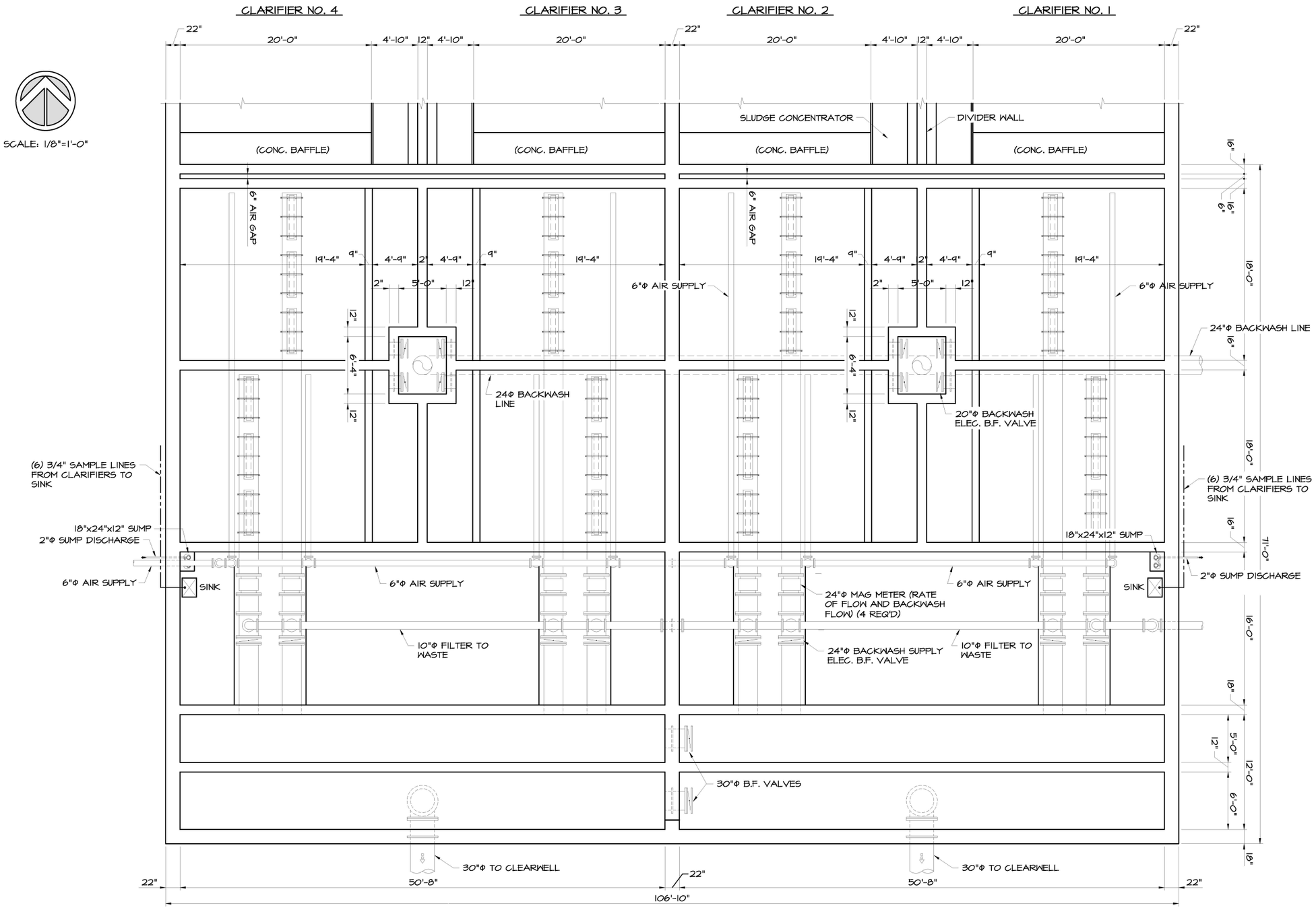
WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: GPM
Date: 2020 | Check: JRU

TREATMENT PROCESS BUILDING SECTIONS @CLARIFIERS

Proj. No. 19SHAWWTP
Sht. No. 24

SCALE: 1/8"=1'-0"



3/25 LOWER LEVEL PLAN
SCALE: 1/8" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

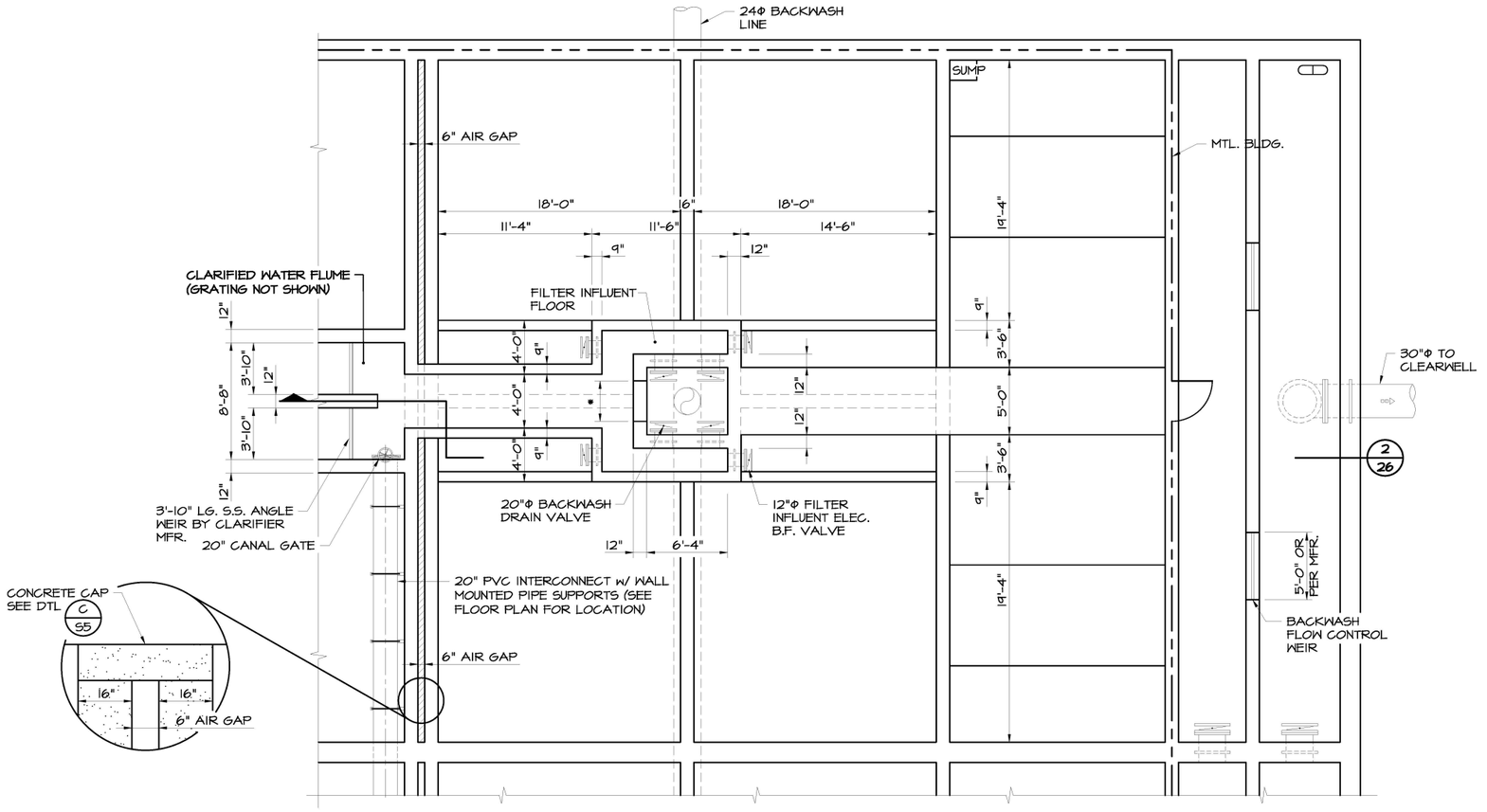
Holloway, Updike and Bellen, Inc.
515 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7861

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: GPM
Date: 2020 | Check: JRU

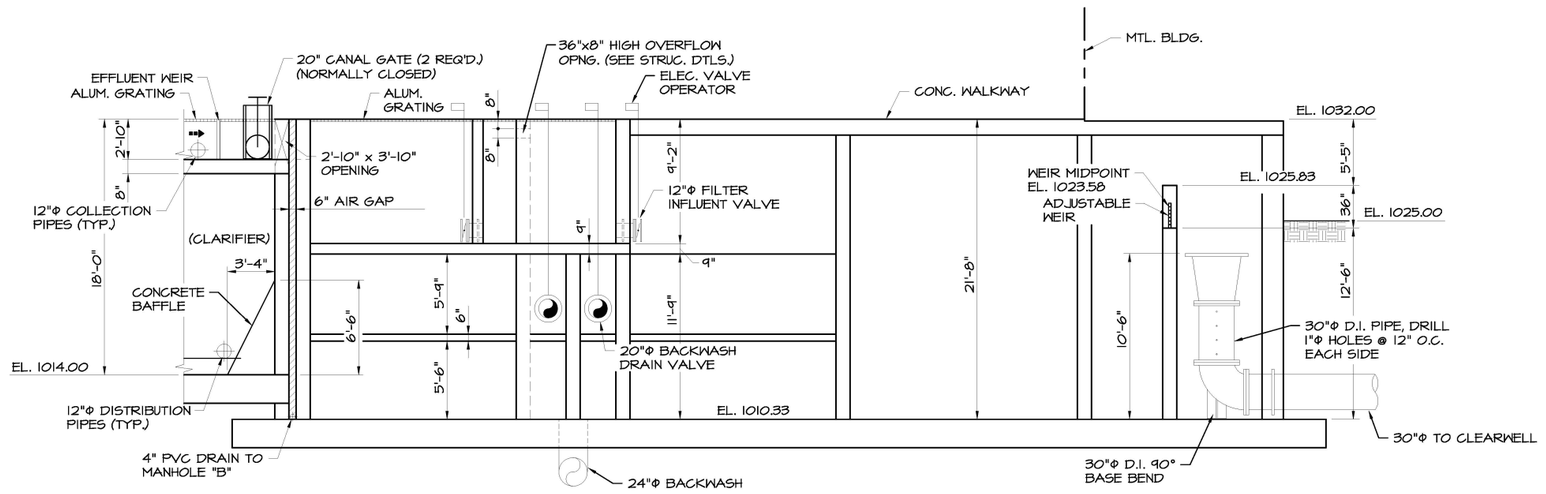
TREATMENT PROCESS BUILDING
FILTER PLAN @ EL. 1028.00

Proj. No. 19SHAWTP
Sht. No. 25

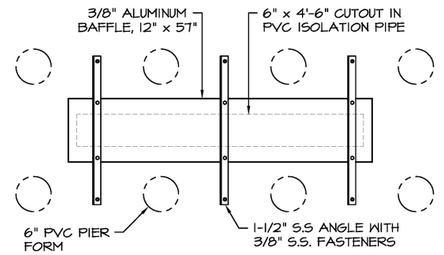


* OVERFLOW OPENING SEE STRUCTURAL

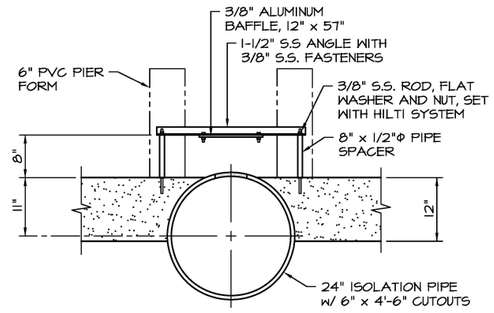
1/26 PLAN @ FILTERS
SCALE: 1/8" = 1'-0"



2/26 SECTION
SCALE: 1/8" = 1'-0"



PLAN



SECTION

A/26 ALUMINUM BAFFLE DETAIL
SCALE: NONE

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

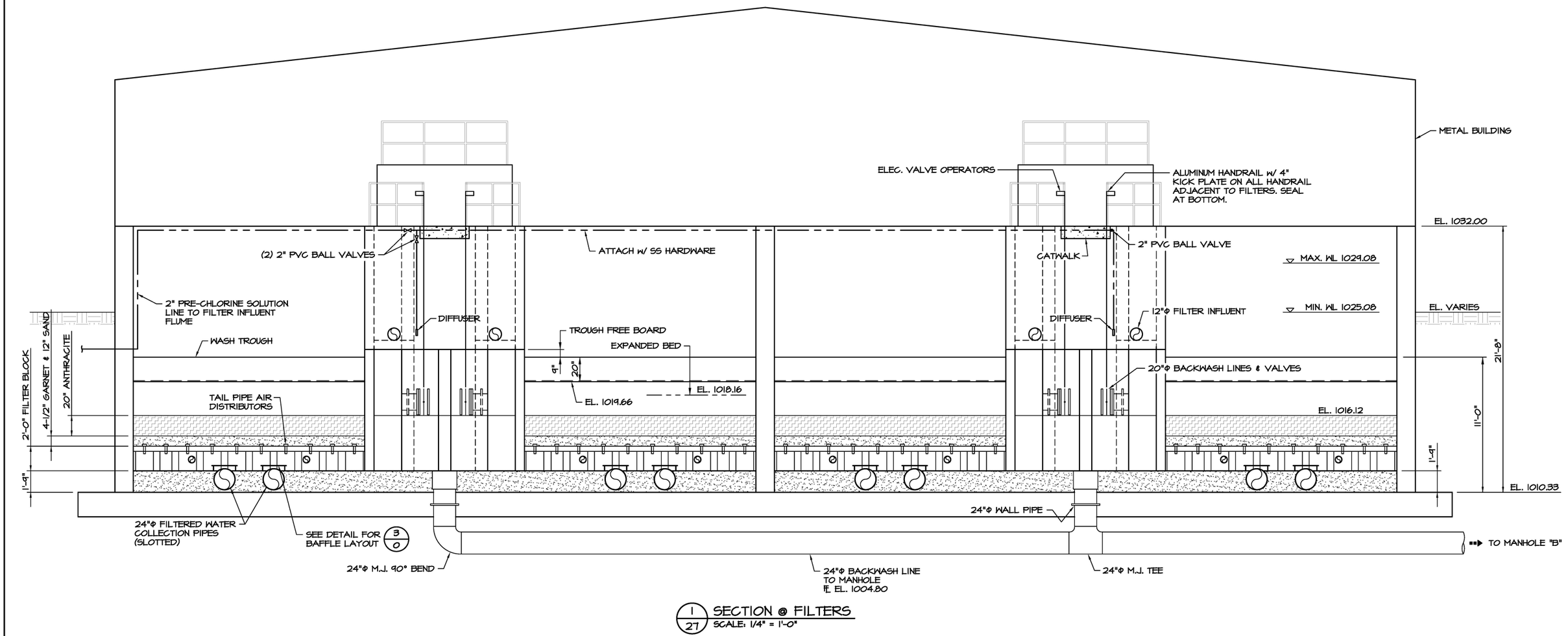
Holloway, Updike and Bellen, Inc.
515 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: GPM
Date: 2020	Check: JRU

TREATMENT PROCESS BUILDING
FILTER PLAN AND SECTIONS

Proj. No. 19SHAWWTP
Sht. No. 26



1/27 SECTION @ FILTERS
SCALE: 1/4" = 1'-0"

NOTES:

SPACING OF 24" BACKWASH / EFFLUENT LINES AND 6" AIR WASH LINES INTO FILTER MAY VARY FROM DRAWINGS BASED ON LAYOUT OF FILTER BOTTOMS BY FILTER MANUFACTURER. CONTRACTOR TO VERIFY REQUIRED SPACING AND MODIFY PIPING ACCORDINGLY.

BAR IS ONE INCH ON ORIGINAL DRAWING — IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

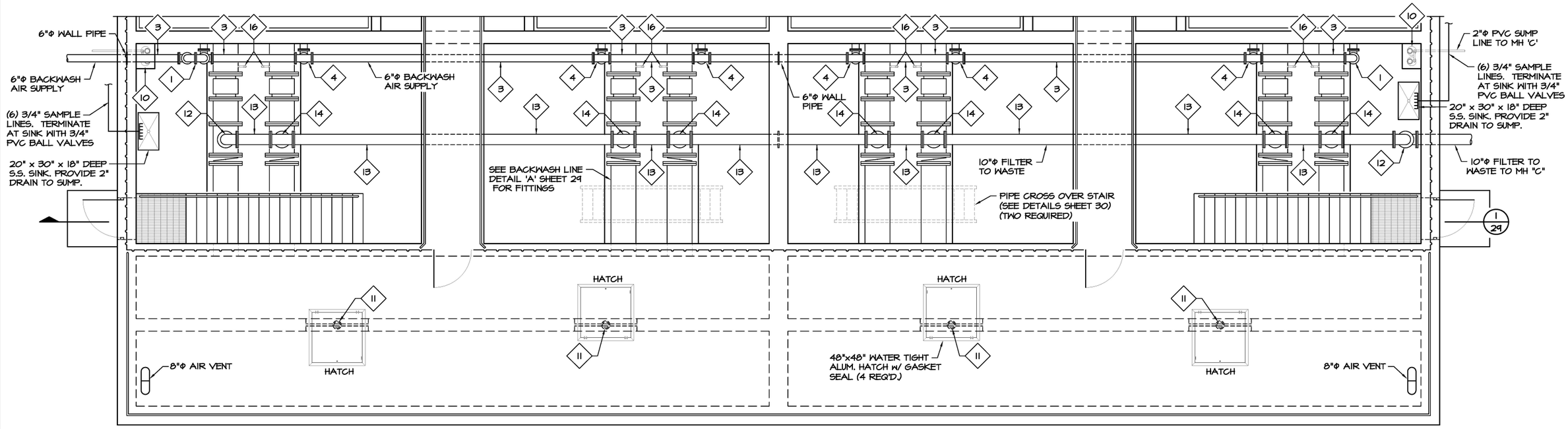
Holloway, Updike and Bellen, Inc.
515 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7861

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: GPM
Date: 2020 | Check: JRU

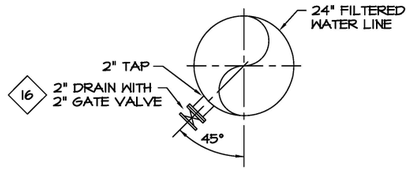
TREATMENT PROCESS
SECTION @ FILTERS

Proj. No. 19SHAWWTP
Sht. No. 27

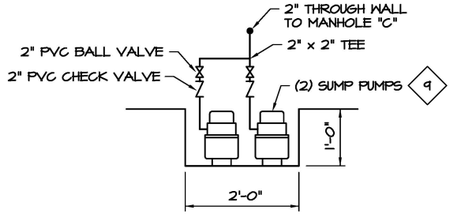


1/28 PLAN @ PIPE GALLERY
SCALE: 1/4" = 1'-0"

PIPING LEGEND	
◇	DESCRIPTION
	6" AIR PIPING LINES
1	6" 90° BEND FLxFL
2	6" BUTTERFLY VALVE FLxFL w/ ELEC. OPERATOR
3	6" SPOOL PIECE FLxFL
4	6" x 6" TEE FLxFL
	24" BACKWASH LINE
5	24" x 10" TEE FLxFL
6	24" BUTTERFLY VALVE FLxFL w/ ELECTRIC OPERATOR
7	24" SPOOL PIECE FLxFL
8	24" MAGNETIC METER FLxFL
	SUMP
9	(2) 20 GPM SUMP PUMPS w/ 2" GATE VALVE AND CHECK VALVE IN LINE
10	2" PVC SUMP PUMP DISCHARGE
	WEIR
11	VALVE BOX FOR WEIR ADJUSTMENT
	10" FILTER TO WASTE
12	10" 90° BEND FLxFL
13	10" SPOOL PIECE FLxFL
14	10" x 10" TEE FLxFL
15	10" BUTTERFLY VALVE w/ ELEC. OPERATOR
	2" FILTER DRAIN
16	2" TAP w/ 90° BEND AND 2" GATE VALVE (FILTER DRAINS)



A/28 FILTER DRAIN DETAIL
SCALE: NONE



B/28 SUMP PUMP DETAIL
SCALE: NONE

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

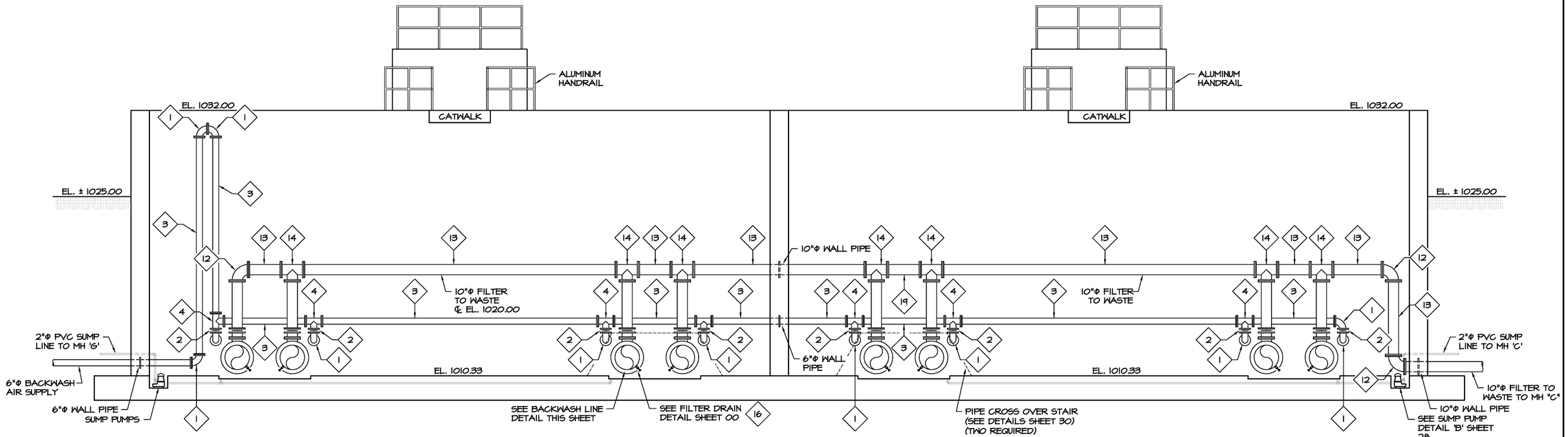
Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

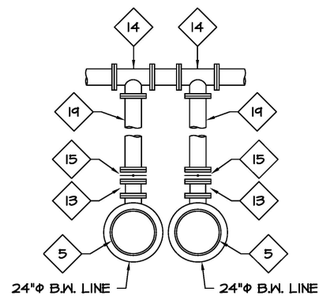
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Date: 2020 | Check: JRU

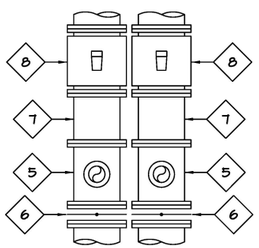
TREATMENT PROCESS BUILDING
PIPE GALLERY PLAN AND DETAILS

Proj. No. 19SHAWWTP
Sht. No. 28



1/29 SECTION @ PIPE GALLERY
SCALE: 1/4" = 1'-0"





A/29 BACKWASH LINE DETAIL
SCALE: NONE

PIPING LEGEND	
◇	DESCRIPTION
	6" AIR PIPING LINES
1	6" 90° BEND FLxFL
2	6" BUTTERFLY VALVE FLxFL W/ ELEC. OPERATOR
3	6" SPOOL PIECE FLxFL
4	6" x 6" TEE FLxFL
	24" BACKWASH LINE
5	24" x 10" TEE FLxFL
6	24" BUTTERFLY VALVE FLxFL W/ ELECTRIC OPERATOR
7	24" SPOOL PIECE FLxFL
8	24" MAGNETIC METER FLxFL
	SUMP
9	(2) 20 GPM SUMP PUMPS W/ 2" GATE VALVE AND CHECK VALVE IN LINE
10	2" PVC SUMP PUMP DISCHARGE
	WEIR
11	VALVE BOX FOR WEIR ADJUSTMENT
	10" FILTER TO WASTE
18	10" 90° BEND FLxFL
19	10" SPOOL PIECE FLxFL
14	10" x 10" TEE FLxFL
15	10" BUTTERFLY VALVE W/ ELEC. OPERATOR
	2" FILTER DRAIN
16	2" TAP W/ 90° BEND AND 2" GATE VALVE (FILTER DRAINS)

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

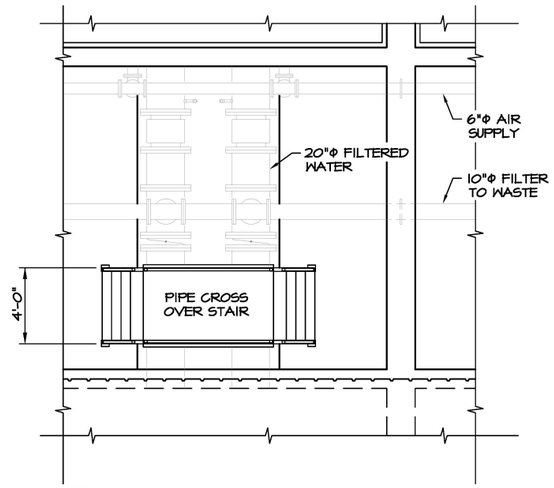
Holloway, Updike and Bellen, Inc.
515 EAST SIXTH BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7861

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

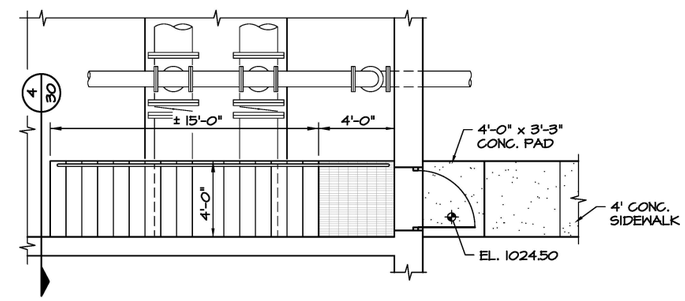
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Date: 2020 | Check: JRU

TREATMENT PROCESS BUILDING
PIPE GALLERY SECTION AND DETAILS

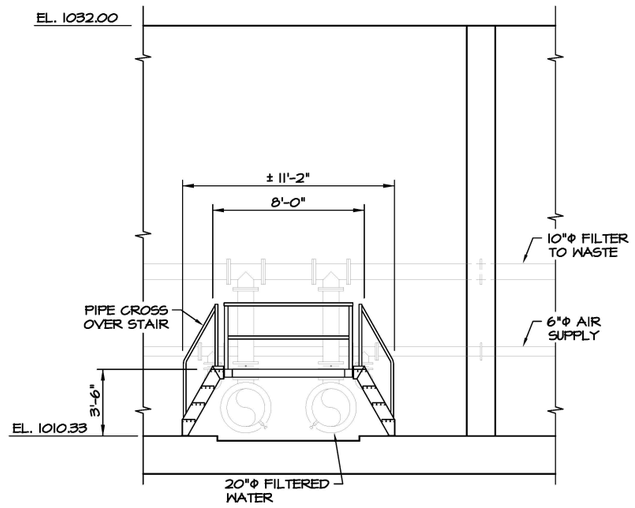
Proj. No. 19SHAWWTP
Sht. No. 29



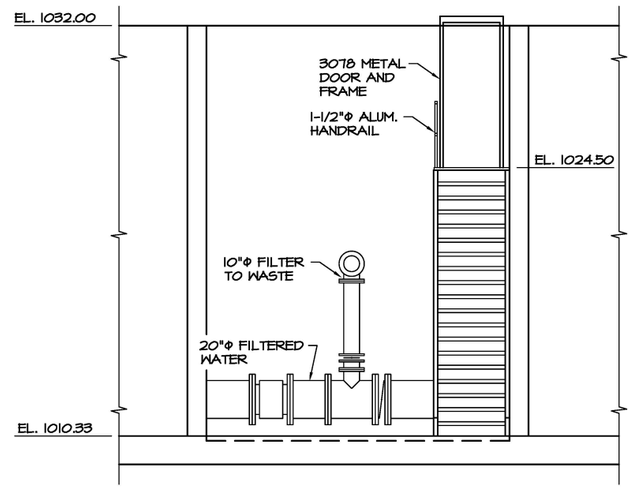
1/30 PLAN @ PIPE CROSS OVER STAIR (TYPICAL OF TWO)
SCALE: 1/4" = 1'-0"



3/30 PLAN @ PIPE GALLERY STAIRWAY (TYPICAL OF TWO)
SCALE: 1/4" = 1'-0"



2/30 ELEVATION @ PIPE CROSS OVER STAIR
SCALE: 1/4" = 1'-0"



4/30 SECTION @ PIPE GALLERY STAIRWAY
SCALE: 1/4" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

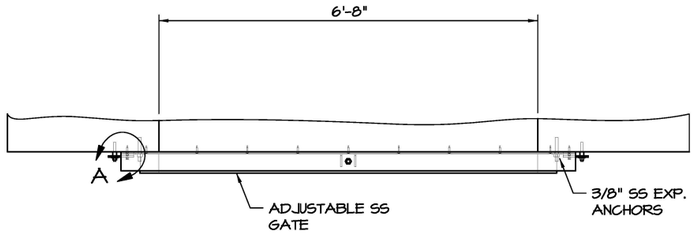
Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

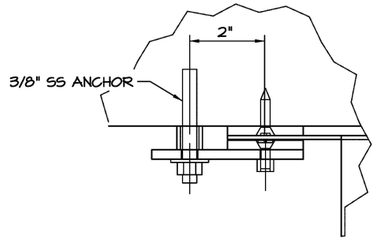
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Date: 2020 | Check: JRU

TREATMENT PROCESS
PIPE GALLERY STAIR PLAN & SECTION

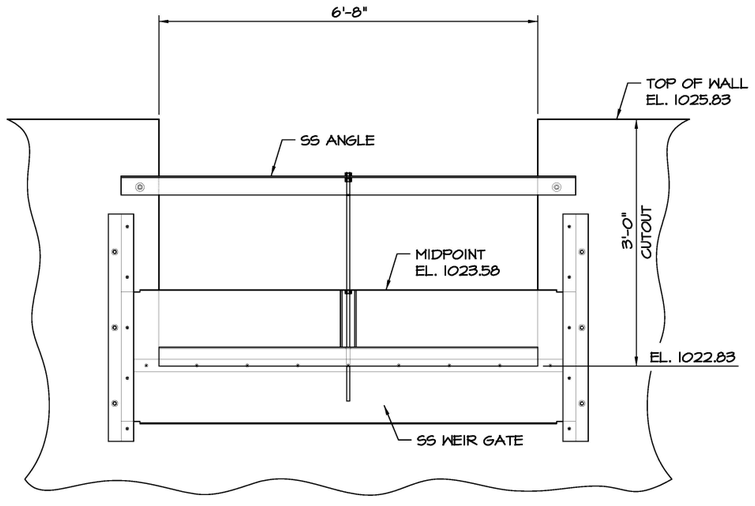
Proj. No. 19SHAWWTP
Sht. No. 30



2/31 BACKWASH CONTROL WEIR PLAN
SCALE: NONE

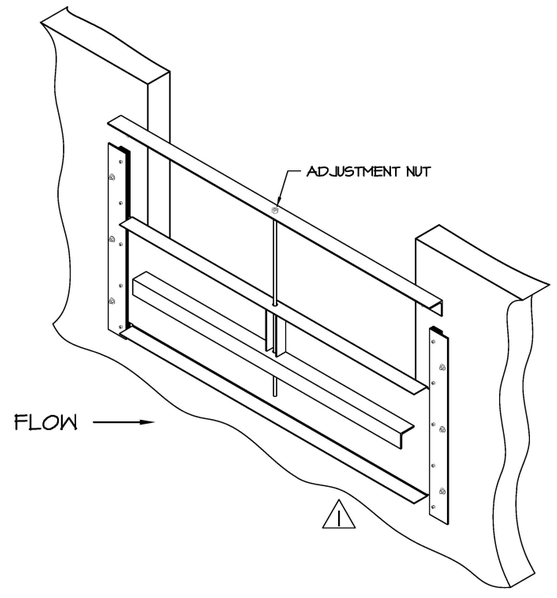


3/31 DETAIL A
SCALE: NONE



2/31 BACKWASH CONTROL WEIR ELEVATION (4 REQUIRED)
SCALE: NONE

NOTE:
FINAL SIZE AND LOCATION OF WEIRS TO BE DETERMINED BY FILTER MFR.



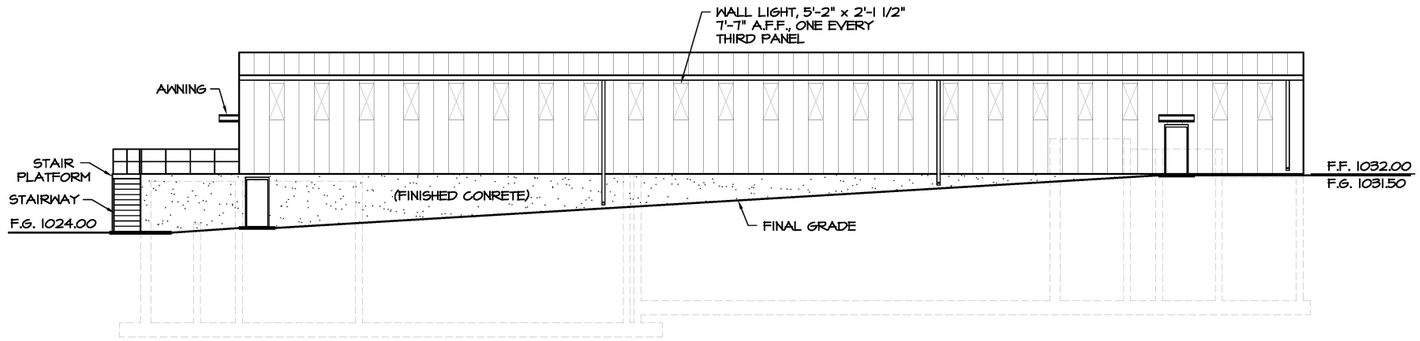
3/31 BACKWASH CONTROL WEIR ISOMETRIC
SCALE: NONE

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

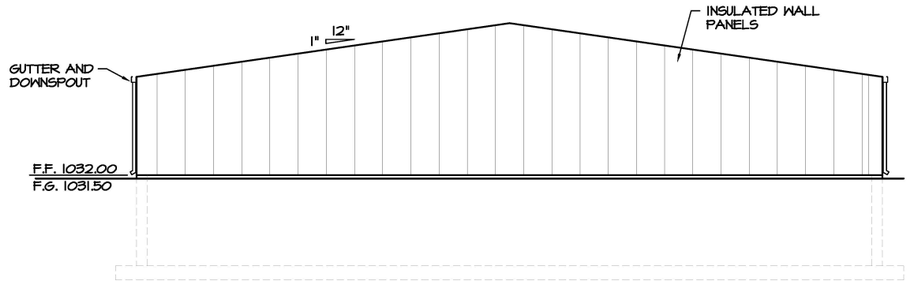
Holloway, Updike and Bellen, Inc.
ENGINEERS
818 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

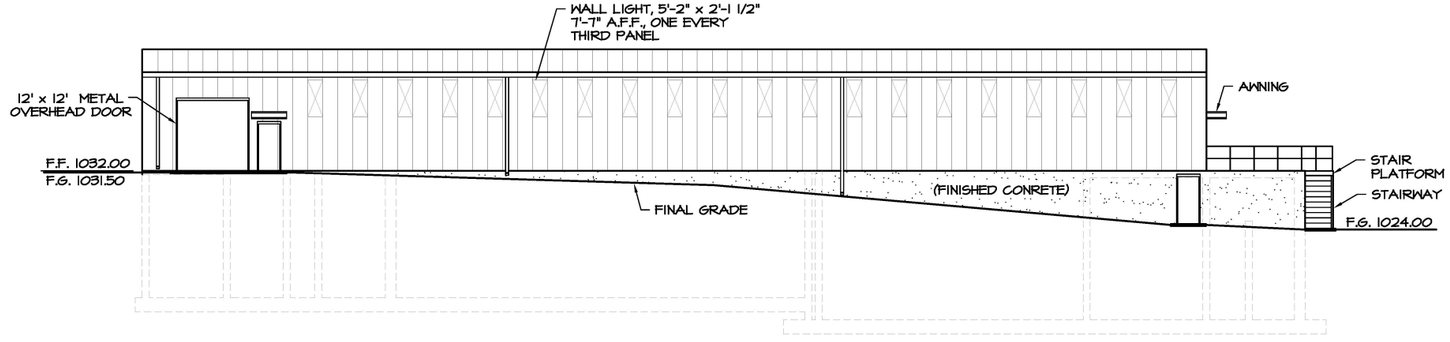
Scale: As Shown	Detail: GPM	TREATMENT PROCESS EFFLUENT WEIR DETAILS	Proj. No. 19SHAWWTP
Date: 2020	Check: JRU		Sht. No. 31



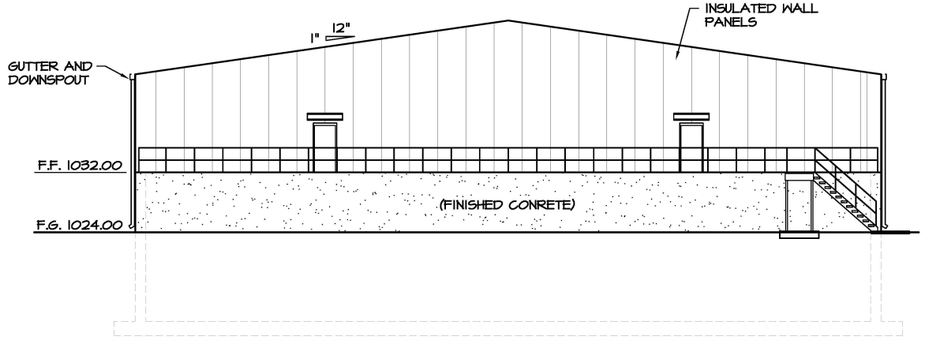
1/32 EAST ELEVATION
SCALE: 3/32" = 1'-0"



3/32 NORTH ELEVATION
SCALE: 3/32" = 1'-0"



2/32 WEST EAST ELEVATION
SCALE: 3/32" = 1'-0"



4/32 SOUTH ELEVATION
SCALE: 3/32" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Holloway, Updike and Bellen, Inc.
ENGINEERS
515 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

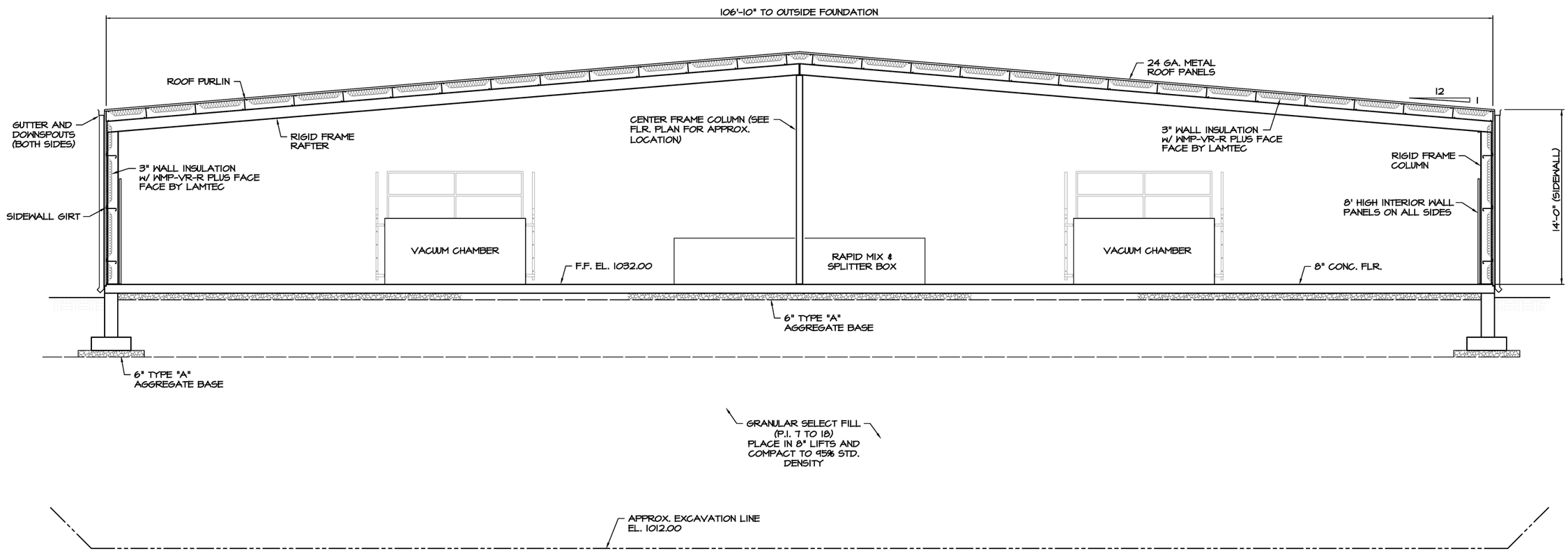
Shawnee

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

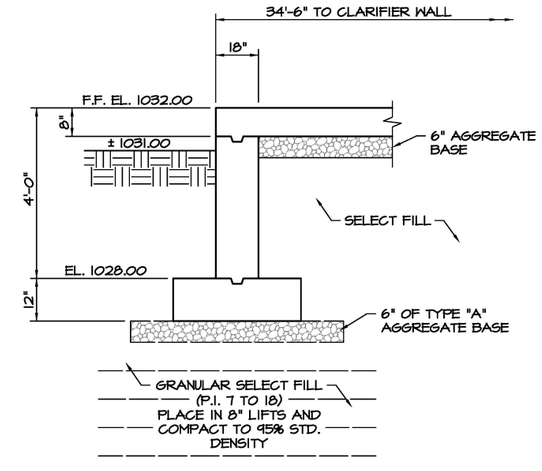
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Date: 2020	Check: JRU

TREATMENT PROCESS BUILDING
EXTERIOR ELEVATIONS

Proj. No. 19SHAWWTP
Sht. No. 32



1/33 SECTION @ NORTH END OF PROCESS BLDG.
SCALE: 1/4" = 1'-0"



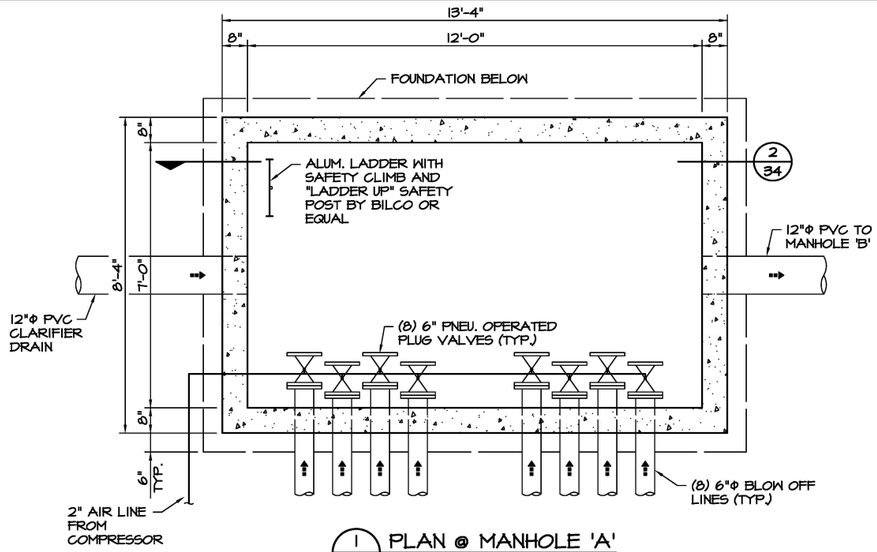
2/33 DETAIL - TYP. FOOTING IN SLAB AREA
SCALE: 3/8" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

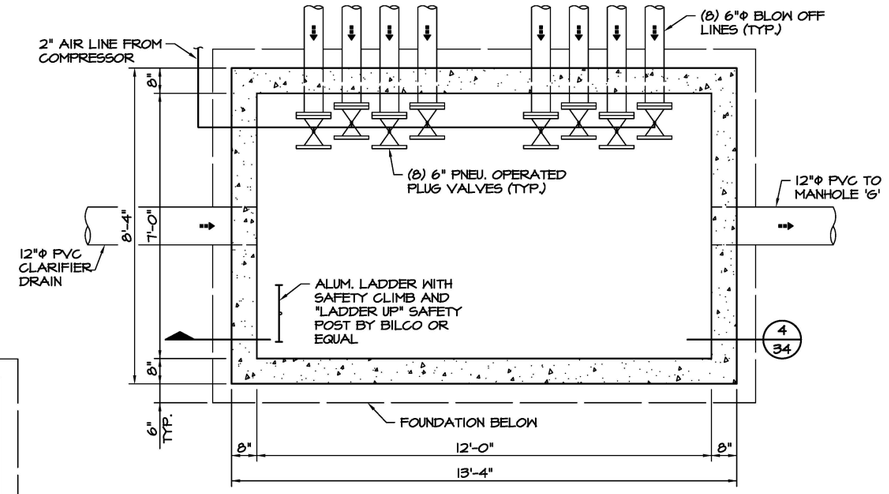
Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

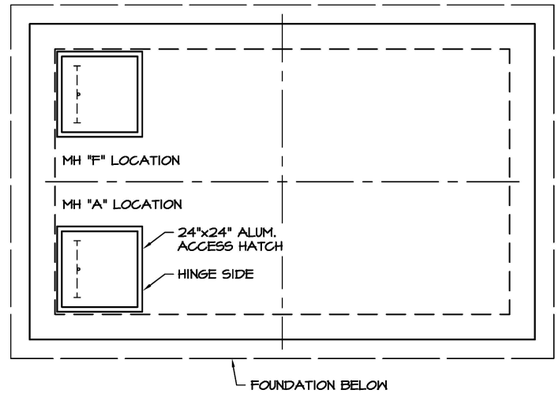
Scale: As Shown	Detail: GPM	TREATMENT PROCESS BUILDING BUILDING SECTION	Proj. No. 19SHAWWTP
Date: 2020	Check: JRU		Sht. No. 33



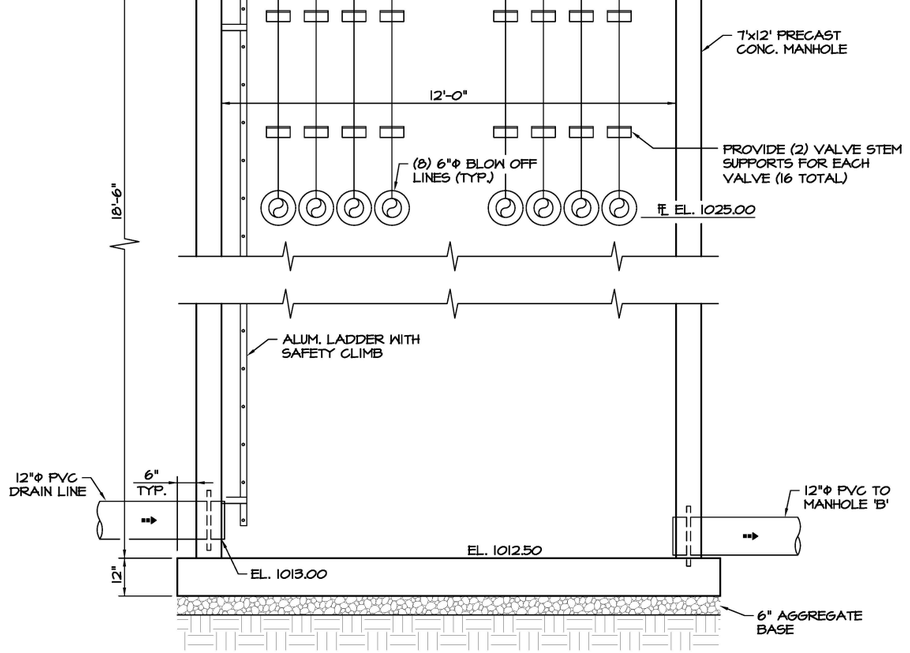
1/34 PLAN @ MANHOLE 'A'
SCALE: 1/2" = 1'-0"



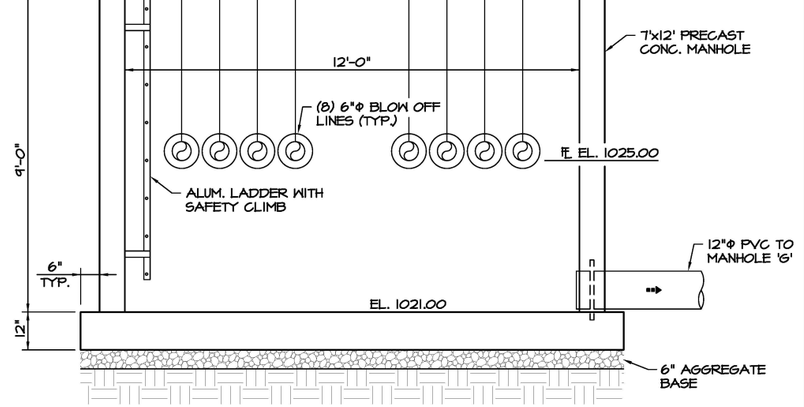
3/34 PLAN @ MANHOLE 'F'
SCALE: 1/2" = 1'-0"



3/34 TOP PLAN @ MANHOLE 'A' & 'F'
SCALE: 1/2" = 1'-0"



2/34 SECTION
SCALE: 1/2" = 1'-0"



4/34 SECTION
SCALE: 1/2" = 1'-0"

GENERAL NOTES:

1. ALL MANHOLES SHALL BE PRECAST CONCRETE PIPE OR POURED IN PLACE CLASS A CONCRETE.
2. PROVIDE 'A-LOK' GASKETS AT ALL PIPE PENETRATIONS.
3. PROVIDE TWO ROWS OF MASTIC AT PIPE JOINTS.
4. PROVIDE 6" AGGREGATE BASE UNDER ALL MANHOLES.
5. PROVIDE STD. 300 LB. RING AND COVER FOR MANHOLES UNLESS OTHERWISE SHOWN

MANHOLE SCHEDULE

MH #	INSIDE DIAMETER	TOP EL.	BOTTOM EL.	INVERT EL. FROM PROCESSES
A	7'-0"x12'-0"	1031.50	1012.50	DRAIN, BLOWOFF
B	5'-0"	1029.00	24" 1004.50 IN, 1004.50 OUT 12" 1012.00 IN	24" BACKWASH
C	5'-0"	1022.67	1004.20	FILTER TO WASTE
F	7'-0"x12'-0"	1030.00	1021.00	DRAIN, BLOWOFF

BAR IS ONE INCH ON ORIGINAL DRAWING — IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

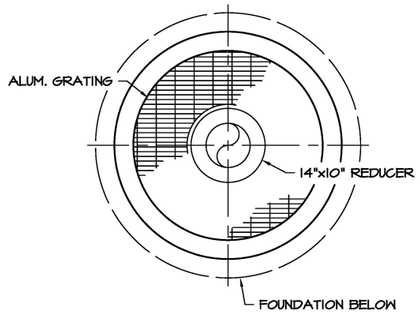
Holloway, Updike and Bellen, Inc.
ENGINEERS
815 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

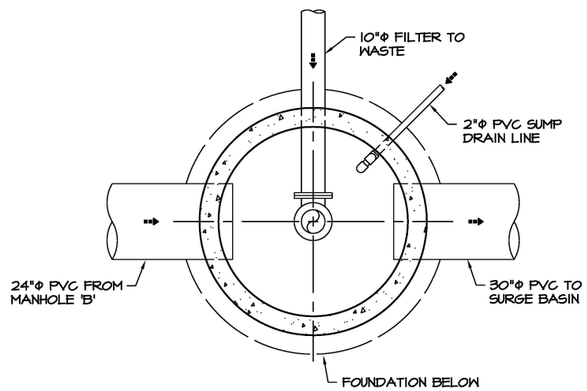
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Date: 2020 | Check: JRU

TREATMENT PROCESS BUILDING
DRAIN SYSTEM MANHOLES

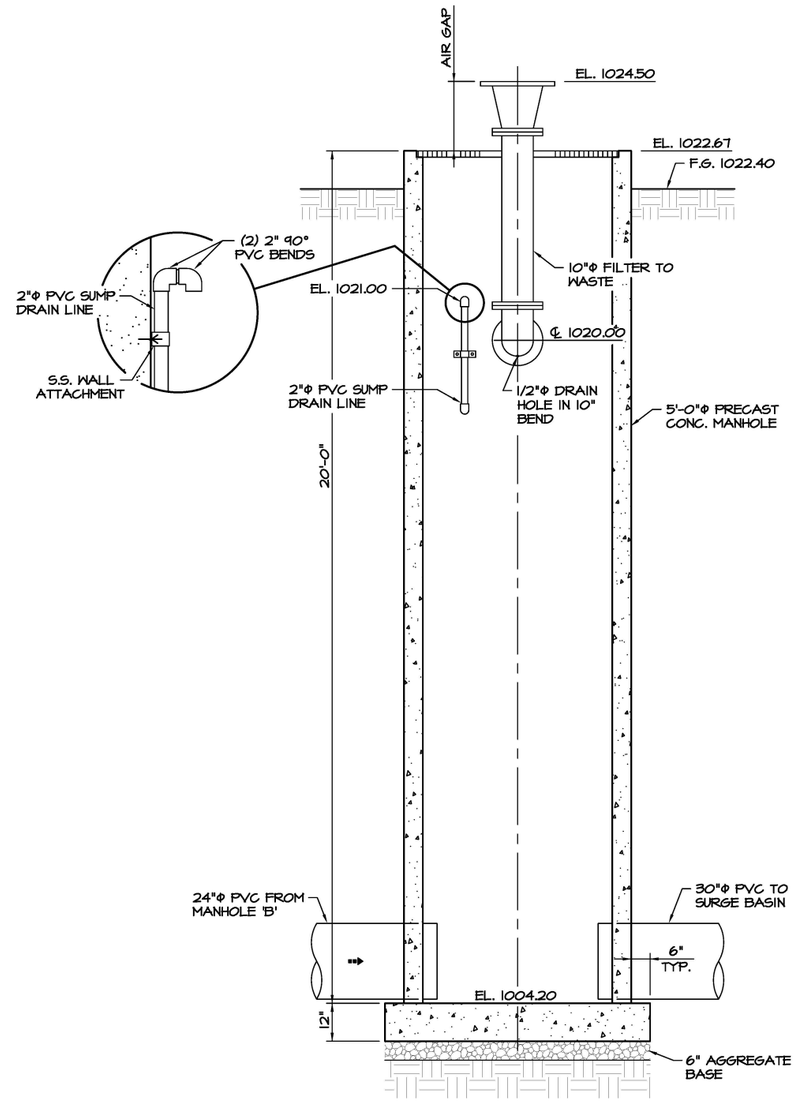
Proj. No. 19SHAWWTP
Sht. No. 34



1/35 TOP PLAN @ MANHOLE 'C'
SCALE: 1/2" = 1'-0"



2/35 LOWER PLAN @ MANHOLE 'C'
SCALE: 1/2" = 1'-0"



3/35 SECTION @ MANHOLE 'C'
SCALE: 1/2" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

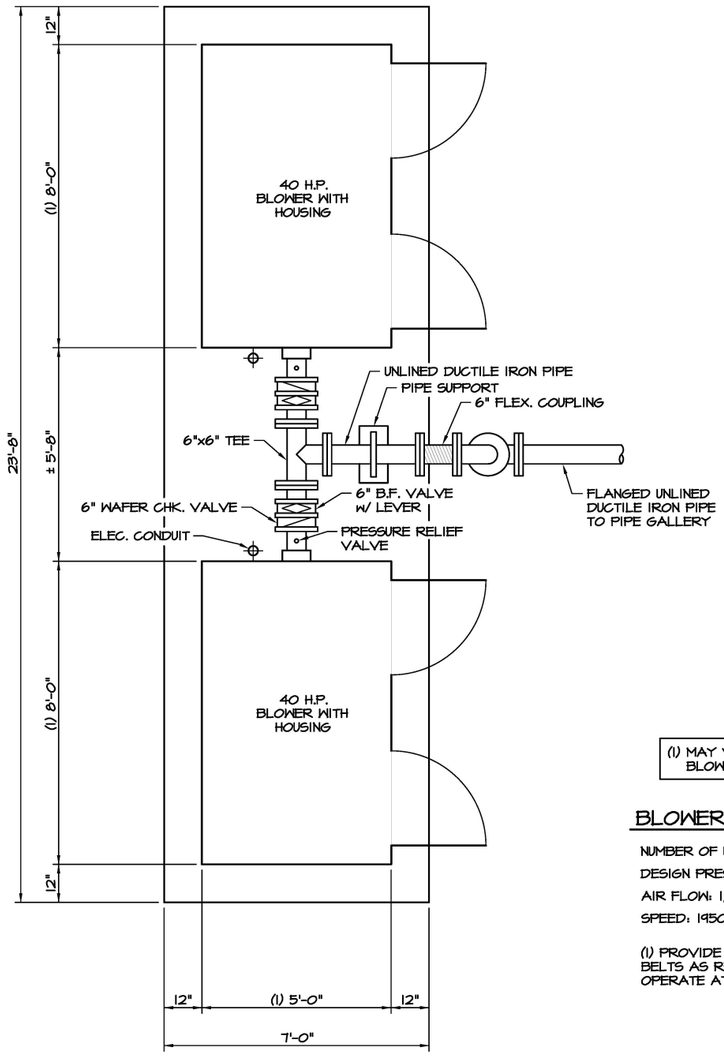
Holloway, Updike and Bellen, Inc.
515 EAST 3RD BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

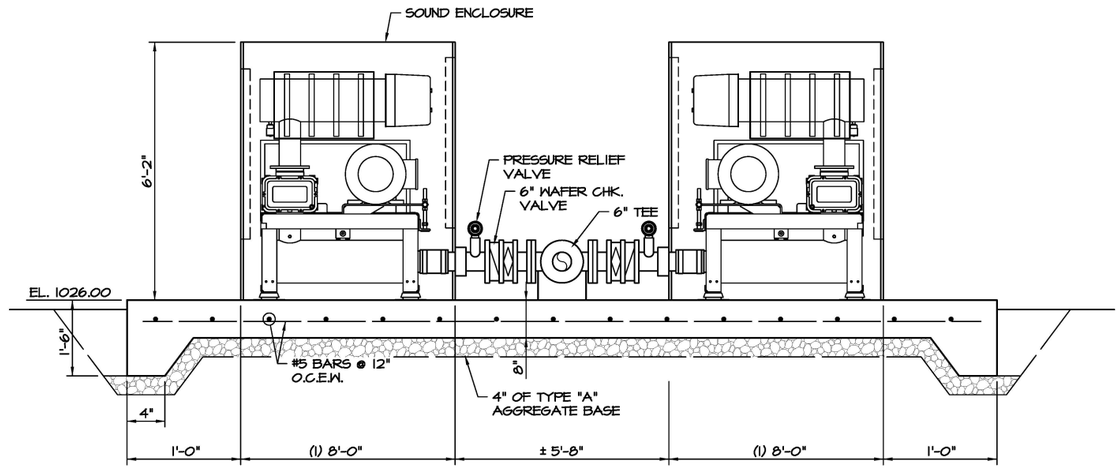
Scale: As Shown	Detail: GPM
Date: 2020	Check: JRU

TREATMENT PROCESS BUILDING
DRAIN SYSTEM MANHOLES

Proj. No. 19SHAWWTP
Sht. No. 35



1/36 PLAN @ AIR BLOWER
SCALE: NONE



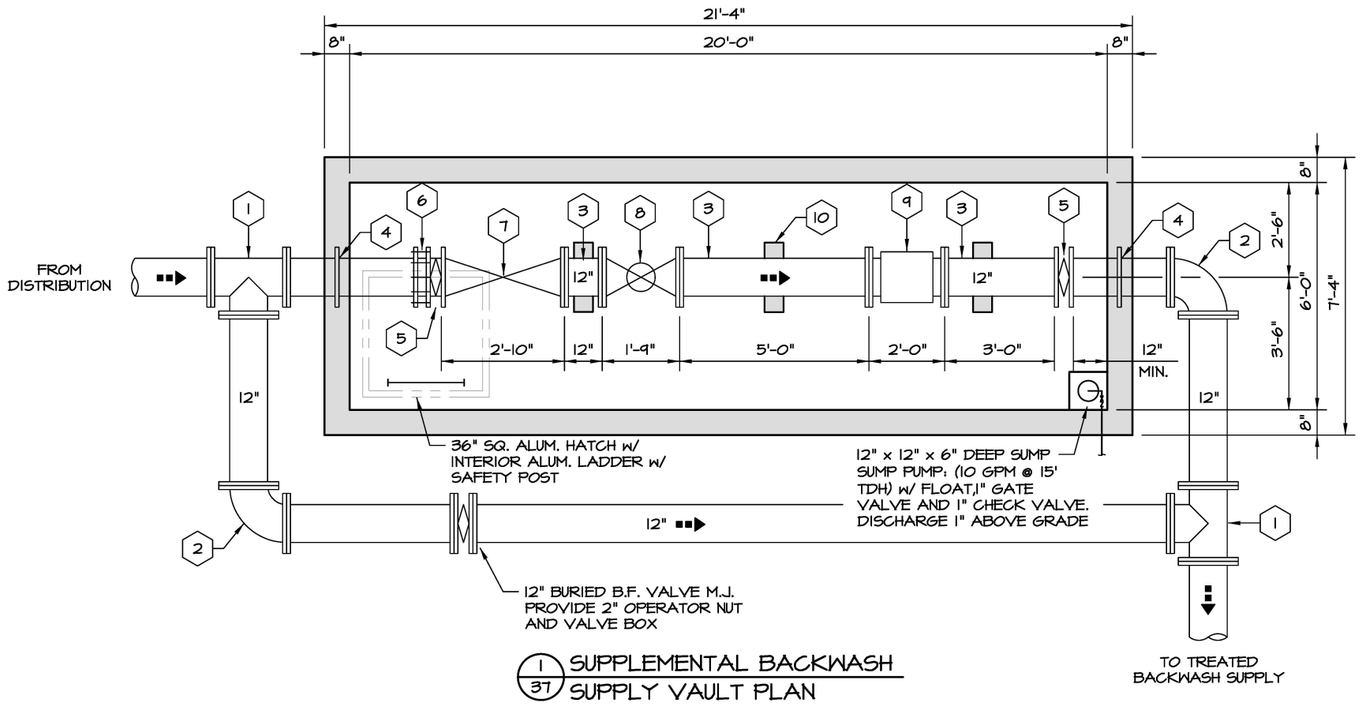
2/36 BLOWER ELEVATION
SCALE: NONE

(1) MAY VARY WITH BLOWER MFR.

BLOWER DATA

NUMBER OF UNITS: 2
DESIGN PRESSURE: 4.5 PSI
AIR FLOW: 1,040 SCMF (1)
SPEED: 1950 RPM

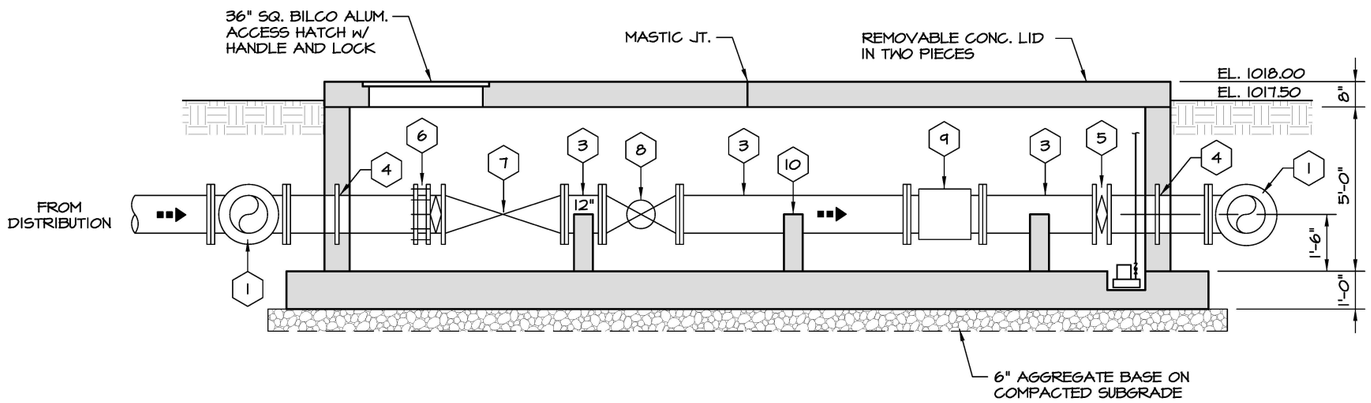
(1) PROVIDE SHIMS AND BELTS AS REQUIRED TO OPERATE AT 750 SCMF



1/37 SUPPLEMENTAL BACKWASH SUPPLY VAULT PLAN

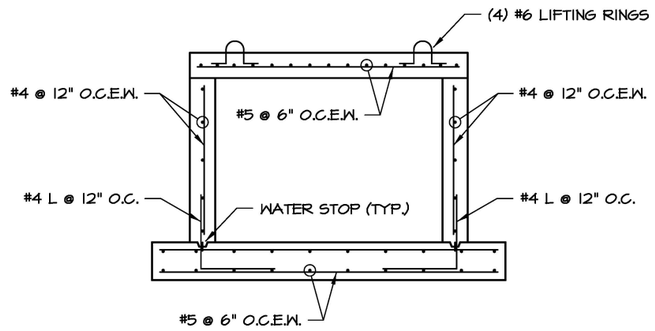
SCALE: 1/2" = 1'-0"

EQUIPMENT SCHEDULE	
MARK	DESCRIPTION
1	12" X 12" TEE MJxMJ
2	12" 90° BEND FLxFL
3	12" SPOOL PC. FLxFL
4	12" WALL PIPE PExPE
5	12" B.F. VALVE w/ HANDWHEEL OPERATOR
6	COUPLING ADAPTER
7	12" PRESSURE REDUCING VALVE FLxFL
8	12" BALL VALVE w/ ELEC. OPERATOR
9	12" MAGNETIC METER FLxFL
10	CONCRETE PIPE SUPPORT (3 REQ'D.)



2/37 SUPPLEMENTAL BACKWASH SUPPLY VAULT SECTION

SCALE: 1/2" = 1'-0"



3/37 REINFORCING SECTION

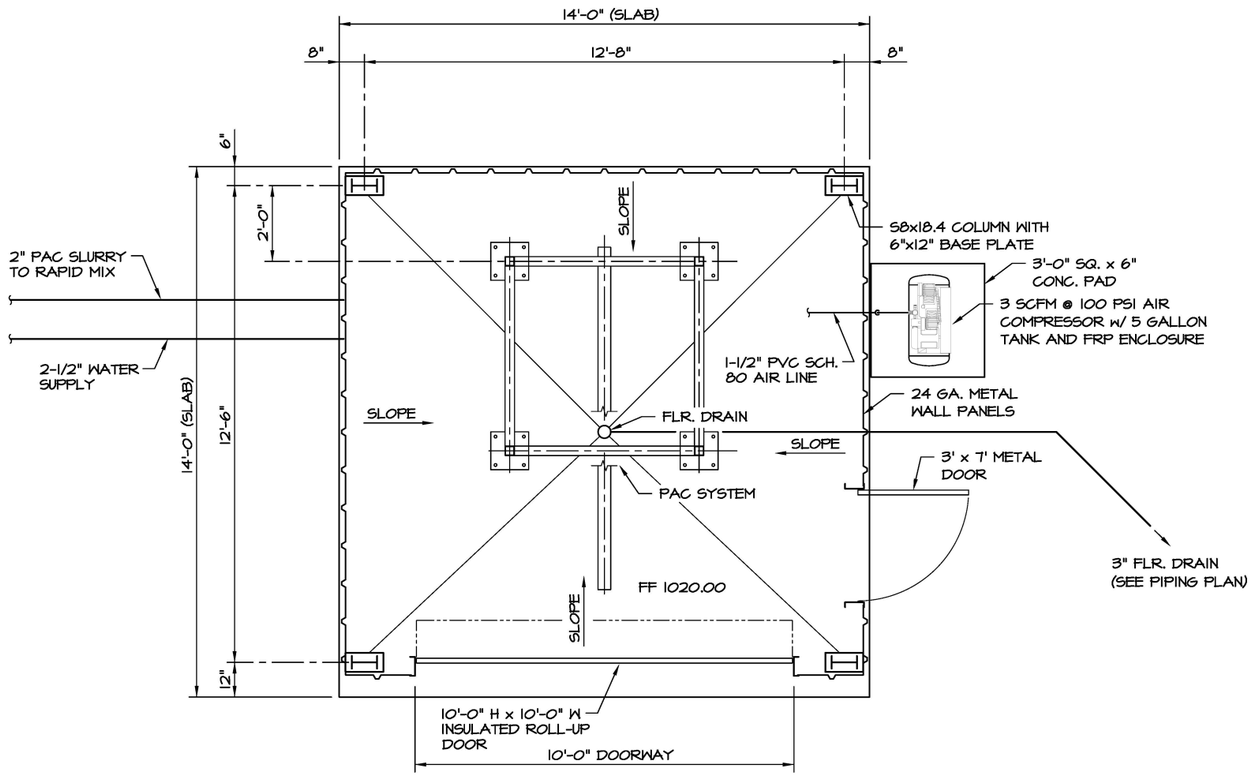
SCALE: 1/2" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

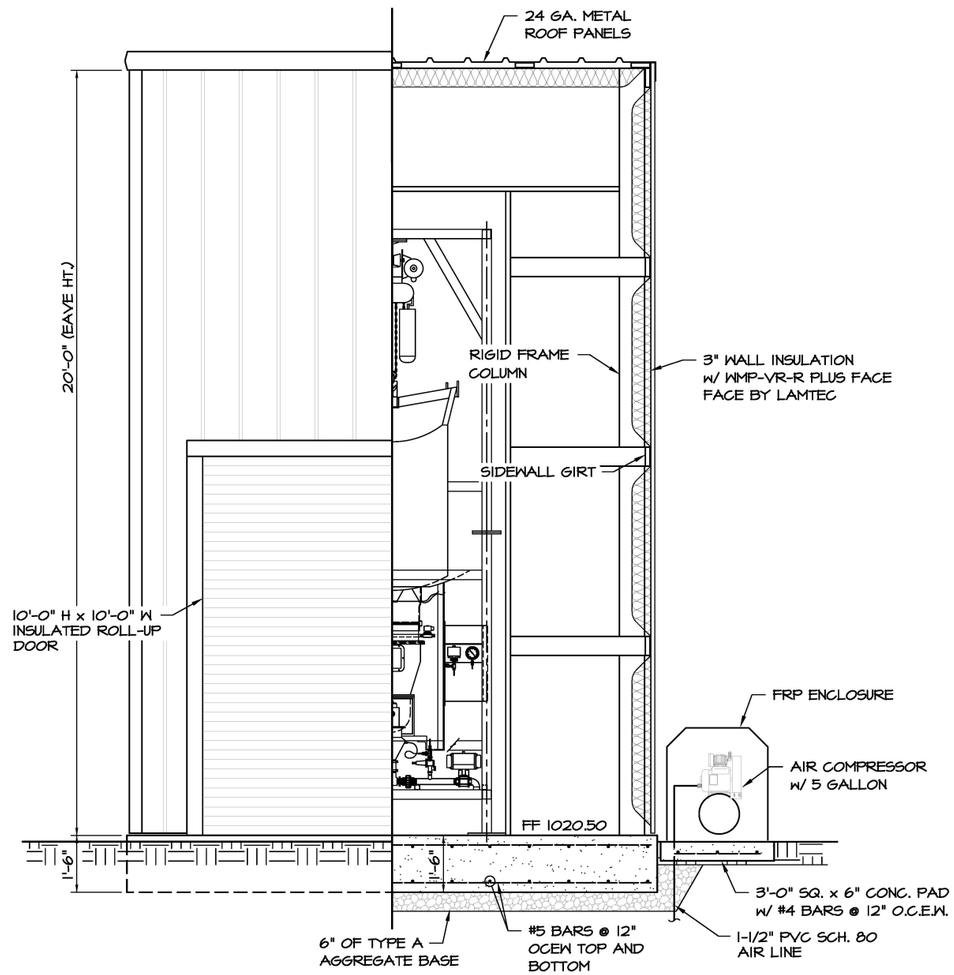
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: GPM	BACKWASH SUPPLEMENTAL SUPPLY VAULT	Proj. No. 19SHAWWTP
Date: 2020	Check: JRU	.	Sht. No. 37



1/38 PAC ENCLOSURE PLAN
SCALE: 1/2"=1'-0"



2/38 PAC ENCLOSURE SECTION
SCALE: 1/2"=1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

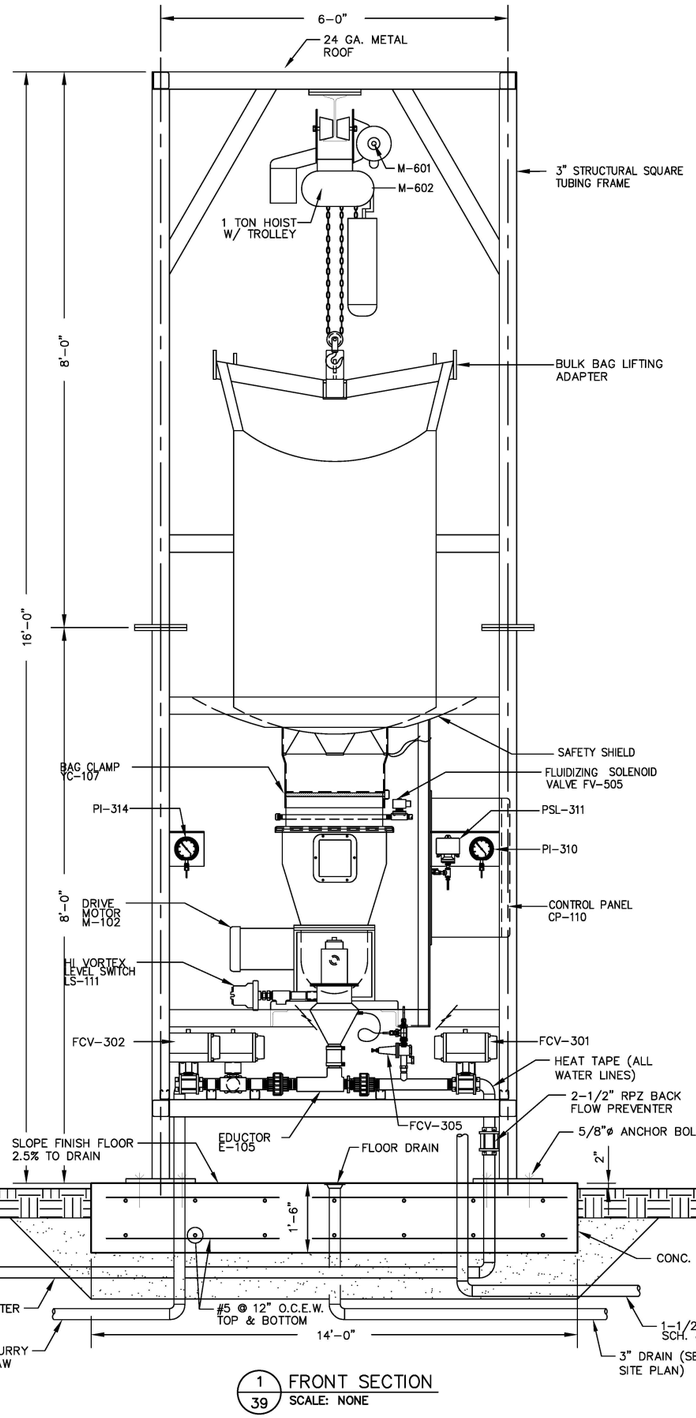
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

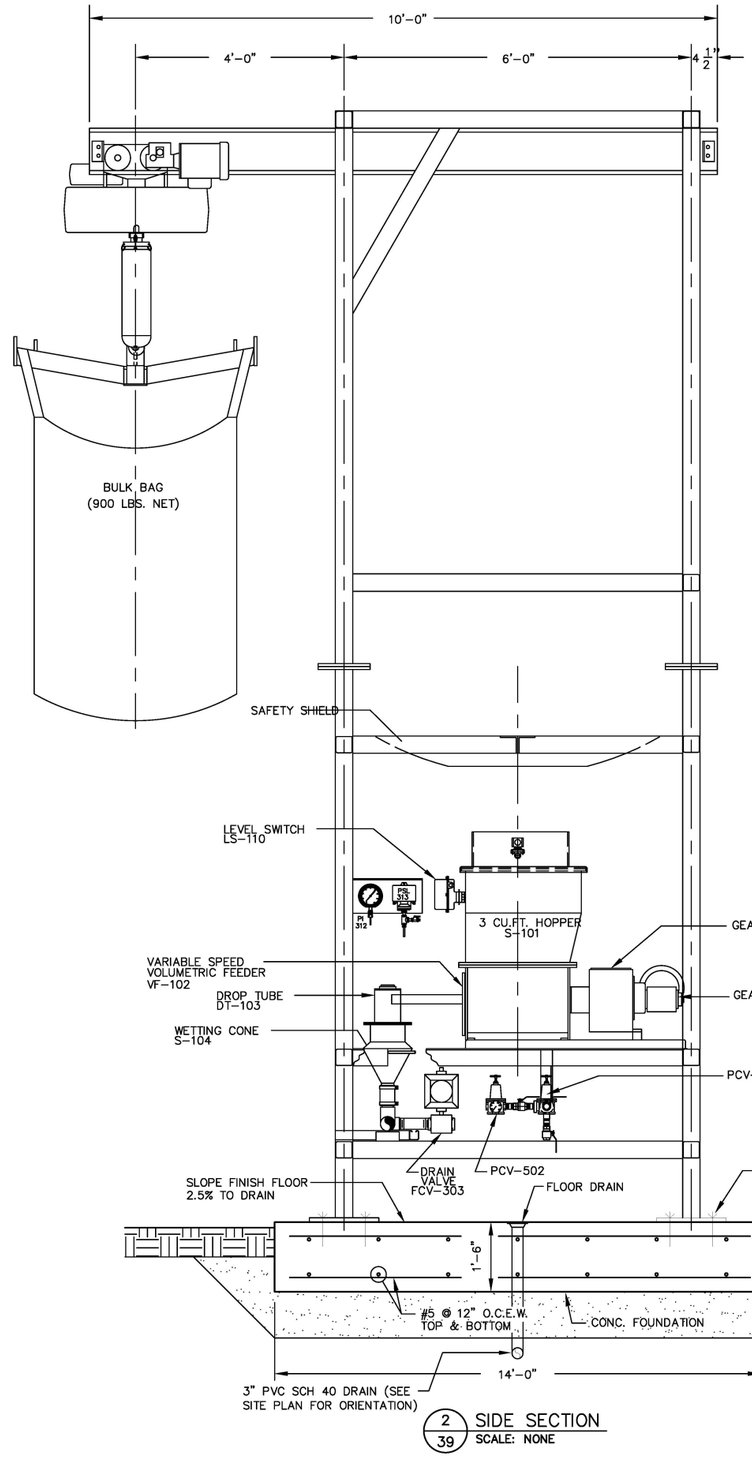
Scale: As Shown | Detail: GPM
Date: 2020 | Check: JRU

TREATMENT PROCESS
PAC ENCLOSURE PLAN AND SECTION

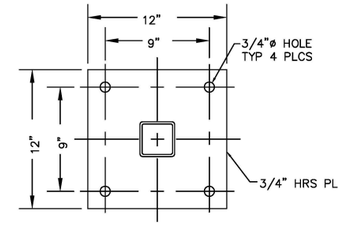
Proj. No. 19SHAWWTP
Sht. No. 38



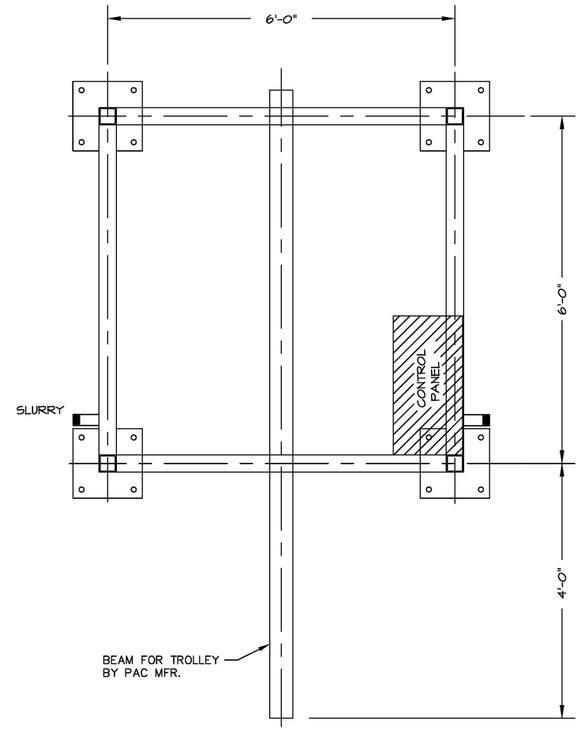
1/39 FRONT SECTION
SCALE: NONE



2/39 SIDE SECTION
SCALE: NONE



BASE PLATE DETAIL



3/39 BASE LAYOUT
SCALE: NONE

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

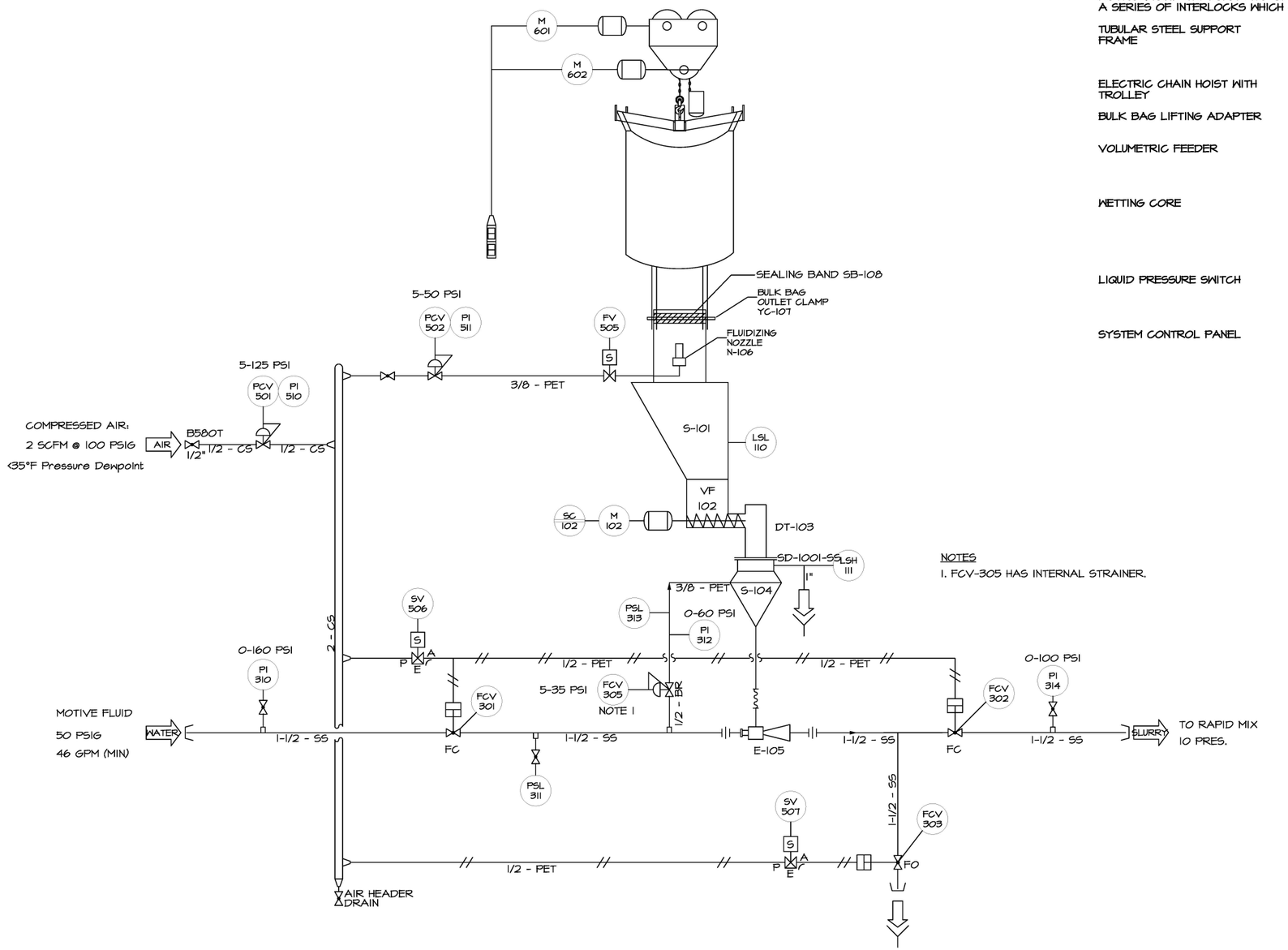
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815 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: GPM
Date: 2020	Check: JRU

TREATMENT PROCESS
PAC ENCLOSURE SECTIONS

Proj. No. 19SHAWWTP
Sht. No. 39



PAC SYSTEM NOTES:

THE FEEDER SHALL BE A WET INJECTION SYSTEM THAT HYDRAULICALLY MIXES AND CONVEYS A PREDETERMINED AND ADJUSTABLE AMOUNT OF PAC FROM BULK BAGS INTO THE LIQUID STREAM BEING PURIFIED. THE FEEDER SHALL BE BUILT IN TWO EIGHT FOOT SECTIONS. THE VOLUMETRIC FEEDER SHALL METER PAC INTO A HYDRAULIC EDUCTOR WHERE A MOTIVE LIQUID TRANSFER THE CARBON SLURRY TO THE INJECTION POINT. FEEDER OPERATION SHALL BE CONTROLLED WITH A SERIES OF INTERLOCKS WHICH ALLOW LOCAL/OR REMOTE OPERATION, AND MONITORING OF THE SYSTEM.

TUBULAR STEEL SUPPORT FRAME	3" SQUARE TUBING, 6 ' x 6' FOOTPRINT, 16 FEET TALL, PRIMED AND PAINTED. MONORAIL FOR INCLUDED CHAIN HOIST. OPERATOR SAFETY SHIELD TO ISOLATE THE OPERATOR FROM THE BULK BAG DURING ATTACHMENT TO THE SYSTEM. FOUR BASE PLATES ALLOW 16 ANCHOR POINTS TO SECURE THE SYSTEM TO THE FOUNDATION.
ELECTRIC CHAIN HOIST WITH TROLLEY	ONE-TON ELECTRIC CHAIN HOIST WITH HANDHELD CONTROL PENDANT, AND A MOTORIZED ELECTRIC TROLLEY FOR SAFE AND EFFORTLESS HORIZONTAL POSITIONING.
BULK BAG LIFTING ADAPTER	TUBULAR STEEL LIFTING CROSS WHICH FACILITATES THE SAFE AND EASY LIFTING OF THE 900 POUND BULK BAG WITH THE CHAIN HOIST.
VOLUMETRIC FEEDER	VOLUMETRIC FEEDER TO DELIVER BETWEEN 5-225 LB/HR OF PAC. UNIT INCLUDES AN ADJUSTABLE SPEED 1 HP DC MOTOR, 3FT³ STAINLESS STEEL SUPPLY HOPPER WITH A LOW CARBON LEVEL SWITCH. A DIGITAL CONTROLLER SHALL REGULATE THE FEEDER MOTOR SPEED.
WETTING CORE	304 STAINLESS STEEL WASH DOWN VESSEL MOUNTED BELOW THE DISCHARGE OF THE VOLUMETRIC FEEDER AND ABOVE THE LIQUID EDUCTOR. ASLIPSTREAM OF THE MOTIVE LIQUID SHALL BE ADDED TANGENTIALLY TO PROMOTE DOWN FLOW OF THE DOSED CARBON INTO THE EDUCTOR MOUTH. THE UNIT SHALL INCLUDE A PIPED OVERFLOW AND A HIGH LIQUID LEVEL SWITCH TO INDICATE AND ALARM IF A HIGH LIQUID LEVEL IS SENSED IN THE VESSEL.
LIQUID PRESSURE SWITCH	A LIQUID PRESSURE SWITCH SHALL BE SUPPLIED TO DETECT THE PRESENCE OF MOTIVE FLUID. ESTABLISHING MOTIVE PRESSURE SHALL BE PERMISSIVE TO THE OPERATION OF THE SYSTEM. PAC SHALL NOT BE DOSED UNTIL SUFFICIENT LIQUID PRESSURE HAS BEEN ESTABLISHED.
SYSTEM CONTROL PANEL	PROVIDE ONE NEMA 4X CONTROL PANEL TO HOUSE THE DIGITAL SPEED CONTROLLER FOR THE VOLUMETRIC FEEDER, ALL SYSTEM ON/OFF SWITCHES, STATUS INDICATOR LIGHTS, PLC, SYSTEM FUSES AND THE MAIN SYSTEM DISCONNECT. PROVIDE 110VAC/1Φ/60Hz 30 AMP ELECTRICAL FEED SERVICE TO THE SYSTEM.

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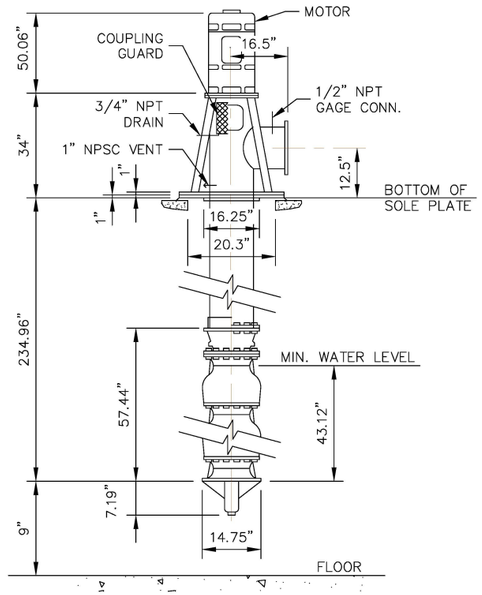
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ENGINEERS
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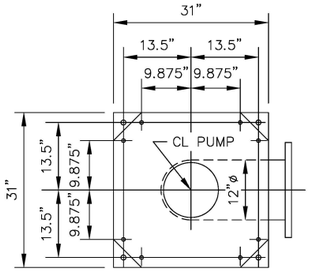
WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: GPM
Date: 2020	Check: JRU

POWDERED ACTIVATED CARBON FEED SYSTEM - SCHEMATIC

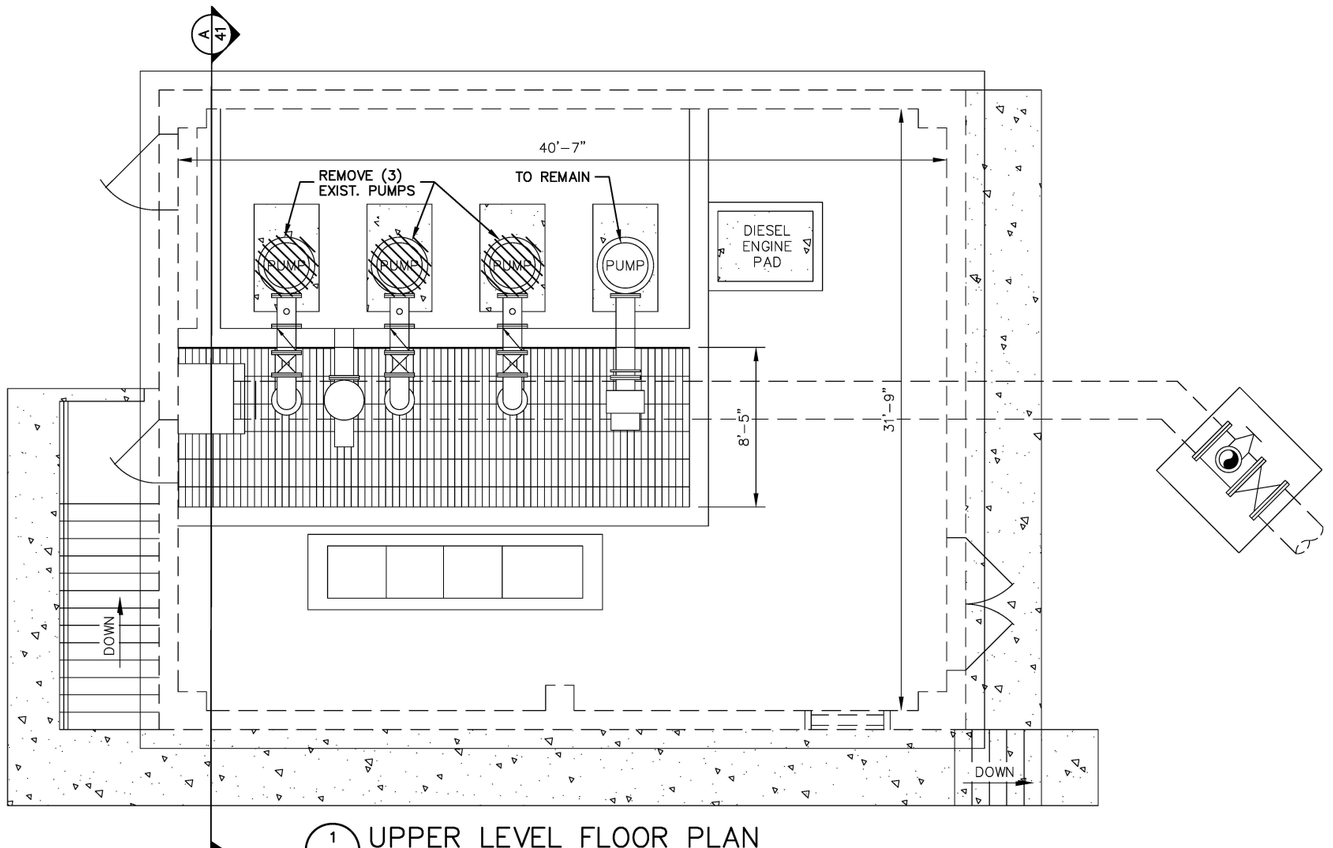
Proj. No. 19SHAWWTP
Sht. No. 40



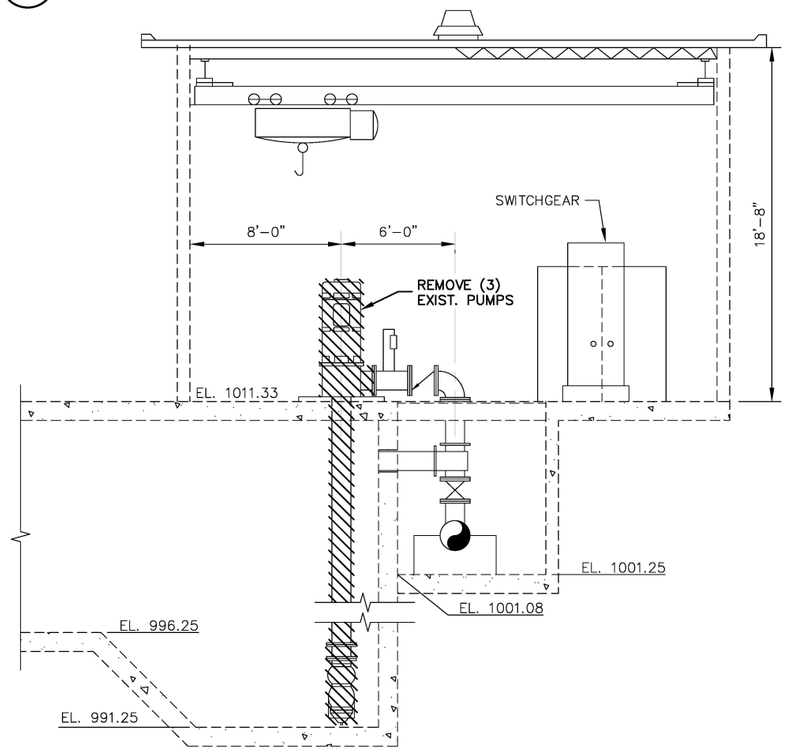


PLAN VIEW OF SOLEPLATE

B/41 EXISTING PUMP SECTION
NTS



1/41 UPPER LEVEL FLOOR PLAN
SCALE: 1/4" = 1'-0"



A/41 SECTION A
SCALE: 1/4" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWNG 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

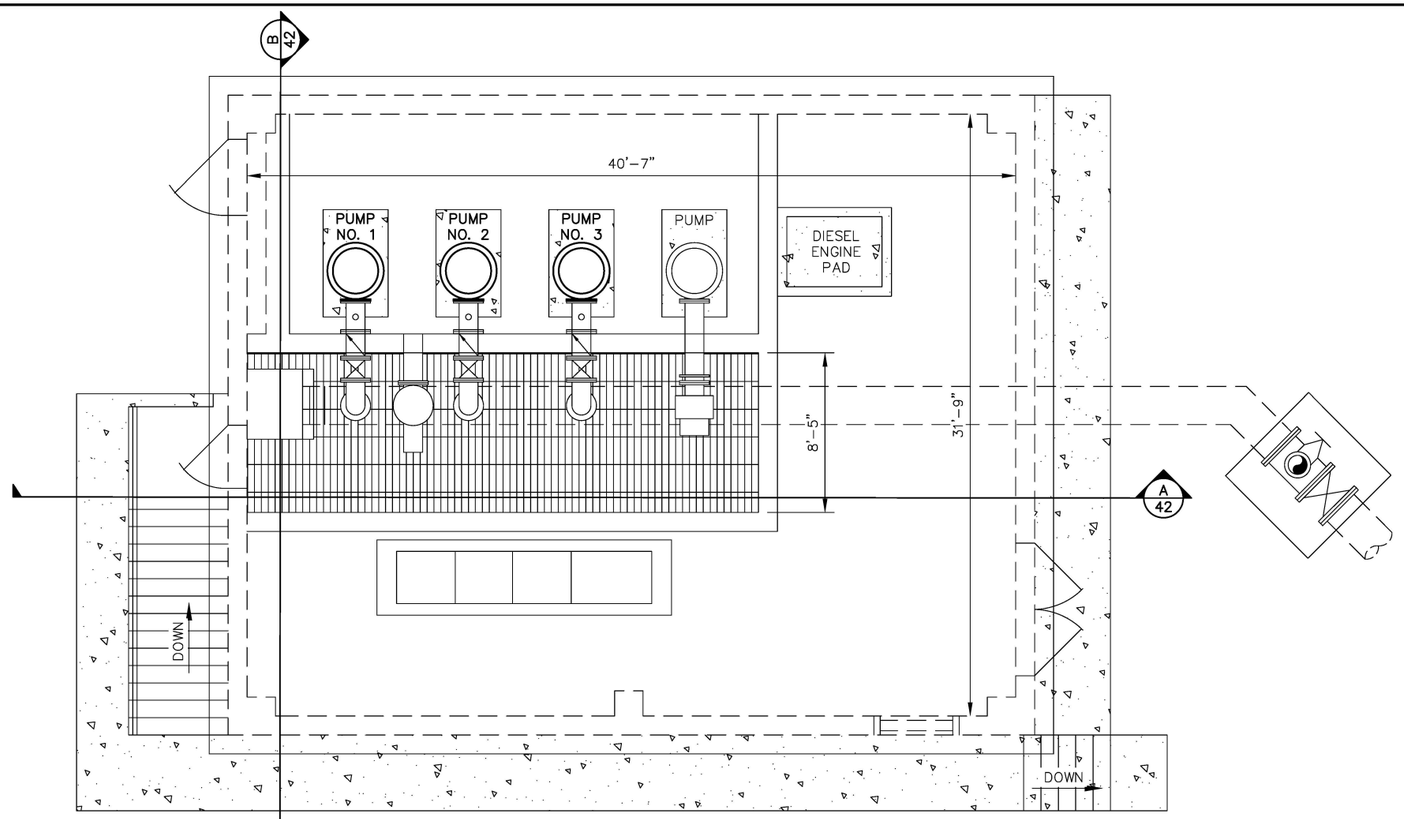
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

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Date: 2020 | Check: JRU

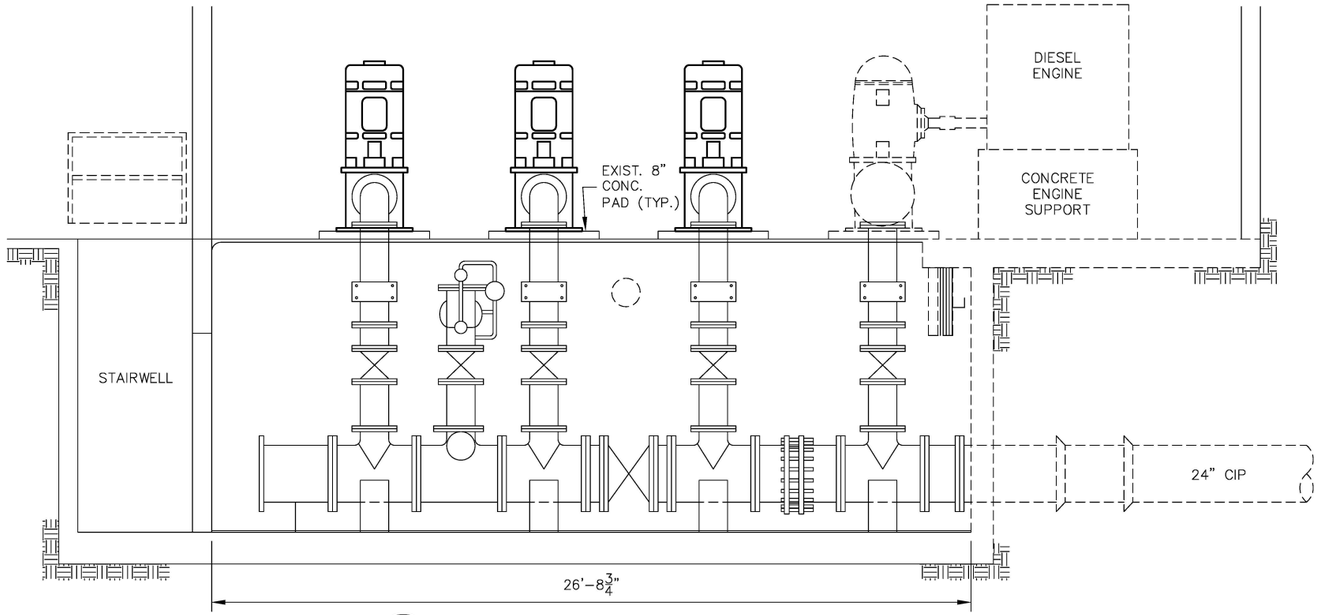
HIGH SERVICE PUMP STATION REPLACEMENT
DEMOLITION PLAN

Proj. No. 19SHAWWTP
Sht. No. 41

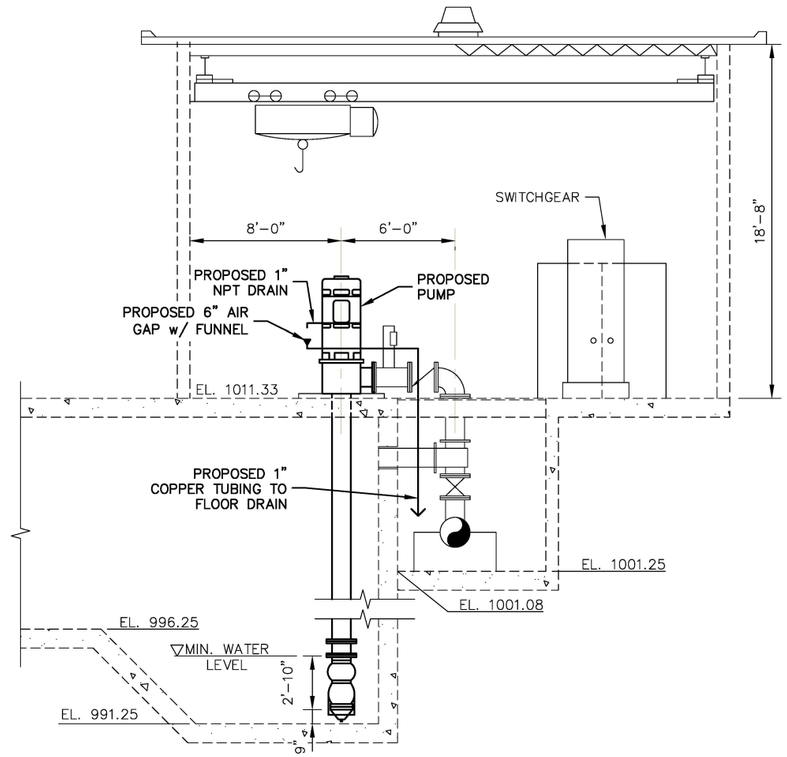


1 / 42 UPPER LEVEL FLOOR PLAN
SCALE: 1/4" = 1'–0"

PUMP SCHEDULE		
PUMP NO.	SIZE	TYPE
P1	12"	VERTICAL TURBINE (3 STAGE)
P2	12"	VERTICAL TURBINE (3 STAGE)
P3	12"	VERTICAL TURBINE (3 STAGE)
PUMP CONDITIONS		
GPM – 2800	HP – 250	PHASE –3
TDH – 264'	VOLTS – 460	HZ – 60



A / 42 SECTION A
SCALE: 3/8" = 1'–0"



B / 42 SECTION B
SCALE: 1/4" = 1'–0"

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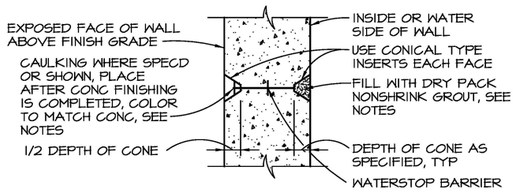
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: PM
Date: 2020 | Check: JRU

HIGH SERVICE PUMP STATION

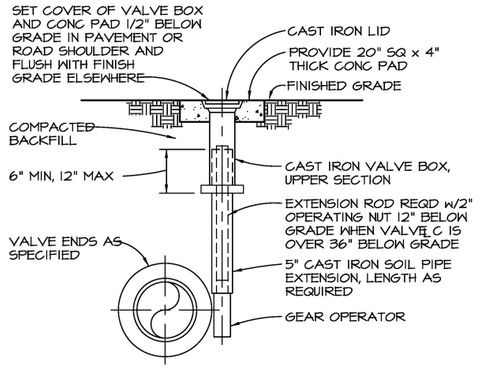
Proj. No. 19SHAWWTP
Sht. No. 42



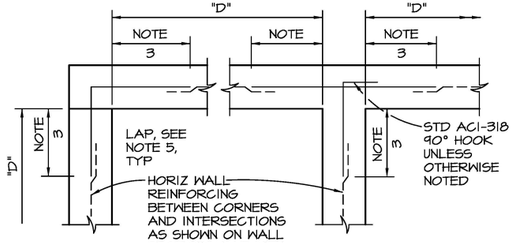
NOTES:

1. FOR FORM TIE HOLES ON OUTSIDE FACE OF WALL BELOW GRADE. FILL WITH NONSHRINK GROUT, (DRY PACK)
2. THE SPACING OF FORM TIES ON EXPOSED PORTIONS OF WALLS SHALL BE APPROXIMATELY EQUAL HORIZONTALLY AND VERTICALLY AND SHALL BE UNIFORM IN EACH DIRECTION
3. WHERE CAULKING IS NOT SPECIFIED OR SHOWN, DRY PACK EXTERIOR TIE HOLES WITH NONSHRINK GROUT WITH COLOR OF GROUT TO MATCH COLOR OF CONCRETE AS CLOSE AS POSSIBLE
4. DRY PACK METHOD SHALL BE AS SPECIFIED USING STEEL TOOLS

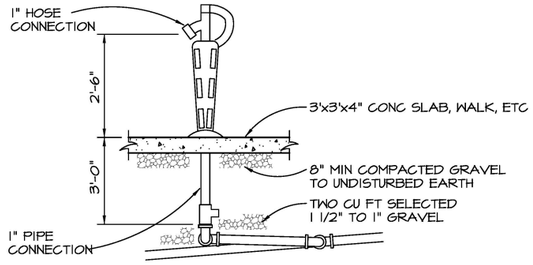
1 MDI FORM SNAP-TIE HOLE



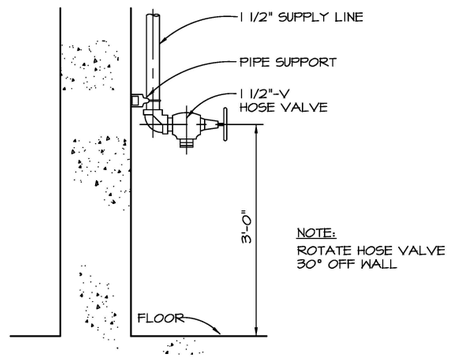
2 MDI BUTTERFLY VALVE BOX



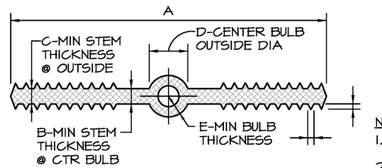
3 MDI TYPICAL SINGLE MAT CORNER AND INTERSECTION REINFORCING



4 MDI NON-FREEZE POST HYDRANT HV-1



5 MDI INTERIOR HOSE VALVE DETAIL



F-APPROXIMATE NO OF RIBS EA SIDE, EA FACE OF WS

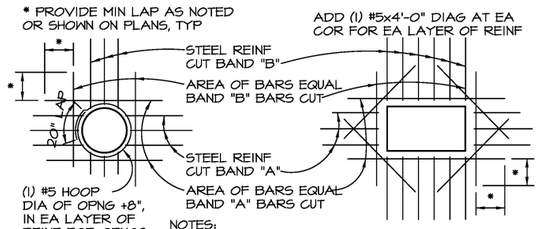
1/8" PROJECTION ALL RIBS,TYP

NOTE:

1. MATERIAL QUALITY PER SPECIFICATIONS
2. DIM REQUIREMENTS INDICATED SHOULD BE GIVEN TO SUPPLIERS PRIOR TO PLACING ORDERS
3. NON-ROUND CENTER BULBS SHALL HAVE A MIN OUTSIDE DIM OF "D"

SIZE	A	B	C	D	E	F
4"x1/4	4"	1/4		5/8	1/4	4
6"x3/8	6"	3/8		7/8	1/4	5
9"x7/8	9"	7/8		1"	1/4	8

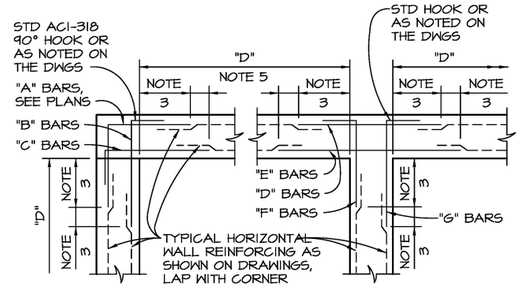
6 MDI PLASTIC WATER STOP



NOTES:

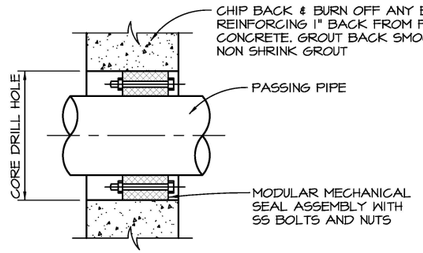
1. TYPICAL FOR ALL OPENINGS IN CONCRETE WALLS AND SLABS UNLESS INDICATED OTHERWISE ON PLANS
2. DO NOT WELD REINFORCEMENT TO PIPE SLEEVES AND INSERTS

7 MDI OPENING REINFORCING



8 MDI TYPICAL DOUBLE MAT CORNER AND INTERSECTION REINFORCING

(SEE PLANS FOR SIZE AND SPACING)



9 MDI EXISTING WALL PENETRATION DETAIL

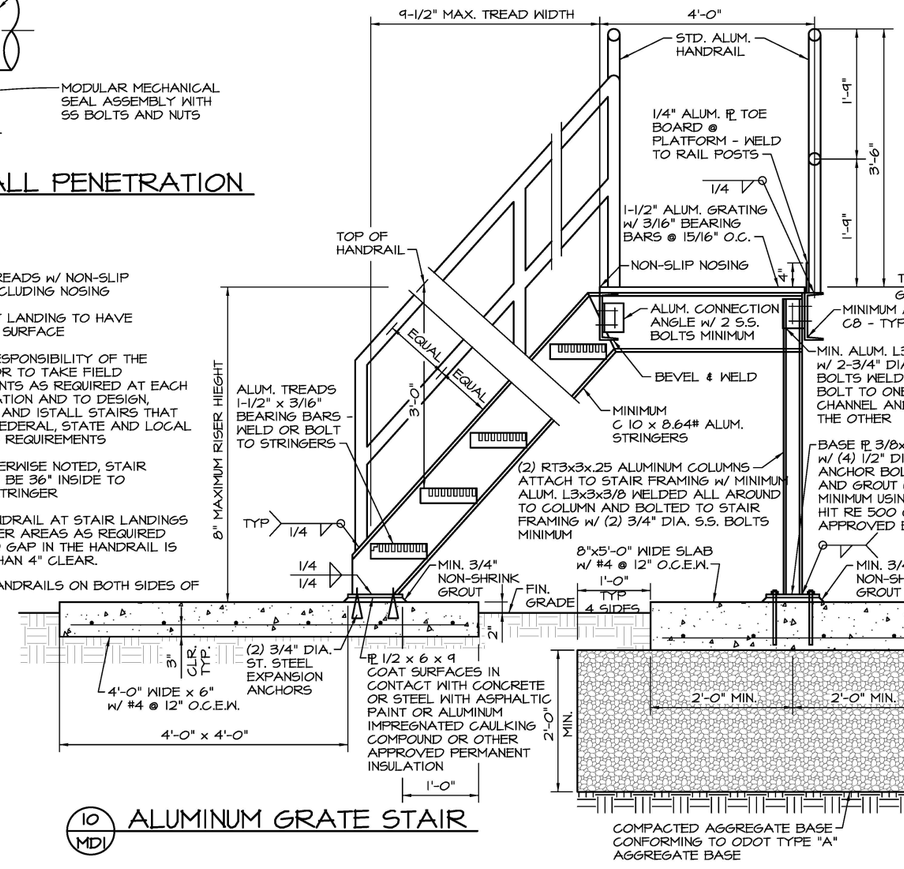
GENERAL CONSTRUCTION NOTES

CORNER AND INTERSECTION REINFORCING DETAILS

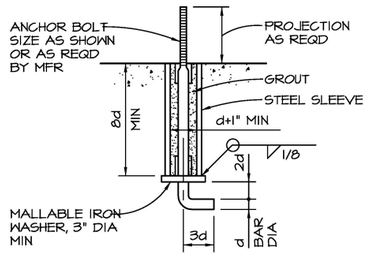
1. TYPICAL HORIZONTAL WALL CORNER AND INTERSECTION REINFORCING LAYOUT IS SHOWN TO AVOID CONGESTION AND PERMIT PROPER PLACEMENT. FOR SIZE AND SPACING SEE PLANS. ALL HORIZONTAL REINFORCING AT CORNERS AND INTERSECTIONS SHALL BE FABRICATED AND INSTALLED WITH SPLICES LOCATED WHERE SHOWN REGARDLESS OF BAR SIZE AND SPACING
2. WHERE THE CORNER OR INTERSECTION REINFORCING SIZE AND SPACING IS NOT SHOWN, NOTED OR TABULATED ON THE PLANS, THE SIZE AND SPACING SHALL BE THE SAME AS THE WALL HORIZONTAL REINFORCING SHOWN ON THE WALL SECTIONS OR AS NOTED FOR THE REINFORCING BETWEEN THE CORNERS OR INTERSECTIONS
3. EXCEPT WHERE OTHERWISE SHOWN ON THE DRAWINGS, THE LENGTH INDICATED AS "NOTE 3" SHALL BE THE LESSER OF D/4, 10 FEET, OR 1.0 TIMES THE HEIGHT OF THE WALL, EXCEPT THAT IN NO CASE SHALL IT BE LESS THAN 2.0 FEET
4. D = LENGTH OF WALL PARALLEL TO THE BAR LENGTH IN QUESTION
5. EXCEPT WHERE OTHERWISE SHOWN ON THE DRAWINGS, THE LENGTH INDICATED AS "NOTE 5" SHALL BE EQUAL TO ONE "LAP LENGTH". USE THE LAP LENGTH AS REQUIRED FOR THE SMALLER OF THE TWO REINFORCING BARS BEING SPLICED
6. UNLESS OTHERWISE NOTED, "B" AND "C" BARS ARE THE SAME SIZE AND SPACING AND "F" AND "G" BARS ARE THE SAME SIZE AND SPACING

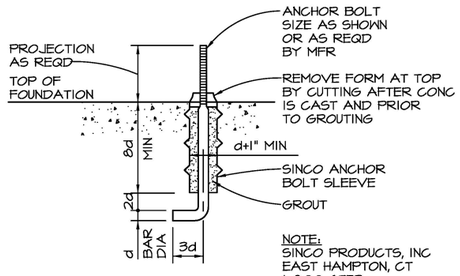
STAIR NOTES:

1. PROVIDE TREADS W/ NON-SLIP SURFACE INCLUDING NOSING
2. GRATING AT LANDING TO HAVE A NON-SLIP SURFACE
3. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO TAKE FIELD MEASUREMENTS AS REQUIRED AT EACH STAIR LOCATION AND TO DESIGN, FABRICATE AND ISTALL STAIRS THAT MEET ALL FEDERAL, STATE AND LOCAL CODES AND REQUIREMENTS
4. UNLESS OTHERWISE NOTED, STAIR WIDTH IS TO BE 36" INSIDE TO INSIDE OF STRINGER
5. EXTEND HANDRAIL AT STAIR LANDINGS AND IN OTHER AREAS AS REQUIRED SO THAT NO GAP IN THE HANDRAIL IS GREATER THAN 4" CLEAR.
6. PROVIDE HANDRAILS ON BOTH SIDES OF STAIRS.

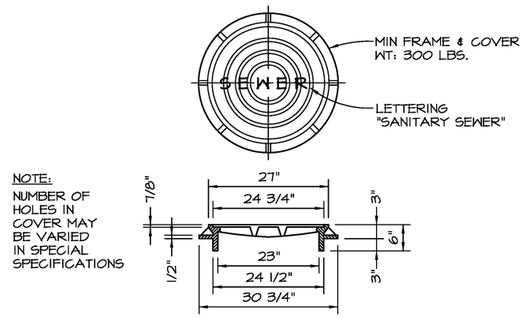


10 MDI ALUMINUM GRATE STAIR

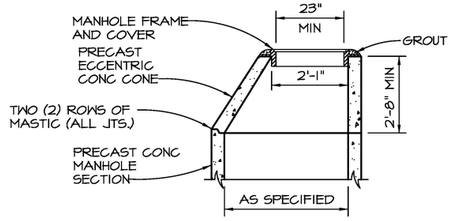




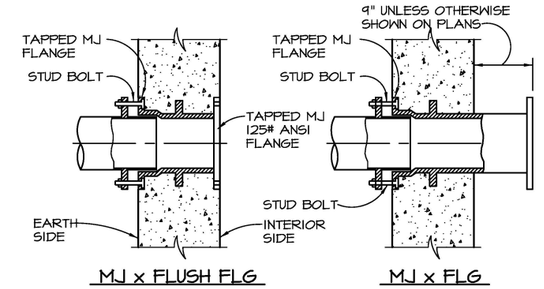
MACHINERY ANCHOR BOLT

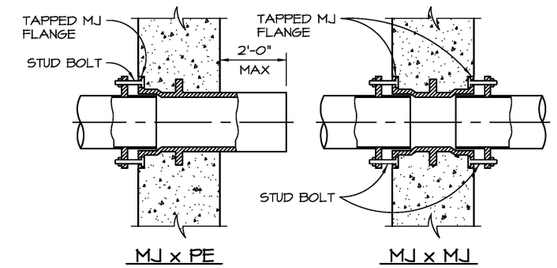


STANDARD MANHOLE FRAME AND COVER

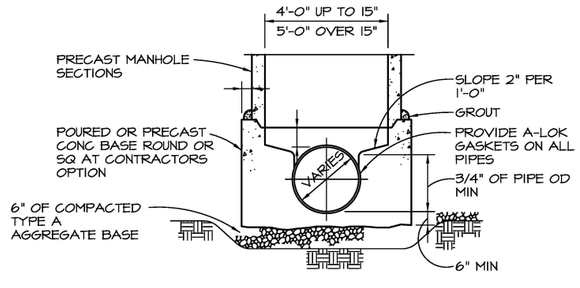


MANHOLE TOP SECTION

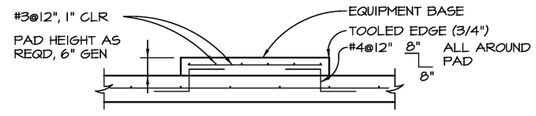




DUCTILE IRON WALL PIPES



MANHOLE BASE SECTION



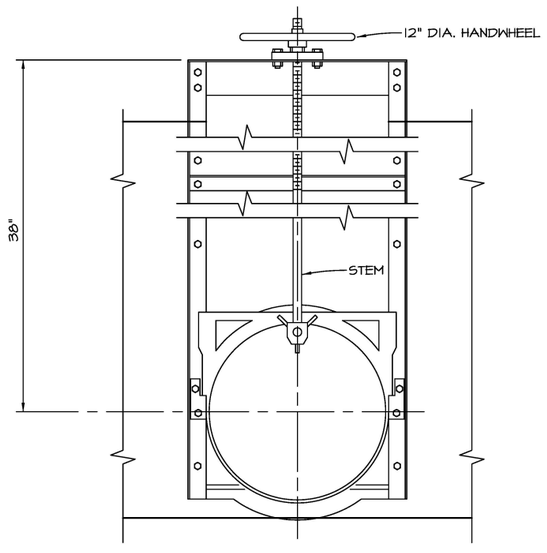
NOTES:
1. SEE EQUIPMENT BASE NOTES
2. WHEN ANCHORAGE OF EQUIPMENT TO SLAB IS REQUIRED, USE SS WEDGE ANCHORS.

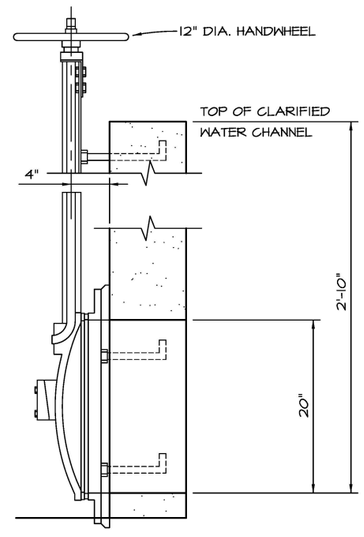
EQUIPMENT PAD

EQUIPMENT BASE NOTES

1. PAD SIZE SHALL BE MINIMUM INDICATED OR AS SHOWN ON THE PLANS OR AS INDICATED BY THE MANUFACTURER AND APPROVED BY THE ENGINEER
2. THE SIZE, NUMBER, TYPE, LOCATION AND THREAD PROJECTION OF THE ANCHOR BOLTS SHALL BE DETERMINED BY THE EQUIPMENT MANUFACTURER AND SHALL BE AS APPROVED BY THE ENGINEER. ANCHOR BOLTS SHALL BE HELD IN POSITION WITH A ONE PIECE TEMPLATE, MATCHING THE BASE PLATE, WHILE PAD IS BEING POURED
3. ANCHOR BOLT SLEEVES SHALL BE USED TO PROVIDE THE ANCHOR BOLT A MINIMUM MOVEMENT OF 1/2" IN ALL DIRECTIONS. THE MINIMUM SLEEVE LENGTH SHALL BE 8 TIMES THE BOLT DIAMETER. SLEEVES SHALL BE FILLED WITH NON-SHRINK GROUT
4. ANCHOR BOLT SLEEVES SHALL HAVE A MINIMUM INTERNAL DIAMETER 1" GREATER THAN BOLT DIAMETER AND A MAXIMUM INTERNAL DIAMETER 3" GREATER THAN ANCHOR BOLT DIAMETER. SLEEVES SHALL BE FILLED WITH NON-SHRINK GROUT
5. EQUIPMENT BASES SHALL BE INSTALLED LEVEL UNLESS SPECIFIED OTHERWISE
6. HEIGHT OF PADS SHALL BE MINIMUM REQUIRED FOR ANCHOR BOLT CLEARANCE TO KEEP ANCHOR BOLT OUT OF SLAB (SEE TABLE BELOW).

AB DIA (IN)	1/2	3/8	3/4	7/8	1	1 1/4	1 3/8	1 1/2	1 3/4	2
MIN PAD HT (IN)	7	8 1/2	10	11	12 1/2	15	16 1/2	18	21	24





INTERCONNECT CANAL GATE

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

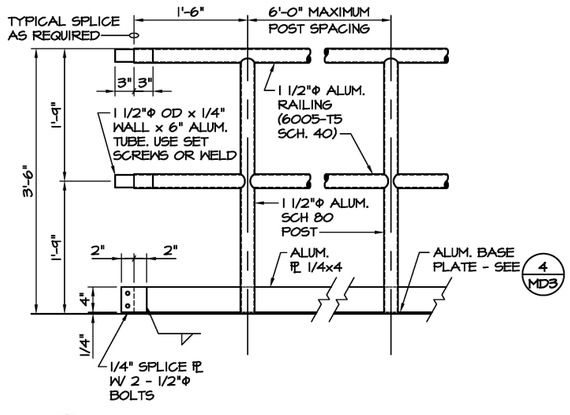
Holloway, Updike and Bellen, Inc.
ENGINEERS
818 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

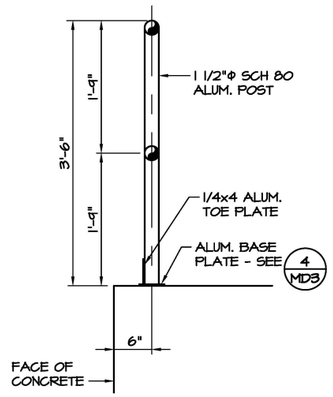
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Date: 2020 | Check: JRU

MISCELLANEOUS DETAILS
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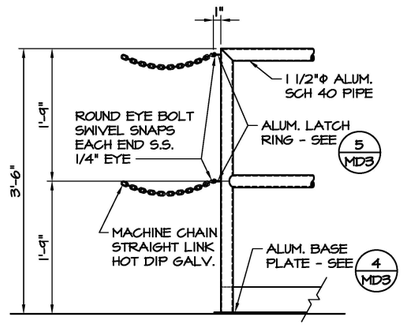
Proj. No. 19SHAWWTP
Sht. No. MD2



1 MD3 SECTION - TYPICAL HANDRAIL
SCALE: 1" = 1'-0"

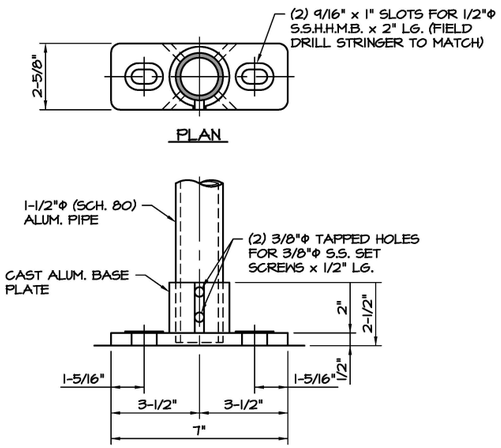


2 MD3 SECTION - TYPICAL HANDRAIL
SCALE: 1" = 1'-0"

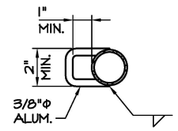


3 MD3 TYPICAL SAFETY CHAIN
SCALE: 1 1/2" = 1'-0"

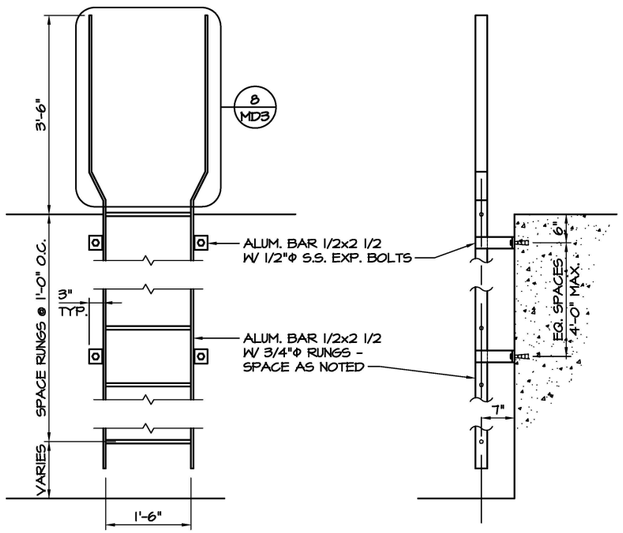
NOTE:
HANDRAIL MAY HAVE WELDED OR MECHANICAL CONNECTIONS



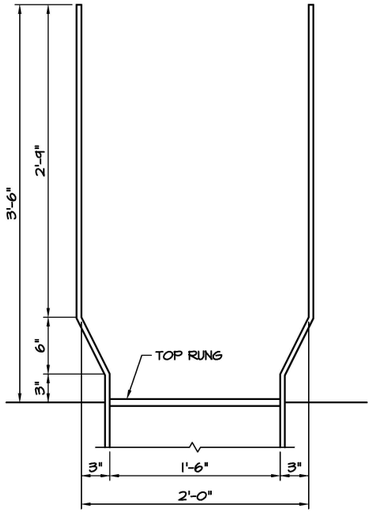
4 MD3 LEVEL STL. LINE POST
SCALE: 3" = 1'-0"



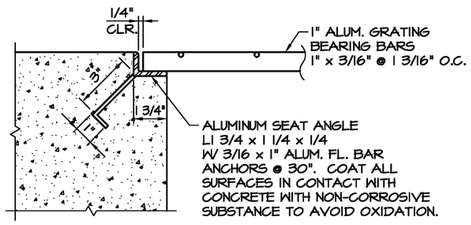
5 MD3 DETAIL - ALUM. LATCH RING
SCALE: 3" = 1'-0"



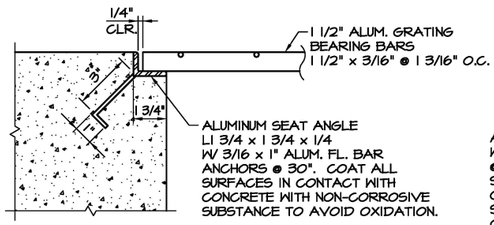
6 MD3 ALUMINUM LADDER DETAIL
SCALE: 3/4" = 1'-0"



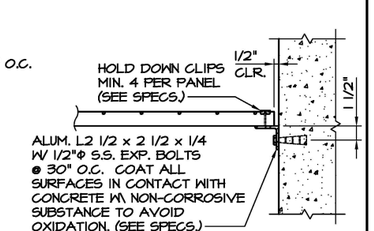
7 MD3 LADDER WALKWAY EXTENSION
SCALE: 1 1/2" = 1'-0"



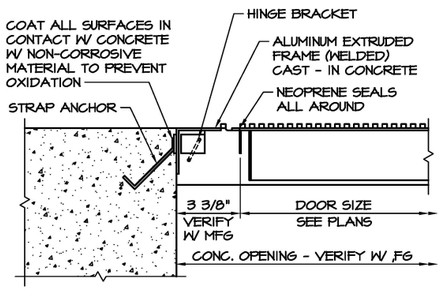
8 MD3 TYP. CONCRETE BEARING ANGLE @ 1" GRATING
SCALE: 3" = 1'-0"



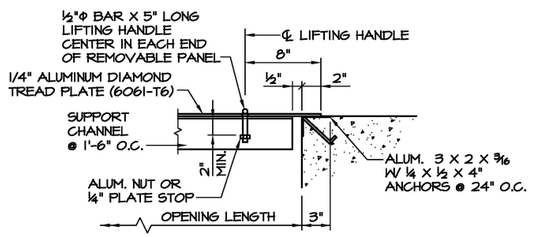
9 MD3 TYP. CONCRETE BEARING ANGLE @ 1 1/2" GRATING
SCALE: 3" = 1'-0"



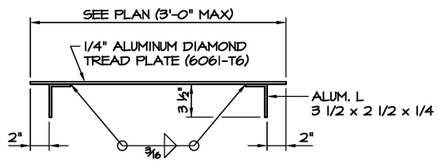
10 MD3 TYP. ALUM. BEARING ANGLE @ 1 1/2" GRATING
SCALE: 1 1/2" = 1'-0"



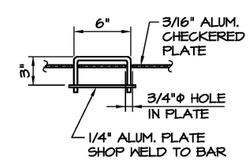
14 MD3 TYP. ACCESS HATCH DETAIL
SCALE: 3" = 1'-0"



11 MD3 TYP. REMOVABLE ALUM. PANEL END DETAIL
SCALE: 1 1/2" = 1'-0"



12 MD3 TYP. REMOVABLE ALUM. PANEL SECTION
SCALE: 1 1/2" = 1'-0"



13 MD3 DETAIL - COVER PLATE HANDLE
SCALE: 3" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

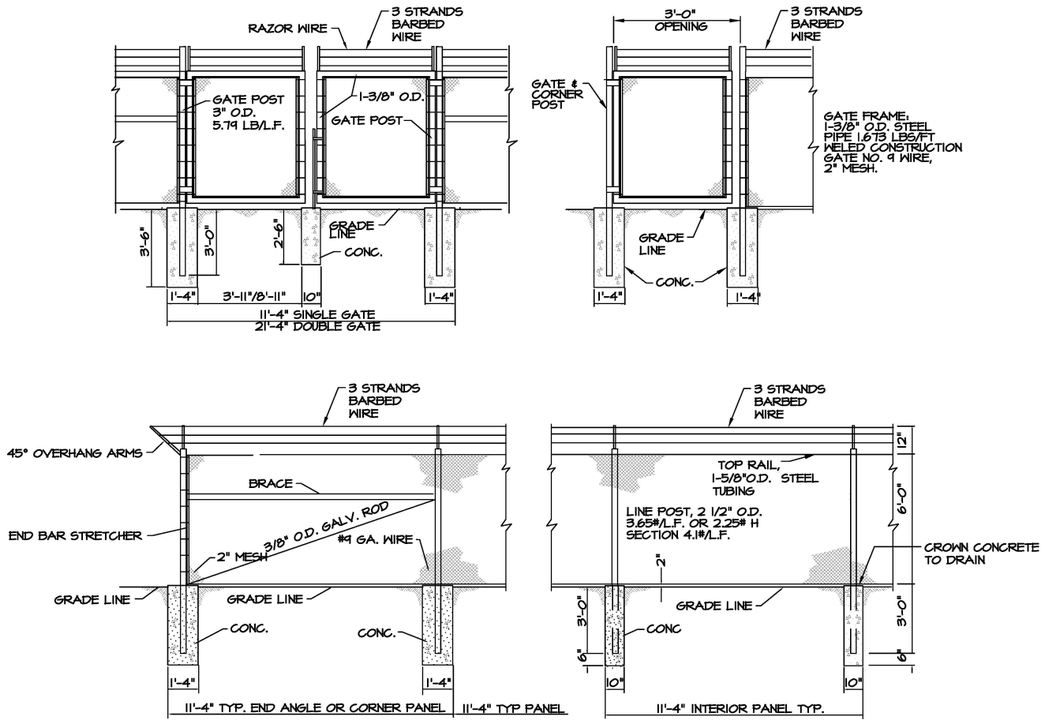
Holloway, Updike and Bellen, Inc.
515 EAST 3RD BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7861

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

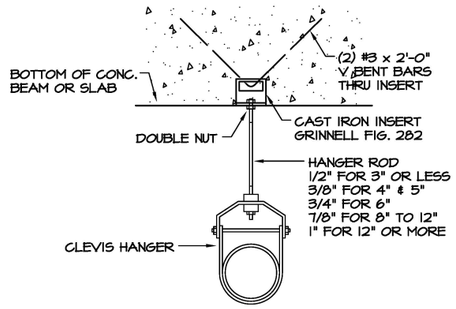
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MISCELLANEOUS DETAILS
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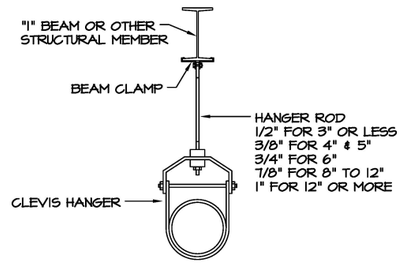
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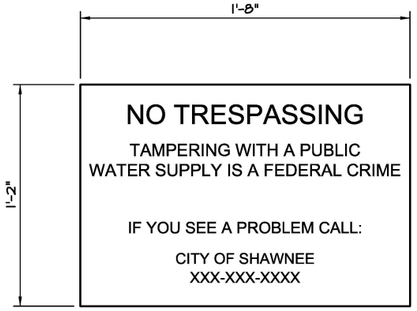
3 MD4 CHAIN LINK FENCE DETAIL
SCALE: NONE



4 MD4 TYP. PIPE HANGER DETAIL #1
SCALE: NONE



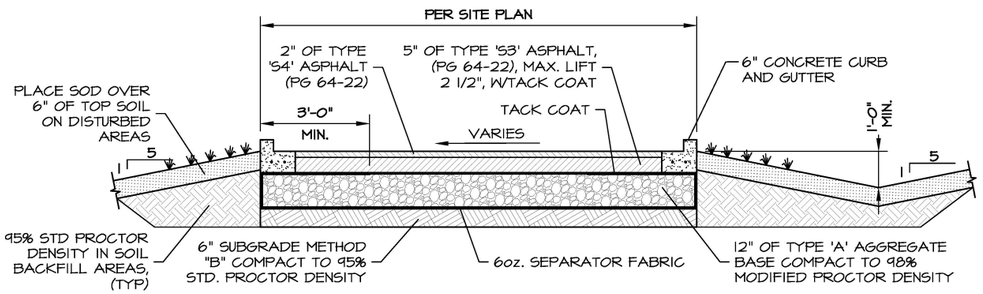
2 MD4 TYP. PIPE HANGER DETAIL #2
SCALE: NONE



NOTES:

1. SIGNS SHALL BE UV RESISTANT SCREEN PRINTED 0.08" ALUMINUM.
2. CONTRACTOR SHALL INSTALL SIGN A MINIMUM OF EVERY 50 L.F. ALONG EXTERIOR PERIMETER OF EXISTING & PROPOSED SECURITY FENCE.
3. SIGNS SHALL BE SECURED AT ALL FOUR CORNERS USING DRILLED HOLES AND WIRE TIES.
4. BLACK LETTERS ON WHITE BACKGROUND.

1 MD4 WARNING SIGN DETAIL
SCALE: NONE



4 MD4 ACCESS ROAD SECTION
SCALE: 1/2" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

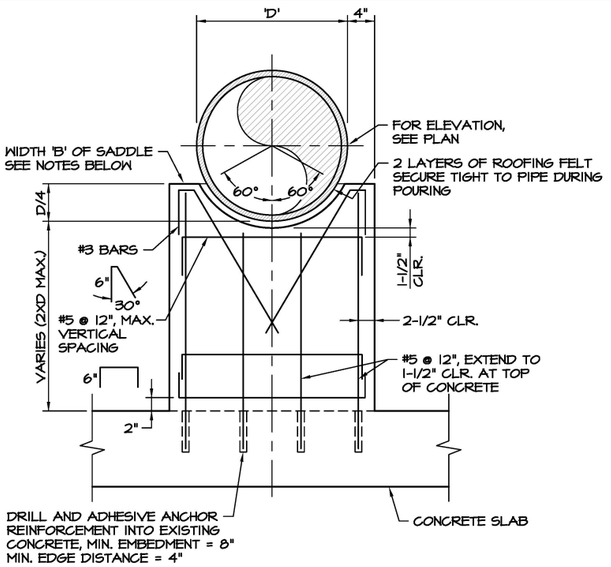
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: GPM
Date: 2020 | Check: JRU

MISCELLANEOUS DETAILS
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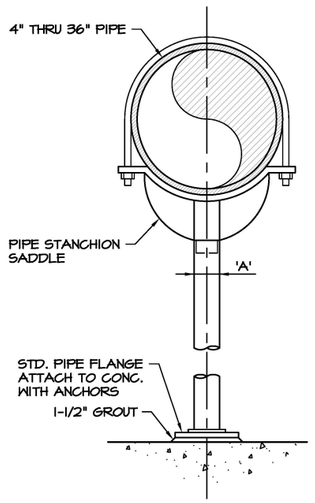
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Sht. No. MD4



NOTES:

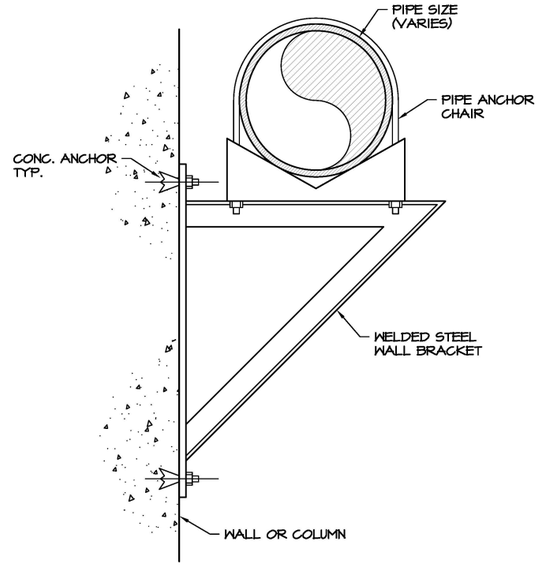
1. THICKNESS 'B' OF SADDLE
   - B = 6", D ≤ 12"
   - B = 8", 12" < D ≤ 24"
   - B = 10", 24" < D ≤ 36"
   - B = 12", 36" < D ≤ 48"
2. 'B' = 10" OR THICKER, USE 2 LAYERS OF REINFORCING, TURN HORIZONTAL BARS 90° TO HOOK AROUND VERTICALS (⊓), 1-1/2" CLEAR OF CONCRETE.
3. FORM 3/4" BEVEL ON ALL EXPOSED CORNERS OF SUPPORT.

1 / MD5 CONCRETE PIPE SUPPORT
SCALE: NONE

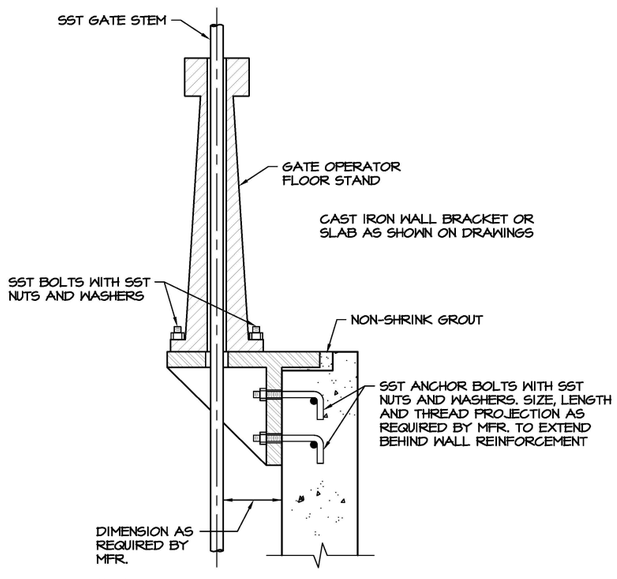


PIPE SIZE	'A'
2-1/2"	2-1/2"
3"	2-1/2"
4"	3"
6"	3"
8"	3"
10"	3"
12"	3"
14"	3"
16"	3"
20"	4"
24"	4"
30"	4"
36"	4"

2 / MD5 PIPE SUPPORT
SCALE: NONE

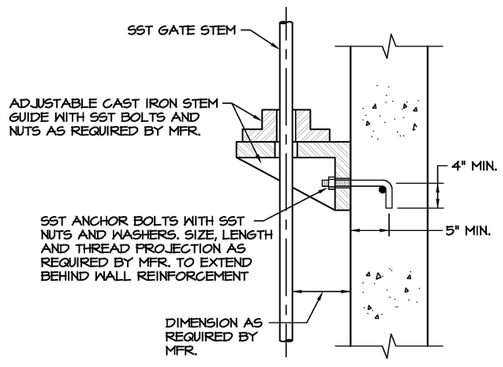


3 / MD5 PIPE SUPPORT - WALL MOUNTED
SCALE: NONE



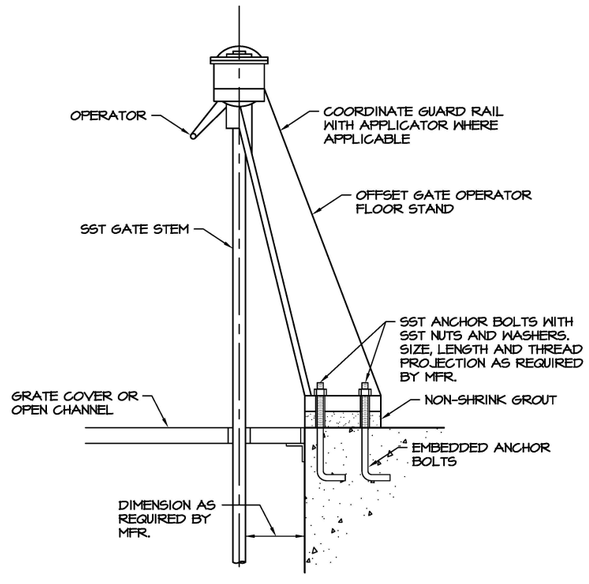
NOTE:
FLOOR STAND IS REPRESENTATIVE ONLY.

4 / MD5 FLOOR STAND
SCALE: NONE



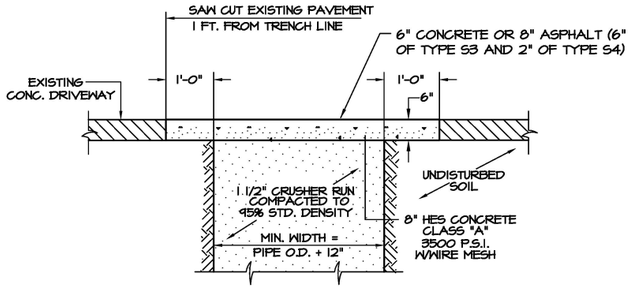
NOTE:
STEM GUIDE IS REPRESENTATIVE ONLY.

5 / MD5 STEM GUIDE
SCALE: NONE



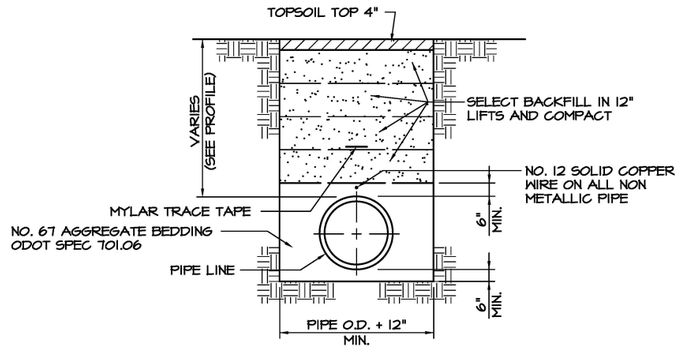
NOTE:
FLOOR STAND AND OPERATOR ARE REPRESENTATIVE ONLY.

6 / MD5 FLOOR STAND
SCALE: NONE



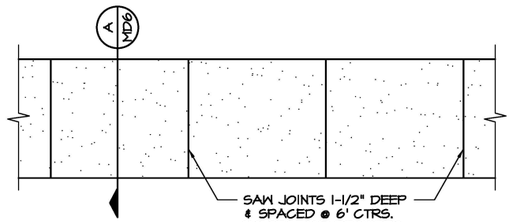
1 / MD6 ASPHALT OR CONCRETE DRIVEWAY REMOVAL AND REPLACEMENT DETAIL

SCALE: NONE



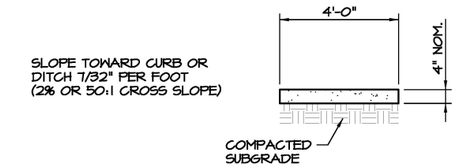
2 / MD6 PIPE BEDDING DETAILS (ALL PROCESS LINES)

SCALE: NONE



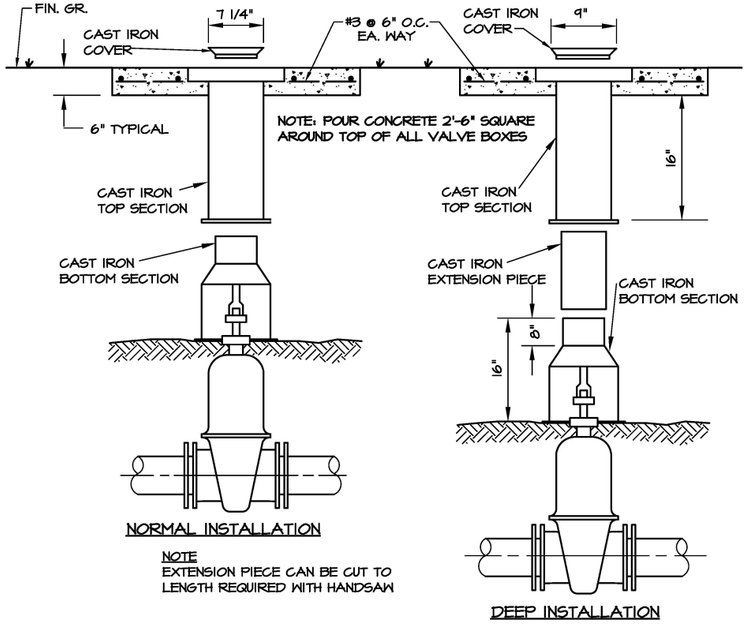
3 / MD6 PLAN DETAIL OF CONCRETE SIDEWALK

SCALE: NONE



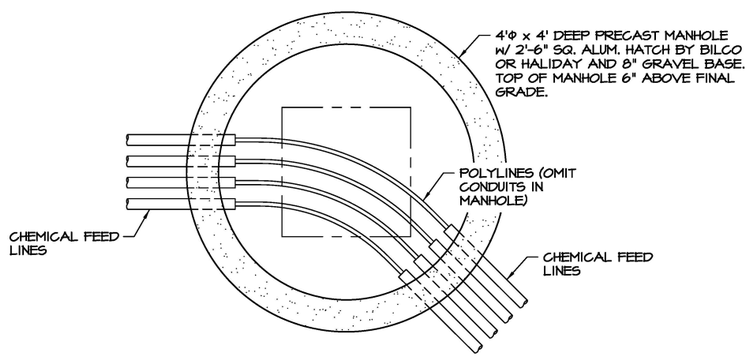
A / MD6 SECTION A

SCALE: NONE



4 / MD6 VALVE BOX INSTALLATION

SCALE: NONE



5 / MD6 TYP. CHEMICAL FEED MANHOLE

SCALE: NONE

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

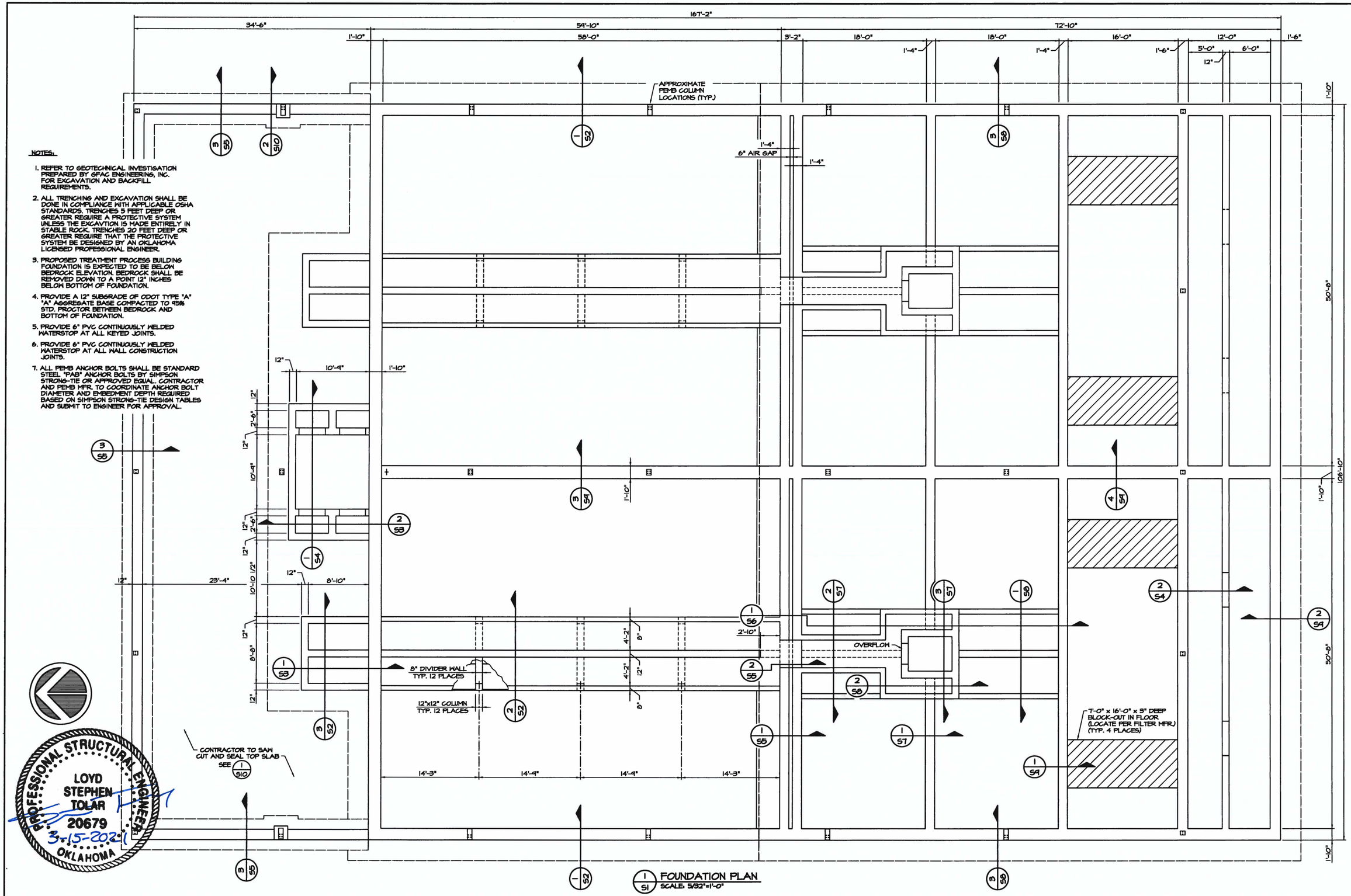
Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: GPM | MISCELLANEOUS DETAILS | Proj. No. 19SHAWWTP
Date: 2020 | Check: JRU | . | Sht. No. MD6

NOTES:

1. REFER TO GEOTECHNICAL INVESTIGATION PREPARED BY GFAC ENGINEERING, INC. FOR EXCAVATION AND BACKFILL REQUIREMENTS.
2. ALL TRENCHING AND EXCAVATION SHALL BE DONE IN COMPLIANCE WITH APPLICABLE OSHA STANDARDS. TRENCHES 5 FEET DEEP OR GREATER REQUIRE A PROTECTIVE SYSTEM UNLESS THE EXCAVTION IS MADE ENTIRELY IN STABLE ROCK. TRENCHES 20 FEET DEEP OR GREATER REQUIRE THAT THE PROTECTIVE SYSTEM BE DESIGNED BY AN OKLAHOMA LICENSED PROFESSIONAL ENGINEER.
3. PROPOSED TREATMENT PROCESS BUILDING FOUNDATION IS EXPECTED TO BE BELOW BEDROCK ELEVATION. BEDROCK SHALL BE REMOVED DOWN TO A POINT 12" INCHES BELOW BOTTOM OF FOUNDATION.
4. PROVIDE A 12" SUBGRADE OF ODOT TYPE "A" "A" AGGREGATE BASE COMPACTED TO 95% STD. PROCTOR BETWEEN BEDROCK AND BOTTOM OF FOUNDATION.
5. PROVIDE 6" PVC CONTINUOUSLY WELDED WATERSTOP AT ALL KEYED JOINTS.
6. PROVIDE 6" PVC CONTINUOUSLY WELDED WATERSTOP AT ALL WALL CONSTRUCTION JOINTS.
7. ALL PEMB ANCHOR BOLTS SHALL BE STANDARD STEEL "PAB" ANCHOR BOLTS BY SIMPSON STRONG-TIE OR APPROVED EQUAL. CONTRACTOR AND PEMB MFR. TO COORDINATE ANCHOR BOLT DIAMETER AND EMBEDMENT DEPTH REQUIRED BASED ON SIMPSON STRONG-TIE DESIGN TABLES AND SUBMIT TO ENGINEER FOR APPROVAL.



1/S1 FOUNDATION PLAN
SCALE: 5/32"=1'-0"

PROFESSIONAL STRUCTURAL ENGINEER
LOYD STEPHEN TOLAR
20679
3-15-2021
OKLAHOMA

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ENGINEERS
869 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7881

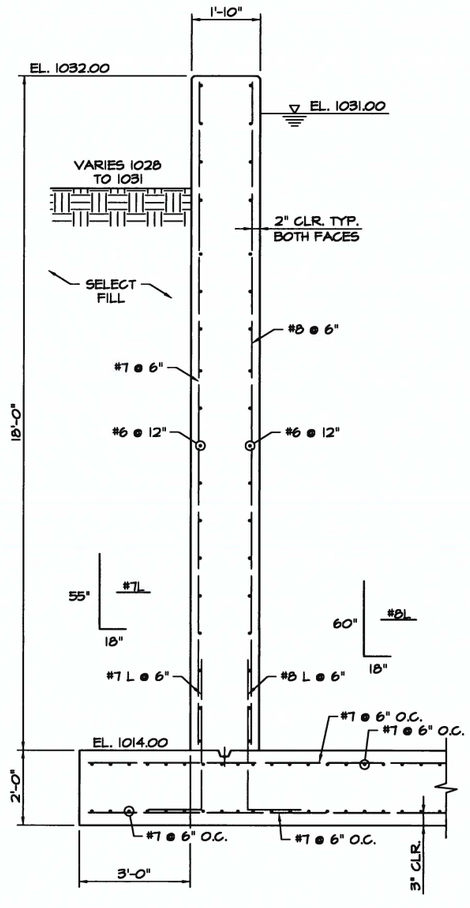
WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: GPM
Date: 2020	Check: JRU

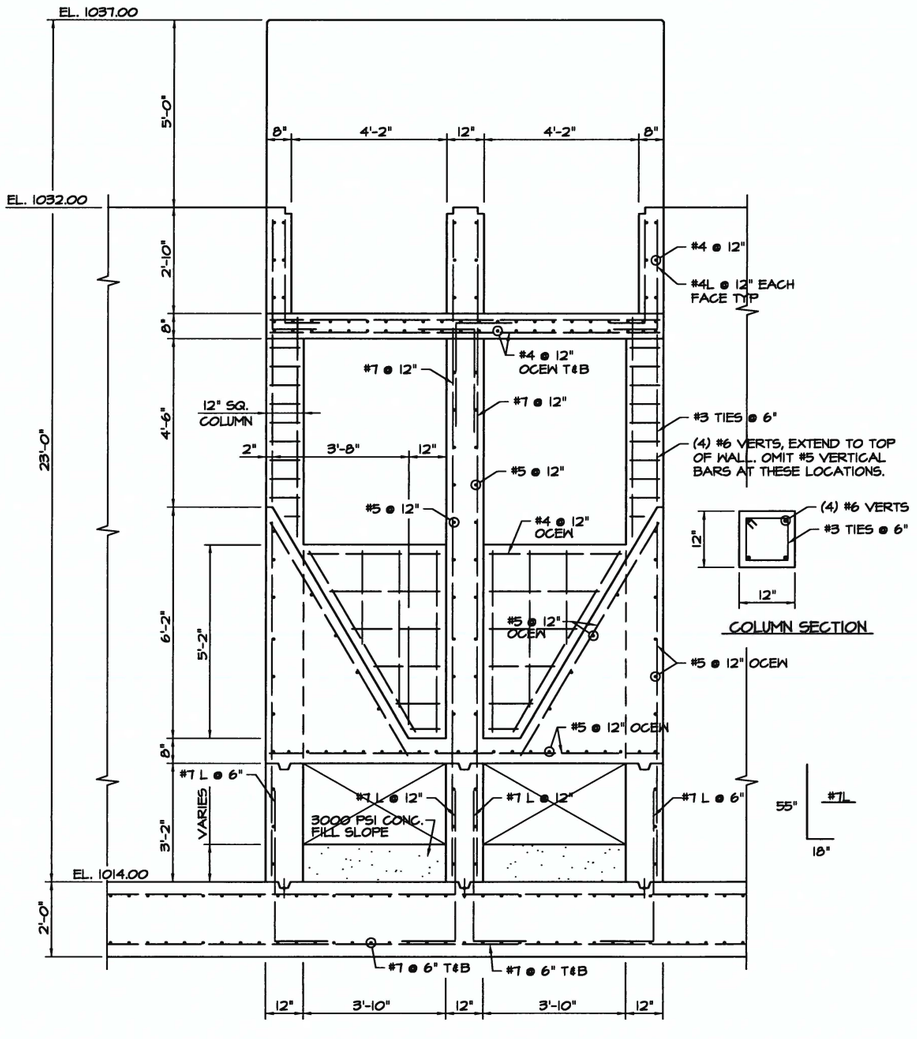
TREATMENT PROCESS BUILDING
FOUNDATION PLAN

Proj. No. 19SHAWWTP
Sht. No. S1

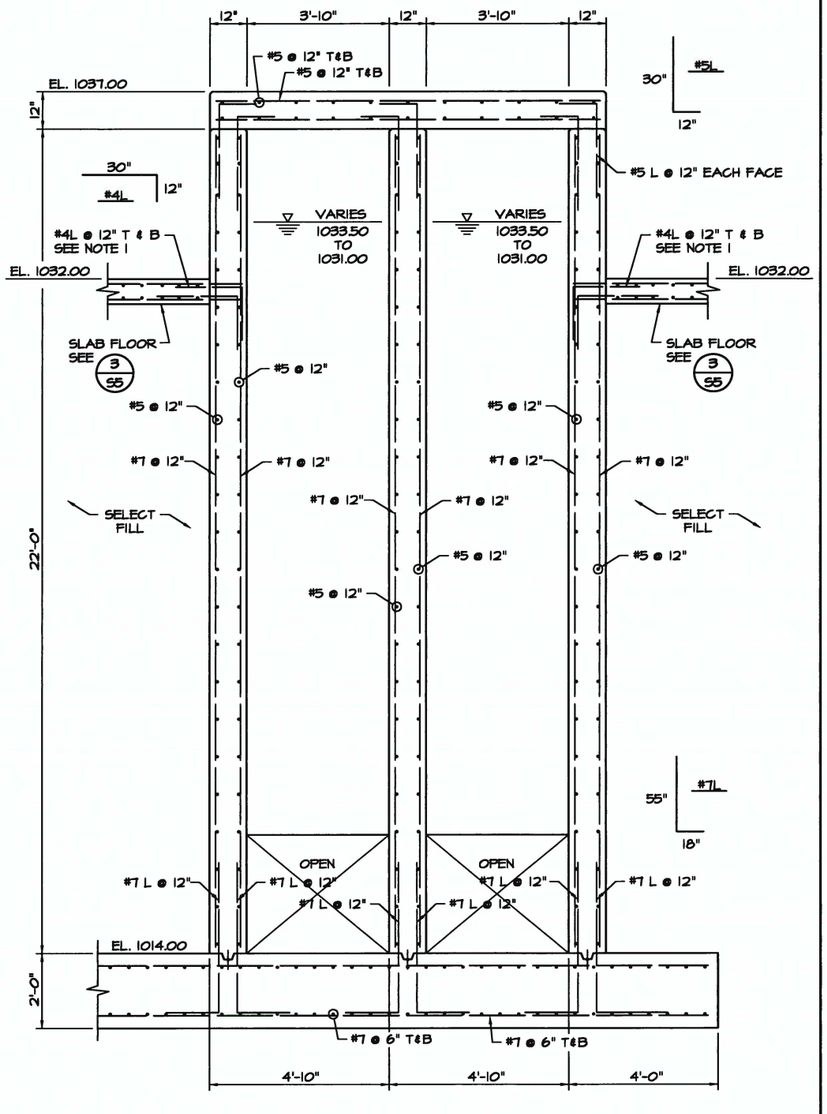
PROFESSIONAL STRUCTURAL ENGINEER
LOYD STEPHEN TOLAR
20679
3-15-202
OKLAHOMA



1/S2 SECTION @ OUTSIDE WALL
SCALE: 1/2" = 1'-0"



2/S2 SECTION @ CLARIFIER FLUMES
SCALE: 1/2" = 1'-0"

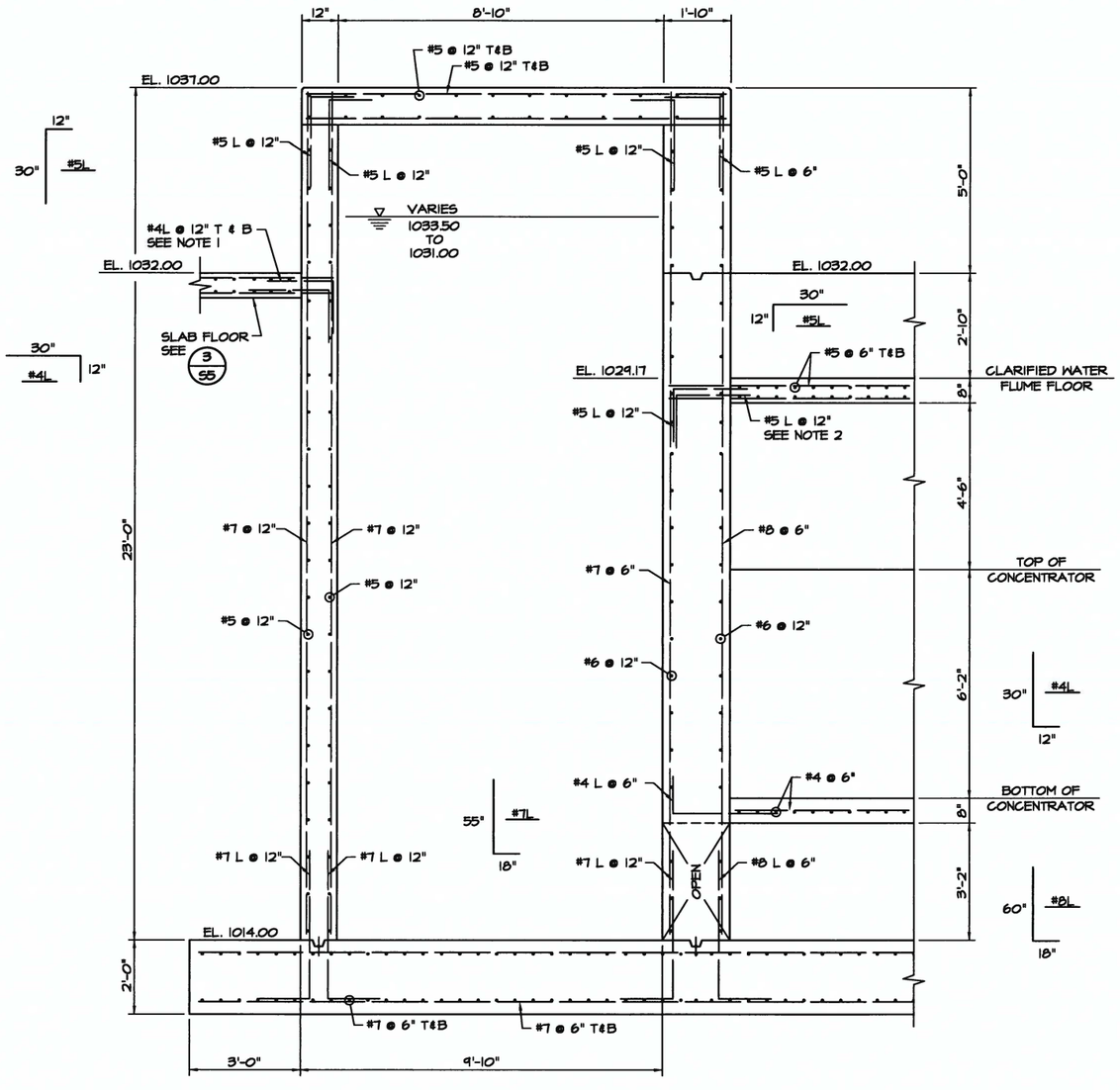


3/S2 SECTION @ PULSATING CHAMBER
SCALE: 1/2" = 1'-0"

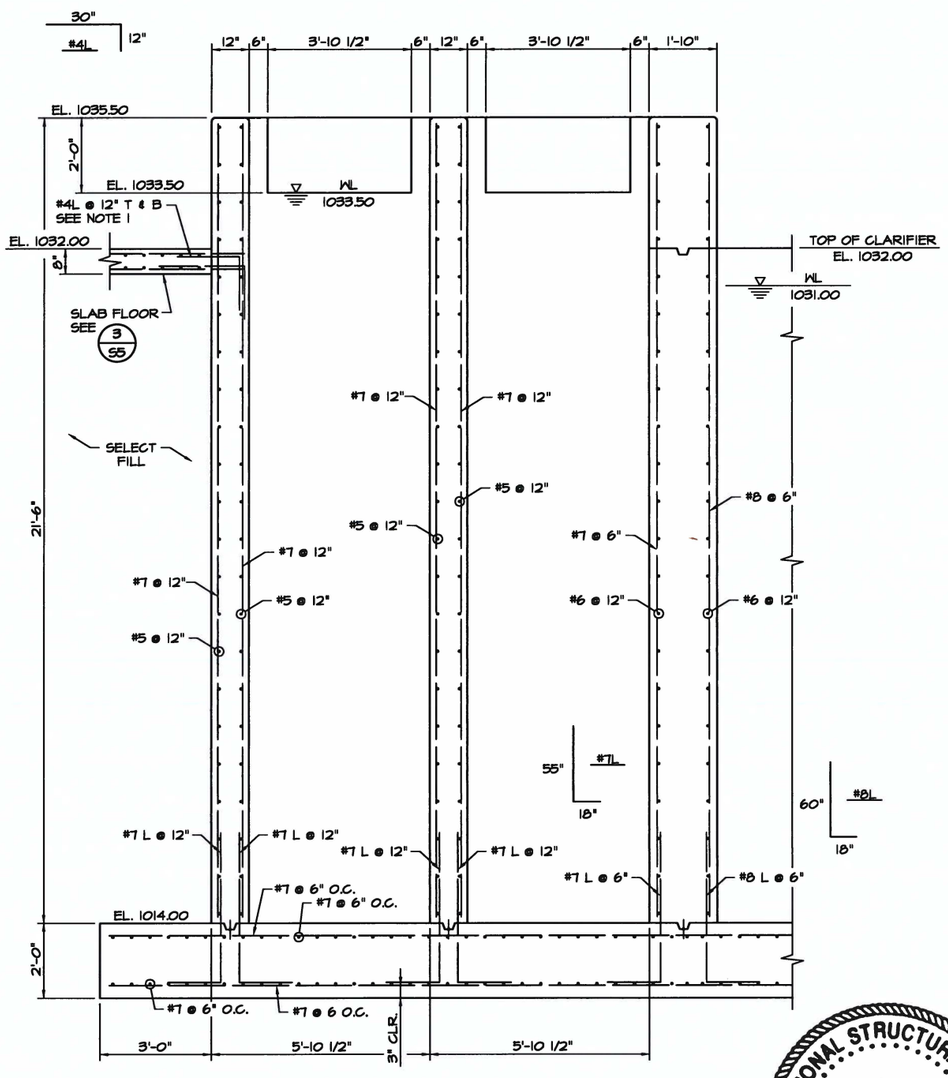
NOTES:

1. PROVIDE #4 L @ 12" T&B OR 32" LG. #4 HILTI HIT HY200 @ 12" WITH 6" MIN. EMBEDMENT

BAR IS ONE INCH ON ORIGINAL DRAWING 0 —— 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	Holloway, Updike and Bellen, Inc. 616 EAST SIDE BOULEVARD HENRYETTA, OKLAHOMA 918/652-7841	WATER TREATMENT PLANT IMPROVEMENTS SHAWNEE MUNICIPAL AUTHORITY	Scale: As Shown	Detail: GPM	TREATMENT PROCESSES STRUCTURAL SECTIONS	Proj. No. 19SHAWWTP
			Date: 2020	Check: JRU		Sht. No. S2



1/53 SECTION @ PULSATING CHAMBER
SCALE: 1/2" = 1'-0"



2/53 SECTION @ RAPID MIX
SCALE: 1/2" = 1'-0"

NOTES:

1. PROVIDE #4 L @ 12" T&B OR 32" LG. #4 HILTI HIT HY200 @ 12" WITH 6" MIN. EMBEDMENT
2. PROVIDE #5 L @ 12" T&B OR 37" LG. #5 HILTI HIT HY200 @ 12" WITH 6" MIN. EMBEDMENT

PROFESSIONAL STRUCTURAL ENGINEER
LOYD STEPHEN TOLAR
20679
3-15-202
OKLAHOMA

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

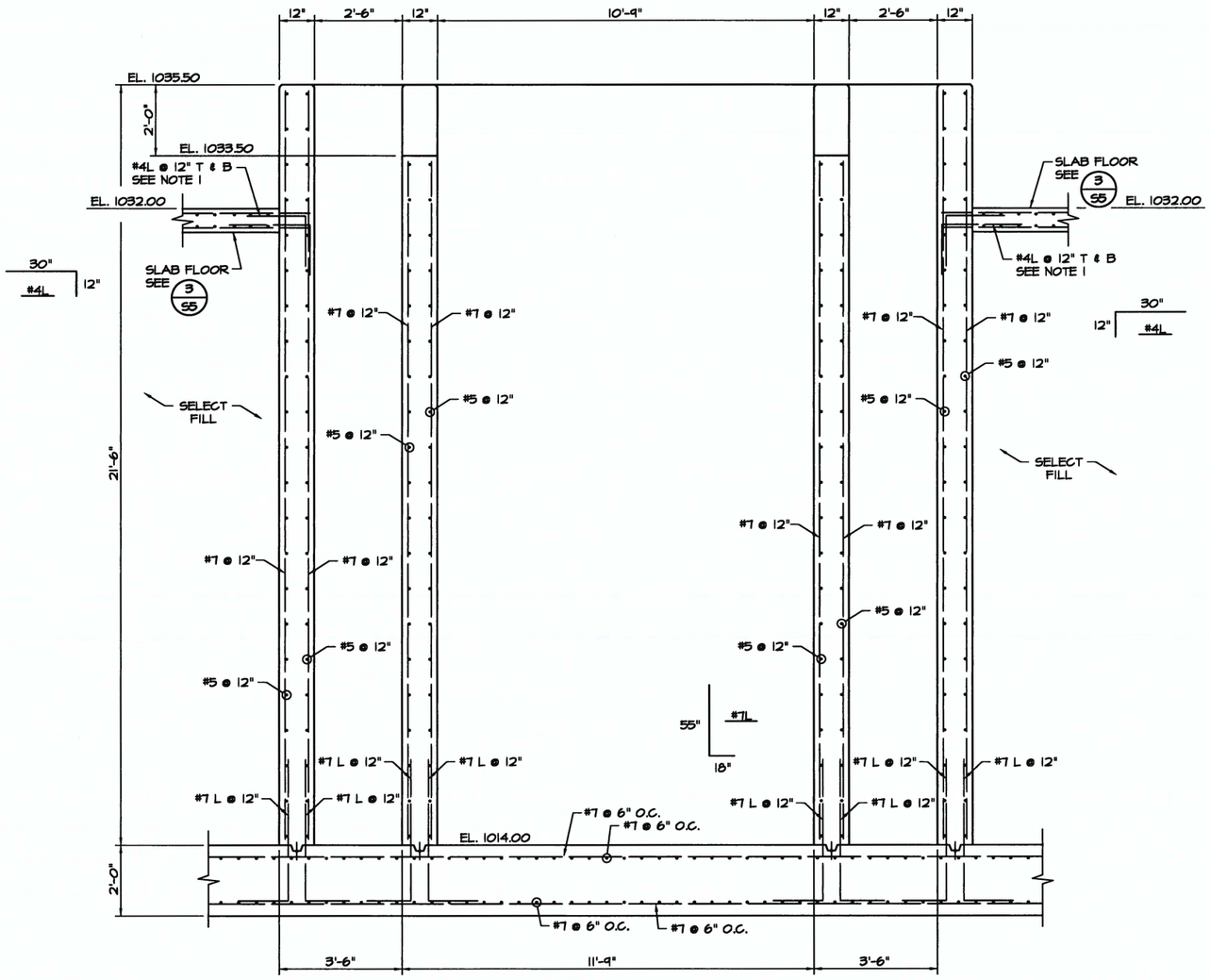
Holloway, Updike and Bellen, Inc.
ENGINEERS
515 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/683-1261

Shawnee WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: GPM
Date: 2020 | Check: JRU

TREATMENT PROCESSES
STRUCTURAL SECTIONS

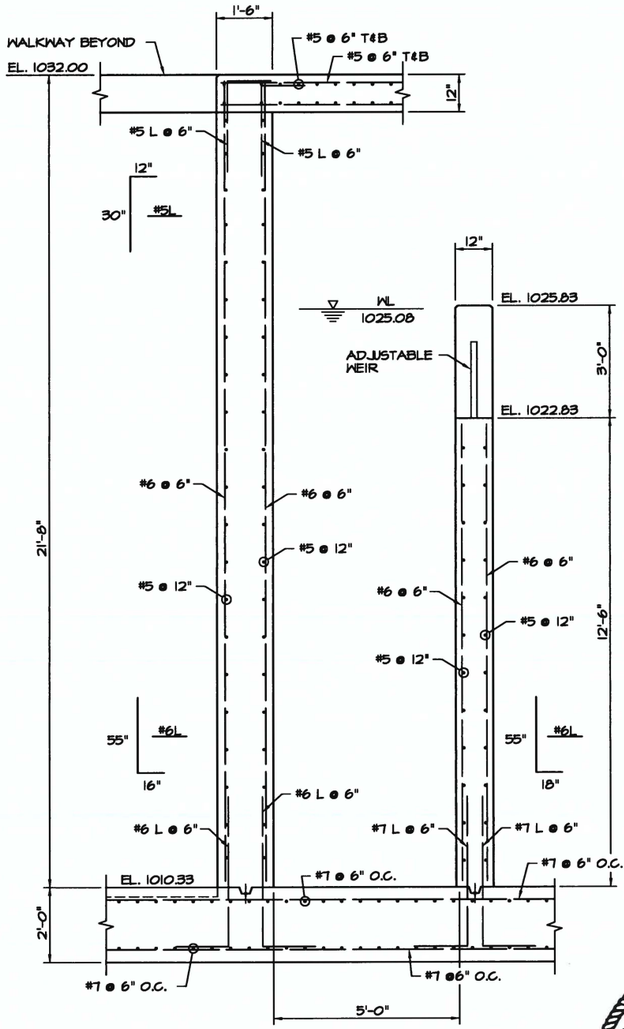
Proj. No. 19SHAWMTP
Sht. No. 53



NOTES:

1. PROVIDE #4 L @ 12" T&B OR 32" LG. #4 HILTI HIT HY200 @ 12" WITH 6" MIN. EMBEDMENT

1/S4 SECTION @ RAPID MIX
SCALE: 1/2" = 1'-0"



2/S4 SECTION @ BACKWASH SUPPLEMENTAL
SCALE: 1/2" = 1'-0"

PROFESSIONAL STRUCTURAL ENGINEER
LOYD STEPHEN TOLAR
20679
3-15-202
OKLAHOMA

BAR IS ONE INCH ON ORIGINAL DRAWING 0 —— 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

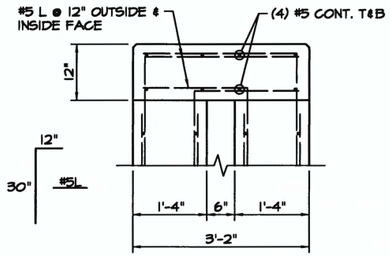
Holloway, Updike and Bellen, Inc.
815 EAST SEE BOULEVARD · MUSKOGEE, OKLAHOMA · 918/683-1316

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

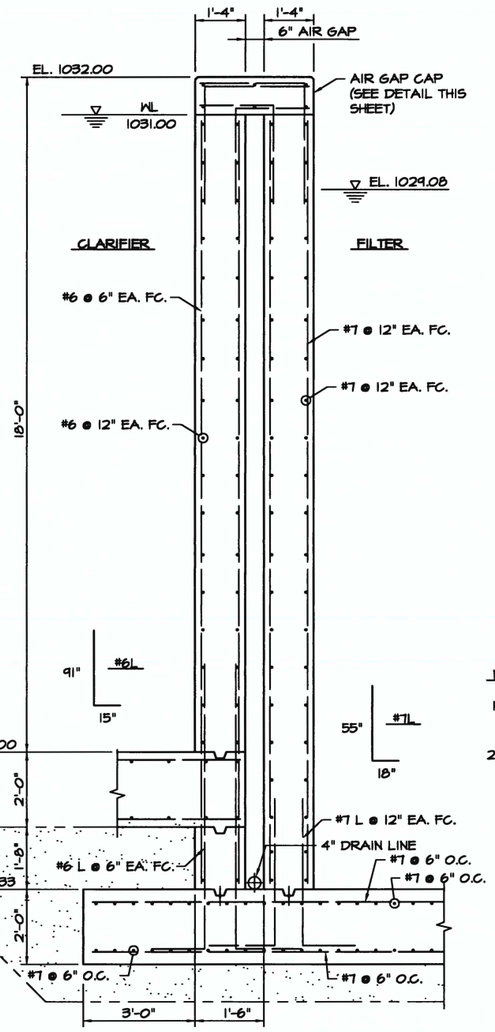
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Date: 2020 | Check: JRU

TREATMENT PROCESSES
STRUCTURAL SECTIONS

Proj. No. 19SHAWWTP
Sht. No. S4



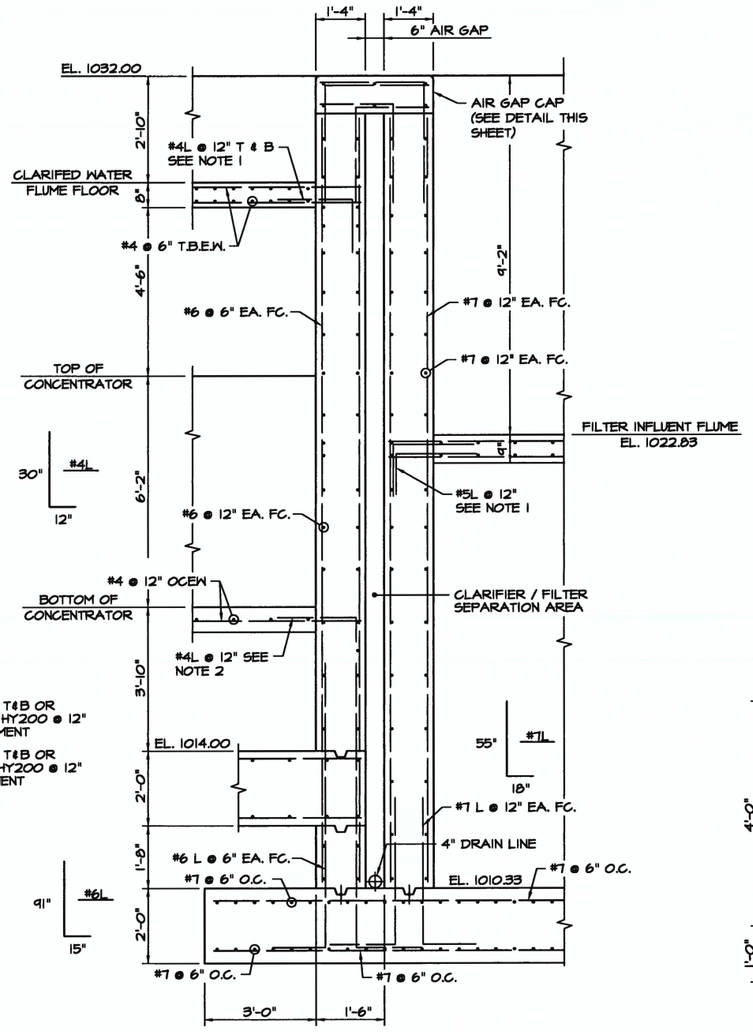
C/S5 AIR GAP WALL CAP DETAIL
SCALE: 3/4" = 1'-0"



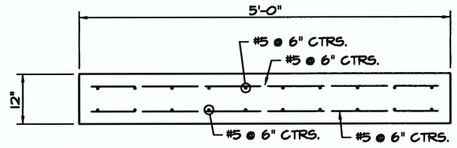
1/S5 SECTION @ CLARIFIER / FILTER AIR GAP
SCALE: 1/2" = 1'-0"

NOTES:

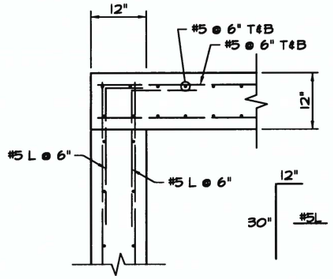
1. PROVIDE #5 L @ 12" T&B OR 32" LG. #5 HILTI HIT HY200 @ 12" WITH 6" MIN. EMBEDMENT
2. PROVIDE #4 L @ 12" T&B OR 22" LG. #4 HILTI HIT HY200 @ 12" WITH 6" MIN. EMBEDMENT



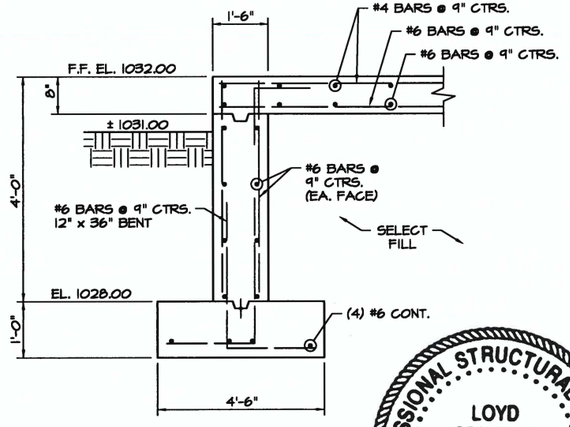
2/S5 SECTION @ CLARIFER TO FILTER WALLS
SCALE: 1/2" = 1'-0"



A/S5 WALKWAY SECTION ABOVE PIPE GALLERY
SCALE: 3/4" = 1'-0"



B/S5 WALKWAY END CONNECTION (TYP. OF EACH END)
SCALE: 3/4" = 1'-0"



3/S5 SECTION
SCALE: 3/4" = 1'-0"



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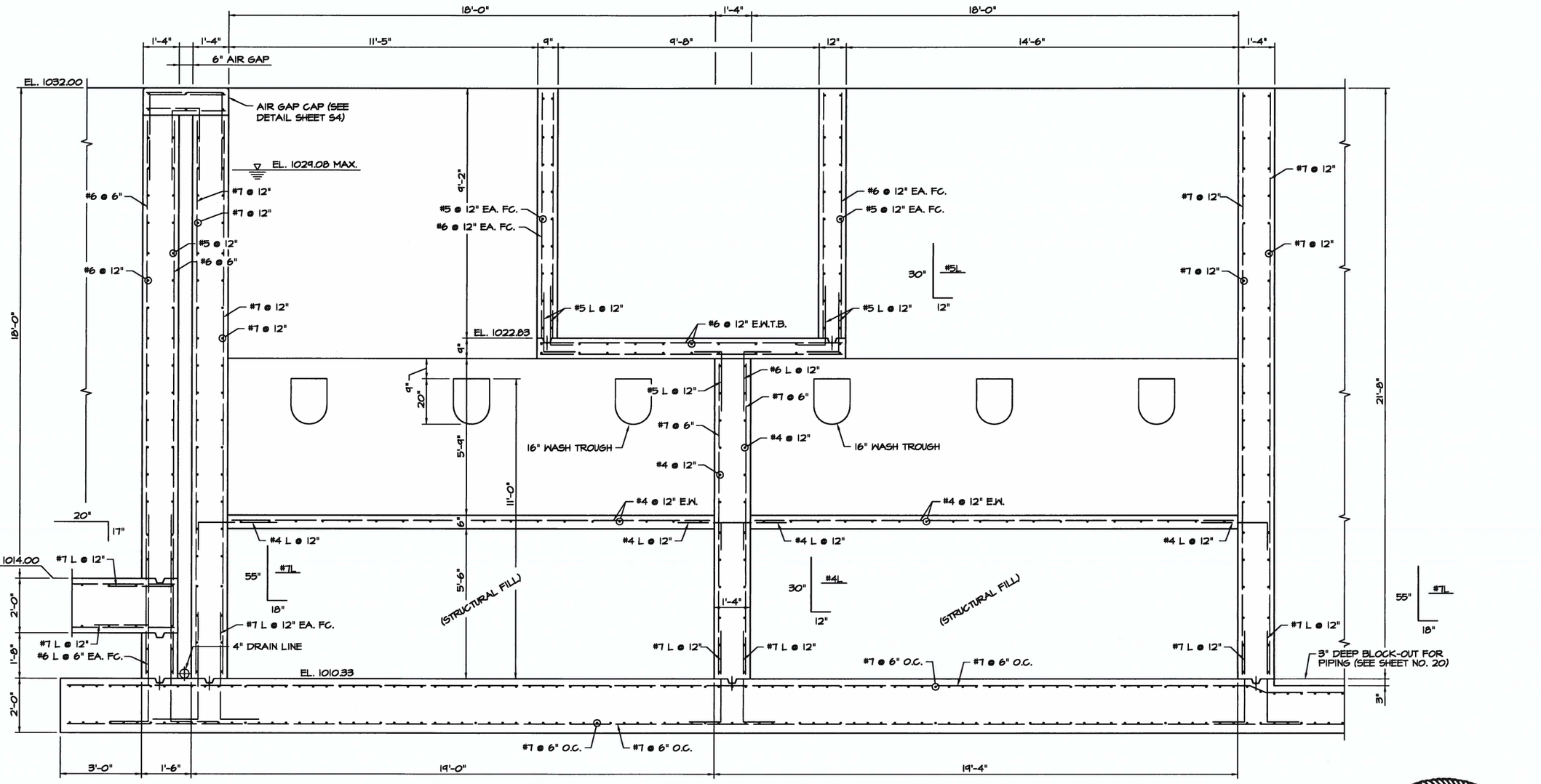
Holloway, Updike and Bellen, Inc.
515 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7816

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: 6PM
Date: 2020 | Check: JRU

TREATMENT PROCESSES
STRUCTURAL SECTIONS

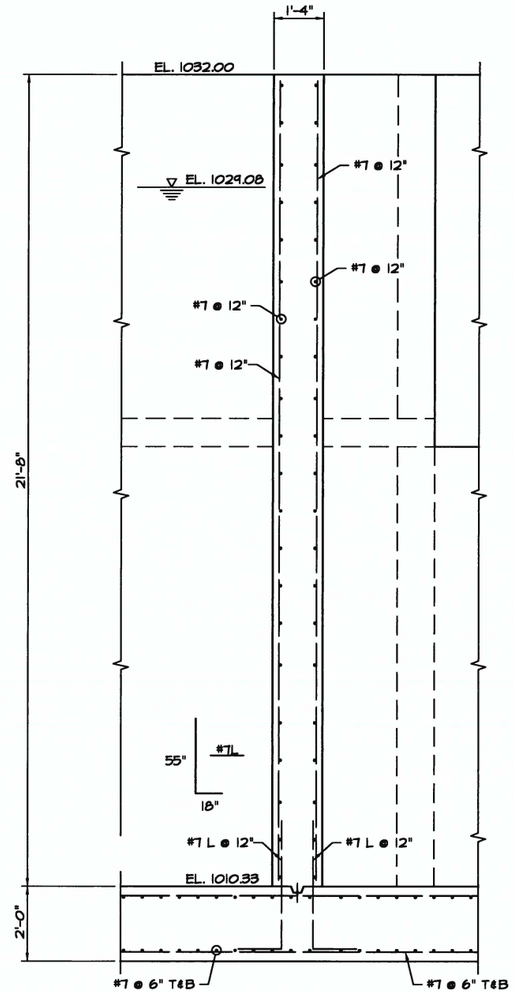
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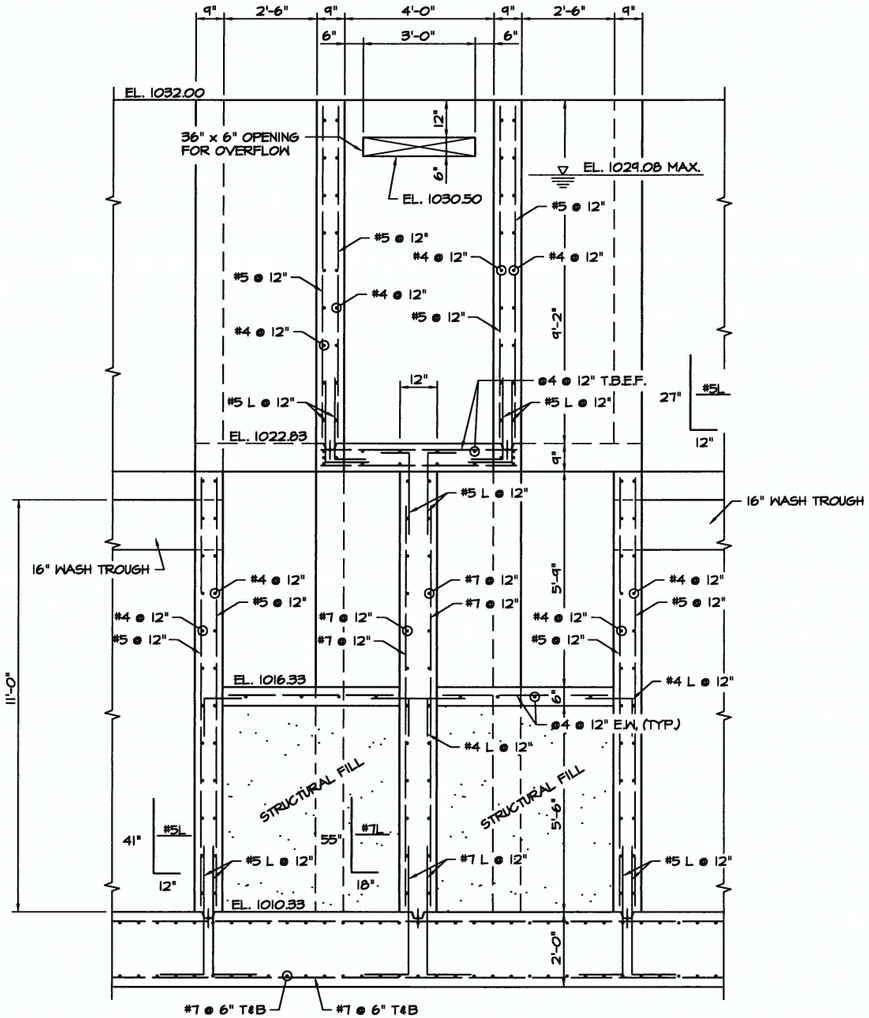
1/S6 SECTION @ FILTERS
SCALE: 1/2" = 1'-0"

PROFESSIONAL STRUCTURAL ENGINEER
LOYD STEPHEN TOLAR
20679
3-15-22
OKLAHOMA

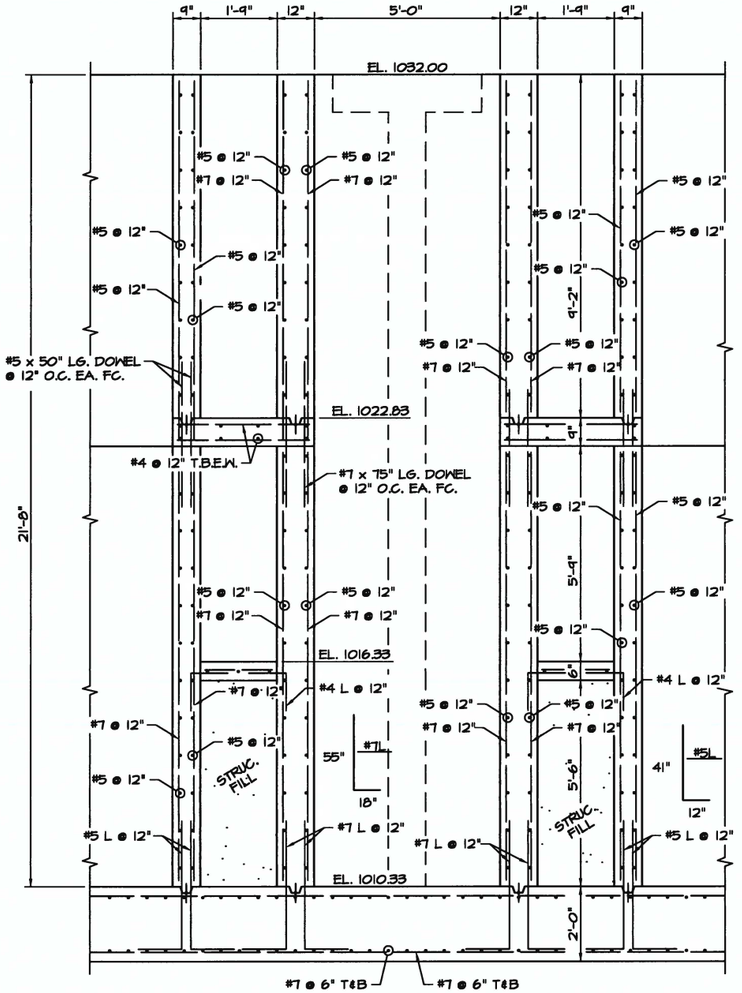
BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	Holloway, Updike and Bellen, Inc. 515 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-1361	WATER TREATMENT PLANT IMPROVEMENTS SHAWNEE MUNICIPAL AUTHORITY	Scale: As Shown	Detail: GPM	TREATMENT PROCESSES STRUCTURAL SECTIONS	Proj. No. 19SHAWWTP
			Date: 2020	Check: JRU		Sht. No. S6



1 / S7 SECTION
SCALE: 1/2" = 1'-0"



2 / S7 SECTION
SCALE: 1/2" = 1'-0"



3 / S7 SECTION
SCALE: 1/2" = 1'-0"

PROFESSIONAL STRUCTURAL ENGINEER
LOYD STEPHEN TOLAR
20679
3-15-202
OKLAHOMA

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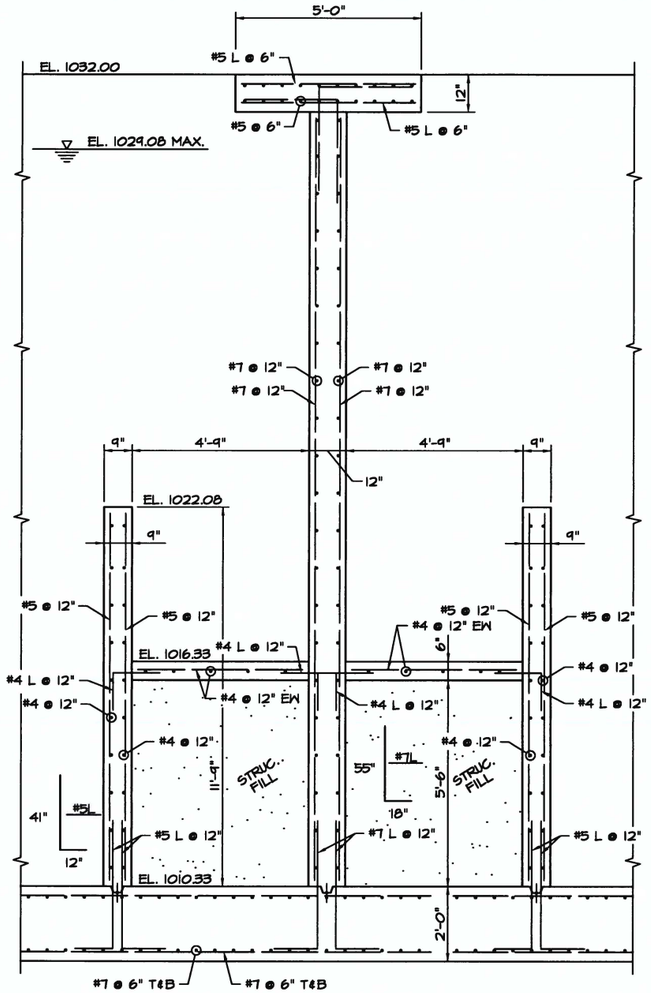
Holloway, Updike and Bellen, Inc.
ENGINEERS
210 EAST SIDE BOULEVARD HENRYETTA, OKLAHOMA 918/652-3311

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

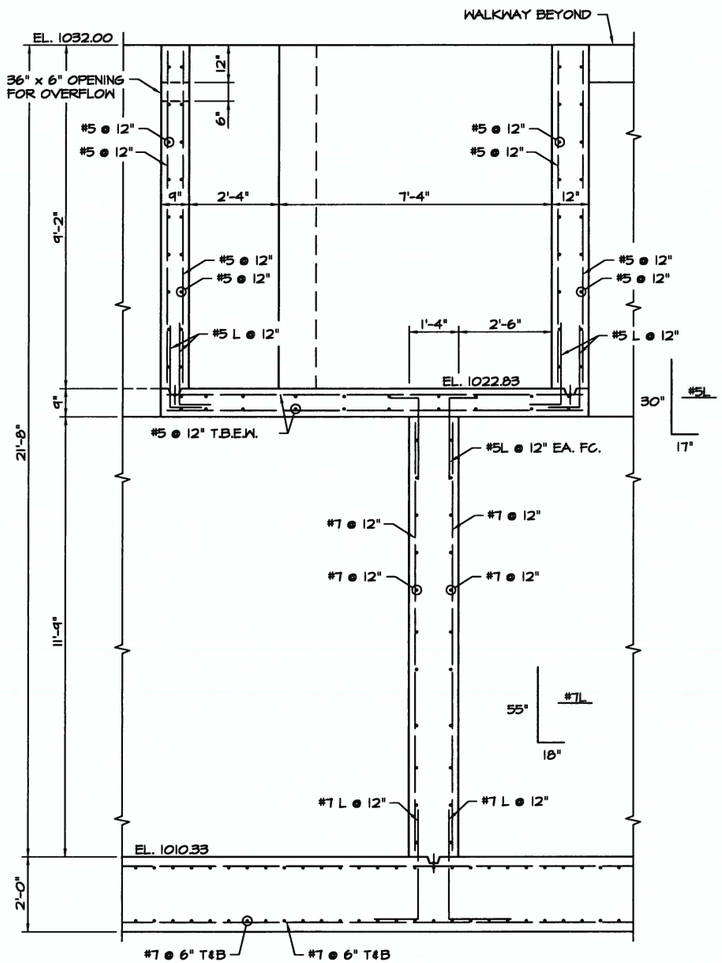
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Date: 2020	Check: JRU

TREATMENT PROCESSES
STRUCTURAL SECTIONS

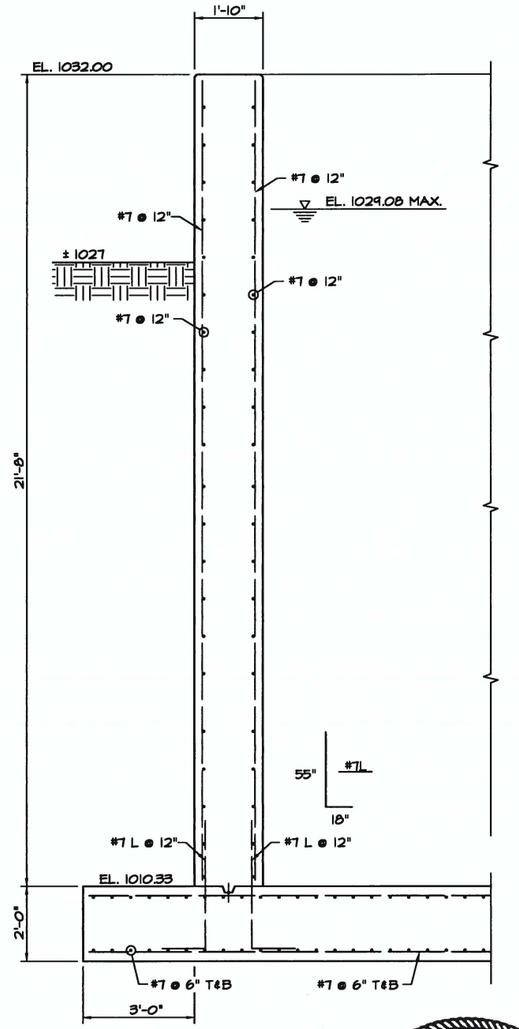
Proj. No. 19SHAWMTP
Sht. No. S7



1 SECTION
58 SCALE: 1/2" = 1'-0"



2 SECTION
58 SCALE: 1/2" = 1'-0"



3 SECTION
58 SCALE: 1/2" = 1'-0"

PROFESSIONAL STRUCTURAL ENGINEER
LOYD STEPHEN TOLAR
20679
3-15-2021
OKLAHOMA

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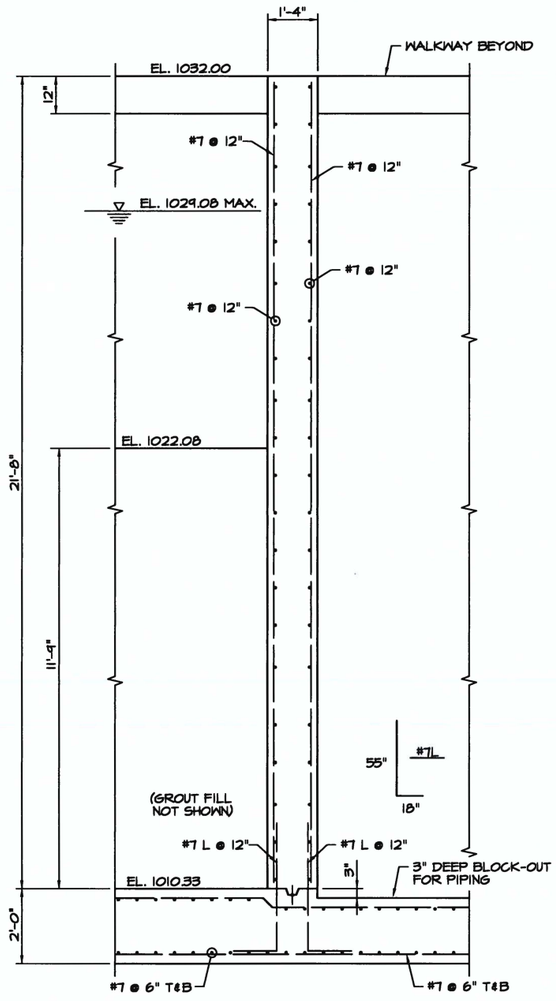
Holloway, Updike and Bellen, Inc.
ENGINEERS
SHAWNEE 210 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/683-1261

Shawnee WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

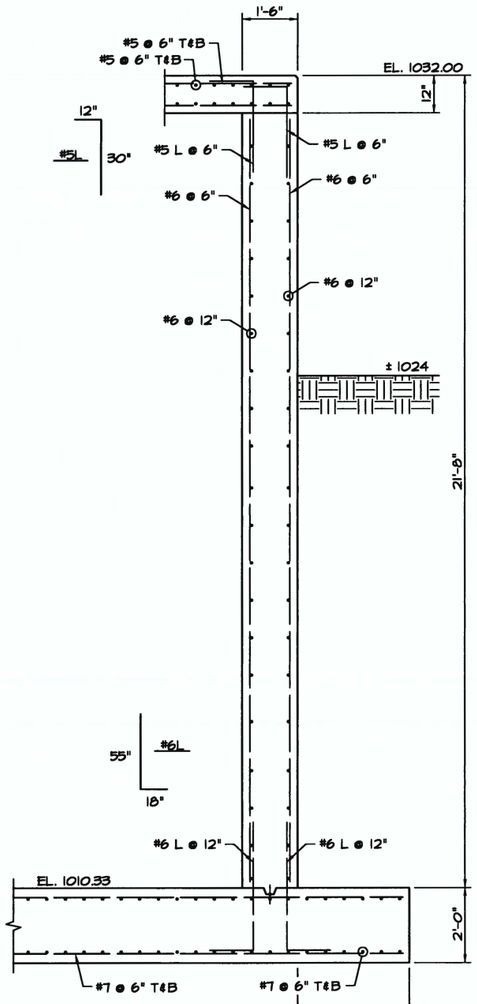
Scale: As Shown	Detail: GPM
Date: 2020	Check: JRU

TREATMENT PROCESSES
STRUCTURAL SECTIONS

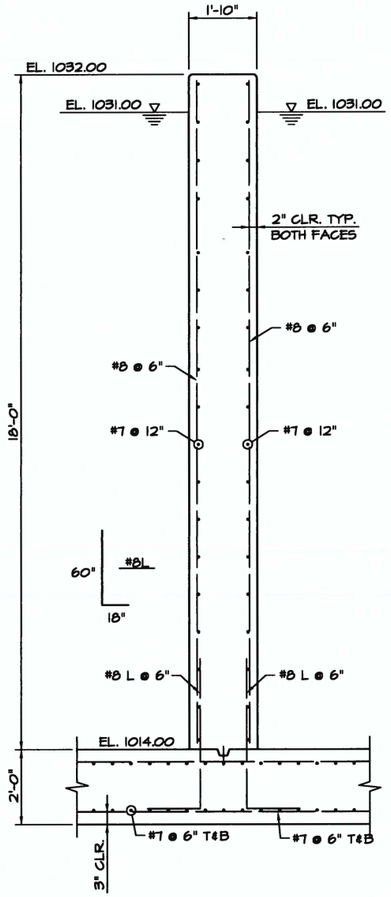
Proj. No. 19SHAWATP
Sht. No. 58



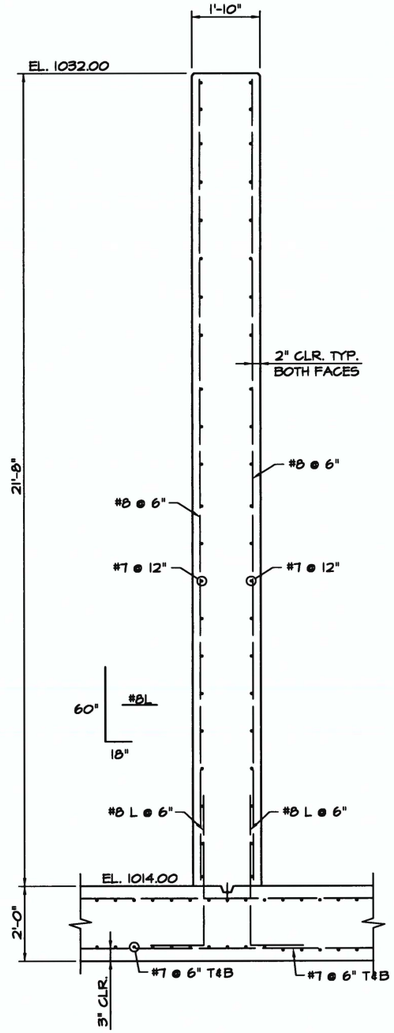
1 / S9 SECTION
SCALE: 1/2" = 1'-0"



2 / S9 SECTION
SCALE: 1/2" = 1'-0"



3 / S9 SECTION
SCALE: 1/2" = 1'-0"



4 / S9 SECTION
SCALE: 1/2" = 1'-0"

PROFESSIONAL STRUCTURAL ENGINEER
LOYD STEPHEN TOLAR
20679
3-15-202
OKLAHOMA

BAR IS ONE INCH ON ORIGINAL DRAWING 0 —— 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

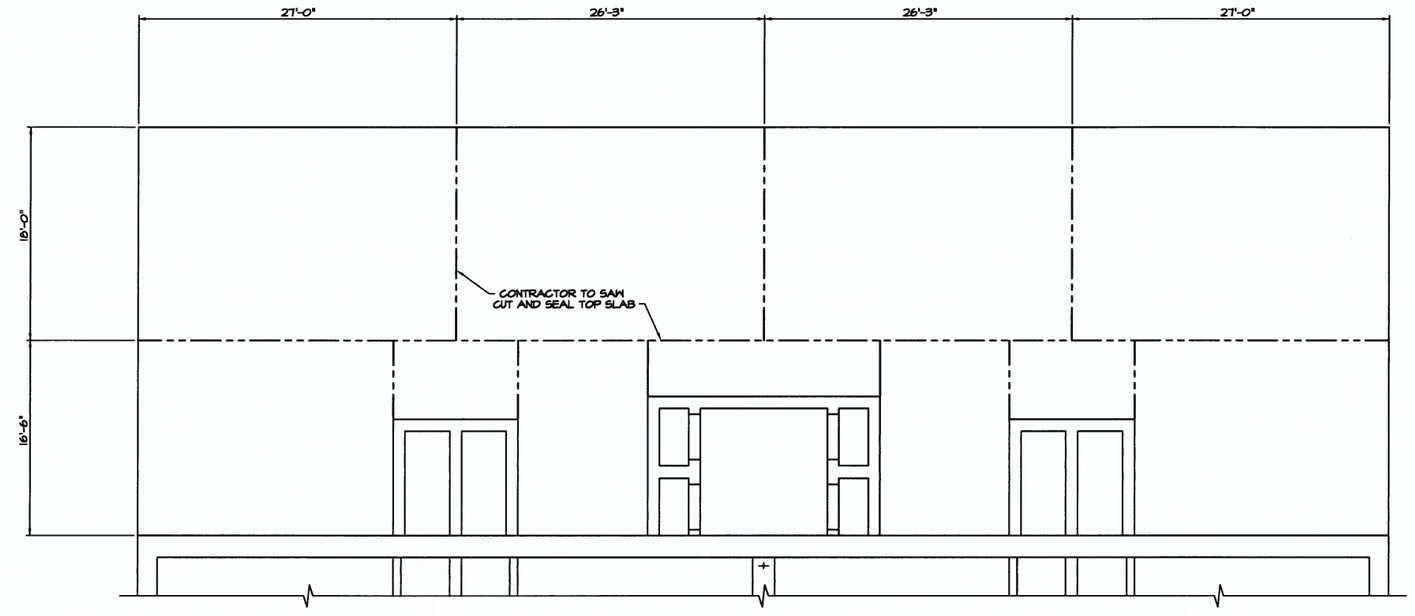
Holloway, Updike and Bellen, Inc.
ENGINEERS
310 EAST SIDE BOULEVARD · HENRYETTA, OKLAHOMA · 918/652-7241

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

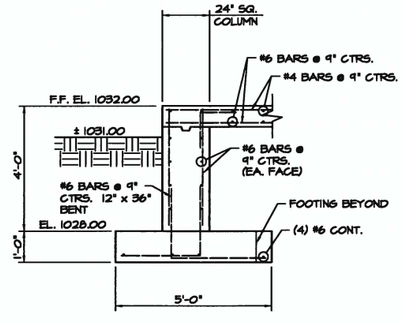
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Date: 2020 | Check: JRU

TREATMENT PROCESSES
STRUCTURAL SECTIONS

Proj. No. 19SHAWMTP
Sht. No. S9



1/S10 SAW CUT & SEAL PLAN
SCALE: 5/32"=1'-0"



2/S10 SECTION
SCALE: 3/4" = 1'-0"

PROFESSIONAL STRUCTURAL ENGINEER
LOYD STEPHEN TOLAR
20679
OKLAHOMA
3-15-202?

BAR IS ONE INCH ON ORIGINAL DRAWING 0 —— 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Holloway, Updike and Bellen, Inc.
ENGINEERS
819 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-781

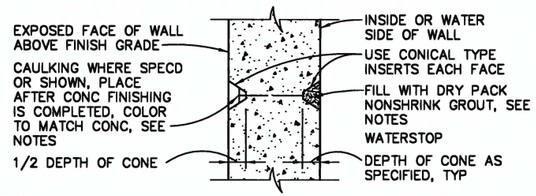
WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: GPM	TREATMENT PROCESS BUILDING FOUNDATION PLAN	Proj. No. 19SHAWATP
Date: 2020	Check: JRU		Sht. No. S10

GENERAL CONSTRUCTION NOTES

CORNER AND INTERSECTION REINFORCING DETAILS

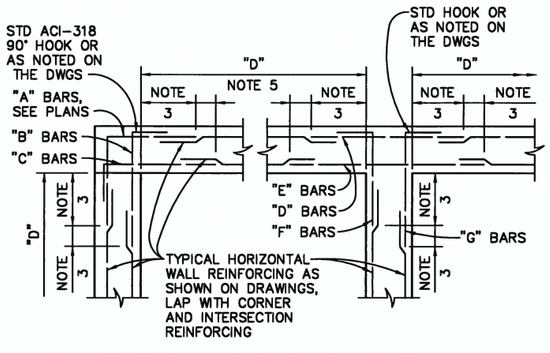
1. TYPICAL HORIZONTAL WALL CORNER AND INTERSECTION REINFORCING LAYOUT IS SHOWN TO AVOID CONGESTION AND PERMIT PROPER PLACEMENT. FOR SIZE AND SPACING SEE PLANS. ALL HORIZONTAL REINFORCING AT CORNERS AND INTERSECTIONS SHALL BE FABRICATED AND INSTALLED WITH SPLICES LOCATED WHERE SHOWN REGARDLESS OF BAR SIZE AND SPACING
2. WHERE THE CORNER OR INTERSECTION REINFORCING SIZE AND SPACING IS NOT SHOWN, NOTED OR TABULATED ON THE PLANS, THE SIZE AND SPACING SHALL BE THE SAME AS THE WALL HORIZONTAL REINFORCING SHOWN ON THE WALL SECTIONS OR AS NOTED FOR THE REINFORCING BETWEEN THE CORNERS OR INTERSECTIONS
3. EXCEPT WHERE OTHERWISE SHOWN ON THE DRAWINGS, THE LENGTH INDICATED AS "NOTE 3" SHALL BE THE LESSER OF D/4, 10 FEET, OR 1.0 TIMES THE HEIGHT OF THE WALL, EXCEPT THAT IN NO CASE SHALL IT BE LESS THAN 2.0 FEET
4. D = LENGTH OF WALL PARALLEL TO THE BAR LENGTH IN QUESTION
5. EXCEPT WHERE OTHERWISE SHOWN ON THE DRAWINGS, THE LENGTH INDICATED AS "NOTE 5" SHALL BE EQUAL TO ONE "LAP LENGTH" AS REQUIRED BY THE GENERAL STRUCTURAL NOTES. USE THE LAP LENGTH AS REQUIRED FOR THE SMALLER OF THE TWO REINFORCING BARS BEING SPLICED
6. UNLESS OTHERWISE NOTED, "B" AND "C" BARS ARE THE SAME SIZE AND SPACING AND "F" AND "G" BARS ARE THE SAME SIZE AND SPACING



NOTES:

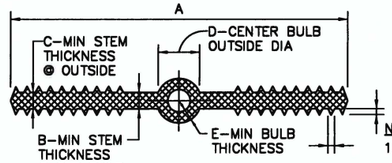
1. FOR FORM TIE HOLES ON OUTSIDE FACE OF WALL BELOW GRADE. FILL WITH NONSHRINK GROUT, (DRY PACK)
2. THE SPACING OF FORM TIES ON EXPOSED PORTIONS OF WALLS SHALL BE APPROXIMATELY EQUAL HORIZONTALLY AND VERTICALLY AND SHALL BE UNIFORM IN EACH DIRECTION
3. WHERE CHAULKING IS NOT SPECIFIED OR SHOWN, DRY PACK EXTERIOR TIE HOLES WITH NONSHRINK GROUT WITH COLOR OF GROUT TO MATCH COLOR OF CONCRETE AS CLOSE AS POSSIBLE
4. DRY PACK METHOD SHALL BE AS SPECIFIED USING STEEL TOOLS

1 / S11 FORM SNAP TIE-HOLE
NTS



TYPICAL DOUBLE MAT CORNER AND INTERSECTION REINFORCING
2 / S11
NTS

(SEE PLANS FOR SIZE AND SPACING)



SIZE	A	B	C	D	E	F
4"x1/4	4"	1/4		3/4	1/4	4
6"x3/8	6"	3/8		7/8	1/4	5
9"x7/8	9"	7/8		1"	1/4	8

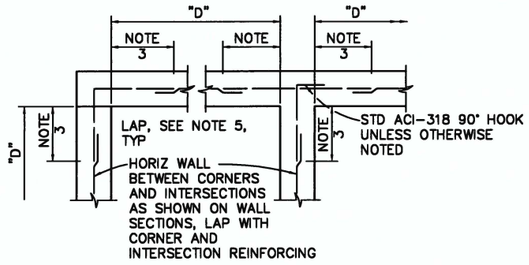
F-APPROXIMATE NO OF RIBS EA SIDE, EA FACE OF WS

1/8" PROJECTION ALL RIBS, TYP

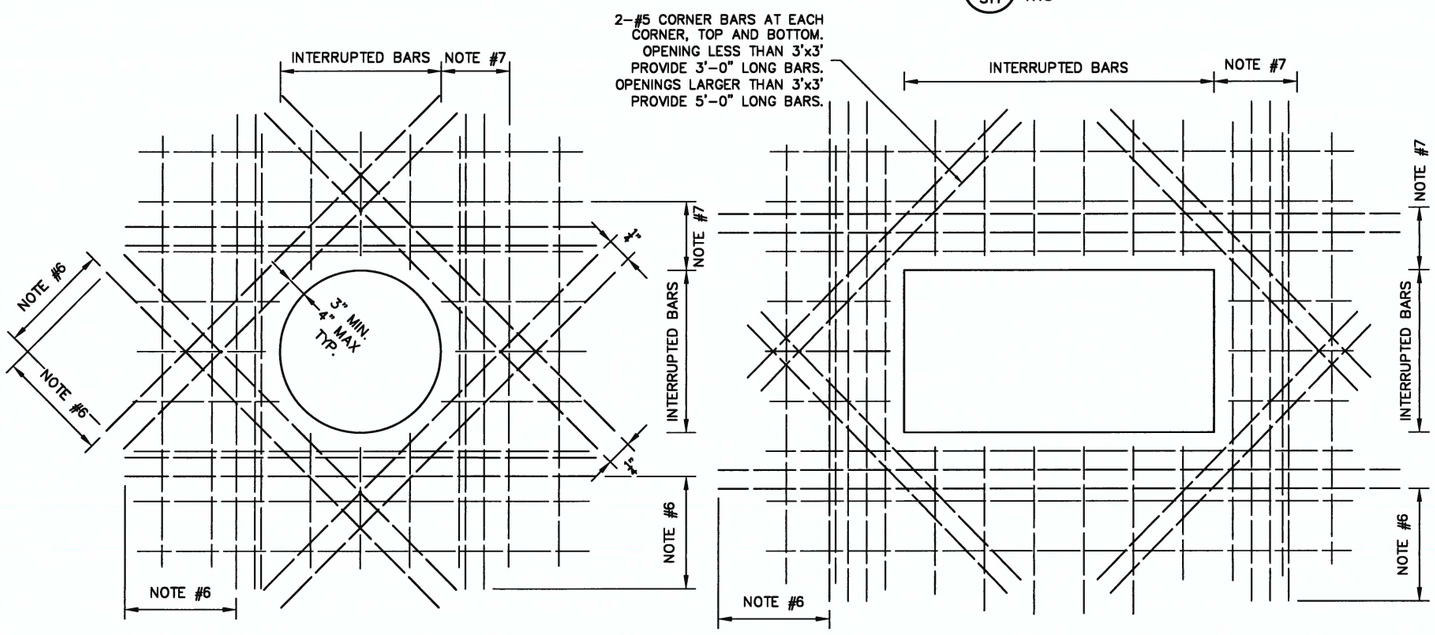
NOTE:

1. MATERIAL QUALITY PER SPECIFICATIONS
2. DIM REQUIREMENTS INDICATED SHOULD BE GIVEN TO SUPPLIERS PRIOR TO PLACING ORDERS
3. NON-ROUND CENTER BULBS SHALL HAVE A MIN OUTSIDE DIM OF "D"

3 / S11 PLASTIC WATER STOP
NTS



TYPICAL SINGLE MAT CORNER AND INTERSECTION REINFORCING
4 / S11
NTS



THICKNESS OF CONCRETE	BAR SIZE	BAR LENGTH "C"
<12"	5	3'-0"
12" TO 18"	5	3'-0"
>18"	6	4'-0"

5 / S11 OPENING REINFORCING
NTS

NOTES:

1. TYPICAL FOR ALL OPENINGS IN CONCRETE WALLS AND SLABS. PROVIDE ADDITIONAL REINFORCEMENT IN ACCORDANCE WITH THIS DETAIL UNLESS OTHER DETAILS ARE SHOWN IN THE CONTRACT DOCUMENTS.
2. INTERRUPTED BARS MATCH SIZE OF REQUIRED REINFORCEMENT. PLACE ADDITIONAL REINFORCEMENT TO MATCH REQUIRED BAR ORIENTATION AND ELEVATION.
3. DO NOT WELD REINFORCEMENT TO PIPE SLEEVES AND INSERTS.
4. DETAILS APPLY TO EACH MAT OF REINFORCEMENT.
5. IF UNEVEN NUMBER OF BARS ARE INTERRUPTED, PLACE ADDITIONAL BAR OF EQUAL SIZE TO HAVE EVEN NUMBER OF BARS ON EACH SIDE OF OPENING.
6. PROVIDE MINIMUM LAP LENGTHS AS REQUIRED
7. PLACEMENT OF ADDED BARS SHALL HAVE MINIMUM SPACING OF 2" O.C. & MAXIMUM SPACING OF 4" O.C., TYPICAL ALL SIDES WHILE MAINTAINING REQUIRED CLEAR DISTANCE BETWEEN BARS FOR CONCRETE PLACEMENT.



POWER, LIGHTING & SYSTEM LEGEND

	UNDER CABINET LIGHT FIXTURE
	1x4 FLUORESCENT LIGHT
	2x4 FLUORESCENT LIGHT
EL	FLUORESCENT LIGHT WITH EMERGENCY LIGHT (EL) BATTERY 1400 LUMENS MINIMUM FOR 2 LAMPS
	2x2 FLUORESCENT LIGHT
	RECESSED LIGHT, UNLESS OTHERWISE SHOWN
	WALL MOUNTED LIGHT–MOUNTING HEIGHT AS INDICATED
	LED EXIT LIGHT, CEILING MOUNTED OR AS INDICATED, DARKENED AREA INDICATES FACE, ARROWS INDICATE DIRECTION OF EGRESS
	EMERGENCY EXIT LIGHT, WALL MOUNT 7'–6" A.F.F. OR AS NOTED
	4 FT. STRIP FLUORESCENT LIGHT
S	LIGHT SWITCH, MTD. 4'–0" A.F.F.
S_2	LIGHT SWITCH, 2 POLE, MTD 4'–0" A.F.F.
S_3	LIGHT SWITCH, 3–WAY, MTD. 4'–0" A.F.F.
S_4	LIGHT SWITCH, 4–WAY, MTD. 4'–0" A.F.F.
S_P	LIGHT SWITCH WITH PILOT LIGHT, MTD. 4'–0" A.F.F.
	20 AMP DUPLEX RECEPTACLE MTD. HORIZ. 6" ABOVE COUNTER TOP UNLESS OTHERWISE SHOWN
	20 AMP DUPLEX RECEPTACLE MTD. 18" A.F.F., WITH #12 GROUND WIRE, GFCI INDICATES GROUND FAULT CIRCUIT INTERRUPTER, WP INDICATES WEATHERPROOF WHILE IN USE ENCLOSURE AND COVER
	SINGLE RECEPTACLE, RATINGS AS NOTED
S_M	HP RATED TOGGLE SWITCH, 1 OR 2 POLES AS REQUIRED W/OVERLOADS
OR	NON–FUSED DISCONNECT SWITCH, SIZE AS NOTED
OR	COMBINATION DISCONNECT AND MOTOR STARTER, SIZE AS NOTED. FUSED TYPE SHOWN.
F OR	FUSED DISCONNECT SWITCH, SIZE AS NOTED
	PUSHBUTTON STATION, NEMA 4X
	ELECTRICAL PANEL, SURFACE MOUNTED, 5'–6" TO TOP OF ENCLOSURE
	ELECTRICAL PANEL, RECESSED MOUNTED, 5'–6" TO TOP OT ENCLOSURE
	EQUIPMENT CABINET SIZE AS NOTED, RECESSED MOUNTED, 5'–6" TO TOP OF ENCLOSURE
	EQUIPMENT CABINET SIZE AS NOTED, SURFACE MOUNTED, 5'–6" TO TOP OF ENCLOSURE
L–1	HOME RUN TO PANEL, RECEPTACLES AND EQUIPMENT SHALL HAVE GREEN GROUND WIRE. NUMBER OF ARROWS INDICATES NUMBER OF PHASE CONDUCTORS, LETTER(S) INDICATE NAME OF PANEL, NUMBER(S) INDICATE CIRCUIT NUMBERS
	BRANCH CIRCUIT WITH PHASE, NEUTRAL, SWITCHED PHASE AND EQUIPMENT GROUNDING CONDUCTORS
W	TELEPHONE OR DATA OUTLET, SINGLE GANG BOX MTD. 18" A.F.F. WITH 3/4"C STUB TO ABOVE LAY–IN CEILING. "W" INDICATES 4'–6" MTD. HEIGHT FOR WALL PHONE.

	3/4" PLYWOOD TELEPHONE BACKBOARD, SIZE AS NOTED, MTD. 5'–6" TO TOP
J	JUNCTION BOX 42 CUBIC INCH MINIMUM CAPACITY
SH	SMOKE DETECTOR, WALL MTD.
S	SMOKE DETECTOR, CEILING MTD.
F	FIRE ALARM PULL STATION MTD. 4'–0" A.F.F.
F	FIRE ALARM PULL STATION MTD. 4'–0" A.F.F. AND HORN MTD. 7'–0" A.F.F.
D	SMOKE DETECTOR, HVAC DUCT MTD.
C	FIRE ALARM CHIME 7'–0" A.F.F.
FS	SPRINKLER FLOW SWITCH
	FLOOR TELEPHONE OUTLET, CAST JUNCTION–BOX
	WALL TELEPHONE/DATA OUTLET
S	DOOR SWITCH MOUNTED IN DOOR JAMB
	DOOR BUTTON WEATHER PROOF, 50" A.F.F.
B	DOOR BUZZER MTD 7'–0" A.F.F.
H OR MH H–1 MH–1	HANDHOLE OR MANHOLE, IDENTIFIER SHOWN, REFER TO HANDHOLE OR MANHOLE SCHEDULE FOR SIZE
	CIRCUIT BREAKER, TRIP RATING SHOWN, 3–POLE UNLESS NOTED
*	FUSE, CURRENT LIMITING, RATING AS SHOWN
* * *	TRANSFORMER, RATINGS AS SHOWN
M 10 HP	ELECTRIC MOTOR, HORSEPOWER SHOWN
*	MOTOR STARTER, SIZE AS SHOWN OR REQUIRED. FVNR UNLESS NOTED
	VARIABLE FREQUENCY DRIVE
4–4"	DUCT BANK, IDENTIFIER SHOWN. REFER TO DUCT BANK SCHEDULE FOR SIZE AND CONFIGURATION.
	3/4" x 10' COPPER CLAD GROUND ROD
SA	SURGE ARRESTOR
G * kW	GENERATOR
ATS/BP/IS 3P400	ATS
	WEATHERHEAD
	CABLE CONNECTION

LINE TYPES

———	FURNISH + INSTALL
- - - - -	EXISTING

GENERAL NOTE:

1. SOME SYMBOLS OR ABBREVIATIONS MAY APPEAR ON THIS SHEET AND NOT BE UTILIZED ON THE PROJECT.

2(3#8 + 1#8 + 1#10EG) 3/4" GRS

- CONDUIT TYPE (SEE ABBREVIATIONS) REFER TO SPECIFICATIONS IF NOT SHOWN
- CONDUIT SIZE
- GROUNDING (GROUND) CONDUCTOR, NUMBER AND SIZE
- GROUNDED (NEUTRAL) CONDUCTOR, NUMBER AND SIZE
- PHASE (HOT) CONDUCTOR, NUMBER AND SIZE
- NUMBER OF SETS

ABBREVIATIONS

A	AMP
ACU	AIR CONDITIONING UNIT
AFF	ABOVE FINISHED FLOOR
AIC	AMPS INTERRUPTING CAPACITY
AM	AMP–METER
ANN	ANNUNCIATOR
AP	AERIAL PRIMARY
AS	AERIAL SECONDARY
AUX	AUXILIARY
BFI	BLOWN FUSE INDICATOR
BKR	BREAKER
C	CONDUIT
CGRS	PVC COATED GALVANIZED RIGID STEEL
CKT	CIRCUIT
COM	COMMON
CONT	CONTINUOUS
CP	CONTROL PANEL
CPT	CONTROL POWER TRANSFORMER
CR	CONTROL RELAY
CS	CORD SET
CU	COEFFICIENT OF UTILIZATION
DEB	DIRECT EARTH BURIED
EC	EMPTY OR EMBEDDED CONDUIT
EF	EXHAUST FAN
EG	EQUIPMENT GROUND
EL	ELEVATION
EMT	ELECTRICAL METALLIC TUBING
ETM	ELASPED TIME METER
FA	FIRE ALARM
FAP	FIRE ALARM PANEL
FC	FAN COIL
FLR	FLOOR
FOC	FIBER OPTIC CABLE
FS	FLOAT SWITCH
FT	FEET
FVNR	FULL VOLTAGE NON–REVERSING STARTER
FVR	FULL VOLTAGE REVERSING STARTER
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GND	GROUND
GRS	GALVANIZED RIGID STEEL
HOA	HAND–OFF–AUTO
HP	HORSEPOWER OR HEAT PUMP
HR	HOUR
JB	JUNCTION BOX
kVA	KILOVOLT–AMPERE
kVAR	KILOVOLT–AMPERE, REACTIVE
kW	KILOWATT
LA	LIGHTNING ARRESTOR
L.O.	LUGS ONLY
LV	LOW VOLTAGE
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MFR	MANUFACTURER
MIN	MINIMUM
MS	MOTOR STARTER
MTD	MOUNTED
NFDS	NON–FUSED DISCONNECT SWITCH
NTS	NOT TO SCALE
OC	ON CENTER
OH	OVERHEAD
OL	OVERLOAD
PB	PUSH BUTTON
PEC	PHOTO ELECTRIC CELL
PF	POWER FACTOR
PL	PILOT LIGHT
PMR	PHASE MONITOR RELAY
PNL	PANEL
PTT	PUSH–TO–TEST
PVC	SCHEDULE 40 POLYVINYL CONDUIT
RECPT	RECEPTACLE
RM	ROOM
RVAT	REDUCED VOLTAGE AUTO–TRANSFORMER STARTER
S	SECOND
SA	SURGE ARRESTER
SDBC	SOFT DRAWN BARE COPPER
SE	SERVICE ENTRANCE
SHT	SHEET
SN	SOLID NEUTRAL
SS	STAINLESS STEEL
STA	STATION
SW	SWITCH
TC	TIME CLOCK
TEL	TELEPHONE
TD	TIME DELAY
TDD	TIME DELAY ON DE–ENERGIZATION
TDE	TIME DELAY ON ENERGIZATION
TYP	TYPICAL
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
UG	UNDER GROUND
UH	UNIT HEATER
UP	UNDERGROUND PRIMARY
US	UNDERGROUND SECONDARY
VA	VOLT–AMP
VFD	VARIABLE FREQUENCY DRIVE
VM	VOLT–METER
W	WATT OR WIRE
WH	WEATHER HEAD
WM	WATT METER
WP	WEATHERPROOF
W/	WITH
XMFR	TRANSFORMER

CONTROL SCHEMATIC LEGEND

———	WIRING WITHIN PANEL
- - - - -	WIRING TO FIELD DEVICE
	PUSHBUTTON SWITCH, NORMALLY OPEN
	PUSHBUTTON SWITCH, NORMALLY CLOSED
	SELECTOR SWITCH, NUMBER OF POSITIONS AND CONTACTS AS SHOWN
	RELAY CONTACT, NORMALLY OPEN
	RELAY CONTACT, NORMALLY CLOSED
	TIME DELAY CONTACT, CLOSE ON ENERGIZATION
	TIME DELAY CONTACT, OPEN ON ENERGIZATION
	TIME DELAY CONTACT, OPEN ON DE–ENERGIZATION
	TIME DELAY CONTACT, CLOSE ON DE–ENERGIZATION
	LEVEL SWITCH
	PRESSURE SWITCH
	LIMIT SWITCH CONTACT, NORMALLY OPEN
	LIMIT SWITCH CONTACT, NORMALLY CLOSED
	LIMIT SWITCH CONTACT, HELD OPEN
	LIMIT SWITCH CONTACT, HELD CLOSED
	RELAY COIL, "TR" INDICATES "TIMING RELAY"
	PILOT LIGHT; "A" INDICATES "AMBER LENS" "G" INDICATES "GREEN LENS" "R" INDICATES "RED LENS"
	SOLENOID
ETM	ELAPSED TIME METER
	TERMINAL BLOCK
	ELECTRICAL CONNECTION
	FUSE, AMPERE RATING AS SHOWN OR REQUIRED "BFI" INDICATES "BLOWN FUSE INDICATOR" TYPE
	GROUND CONNECTION TO ENCLOSURE GROUND BAR



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11/10/2020 9:55 AM

BAR IS ONE INCH ON ORIGINAL DRAWING — IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

BROWN ENGINEERS 501-448-0100

Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

Shawnee — WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

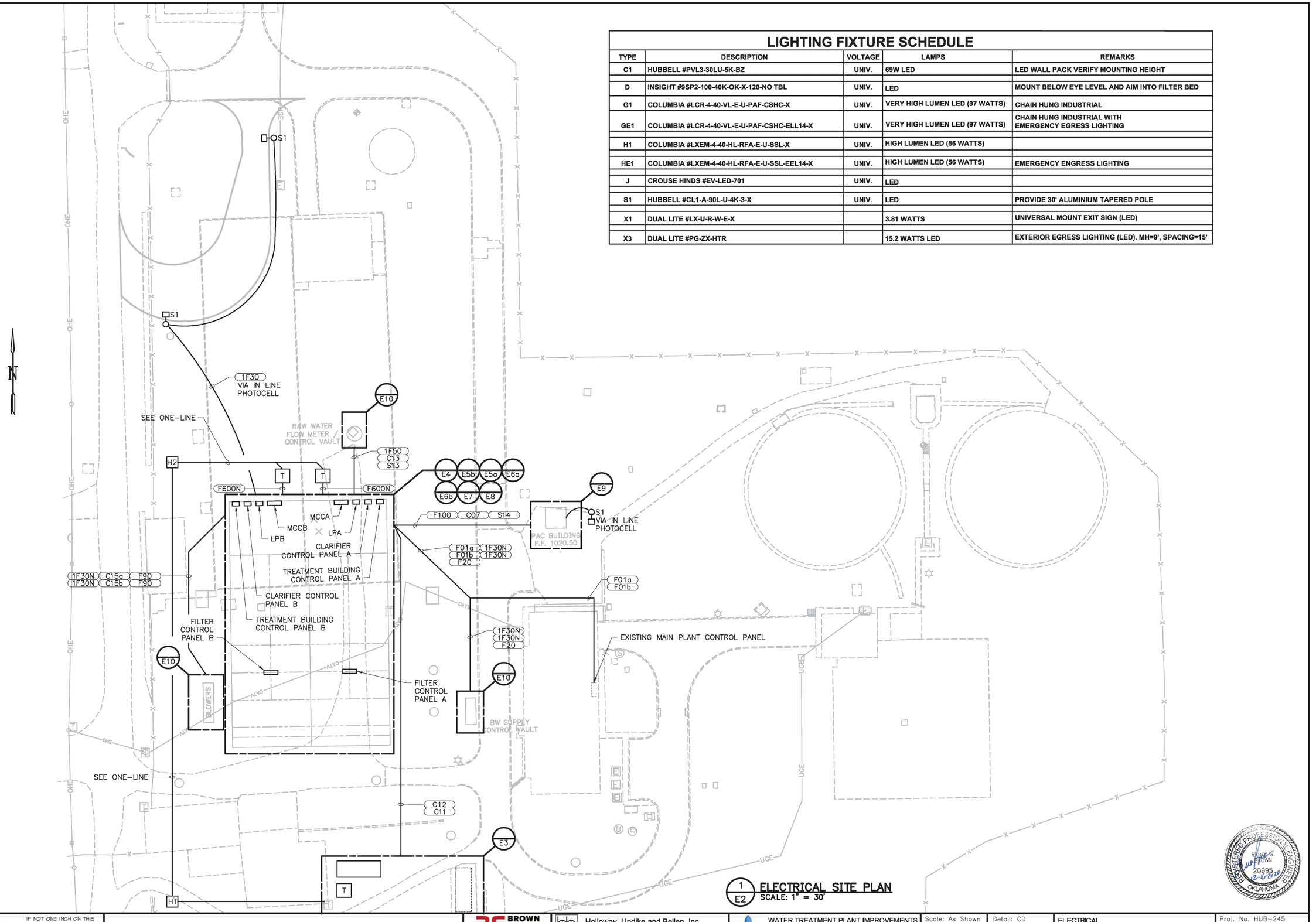
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Date: 2020 | Check: BB

ELECTRICAL
LEGEND AND ABBREVIATIONS

Proj. No. HUB–245
Sht. No. E1

LIGHTING FIXTURE SCHEDULE

TYPE	DESCRIPTION	VOLTAGE	LAMPS	REMARKS
C1	HUBBELL #PVL3-30LU-5K-BZ	UNIV.	69W LED	LED WALL PACK VERIFY MOUNTING HEIGHT
D	INSIGHT #9SP2-100-40K-OK-X-120-NO TBL	UNIV.	LED	MOUNT BELOW EYE LEVEL AND AIM INTO FILTER BED
G1	COLUMBIA #LCR-4-40-VL-E-U-PAF-CSHC-X	UNIV.	VERY HIGH LUMEN LED (97 WATTS)	CHAIN HUNG INDUSTRIAL
GE1	COLUMBIA #LCR-4-40-VL-E-U-PAF-CSHC-ELL14-X	UNIV.	VERY HIGH LUMEN LED (97 WATTS)	CHAIN HUNG INDUSTRIAL WITH EMERGENCY EGRESS LIGHTING
H1	COLUMBIA #LXEM-4-40-HL-RFA-E-U-SSL-X	UNIV.	HIGH LUMEN LED (56 WATTS)	
HE1	COLUMBIA #LXEM-4-40-HL-RFA-E-U-SSL-EEL14-X	UNIV.	HIGH LUMEN LED (56 WATTS)	EMERGENCY ENGRESS LIGHTING
J	CROUSE HINDS #EV-LED-701	UNIV.	LED	
S1	HUBBELL #CL1-A-90L-U-4K-3-X	UNIV.	LED	PROVIDE 30' ALUMINIUM TAPERED POLE
X1	DUAL LITE #LX-U-R-W-E-X		3.81 WATTS	UNIVERSAL MOUNT EXIT SIGN (LED)
X3	DUAL LITE #PG-ZX-HTR		15.2 WATTS LED	EXTERIOR EGRESS LIGHTING (LED). MH=9', SPACING=15'



1 / E2 **ELECTRICAL SITE PLAN**
SCALE: 1" = 30'

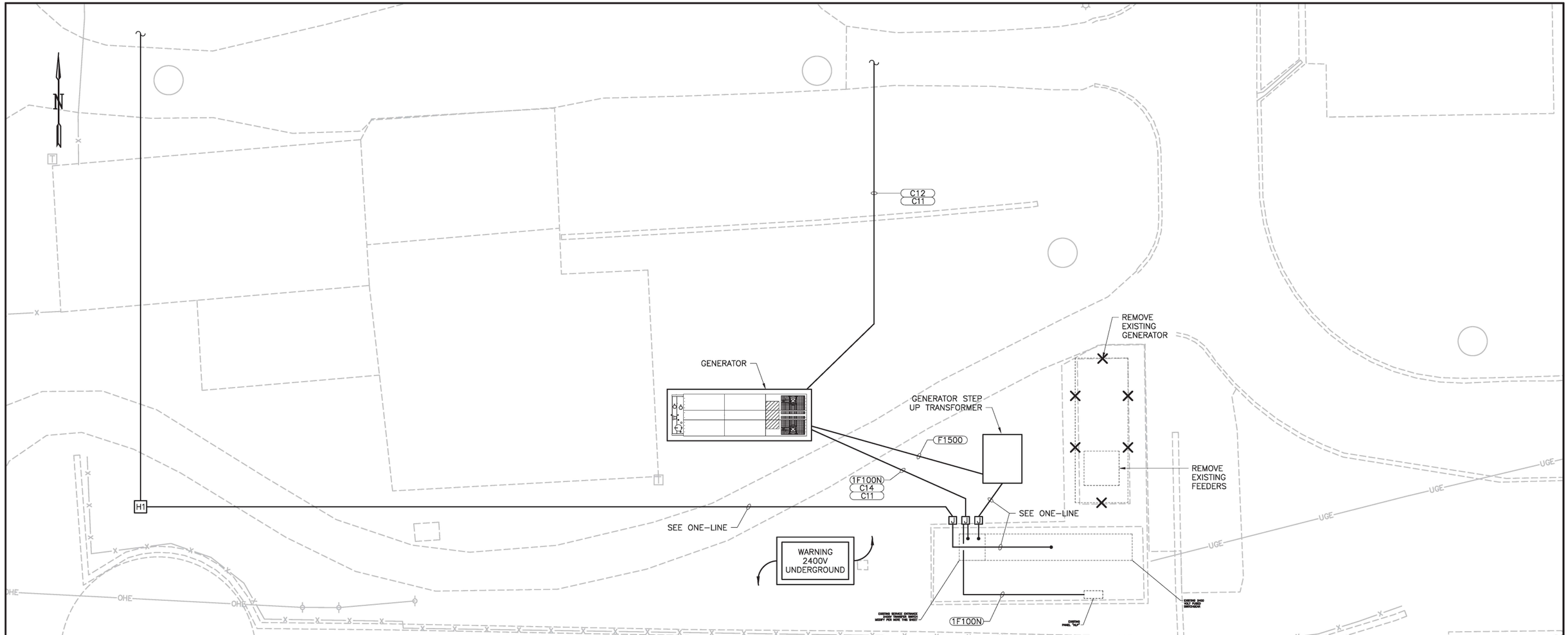
REGISTERED PROFESSIONAL ENGINEER — STATE OF OKLAHOMA — 20995 — 12-16-20

C:\USERS\CHARLES\SYNOLOGYDRIVE\HUB ENGINEERS (HUB)\HUB-245 SHAWNEE WTP\DWG\E02_SITE PLAN.DWG
12/16/2020 11:20 AM

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

BROWN ENGINEERS 501-448-0100 | Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD · MUSKOGEE, OKLAHOMA · 918/682-7811

Shawnee Municipal Authority | WATER TREATMENT PLANT IMPROVEMENTS SHAWNEE MUNICIPAL AUTHORITY | Scale: As Shown | Date: 2020 | Detail: CD | Check: BB | ELECTRICAL SITE PLAN | Proj. No. HUB-245 | Sht. No. E2



SERVICE ENTRANCE SWITCHGEAR MODIFICATIONS

CONTRACTOR SHALL CONTRACT WITH ENERCON FOR THE FOLLOWING SERVICE
ENERCON, DAVE KIMMEY, (309) 339-5005 CELL, (309) 427-4671 OFFICE

BILL OF MATERIAL

- RE-PROGRAM PLC TO EXCLUDE UNNEEDED FUNCTIONS
- RE-PROGRAM TOUCHSCREEN TO INCLUDE EASIER FUNCTIONALITY
  - ENGINE CONTROLS – OFF\RESET, MANUAL\TEST – AUTOMATIC
  - COMMON ENGINE FAULT ALARM INDICATIONS
- REMOVE ANY UNNECESSARY COMPONENTS
- PROTECTIVE RELAYS REMAIN
- PROVIDE INSTALLATION SERVICES PER INFORMATION BELOW
- PROVIDE NEW AS BUILT DRAWINGS
- PROVIDE SET OF MANUALS PER INFORMATION BELOW (EXCEPT NO CUT-SHEETS)

- DEVICE 59G – GROUND OVERVOLTAGE RELAY, WITH ADJUSTABLE PICKUP & TIME DELAY SETTINGS, AND TRIP TARGET. DAMPING RESISTOR AND CONTROL VOLTAGE AS REQUIRED. INSTALLED ONTO DOOR.
- SET OF POTENTIAL TRANSFORMERS, FUSED, TRUNION MOUNTED. INSTALLED IN REAR OF CUBICLE.

MANUALS

- AN ENERCON STANDARD MANUAL PACKAGE IS OFFERED IN PDF FORMAT. IT SHALL INCLUDE, WHERE APPLICABLE: GENERAL DESCRIPTIONS, TRANSPORTATION AND INSPECTION INFORMATION, OPERATING INSTRUCTIONS, STANDARD DRAWINGS AND BILL OF MATERIAL.
- COMPONENT MANUFACTURER'S OPERATING AND MAINTENANCE INSTRUCTIONS (CUT-SHEETS) ARE INCLUDED WHEN APPLICABLE.

1/E3 ENLARGED ELECTRICAL SITE PLAN

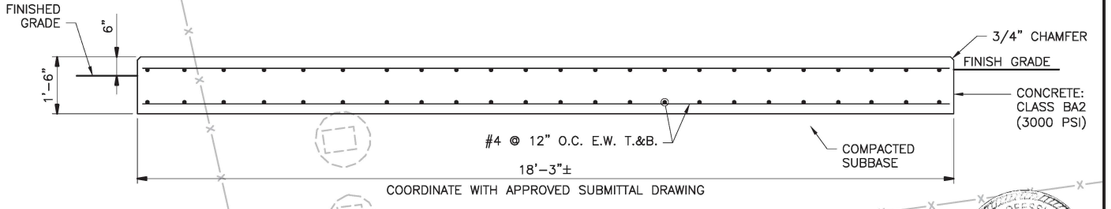
SCALE: 1" = 30'

10 5 0 10 20 30

SCALE: 1" = 10'

SEQUENCE OF OPERATION – OPEN TRANSITION STANDBY ONLY

- NORMAL OPERATION – BREAKER POSITIONS
  - NORMAL BREAKER IS CLOSED
  - EMERGENCY BREAKER IS OPEN
  - GENSET CONTROLS ARE IN AUTOMATIC POSITION
- LOSS OF UTILITY SOURCE
  - AFTER TIME DELAY, GENSET SIGNALED TO START
  - AFTER GENERATOR BUILDS UP FREQUENCY AND VOLTAGE, NORMAL BREAKER OPENS
  - EMERGENCY BREAKER CLOSES
  - GENERATOR PROVIDES POWER TO THE SITE
- RETURN OF UTILITY SOURCE – OPEN TRANSITION
  - AFTER VERIFICATION OF STABLE SOURCE, EMERGENCY BREAKER OPENS
  - NORMAL BREAKER CLOSES
  - GENSET RUNS IN COOLDOWN MODE
  - UTILITY PROVIDES POWER TO THE SITE



2/E3 GENSET CONCRETE PAD DETAIL

SCALE: NONE

Existing Sludge Pump Station

STATE OF OKLAHOMA REGISTERED PROFESSIONAL ENGINEER BRIAN BROWN 20995 12-16-2020

C:\USERS\CHARLES\SYNOLOGYDRIVE\HUB ENGINEERS (HUB)\HUB-245 SHAWNEE WTP\DWG\E03_PROCESS BLDG SITE PLAN.DWG
12/16/2020 11:45 AM

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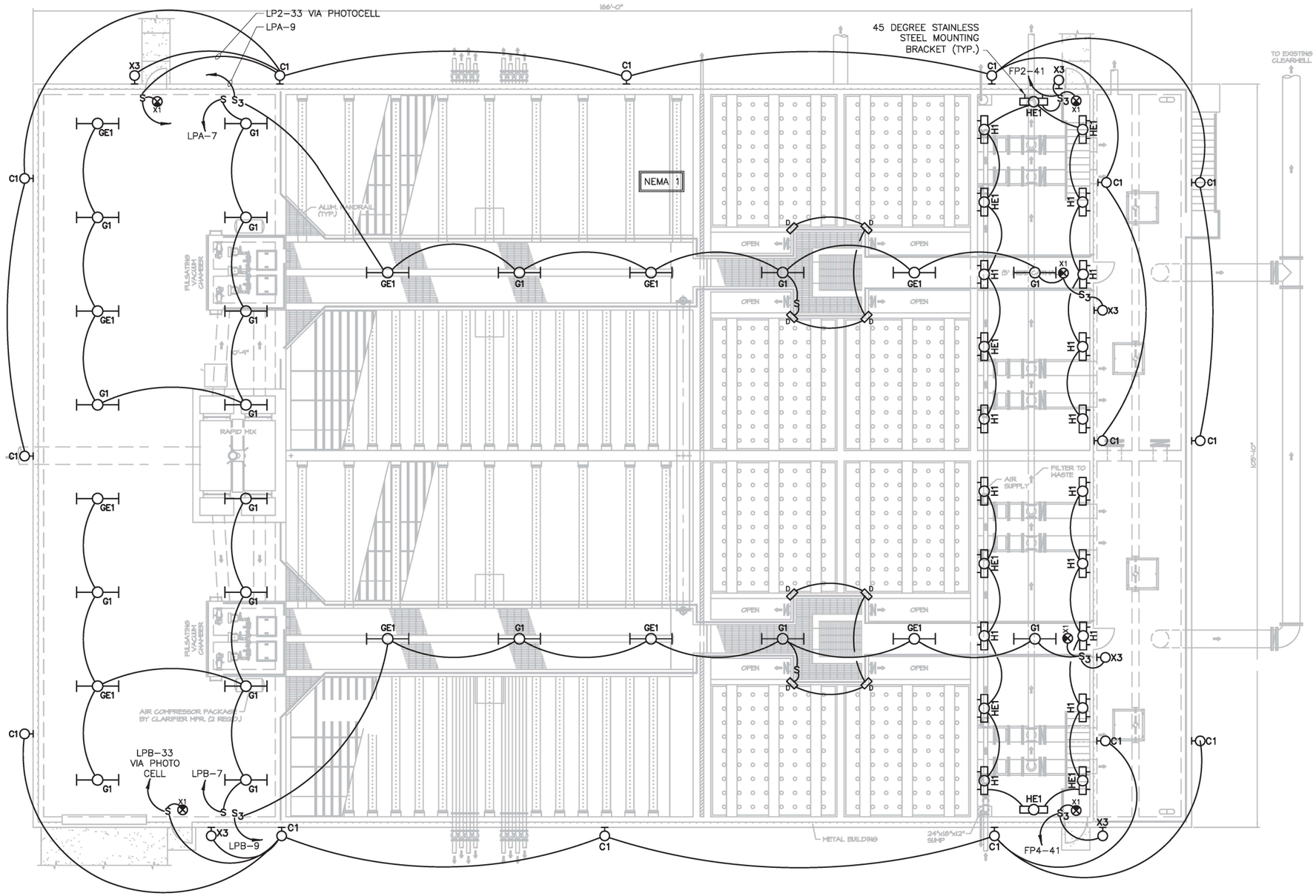
Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD - MUSKOGEE, OKLAHOMA - 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

ELECTRICAL
PROCESS BUILDING SITE PLAN

Proj. No. HUB-245
Sht. No. E3



1/E4 PROCESS BUILDING LIGHTING PLAN
SCALE: 1/8" = 1'-0"

REGISTERED PROFESSIONAL ENGINEERS — STATE OF OKLAHOMA — BRIAN BROWN — 20995 — 12-16-2020

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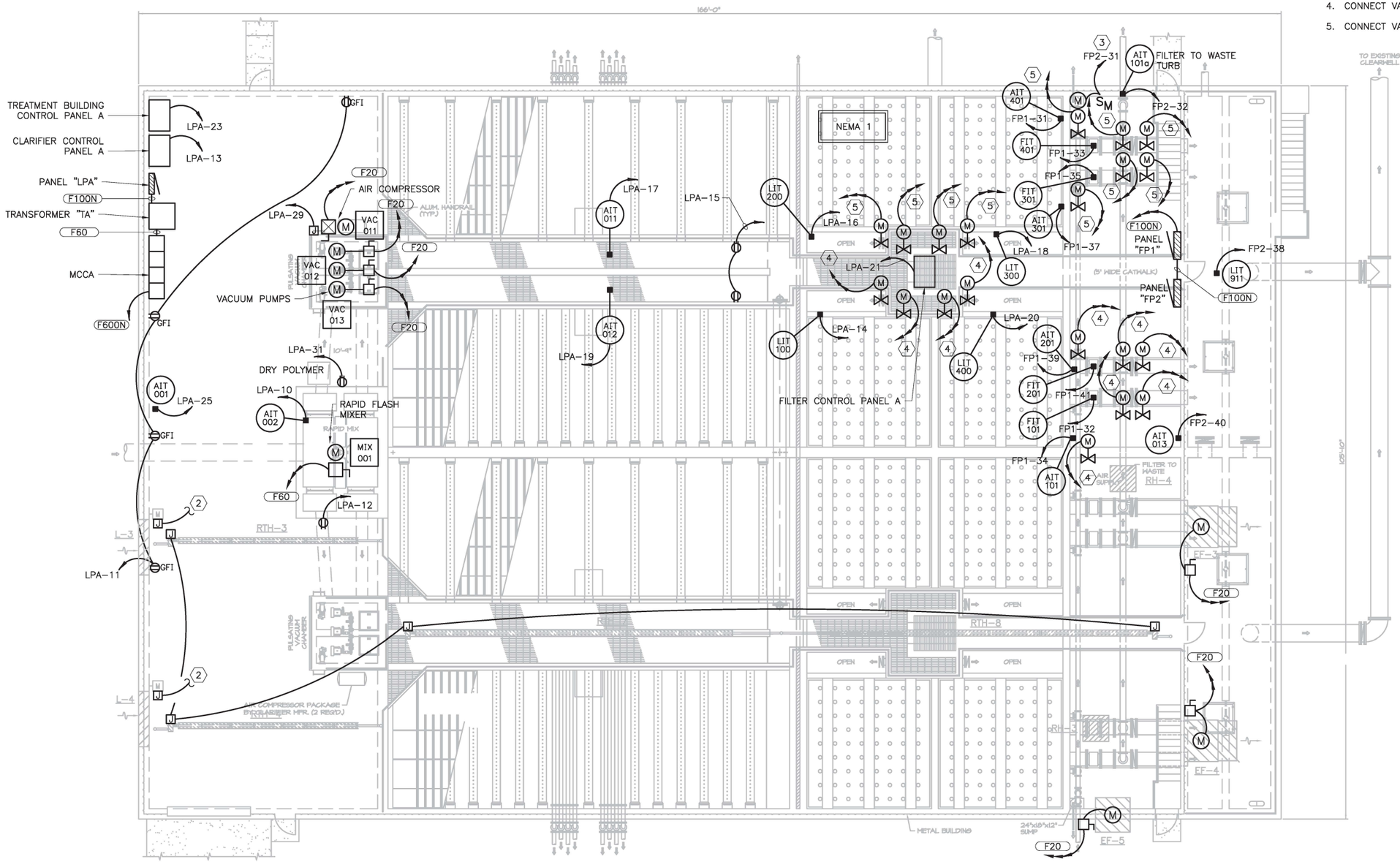
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: CD	ELECTRICAL	Proj. No. HUB–245
Date: 2020	Check: BB	PROCESS BUILDING LIGHTING PLAN	Sht. No. E4

KEYED NOTES:

1. NOT USED.
2. INTERLOCK WITH LOUVERS – SEE MECHANICAL.
3. FURNISH AND INSTALL STARTER, OVER-CURRENT DEVICE AND CIRCUIT FOR EACH SUMP PUMP – COORDINATE WITH ACTUAL EQUIPMENT SUPPLIED.
4. CONNECT VALVE TO PANEL FP1.
5. CONNECT VALVE TO PANEL FP2.



ALL CONDUIT THIS AREA SHALL BE EMBEDDED IN CONCRETE

ALL CONDUIT THIS AREA SHALL BE RUN OVERHEAD AND DROPPED TO EACH LOAD

1/E5a PROCESS BUILDING POWER PLAN
SCALE: 1/8" = 1'-0"

STEVEN R. BROWN 20995 REGISTERED PROFESSIONAL ENGINEER OKLAHOMA

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12/16/2020 12:42 PM

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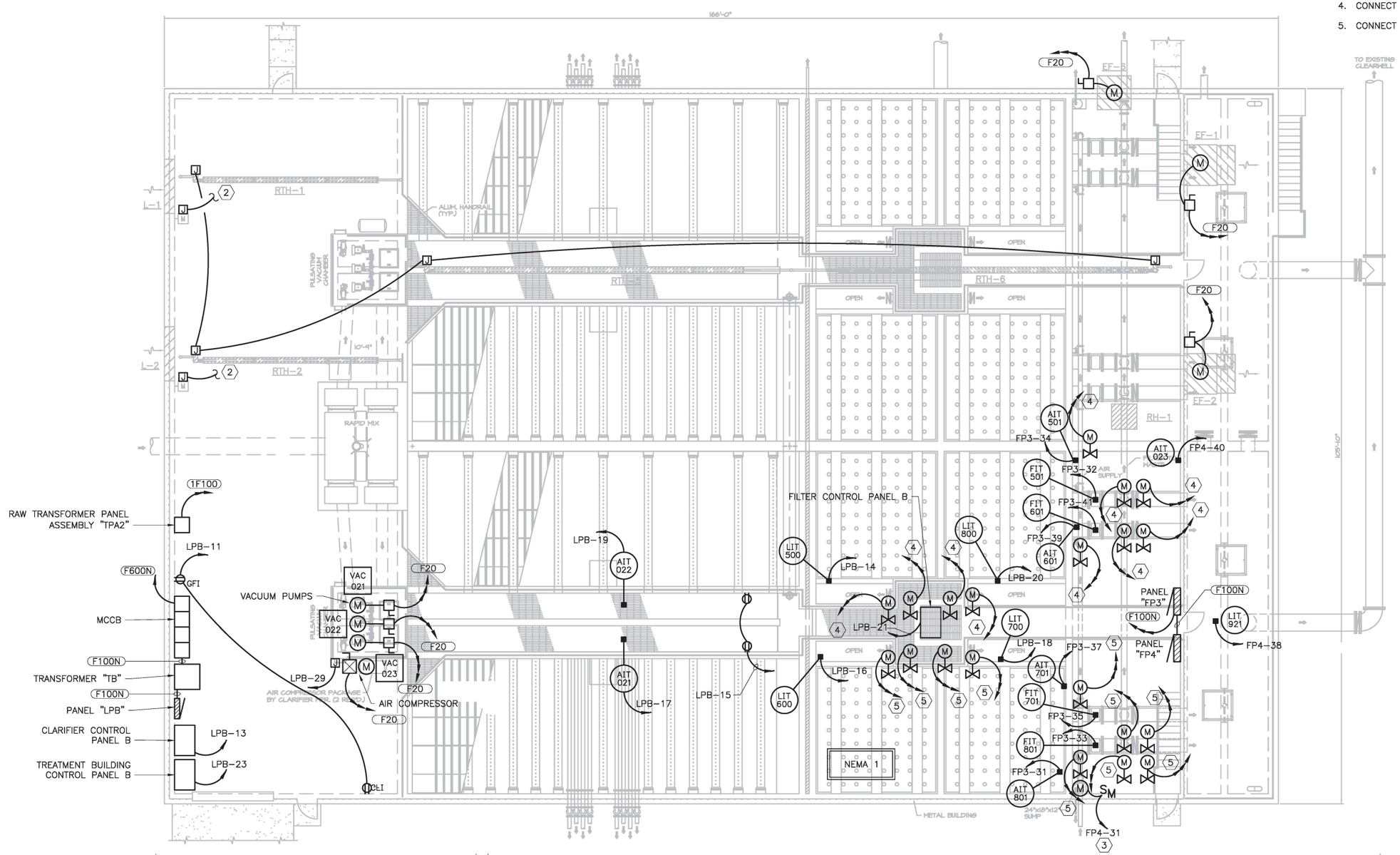
WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD | ELECTRICAL
Date: 2020 | Check: BB | PROCESS BUILDING POWER PLAN

Proj. No. HUB-245
Sht. No. E5a

KEYED NOTES:

1. NOT USED.
2. INTERLOCK WITH LOUVERS – SEE MECHANICAL.
3. FURNISH AND INSTALL STARTER, OVER-CURRENT DEVICE AND CIRCUIT FOR EACH SUMP PUMP – COORDINATE WITH ACTUAL EQUIPMENT SUPPLIED.
4. CONNECT VALVE TO PANEL FP3.
5. CONNECT VALVE TO PANEL FP4.



1 / E5b **PROCESS BUILDING POWER PLAN**
SCALE: 1/8" = 1'-0"

STEVEN B. TOWN 20995 12-16-2020 REGISTERED PROFESSIONAL ENGINEER OKLAHOMA

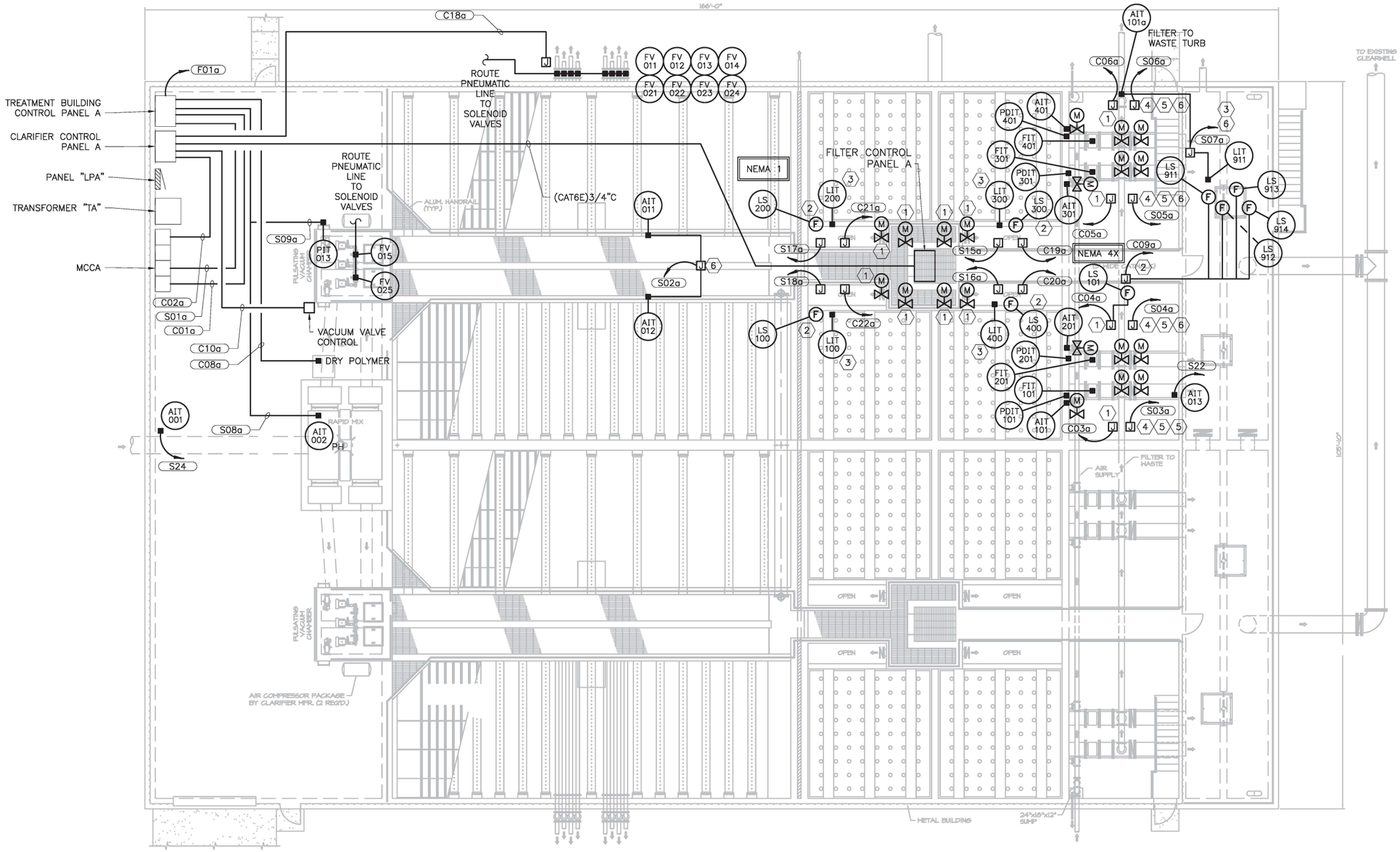
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12/16/2020 2:43 PM

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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: CD	ELECTRICAL	Proj. No. HUB-245
Date: 2020	Check: BB	PROCESS BUILDING POWER PLAN	Sht. No. E5b



KEYED NOTES:

1. ROUTE (8#14)3/4"C FROM JUNCTION BOX TO EACH VALVE.
2. ROUTE (3#14)3/4"C FROM JUNCTION BOX TO EACH FLOAT
3. ROUTE (2ISP16)3/4"C FROM JUNCTION BOX TO EACH LEVEL TRANSMITTER.
4. ROUTE (2ISP16)3/4"C FROM JUNCTION BOX TO EACH FLOW METER.
5. ROUTE (2ISP16)3/4"C FROM JUNCTION BOX TO EACH PRESSURE TRANSMITTER.
6. ROUTE (2ISP16)3/4"C FROM JUNCTION BOX TO EACH TURB.

1/E6a PROCESS BUILDING CONTROL PLAN
SCALE: 1/8" = 1'-0"

STATE OF OKLAHOMA
CHARLES E. BROWN
20995
12-11-2020
REGISTERED PROFESSIONAL ENGINEER

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12/7/2020 2:38 PM

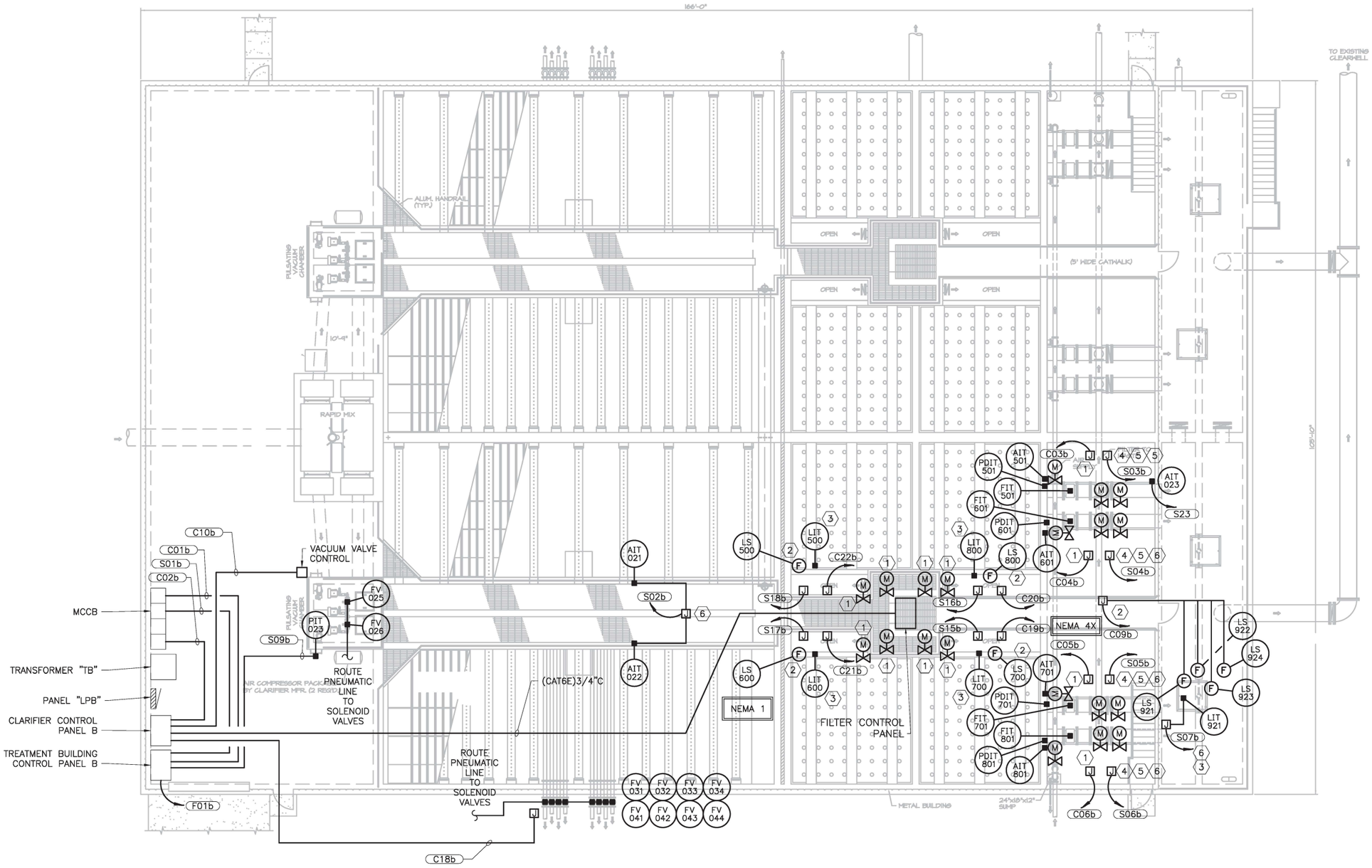
BAR IS ONE INCH ON ORIGINAL DRAWING — IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD | ELECTRICAL
Date: 2020 | Check: BB | PROCESS BUILDING CONTROL PLAN

Proj. No. HUB-245
Sht. No. E6a



KEYED NOTES:

1. ROUTE (8#14)3/4"C FROM JUNCTION BOX TO EACH VALVE.
2. ROUTE (3#14)3/4"C FROM JUNCTION BOX TO EACH FLOAT
3. ROUTE (2ISP16)3/4"C FROM JUNCTION BOX TO EACH LEVEL TRANSMITTER.
4. ROUTE (2ISP16)3/4"C FROM JUNCTION BOX TO EACH FLOW METER.
5. ROUTE (2ISP16)3/4"C FROM JUNCTION BOX TO EACH PRESSURE TRANSMITTER.
6. ROUTE (2ISP16)3/4"C FROM JUNCTION BOX TO EACH TURB.

1/E6b PROCESS BUILDING CONTROL PLAN

SCALE: 1/8" = 1'-0"

REGISTERED PROFESSIONAL ENGINEER — BRIAN BROWN — 20995 — 12-16-2020 — OKLAHOMA

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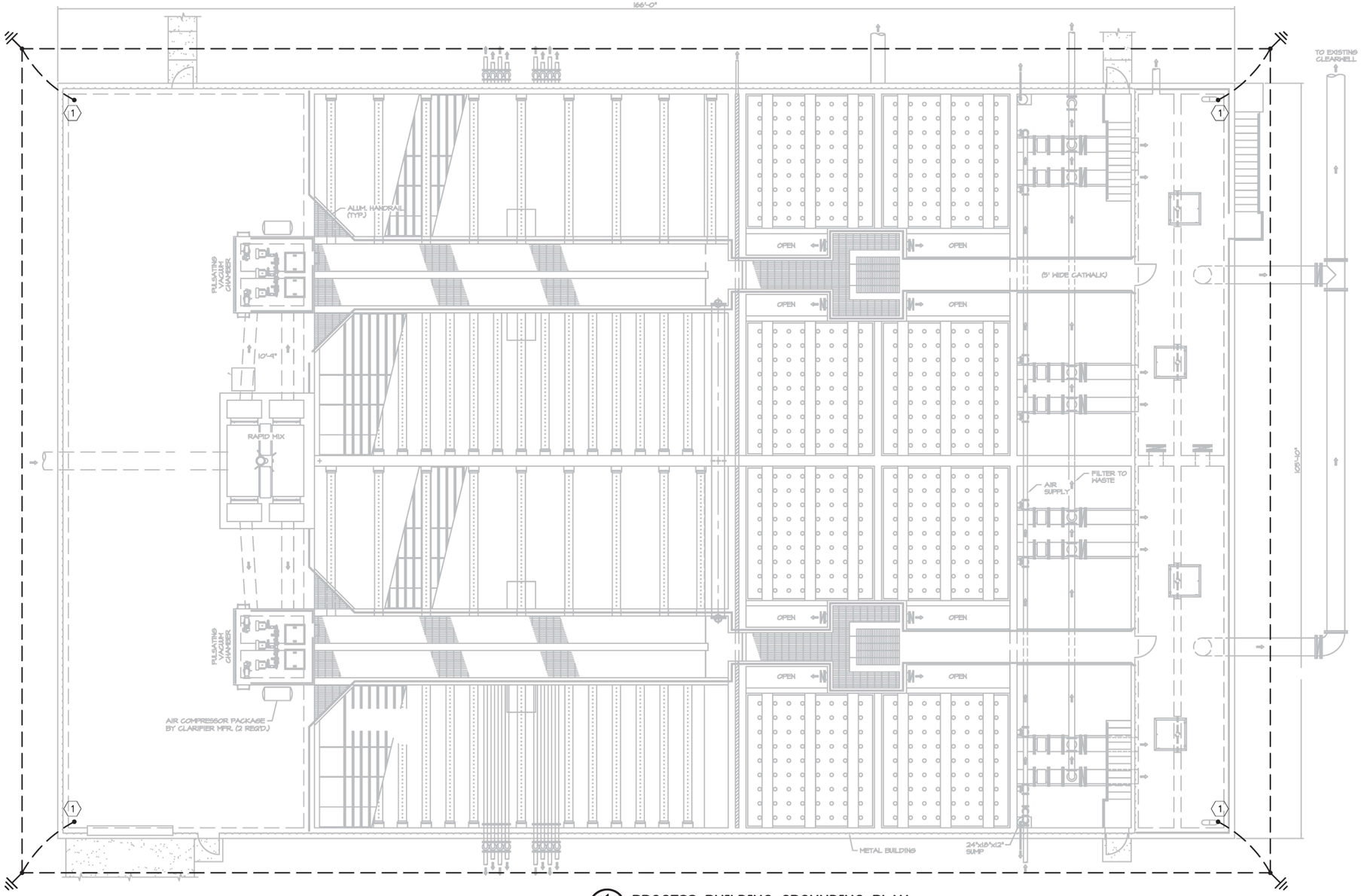
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

ELECTRICAL
PROCESS BUILDING CONTROL PLAN

Proj. No. HUB-245
Sht. No. E6b



1/E7 PROCESS BUILDING GROUNDING PLAN
SCALE: 1/8" = 1'-0"

LIGHTNING PROTECTION SYSTEM NOTES:

1. INSTALL A LIGHTNING PROTECTION SYSTEM CONSISTING OF A COMPLETE SYSTEM OF AIR TERMINALS, CONDUCTORS, GROUND TERMINALS, INTERCONNECTING CONDUCTORS, AND OTHER CONNECTORS AND/OR FITTINGS REQUIRED FOR A COMPLETE SYSTEM.
2. THE NEW INSTALLATION SHALL FULLY COMPLY WITH THE NFPA 780, LIGHTNING PROTECTION SYSTEM. ORDINARY STRUCTURES NOT EXCEEDING 75 FEET IN HEIGHT SHALL BE PROTECTED WITH COPPER CLASS 1 MATERIAL.
3. AIR TERMINALS SHALL NOT BE LESS THAN 12" ABOVE THE OBJECT OR AREA TO BE PROTECTED, SHALL BE PLACED AT INTERVALS NOT TO EXCEED 20 FEET, AND SHALL BE PLACED AT OR WITHIN 2 FEET OF THE EDGE OR OUTSIDE CORNER OF THE FLAT OR GENTLY SLOPING ROOF.
4. ADDITIONAL ROOF TERMINALS SHALL BE PLACED AT INTERVALS NOT TO EXCEED 50 FEET ON FLAT OR GENTLY SLOPING ROOFS THAT EXCEED 50 FEET IN WIDTH OR LENGTH.
5. CONDUCTORS SHALL INTERCONNECT ALL AIR TERMINALS AND FORM A TWO-WAY PATH FROM EACH TERMINAL TO CONNECTIONS WITH GROUND TERMINALS.
6. PROVIDE UL STANDARD 96A MASTER LABEL FOR THE LIGHTNING PROTECTION SYSTEM SYSTEM UPON COMPLETION OF INSTALLATION. PROVIDE AN ENGRAVED PLAQUE WITH THE MASTER LABEL INFORMATION.
7. ALL LIGHTNING PROTECTION CONDUCTORS SHALL BE FASTENED NOT MORE THAN 3'-0" MAXIMUM SPACING.
8. CONNECTIONS TO THE GROUND ROD OR GROUND RING CONDUCTOR SHALL BE MADE AT A POINT NOT LESS THAN 1'-0" BELOW GRADE AND 2'-0" AWAY FROM FOUNDATION WALL.
9. THE LIGHTNING PROTECTION SYSTEM SHALL BE INSTALLED IN A NEAT AND INCONSPICUOUS MANNER SO THAT ALL COMPONENTS WILL BLEND IN WITH THE APPEARANCE OF THE BUILDING.
10. CONNECT AND BOND SECONDARY CONDUCTOR CABLE TO ALL EQUIPMENT, VENTS, ROOF DRAIN, ROOF CAPS, HATCHES, ETC. AS INDICATED.

LEGEND:

- #4/0 AWG SOFT DRAWN BARE COPPER COUNTERPOISE, DIRECT BURIED 24" BELOW FINISHED GRADE.
- EXOTHERMIC WELD, CADWELD
- 3/4"X10'-0" COPPERCLAD GROUND ROD WITH EXOTHERMIC WELD

KEYED NOTES:

1. BOND COUNTERPOISE TO BUILDING STEEL.
2. BOND COUNTERPOISE TO ELECTRICAL EQUIPMENT.

REGISTERED PROFESSIONAL ENGINEER — STATE OF OKLAHOMA — BRIAN K. BROWN — 20995 — 2-18-2020

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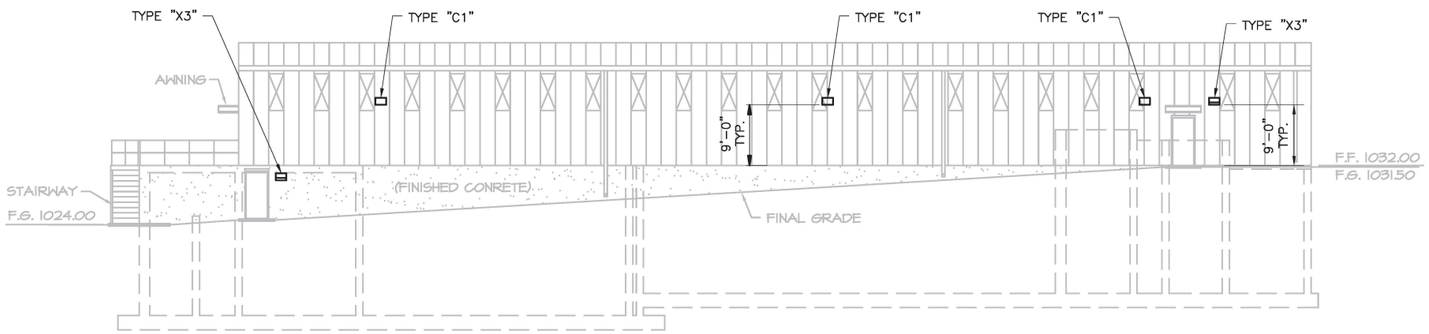
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

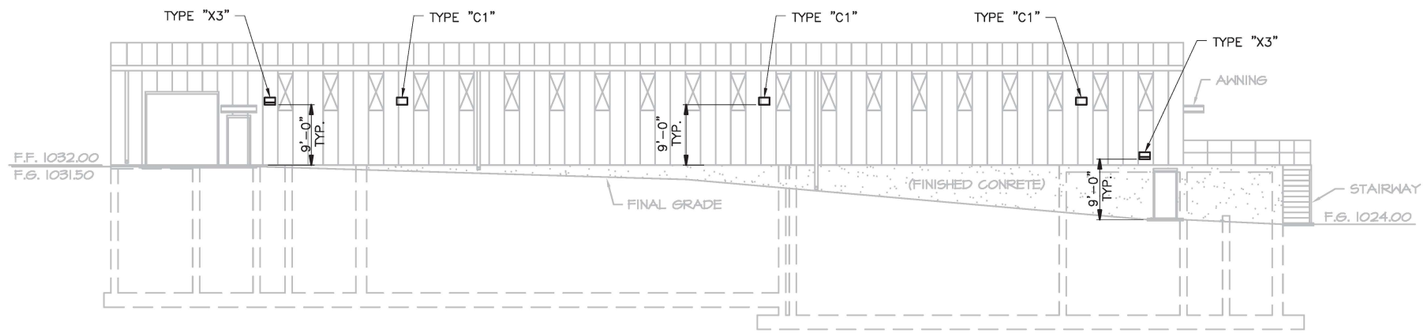
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ELECTRICAL
PROCESS BUILDING GROUNDING PLAN

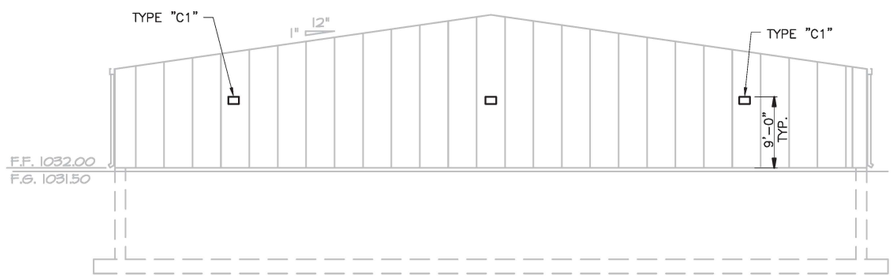
Proj. No. HUB-245
Sht. No. E7



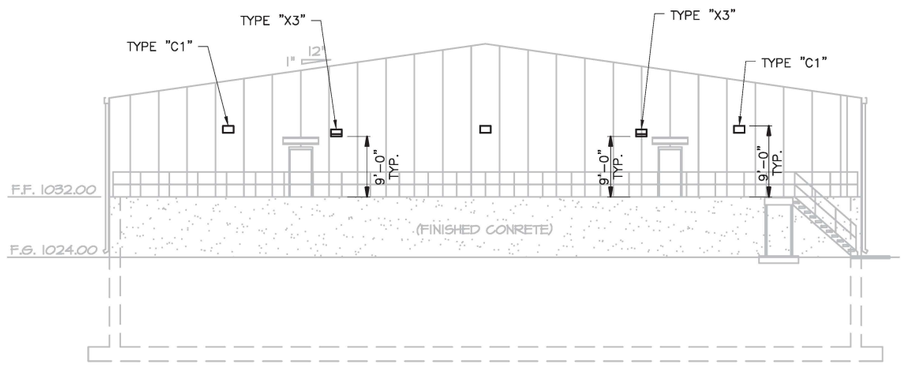
1 — **EAST ELEVATION**
SCALE: 3/32" = 1'-0"



2 — **WEST ELEVATION**
SCALE: 3/32" = 1'-0"



3 — **NORTH ELEVATION**
SCALE: 3/32" = 1'-0"



4 — **SOUTH ELEVATION**
SCALE: 3/32" = 1'-0"

REGISTERED PROFESSIONAL ENGINEER
SEAL
BRIAN
20995
OKLAHOMA

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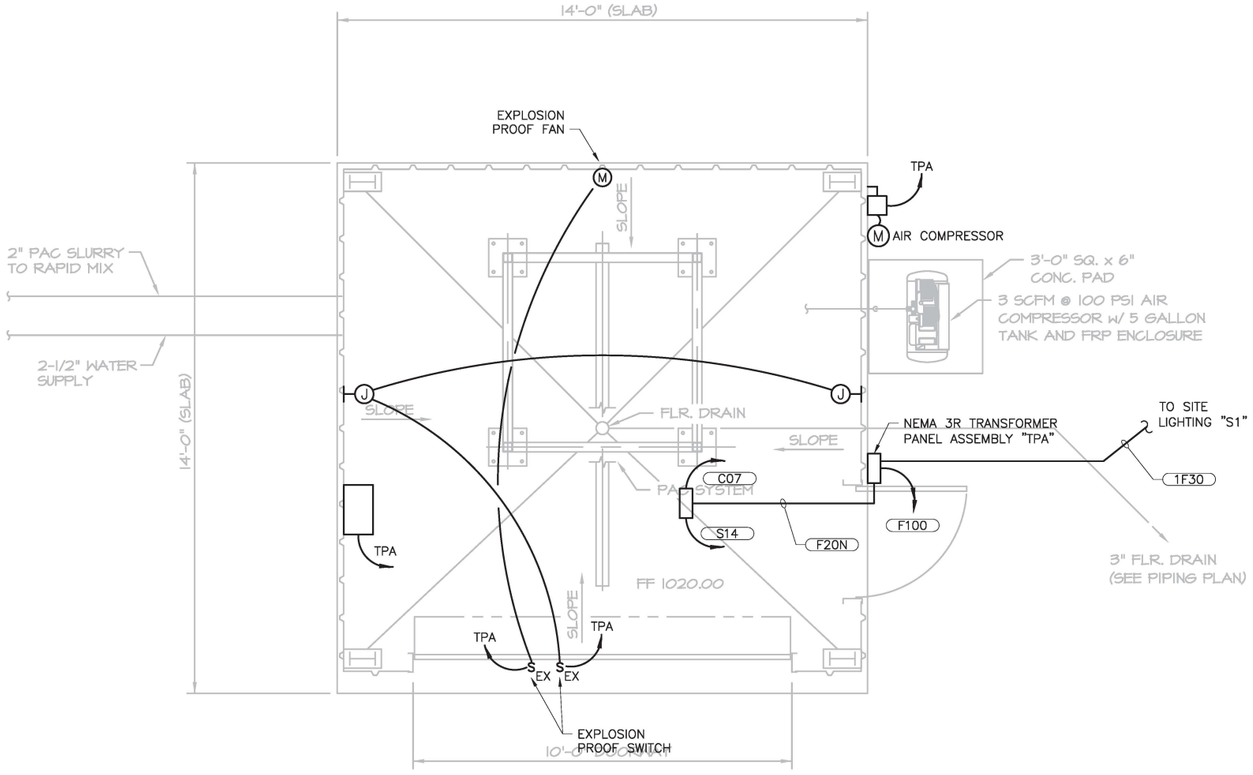
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

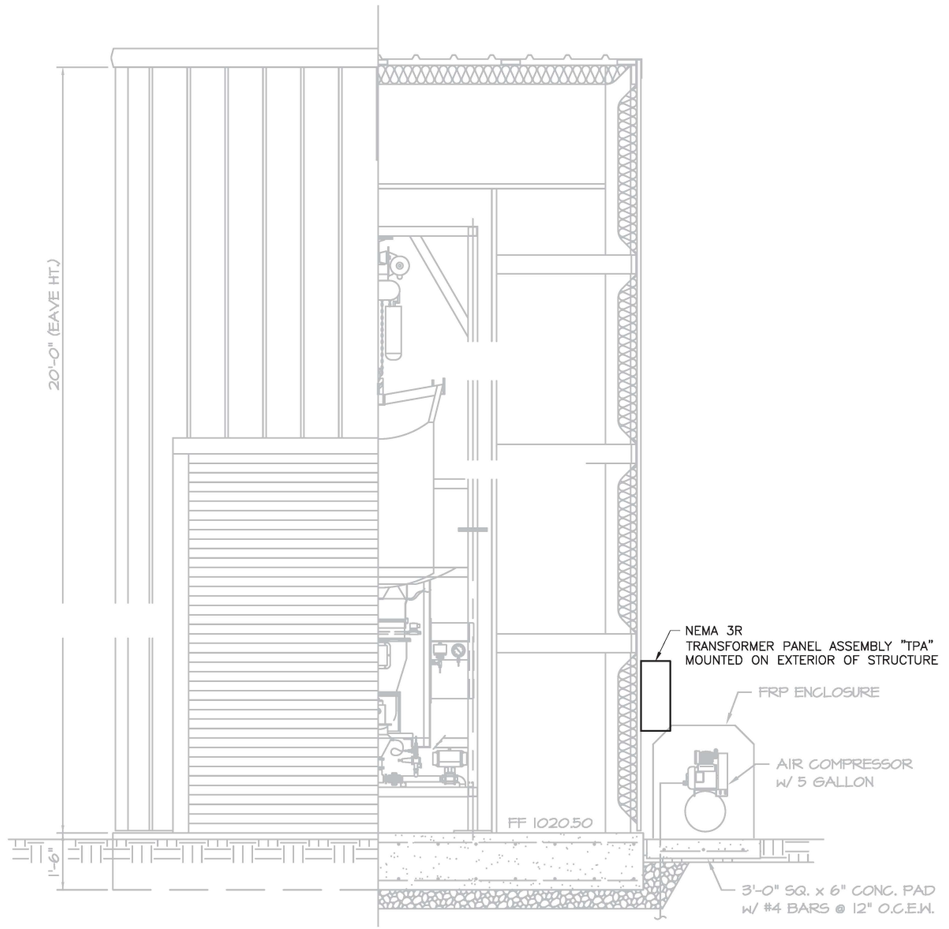
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Date: 2020 | Check: BB

ELECTRICAL ELEVATIONS

Proj. No. HUB-245
Sht. No. E8



1 — **PAC ENCLOSURE PLAN**
SCALE: 1/2" = 1'-0"



2 — **PAC ENCLOSURE SECTION**
SCALE: 1/2" = 1'-0"

STEPHEN BROWN 20995 OKLAHOMA REGISTERED PROFESSIONAL ENGINEER 12-17-2020

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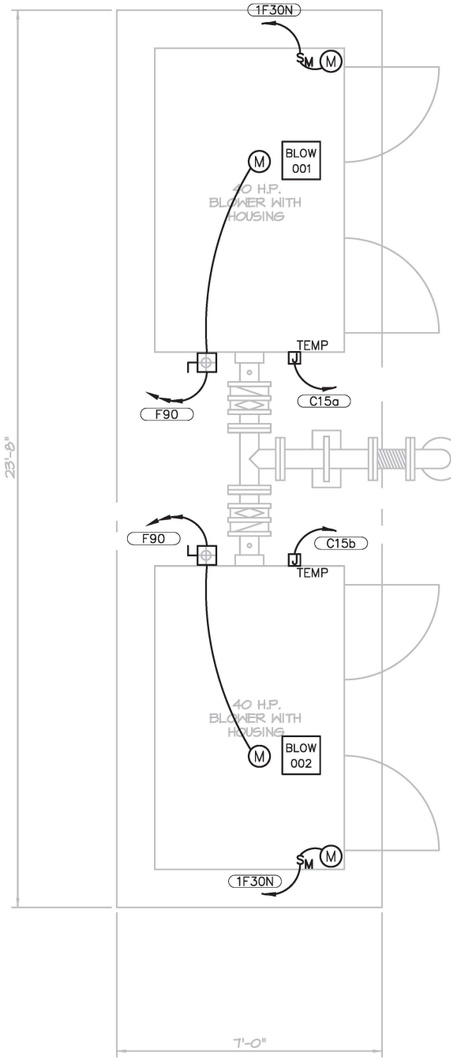
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

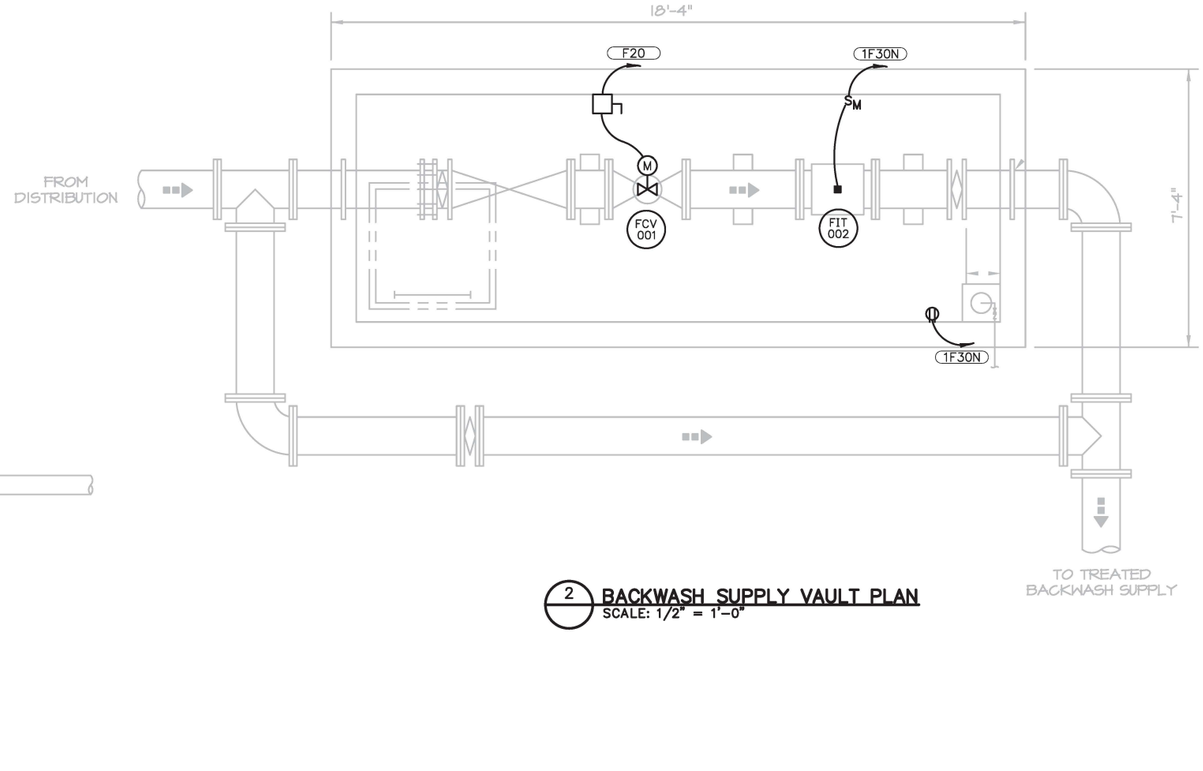
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ELECTRICAL
TREATMENT PROCESS PAC ENCLOSURE PLAN

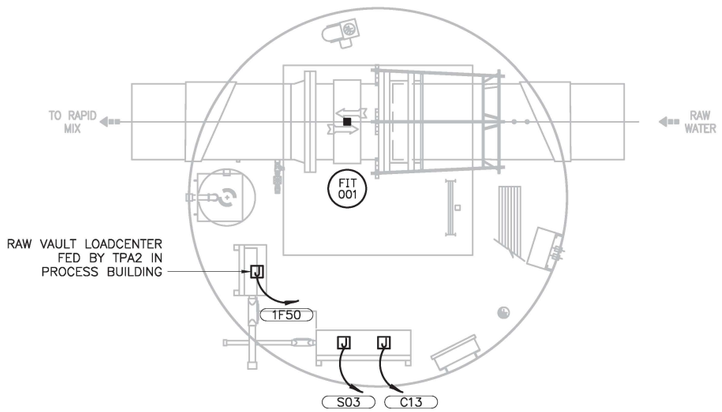
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Sht. No. E9



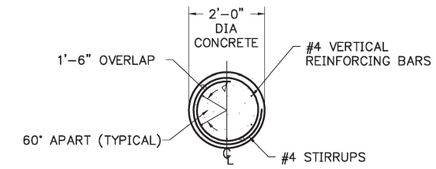
1 **AIR BLOWER PLAN**
SCALE: NONE



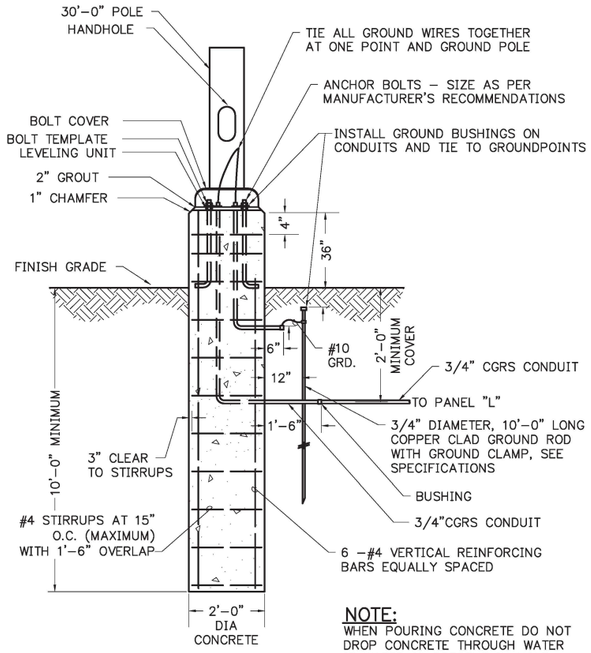
2 **BACKWASH SUPPLY VAULT PLAN**
SCALE: 1/2" = 1'-0"



3 **RAW WATER MASTER METER PLAN**
SCALE: NONE



BASE PLAN



BASE ELEVATION

NOTE:
WHEN POURING CONCRETE DO NOT DROP CONCRETE THROUGH WATER IF WATER IS PRESENT IN HOLE.

4 **POLE BASE DETAIL**
SCALE: NONE



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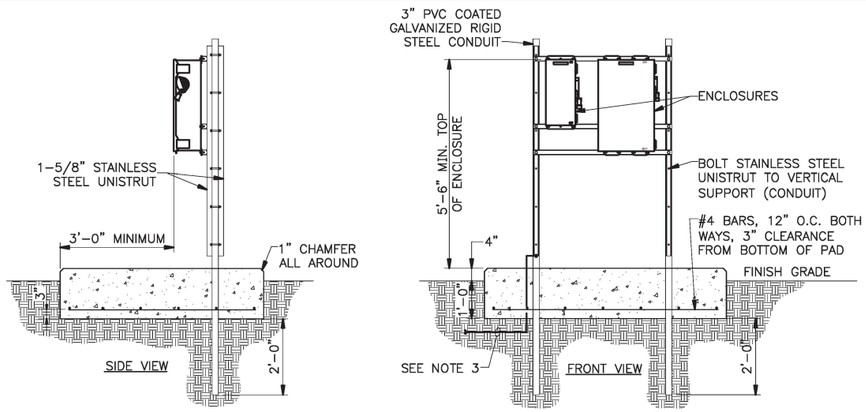
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Shawnee Municipal Authority
WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

ELECTRICAL
TREATMENT PROCESS AIR BLOWER PLAN

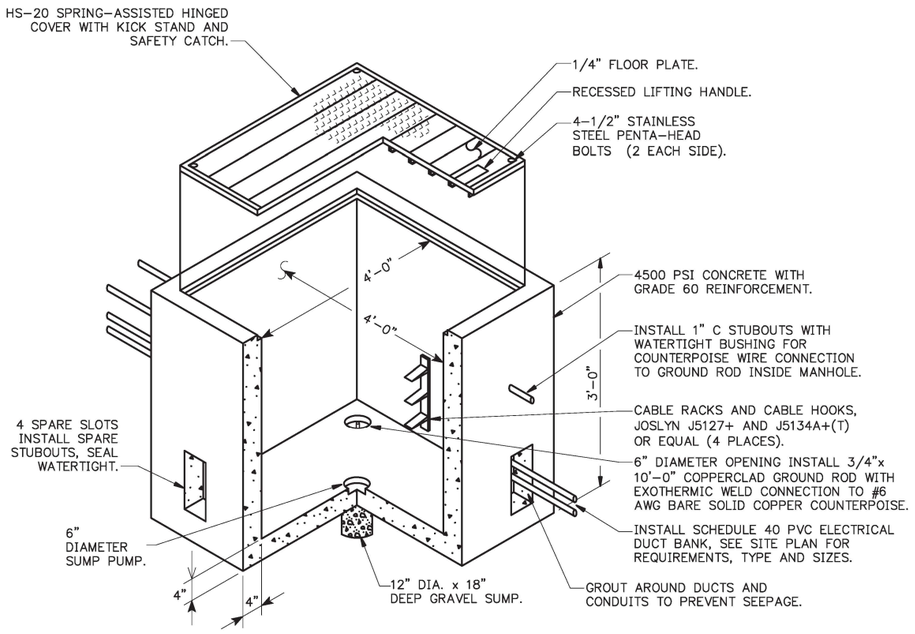
Proj. No. HUB-245
Sht. No. E10



1 — **MISC. SUPPORT DETAIL**
SCALE: NTS

NOTES:

1. ALL BOLTS, NUTS, WASHERS, ANCHORS, PLATES, AND OTHER MOUNTING STEMS SHALL BE CORROSION RESISTANT, STAINLESS STEEL.
2. BOND ELECTRICAL EQUIPMENT SUPPORT FRAME TO COUNTERPOISE AND GROUND RINGS USING 1#4/0 AND EXOTHERMIC WELDS.
3. PROVIDE VERTICAL SUPPORTS EVERY 3 FEET.



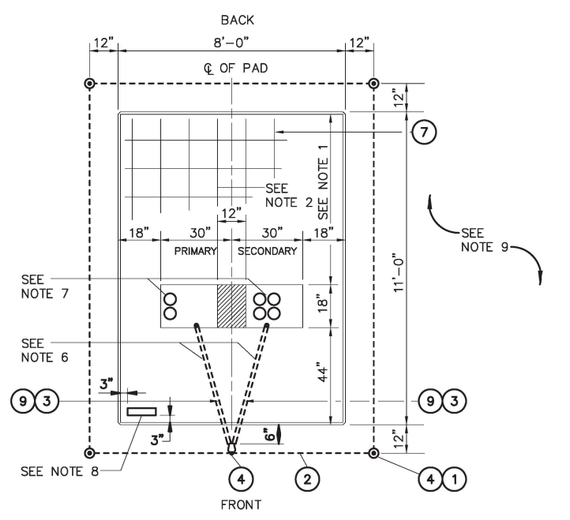
2 — **PREFABRICATED CONCRETE PULL BOX**
SCALE: NONE

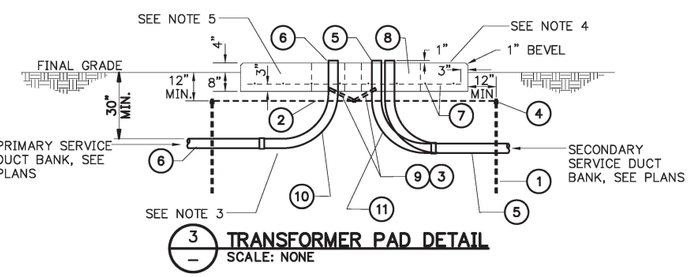
NOTES:

1. EACH CABLE SHALL BE IDENTIFIED WITH BRADY WIRE MARKER GIVING CIRCUIT NUMBER (#PWC-PK-6 OR APPROVED EQUAL).
2. ALL CABLE THROUGH BOX SHALL HAVE SUFFICIENT SLACK SO CABLE CAN BE BROUGHT TO SURFACE FOR SPLICING, MINIMUM 5' SLACK CABLE LOOP.
3. COVER AND PULL BOX SHALL BE DESIGNED FOR A 60 KIPS CONCENTRATED WHEEL LOAD OVER A 12" x 24" AREA.
4. GROUND ROD INSIDE OF PULL BOX SHALL BE DRIVEN PRIOR TO PLACEMENT OF BOX AND CAST IN BOTTOM OF BOX. IT WILL NOT BE CONNECTED TO ANY CIRCUIT.
5. PROVIDE HANDHOLES WITH 2-4"C SCHEDULE 40 PVC SPARE STUBOUTS IN EACH FACE, EXTENDED 3' MINIMUM BEYOND HANDHOLE, CAPPED WATERTIGHT.
6. EXCAVATION AND BACKFILL NECESSARY FOR THE CONSTRUCTION OF THE HANDHOLE SHALL BE PERFORMED IN ACCORDANCE WITH THE SPECIFICATION REQUIREMENTS.
7. PROVIDE WATERTIGHT CONDUIT BUSHING AND WATERTIGHT SEALS FOR ALL DIRECT BURIED COUNTERPOISE ENTERING THE HANDHOLE VIA A CONDUIT STUBOUT.
8. HANDHOLE COVER SHALL BE 1" MAXIMUM ABOVE FINISHED GRADE. AREA SURROUNDING HANDHOLE SHALL BE GRADED TO DRAIN AWAY FROM HANDHOLE.
9. BOND AND GROUND COVER AND FRAME TO ROD USING BRAIDED COPPER GROUND STRAP EQUIVALENT AMPACITY TO #6 AWG COPPER WIRE.
10. GRADE THE AREA AROUND THE HANDHOLE 10' IN ALL DIRECTIONS SUCH TO PREVENT WATER AND DIRT ACCUMULATION ACROSS THE TOP OF THE COVER AND ALLOW WATER TO DRAIN AWAY FROM THE HANDHOLE.

TRANSFORMER PAD KEYED NOTES:

1. INSTALL NEW COPPER CLAD GROUND ROD, 3/4" x 10"-0", TYPICAL OF 4.
2. INSTALL NEW #2/0 BARE COPPER CONDUCTOR (TYPICAL).
3. INSTALL NEW #2 BARE COPPER CONDUCTOR.
4. INSTALL NEW EXOTHERMIC WELD, TYPICAL OF 5.
5. INSTALL NEW SECONDARY CONDUITS, SEE SITE PLAN.
6. INSTALL NEW PRIMARY CONDUITS, SEE SITE PLAN.
7. INSTALL NEW #4 REBAR, 12"O.C. BOTH WAYS.
8. CONSTRUCT NEW PAD USING CONCRETE, 3500 PSI AT 28 DAYS.
9. INSTALL NEW 1" GRSC UNDER PAD FOR GROUND WIRES (TYPICAL).
10. UTILIZE LONG SWEEP 90° BEND PVC CONDUITS ON PRIMARY CONDUITS.
11. UTILIZE LONG SWEEP 90° BEND CONDUITS ON SECONDARY CONDUITS.

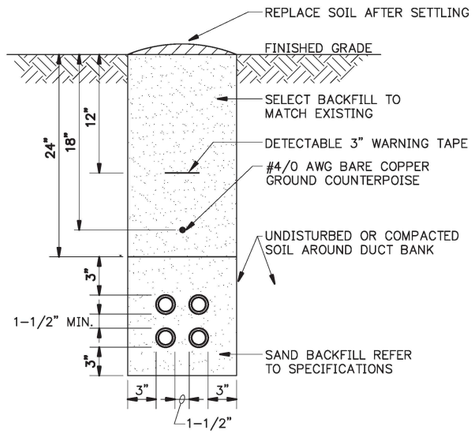




3 — **TRANSFORMER PAD DETAIL**
SCALE: NONE

TRANSFORMER PAD NOTES:

1. WHERE POSSIBLE. DO NOT PLACE CONDUIT UNDER THIS SECTION OF FOUNDATION.
2. REINFORCING – #4 BARS 12" O.C. BOTH WAYS.
3. WHEN INSTALLING CONDUIT, DISTURB GROUND IN FOUNDATION AREA AS LITTLE AS POSSIBLE. EXTEND CONDUIT 1" ABOVE FOUNDATION.
4. TOP OF FOUNDATION TO BE SMOOTH AND LEVEL. FINAL GRADE SHALL SLOPE AWAY FROM PAD.
5. CONCRETE SHALL BE 3500 PSI AT 28 DAYS AND 1:2:4 MIXTURE WITH 6 GAL. MAX. WATER CONTENT PER SACK OF CEMENT.
6. CONTRACTOR TO FURNISH 1" CONDUIT UNDER PAD FOR GROUND WIRE.
7. LOCATE CONDUITS UNDER PRIMARY AND SECONDARY BUSHINGS.
8. TRANSFORMER LOCATION TAG SHALL BE ATTACHED TO PAD WITH CONCRETE NAILS OR SHEET METAL SCREWS.
9. TRANSFORMER PAD REQUIRES A MINIMUM 3'-0" CLEARANCE AROUND EACH SIDE AND BACK OF PAD. A 15'-0" CLEARANCE IS REQUIRED ON FRONT SIDE OF PAD.



4 — **TRENCH DETAIL**
SCALE: NONE

ELECTRICAL DUCT NOTES:

1. CONTRACTOR SHALL STAKE THE DUCT INSTALLATION IN PLAN AND ELEVATION FOR NEW ELECTRICAL DUCTS TO AVOID EXISTING UTILITIES.
2. CONTRACTOR SHALL ADJUST THE DEPTH OF THE ELECTRICAL DUCTS AS REQUIRED TO MAINTAIN THE MINIMUM COVER REQUIREMENT INDICATED AND AVOID EXISTING UTILITIES.
3. SIMILAR CONSTRUCTION FOR OTHER DUCT SIZES. SEE DUCT BANK SCHEDULE FOR QUANTITY AND SIZES.
4. INSTALL DUCT CONDUIT SUPPORTS AT 5'-0" O.C. MAXIMUM SPACING (TYPICAL ALL DUCTS).
5. OFFSETS AND BENDS OVER 10 DEGREES AND ELBOWS IN PVC CONDUIT RUNS SHALL BE CGRS.
6. NO PVC SHALL EMERGE FROM THE GROUND OR CONCRETE SLAB OR ENCASEMENT, PVC SHALL CONVERT TO CGRS PRIOR TO ITS EMERGENCE.
7. INSTALL GROUND RODS AT ENDS OF ELECTRICAL DUCT OR CONNECT TO GROUND RING.
8. INSTALL CONDUCTORS AND CABLES AS NOTED ON DRAWING. INSTALL PULLWIRE IN ALL SPARE DUCTS.
9. MINIMUM COVER REQUIREMENT FOR DUCT BANKS UNDER ROADS, DRIVEWAYS AND PARKING LOTS SHALL BE 24".
10. MINIMUM COVER REQUIREMENTS FOR ELECTRICAL SECONDARY SERVICE DUCT BANKS SHALL BE 30".
11. MINIMUM COVER REQUIREMENTS FOR ELECTRICAL PRIMARY SERVICE DUCT BANKS SHALL BE 36".



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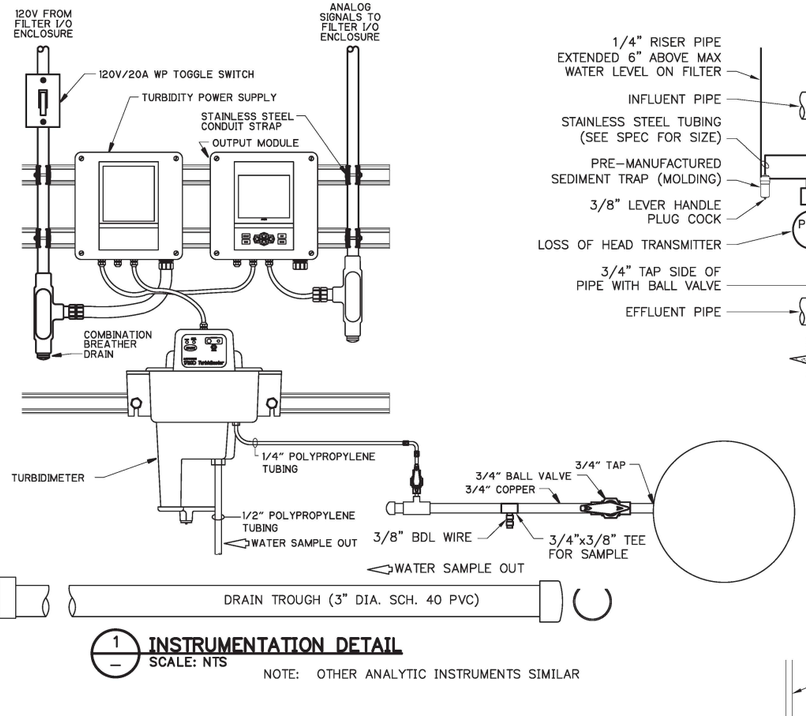
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

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Date: 2020 | Check: BB

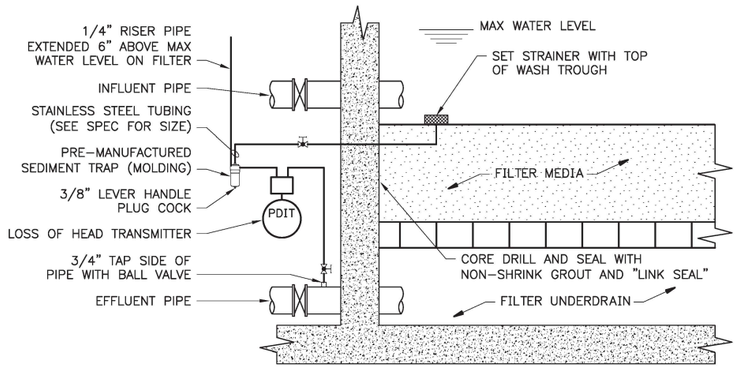
ELECTRICAL DETAILS I

Proj. No. HUB-245
Sht. No. E11

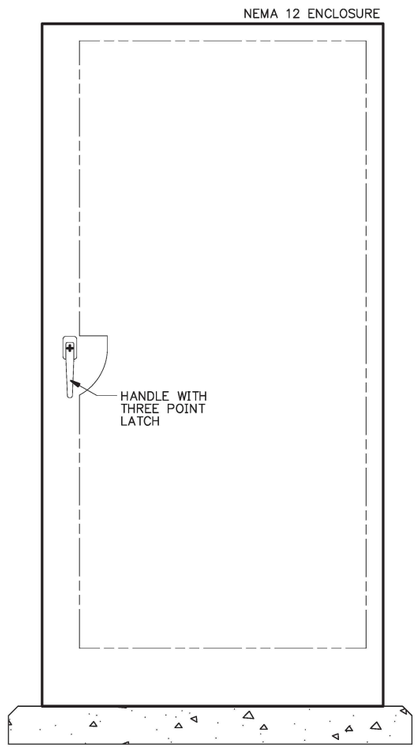


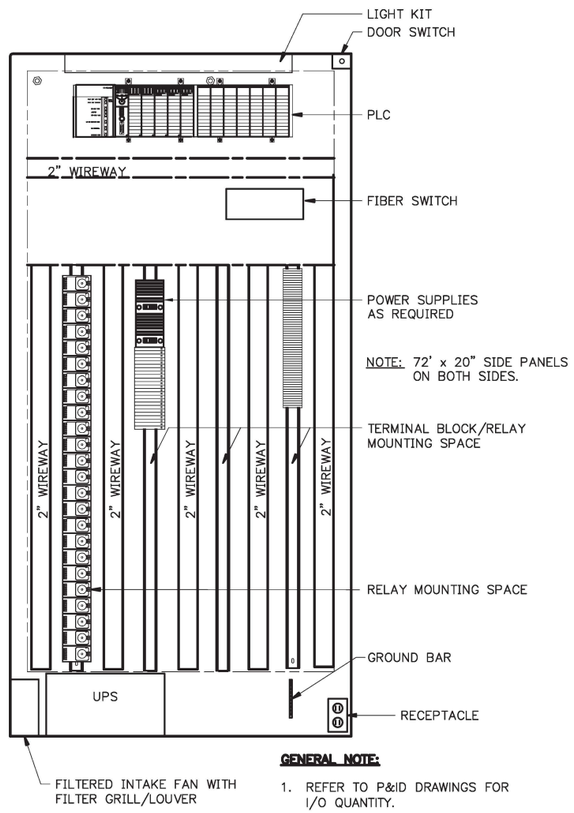
1 — **INSTRUMENTATION DETAIL**
SCALE: NTS

NOTE: OTHER ANALYTIC INSTRUMENTS SIMILAR



2 — **LOSS OF HEAD INSTALLATION**
SCALE: NONE

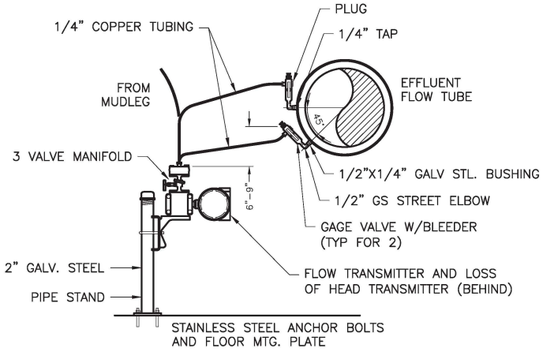




3 — **PLANT CONTROL PANEL LAYOUT (TYP)**
SCALE: NONE

GENERAL NOTE:

1. REFER TO P&ID DRAWINGS FOR I/O QUANTITY.
2. REFER TO SPECIFICATIONS FOR SPARE REQUIREMENTS.

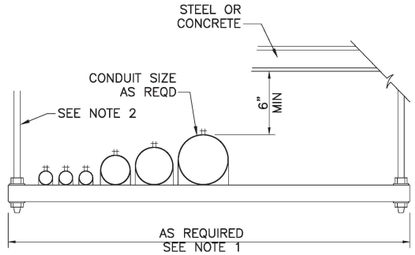


4 — **NAMEPLATE DETAIL**
SCALE: NONE

NOTE:
LOSS OF HEAD AND FLOW TRANSMITTERS SHARE ONE COMMON TAP LOCATION ON FLOW TUBE

PIPE STAND MOUNTED

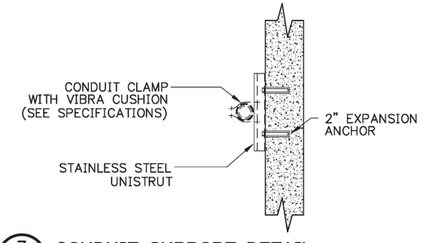
6 — **DIFFERENTIAL PRESSURE TRANSMITTER INSTALLATION**
SCALE: NTS



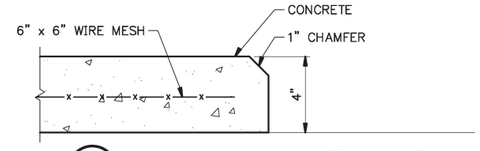
NOTES:

1. LENGTH VARIES WITH NUMBER OF PIPES TO BE SUPPORTED AND SPACING BETWEEN PIPES
2. HANGER RODS SHALL BE SIZED FOR LOADS AND SPACING
3. ALLOWABLE SPAN, NUMBER AND SIZE OF SUPPORT RODS AND ALLOWABLE LOADING PER MANUFACTURERS RECOMMENDATIONS
4. FOR HANGER ROD SUPPORT IN CONCRETE APPLICATIONS, USE SWIVEL CONCRETE INSERTS. FOR STEEL BEAM APPLICATIONS, USE SWIVEL BEAM CLAMPS
5. USE STAINLESS STEEL STRUT AND HARDWARE

5 — **PIPE AND CONDUIT RACKING SYSTEM**
SCALE: NTS



7 — **CONDUIT SUPPORT DETAIL (SINGLE CONDUIT SHOWN, MULTIPLE CONDUIT SIMILAR)**
SCALE: NONE



9 — **HOUSEKEEPING PAD (TYPICAL)**
SCALE: NTS



GENERAL NOTES:

1. POWER MARKING TAPES SHALL BE DETECTABLE TYPE CONSTRUCTION WITH RED BACKGROUND AND BLACK LETTERING.
2. COMMUNICATION MARKING TAPES SHALL BE DETECTABLE TYPE CONSTRUCTION WITH ORANGE BACKGROUND AND BLACK LETTERING, "TELEPHONE LINE" OR "FIBER OPTIC LINE" RESPECTIVELY.
3. TAPE SHALL BE DETECTABLE, DURABLE, HIGHLY VISIBLE, RESISTANT TO ELEMENTS, MEETING AND/OR EXCEEDING ALL INDUSTRY STANDARDS.

8 — **UNDERGROUND DETECTABLE WARNING TAPE**
SCALE: NONE



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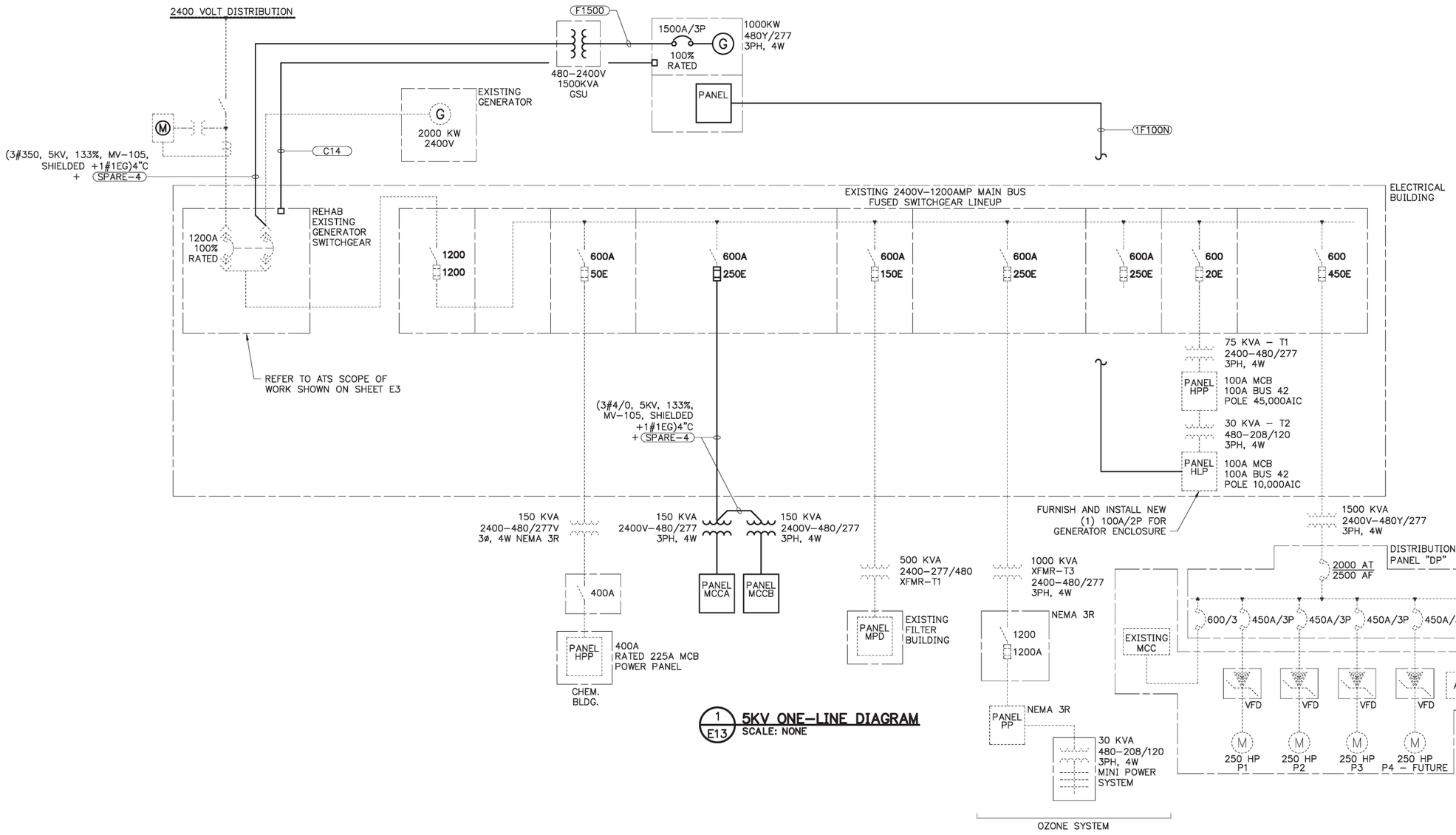
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

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ELECTRICAL DETAILS II

Proj. No. HUB-245
Sht. No. E12



7/9/2020 MAX 12 MONTH PEAK LOAD	452 KW
NEW LOAD MCCA	107 KW
NEW LOAD MCCB	85 KW
NEW TOTAL LOAD	644 KW

1 E13 **5KV ONE–LINE DIAGRAM**
SCALE: NONE

REGISTERED PROFESSIONAL ENGINEER
STATE OF OKLAHOMA
20995
12-16-2020

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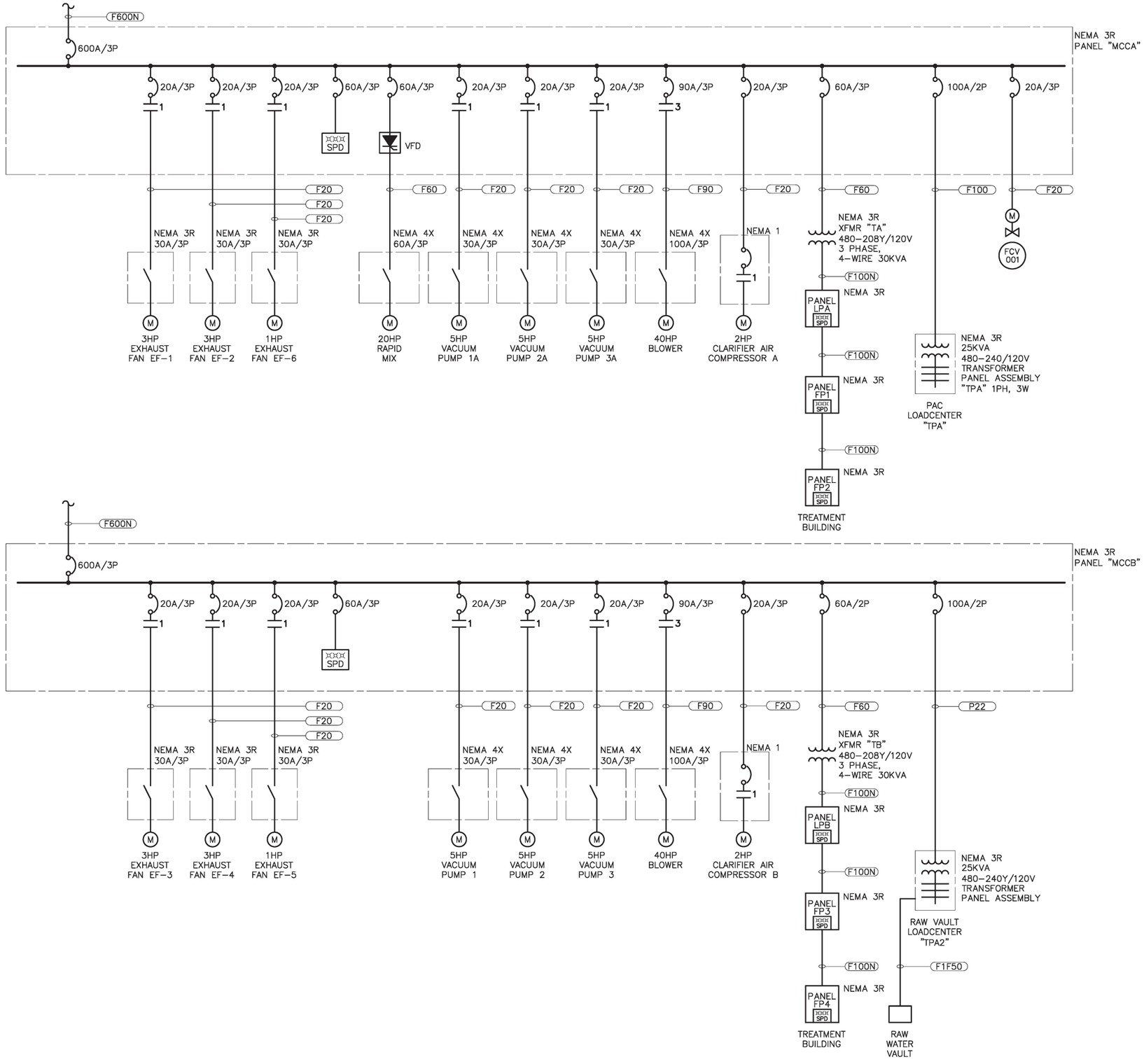
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Shawnee Municipal Authority
WATER TREATMENT PLANT IMPROVEMENTS
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ELECTRICAL
5KV ONE–LINE DIAGRAM

Proj. No. HUB–245
Sht. No. E13



REGISTERED PROFESSIONAL ENGINEER
STATE OF OKLAHOMA
STEVEN R. BROWN
20995
12-16-2020

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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

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Date: 2020
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Check: BB

ELECTRICAL
480V ONE-LINE DIAGRAM

Proj. No. HUB-245
Sht. No. E14

NEMA 3R

POWER PANEL "MCCA"

480 Y / 277 VOLTS, 3 PHASE 4 WIRE — **600 AMP MAIN CIRCUIT BREAKER** — **65,000 AIC**

CKT.	DESCRIPTION	LOAD				OVERCURRENT		
		KVA	AMPS	HP	STARTER	TRIP	POLES	FRAME
1	SPARE	0.000	0.00			90	3	100
2	SPARE	0.000	0.00			200	3	100
3	SPARE	0.000	0.00			60	3	100
4	FCV-001	1.000	1.20			20	3	200
5	RAPID MIX	22.400	26.94	20	VFD	60	3	100
6	VACUUM PUMP 1A	6.300	7.58	5	1	20	3	100
7	VACUUM PUMP 2A	6.300	7.58	5	1	20	3	100
8	VACUUM PUMP 3A	6.300	7.58	5	1	20	3	100
9	BLOWER	43.000	51.72	40	3	90	3	100
10	AIR COMPRESSOR A	2.800	3.37	2	--	20	3	100
11	SPARE	0.000	0.00		--	125	2	100
12	TRANSFORMER TA	20.000	24.06		--	60	3	100
13		0.000	0.00		--	400	3	400
14	PAC LOADCENTER TPA	5.000	10.42			100	2	100
15	EF-1	3.000	3.61	3	1	20	3	100
16	EF-2	3.000	3.61	3	1	20	3	100
17	EF-6	1.000	1.20	1	1	20	3	100
18	SURGE PROTECTIVE DEVICE	0.000	0.00			60	3	100
19		0.000	0.00					
20		0.000	0.00					
21		0.000	0.00					
22		0.000	0.00					
23		0.000	0.00					
24		0.000	0.00					
25		0.000	0.00					
26		0.000	0.00					
27		0.000	0.00					
28		0.000	0.00					

CONNECTED LOAD	120.100	KVA
DESIGN FACTOR	1.5625	
DESIGN LOAD	187.656	KVA
DESIGN CURRENT	225.72	AMPS

NEMA 3R

POWER PANEL "MCCB"

480 Y / 277 VOLTS, 3 PHASE 4 WIRE — **600 AMP MAIN CIRCUIT BREAKER** — **65,000 AIC**

CKT.	DESCRIPTION	LOAD				OVERCURRENT		
		KVA	AMPS	HP	STARTER	TRIP	POLES	FRAME
1		0.000	0.00					
2		0.000	0.00					
3	SPARE	0.000	0.00			90	3	100
4	SPARE	0.000	0.00			200	3	200
5	SPARE	0.000	0.00			60	3	100
6	VACUUM PUMP 1B	6.300	7.58	5	1	20	3	100
7	VACUUM PUMP 2B	6.300	7.58	5	1	20	3	100
8	VACUUM PUMP 3B	6.300	7.58	5	1	20	3	100
9	BLOWER	43.000	51.72	40	3	90	3	100
10	AIR COMPRESSOR B	2.800	3.37	2	--	20	3	100
11	SPARE	0.000	0.00		--	125	2	100
12	TRANSFORMER TB	20.000	24.06		--	60	3	100
13		0.000	0.00					
14	RAW LOADCENTER	5.000	10.42			100	2	100
15	EF-3	3.000	3.61	3	1	20	3	100
16	EF-4	3.000	3.61	3	1	20	3	100
17	EF-5	1.000	1.20	1	1	20	3	100
18	SURGE PROTECTIVE DEVICE	0.000	0.00			60	3	100
19		0.000	0.00					
20		0.000	0.00					
21		0.000	0.00					
22		0.000	0.00					
23		0.000	0.00					
24		0.000	0.00					
25		0.000	0.00					
26		0.000	0.00					
27		0.000	0.00					
28		0.000	0.00					

CONNECTED LOAD	96.700	KVA
DESIGN FACTOR	1.5625	
DESIGN LOAD	151.094	KVA
DESIGN CURRENT	181.74	AMPS

REGISTERED PROFESSIONAL ENGINEER
STATE OF OKLAHOMA
BRIAN BROWN
20995
12-16-2020

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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

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ELECTRICAL SCHEDULES I

Proj. No. HUB-245
Sht. No. E15

NEMA 3R

PANELBOARD SCHEDULE

PANEL	LPA	VOLTS	208Y/120 3PH, 4W		MAIN	100A MCB		INTERRUPT RATING		10,000	
DESCRIPTION	BKR	NO.	A	B	C	A	B	C	NO.	BKR	DESCRIPTION
SURGE PROTECTIVE DEVICE	60A/3P	1	0.000			2.976			2	100A/3P	PANEL FP1
SURGE PROTECTIVE DEVICE	–	3		0.000			2.976		4	–	PANEL FP1
SURGE PROTECTIVE DEVICE	–	5			0.000			2.976	6	–	PANEL FP1
INTERIOR LIGHTS	20A/1P	7	0.970			0.500			8	20A/1P	FIT–002
INTERIOR LIGHTS	20A/1P	9		0.873			0.250		10	20A/1P	AIT–002
RECEPT	20A/1P	11			0.120			1.000	12	20A/1P	SAMPLE PUMP
CLARIFIER CONTROL PANEL A	20A/1P	13	1.000			0.250			14	20A/1P	LIT–100
SAMPLE PUMP	20A/1P	15		0.500			0.250		16	20A/1P	LIT–200
AIT–011	20A/1P	17			0.250			0.250	18	20A/1P	LIT–300
AIT–012	20A/1P	19	0.250			0.250			20	20A/1P	LIT–400
FILTER CONTROL PANEL A	20A/1P	21		1.000			0.000		22	20A/1P	SPARE
PLANT CONTROL PANEL A	20A/1P	23			1.000			0.500	24	20A/1P	VAULT RECEPT
AIT–001	20A/1P	25	0.250			0.000			26	20A/1P	SPARE
BLOWER VENT A	20A/1P	27		1.000			0.000		28	20A/1P	SPARE
DRYER	20A/1P	29			1.000			0.000	30	20A/1P	SPARE
DRY POLYMER FEED	20A/1P	31	1.000			0.000			32	20A/1P	SPARE
EXTERIOR LIGHTS	20A/1P	33		0.690			0.000		34	20A/1P	SPARE
SPARE	50A/2P	35			0.000			0.000	36	20A/1P	SPARE
SPARE	–	37	0.000			0.000			38	20A/1P	SPARE
SPARE	20A/1P	39		0.000			0.000		40	20A/1P	SPARE
RH–*	20A/1P	41			0.500			0.000	42	20A/1P	SPARE
			3.4700	4.0630	2.8700	3.9760	3.4760	4.7260			
			7.4460	7.5390	7.5960	TOTAL CONNECTED KVA					
			22.5810								
			35.2828			DESIGN KVA					
			97.938168			DESIGN AMPS	@	208			

NEMA 1

PANELBOARD SCHEDULE

PANEL	LPB	VOLTS	208Y/120 3PH, 4W		MAIN	100A MCB		INTERRUPT RATING		10,000	
DESCRIPTION	BKR	NO.	A	B	C	A	B	C	NO.	BKR	DESCRIPTION
SURGE PROTECTIVE DEVICE	60A/3P	1	0.000			2.976			2	100A/3P	PANEL FP3
SURGE PROTECTIVE DEVICE	–	3		0.000			2.976		4	–	PANEL FP3
SURGE PROTECTIVE DEVICE	–	5			0.000			2.976	6	–	PANEL FP3
INTERIOR LIGHTS	20A/1P	7	0.970			0.000			8	20A/1P	SPARE
INTERIOR LIGHTS	20A/1P	9		0.873			0.000		10	20A/1P	SPARE
RECEPT	20A/1P	11			0.120			0.000	12	20A/1P	SPARE
CLARIFIER CONTROL PANEL B	20A/1P	13	1.000			0.250			14	20A/1P	LIT–500
SAMPLE PUMP	20A/1P	15		0.500			0.250		16	20A/1P	LIT–600
AIT–021	20A/1P	17			0.250			0.250	18	20A/1P	LIT–700
AIT–022	20A/1P	19	0.250			0.250			20	20A/1P	LIT–800
FILTER CONTROL PANEL B	20A/1P	21		1.000			0.000		22	20A/1P	SPARE
PLANT CONTROL PANEL B	20A/1P	23			1.000			0.500	24	20A/2P	SITE LIGHTING
BLOWER VENT A	20A/1P	25	1.000			0.000			26	–	SITE LIGHTING
BLOWER VENT B	20A/1P	27		1.000			0.000		28	20A/1P	SPARE
DRYER	20A/1P	29			1.000			0.000	30	20A/1P	SPARE
SPARE	20A/1P	31	0.000			0.000			32	20A/1P	SPARE
EXTERIOR LIGHTS	20A/1P	33		0.690			0.000		34	20A/1P	SPARE
SPARE	50A/2P	35			0.000			0.000	36	20A/1P	SPARE
SPARE	–	37	0.000			0.000			38	20A/1P	SPARE
SPARE	20A/1P	39		0.000			0.000		40	20A/1P	SPARE
RH–*	20A/1P	41			0.500			0.000	42	20A/1P	SPARE
			3.2200	4.0630	2.8700	3.4760	3.2260	3.7260			
			6.6960	7.2890	6.5960	TOTAL CONNECTED KVA					
			20.5810								
			32.1578			DESIGN KVA					
			89.263780			DESIGN AMPS	@	208			

NEMA 3R

PANELBOARD SCHEDULE

PANEL:	TPA	VOLTS: 240/120 1PH, 3W			MAIN: 225A MCB			10,000 AIC	
DESCRIPTION	BKR	NO.	A	B	A	B	NO.	BKR	DESCRIPTION
SURGE PROTECTIVE DEVICE	60A/2P	1	0.000		0.500		2	20A/1P	EXHAUST
SURGE PROTECTIVE DEVICE	–	3		0.000		0.000	4	20A/1P	SITE LIGHTING
AIR COMPRESSOR	60A/2P	5	3.300		0.000		6	20A/2P	SPARE
AIR COMPRESSOR	–	7		3.300		0.000	8	–	SPARE
PAC CONTROL PANEL	20A/1P	9	1.000		0.000		10	30A/2P	SPARE
LIGHTING	20A/1P	11		0.250		0.000	12	–	SPARE
HEATER	60A/2P	13	5.000		0.000		14		
HEATER	–	15		5.000		0.000	16		
		17	0.000		0.000		18		
		19		0.000		0.000	20		
		21	0.000		0.000		22		
		23		0.000		0.000	24		
		25	0.000		0.000		26		
		27		0.000		0.000	28		
		29	0.000		0.000		30		
		31		0.000		0.000	32		
		33	0.000		0.000		34		
		35		0.000		0.000	36		
		37	0.000		0.000		38		
		39		0.000		0.000	40		
		41	0.000		0.000		42		
			9.300	8.550	0.500	0.000			
			9.800	8.550	TOTAL CONNECTED KVA				
			18.350						
			22.938		DESIGN KVA				
			96		DESIGN AMPS				



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BROWN ENGINEERS 501-448-0100

Holloway, Updike and Bellen, Inc.
815 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

ELECTRICAL SCHEDULES II

Proj. No. HUB-245
Sht. No. E16

NEMA 3R

PANELBOARD SCHEDULE

PANEL	FP1	VOLTS	208Y/120 3PH, 4W			MAIN	100A MCB		INTERRUPT RATING		10,000
DESCRIPTION	BKR	NO.	A	B	C	A	B	C	NO.	BKR	DESCRIPTION
INLET VALVE	20A/3P	1	0.420			0.420			2	20A/3P	INLET VALVE
INLET VALVE	–	3		0.420			0.420		4	–	INLET VALVE
INLET VALVE	–	5			0.420			0.420	6	–	INLET VALVE
OUTLET VALVE	20A/3P	7	0.420			0.420			8	20A/3P	OUTLET VALVE
OUTLET VALVE	–	9		0.420			0.420		10	–	OUTLET VALVE
OUTLET VALVE	–	11			0.420			0.420	12	–	OUTLET VALVE
AIR WASH VALVE	20A/3P	13	0.420			0.420			14	20A/3P	AIR WASH VALVE
AIR WASH VALVE	–	15		0.420			0.420		16	–	AIR WASH VALVE
AIR WASH VALVE	–	17			0.420			0.420	18	–	AIR WASH VALVE
BACKWASH VALVE	20A/3P	19	0.420			0.420			20	20A/3P	BACKWASH VALVE
BACKWASH VALVE	–	21		0.420			0.420		22	–	BACKWASH VALVE
BACKWASH VALVE	–	23			0.420			0.420	24	–	BACKWASH VALVE
WASTE VALVE	20A/3P	25	0.420			0.420			26	20A/3P	WASTE VALVE
WASTE VALVE	–	27		0.420			0.420		28	–	WASTE VALVE
WASTE VALVE	–	29			0.420			0.420	30	–	WASTE VALVE
AIT–401	20A/1P	31	0.250			0.250			32	20A/1P	FIT–101
FIT–401	20A/1P	33		0.250			0.250		34	20A/1P	AIT–101
FIT–301	20A/1P	35			0.250			0.000	36	20A/1P	SPARE
AIT–301	20A/1P	37	0.250			1.386			38	100A/3P	PANEL FP2
AIT–201	20A/1P	39		0.250			1.386		40	–	PANEL FP2
FIT–201	20A/1P	41			0.250			1.386	42	–	PANEL FP2
CONNECTED LOAD WITH DIVERSITY – 4.77+4.16 = 8.93KVA			2.6000	2.6000	2.6000	3.7360	3.7360	3.4860			
			6.3360	6.3360	6.0860	TOTAL CONNECTED KVA					
			18.7580								
			29.3094			DESIGN KVA					
			81.357077			DESIGN AMPS	@	208			

NEMA 3R

PANELBOARD SCHEDULE

PANEL	FP2	VOLTS	208Y/120 3PH, 4W			MAIN	100A MCB		INTERRUPT RATING		10,000
DESCRIPTION	BKR	NO.	A	B	C	A	B	C	NO.	BKR	DESCRIPTION
INLET VALVE	20A/3P	1	0.420			0.420			2	20A/3P	INLET VALVE
INLET VALVE	–	3		0.420			0.420		4	–	INLET VALVE
INLET VALVE	–	5			0.420			0.420	6	–	INLET VALVE
OUTLET VALVE	20A/3P	7	0.420			0.420			8	20A/3P	OUTLET VALVE
OUTLET VALVE	–	9		0.420			0.420		10	–	OUTLET VALVE
OUTLET VALVE	–	11			0.420			0.420	12	–	OUTLET VALVE
AIR WASH VALVE	20A/3P	13	0.420			0.420			14	20A/3P	AIR WASH VALVE
AIR WASH VALVE	–	15		0.420			0.420		16	–	AIR WASH VALVE
AIR WASH VALVE	–	17			0.420			0.420	18	–	AIR WASH VALVE
BACKWASH VALVE	20A/3P	19	0.420			0.420			20	20A/3P	BACKWASH VALVE
BACKWASH VALVE	–	21		0.420			0.420		22	–	BACKWASH VALVE
BACKWASH VALVE	–	23			0.420			0.420	24	–	BACKWASH VALVE
WASTE VALVE	20A/3P	25	0.420			0.420			26	20A/3P	WASTE VALVE
WASTE VALVE	–	27		0.420			0.420		28	–	WASTE VALVE
WASTE VALVE	–	29			0.420			0.420	30	–	WASTE VALVE
SUMP PUMP	20A/1P	31	1.000			0.250			32	20A/1P	AIT–101a
SPARE	20A/3P	33		0.420			0.000		34	20A/1P	SPARE
SPARE	–	35			0.420			0.000	36	20A/1P	SPARE
SPARE	–	37	0.420			0.250			38	20A/1P	LIT–911
SPARE	20A/1P	39		0.250			0.000		40	20A/1P	AIT–013
INTERIOR LIGHTS	20A/1P	41			0.560			0.000	42	20A/1P	SPARE
CONNECTED LOAD WITH DIVERSITY – 4.16KVA			3.5200	2.7700	3.0800	2.6000	2.1000	2.1000			
			6.1200	4.8700	5.1800	TOTAL CONNECTED KVA					
			16.1700								
			25.2656			DESIGN KVA					
			70.132420			DESIGN AMPS	@	208			

NEMA 3R

PANELBOARD SCHEDULE

PANEL	FP3	VOLTS	208Y/120 3PH, 4W			MAIN	100A MCB		INTERRUPT RATING		10,000
DESCRIPTION	BKR	NO.	A	B	C	A	B	C	NO.	BKR	DESCRIPTION
INLET VALVE	20A/3P	1	0.420			0.420			2	20A/3P	INLET VALVE
INLET VALVE	–	3		0.420			0.420		4	–	INLET VALVE
INLET VALVE	–	5			0.420			0.420	6	–	INLET VALVE
OUTLET VALVE	20A/3P	7	0.420			0.420			8	20A/3P	OUTLET VALVE
OUTLET VALVE	–	9		0.420			0.420		10	–	OUTLET VALVE
OUTLET VALVE	–	11			0.420			0.420	12	–	OUTLET VALVE
AIR WASH VALVE	20A/3P	13	0.420			0.420			14	20A/3P	AIR WASH VALVE
AIR WASH VALVE	–	15		0.420			0.420		16	–	AIR WASH VALVE
AIR WASH VALVE	–	17			0.420			0.420	18	–	AIR WASH VALVE
BACKWASH VALVE	20A/3P	19	0.420			0.420			20	20A/3P	BACKWASH VALVE
BACKWASH VALVE	–	21		0.420			0.420		22	–	BACKWASH VALVE
BACKWASH VALVE	–	23			0.420			0.420	24	–	BACKWASH VALVE
WASTE VALVE	20A/3P	25	0.420			0.420			26	20A/3P	WASTE VALVE
WASTE VALVE	–	27		0.420			0.420		28	–	WASTE VALVE
WASTE VALVE	–	29			0.420			0.420	30	–	WASTE VALVE
AIT–801	20A/1P	31	0.250			0.250			32	20A/1P	FIT–501
FIT–801	20A/1P	33		0.250			0.250		34	20A/1P	AIT–501
FIT–701	20A/1P	35			0.250			0.000	36	20A/1P	SPARE
AIT–701	20A/1P	37	0.250			1.386			38	100A/3P	PANEL FP4
AIT–601	20A/1P	39		0.250			1.386		40	–	PANEL FP4
FIT–601	20A/1P	41			0.250			1.386	42	–	PANEL FP4
CONNECTED LOAD WITH DIVERSITY – 4.77+4.16 = 8.93KVA			2.6000	2.6000	2.6000	3.7360	3.7360	3.4860			
			6.3360	6.3360	6.0860	TOTAL CONNECTED KVA					
			18.7580								
			29.3094			DESIGN KVA					
			81.357077			DESIGN AMPS	@	208			

NEMA 3R

PANELBOARD SCHEDULE

PANEL	FP4	VOLTS	208Y/120 3PH, 4W			MAIN	100A MCB		INTERRUPT RATING		10,000
DESCRIPTION	BKR	NO.	A	B	C	A	B	C	NO.	BKR	DESCRIPTION
INLET VALVE	20A/3P	1	0.420			0.420			2	20A/3P	INLET VALVE
INLET VALVE	–	3		0.420			0.420		4	–	INLET VALVE
INLET VALVE	–	5			0.420			0.420	6	–	INLET VALVE
OUTLET VALVE	20A/3P	7	0.420			0.420			8	20A/3P	OUTLET VALVE
OUTLET VALVE	–	9		0.420			0.420		10	–	OUTLET VALVE
OUTLET VALVE	–	11			0.420			0.420	12	–	OUTLET VALVE
AIR WASH VALVE	20A/3P	13	0.420			0.420			14	20A/3P	AIR WASH VALVE
AIR WASH VALVE	–	15		0.420			0.420		16	–	AIR WASH VALVE
AIR WASH VALVE	–	17			0.420			0.420	18	–	AIR WASH VALVE
BACKWASH VALVE	20A/3P	19	0.420			0.420			20	20A/3P	BACKWASH VALVE
BACKWASH VALVE	–	21		0.420			0.420		22	–	BACKWASH VALVE
BACKWASH VALVE	–	23			0.420			0.420	24	–	BACKWASH VALVE
WASTE VALVE	20A/3P	25	0.420			0.420			26	20A/3P	WASTE VALVE
WASTE VALVE	–	27		0.420			0.420		28	–	WASTE VALVE
WASTE VALVE	–	29			0.420			0.420	30	–	WASTE VALVE
SUMP PUMP	20A/1P	31	1.000			0.000			32	20A/1P	SPARE
SPARE	20A/3P	33		0.420			0.000		34	20A/1P	SPARE
SPARE	–	35			0.420			0.000	36	20A/1P	SPARE
SPARE	–	37	0.420			0.250			38	20A/1P	LIT–921
SPARE	20A/1P	39		0.250			0.000		40	20A/1P	AIT–023
INTERIOR LIGHTS	20A/1P	41			0.560			0.000	42	20A/1P	SPARE
CONNECTED LOAD WITH DIVERSITY – 4.16KVA			3.5200	2.7700	3.0800	2.3500	2.1000	2.1000			
			5.8700	4.8700	5.1800	TOTAL CONNECTED KVA					
			15.9200								
			24.8750			DESIGN KVA					
			69.048121			DESIGN AMPS	@	208			



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Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

ELECTRICAL SCHEDULES III

Proj. No. HUB–245
Sht. No. E17

FEEDER SCHEDULE

FEEDER DESIGNATION	AMPERE RATING	CONDUCTOR SIZE (AWG OF KCMIL) PH	CONDUCTOR SIZE (AWG OF KCMIL) GND	CONDUIT NO. RUNS	CONDUIT SIZE WITHOUT NEUTRAL	CONDUIT SIZE WITH NEUTRAL
F20	20	12	12	1	3/4"	1"
F30	30	10	10	1	1"	1"
F40	40	8	10	1	1-1/4"	1-1/4"
F50	50	6	10	1	1-1/4"	1-1/4"
F60	60	6	10	1	1-1/4"	1-1/4"
F70	70	4	8	1	1-1/4"	1-1/2"
F80	80	4	8	1	1-1/4"	1-1/2"
F90	90	2	8	1	1-1/2"	2"
F100	100	2	8	1	1-1/2"	2"
F110	110	2	6	1	1-1/2"	2"
F125	125	1/0	6	1	2"	2-1/2"
F150	150	1/0	6	1	2"	2-1/2"
F175	175	2/0	6	1	2-1/2"	2-1/2"
F200	200	3/0	6	1	2-1/2"	3"
F225	225	4/0	4	1	2-1/2"	3"
F250	250	250	4	1	3"	4"
F300	300	350	4	1	3"	4"
F350	350	500	2	1	4"	4"
F400	400	500	1/0	1	4"	4"
F450	450	4/0	2	2	2-1/2"	3"
F500	500	250	2	2	3"	4"
F600	600	350	1/0	2	3"	4"
F700	700	500	1/0	2	4"	4"
F800	800	500	1/0	2	4"	4"
F1000	1000	500	2/0	3	4"	4"
F1200	1200	350	3/0	4	3"	4"
F1600	1600	500	4/0	5	4"	4"
F2000	2000	500	250	6	4"	4"
F2500	2500	500	350	7	4"	4"
F3000	3000	500	500	8	4"	4"
F4000	4000	500	500	11	4"	4"

240/208V VFD MOTOR FEEDER SCHEDULE SHIELDED VFD CABLE TYPE TC-ER (XHHW-2)

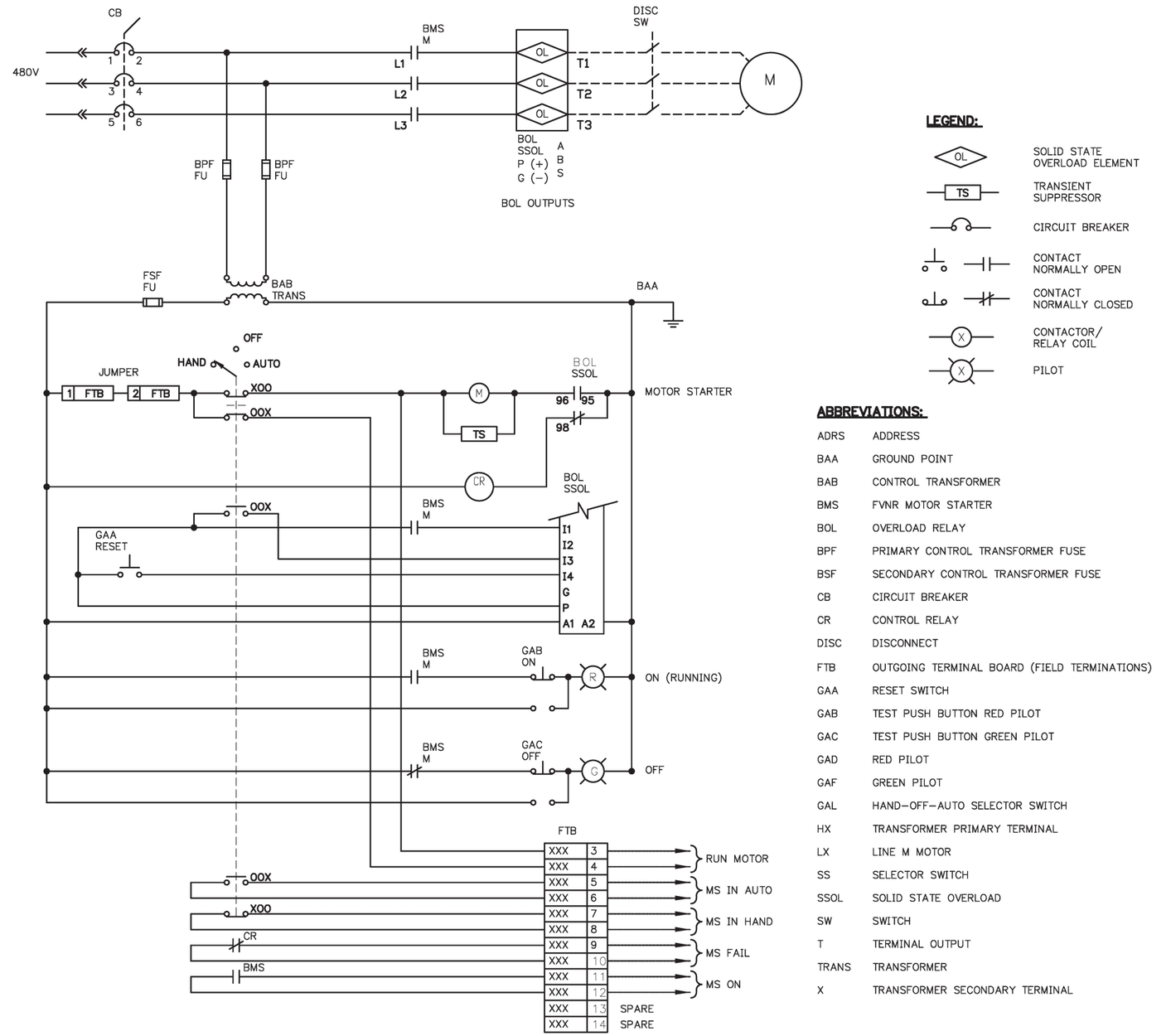
FEEDER DESIGNATION	CABLE AMPERE RATING	CONDUCTOR SIZE (AWG OF KCMIL) PH	CONDUCTOR SIZE (AWG OF KCMIL) GND	CONDUIT NO. RUNS	CONDUIT SIZE
V5 L	30	10	3#14	1	1"
V7 L	50	8	3#14	1	2"
V10 L	50	8	3#14	1	2"
V15 L	65	6	3#12	1	2"
V20 L	85	4	3#12	1	2"
V25 L	115	2	3#10	1	2"
V30 L	115	2	3#10	1	2"
V40 L	150	1/0	3#10	1	2"
V50 L	230	4/0	3#8	1	3"
V60 L	230	4/0	3#8	1	3"
V75 L	310	350	3#7	1	4"
V100 L	380	500	3#6	1	4"
V125 L	460	4/0	3#8	2	3"
V150 L	620	350	3#7	2	4"

480V VFD MOTOR FEEDER SCHEDULE SHIELDED VFD CABLE TYPE TC-ER (XHHW-2)

FEEDER DESIGNATION	CABLE AMPERE RATING	CONDUCTOR SIZE (AWG OF KCMIL) PH	CONDUCTOR SIZE (AWG OF KCMIL) GND	CONDUIT NO. RUNS	CONDUIT SIZE
V10 H	20	12	3#16	1	1"
V15 H	30	10	3#14	1	1"
V20 H	50	8	3#14	1	2"
V25 H	50	8	3#14	1	2"
V30 H	50	8	3#14	1	2"
V40 H	65	6	3#12	1	2"
V50 H	85	4	3#12	1	2"
V60 H	115	2	3#10	1	2"
V75 H	130	1	3#10	1	2"
V100 H	175	2/0	3#10	1	3"
V125 H	230	4/0	3#8	1	3"
V150 H	230	4/0	3#8	1	3"
V200 H	310	350	3#7	1	4"
	380	500	3#6	1	4"
	475	750	3#5	1	5"
	545	1000	3#4	1	5"

FEEDER SCHEDULE NOTES:

1. "H" SUFFIX INDICATES THAT FEEDER IS TO BE USED ON A 480 VOLT CIRCUIT.
2. "L" SUFFIX INDICATES THAT FEEDER IS TO BE USED ON 208/240 VOLT CIRCUIT.
3. "N" SUFFIX INDICATES THAT FEEDER CONTAINS A FULL SIZE NEUTRAL CONDUCTOR. OTHERWISE PROVIDE ONLY PHASE AND GROUND CONDUCTORS.
4. "1" PREFIX INDICATES A SINGLE PHASE FEEDER (LINE-TO-LINE). OTHERWISE ASSUME 3-PHASE FEEDER.
5. "S" PREFIX INDICATES A SERVICE FEEDER CONSISTING OF PHASE CONDUCTORS PLUS A FULL SIZE GROUNDED SERVICE CONDUCTOR (NEUTRAL).
6. "CO" MEANS PROVIDE CONDUIT ONLY FOR THAT FEEDER SIZE.



1 MCC MOTOR STARTER ELEMENTARY
SCALE: NTS

LEGEND:

- OL — SOLID STATE OVERLOAD ELEMENT
- TS — TRANSIENT SUPPRESSOR
- CIRCUIT BREAKER
- CONTACT NORMALLY OPEN
- CONTACT NORMALLY CLOSED
- X — CONTACTOR/ RELAY COIL
- X — PILOT

ABBREVIATIONS:

ADRS	ADDRESS
BAA	GROUND POINT
BAB	CONTROL TRANSFORMER
BMS	FVNR MOTOR STARTER
BOL	OVERLOAD RELAY
BPF	PRIMARY CONTROL TRANSFORMER FUSE
BSF	SECONDARY CONTROL TRANSFORMER FUSE
CB	CIRCUIT BREAKER
CR	CONTROL RELAY
DISC	DISCONNECT
FTB	OUTGOING TERMINAL BOARD (FIELD TERMINATIONS)
GAA	RESET SWITCH
GAB	TEST PUSH BUTTON RED PILOT
GAC	TEST PUSH BUTTON GREEN PILOT
GAD	RED PILOT
GAF	GREEN PILOT
GAL	HAND-OFF-AUTO SELECTOR SWITCH
HX	TRANSFORMER PRIMARY TERMINAL
LX	LINE M MOTOR
SS	SELECTOR SWITCH
SSOL	SOLID STATE OVERLOAD
SW	SWITCH
T	TERMINAL OUTPUT
TRANS	TRANSFORMER
X	TRANSFORMER SECONDARY TERMINAL

GENERAL NOTES:

COORDINATE ALL INTERCONNECTIONS BETWEEN THE EXISTING POWER/CONTROL SYSTEM AND APPROVED SHOP DRAWINGS AND MANUFACTURER RECOMMENDATIONS OF NEW EQUIPMENT.

FURNISH AND INSTALL ALL NECESSARY LABOR AND MATERIAL TO PLACE NEW GENERATOR SYSTEM AND AUXILIARY COMPONENTS INTO SUCCESSFUL OPERATION.



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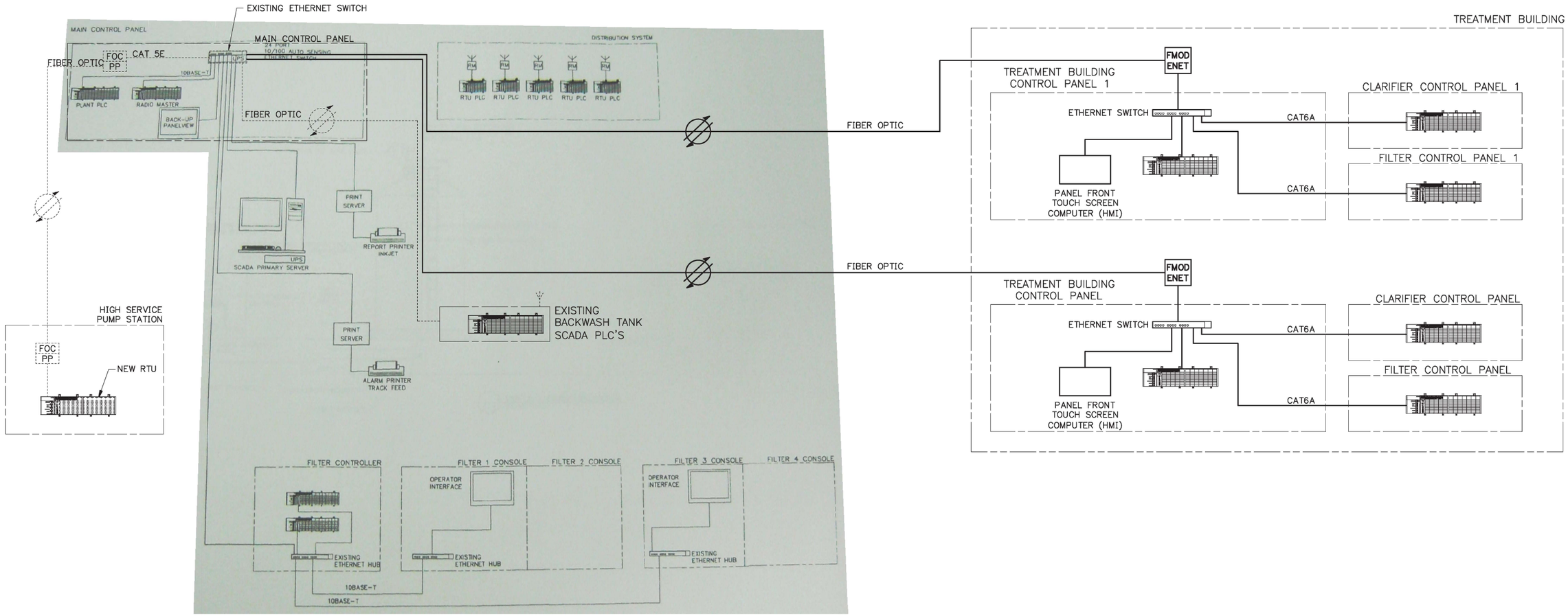
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD | Date: 2020 | Check: BB

ELECTRICAL SCHEMATIC I

Proj. No. HUB-245 | Sht. No. E18



1 — MODIFIED NETWORK RISER DIAGRAM
SCALE: NONE

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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

ELECTRICAL
NETWORK RISER DIAGRAM

Proj. No. HUB-245
Sht. No. E19

REGISTERED PROFESSIONAL ENGINEER
STATE OF OKLAHOMA
20995
2-1-2020

CONDUIT AND CABLE SCHEDULE

CIRCUIT	DESCRIPTION	SERVICE VOLTAGE	SERVICE AMPS	ROUTING FROM	ROUTING TO	WIRE & CONDUIT
U01						
U02						
P01						
P02						
P03						
P04						
P05						
P06						
P07						
P08						
P09						
P10						
P11						
P12						
P13						
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CONTROL / SIGNAL CONDUCTOR/CABLE SCHEDULE

CIRCUIT	DESCRIPTION	SERVICE VOLTAGE	SERVICE AMPS	ROUTING FROM	ROUTING TO	CONDUCTOR/ CABLE COUNT
						(X#14)
C01a,b	MCC CONTROL	120VAC	--	MCC	TREATMENT BLDG PLC	20
C02a,b	VACUUM PUMP/MOTOR CONTROL	120VAC	--	MCC	CLARIFIER PLC	16
C03a,b	FILTER 1,5 CONTROL	120VAC	--	J-BOX	FILTER PLC	24
C04a,b	FILTER 2,6 CONTROL	120VAC	--	J-BOX	FILTER PLC	26
C05a,b	FILTER 3,7 CONTROL	120VAC	--	J-BOX	FILTER PLC	24
C06a,b	FILTER 4,8 CONTROL	120VAC	--	J-BOX	FILTER PLC	24
C07	POWDER ACTIVATED CARBON CONTROL	120VAC	--	PAC FEEDER	TREATMENT BLDG PLC	20
C08a	DRY POLYMER CONTROL	120VAC	--	DRY POLYMER	TREATMENT BLDG PLC	8
C09a,b	TREATED WATER CONTROL	120VAC	--	FINISHED WATER FLOATS	TREATMENT BLDG PLC	12
C10a,b	VACUUM VALVE CONTROL	120VAC	--	CLARIFIER PLC	VACUUM VALVES	18
C11	ATS STATUS	120VAC	--	ATS	TREATMENT BUILDING PLC	12
C12	GENERATOR STATUS	120VAC	--	GENERATOR	TREATMENT BUILDING PLC	12
C13	RAW VAULT CONTROL	120VAC	--	RAW VAULT	TREATMENT BUILDING PLC	12
C14	GENERATOR CONTROL	120VAC	--	GENERATOR	ATS	12
C15a,b	BLOWER TEMP SWITCH	120VAC	--	BLOWER	BLOWER STARTER	4
C18a,b	SLUDGE BLOWOFF VALVE CONTROL	120VAC	--	CLARIFIER PLC	SLUDGE VALVES	48
C19a,b	FILTER 3,7 CONTROL	120VAC	--	J-BOX	FILTER PLC	16
C20a,b	FILTER 4,8 CONTROL	120VAC	--	J-BOX	FILTER PLC	16
C21a,b	FILTER 2,6 CONTROL	120VAC	--	J-BOX	FILTER PLC	16
C22a,b	FILTER 1,5 CONTROL	120VAC	--	J-BOX	FILTER PLC	16
						X(2ISP16)
S01a,b	MCC SIGNAL	24VDC	4-20mA	MCCB	TREATMENT BLDG PLC	8
S02a,b	TREATMENT SIGNAL	24VDC	4-20mA	SETTLED WATER	TREATMENT BLDG PLC	2
S03a,b	FILTER 1,5 SIGNAL	24VDC	4-20mA	J-BOX	FILTER PLC	3
S04a,b	FILTER 2,6 SIGNAL	24VDC	4-20mA	J-BOX	FILTER PLC	3
S05a,b	FILTER 3,7 SIGNAL	24VDC	4-20mA	J-BOX	FILTER PLC	3
S06a,b	FILTER 4,8 SIGNAL	24VDC	4-20mA	J-BOX	FILTER PLC	3
S07a,b	TREATED WATER LEVEL SIGNAL	24VDC	4-20mA	J-BOX	TREATMENT BLDG PLC	2
S08a	DRY POLYMER SIGNAL/PH	24VDC	4-20mA	DRY POLYMER	TREATMENT BLDG PLC	2
S09a,b	AIR COMPRESSOR PRESSURE	24VDC	4-20mA	PIT-013, 023	TREATMENT BLDG PLC	2
S13	RAW VAULT SIGNAL	24VDC	4-20mA	RAW VAULT	TREATMENT BLDG PLC	4
S14	POWDER ACTIVATED CARBON SIGNAL	24VDC	4-20mA	PAC FEEDER	TREATMENT BLDG PLC	4
S15a,b	FILTER 3,7 SIGNAL	24VDC	4-20mA	J-BOX	FILTER PLC	1
S16a,b	FILTER 4,8 SIGNAL	24VDC	4-20mA	J-BOX	FILTER PLC	1
S17a,b	FILTER 2,6 SIGNAL	24VDC	4-20mA	J-BOX	FILTER PLC	1
S18a,b	FILTER 1,5 SIGNAL	24VDC	4-20mA	J-BOX	FILTER PLC	1
S22	AIT-013	24VDC	4-20mA	COMBINED TURB	TREATMENT BLDG PLC	1
S23	AIT-023	24VDC	4-20mA	COMBINED TURB	TREATMENT BLDG PLC	1
S24	AIT-001 SIGNAL	24VDC	4-20mA	RAW WATER TURB	TREATMENT BLDG PLC	1
F01a,b	TREATMENT BUILDING CONTROL PANEL	--	--	TREATMENT BUILDING PLC	EXISTING BUILDING	12STRAND 2"C
SPARE-4	SPARE	--	--			EMPTY 4"C
SPARE-5	SPARE	--	--			EMPTY 5"C

SIGNAL CONDUIT FILL	
QTY (2ISP16)	CONDUIT SIZE
1	1"C
2–4	1–1/2"C
5–7	2"C
8–16	3"C
17–27	4"C

CONTROL CONDUIT FILL	
QTY #14'S	CONDUIT SIZE
1–30	1"C
31–80	1–1/2"C
81–140	2"C
141–300	3"C
301–530	4"C

STEVEN M. HOFFMAN 20995 OKLAHOMA PROFESSIONAL ENGINEER

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BROWN ENGINEERS 501-448-0100 | Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811 | Shawnee Municipal Authority

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

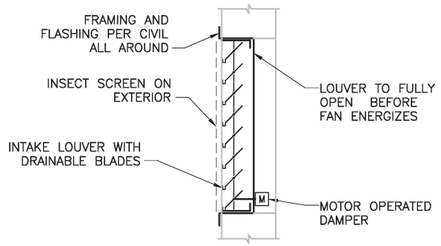
ELECTRICAL
CONDUIT AND CABLE SCHEDULE

Proj. No. HUB-245
Sht. No. E20

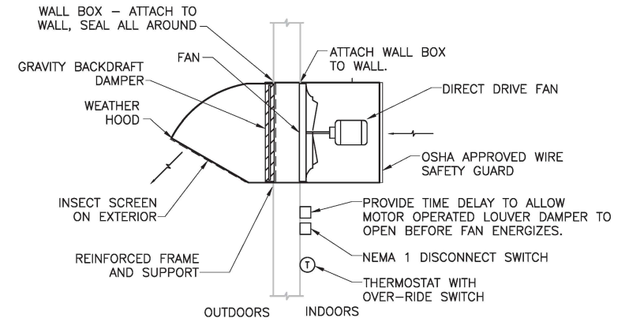
C:\USERS\CHARLES\SYNOLOGYDRIVE\HUB ENGINEERS (HUB)\HUB-245 SHAWNEE WTP\DWG\E20_CONDUIT AND CABLE SCHEDULE.DWG
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GENERAL NOTES:

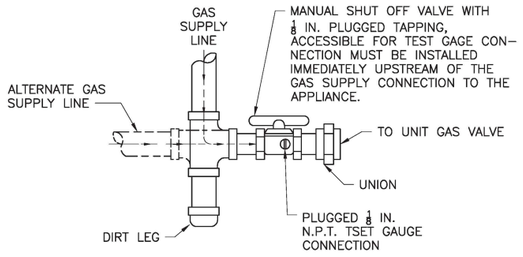
1. ALL MECHANICAL WORK SHALL COMPLY WITH ALL LOCAL CODES, DRAWINGS, SPECIFICATIONS, AND AUTHORITIES HAVING JURISDICTION. IF DISCREPANCIES ARE FOUND, THE MOST STRINGENT REQUIREMENT SHALL GOVERN WORK. WHERE INSPECTIONS ARE REQUIRED BY AUTHORITIES HAVING JURISDICTION, WORK MUST NOT BE CONCEALED UNTIL INSPECTIONS AND TESTING ARE COMPLETE AND WORK IS ACCEPTED.
2. REFER TO SPECIFICATIONS AND PROJECT MANUAL FOR ADDITIONAL INFORMATION AND REQUIREMENTS.
3. REFER TO ALL PROJECT DRAWINGS FOR DETAILS OF CONSTRUCTION AND INSTALLATION REQUIREMENTS.
4. PRIOR TO BID, CONTRACTOR SHALL BECOME THOROUGHLY FAMILIAR WITH THE REQUIREMENTS OF THESE NOTES AS WELL AS OTHER NOTES SHOWN ON THE CONTRACT DOCUMENTS.
5. THESE DRAWINGS REFLECT A SYSTEM DESIGNED AROUND SPECIFIED REFERENCE PRODUCTS, THE SELECTION OF WHICH HAS INFLUENCED THE DESIGNS OF OTHER TRADES. IF SUBSTITUTE MANUFACTURERS, SIZES, OR MODEL NUMBERS ARE BID OR SUBMITTED, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO COORDINATE ALL DIFFERENCES PRIOR TO BID. ALL COSTS OF ALL TRADES ASSOCIATED WITH THE SUBSTITUTION SHALL BE INCLUDED IN THE BID.
6. COORDINATION OF ALL MODIFICATIONS TO EACH DISCIPLINE WHICH RESULT FROM SUBSTITUTION OF EQUIPMENT OR MATERIALS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. SUBSTITUTIONS WHICH ARE INSTALLED AND SUBSEQUENTLY ARE PROVEN UNSATISFACTORY BY OWNER AND/OR ENGINEER WITHIN THE WARRANTY PERIOD, SHALL BE REMOVED COMPLETELY BY THE CONTRACTOR AND REPLACED WITH THE ORIGINAL DESIGN OR CORRECTED AS DIRECTED BY THE ENGINEER WITHOUT ADDITIONAL COST TO THE OWNER.
7. ALL DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL ARRANGEMENTS OR GEOMETRICAL RELATIONSHIPS OF EQUIPMENT AND SERVICES. THEY ARE NOT INTENDED TO SPECIFY OR SHOW EVERY OFFSET, SEQUENCE, DEVICE, OPTION, FITTING, OR COMPONENT.
8. INFORMATION AND COMPONENTS ON DETAILS OR IN SPECIFICATIONS, BUT NOT SHOWN ON PLANS, AND VICE VERSA, SHALL BE PROVIDED AS IF EXPRESSLY REQUIRED BY BOTH.
9. CONTRACTOR SHALL NOT SCALE DRAWINGS. DRAWINGS SPECIFIC TO THIS DISCIPLINE DO NOT LIMIT THE RESPONSIBILITY OF WORK REQUIRED BY THE CONTRACT DOCUMENTS.
10. EXACT LOCATIONS OF ALL EQUIPMENT, DUCTS, DIFFUSERS, AND PIPING SHALL BE COORDINATED WITH OTHER TRADES.
11. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL WORK WITH THAT OF OTHER TRADES. REFER TO ALL CONSTRUCTION DOCUMENTS FOR COMPLETE INFORMATION PRIOR TO BID.
12. ALL MECHANICAL CONSTRUCTION DETAILS SHALL BE AS SHOWN AND AS REQUIRED TO MAINTAIN "UL" ASSEMBLY RATINGS. SEAL AROUND ALL PENETRATIONS THOROUGH UL RATED ASSEMBLIES, FIRE AND SMOKE WALLS. COORDINATE WITH GENERAL CONTRACTOR.
13. NO OTHER TRADES, I.E., ELECTRICAL, CEILING, PLUMBING, OR OTHER SYSTEMS SHALL BE SUSPENDED, HUNG, OR SUPPORTED FROM PIPING.
14. CLOSELY COORDINATE FINAL LOCATIONS OF INSTALLED EQUIPMENT TO ACHIEVE THE GREATEST ACCESSIBILITY FOR MAINTENANCE PURPOSES.
15. CONTRACTOR SHALL VISIT THE SITE TO ESTABLISH THE EXISTING CONDITIONS PRIOR TO DUCT, PIPE OR EQUIPMENT FABRICATION. SYSTEMS SHALL BE ERECTED USING FIELD MEASUREMENTS FOR COORDINATION WITH THE EXISTING EQUIPMENT, STRUCTURE, FIRE PROTECTION AND ELECTRICAL IN THE SPACE.
16. MAINTAIN THE SECURITY OF THE BUILDING AT ALL TIMES.
17. CORE DRILL ALL PIPING PENETRATIONS OF CONCRETE WALLS AND FLOORS.
18. CONTRACTOR SHALL FIELD VERIFY ALL PIPE ROUTING AND ADJUST ELEVATIONS AS REQUIRED TO AVOID CONFLICTS. FINAL PLACEMENT OF PIPING SHALL BE DETERMINED BY FIELD MEASUREMENT AND VERIFICATION.
19. ALL EQUIPMENT, DEVICES, AND FIXTURES SHALL BE INSTALLED AS PER MANUFACTURER'S RECOMMENDATION.
20. CONTRACTOR SHALL VERIFY CLOSELY AT SITE TRANSPORTATION OF NEW HVAC EQUIPMENT INTO MECHANICAL AREAS BEFORE BIDDING. PROVIDE COMPLETE DISASSEMBLY AND RE-ASSEMBLY OF NEW EQUIPMENT AS REQUIRED FOR A COMPLETE INSTALLATION.
21. COORDINATE WORK CLOSELY WITH CONTROL REQUIREMENTS. PROVIDE ALL NECESSARY DUCT TAPS, PIPE TAPS, WELLS, AND OTHER APPURTENANCES REQUIRED BY CONTROL SYSTEM. PROVIDE SPARE PIPE WELL ADJACENT TO EACH TEMPERATURE SENSOR IN PIPING.
22. COORDINATE FINAL PLACEMENT OF ALL THERMOSTATS WITH WALL-MOUNTED DEVICES AND OWNER'S REPRESENTATIVE. MOUNT PER A.D.A. REQUIREMENTS. ANY THERMOSTAT THAT IS REQUIRED TO BE MOUNTED ON AN EXTERIOR WALL SHALL BE MOUNTED ON AN INSULATED PAD.
23. REPLACE ALL ARCHITECTURAL FEATURES REMOVED OR DAMAGED DURING THE COURSE OF THE WORK.
24. CONTRACTOR SHALL PATCH ALL WALLS, FLOORS, AND CEILINGS TO MATCH NEW/EXISTING FOR ALL OPENINGS CREATED BY INSTALLATION OF EQUIPMENT AND HVAC SERVICE PENETRATIONS.
25. ALL HVAC COMPONENTS WITH ELECTRICAL REQUIREMENTS SHALL BE INSTALLED WITH ELECTRICAL INFRASTRUCTURE NECESSARY TO PROVIDE A FULLY FUNCTIONING SYSTEM. IF NOT SPECIFICALLY SHOWN ON ELECTRICAL SCHEDULE, HVAC FIXTURES REQUIRING ELECTRICAL SERVICE SHALL BE FED FROM BREAKER OF ADEQUATE CAPACITY.
26. ALL CONTROL WIRING SHALL BE INSTALLED IN CONDUIT.



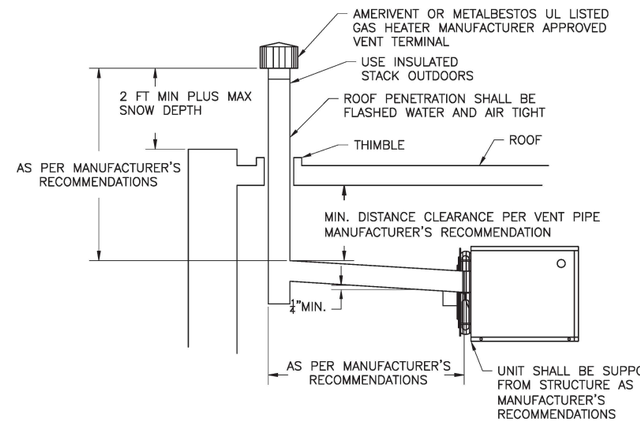
1 / M1 **ADJUSTABLE WALL LOUVER**
SCALE: NONE



2 / M1 **WALL EXHAUST FAN**
SCALE: NONE

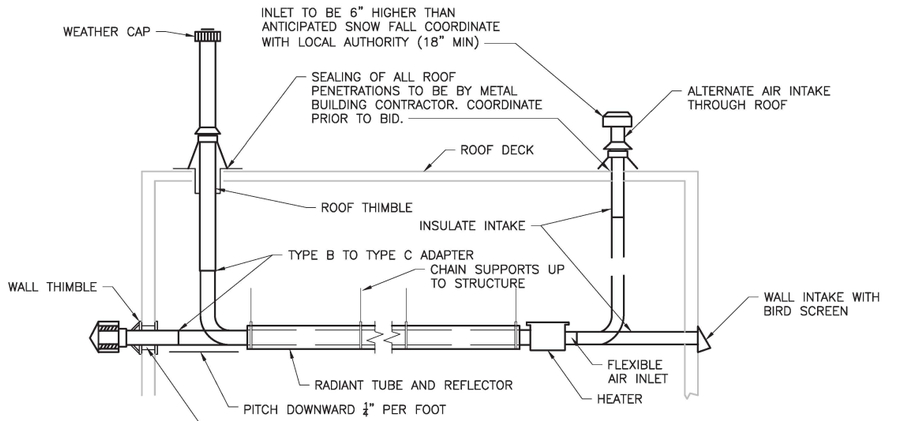


3 / M1 **UNIT HEATER GAS CONNECTION DETAIL**
SCALE: NONE



NOTE:
1. UNIT HEATER SHALL BE PROVIDED AND INSTALLED WITH CONCENTRIC VENT KIT.
2. UNIT SHALL BE PROVIDED AND INSTALLED WITH ELECTRICAL DISCONNECT.
3. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.

5 / M1 **UNIT HEATER VENT CONNECTION DETAIL**
SCALE: NONE



NOTE:
ALL GAS HEATERS SHALL BE INSTALLED WITH DUCTED COMBUSTION AIR INTAKES AND FLUES, AS PER MANUFACTURER'S RECOMMENDATION AND ALL AUTHORITIES HAVING JURISDICTION.

4 / M1 **GAS HEATER INSTALLATION**
SCALE: NONE

REGISTERED PROFESSIONAL ENGINEERS — STATE OF OKLAHOMA — STEVEN W. BROWN — 20995 — 2-17-2020

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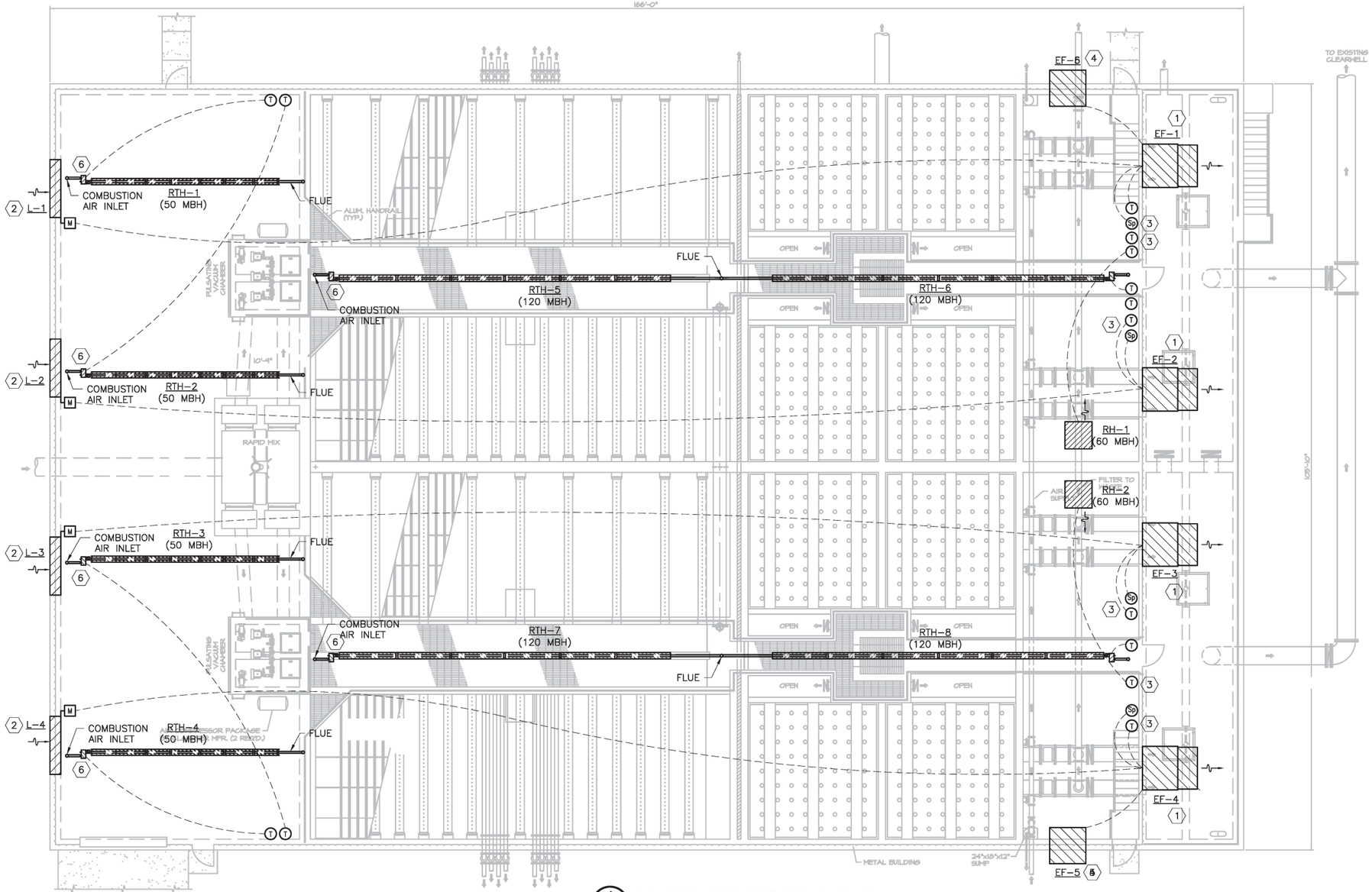
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

MECHANICAL
NOTES AND DETAILS

Proj. No. HUB-245
Sht. No. M1



1 / M2 **PROCESS BUILDING HVAC PLAN**
SCALE: 1/8" = 1'-0"

KEYED NOTES:

1. EXHAUST FAN EF-2,3 EQUAL TO GREENHECK MODEL SBE-2L36. FAN TO PROVIDE 15,000 CFM AGAINST 0.35" ESP WITH 3 HP MOTOR OPERATING ON 480/3 POWER. PROVIDE WITH MID MOUNT WALL BOX WITH SAFETY SCREEN AND DISCHARGE BACKDRAFT DAMPER, WEATHER HOOD WITH BIRD SCREEN AND NEMA 1 DISCONNECT SWITCH. PROVIDE WITH PHENOLIC EPOXY WITH UV TREATMENT COATING. COORDINATE FRAMING FOR FAN WITH THE GENERAL CONTRACTOR. MOUNT FAN APPROXIMATELY 9'-6" ABOVE FINISHED FLOOR. FIELD VERIFY FINAL MOUNTING HEIGHT.
2. LOUVER L-1,2,3,4 EQUAL TO RUSKIN MODEL ELF6811DD ADJUSTABLE LOUVER. LOUVER TO BE 6" DEEP DRAINABLE BLADE. DAMPER MOTOR TO BE 120 VOLT. PROVIDE BIRDSCREEN ON EXTERIOR OF LOUVER. PROVIDE MILL FINISH. LOUVER SIZE TO BE 60" WIDE X 72" TALL. COORDINATE FRAMING FOR LOUVER WITH GENERAL CONTRACTOR. MOUNT LOUVER 18" ABOVE FLOOR. PROVIDE DISCONNECT SWITCH FOR DAMPER MOTOR. LOUVER SHALL HAVE A MINIMUM OF 58 PERCENT FREE AREA. WATER PENETRATION SHALL BEGIN AT 1,200 FEET PER MINUTE.
3. 120 VOLT THERMOSTAT PER EF MANUFACTURER'S RECOMMENDATION. COORDINATE FINAL MOUNTING LOCATION AND HEIGHT WITH BUILDING SERVICE PIPING AND EQUIPMENT. PROVIDE WITH HEAVY DUTY WIRE CAGE COVER. THERMOSTAT TO CYCLE FAN ON AT 95 DEGREES (ADJUSTABLE) AND CYCLE FAN OFF AT 85 DEGREES (ADJUSTABLE). PROVIDE 5 SECOND TIME DELAY RELAYS AS REQUIRED TO OPEN MOTOR DAMPERS. INTERLOCKS SHALL BE AS FOLLOWS: L-1 WITH EF-1 AND EF-6; L-2 WITH EF-2; L-3 WITH EF-3; L-4 WITH EF-4; EF-5 TO BE INTERLOCKED WITH EF-4 SO THAT EF-5 ENERGIZES WHEN EF-4 IS ENERGIZED.
4. EXHAUST FAN EF-5 EQUAL TO GREENHECK MODEL SBE-2L24. FAN TO PROVIDE 6,000 CFM AGAINST 0.3" ESP WITH 1 HP MOTOR OPERATING ON 480/3 POWER. PROVIDE WITH MID MOUNT WALL BOX WITH SAFETY SCREEN AND DISCHARGE BACKDRAFT DAMPER, WEATHER HOOD WITH BIRD SCREEN AND NEMA 1 DISCONNECT SWITCH. PROVIDE WITH PHENOLIC EPOXY WITH UV TREATMENT COATING. COORDINATE FRAMING FOR FAN WITH THE GENERAL CONTRACTOR. MOUNT FAN LOW, APPROXIMATELY 18" ABOVE GRADE. FIELD VERIFY FINAL MOUNTING HEIGHT.
5. CONTROL WIRING TYPICAL. ROUTE ALL CONTROL WIRING IN CONDUIT.
6. MOUNT HEATERS SO AS TO MAINTAIN CLEARANCE FROM COMBUSTIBLES PER ALL MANUFACTURER'S CLEARANCE REQUIREMENTS.

GENERAL NOTES:

1. PROVIDE ALL EXHAUST FAN THERMOSTATS WITH MANUAL OVERRIDE SWITCH.
2. ALL HEATER FAN THERMOSTATS SHALL BE SET TO 55 DEG F (ADJ).
3. COORDINATE FINAL MOUNTING LOCATION OF THERMOSTATS WITH OWNER.
4. MOUNT ALL THERMOSTATS APPROX. 48" A.F.F. PER ADA REQUIREMENTS. MOUNT SPECIFICALLY RH-1,2 THERMOSTATS APPROX. 48" A.F.F. OF LOWER BASIN. SET ALL HEATER THERMOSTATS TO 65 DEG HEATING (ADJUSTABLE BY OWNER)

GAS STRAIGHT TUBE TWO (2) STAGE RADIANT HEATERS

MARK	LOCATION	HEIGHT	FUEL	MBH INPUT (HI / LOW)	ELECTRICAL	MANUFACTURER AND MODEL NO.; LENGTH	REMARKS
RTH-1,2,3,4	UPPER BASIN LEVEL	14'-0" A.F.F.	LIQUID PROP.	50 / 31	MAXIMUM: 1.3 AMPS 120 VAC - 60HZ - 1PH	SPACE-RAY: LTS-40; 17'-3"	PROVIDE WITH AIR INLET AND EXHAUST KITS, WALL MOUNTED TWO STAGE T-STAT, CHAIN HANGING KITS, ALUMINUM GRILLE.
RTH-5,6,7,8,	UPPER BASIN LEVEL	14'-0" A.F.F.	LIQUID PROP.	120 / 76	MAXIMUM: 1.3 AMPS 120 VAC - 60HZ - 1PH	SPACE-RAY: LTS-120; 32'-3"	PROVIDE WITH AIR INLET AND EXHAUST KITS, WALL MOUNTED TWO STAGE T-STAT, CHAIN HANGING KITS, ALUMINUM GRILLE.

GAS HIGH INTENSITY TWO (2) STAGE INFRARED HEATERS

MARK	LOCATION	MOUNTING HEIGHT	FUEL	MBH INPUT (HI / LOW)	ELECTRICAL	MANUFACTURER AND MODEL NO. OR EQUAL	REMARKS
RH-1,2	LOWER BASIN LEVEL	12'-0" A.F.F.	LIQUID PROP.	60 / 40	MAXIMUM: 0.96 AMPS 24 VAC - 60HZ - 1PH	STERLING: GG	PROVIDE WITH INTEGRAL DISCONNECT, WALL MOUNTED TWO STAGE T-STAT, FLEXIBLE GAS CONNECTOR ASSEMBLY, HEAT SHIELD, PROTECTIVE SCREEN, UNIT REGULATOR AND CHAIN MOUNTING KIT.

REGISTERED PROFESSIONAL ENGINEER — STEVEN A. WOLFTOWN — 20995 — 12-16-2020 — OKLAHOMA

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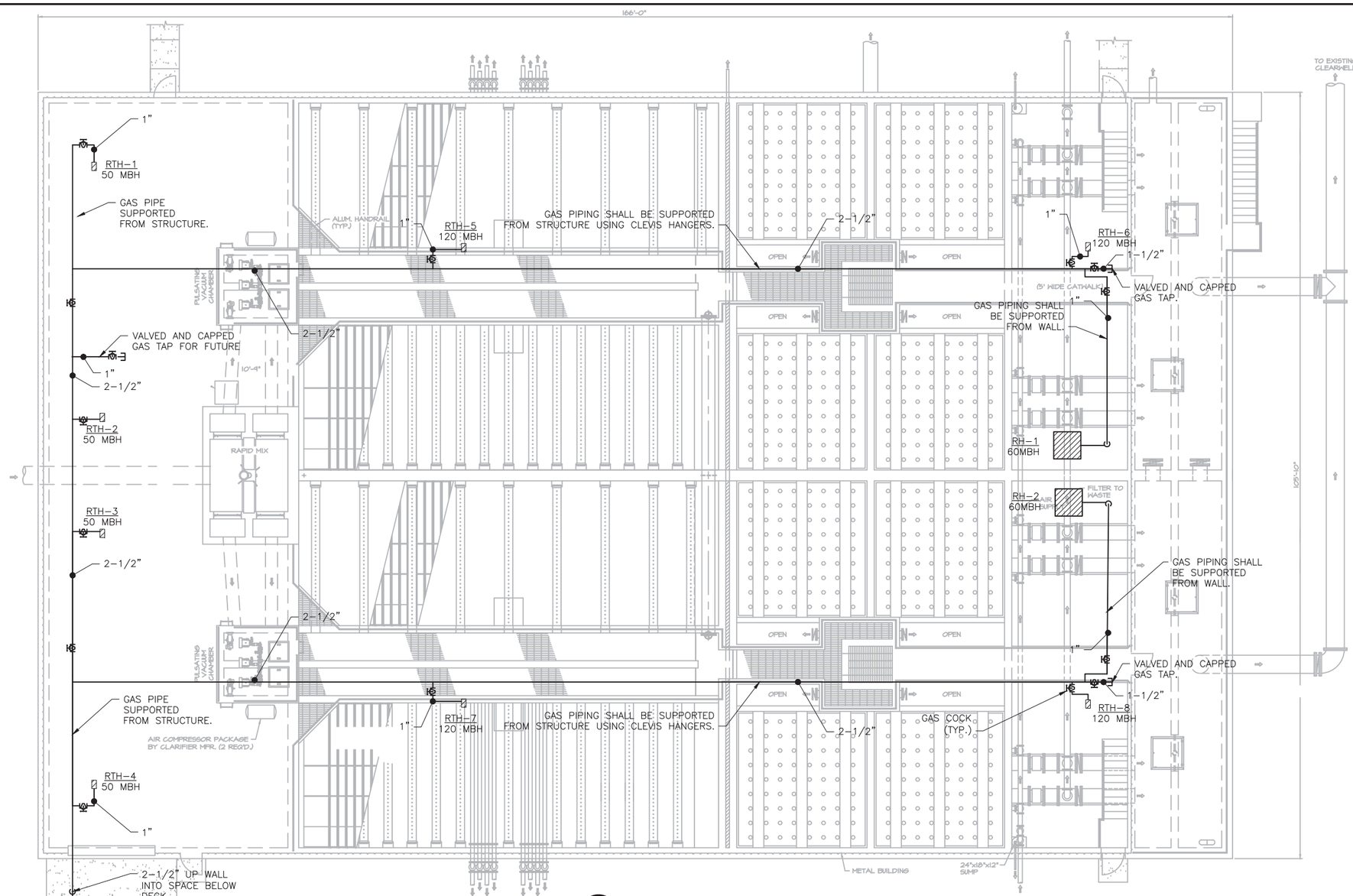
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD | MECHANICAL
Date: 2020 | Check: BB | PROCESS BUILDING HVAC PLAN

Proj. No. HUB-245
Sht. No. M2



1/M3 **PROCESS BUILDING GAS PLAN**
SCALE: 1/8" = 1'-0"

GENERAL NOTES:

1. PIPE SUPPORT SYSTEMS SHALL BE EQUAL TO COPPER B-LINE B3100, STANDARD CLEVIS HANGER, OR B2417, STRUT MOUNTED PIPE GUIDE. GAS PIPING SUPPORT FROM WALL SHALL BE SUPPORTED THROUGH USE OF UNISTRUT SYSTEM.
2. GAS PIPE TO BE PAINTED YELLOW AND LABELED AS "GAS".
3. REFER TO M1 DETAILS FOR TYPICAL GAS PIPING EQUIPMENT CONNECTION REQUIREMENTS.

REGISTERED PROFESSIONAL ENGINEER
BRIAN K. BROWN
20995
2-17-2020
OKLAHOMA

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BROWN ENGINEERS 501-448-0100

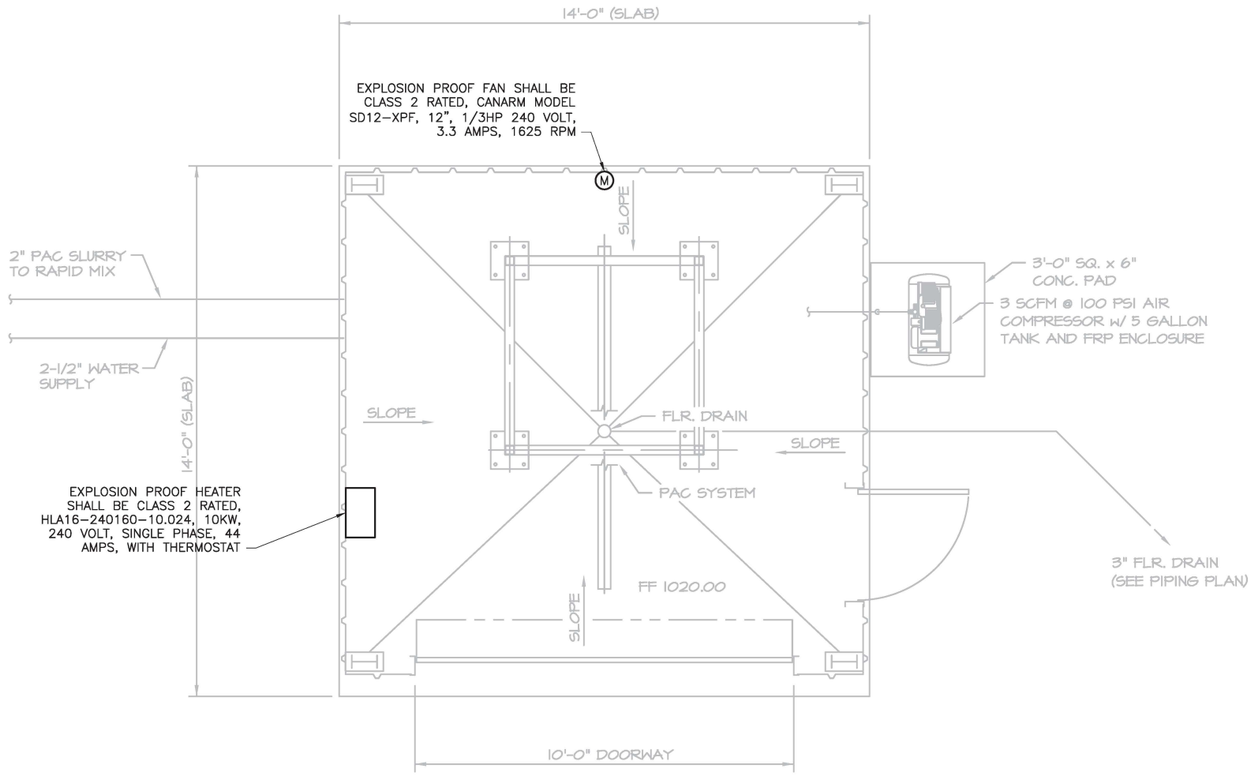
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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

MECHANICAL
PROCESS BUILDING GAS PLAN

Proj. No. HUB-245
Sht. No. M3



1 PAC ENCLOSURE HVAC PLAN
SCALE: 1/2" = 1'-0"

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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

MECHANICAL
PAC ENCLOSURE HVAC PLAN

Proj. No. HUB-245
Sht. No. M4

REGISTERED PROFESSIONAL ENGINEER
STEPHEN A. BROWN
20995
12-17-2020
OKLAHOMA

IDENTIFICATION, GENERAL

SYMBOL	DESCRIPTION
XXXX / ####	EQUIPMENT TAG
P-99	SHEET INTERFACE
	SEQUENCE NUMBER
	DRAWING TYPE
P-99 / FROM/TO XXXX	SHEET INTERFACE WITH PROCESS FLAG
	PROCESS

INSTRUMENT POWER SUPPLY

120 PSIG — A — POWER SUPPLY, TYPE AND LEVEL SHOWN, ABBREVIATIONS AS FOLLOWS:
- AS — AIR SUPPLY
  - IA — INSTRUMENT AIR
  - PA — PLANT AIR
- ES — ELECTRIC SUPPLY
- GS — GAS SUPPLY
- HS — HYDRAULIC SUPPLY
- NS — NITROGEN SUPPLY
- ST — STEAM SUPPLY
- WS — WATER SUPPLY

PIPING LINE TYPES

LINE	DESCRIPTION
———	PROCESS LINE — PRIMARY
———	PROCESS LINE — SECONDARY
— — — — —	PACKAGE BOUNDARY
— — — — —	AREA/BUILDING BOUNDARY
----------	SHOWN ELSEWHERE

PIPING, MISCELLANEOUS

SYMBOL	DESCRIPTION
	SLOPE ARROW ARROW DIRECTION DOWN
ST	LINE HEAT TRACED AND INSULATED ST = STEAM TRACED ET = ELECTRIC TRACED
	OUTSIDE GRADE LEVEL

MEANING OF FUNCTIONAL INSTRUMENT IDENTIFICATION LETTERS

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER FLAME		USER CHOICE	USER CHOICE	USER CHOICE
C	CONDUCTIVITY (ELECTRICAL)			CONTROL	
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL			
E	VOLTAGE (EMF)		PRIMARY ELEMENT		
F	FLOW RATE	RATIO(FRACTION)			
G	GAUGING(DIMENSIONAL)		GLASS		
H	HAND(MANUALLY INITIATED)				HIGH
I	CURRENT(ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME OR TIME-SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT(PILOT)		LOW
M	MOISTURE OR HUMIDITY	MOMENTARY			MIDDLE OR INTERMEDIATE
N	USER CHOICE		USER CHOICE	USER CHOICE	USER CHOICE
O	USER CHOICE		ORIFICE(RESTRICTION)		
P	PRESSURE OR VACUUM		POINT(TEST POINT)		
Q	QUANTITY OR EVENT	INTEGRATE OR TOTALIZE			
R	RADIATION		RECORD OR PRINT		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNC.	MULTIFUNCTION
V	VIBRATION OR MECHANICAL ANALYSIS			VALVE, DAMPER, OR LOUVER	
W	WEIGHT OR FORCE		WELL		
X	UNCLASSIFIED		UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE			RELAY OR COMPUTE	
Z	POSITION			DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

JI SURGE ARRESTOR, SEE SPECIFICATIONS

EQUIPMENT LINE TYPES

LINE	DESCRIPTION
———	PROPOSED OR NEW EQUIPMENT
----------	EXISTING EQUIPMENT
	CONNECT NEW CABLE TO EXISTING CABLE ON TERMINAL BLOCK

SIGNAL CONDITIONERS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
A/D	ANALOG TO DIGITAL	Σ	SUM
D/A	DIGITAL TO ANALOG	Δ	DIFFERENCE
I/P	CURRENT TO PRESSURE	√	SQUARE ROOT
P/I	PRESSURE TO CURRENT	f(x)	CHARACTERIZATION
F/I	FREQUENCY TO CURRENT	∫	INTEGRATION
I/I	CURRENT BOOST/ REPEATER		

ACCESSORIES AND APPURTENANCES

SYMBOL	DESCRIPTION
	UNION
	PLUG
	BLIND FLANGE
	HOSE CONNECTION
	SPRAY NOZZLE
	DRAIN
	FLEXIBLE CONNECTION, GENERAL
	FLEXIBLE HOSE
	QUICK CONNECTOR
1"	THREADED TAP
	FILTER
	'Y' TYPE STRAINER
	STRAINER
	EXPANSION JOINT

VALVES

SYMBOL	DESCRIPTION
	CHECK VALVE
	GATE VALVE
	BUTTERFLY VALVE
	BALL VALVE
	PLUG VALVE
	NEEDLE VALVE
	ROTARY VALVE
	KNIFE GATE VALVE
	THREE WAY VALVE
	FOUR WAY VALVE
	GLOBE VALVE
	CHARACTERIZED OR VEE-BALL VALVE
	STOP CHECK VALVE
	DIAPHRAM VALVE
	PRESSURE CONTROL VALVE (SELF CONTAINED)
	PRESSURE RELIEF VALVE
	VACUUM-RELIEF VALVE

VALVE OPERATORS

SYMBOL	DESCRIPTION
	HAND OPERATOR
	HAND OPERATOR (LONG)
	CHAIN OPERATOR
F	FLOAT OPERATOR
	AIR DIAPHRAGM OPERATOR
	POSITIONER
S	SOLENOID OPERATOR
	CYLINDER OPERATOR
	PRESSURE BALANCED DIAPHRAM OPERATOR
M	MOTOR OPERATOR
D	DIGITAL OPERATOR
E/P	ELECTRO-HYDRAULIC OPERATOR
	FAIL ARROWS INDICATE OPEN PORTS
	LIMIT SWITCH

PROCESS EQUIPMENT

SYMBOL	DESCRIPTION
M	ELECTRIC MOTOR
V	VARIABLE SPEED DRIVE
G	ELECTRIC GENERATOR
	HYDRAULIC MOTOR
	AIR MOTOR
	SHAFT
	COUPLING
	DYNAMIC PUMP
	DYNAMIC COMPRESSOR
	POSITIVE DISPLACEMENT PUMP
	POSITIVE DISPLACEMENT COMPRESSOR
	EDUCTOR/EJECTOR
	HEATER, GENERAL
	HEATER W/FAN (INDUCED DRAFT)
	HEATER W/FAN (FORCED DRAFT)
	HEAT EXCHANGER, GENERAL
	HYDRAULIC CYLINDER
	AIR CYLINDER

INSTRUMENT PRIMARY ELEMENTS

SYMBOL	DESCRIPTION
	THREADED TAP
	THERMOWELL
	SIGHT FLOW INDICATOR
	ROTAMETER
	FLOW ORIFICE
	FLOW ORIFICE IN QUICK CHANGE FITTING
	SINGLE PORT PITOT
	VENTURI TUBE
	AVERAGING PITOT STATION
	FLUME
	WEIR
	TURBINE ELEMENT
	POSITIVE DISPLACEMENT FLOWMETER
	VORTEX SENSOR
	TARGET ELEMENT
MASS	MASS FLOWMETER
	SONIC FLOWMETER
M	MAG. FLOWMETER
	pH ELECTRODE ASSEMBLY
SA	SURGE PROTECTIVE DEVICE

INSTRUMENTS OR FUNCTIONS

KEY [SYMBOL] BLOCK TAG	PRIMARY LOCATION; OPERATOR ACCESSIBLE	AUXILIARY LOCATION; OPERATOR ACCESSIBLE	LOCATION NOT NORMALLY OPERATOR ACCESSIBLE	FIELD MOUNTED
DISCRETE INSTRUMENTS	◯	◯	◯	◯
SHARED DISPLAY SHARED CONTROL	◯	◯	◯	◯
COMPUTER FUNCTION	⬡	⬡	⬡	⬡
PROGRAMMABLE LOGIC CONTROLLER	▭	▭	▭	▭

I/O INTERFACE

(2) — DIGITAL SYSTEM I/O INTERFACE. DIRECTION OF TRIANGLE DENOTES WHETHER INPUT OR OUTPUT

NOTE:
QUANTITY OF INPUTS AND OUTPUTS IS DEPENDENT UPON THE NUMBER OF DEVICES OR PIECES OF EQUIPMENT THAT ARE BEING CONTROLLED AND/OR MONITORED. NUMBER IN PARENTHESES DENOTES QUANTITY OF MULTIPLE TYPICAL SIGNALS REPRESENTED.

FILLING DENOTES SIGNAL TYPE. THE FILLED TRIANGLE DENOTES AN ANALOG SIGNAL.

INSTRUMENT LINE TYPES

LINE	DESCRIPTION
———	PROCESS CONNECTION
———	UNDEFINED SIGNAL
// // //	PNEUMATIC SIGNAL
- - - - - -	ELECTRIC SIGNAL
L L L	HYDRAULIC SIGNAL
X X	CAPILLARY OR FILLED TUBE
~	ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
~ ~ ~	ELECTROMAGNETIC OR SONIC SIGNAL (UNGUIDED)
o o o	INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)
• • •	MECHANICAL LINK
// //	PNEUMATIC BINARY (ON-OFF) SIGNAL
— — \ — — \ — — \ — —	ELECTRIC BINARY (ON-OFF) SIGNAL

AUXILIARY INSTRUMENTS OR FUNCTIONS

SYMBOL	DESCRIPTION
	TEST POINT, TERMINAL BLOCK WITH SLIDING LINK AND MINI-BANANA SOCKETS
P	PURGE OR FLUSHING DEVICE
I	INTERLOCK LOGIC WITH REFERENCE
	DIAPHRAM SEAL
R	RESET FOR LATCH TYPE OPERATOR
	PANEL MOUNTED PATCHBOARD POINT
	PILOT LIGHT FOR PROCESS SIGNALS
	INSTRUMENTS SHARING COMMON HOUSING
+ - PS	LOOP POWER SUPPLY
pH	POWER OF HYDROGEN
TURB.	TURBIDITY

REGISTERED PROFESSIONAL ENGINEER — SETH A. TOWN — 20995 — 12-17-2020 — OKLAHOMA

C:\USERS\CHARLES\SYNOLOGYDRIVE\HUB ENGINEERS (HUB)\HUB-245 SHAWNEE WTP\DWG\P01_LEGEND.DWG
10/8/2020 1:41 PM

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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: CD	PROCESS AND INSTRUMENTATION LEGEND AND ABBREVIATIONS	Proj. No. HUB-245
Date: 2020	Check: BB		Sht. No. P1

NEW TREATMENT BLDG PLC

AIR PRESSURE
RAW WATER FLOW
RAW WATER TURBIDITY
DRY POLYMER START/STOP
RUNNING
FLOW PACE
FLASH MIX START/STOP
FLASH MIX RUNNING
POST RAPID MIX PH
FLOW PACE (RAW FLOW)
UY
COMM
SETTLED TURB #1
SETTLED TURB #2
BACKWASH WATER HIGH
BACKWASH WATER LOW
MAKE UP VALVE OPEN
MAKE UP VALVE CLOSE
FULL OPENED
FULL CLOSED
FINISHED WATER LEVEL
FINISHED WATER HIGH
FINISHED WATER LOW
SUPPLIMENTAL FLOW
COMBINED TURB
1

M
480V
2HP
PIT 013
AIR COMPRESSOR

SUPERPULSATOR CONTROL PANEL
120V
ALLEN-BRADLEY PLC WITH ETHERNET INTERFACE

480V 5HP
VAC 011
VAC 012
VAC 013

FV 015
FV 016

120V
AIT 001
TURB
DRY POLYMER SYSTEM

AIT 002

120V
FIT 001
M
RAW WATER

RAW WATER METER VAULT

MIX 001
480V
20HP
RAPID MIX

SUPERPULSATOR

X2
SLUDGE BLOWOFF

FV 011
FV 012
FV 013
FV 014
FV 021
FV 022
FV 023
FV 024

BACKWASH

P3
TRAIN 2

120V
AIT 011
TURB
DRAIN

120V
AIT 012
TURB
DRAIN

FCV 001
480V

FIT 002
M
SUPPLEMENTAL BACKWASH

LS 912
FILTER 1-4
LS 911
LIT 911
LS 913
LS 914

AIT 013
TURB

FILTER 1-4

P2
TRAIN 2

CLEARWELL

KEYED NOTES:

1. CONTROL FCV-001 TO MAINTAIN BACKWASH LEVEL BETWEEN LS-911/921 AND LS-912/922.

REGISTERED PROFESSIONAL ENGINEER
SEAL
BROWN
20995
OKLAHOMA
12-16-20

C:\USERS\CHARLES\SYNOLOGYDRIVE\HUB ENGINEERS (HUB)\HUB-245 SHAWNEE WTP\DWG\P02_DIAGRAM I.DWG
12/16/2020 10:53 AM

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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

PROCESS AND INSTRUMENTATION DIAGRAM I

Proj. No. HUB-245
Sht. No. P2

NEW TREATMENT BLDG PLC

AIR PRESSURE

FLOW PACE (RAW FLOW)

UY
COMM

SETTLED TURB #1

SETTLED TURB #2

1

BACKWASH WATER HIGH

BACKWASH WATER LOW

FINISHED WATER LEVEL

FINISHED WATER HIGH

FINISHED WATER LOW

COMBINED TURB

M
480V
2HP
PIT
023
AIR COMPRESSOR

SUPERPULSATOR
CONTROL PANEL

120V

ALLEN–BRADLEY
PLC WITH
ETHERNET
INTERFACE

480V
5HP
M

VAC
021

VAC
022

VAC
023

FV
025

FV
026

120V
AIT
021
TURB
DRAIN

120V
AIT
022
TURB
DRAIN

LS
922

FILTER 5–8

LS
921

LIT
921

F
LS
923

F
LS
924

AIT
023
TURB

P2
RAPID
MIX

SUPERPULSATOR

FILTER 5–8

FV
031
FV
041

FV
032
FV
042

FV
033
FV
043

FV
034
FV
044

X2

SLUDGE
BLOWOFF

BACKWASH
P.S.

REGISTERED PROFESSIONAL ENGINEER
STEVEN K. DOWN
20995
OKLAHOMA

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Shawnee Municipal Authority

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown
Date: 2020
Detail: CD
Check: BB

PROCESS AND INSTRUMENTATION DIAGRAM II

Proj. No. HUB–245
Sht. No. P3

NEW TREATMENT BLDG PLC

NEW FILTER PLC

COMM

COMM

FILTER LEVEL

BLOWER START/STOP
BLOWER RUNNING
ALARM
BLOWER START/STOP
BLOWER RUNNING
ALARM
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
FILTER LEVEL HIGH
LOSS OF HEAD
FILTERED TURBIDITY
FILTER GALLERY FLOOD
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
FILTER FLOW
FILTER WASTE TURB.
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

YC
YC

480V 40HP
M
BLOW 001
AIR SCOUR

480V 40HP
M
BLOW 002
AIR SCOUR

M
VLV 101

FILTER #2
FILTER #3
FILTER #4
FILTER #5
FILTER #6
FILTER #7
FILTER #8

M
VLV 102

SETTLED WATER

INFLUENT

LIT 100

F
LS 100

normal

anthracite

sand

filter block

FILTER #1

PDIT 101

BACKWASH WASTE

M
VLV 104

BACKWASH WASTE

NORMAL/BACKWASH

EFFLUENT

FIT 101
M
LS 101
F
FILTER GALLERY FLOOD

M
VLV 105

AIT 101
TURB
DRAIN

M
VLV 103

AIT 101a
TURB
DRAIN
(TYP. OF 1)

P5
CLEARWELL/ BACKWASH

FILTER TO WASTE

STEVEN R. BROWN
20995
12-11-2020
REGISTERED PROFESSIONAL ENGINEER
OKLAHOMA

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10/8/2020 2:56 PM

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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

PROCESS AND INSTRUMENTATION DIAGRAM III

Proj. No. HUB-245
Sht. No. P4

NEW TREATMENT BLDG PLC

NEW FILTER PLC

COMM

COMM

FILTER LEVEL

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

FILTER LEVEL HIGH

LOSS OF HEAD

FILTERED TURBIDITY

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

FILTER FLOW

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

P4
AIR

VLV 201

VLV 202

SETTLED WATER

INFLUENT

LIT 200

LS 200

normal

anthracite

sand

filter block

FILTER #2

PDIT 201

BACKWASH WASTE

VLV 204

BACKWASH WASTE

NORMAL/BACKWASH

FIT 201

EFFLUENT

AIT 201

TURB

DRAIN

VLV 205

VLV 203

P6
CLEARWELL/
BACKWASH

FILTER TO WASTE

STATE OF OKLAHOMA
REGISTERED PROFESSIONAL ENGINEER
STEVEN A. TOWN
20995
12-17-2020
OKLAHOMA

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12/7/2020 7:43 AM

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Shawnee

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown
Date: 2020
Detail: CD
Check: BB

PROCESS AND INSTRUMENTATION DIAGRAM IV

Proj. No. HUB-245
Sht. No. P5

NEW TREATMENT BLDG PLC

NEW FILTER PLC

COMM

COMM

FILTER LEVEL

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

FILTER LEVEL HIGH

LOSS OF HEAD

FILTERED TURBIDITY

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

FILTER FLOW

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

P4
AIR

VLV 301

VLV 302

SETTLED WATER

INFLUENT

LIT 300

LS 300

normal

anthracite

sand

filter block

PDIT 301

BACKWASH WASTE

VLV 304

BACKWASH WASTE

NORMAL/BACKWASH

FIT 301

EFFLUENT

AIT 301

TURB

DRAIN

VLV 305

VLV 303

P7
CLEARWELL/ BACKWASH

FILTER TO WASTE

FILTER #3

STATE OF OKLAHOMA REGISTERED PROFESSIONAL ENGINEER STEVEN A. TOWN 20995 12-17-2020

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11/10/2020 8:29 AM

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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown
Date: 2020
Detail: CD
Check: BB

PROCESS AND INSTRUMENTATION DIAGRAM V

Proj. No. HUB-245
Sht. No. P6

NEW TREATMENT BLDG PLC

NEW FILTER PLC

COMM

COMM

FILTER LEVEL

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

FILTER LEVEL HIGH

LOSS OF HEAD

FILTERED TURBIDITY

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

FILTER FLOW

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

P4
AIR

VLV 401

VLV 402

SETTLED WATER

INFLUENT

LIT 400

LS 400

normal

anthracite

sand

filter block

PDIT 401

BACKWASH WASTE

VLV 404

BACKWASH WASTE

NORMAL/BACKWASH

FIT 401

EFFLUENT

AIT 401

TURB

DRAIN

VLV 105

VLV 403

P8
CLEARWELL/ BACKWASH

FILTER TO WASTE

FILTER #4

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C:\USERS\CHARLES\SYNOLOGYDRIVE\HUB ENGINEERS (HUB)\HUB-245 SHAWNEE WTP\DWG\P07_DIAGRAM V1.DWG
11/10/2020 8:30 AM

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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

PROCESS AND INSTRUMENTATION DIAGRAM VI

Proj. No. HUB-245
Sht. No. P7

NEW TREATMENT BLDG PLC

NEW FILTER PLC

COMM

COMM

FILTER LEVEL

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

FILTER LEVEL HIGH

LOSS OF HEAD

FILTERED TURBIDITY

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

FILTER FLOW

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

P4
AIR

VLV 501

VLV 502

SETTLED WATER

INFLUENT

LIT 500

LS 500

normal

anthracite

sand

filter block

FILTER #5

PDIT 501

BACKWASH WASTE

VLV 504

BACKWASH WASTE

NORMAL/BACKWASH

FIT 501

EFFLUENT

AIT 501

TURB

DRAIN

VLV 505

VLV 503

P9
CLEARWELL/ BACKWASH

FILTER TO WASTE

REGISTERED PROFESSIONAL ENGINEER
STATE OF OKLAHOMA
STEVEN TOWN
20995
12-17-2020

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11/10/2020 8:32 AM

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WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown
Date: 2020
Detail: CD
Check: BB

PROCESS AND INSTRUMENTATION DIAGRAM VII

Proj. No. HUB-245
Sht. No. P8

NEW TREATMENT BLDG PLC

NEW FILTER PLC

COMM

COMM

FILTER LEVEL

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

FILTER LEVEL HIGH

LOSS OF HEAD

FILTERED TURBIDITY

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

FILTER FLOW

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

P4
AIR

VLV 601

VLV 602

SETTLED WATER

LIT 600

LS 600

INFLUENT

normal

anthracite

sand

filter block

FILTER #6

PDIT 601

BACKWASH WASTE

VLV 604

BACKWASH WASTE

NORMAL/BACKWASH

FIT 601

AIT 601

TURB

DRAIN

EFFLUENT

VLV 605

VLV 603

P10
CLEARWELL/
BACKWASH

FILTER
TO WASTE

STATE OF OKLAHOMA
REGISTERED PROFESSIONAL ENGINEER
STEVEN TOWN
20995
12-17-2020

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11/10/2020 8:32 AM

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818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

PROCESS AND INSTRUMENTATION DIAGRAM VIII

Proj. No. HUB-245
Sht. No. P9

NEW TREATMENT BLDG PLC

NEW FILTER PLC

COMM

COMM

FILTER LEVEL

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

FILTER LEVEL HIGH

LOSS OF HEAD

FILTERED TURBIDITY

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

FILTER FLOW

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

P4
AIR

VLV 701

VLV 702

SETTLED WATER

INFLUENT

LIT 700

LS 700

normal

anthracite

sand

filter block

PDIT 701

BACKWASH WASTE

VLV 704

BACKWASH WASTE

NORMAL/BACKWASH

FIT 701

EFFLUENT

AIT 701

TURB

DRAIN

VLV 705

VLV 703

P11
CLEARWELL/
BACKWASH

FILTER
TO WASTE

FILTER #7

STATE OF OKLAHOMA
REGISTERED PROFESSIONAL ENGINEER
STEVEN T. TOWN
20995
12-17-2020
OKLAHOMA

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BROWN ENGINEERS 501-448-0100

Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

PROCESS AND INSTRUMENTATION DIAGRAM IX

Proj. No. HUB-245
Sht. No. P10

NEW TREATMENT BLDG PLC

NEW FILTER PLC

COMM

COMM

FILTER LEVEL

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

FILTER LEVEL HIGH

LOSS OF HEAD

FILTERED TURBIDITY

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE
VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

FILTER FLOW

VALVE OPEN
VALVE CLOSE
FULL OPEN
FULL CLOSE

P4
AIR

VLV 801

VLV 802

SETTLED WATER

INFLUENT

LIT 800

LS 800

normal

anthracite

sand

filter block

PDIT 801

BACKWASH WASTE

VLV 804

BACKWASH WASTE

NORMAL/BACKWASH

FIT 801

EFFLUENT

AIT 801

TURB

DRAIN

VLV 805

VLV 803

P12
CLEARWELL/
BACKWASH

FILTER
TO WASTE

FILTER #8

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BROWN ENGINEERS 501-448-0100

Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

PROCESS AND INSTRUMENTATION DIAGRAM X

Proj. No. HUB-245
Sht. No. P11

REGISTERED PROFESSIONAL ENGINEER
STATE OF OKLAHOMA
STEVEN TOWN
20995
12-17-2020

NEW TREATMENT BLDG PLC

GENERATOR RUNNING
UTILITY AVAILABILITY
GENERATOR AVAILABILITY
ATS POSITION
GENERATOR ALARM
GENERATOR START/STOP

GENERATOR AND ATS

FEEDER MALFUCNTION
VORTEX WATER LEVEL HIGH
MOTOR WATER PRESSURE LOW
WASH WATER PRESSURE LOW
FEEDER HOPPER PAC LEVEL LOW
START
STOP
OFF/AUTO
PACED/NONPACED SELECTOR
PAC FEED RATE

POWER ACTIVATED CARBON



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BROWN ENGINEERS 501-448-0100

Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown | Detail: CD
Date: 2020 | Check: BB

PROCESS AND INSTRUMENTATION DIAGRAM XI

Proj. No. HUB-245
Sht. No. P12

Specifications

Water Treatment Plant Expansion
DWSRF No. P40-1020504-03

for the

Shawnee Municipal Authority
Shawnee, Oklahoma

Shawnee
MUNICIPAL AUTHORITY

Prepared by:

Holloway, Updike and Bellen
Consulting Engineers
Muskogee · Broken Arrow

REGISTERED PROFESSIONAL ENGINEER
JAY R. UPDIKE
11252
OKLAHOMA

2020
19SHAWWTP

CA 219
Expires 6/30/21

Jay Updike, P.E.
OK 11252

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Oklahoma Drinking Water State Revolving Fund
Advertisement for Bids
Notice to Bidders

Notice is hereby given that Shawnee Municipal Authority, hereinafter called the "Owner" will receive sealed bids at the City Clerk's office at the City of Shawnee located at 16 West 9th Street, Shawnee Oklahoma 74801, until 4:00 p.m. on the 3rd day of May, 2021. The bids will be opened by the staff after authorization of the City Commissioners/Shawnee Municipal Authority Trustees at their 6:00 p.m. meeting on May 3, 2021. The bids will be presented to the City Commissioners/Shawnee Municipal Authority Trustees at said meeting for consideration.

This project is in cooperation with the Oklahoma Department of Environmental Quality.

Water System Improvements
DWSRF Project No. P40-1020504-03

The project includes the following work:

Water Treatment Plant Expansion including process building with clarifiers and filters, demolition, sitework, site piping, electrical and instrumentation.

All bids received at said time shall be publicly opened and read aloud. All work shall be performed and all construction and material used and furnished shall be in accordance with the Plans and Specifications prepared by Holloway, Updike and Bellen, Inc., and on file at the Public Works Building located at 111 South Kickapoo, Shawnee, Oklahoma 74801.

The Notice to Bidders, Form of Bid, Form of Contract, Plans and Specifications, Forms of Bid Bond, Performance and Statutory Payment Bond, and other Contract Documents may be examined at the following:

1. Owner: Shawnee Municipal Authority
111 South Kickapoo
Shawnee, OK 74801

2. Engineer: Holloway, Updike and Bellen, Inc.
818 Eastside Boulevard
Muskogee, OK 74403

Plans and Specifications can be obtained online at http://www.hubengineers.com or at the Office of Holloway, Updike & Bellen Inc., 818 East Side Blvd, P.O. Box 1543, Muskogee, Oklahoma, 74402; (918) 682-7811. **Payment Options: Online Download $50.00 or ½ size Paper Set $100.00, *none*** of which are refundable. All checks shall be made payable to Holloway, Updike & Bellen. BIDDER must purchase plans and specifications from Holloway, Updike and Bellen, Inc. either directly for paper plans and specifications or through our website for download. BIDDER must be on plan holders list at Holloway, Updike and Bellen, Inc. in order to submit a bid.

Each bidder shall accompany his original bid, with a certified or Cashier's Check on a solvent bank located in Oklahoma or a Bidder's Bond, in the amount of five (5) percent of the amount bid, as a guarantee of his ability to perform the contract bid upon, and that he will enter into a written contract with the Owner to perform said work and/or furnish said materials in accordance with said plans and specifications and furnish the required bonds within ten (10) days after the acceptance of his bid.

The deposit will be retained by the Owner as, and for, liquidated damages in case the successful bidder fails to enter in said contract and furnish the required bonds provided for in the specifications within the time required. Deposit of the unsuccessful bidders will be returned upon the execution of the Contract and required bonds.

Each bidder shall accompany his bid with a DW- 412 Noncollusion Affidavit and a DW-413 Business Relationships Affidavit in writing displaying that the Bidder has not directly or indirectly entered into an agreement, express of implied, with any other bidder or the price or amount of such bid or any bids, the limiting of the bids or bidders, the paying to anyone any money for promotion expenses, the parceling or farming out to any bidder or bidders or other persons of any part of the contract or any part of the subject matter of the bid or of the profits thereof. Performance, Maintenance and Statutory Payment Bonds in the amount of 100% of the contract price with a Corporate Surety licensed in Oklahoma and approved by the Owner and Engineer, will be required for the faithful performance of the contract. A Maintenance Bond guaranteeing the repair of all damage due to improper materials or workmanship for a period of one (1) year, after the acceptance of the work by the Owner, will be required.

This project is to be financed by a loan from the Oklahoma Water Resources Board through the Department of Environmental Quality Drinking Water State Revolving Fund (DWSRF) and shall be referred to as DWSRF Project No. P40-1020504-03.

A. "Equal Opportunity in Employment: All qualified applicants will receive considerations for employment without regard to race, color, religion, sex, national origin, age or physical handicap. Bidders on this work will be required to comply with the President's Executive Order No. 11246, as amended. The requirements for bidders and contractors under this order are explained in the specifications."

B. "Each bidder must fully comply with the requirement, terms and conditions of the Department of Environmental Quality Small, Minority, Women's Businesses Requirements including affirmative steps to contract with small, minority and women's businesses during the performance of this contract. The bidder commits itself to the affirmative steps to contract with small, minority and women's businesses contained herein and all other requirements, terms and conditions of these bid conditions by submitting a properly signed bid. Requirements are contained in DEQ Guidance and Procedures, DW-700."

C. "All bidders must comply with the Anti-Kickback Act and the Contract Work Hours Standards Act."

D. "Davis Bacon Act wage rules shall apply. All laborers and mechanics employed by contractors and sub-contractors on projects funded directly by or assisted in whole or in part by and through the Federal Government shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of Chapter 31 of Title 40, United States Code. The Department of Labor provides all pertinent information related to compliance with labor standards, including prevailing wage rates and instructions for reporting. For more information please refer to http://www.wdol.gov/ and http://www.beta.SAM.gov."

E. American Iron and Steel provisions also apply to projects funded directly by or assisted in whole or in part by and through the Federal Government pursuant to the "Consolidated Appropriations Act, 2014". Sec. 436(a)(1) of the act states that "None of the funds made available by a State Water Pollution Control Revolving Fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C 1381 et seq.) or made available by a Drinking Water Treatment Revolving Loan Fund as authorized by Section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States."

A mandatory pre-bid conference will be held on this project at 2:00 p.m. on April 27, 2021 in the Commission Chambers at City Hall located at 16 West 9th Street, Shawnee, Oklahoma 74801.

The contract is to be awarded to the lowest responsive, responsible bidder. The Owner reserves the right to waive any informalities in the bidding and the right to reject any and all bids in accordance with the Oklahoma Competitive Bidding Act. Conditional bids shall not be accepted.

Brad Schmidt
Name

Public Works Director
Title

March 31, 2021

INFORMATION FOR BIDDERS

1. DEFINED TERMS.

Terms used in this Information for Bidders which are defined in the General Conditions of the Construction Contract have the meanings assigned to them in the General Conditions. The term "Successful Bidder" means the lowest, qualified, responsible Bidder to whom Owner (on the basis of Owner's evaluation as hereinafter provided) makes an award.

2. COPIES OF BIDDING DOCUMENTS.

2.1 Complete sets of the Bidding Documents in the number and for the payment stated in the Advertisement may be obtained from Engineer.

2.2 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assume any responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

2.3 Owner and Engineer in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant for any other use.

3. EXAMINATION OF CONTRACT DOCUMENTS AND SITE.

3.1 Before submitting a Bid, each Bidder shall (a) examine the Contract Documents thoroughly, (b) visit the site to familiarize himself with local conditions that may in any manner affect cost, progress or performance of the Work, (c) familiarize himself with federal, state and local laws, ordinances, rules and regulations that may in any manner affect cost, progress or performance of the Work; and (d) study and carefully correlate Bidder's observations with the Contract Documents.

3.2 Reference is made to the Contract documents for the identification of those reports of investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting cost, progress or performance of the Work which have been relied upon by Engineer in preparing the Drawing and Specifications. Owner will make copies of such reports available to any Bidder requesting them. These reports are not guaranteed as to accuracy or completeness, nor are they part of the Contract Documents. Before submitting his Bid each Bidder will, at his own expense, make such additional investigation and tests as the Bidder may deem necessary to determine his Bid for performance of the Work in accordance with the time, price and other terms and conditions of the Contract Documents.

3.3 On request, Owner will provide each Bidder access to the site to conduct such investigations and tests as each Bidder deems necessary for submission of his Bid.

3.4 The lands upon which the Work is to be performed, rights-of-way for access thereto and other lands designated for use by Contractor in performing the Work are identified in the General Requirements or Drawings.

3.5 The submission of a Bid will constitute an incontrovertible representation of the Bidder that he has complied with every requirement of this Article 4 and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the Work.

3.6 Information obtained from an officer, agent, or employees of the Owner, Engineer, or any other person shall not affect the risks or obligations assumed by the Contractor or relieve him from fulfilling any of the conditions of the Contract.

4. INTERPRETATIONS.

All questions about the meaning or intent of the Contract documents shall be submitted to Engineer in writing no later than four days prior to the time set for receipt of bids. Replies will be issued by Addenda mailed or delivered to all parties recorded by Engineer as having received the Bidding Documents. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

5. BID SECURITY.

5.1 Bid Security shall be made payable to Owner, in an amount of five percent of the Bidder's maximum Bid price and in the form of a certified check or a Bid Bond issued by a Surety meeting the requirements of the General Conditions.

5.2 The Bid Security of the Successful Bidder will be retained until such Bidder has executed the Agreement and furnished the required Contract Security, whereupon it will be returned; if the Successful Bidder fails to execute and deliver the Agreement and furnish the required Contract Security with 15 days of the Notice of Award, Owner may annul the Notice of Award and the Bid Security of that Bidder will be forfeited. Attorneys-in-fact who sign Bid Bonds shall file with each bond a certified and effective dated copy of their power of attorney. The Bid Security of any Bidder whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the seventh day after the effective date of the Agreement by Owner to Contractor and the required Contract Security is furnished or the ninety-first day after the Bid opening.

6. CONTRACT TIME.

The number of calendar days with which, or the date by which, the Work is to be completed (the Contract Time) is set forth in the Bid Form and will be included in the Agreement.

7. LIQUIDATED DAMAGES.

Liquidated damages are two thousand ($2,000.00) per day on each contract as set out in the Agreement.

8. SUBSTITUTE MATERIAL AND EQUIPMENT.

The Contract, if awarded, will be on the basis of material and equipment described in the Drawings or specified in the Specifications without consideration of possible substitute or "or equal" items. Application for acceptance of substitute items will not be considered by Engineer until after the "Effective Date of the Agreement."

9. SUBCONTRACTORS AND MANUFACTURERS.

9.1 The General Conditions require the identity of certain Subcontractors and other persons and organizations to be submitted to Owner. The apparent successful bidder shall submit to Owner a list of all Subcontractors and other persons and organizations (including those who are to furnish the principal items of material and equipment) proposed for the Work. Such list shall be accompanied by evidence stating qualification for each such Subcontractor, person and organization. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, other person or organization, either may request the apparent Successful Bidder to submit an acceptable substitute. Any Subcontractor, other person or organization so listed and to whom Owner or Engineer does not make written objection prior to the giving of the Notice of Award will be considered acceptable to Owner and Engineer.

10. BID FORM.

10.1 The Bid Form shall be executed when submitted. Only one copy of the Bid Form is required. All bids shall be made only on the Bid Form furnished in the Specifications. All blank spaces for bid prices on each Bid Form furnished with the Specifications. All blank spaces for bid prices on the Bid Schedule shall be filled in or it will be presumed that any such omitted entry is intentional and the corresponding item is bid at no cost.

10.2 Bid Forms shall be completed in ink.

10.3 Bids by corporations shall be executed in the corporate name by the president or a vice president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature. Bids by partnerships shall be executed in the partnership name and signed by a partner, whose title must appear under the signature and the official address of the partnership must be shown below the signature.

10.4 All names shall be typed or printed below the signature.

10.5 The Bid shall contain an acknowledgment of receipt of all Addenda (the numbers of which shall be filled in on the Bid Form).

10.6 The address to which communications regarding the Bid are to be directed shall be shown.

10.7 Tied or conditional bids will not be accepted.

11. SUBMISSION OF BIDS.

11.1 Bids shall be accepted by the Shawnee Municipal Authority, hereinafter called the "Owner" at the City Clerk's office at the City of Shawnee located at 16 West 9th Street, Shawnee Oklahoma 74801, until 4:00 p.m. on the 3rd day of May, 2021 and shall be included in an opaque sealed envelope, addressed to the Owner and marked on the outside as Bid for "Water System Improvements – Water Treatment Plant Expansion." Bids shall also be marked with the name and address of the Bidder and accompanied by the Bid Security and other required documents. The envelope shall also bear the name of the Bidder, his address and his license number, if such license is required by applicable law. If the Bid is sent through the mail or other delivery system the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face thereof. Any bid received after the time and specified will not be considered.

11.2 The following shall be submitted with and included as a part of the Bid on the forms provided or as otherwise described herein:

Bid Form
Bid Bond
Labor Standards Certification for Bidding (DW-074A)
Forms DW211, 212 and 212a
Business Relationships Affidavit
Noncollusion Affidavit
Certification Regarding Lobbying (DW414)
DW-501 Bidders American Iron and Steel Certification

12. OPENING OF BIDS.

12.1 The bids will be opened by the staff after authorization of the City Commissioners/Shawnee Municipal Authority Trustees at their 6:00 p.m. meeting on May 3, 2021. The bids will be presented to the City Commissioners/Shawnee Municipal Authority Trustees at said meeting for consideration.

13. BIDS TO REMAIN OPEN.

No bid may be withdrawn for Ninety (90) days from the Bid opening, but Owner may, in his sole discretion, release any Bid and return the Bid Security prior to that date.

14. AWARD OF CONTRACT.

14.1 Owner reserves the right to reject any and all Bids, to waive any and all informalities and to negotiate contract terms with the Successful Bidder, and the right to disregard all nonconforming, non-responsive, conditional or unbalance Bids.

14.2 In evaluating Bids, Owner will consider the qualifications of the Bidders, whether or not the Bids comply with the prescribed requirements and unit prices, if requested, in the Bid Forms.

14.3 Owner may conduct such investigations as he deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of the Bidders, proposed Subcontractors and other persons and organizations to do the Work in accordance with the Contract Documents to Owner's satisfaction within the prescribed time.

14.4 Owner reserves the right to reject the Bid of any Bidder who does not pass any such evaluation to Owner's satisfaction; such rejection shall not give rise to a cause of action against the Owner or Engineer, or impose a requirement upon the Owner or Engineer to divulge the information upon which such rejection is based.

14.5 If the contract is to be awarded, it will be awarded to the lowest Bidder whose evaluation by Owner indicates to Owner that the award will be in the best interest of the Owner.

14.6 If the contract is to be awarded, Owner will give the Successful Bidder a Notice of Award within Ninety (90) days after the day of the Bid opening unless extended by mutual agreement between Owner and the Successful Bidder.

- Contractor shall submit executed Agreement and bonds within 10 days after its receipt from the Owner.
- Owner shall return executed copy of the Agreement within 15 days after its receipt from the contractor.
- Owner shall issue a notice to Proceed within 10 days after the Owner executes the Agreement.
- Contractor shall begin construction within 10 days of the date shown on the Notice to Proceed.

15. PERFORMANCE AND OTHER BONDS.

The General Conditions set forth Owner's requirements as to performance and other bonds. When the Successful Bidder delivers the executed Agreement to Owner it shall be accompanied by the required Contract Security. Attorneys-in-fact who sign a Payment Bond, a Performance Bond and a one-year Maintenance Bond in the amount of 100% of the contract price shall file with each bond a certified and effective dated copy of their power of attorney.

16. SIGNING OF AGREEMENT.

When Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by at least five (5) unsigned counterparts of the Agreement and all other Contract Documents. Within fifteen days thereafter Contractor shall sign and deliver at least five (5) counterparts of the Agreement to Owner with all other Contract Documents attached. Within ten days thereafter Owner will deliver all fully signed counterparts to Contractor.

17. CONFLICTS

In the event of a conflict between the specifications and the DWSRF Supplemental Conditions (DW-185 "Pink Sheets") the latter shall govern.

In the event of a conflict between the plans and specifications, the specifications shall govern.

18. WAGE RATES

This project is subject to the Davis Bacon Act and prevailing wage rates.

19. PLANS AND SPECIFICATIONS

BIDDER must purchase plans and specifications from Holloway, Updike and Bellen, Inc. either directly for paper plans and specifications or through Quest CDN for download. BIDDER must be on plan holders list at Holloway, Updike and Bellen, Inc. in order to submit a bid.

20. DESCRIPTION OF WORK

Water Treatment Plant Expansion including process building with clarifiers and filters, sitework, site piping, demolition, electrical and instrumentation.

21. MAINTENANCE OF WATER SUPPLIES

The contractor shall conduct the work so as to minimize water service interruption to existing water customers. Tie-ins and/or shut downs shall be coordinated with the water system owner 2 days in advance of the work.

22. SYSTEM FOR AWARD MANAGEMENT (SAM)

"System for Award Management (SAM) registration is required for all DWSRF program applicants and Awardees (Entities, prime contractors, subcontractors, vendors) in order to be awarded contracts by the DWSRF program. SAM replaces Central Contractor Registration/Federal Agency Registration, Online Representations and Certifications Application, and Excluded Parties List System. Applicants and awardees are required to complete a one-time free registration to provide basic information relevant to procurement and financial transactions. New Applicants and awardees must go to Sam.gov to complete the registration process.

Note: In order to register in SAM, a Data Universal Number System (DUNS) number will be required. DUNS number is a unique, non-indicative 9-digit identifier issued and maintained by Dun & Bradstreet (D&B) that verifies the existence of a business entity globally. D&B assigns DUNS numbers for each physical location of a business. All entities doing business with the U.S. Government can receive a DUNS number FREE of charge and, under normal circumstances, within 1-2 business days when using the D&B web form process at http://fedgov.dnb.com/webform"

23. AMERICAN IRON AND STEEL

"American Iron and Steel provisions also apply to projects funded directly by or assisted in whole or in part by and through the Federal Government pursuant to the "Consolidated Appropriations Act, 2014". Sec. 436(a)(1) of the act states that "None of the funds made available by a State Water Pollution Control Revolving Fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C 1381 et seq.) or made available by a Drinking Water Treatment Revolving Loan Fund as authorized by Section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States."

Instructions to Bidders

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ARTICLE 1 - DEFINED TERMS

1.01 Terms used in these Instructions to Bidders will have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. Issuing Office--The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents in the number and for the fee as stated in the Advertisement for Bids may be obtained from the Issuing Office. The fee will not be refunded.

2.02 Complete sets of Bidding Documents must be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 Owner and Engineer in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, within five days of Owner's request, Bidder shall submit written evidence such as financial data, previous experience, present commitments, and such other data as may be requested by the Owner.

ARTICLE 4 - EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

4.01 Subsurface and Physical Conditions

A. The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Bidding Documents.

2. Those drawings of physical conditions in or relating to existing surface and subsurface structures at or contiguous to the Site (except Underground Facilities) that Engineer has used in preparing the Bidding Documents.

B. Copies of reports and drawings referenced in paragraph 4.01.A will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.02 Underground Facilities

A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

4.03 Hazardous Environmental Condition

A. The Supplementary Conditions identify those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that ENGINEER has used in preparing the Bidding Documents.

B. Copies of reports and drawings referenced in paragraph 4.03.A will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions appear in paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work appear in paragraph 5.06 of the General Conditions.

4.05 On request, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to locating of excavation and utility.

4.06 Additional Owner Provided Information:

A. Reference is made to Article 7 of the Supplementary Conditions for the identification of the general nature of other work that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of Contract Documents (other than portions thereof related to price) for such other work.

4.07 It is the responsibility of each Bidder before submitting a Bid to:

A. Examine and carefully study the Bidding Documents, the other related data identified in the Bidding Documents, and any Addenda;

B. Visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. Become familiar with and satisfy Bidder as to all Federal, State, and local Laws and Regulations that may affect cost, progress, or performance of the Work;

D. Carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing

surface or subsurface structures at or contiguous to the Site (except Underground Facilities), and (2) reports and drawings of Hazardous Environmental Conditions at the Site.

E. Obtain and carefully study (or accept consequences for not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto;

F. Agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents;

G. Become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. Correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;

I. Promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder; and

J. Determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.

4.08 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 - PRE-BID CONFERENCE

5.01 A mandatory pre-bid conference will be held if noted in the Advertisement for Bids. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 6 - SITE AND OTHER AREAS

6.01 The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Engineer as having received the Bidding Documents. Questions received less than five days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer.

ARTICLE 8 - BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5 % of Bidder's maximum Bid price and in the form of a certified check or a Bid bond issued by a surety meeting the requirements of the General Conditions.

8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Agreement or 91 days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.

8.03 Bid security of other Bidders whom OWNER believes do not have a reasonable chance of receiving the award will be returned within seven days after the Bid opening.

ARTICLE 9 - CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be substantially completed and ready for final payment are set forth in the Agreement.

ARTICLE 10 -LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages are set forth in the Agreement.

ARTICLE 11 - SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, or "or-equal" materials and equipment as defined in paragraph 7.04 of the General Conditions, or those substitute materials and equipment approved by the Engineer and identified by Addendum. The materials and equipment described in the Bidding Documents establish a standard of required type, function and quality to be met by any proposed substitute or "or-equal" item. Request for Engineer's clarification of materials and equipment considered "or-equal" prior to the Effective Date of the Agreement must be received by the Engineer at least 5 days prior to the date for receipt of Bids. No item of material or equipment will be considered by Engineer as a substitute unless written request for approval has been submitted by Bidder and has been received by Engineer at least 15 days prior to the date for receipt of Bids. Each request shall conform to the requirements of paragraph 7.05 of the General Conditions. The burden of proof of the merit of the proposed item is upon the Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any proposed substitute item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner.

ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, without an increase in the Bid.

12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest responsible Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner and Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in the General Conditions.

12.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

ARTICLE 13 - PREPARATION OF BID

13.01 The Bid form is included with the Bidding Documents.

13.02 All blanks on the Bid form shall be completed in ink and the Bid signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid From. A Bid price shall be indicated for each Bid item, listed therein, or the words "No Bid," "No Change," or "Not Applicable" entered.

13.03 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be provided on the Bid Form.

13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be provided on the Bid Form.

13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown.

13.06 A Bid by an individual shall show the Bidder's name and business address.

13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid form. The official address of the joint venture must be provided on the Bid Form.

13.08 All names shall be printed in ink below the signatures.

13.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers and dates of which shall be filled in on the Bid form.

13.10 The postal and email addresses and telephone number for communication regarding the Bid shall be shown.

13.11 The Bid shall contain evidence of Bidder's authority and qualification to do business the state or locality where the Project is located or Bidder shall covenant in writing to obtain such qualification prior to award of the Contract and attach such covenant to the Bid. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 14 - BASIS OF BID; COMPARSION OF BIDS

14.01 Lump Sum

A. Bidders shall submit a Bid on lump sum basis as set forth in the Bid Form.

14.02 Allowances

A. For cash allowances the Bid price shall include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

ARTICLE 15 - SUBMITTAL OF BID

15.01 Submit copy of bid documents with bid bond and other items required by the Bid Form.

15.02 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Advertisement for Bids and shall be enclosed in an opaque sealed envelope plainly marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation "BID ENCLOSED." When using the mail or other delivery system, the Bidder is totally responsible for the mail or other delivery system delivering the Bid at the place and prior to the time indicated in the Advertisement for Bid. A mailed Bid shall be addressed to Owner at address in the Bid Form.

15.03 BIDDER must be on plan holders list at Holloway, Updike and Bellen, Inc. in order to submit a bid.

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.

16.02 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid or

negotiated, that Bidder will be disqualified from further bidding on the Work. This provision to withdraw a Bid without forfeiting the Bid security does not apply to Bidder's errors in judgment in the Bid.

ARTICLE 17 - OPENING OF BIDS

17.01 Bids will be opened as indicated in the Advertisement for Bids.

ARTICLE 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, at its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 - EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to be non-responsible. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.

19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

19.03 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

19.04 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers and other individuals or entities must be submitted as provided in the Supplementary Conditions.

19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the contract Documents.

19.06 If the Contract is to be awarded, Owner will award the Contract to the responsible Bidder whose Bid, conforming with all the material terms and conditions of the Instructions to Bidders, is lowest, price and other factors considered. If detailed in the bid form, factors

such as discounts, transportation costs, and life cycle costs may be used to determine which bidder, if any, is to offered the award.

ARTICLE 20 - CONTRACT SECURITY AND INSURANCE

20.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by such bonds.

ARTICLE 21 - SIGNING OF AGREEMENT

21.01 When Owner gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within 15 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within ten days thereafter, Owner shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

ARTICLE 22 - SALES AND USE TAXES

22.01 Materials and supplies purchased under the terms of this contract shall be ordered by the Contractor from up to 8 vendors or suppliers who shall be directed to invoice the Shawnee Municipal Authority direct. No sales tax shall be added to the Invoice. The invoice will be paid direct by the Shawnee Municipal Authority in accordance with the terms and conditions of the invoice. The monies paid direct by Shawnee Municipal Authority to the vendor or supplier shall be deducted from the total contract price. The Contractor shall accept delivery and be responsible for and shall warrant and hold the Shawnee Municipal Authority harmless for the safety and security of all of the materials and supplies furnished for the project under this contract. The Shawnee Municipal Authority will issue the Contractor a letter similar to the attached.

ARTICLE 23 - CONTRACT TO BE ASSIGNED

Not Used

ARTICLE 24 - WAGE RATE REQUIREMENTS

24.01 If the contract price is in excess of $100,000, provisions of the Contract Work Hours and Safety Standards Act at 29 CFR 5.5(b) apply.

24.02 Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron

and steel products used in this project must be produced in the United States. The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. The deminimis and minor components waiver apply to this contract."

Shawnee Municipal Authority

Contractor
Address

RE: WATER TREATMENT PLANT EXPANSION

The vendor of materials and supplies under the above referenced contract is hereby authorized to invoice the Shawnee Municipal Authority (SMA), P.O. Box 1448, Shawnee, OK 74802, for materials and supplies purchased under the above contract omitting all sales taxes. All invoices shall include the contract number and the name of the contractor ordering the materials or supplies.

Upon receipt the Shawnee Municipal Authority will pay the invoice, in accordance with its terms and conditions, as money is due the Contractor.

Shawnee Municipal Authority

Chairman

Federal Wage Rates

"General Decision Number: OK20210035 01/01/2021

Superseded General Decision Number: OK20200035

State: Oklahoma

Construction Type: Heavy

Counties: Atoka, Bryan, Carter, Choctaw, Coal, Garvin, Haskell, Hughes, Johnston, Latimer, Love, Marshall, McCurtain, Murray, Pittsburg, Pontotoc, Pottawatomie, Pushmataha and Seminole Counties in Oklahoma.

HEAVY CONSTRUCTION PROJECTS (including sewer/water line construction; heavy construction projects on treatment plants) (excludes heavy dredging and water well drilling)

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.95 for calendar year 2021 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.95 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2021. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/01/2021

* ELEC1002-005 07/05/2020

	Rates	Fringes
ELECTRICIAN	$ 39.32	29.5%+7.50

ENGI0627-017 06/01/2019

	Rates	Fringes
POWER EQUIPMENT OPERATOR:		
Group 1	$ 31.05	13.75
Group 2	$ 29.35	13.75
Group 3	$ 28.80	13.75
Group 4	$ 28.00	13.75

Group 5	$ 26.90	13.75
Group 6	$ 25.25	13.75
Group 8	$ 23.65	13.75
Group 9	$ 23.15	13.75
Group10	$ 22.20	13.75

POWER EQUIPMENT OPERATOR
GROUP 1: All Crane Type Equipment 200 ton and larger and including 400 ton capacity cranes. All Tower Cranes.

GROUP 2: All Crane Type Equipment 100 ton capacity and larger cranes, and less than 200 ton capacity.

GROUP 3: All Crane Type Equipment 50 ton capacity and larger cranes, and less than 100 ton capacity. Crane Equipment (as rated by mfg.) 3 cu. yd. and over Guy derrick Whirley Power Driven Hole Digger (with 30' and longer mast).

GROUP 4: CRANES with Boom Incl. Jib less than 100 ft and less than 3 cu. Yd.; Overhead Monorail Crane; MECHANIC; BACKHOE; TRACKHOE; GRADER/BLADE; Power Driven Hole Digger with less than 30' mast
GROUP 5: BULLDOZER; BOBCAT/SKID STEER/SKID LOADER
GROUP 6: Rotary Drilling Machine when operated from console
GROUP 8: FORK-LIFT; TRACTOR
GROUP 9: PUMPS
GROUP 10:OILER

IRON0048-008 06/01/2019

CARTER, GARVIN, JOHNSTON, LOVE, MARSHALL, MURRAY, PONTOTOC, POTTAWATOMIE, AND SEMINOLE COUNTIES

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 26.00	15.35

IRON0584-022 06/01/2019

ATOKA, BRYAN, CHOCTAW, COAL, HASKELL, HUGHES, LATIMER, MCCURTAIN, PITTSBURG, AND PUSHMATAHA COUNTIES

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 26.00	15.35

TEAM0516-006 06/04/2019

	Rates	Fringes
TRUCK DRIVER		
(3) Flatbed Truck	$ 27.25	11.85

SUOK2012-013 05/18/2012

	Rates	Fringes
CARPENTER (Form Work Only)	$ 14.00	0.00
LABORER: Common or General	$ 13.09	0.00
LABORER: Pipelayer	$ 14.00	0.00

OPERATOR: Scraper.....$ 14.00 0.00

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations

Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION
"

"General Decision Number: OK20210071 01/01/2021

Superseded General Decision Number: OK20200071

State: Oklahoma

Construction Type: Building
Building Construction -does not include residential construction consisting of single family homes and apartments up to and including 4 stories. (Including building projects on treatment plants)

Counties: Coal, Garvin, Haskell, Hughes, Latimer, Marshall, McCurtain, Pittsburg, Pontotoc, Pottawatomie, Pushmataha and Seminole Counties in Oklahoma.

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.95 for calendar year 2021 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.95 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2021. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/01/2021

BOIL0592-001 01/01/2017

	Rates	Fringes
BOILERMAKER	$ 28.47	21.88

ELEC0301-006 06/01/2017

MCCURTAIN COUNTY ONLY

	Rates	Fringes
ELECTRICIAN	$ 23.80	10.85

ELEC0301-007 06/01/2017

MCCURTAIN COUNTY ONLY

	Rates	Fringes
ELECTRICIAN (Low Voltage Wiring, Alarm Installation, and Sound and Communications Systems Installation Only)	$ 23.80	10.85

ELEC0584-013 05/28/2018

COAL, HASKELL, HUGHES, LATIMER, PITTSBURG AND PUSHMATAHA COUNTIES ONLY

	Rates	Fringes
ELECTRICIAN (Low Voltage Wiring, Alarm Installation, and Sound and Communications Systems Installation Only)	$ 30.43	7%+9.70

ELEC0584-016 05/28/2018

COAL, HASKELL, HUGHES, LATIMER, PITTSBURG AND PUSHMATAHA COUNTIES ONLY

	Rates	Fringes
ELECTRICIAN	$ 30.43	7%+9.70

ELEC1141-015 05/27/2019

GARVIN, MARSHALL, PONTOTOC, POTTAWATOMIE AND SEMINOLE COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 33.45	17.25%+5.60

ELEC1141-019 06/01/2018

GARVIN, MARSHALL, PONTOTOC, POTTAWATOMIE AND SEMINOLE COUNTIES

	Rates	Fringes
ELECTRICIAN (Low Voltage Wiring, Alarm Installation, and Sound and Communication Systems Installation Only)	$ 19.86	15.5%+5.60

ENGI0627-018 06/01/2019

	Rates	Fringes
POWER EQUIPMENT OPERATOR:		
Group 1	$ 31.05	13.75
Group 2	$ 29.35	13.75
Group 3	$ 28.80	13.75
Group 4	$ 28.00	13.75
Group 5	$ 26.90	13.75
Group10	$ 22.20	13.75

POWER EQUIPMENT OPERATOR

GROUP 1: All Crane Type Equipment 200 ton and larger and including 400 ton capacity cranes. All Tower Cranes.

GROUP 2: All Crane Type Equipment 100 ton capacity and larger cranes, and less than 200 ton capacity.

GROUP 3: All Crane Type Equipment 50 ton capacity and larger, and less than 100 ton capacity. Crane Equipment (as rated by mfg.) 3 cu. yd. and over Guy derrick Whirley Power Driven Hole Digger (with 30' and longer mast).

GROUP 4: CRANES with Boom Incl. Jib less than 100 ft and less than 3 cu. Yd.; Overhead Monorail Crane.

GROUP 5: BULLDOZER
GROUP 10: OILER

IRON0048-013 06/01/2019

GARVIN, MARSHALL, PONTOTOC, POTTAWATOMIE AND SEMINOLE COUNTIES ONLY

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 26.00	15.35

IRON0584-024 06/01/2019

COAL, HASKELL, HUGHES, LATIMER, MCCURTAIN, PITTSBURG AND PUSHMATAHA COUNTIES ONLY

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 26.00	15.35

PLUM0344-015 07/01/2019

COAL, GARVIN, HUGHES, MARSHALL, PONTOTOC, POTTAWATOMIE, PUSHMATAHA AND SEMINOLE COUNTIES

	Rates	Fringes
PIPEFITTER (Including Installation of HVAC Electrical/Temperature Controls and HVAC Pipe Installation)	$ 33.00	15.19

PLUM0344-018 07/01/2019

COAL, GARVIN, HUGHES, MARSHALL, PONTOTOC, POTTAWATOMIE, PUSHMATAHA AND SEMINOLE COUNTIES

	Rates	Fringes
PLUMBER (Excludes HVAC Pipe Installation)	$ 33.00	15.19

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* PLUM0430-015 10/01/2020

HASKELL, LATIMER, MCCURTAIN AND PITTSBURG COUNTIES

	Rates	Fringes
PIPEFITTER (Including Installation of HVAC Electrical/Temperature Controls and HVAC Pipe Installation)	$ 32.25	13.98

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* PLUM0430-018 10/01/2020

HASKELL, LATIMER, MCCURTAIN AND PITTSBURG COUNTIES

	Rates	Fringes
PLUMBER (Excludes HVAC Pipe Installation)	$ 32.25	13.98

SHEE0124-013 07/01/2020

COAL, GARVIN, HUGHES, MARSHALL, PONTOTOC, POTTAWATOMIE AND SEMINOLE COUNTIES ONLY

	Rates	Fringes
SHEET METAL WORKER (Including HVAC Duct Installation)	$ 32.98	15.66

SHEE0270-007 06/01/2017

HASKELL, LATIMER, MCCURTAIN, PITTSBURG AND PUSHMATAHA COUNTIES ONLY

	Rates	Fringes
SHEET METAL WORKER (Including HVAC Duct Installation)	$ 31.89	14.31

SUOK2012-051 06/18/2012

	Rates	Fringes
BRICKLAYER	$ 20.00	0.00
CARPENTER (Acoustical Ceiling Installation Only)	$ 16.24	0.00
CARPENTER (Drywall Hanging Only)	$ 14.96	0.00
CARPENTER, Excludes Acoustical Ceiling Installation, Drywall Hanging, and Form Work	$ 16.82	2.82
CEMENT MASON/CONCRETE FINISHER	$ 14.50	0.00
FLOOR LAYER (Hardwood and Carpet)	$ 18.74	1.10
FORM WORKER	$ 16.79	3.12

GLAZIER.....$ 15.27 1.46

LABORER: Common or General.....$ 11.43 0.00

LABORER: Mason Tender - Brick...$ 12.00 0.00

LABORER: Mason Tender - Cement/Concrete.....$ 13.04 0.00

LABORER: Pipelayer.....$ 11.65 0.00

OPERATOR: Backhoe/Excavator/Trackhoe.....$ 16.83 0.00

OPERATOR: Forklift.....$ 18.02 0.00

PAINTER: Brush, Roller and Spray.....$ 12.32 0.00

ROOFER.....$ 15.00 0.29

SPRINKLER FITTER (Fire Sprinklers).....$ 21.52 6.00

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

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A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can

be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

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Wage and Hour Division
U.S. Department of Labor
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Washington, DC 20210

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U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

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U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

==========

END OF GENERAL DECISION
"

Oklahoma Drinking Water State Revolving Fund
LABOR STANDARDS CERTIFICATE FOR BIDDING

I certify that all the Davis Bacon Act and Labor Standards Contract Provisions of the specifications will be complied with during construction of the drinking water treatment works known as Drinking Water State Revolving Fund Project Number P40-1020504-03

Project Description:

_____

_____

_____
Printed Name of Authorized Representative

_____ _____
Signature of Authorized Representative Date

DW-074B
Rev. 3/15/2010

LABOR STANDARDS CERTIFICATE FOR PROJECT CLOSE-OUT

I certify that all the Davis Bacon Act and Labor Standards Contract Provisions of the specifications have been fully complied with during construction of the drinking water treatment works known as Drinking Water State Revolving Fund Project Number P40-1020504-03.

Project Description:

_____

_____

_____
Printed Name of Authorized Representative

_____ _____
Signature of Authorized Representative Date

PROSPECTIVE PRIME CONTRACTOR'S (BIDDER) STATEMENT ABOUT EQUAL OPPORTUNITY CLAUSE

☐ I have participated in previous contract(s) or subcontract(s) subject to the equal opportunity clause under Executive Orders 11246 and 11375 or preceding Executive Orders 10925 and 11114. I have filed all reports due under the requirements contained in 40 CFR, Part C, 8.11.

☐ I have not participated in previous contract(s) subject to the equal opportunity clause under Executive Orders 11246 and 11375 or preceding Executive Orders 10925 and 11114.

I will obtain a similar statement from any proposed subcontractor(s), when appropriate.

_____

(Signature and Title of Prospective Prime or Subcontractor's Representative)

_____

(Printed or typed Name and Title of Prospective Prime or Subcontractor's Representative)

_____

_____

_____

(Name and address of Prospective Prime or Subcontractor)

PROSPECTIVE PRIME CONTRACTOR'S (BIDDER) CERTIFICATION OF NONSEGREGATED FACILITIES

I hereby certify that I do not and will not maintain any facilities provided for my employees in a segregated manner, or permit my employees to perform their services at any location under my control where segregated facilities are maintained; and that I will obtain a similar certification prior to the award of any federally assisted subcontract exceeding $10,000 which is not exempted from the equal opportunity clause.

_____

(Signature and Title of Prospective Prime Contractor's Representative)

_____

(Printed or typed Name and Title of Prospective Prime Contractor's Representative)

_____

_____

_____

(Name and address of Prospective Prime Contractor)

DW-212a
Rev. 3/07
FILE #1 CLIP #4

SUB-CONTRACTOR'S CERTIFICATION OF NONSEGREGATED FACILITIES AND INCORPORATION OF EQUAL OPPORTUNITY CLAUSES

I hereby certify that I do not and will not maintain any facilities provided for my employees in a segregated manner, or permit my employees to perform their services at any location under my control where segregated facilities are maintained; and that I will obtain a similar certification prior to the award of any federally assisted subcontract exceeding $10,000 which is not exempted from the equal opportunity clause;

In addition, I hereby incorporate into my sub-agreement with the prime contractor the Equal Opportunity Clauses 1-7 as set forth in Executive Order No. 11246 and issued by the Secretary of Labor in Title 41 CFR Chapter 60-1.4 of the federal rules and regulations.

_____

(Printed or Typed Name & Address of Sub-contractor)

_____

_____

(Signature of Sub-contractor's Representative)

_____

(Printed or typed Name and Title of Sub-contractor's Representative)

Note: EEO clauses are included in DW-185 in the contract specifications

BID FORM

OWNER: Shawnee Municipal Authority
P.O. Box 1448
222 N. Broadway 74801
Shawnee, OK 74802

PROJECT: Water System Improvements
Water Treatment Plant Expansion

DWSRF Project No.: P40-1020504-03

1. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with OWNER in the form included in the Contract Documents to complete all Work as specified or indicated in the Contact Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with the Contract Documents.

2. BIDDER accepts all of the terms and conditions of the Information for Bidders, including without limitation those dealing with the disposition of Bid Security. Bids shall be held for 90 days after the day of Bid opening. BIDDER shall sign the Agreement and submit the Contract Security and other documents required by the Contract Documents within fifteen days after the date of OWNER'S Notice of Award.

3. In submitting this Bid, the BIDDER represents, as more fully set forth in the Agreement, that:

   (a) BIDDER has examined copies of all the Contract Documents and Bidding Documents and of the following addenda:

Date	Number

   (receipt of all of which is hereby acknowledged) and also copies of the Advertisement and the Information for Bidders;

   (b) BIDDER has examined the site and locality where the Work is to be performed, the legal requirements (federal, state and local laws, ordinances, rules and regulations) and the conditions affecting cost, progress or performance of the Work and has made such independent investigations as BIDDER deems necessary.

   (c) BIDDER has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; BIDDER has not solicited or induced any person, firm or a corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for himself any advantage over any other Bidder or over OWNER.

4. In submitting this Bid, BIDDER represents that:

(a) The total bid for the Bid Schedule includes all work necessary to complete that portion of the project described in the Bid Schedule and represents the entire scope of work covered by the Contract Documents. If a particular item of work is not specifically separated as a bid item the cost therefore is to be considered included in the bid item most nearly related.

(b) The total bid for each Bid Schedule is based on the quantities shown on the Bid Form and on the dimensions shown on the drawings where specific quantities are not itemized. The Contract Amount will be adjusted for bid schedule items with unit prices according to the actual quantities and measurement of the finished construction as determined by the Engineer.

(c) BIDDER will complete the work for the following price(s):

BID SCHEDULE
WATER SYSTEM IMPROVEMENTS
WATER TREATMENT PLANT EXPANSION

Item No.	Qty. & Unit	Description	Unit Cost	Total Cost
1.	LS	All work shown on the plans or required by the specifications. _____ Dollars – Lump Sum	$_____	$_____
2.	2000 CY	Undercut and backfill with aggregate base if needed. _____ Dollars –	$_____	$_____
3.	Allowance	Changes in size of process lines due to unknown lines or structures _____ Dollars – Allowance	$120,000.00	$120,000.00
OVERALL TOTAL BID WATER TREATMENT PLANT EXPANSION _____ (in words)			$_____ (in figures)	

5. The OWNER reserves the right to award the lowest and best base bid.

6. BIDDER agrees that the Work shall be completed in (600) Six Hundred consecutive calendar days.

   BIDDER accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work on time.

7. The following items shall be completed and submitted with the Bid Documents.

   Bid Form
   Bid Bond for 5% of bid amount
   Labor Standards Certification for Bidding (DW-074A)
   Forms DW211, 212 and 212a
   Business Relationships Affidavit
   Noncollusion Affidavit
   Certification Regarding Lobbying (DW414)
   Buy American Certification (DW-501)

8. The terms used in this Bid which are defined in the General Conditions of the Construction Contract are included as part of the Contract Documents and have the meaning assigned to them in the General Conditions.

9. By submitting a bid/proposal under this solicitation, the Bidder understands that the bid/proposal is subjected to the Davis-Bacon Act including prevailing wage rates and the Contract Work Hours and Safety Standards Act.

10. Liquidated Damages: The bidder recognizes that time is of the essence and that the Owner will suffer financial loss if the Work is not substantially complete within the time specified, plus any extensions thereof allowed in accordance with the General Conditions. Accordingly, instead of requiring any such proof the bidder agrees that as liquidated damages for delay (but not as a penalty) the successful contractor shall pay Owner $2,000.00 for each calendar day that expires after the time specified for completion.

11. By submitting a bid/proposal under this solicitation, the Bidder certifies that all Iron and Steel used in the project are produced in the United States in accordance with the Safe Drinking Water Act, Section 1452(a)(4).

    By submitting a bid/proposal under this solicitation, the Bidder shall submit American Iron and Steel Certification Form DW-501 with the bid.

12. Bids shall be good for ninety (90) calendar days.

THE BIDDER SHALL COMPLETE THE FOLLOWING AS APPLICABLE:

AN INDIVIDUAL

By _____ (Individual's Name)

doing business as _____

A PARTNERSHIP

By _____ (Firm Name)

A CORPORATION

By _____ (Corporation Name)

_____
(State of Incorporation)

By _____
(Name)

_____
(Title)

Attest _____
(Secretary)

(Corporate Seal)

Business address: _____
_____
_____
_____

Phone No. : _____
Fax No.: _____
Email: _____
SUBMITTED ON: _____

BID BOND

KNOW ALL MEN BE THESE PRESENTS, that we, _____,
hereinafter called the Principal, and the _____ of,
_____, a corporation duly organized under the laws of the
State of _____, hereinafter called the Surety, as Surety, are held and firmly bound unto
_____
_____,
hereinafter called the Obligee, in the sum of: _____
_____Dollars ($_____), for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for _____
_____
_____
_____

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract, and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty which the Obligee may in good faith contract with another party to perform the work covered by said bid, this obligation shall be null and void, otherwise to remain in full force and effect.

SIGNED AND SEALED this _____ day of _____, _____.

(_____ (Seal)
(PRINCIPAL
(
_____ (_____
WITNESS (TITLE

(_____ (Seal)
(SURETY
(
_____ (_____
WITNESS (TITLE

DW-413
Rev. 3/07
FILE #1 CLIP #4

BUSINESS RELATIONSHIPS AFFIDAVIT

STATE OF _____) ss.
COUNTY OF _____)

_____, of lawful age, being first duly sworn, on oath says that (s)he is the agent authorized by the bidder to submit the attached bid. Affiant further states that the nature of any partnership, joint venture, or other business relationship presently in effect or which existed within one (1) year prior to the date of this statement with the architect, engineer, or other party to the project is as follows:

_____

_____

Affiant further states that any such business relationship presently in effect or which existed within one (1) year prior to the date of this statement between any officer or director of the bidding company and any officer or director of the architectural or engineering firm or other party to the project is as follows:

_____

_____

Affiant further states that the names of all persons having any such business relationships and the positions they hold with their respective companies or firms are as follows:

_____

_____

(If none of the business relationships hereinabove mentioned exist, affiant should so state.)

Signed: _____

Subscribed and sworn to before me this _____ day of _____, _____.

_____
Notary Public

My Commission Expires:

_____

NONCOLLUSION AFFIDAVIT

STATE OF _____) ss.
COUNTY OF _____)

_____, of lawful age, being first duly sworn, on oath says that (s)he is the agent authorized by the bidder to submit the attached bid. Affiant further states that the bidder has not been a party to any collusion among bidders in restraint of freedom of competition by agreement to bid at a fixed price or to refrain from bidding; or with any government official or employee as to quantity, quality, or price in the prospective contract, or any other terms of said prospective contract; or in any discussions between bidders and any government official concerning exchange of money or other value for special consideration in the letting of a contract; that the bidder/contractor had not paid, given or donated or agreed to pay, give or donate to any officer or employee of the _____ (or other entity) any money or other thing of value, either directly or indirectly in the procurement of a contract or pursuant to this bid.

Signed:

_____

Subscribed and sworn to before me this _____ day of _____, _____.

_____

Notary Public

My Commission Expires:

_____

DW-414
Rev. 3/98
FILE #1 CLIP #4

CERTIFICATION REGARDING LOBBYING
FOR CONTRACTS OR SUBAGREEMENTS UNDER FEDERAL CONTRACTS, GRANTS OR LOANS

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying," in accordance with the instructions on that form.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans and cooperative agreement and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

DATE:_____ BY: _____

_____
Typed Name and Title

_____
Grantee

P-40-1020504-03

BIDDER'S AMERICAN IRON AND STEEL CERTIFICATION
(Submit with the Bid)

This is a certification that I, the bidder, _____ (Name and Title) of _____ (Company Name, Partnership, LLC, Inc., etc.) hereby certify and is aware that none of the funds appropriated or otherwise made available by the Consolidated Appropriation Act, 2014," (Appropriations Act) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States. The Bidder is aware that all iron and steel products used for this project must be produced in the United States per Section 436(a)-(f) of the Consolidated Appropriations Act, 2014, and incorporated into this project Shawnee Municipal Authority, DWSRF Project #: P40-1020504-03, and furthermore certifies as follows.

1. The bidder understands the term "iron and steel products" applies to all projects for the construction, alteration, maintenance, or repair of publically owned treatment works or public water systems.
2. The bidder understands the term "iron and steel products" refers to the following products made primarily of iron or steel, lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. Additional information, including any published waivers, is posted on the EPA Website, http://water.epa.gov/grants_funding/aisrequirement.cfm.
3. The bidder further states that this requirement applies to all portions of the project that are subcontracted.
4. This "Bidder's American Iron and Steel Certification" is to be submitted by Bidder as a part of this bid and proposal.
5. Iron and steel of unknown origin are considered to have been produced or manufactured outside the United States.
6. Identification of American-produced Iron and Steel Goods: Consistent with the terms of the Owner's bid solicitation and the provisions of Use of American Iron and Steel Section 436, the Bidder certifies that this bid reflects the Bidder's best, good faith effort to identify domestic sources of iron and steel goods in the bid solicitation where such American-made goods are available on the schedule and consistent with the deadlines prescribed in or required by the bid solicitation.
7. Verification of U.S. Production: The bidder certifies that all iron and steel products contained in the bid solicitation that are American-made have been so identified, and if this bid is accepted, the Bidder agrees that it will provide reasonable, sufficient, and timely verification to the Owner of the U.S. production of each component so identified.
8. Documentation Regarding Non-American-made Iron and Steel Goods: The Bidder certifies that for any iron and steel products that are not American-made and are so identified in this bid, the Bidder has included in or attached to this bid one or both of the following, as applicable:
9. Identification of and citation to a categorical waiver published by the U.S. Environmental Protection Agency in the Federal Register that is applicable to such component or components, and an analysis that supports its applicability to the component or components; If the Administrator of the Environmental Protection Agency (EPA) receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Website of the Environmental Protection Agency.

10. Verifiable documentation sufficient to the Owner, as required in the bid solicitation or otherwise, that the Bidder has sought to secure American-produced goods but has determined that such goods are not available on the schedule and consistent with the deadlines prescribed in the bid solicitation, with assurance adequate for the Bidder under the applicable conditions stated in the bid solicitation or otherwise.
11. Information and Detailed Justification Regarding Non-American-produced Iron and Steel Goods: The Bidder certifies that for any such product or products that are not so available, the Bidder has also provided in or attached to this bid certification, including but not limited to the verifiable documentation and a full description of the bidder's efforts to secure any such American-produced iron and steel goods, that the Bidder believes are sufficient to provide and as far as possible constitute the detailed justification required for a waiver under Use of American Iron and Steel with respect to such product or products.
12. If use of a noncompliant iron and/or steel product is permanently incorporated into a project, one or more of the following can occur: 1) Request a waiver where appropriate. 2) Require the removal of the non-domestic item. 3) Payment for all or part of the project will be withheld.
13. The Bidder further agrees that, if this bid is accepted, it will assist the Owner in amending, supplementing, or further supporting such information as required by the Owner to request and, as applicable, implement the terms of a waiver with respect to any such product or products. The EPA strongly recommends the use of a step certification, similar to the one used by the Federal Highway Administration. The final manufacturer can also certify that the manufacturing process occurred in the United States.

_____
Name of Construction Company

Signed_____
Signature of Authorized Official

By_____
Type Name of Authorized Official

Title_____
Title of Authorized Official

AGREEMENT

OWNER: Shawnee Municipal Authority
P.O. Box 1448
Shawnee, OK 74802

PROJECT: Water System Improvements
Description: Water Treatment Plant Expansion

CONTRACTOR:

DWSRF PROJECT NO. P40-1020504-03
CONTRACT NO. _____

THIS AGREEMENT is dated as of the _____ day of _____, _____ by and between the OWNER and CONTRACTOR each above identified and collectively referred to as the Parties.

WITNESSETH: That for and in consideration of the payments, covenants and agreements stated herein, the Parties agree as follows:

Article 1. WORK.

CONTRACTOR shall complete all work as specified or indicated in the Contract Documents. The Work is generally described as follows:

Article 2. CONTRACT TIME.

2.1 The Work shall be fully completed within 600 consecutive calendar days after the date of the Notice to Proceed.

2.2 Liquidated Damages. OWNER and CONTRACTOR recognize that time is of the essence of this Agreement and that the OWNER will suffer financial loss if the Work is not substantially complete within the time specified in Paragraph 2.1 above, plus any extensions thereof allowed in accordance with the General Conditions. They also recognize the delays, expense and difficulties involved with a legal or arbitration proceeding the actual loss suffered by the OWNER if the Work is not substantially complete on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay OWNER **Two Thousand Dollars ($2,000.00)** for each calendar day for each contract that expires after the time specified in paragraph 2.1 for substantial completion until the Work is fully complete.

Article 3. CONTRACT PRICE.

3.1 OWNER shall pay CONTRACTOR for performance of the Work in accordance with the Contract Documents in the amount of $_____.

Article 4. PAYMENT PROCEDURES.

CONTRACTOR shall submit Applications for Payment in accordance with the General Conditions. Applications for payment will be processed by the OWNER as provided in the General Conditions.

4.1 PROGRESS PAYMENTS: OWNER will make progress payments on the basis of the CONTRACTOR'S Applications for Payment as recommended by the ENGINEER, on or about the first day of each month during construction as provided below. All progress payments will be on the basis of the progress of the Work measured by the schedule of values.

4.1.1 Progress payments will be in an amount equal to 95 percent of the Work completed and 95 percent of materials and equipment not incorporated in the Work but delivered and suitably stored, less the aggregate of payments previously made.

4.2 Final Payment. Upon final completion and acceptance of the Work in accordance with paragraph 15.06 of the General Conditions, OWNER will pay the remainder of the Contract Price as recommended by the ENGINEER.

Article 5. CONTRACTOR'S REPRESENTATIONS.

In order to induce OWNER to enter into this Agreement CONTRACTOR makes the following representations.

5.1 CONTRACTOR has familiarized himself with the nature and extent of the Contract Documents, Work locality, and with all local conditions and federal, state and local laws, ordinances, rules and regulations that in any manner may affect cost, progress or performance of the Work.

5.2 CONTRACTOR has studied carefully all reports of investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting cost, progress or performance of the Work which were relied upon by the ENGINEER in the preparation of the Drawings and Specifications and which have been identified in the Contract Documents.

5.3 CONTRACTOR has made or caused to be made examinations, investigations and tests and studies of such reports and related data as he deems necessary for the performance of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents; and no additional examinations, investigations, tests, reports or similar data are or will be required by CONTRACTOR for such purposes.

5.4 CONTRACTOR has correlated the results of all such observations, examinations, investigations, tests, reports and data with the terms and conditions of the Contract Documents.

Article 6. CONTRACT DOCUMENTS.

The Contract Documents which comprise the entire agreement between OWNER and CONTRACTOR are attached to this Agreement, made a part hereof and consist of the following:

6.1 This Agreement

6.2 Exhibits to this Agreement.

6.3 Performance, Maintenance and Payment Bonds.

6.4 Notice of Award and Notice to Proceed.

6.5 General Conditions

6.6 Supplemental General Conditions

6.7 ODEQ Supplemental Conditions (Pink Sheets)

6.8 Bid and Contract Documents – Technical Specifications bearing the title Water System Improvements – Water Treatment Plant Expansion and consisting of divisions and pages as listed in table of contents thereof.

6.9 Drawings bearing the title Water System Improvements - Water Treatment Plant Expansion or as elsewhere described in the Contract Documents.

6.10 Addenda numbers _____ to _____, inclusive.

6.11 CONTRACTOR'S Bid

6.12 Any Written Amendment or Work Directive Change, including Change Orders, duly delivered after execution of Agreement.

The Contract Documents may only be altered, amended or repealed by a Written Amendment or Work Directive Change.

Article 7. MISCELLANEOUS.

7.1 Terms used in this Agreement which are defined in the General Conditions shall have the meanings indicated in the General Conditions.

7.2 No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

7.3 OWNER and CONTRACTOR each binds himself, his partners, successors, assigns and legal representatives to the other party hereto, in respect to all covenants, agreements, and obligations contained in the Contract Documents.

7.4 Davis Bacon Act wages rules shall apply. All laborers and mechanics employed by contractors and sub-contractors on projects funded directly by or assisted in whole or in part by the through the Federal Government shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of Chapter 31 of Title 40, United States Code and the DW-185 Supplemental Conditions (Pink Sheets). The Department of Labor provides all pertinent information related to compliance with labor standards, including prevailing wage rates and instructions for reporting. For more information please refer to http://www.wdol.gov and http://www.beta.SAM.gov.

7.5 The Contractor acknowledges to and for the benefit of the Shawnee Municipal Authority ("Owner") and the Oklahoma Drinking Water State Revolving Fund (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the

American Iron and Steel Requirement, as may be requested by the Owner or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Owner or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Owner). While the Contractor has no direct contractual privity with the State, as a lender to the Owner for the funding of its project, the Owner and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

IN WITNESS WHEREOF, the parties hereto have signed this Agreement in 6 counterparts each of which shall be deemed an original on the date first above written. All portions of the Contract Documents have been signed or identified by OWNER and CONTRACTOR.

OWNER: SHAWNEE MUNICIPAL AUTHORITY	**CONTRACTOR:**
By_____ (Chairman)	_____ By: Title:
(SEAL)	(SEAL)
ATTEST_____ (Secretary)	ATTEST:_____ Secretary
Address for giving notices:	Address for giving notices:
PO Box 1448	
Shawnee, OK 74802	
(405) 878-1660	( )____-_____, FAX ( )_____-_____

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ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PERFORMANCE BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:
Shawnee Municipal Authority
PO Box 1448
Shawnee, OK 74802

CONSTRUCTION CONTRACT
Effective Date of the Agreement:
Amount:
Description *(name and location)*: Water System Improvements – Water Treatment Plant Expansion

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ *(seal)*	_____ *(seal)*
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	**By:** _____
Signature	Signature *(attach power of attorney)*
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	**Attest:** _____
Signature	Signature
_____	_____
Title	Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after:

3.1 The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

3.3 The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

7.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2 additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

7.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than

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the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

14. Definitions

14.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

14.2 Construction Contract: The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

14.3 Contractor Default: Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

14.4 Owner Default: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

14.5 Contract Documents: All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

16. Modifications to this Bond are as follows:

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STATUTORY BOND

KNOW ALL MEN BE THESE PRESENTS, that we, _____, hereinafter called the Principal, and the _____ of, _____, a corporation duly organized under the laws of the State of _____, hereinafter called the Surety, as Surety, are held and firmly bound unto The Shawnee Municipal Authority, hereinafter called the Obligee, in the sum of _____ Dollars ($_____), for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, said Principal entered into a written Contract with said Obligee dated _____, _____, for Water System Improvements – Water Treatment Plant Expansion, all in compliance with the plans and specifications therefore, made a part of said Contract and on file in the office of the Shawnee Municipal Authority.

NOW THEREFORE, if said Principal shall fail or neglect to pay all indebtedness incurred by said Principal or subcontractors of said Principal who perform work in the performance of such contract, for labor and materials and repairs to and parts for equipment used and consumed in the performance of said contract after the same becomes due and payable the person, firm, or corporation entitled thereto may sue and recover on this bond, the amount so due and unpaid.

It is further expressly agreed and understood by the parties hereto that no changes or alternations in said Contract and no deviations from the plan or mode of procedure herein fixed shall have the effect of releasing the sureties, or any of them, from the obligations of this Bond.

IN WITNESS WHEREOF, this instrument is executed in _____ counterparts, each of which shall be deemed an original, this _____ day of _____, _____.

(_____
(PRINCIPAL
(
_____ (BY: _____
WITNESS AS TO PRINCIPAL

(_____
(SURETY
(
_____ (BY: _____
WITNESS AS TO SURETY (ATTORNEY-IN-FACT

MAINTENANCE BOND

KNOW ALL MEN BE THESE PRESENTS, that we, _____,
hereinafter called the Principal, and the _____ of,
_____, a corporation duly organized under the laws of the State of
_____, hereinafter called the Surety, as Surety, are held and firmly bound unto the Shawnee Municipal Authority, hereinafter called the Obligee, in the sum of _____ Dollars ($_____), for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, said Principal entered into a written Contract with said Obligee dated _____, _____, for Water System Improvements Water Treatment Plant Expansion all in compliance with the plans and specifications, therefore, made a part of said Contract and on file in the office of Shawnee Municipal Authority.

NOW THEREFORE, if said Principal shall pay or cause to be paid to Obligee all damage, loss, and expense which may result by reason of defective materials and/or workmanship in connection with said work, occurring within a period of one (1) year after acceptance of said project by Obligee; and if Principal shall pay or cause to be paid all labor and materials, including the prime contractor and all subcontractors; and if Principal shall save and hold Obligee harmless from all damages, loss, and expense occasioned by, or resulting from, any failure whatsoever of said Principal, then this obligation shall be null and void, otherwise to be and remain in full force and effect.

It is further expressly agreed and understood by the parties hereto that no changes or alternations in said Contract and no deviations from the plan or mode of procedure herein fixed shall have the effect of releasing the sureties, or any of them, from the obligations of this Bond.

IN WITNESS WHEREOF, this instrument is executed in _____ counterparts, each of which shall be deemed an original, this_____ day of _____ , _____.

(_____
(PRINCIPAL
(
_____ (BY: _____
WITNESS AS TO PRINCIPAL

(_____
(SURETY
(
_____ (BY: _____
WITNESS AS TO SURETY (ATTORNEY-IN-FACT

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

NOTICE OF AWARD

Date of Issuance:

Owner:	Shawnee Municipal Authority	Owner's Contract No.:	
Engineer:	Holloway, Updike and Bellen, Inc.	Engineer's Project No.:	19SHAWWTP
Project:	DWSRF Project No. P40-1020504-03	Contract Name:	Water System Improvements - Water Treatment Plant Expansion

Bidder:

Bidder's Address:

TO BIDDER:

You are notified that Owner has accepted your Bid dated [_____] for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

Water System Improvements – Water Treatment Plant Expansion .

The Contract Price of the awarded Contract is: $_____

[ ] unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

☐ a set of the Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of this Notice of Award:

1. Deliver to Owner [____]counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security *[e.g., performance and payment bonds]* and insurance documentation as specified in the Instructions to Bidders and General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: SHAWNEE MUNICIPAL AUTHORITY

_____

Authorized Signature

By: _____

Title: _____

Copy: Engineer

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

NOTICE TO PROCEED

Owner:	Shawnee Municipal Authority	Owner's Contract No.:	
Contractor:		Contractor's Project No.:	
Engineer:	Holloway, Updike and Bellen, Inc.	Engineer's Project No.:	19SHAWWTP
Project:	DWSRF Project No. P40-1020504-03	Contract Name:	Water System Improvements Water Treatment Plant Expansion
		Effective Date of Contract:	

TO CONTRACTOR:

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on [_____, 20__]. *[see Paragraph 4.01 of the General Conditions]*

On that date, Contractor shall start performing its obligations under the Contract Documents. In accordance with the Agreement, the number of days to achieve completion is 600.

Owner: Shawnee Municipal Authority

_____

Authorized Signature

By: _____

Title: _____

Date Issued: _____

Copy: Engineer

DW-415
Rev. 3/07
FILE #1 CLIP #4

CLAIM OR INVOICE AFFIDAVIT

STATE OF _____) ss.
COUNTY OF _____)

The undersigned (contractor or supervisory official), certifies that this (invoice, claim or contract) is true and correct. Affiant further states the work, services or materials as shown by this invoice or claim have been completed or supplied in accordance with the plans, specifications, orders, or requests furnished to the affiant. Affiant further states that (s)he has made no payment, given, donated or agreed to pay, give or donate either directly or indirectly, to any elected official, officer, or employee of the State of Oklahoma, of money or any other thing of value to obtain payment or the award of this contract.

Signed: _____

Subscribed and sworn to before me this _____ day of _____, 20___.

_____
Notary Public

My Commission Expires:

_____

**CERTIFICATE OF APPROVAL
OF CONTRACT AND BONDS**

I, the undersigned_____, being duly authorized and acting legal representative of _____, _____ County, State of Oklahoma, do certify as follows:

I have examined the construction contract between the contractor, _____ _____, and the above named entity, and the surety bonds given by the contractor in connection with the performance of said contract, and the manner of execution of the contract and surety bonds; and I am of the opinion that each of the aforesaid agreements has been duly executed by the proper parties thereto, acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named therein; and that the foregoing contract and surety bonds constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

Dated this _____ day of _____, _____.

_____
ATTORNEY

_____ County

State of Oklahoma

Contractor's Application for Payment No. _____

	Application Period:	Application Date:
To (Owner):	From (Contractor):	Via (Engineer):
Project:	Contract:	
Owner's Contract No.:	Contractor's Project No.:	Engineer's Project No.:

Application For Payment

Change Order Summary

Approved Change Orders		
Number	Additions	Deductions
TOTALS		
NET CHANGE BY CHANGE ORDERS		

1. **ORIGINAL CONTRACT PRICE** ..... $ _____
2. **Net change by Change Orders** ..... $ _____
3. **Current Contract Price (Line 1 ± 2)** ..... $ _____
4. **TOTAL COMPLETED AND STORED TO DATE (Column F on Progress Estimate)** ..... $ _____
5. **RETAINAGE:**
   - a. X _____ **Work Completed** ..... $ _____
   - b. X _____ **Stored Material** ..... $ _____
   - c. **Total Retainage (Line 5a + Line 5b)** ..... $ _____
6. **AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5c)** ..... $ _____
7. **LESS PREVIOUS PAYMENTS (Line 6 from prior Application)** ..... $ _____
8. **AMOUNT DUE THIS APPLICATION** ..... $ _____
9. **BALANCE TO FINISH, PLUS RETAINAGE (Column G on Progress Estimate + Line 5 above)** ..... $ _____

Contractor's Certification

The undersigned Contractor certifies that to the best of its knowledge: (1) all previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with Work covered by prior Applications for Payment; (2) title of all Work, materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to Owner at time of payment free and clear of all Liens, security interests and encumbrances (except such as are covered by a Bond acceptable to Owner indemnifying Owner against any such Liens, security interest or encumbrances); and (3) all Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

By:	Date:

Payment of: $ _____
(Line 8 or other - attach explanation of the other amount)

is recommended by: _____ _____
(Engineer) (Date)

Payment of: $ _____
(Line 8 or other - attach explanation of the other amount)

is approved by: _____ _____
(Owner) (Date)

Approved by: _____ _____
Funding Agency (if applicable) (Date)

Endorsed by the Construction Specifications Institute.

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Progress Estimate

Contractor's Application

For (contract):	Application Number:
Application Period:	Application Date:

A		B	Work Completed		E	F		G
Item			C	D				
Specification Section No.	Description	Scheduled Value	From Previous Application (C+D)	This Period	Materials Presently Stored (not in C or D)	Total Completed and Stored to Date (C + D + E)	% (F) B	Balance to Finish (B - F)
	Totals							

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Progress Estimate

Contractor's Application

For (contract):							Application Number:			
Application Period:							Application Date:			
A				B	C	D	E	F		
Item		Bid Quantity	Unit Price	Bid Value	Estimated Quantity Installed	Value	Materials Presently Stored (not in C)	Total Completed and Stored to Date (D + E)	% (F) B	Balance to Finish (B - F)
Bid Item No.	Description									
	Totals									

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Stored Material Summary

Contractor's Application

For (contract):	Application Number:
Application Period:	Application Date:

A	B	C	D		E		F		G
			Stored Previously		Stored this Month		Incorporated in Work		
Invoice No.	Shop Drawing Transmittal No.	Materials Description	Date (Month/Year)	Amount ($)	Amount ($)	Subtotal	Date (Month/Year)	Amount ($)	Materials Remaining in Storage ($) (D + E - F)
		Totals							

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EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

Change Order No. _____

Date of Issuance: | Effective Date:

Owner: | Owner's Contract No.:

Contractor: | Contractor's Project No.:

Engineer: | Engineer's Project No.:

Project: | Contract Name:

The Contract is modified as follows upon execution of this Change Order:

Description:

Attachments: *[List documents supporting change]*

CHANGE IN CONTRACT PRICE	**CHANGE IN CONTRACT TIMES** *[note changes in Milestones if applicable]*
Original Contract Price: $_____	Original Contract Times: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] from previously approved Change Orders No. __ to No. __: $_____	[Increase] [Decrease] from previously approved Change Orders No. __ to No. __: Substantial Completion: _____ Ready for Final Payment: _____ days
Contract Price prior to this Change Order: $_____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] of this Change Order: $_____	[Increase] [Decrease] of this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
Contract Price incorporating this Change Order: $_____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for Final Payment: _____ days or dates

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____	By: _____	By: _____
Engineer (if required)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Title: _____	Title _____	Title _____
Date: _____	Date _____	Date _____

Approved by Funding Agency (if applicable)

By: _____ Date:

Title: _____

Oklahoma Drinking Water State Revolving Fund
Disadvantaged Business Enterprise (DBE) Program Guidance

The Oklahoma Drinking Water State Revolving Fund (DWSRF) receives federal funds from the U.S. Environmental Protection Agency (EPA) to provide low interest rate loans to finance water infrastructure projects. As a condition of federal grant awards, EPA regulations require that loan recipients and sub-recipients (i.e., prime contractors and subcontractors) make a good-faith effort to award a fair share of work to DBE's who are minority business enterprises (MBE's) and women's business enterprises (WBE's). DBE requirements can be found in 40 CFR Part 33.

To ensure compliance with EPA's DBE requirements, both **Project Owners (Loan Recipients)** and **Prime Contractors must** undertake the good faith efforts to provide opportunities for DBE companies to participate in procurements. EPA regulations require evidence of the demonstration of the six good faith efforts in trying to achieve the DBE participation goals. DWSRF negotiated DBE participation goals with EPA of 11.25% for MBEs and 7.41% for WBEs. The DBE goals are not a quota.

Good Faith Efforts – 40 CFR 33.301

The following good faith efforts which apply to the procurement categories involving EPA financial assistance funds can be found in **40 CFR, Subpart C, Part 33** of EPA's Disadvantaged Business Enterprise Program Rule.

1. Ensure DBE's are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities.
2. Search DBE lists for potential subcontracts/suppliers.
    a. The DBE lists are updated frequently, so search on-line for the most current list.
    b. Contact at least one DBE for each subcontract/supplier needed.
3. Provide notice to DBE organizations of opportunities to bid.
4. Arrange time frames for contracts and establish delivery schedules in a way that encourages and facilitates participation by DBEs in the competitive process.
5. Divide total requirements into smaller tasks or quantities and using DBE prime contractors and subcontractors when feasible to permit maximum DBE participation.
6. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
7. Use the services and assistance of the Small Business Administration (SBA), Department of Transportation (DOT) and Minority Business Development Agency of the U. S. Department of Commerce.
8. If the Prime Contractor awards subcontracts, require the subcontractor to take these same Good Faith Efforts.

TO PROVIDE PROCUREMENT OPPORTUNITIES TO DBE FIRMS, THE PROJECT OWNER SHOULD:

- Conduct pre-bid meetings to inform potential bidders/contractors about DBE requirements and provide guidance in undertaking the required good faith efforts found at 40 CFR 33.301.
- When appropriate invite DBE companies to meetings, conferences, etc., to inform them of procurement opportunities.

- Use databases of certified DBEs from the U.S. Small Business Administration (SBA), Oklahoma Department of Transportation (ODOT), etc, to solicit DBE companies as prime contractors whenever they are potential.
- The SBA maintains a list that can be found at the following link http://dsbs.sba.gov/dsbs/search/dsp_dsbs.cfm
- The ODOT maintains a database which can be found at the following link https://okdot.gob2g.com/?TN=okdot
- Cherokee Nation Tribal Employment Rights Office (TERO) maintains a list which can be found at http://www.cherokeetero.com/

Procurement, Recordkeeping and Reporting

1. PROJECT OWNERS ARE REQUIRED TO:
   A. Ensure all prime contractors apply the Good Faith Efforts.
   B. Project Owners must require its prime contractor to pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the project owner/recipient.
   40 CFR 33.302(a)
   C. Maintain copies of all DBE documentation.

2. PRIME CONTRACTORS ARE REQUIRED TO:
   A. Notify the loan recipient in writing prior to any termination of a DBE subcontractor by the prime contractor. 40 CFR 33.302(b)
   B. Follow the six good faith efforts if soliciting a replacement subcontractor after a DBE subcontractor fails to complete work under the subcontract for any reason. 40 CFR 33.302(c)
   C. Follow the six good faith efforts for all subcontract and/or supplier procurements even if the prime contractor has achieved its fair share objectives. 40 CFR 33.302(d)
   D. Provide documentation of solicitation of DBEs within three days of being declared the apparent low bidder:

3. **All DWSRF loan recipients are required to create and maintain a bidders list in accordance with 40 CFR, Subpart E, Part 33** of EPA's Disadvantaged Business Enterprise Program rule, (40 CFR 33.501(b). The bidder's list must include **all** companies that bid/quote on prime contracts and/or bid/quote on subcontracts and supplies for DWSRF funded projects (including DBEs and non-DBEs). The bidder's list must include the following prime and subcontractor information (40 CFR 33.501): entity's name and the name of the person contacted; entity's mailing address, telephone number, and e-mail address; the task or material on which the entity bid/quoted, the amount and date of bid/quote; and the entity's status as an MBE/WBE or non-MBE/WBE.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer

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has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Engineer*—The individual or entity named as such in the Agreement.

21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.

23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

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24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.

26. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

27. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.

32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or "RPR" includes any assistants or field staff of Resident Project Representative.

33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals and the performance of related construction activities.

35. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

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37. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.

38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

39. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

40. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.

42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.

45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

46. *Unit Price Work*—Work to be paid for on the basis of unit prices.

47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

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48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*:

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*:

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*:

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

a. does not conform to the Contract Documents; or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).

E. *Furnish, Install, Perform, Provide*:

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

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3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Contractor's Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.

C. *Evidence of Owner's Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

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3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.

B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or

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computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

A. Standards Specifications, Codes, Laws and Regulations

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*:

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict,

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error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*:

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

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3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

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2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. abnormal weather conditions;

3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and

4. acts of war or terrorism.

D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.

E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.

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G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*:

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part

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by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site either:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or

2. is of such a nature as to require a change in the Drawings or Specifications; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

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c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or

b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice as required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;

c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after

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becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

C. *Engineer's Review*: Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;

    b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

    c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and

    d. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

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5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

2. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

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F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.

H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

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ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.

B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.

D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.

E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is

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maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.

H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.

I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.

J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 *Contractor's Insurance*

A. *Workers' Compensation*: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.

2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).

3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

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4. Foreign voluntary worker compensation (if applicable).

B. *Commercial General Liability—Claims Covered*: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:

1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.

2. claims for damages insured by reasonably available personal injury liability coverage.

3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

C. *Commercial General Liability—Form and Content*: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage:

a. Such insurance shall be maintained for three years after final payment.

b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

3. Broad form property damage coverage.

4. Severability of interest.

5. Underground, explosion, and collapse coverage.

6. Personal injury coverage.

7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.

8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

D. *Automobile liability*: Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.

E. *Umbrella or excess liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.

F. *Contractor's pollution liability insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result

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of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.

G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.

H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:

1. include at least the specific coverages provided in this Article.

2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.

3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.

4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.

5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.

J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

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6.04 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."

2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.

3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).

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5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).

6. extend to cover damage or loss to insured property while in transit.

7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

8. allow for the waiver of the insurer's subrogation rights, as set forth below.

9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.

10. not include a co-insurance clause.

11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.

12. include performance/hot testing and start-up.

13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.

B. *Notice of Cancellation or Change*: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

C. *Deductibles*: The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

E. *Additional Insurance*: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.

F. *Insurance of Other Property*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

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6.06 *Waiver of Rights*

A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.

D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the

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policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and

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guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 *"Or Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) it has a proven record of performance and availability of responsive service; and

4) it is not objectionable to Owner.

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

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D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 *Substitutes*

A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

a. shall certify that the proposed substitute item will:

1) perform adequately the functions and achieve the results called for by the general design,

2) be similar in substance to that specified, and

3) be suited to the same use as that specified.

b. will state:

1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,

2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

c. will identify:

1) all variations of the proposed substitute item from that specified, and

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2) available engineering, sales, maintenance, repair, and replacement services.

d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.

B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.

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E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.

F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.

J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.

K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.

L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.

N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

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O. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.08 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

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7.09 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.10 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.12 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

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2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or

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exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements*:

1. Before submitting a Shop Drawing or Sample, Contractor shall have:

a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings*:

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to

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provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.

2. *Samples*:

   a. Contractor shall submit the number of Samples required in the Specifications.

   b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Other Submittals*: Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.

D. *Engineer's Review*:

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.

5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

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8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

E. *Resubmittal Procedures*:

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal;

6. the issuance of a notice of acceptability by Engineer;

7. any inspection, test, or approval by others; or

8. any correction of defective Work by Owner.

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D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.

B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop

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Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

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8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. an itemization of the specific matters to be covered by such authority and responsibility; and

3. the extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner for whom the Owner is responsible causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.

C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.

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D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

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9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during

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or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.

B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.

C. Engineer's authority as to Change Orders is set forth in Article 11.

D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

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B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

1. *Change Orders*:

a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.

b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.

2. *Work Change Directives*: A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an

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adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

3. *Field Orders*: Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on

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the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.04.C.2.a and 11.04.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.

B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under

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the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures*: Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.

2. *Engineer's Action*: Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

3. *Binding Decision*: Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

B. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and

4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

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B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12 – CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*:

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim

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submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable

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thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

    c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

    d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

    e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

    f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes

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other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*: When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. *Documentation*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

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B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.

E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

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ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to

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cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

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B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will

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include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*:

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*:

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

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a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

a. the Work is defective, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

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e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*:

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*:

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. the Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. the Contract Price has been reduced by Change Orders;

i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;

j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

l. there are other items entitling Owner to a set off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount

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remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

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E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.

2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*:

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of

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inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

   d. a list of all disputes that Contractor believes are unsettled; and

   e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Application and Acceptance*:

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.

D. *Payment Becomes Due*: Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation,

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including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;
2. correct such defective Work;
3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

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E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);
2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and
2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses,

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and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for

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expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this Article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and

2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this Article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

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18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

Supplemental Conditions

for

Projects funded from the

Drinking Water State Revolving Loan Fund

REPRODUCTION OF THIS GUIDANCE SHOULD
BE ON COLORED PAPER, PREFERABLY PINK

RULES AND REGULATIONS
TITLE 41 - PUBLIC CONTRACT AND PROPERTY MANAGEMENT
CHAPTER 60 - OFFICE OF FEDERAL CONTRACT COMPLIANCE PROGRAMS, EQUAL EMPLOYMENT OPPORTUNITY, DEPARTMENT OF LABOR
COMPLIANCE RESPONSIBILITY FOR EQUAL EMPLOYMENT OPPORTUNITY

60–1.4 Equal opportunity clause.

(b) Federally assisted construction contracts.

(1) Except as otherwise provided, each administering agency shall require the inclusion of the following language as a condition of any grant, contract, loan, insurance, or guarantee involving federally assisted construction which is not exempt from the requirements of the equal opportunity clause:
The applicant hereby agrees that it will incorporate or cause to be incorporated into any contract for construction work, or modification thereof, as defined in the regulations of the Secretary of Labor at 41 CFR Chapter 60, which is paid for in whole or in part with funds obtained from the Federal Government or borrowed on the credit of the Federal Government pursuant to a grant, contract, loan insurance, or guarantee, or undertaken pursuant to any Federal program involving such grant, contract, loan, insurance, or guarantee, the following equal opportunity clause:

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.

(3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance

with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, That in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency the contractor may request the United States to enter into such litigation to protect the interests of the United States.

The applicant further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work: Provided, That if the applicant so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.

The applicant agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of contractors and subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance.

The applicant further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and subcontractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this grant (contract, loan, insurance, guarantee); refrain from extending any further assistance to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

(c) Subcontracts. Each nonexempt prime contractor or subcontractor shall include the equal opportunity clause in each of its nonexempt subcontracts.

(d) Incorporation by reference. The equal opportunity clause may be incorporated by reference in all Government contracts and subcontracts, including Government bills of lading, transportation requests, contracts for deposit of Government funds, and contracts for issuing and paying U.S. savings bonds and notes, and such other contracts and subcontracts as the Deputy Assistant Secretary may designate.

(e) Incorporation by operation of the order. By operation of the order, the equal opportunity clause shall be considered to be a part of every contract and subcontract required by the order and the regulations in this part to include such a clause whether or not it is physically incorporated in such contracts and whether or not the contract between the agency and the contractor is written.

(f) Adaptation of language. Such necessary changes in language may be made in the equal opportunity clause as shall be appropriate to identify properly the parties and their undertakings.

[43 FR 49240, Oct. 20, 1978, as amended at 62 FR 66971, Dec. 22, 1997]

60-4.2 Solicitations.

(a) All Federal contracting officers and all applicants shall include the notice set forth in paragraph (d) of this section and the Standard Federal Equal Employment Opportunity Construction Contract Specifications set forth in § 60-4.3 of this part in all solicitations for offers and bids on all Federal and federally assisted construction contracts or subcontracts to be performed in geographical areas designated by the Director pursuant to § 60-4.6 of the part. Administering agencies shall require the inclusion of the notice set forth in paragraph (d) of this section and the specifications set forth in § 60-4.3 of this part as a condition of any grant, contract, subcontract, loan, insurance or guarantee involving federally assisted construction covered by this Part 60-4.

(b) All nonconstruction contractors covered by Executive Order 11246 and the implementing regulations shall include the notice in paragraph (d) of this section in all construction agreements which are necessary in whole or in part to the performance of the covered nonconstruction contract.

(c) Contracting officers, applicants and nonconstruction contractors shall given written notice to the Director within 10 working days of award of a contract subject to these provisions. The notification shall include the name, address and telephone number of the contractor; employer identification number; dollar amount of the contract, estimated starting and completion dates of the contract; the contract number; and geographical area in which the contract is to be performed.

(d) The following notice shall be included in, and shall be a part of, all solicitations for offers and bids on all Federal and federally assisted construction contracts or subcontracts in excess of $10,000 to be performed in geographical areas designated by the Director pursuant to § 60-4.6 of this part (see 41 CFR 60-4.2(a)):

Notice of Requirement for Affirmative Action To Ensure Equal Employment Opportunity (Executive Order 11246)

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation in each trade	Goals for female participation in each trade
11.25%	7.41%

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

2. The Contractor shall provide written notification to the Director of the Office of

Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is (insert description of the geographical areas where the contract is to be performed giving the state, county and city, if any).

[43 FR 49254, Oct. 20, 1978; 43 FR 51401, Nov. 3, 1978, as amended at 45 FR 65977, Oct. 3, 1980]

60-4.3 Equal opportunity clauses.

(a) The equal opportunity clause published at 41 CFR 60-1.4(a) of this chapter is required to be included in, and is part of, all nonexempt Federal contracts and subcontracts, including construction contracts and subcontracts. The equal opportunity clause published at 41 CFR 60-1.4(b) is required to be included in, and is a part of, all nonexempt federally assisted construction contracts and subcontracts. In addition to the clauses described above, all Federal contracting officers, all applicants and all nonconstruction contractors, as applicable, shall include the specifications set forth in this section in all Federal and federally assisted construction contracts in excess of $10,000 to be performed in geographical areas designated by the Director pursuant to § 60-4.6 of this part and in construction subcontracts in excess of $10,000 necessary in whole or in part to the performance of nonconstruction Federal contracts and subcontracts covered under the Executive order.

Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246)

1. As used in these specifications:
   a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
   b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
   c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
   d. "Minority" includes:
      (i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
      (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
      (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
      (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan.

Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7 a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

   a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

   b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

   c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a

recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation

employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

m. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

n. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

o. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract."

12. The Contractor shall not enter into any

Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

13. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

14. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

15. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

16. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

(b) The notice set forth in 41 CFR 60-4.2 and the specifications set forth in 41 CFR 60-4.3 replace the New Form for Federal Equal Employment Opportunity Bid Conditions for Federal and Federally Assisted Construction published at 41 FR 32482 and commonly known as the Model Federal EEO Bid Conditions, and the New Form shall not be used after the regulations in 41 CFR Part 60-4 become effective.

[43 FR 49254, Oct. 20, 1978; 43 FR 51401, Nov. 3, 1978, as amended at 45 FR 65978, Oct. 3, 1980]

DAVIS BACON ACT REQUIREMENTS (29 CFR 5.5)

The Project or Program to which the construction work covered by this contract pertains is being assisted by the United States of America and the following Federal Labor Standards Provisions are included in this contract pursuant to the provisions applicable to such assistance.

Regarding the following text: a ***subrecipient*** typically refers to a municipal or other local governmental entity that manages funds and are eligible to receive subgrant or loans from the ***recipient***, which refers to the Oklahoma Drinking Water State Revolving Fund (DWSRF).

1. Applicability of the Davis-Bacon (DB) prevailing wage requirements. DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State [DWSRF] before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor www.wdol.gov weekly to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if the Department of Labor issues a modification more than 10 days prior to the closing date (i.e., bid opening) for the solicitation. If the Department of Labor modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient [DWSRF] that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes the Department of Labor makes to the wage determination contained in the solicitation shall be effective unless the State recipient [DWSRF], at the request of the subrecipient, obtains an extension of the 90 day period from the Department of Labor pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor www.wdol.gov on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate Department of Labor wage determination from www.wdol.gov into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if the Department of Labor determines that the subrecipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate the Department of Labor's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wage sresulting from the use of the Department of Labor's revised wage determination.

3. Contracts and Subcontract provisions.

(a) Any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in §5.1 or the FY 2013 Full-Year Continuing Resolution, shall including the following clauses **[(1) – (10)]**:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions

made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in §5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

(ii)(A) The subrecipient, on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official [DWSRF] shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient to the State award official [DWSRF]. The State award official [DWSRF] will transmit the request to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official [DWSRF] or will notify the State award official [DWSRF] within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the recipient [DWSRF] do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the State award official [DWSRF] shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official [DWSRF], to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer [DWSRF] or will notify the contracting officer [DWSRF] within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient , that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient [DWSRF] or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/esa/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient for transmission to the State [DWSRF] or EPA if requested by EPA, the State [DWSRF], the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It

is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).
(B) Each payroll submitted shall be accompanied by a ``Statement of Compliance,'' signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the ``Statement of Compliance'' required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.
(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State [DWSRF], EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State [DWSRF] may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the

apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate [instructions require], and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the

contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. **Contract Provision for Contracts in Excess of $100,000**

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above, or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (a)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the DWSRF and the Department of Labor, and the contractor or

subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, the subrecipient should conduct interviews with a representative group of covered employees within two weeks of each contractor or subcontractor's submission of its initial weekly payroll data and two weeks prior to the estimated completion date for the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract of subcontract. At a minimum, if practicable, the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date [of] the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor of subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontracotrs who claim credit for fringe benefit contributions.

(d) The subrecipient shall periodically review contractor's and subcontractor's use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S. Department of Labor or a state, as appropriate, and the contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office list at http://www.dol.gov/esa/contracts/whd/america2.htm.

AMERICAN IRON AND STEEL

Consolidated Appropriations Act, 2014 (Appropriations Act)

Section 436

(a)(1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by Section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. Steel means an alloy that includes at least 50 percent iron, between 0.02 of 2 percent carbon, and may include other elements.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of

the Environmental Protection Agency (in this section referred to as the "Administrator") finds that:

(1) applying subsection (a) would be inconsistent with the public interest;

(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

(e) The Administrator may retain up to 0.25 percent of the funds appropriated in this Act for the Clean and Drinking Water State Revolving Funds for carrying out the provisions described in subsection (a)(1) for management and oversight of the requirements of this section.

(f) This section does not apply with respect to a project if a State Agency approves the engineering plans and specifications for the project, in that agency's capacity to approve such plans and specifications prior to a project requesting bids, prior to the date of the enactment of this Act.

OTHER SUPPLEMENTAL CONDITIONS

Small, Minority and Women's Business

40 CFR 31.36(e) Contracting with small and minority firms, women's business enterprise and labor surplus area firms.

1. The SRF loan recipient and subcontractors will take all necessary affirmative steps to assure that minority firms, women's business enterprises, and labor surplus area firms are used when possible.

2. Affirmative Steps shall include:

(i) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;

(ii) Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;

(iii) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority business, and women's business enterprises;

(iv) Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority business, and women's business enterprises;

(v) Using the services and assistance of the Small Business Administration, and the Minority Business Development Agency of the Department of Commerce; and

(vi) Requiring the prime contractor, if subcontracts are to be let, to take the affirmative steps listed in paragraphs (e)(2)(i) through (v) of this section.

Completion Date

If not stated elsewhere in these specifications, the contractor shall complete work under this contract within _____ working days or _____ calendar days. Time for completion shall begin on the 10th day after issuance of the work order, which shall consist of a written request by the engineer for the contractor to proceed with the construction of the project.

Contractor's Liability and Builders All Risk Insurance

The contractor shall furnish the following insurance when the contract is awarded:

(A) Workmen's Compensation: The contractor shall carry on his work in accordance with the requirements of the Workmen's Compensation Law of the State of Oklahoma, and shall not reject the provisions thereof during the life of the

contract. A certificate of coverage must be returned with the contract.

(B) Public Liability and Property Damage: He shall also protect himself by liability insurance against any and all claims for damages to persons or property which may arise out of operations under this contract, whether such operations be by himself or a subcontractor or by anyone directly employed by either of them. Certificates of such insurance shall be file with the Owner and shall be subject to its approval as to adequacy of protection. The public liability insurance shall have limits of not less than $100,000/$300,000 and Property Damage insurance of not less than $50,000/$100,000 shall be carried by the contractor during the life of the contract. A certificate of such coverage must be returned with the contract.

(C) Builder's Risk: Provide Builders Risk Insurance only if called for in other sections of the specifications.

Bonds

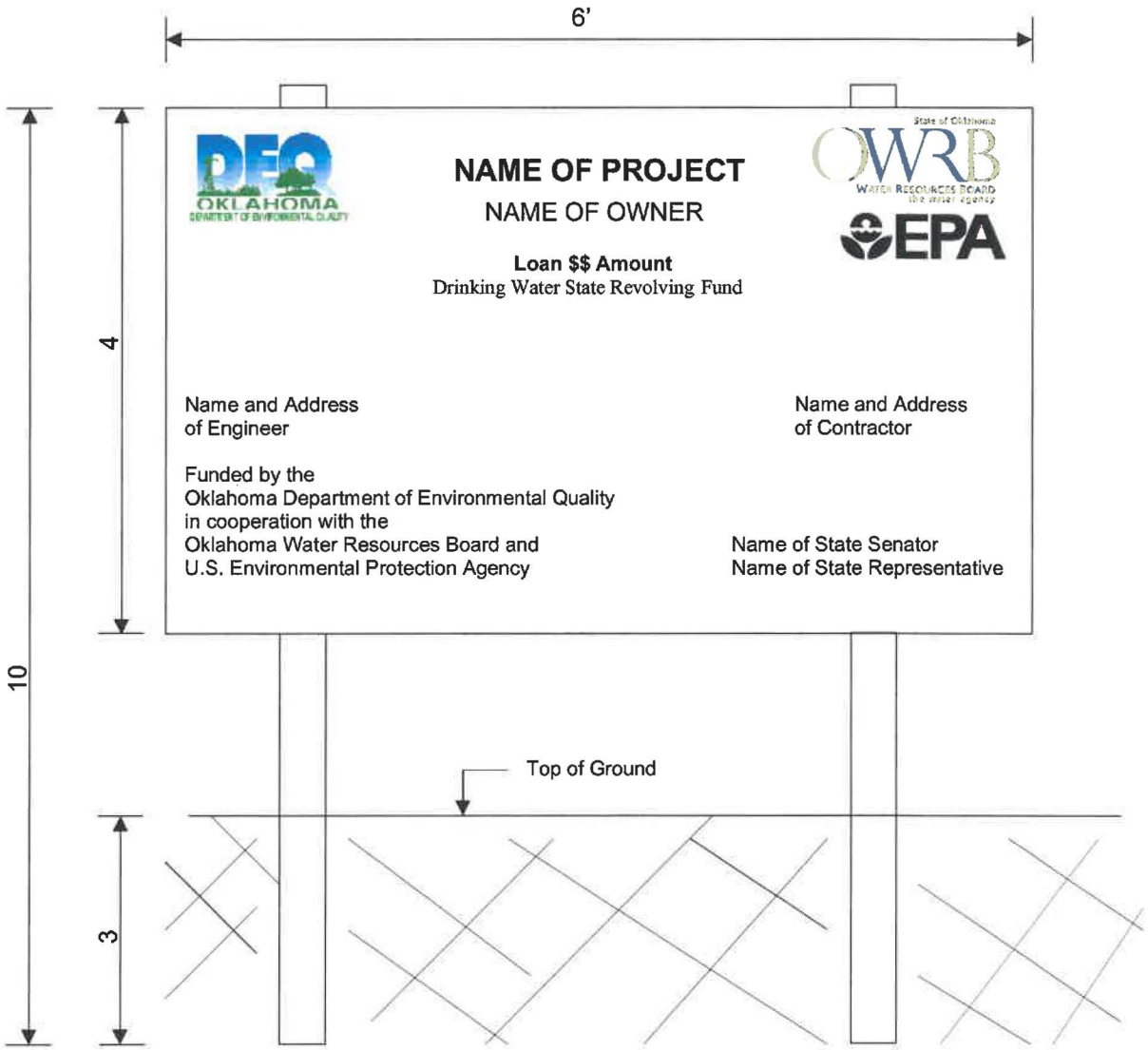
All bonds are for the full value of the contract and must be issued by a surety company authorized by the Oklahoma Insurance Commission to do business in the State of Oklahoma. They will be required after the award of the contact.

Three bonds are required for all contracts with a value exceeding Seven Thousand Five Hundred Dollars ($7,500.00) They are : (1.) Performance Bond to insure the completion of the work in accordance with the contract documents in the time stipulated; (2.) Maintenance Bond to provide for defects in construction or materials for a period of one (1) year from the date of acceptance of the completed work; and (3.) Statutory Bond to assure the Owner is protected from the action of subcontractors, suppliers and employees for unpaid debts of the contractor.

Irrevocable Letters of Credit may be used as a substitute for bonds on contracts One Hundred Thousand Dollars ($100,000.00) or less. The letters of credit must be issued by a financial institution insured by the Federal Deposit Insurance Corporation or the Federal Savings and Loan Insurance Corporation on forms obtained from the Owner.

PROJECT SIGN

- The general contractor shall erect and maintain for the life of the construction contract a suitable sign, 4' x 6' in size, and detailed hereon, lettered black on white background.
- Sign shall be professionally painted.
- Lettering to be appropriate size.
- Posts shall be 4" x 4" x 10' buried securely a minimum of 3 feet below ground.
- Sign face shall be constructed of ¾" x 4' x 6' – 5 ply Dura-plywood board & mounted to Posts with four (4) 5/8" x 6" Carriage Bolts.
- Sign shall be the general obligation of the Contractor. The Contractor must provide maintenance to prevent deterioration or provide repairs for damage caused during the construction period.



SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Contract (EJCDC C-700) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in the Supplementary Conditions which are defined in the Standard General Conditions of the Construction Contract have the meanings assigned to them in the General Conditions.

SC 1.01.A.20 Engineer – The person, firm or corporation with whom the OWNER has entered into an Agreement to provide engineering related services such as design of certain public improvements.

SC 2.02 Amend the first sentence of paragraph 2.02 A to read as follows: "Owner shall furnish to Contractor up to five (5) copies of the Contract Documents,----"

SC 6.01 Performance and Other Bonds. Amend the first sentence of paragraph 6.01 of the General Conditions to read as follows: "CONTRACTOR shall furnish Performance, Payment and Maintenance Bonds,--" and as so amended paragraph 6.01 remains in effect.

SC 6.03 Add the following new paragraphs immediately after Paragraph 6.03.1:

K. Contractor's Insurance - Contractor shall obtain insurance of the types and in the amounts described below. The insurance shall be written by insurance companies and on forms acceptable to Owner.

Owner and Holloway, Updike and Bellen, Inc. shall be included as an insured under the CGL, (using ISO Additional Insured Endorsement CG 20 10 11 85 or a substitute providing equivalent coverage), and under the commercial automobile liability (using ISO Additional Insured Endorsement CA 2048 or a substitute providing equivalent coverage), and commercial umbrella, if any. This insurance, including insurance provided under the commercial umbrella, if any, shall apply as primary and non-contributory insurance with respect to any other insurance or self-insurance programs afforded to, or maintained by, Owner.

L. Commercial General and Umbrella Liability Insurance - Contractor shall maintain commercial general liability (CGL) and, if necessary, commercial umbrella insurance, with a limit of not less than $1,000,000 each occurrence. If such CGL insurance contains a general aggregate limit, it shall apply separately to the Project.

CGL insurance shall be written on ISO occurrence form CG 20 10 (11-85) (or a substitute combination of the following forms CG 20 10 (10-01) and CG 20 37 (10-01) providing equivalent coverage) and shall cover liability arising from premises, operations, independent contractors, products-completed operations, personal injury and advertising injury and liability assumed under an insured contract.

There shall be no endorsement or modification of the CGL limiting the scope of coverage for liability arising from pollution, explosion, collapse, underground property damage, or amending the contractual coverage in the ISO occurrence form.

M. The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers' Compensation, and related coverages under Paragraphs 6.03.A.1 and A.2 of the General Conditions:

   Contractor shall maintain workers' compensation and employer's liability insurance.

   The employer's liability, and if necessary commercial umbrella, limits shall not be less than $1,000,000 each accident for bodily injury by accident or $1,000,000 each employee for bodily injury by disease.

   If Contractor leases its employees, the alternate employer endorsement (WC 00 03 01 A) shall be attached showing Owner in the schedule as the alternate employer.

State:	Statutory
Federal, if applicable (e.g., Longshoreman's):	Statutory
Employer's Liability:	
Bodily injury, each accident	$1,000,000
Bodily injury by disease, each employee	$1,000,000
Bodily injury/disease aggregate	$1,000,000

2. Contractor's Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:

Contractor shall maintain commercial general liability (CGL) and, if necessary, commercial umbrella insurance, with a limit of not less than $1,000,000 each occurrence. If such CGL insurance contains a general aggregate limit, it shall apply separately to the Project.

CGL insurance shall be written on ISO occurrence form CG 20 10 (11-85) (or a substitute combination of the following forms CG 20 10 (10-01) and CG 20 37 (10-01) providing equivalent coverage) and shall cover liability arising from premises, operations, independent contractors, products-completed operations, personal injury and advertising injury and liability assumed under an insured contract.

There shall be no endorsement or modification of the CGL limiting the scope of coverage for liability arising from pollution, explosion, collapse, underground property damage, or amending the contractual coverage in the ISO occurrence form.

Contractor shall maintain commercial general liability (CGL) and, if necessary, commercial umbrella liability insurance, with a limit of not less than $1,000,000 each occurrence for at least 3 years following substantial completion of the Work.

General Aggregate	$2,000,000
Products - Completed Operations Aggregate	$2,000,000
Personal and Advertising Injury	$1,000,000
Each Occurrence (Bodily Injury and Property Damage)	$1,000,000

3. Automobile Liability under Paragraph 6.03.D. of the General Conditions:

Contractor shall maintain business auto liability and, if necessary, commercial umbrella liability insurance with a limit of not less than $1,000,000 each accident.

Such insurance shall cover liability arising out of any auto (including owned, hired and non-owned autos).

Commercial auto coverage shall be written on ISO form CA 00 01, CA 00 05, CA 00 12, CA 00 20, or a substitute form providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide contractual liability coverage equivalent to that provided in the 1990 and later editions of CA 00 01.

If the Contract Documents require Contractor to remove and haul hazardous waste from the Project site, or if the Project involves such similar environmental exposure, pollution liability coverage equivalent to that provided under the ISO Pollution Liability-Broadened Coverage for Covered Autos Endorsement (CA 99 48) shall be provided, and the Motor Carrier Act Endorsement (MCS 90) shall be attached.

Bodily Injury:	
Each person	$1,000,000
Each accident	$1,000,000
Property Damage:	
Each accident	$1,000,000

4. Excess or Umbrella Liability:

Commercial Excess/umbrella coverage, if any, shall include liability coverage for damage to the insured's completed Work equivalent to that provided under ISO form CG 00 01.

Per Occurrence	$1,000,000
General Aggregate	$1,000,000

5. Contractor's Pollution Liability:

Contractor shall maintain contractor's pollution liability coverage applicable to the Project with a limit of not less than $1,000,000. Owner and Holloway, Updike and Bellen, Inc. shall be included as an additional insured under the contractor's pollution liability policy.

Each Occurrence	$1,000,000
General Aggregate	$1,000,000

6. Contractor's Professional Liability:

Each Claim	$1,000,000
Annual Aggregate	$1,000,000

7. Builder's Risk Insurance:

Contractor shall purchase and maintain property insurance for the Work. Such insurance shall be written in an amount at least equal to the initial contract sum as well as subsequent modifications of that sum. The insurance shall apply on a replacement cost basis. If the insurance obtained in compliance with this paragraph is builders risk insurance, coverage shall be written on a completed value form.

The property insurance as required above shall name as insureds the Owner, Contractor, and all subcontractors and sub- subcontractors on the Project.

N. Waiver of Subrogation - Contractor waives all rights against the Owner and Holloway, Updike and Bellen, Inc. and its agents, officers, directors and employees for recovery of damages to the extent these damages are covered by the commercial general liability, commercial umbrella liability insurance, automobile liability insurance and workers compensation insurance maintained pursuant to paragraph GC.7 of this agreement.

O. No Implied Waiver - Contractor shall furnish certifications matching the coverage requirements. Failure of Owner or Holloway, Updike and Bellen, Inc. to demand such certificate or other evidence of full compliance with these insurance requirements or failure of Owner or Engineer to identify a deficiency from evidence that is provided shall not be construed as a waiver of the contractors obligations to furnish and maintain such insurance, or as a waiver to the enforcement of any of the provisions at a later date.

Any waiver of the contractor's obligation to furnish such certificate or maintain such evidence must be by written change order and signed by a Managing Member (Officer) of the Engineer and the Owner.

P. Cancellation, Non-Renewal, and/or Impairment Notification - The Contractor shall not cause any insurance policy to be cancelled or permit it to lapse and all insurance policies shall include an endorsement to the effect that the insurance policy or certificate shall not be subject to cancellation or to a reduction in the required limits of liability or amounts of insurance until notice has been mailed to the Owner and Engineer, stating the date when such cancellation or reduction shall be effective, which date shall not be less than

(60) days after such notice.

Notice shall be sent via email and regular mail to the following persons and addresses:

Owner:

Shawnee Municipal Authority
Brad Schmidt
Utility Director
Bradley.Schmidt@shawneeok.org
P.O. Box 1448
Shawnee, OK 74802

Engineer:

Holloway, Updike and Bellen, Inc.: Jay Updike, P.E.
jupdike@hubengineers.com
818 East Side Blvd., PO Box 1543
Muskogee, OK 74402 (918) 682-7811

SC 7.09 Amend the first sentence in paragraph 7.09 to read as follows: "The OWNER qualifies for state and local sales tax exemption in the purchase of certain materials and equipment. The Authority will appoint the Contractor and his subcontractors as a special purchasing agent of the Authority. Refer to the "Appointment of Agent" form in the Specifications for limitations and exclusions".

SC 15.01.A Add the following sentence to the end of paragraph 15.01.A: The OWNER will retain 5% of the work completed and materials stored until the completion of the work.

1.1 PROJECT TITLE:

Water System Improvements
Water Treatment Plant Expansion
Shawnee Municipal Authority
Shawnee, Oklahoma

1.2 PROJECT IDENTIFICATION:

HUB Project No. 19SHAWWTP

1.3 OWNER:

Chance Allison, Manager
Shawnee Municipal Authority
P.O. Box 1448
222 N. Broadway 74801
Shawnee, OK 74802
(405) 878-1660

1.4 PROJECT ENGINEER:

Jay Updike, P.E.
Holloway, Updike & Bellen, Inc.
P.O. Box 1543
Muskogee, OK 74402
(918) 682-7811

1.5 MEASUREMENT AND PAYMENT:

It is the intent of the Proposal and these Special Conditions that the total bid, as submitted, shall cover all work shown on the contract drawings and required by the Specifications and other Contract Documents. All costs in connection with the work, including furnishing of all materials, equipment, supplies and appurtenances; providing all construction equipment and tools, and performing all necessary labor to fully complete the work, shall be included in the unit and lump sum prices named in the Proposal. No item of work that is required by the Contract Documents for the proper and successful completion of that contract will be paid for outside of or in addition to the prices submitted in the Proposal. All work not specially set forth in the Proposal as a pay item shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the Lump Sum Prices named in the Proposal.

The allowances will be used to pay for additional work which is clearly a change in the project scope.

The allowance will be used only upon approval of the Engineer and Owner. The allowance will be paid on a time and materials basis based on the contractor's cost for direct labor, materials and equipment plus an overhead rate of 30% plus a profit of 10%. No payment for down time due to utility line conflicts or utility line relocation work will be made. The successful bidder shall submit, prior to use of the allowance, a list of equipment with hourly rates for the use of said equipment under the allowance. The allowance is a maximum. Any remaining funds will be returned and/or remain with the owner via a change order.

1.6 TRADE NAMES AND MATERIALS:

Where materials or equipment are specified by a trade or brand name, it is not the intention of the Owner to discriminate against an equal product of another manufacturer, but rather to set a definite standard of quality of performance, and to establish equal basis for the evaluation of bids. Where the words "Equivalent", "proper", or "equal to" are used, they shall be understood to mean that the thing referred to shall be proper, the equivalent of, or equal to some other thing, in the opinion or judgment of the Engineer. Unless otherwise specified, all materials shall be the best of their respective kinds and shall be in all cases fully equal to approved samples. Not-withstanding that the words "or equal to" or other such expressions may be used in the Specification in connection with a material, manufactured article or process, the material, article or process, specifically designated shall be used, unless a substitute shall have been approved in writing by the Engineer and the Engineer shall have the right to require the use of such specifically designed material, article or process.

No material which has been used by the Contractor for any temporary purpose whatsoever is to be incorporated in the permanent structure without written consent of the Engineer.

1.7 GENERAL:

The Contractor shall give the Engineer seven calendar days' notice prior to starting any work so that a Pre-construction conference can be held with the Owner's representative, the Contractor, and the Engineer. The pre-construction conference will be held at the job site at a time mutually agreed upon, but prior to starting any work.

The Contractor shall provide description for hauling, handling, loading, unloading, stringing, cutting, joining, laying, backfilling or other operations. All technical Specifications herein shall be mandatory and shall be followed to the fullest extent.

Deviations from the technical Specifications herein, without prior approval from the Engineer, will be cause for the Contractor to perform corrective action as deemed necessary by the Engineer, including the furnishing of additional lengths of replacement pipe if necessary.

1.8 STANDARD SPECIFICATIONS:

The Oklahoma State Highway Commission "Standard Specifications for Highway Construction" latest edition are hereby adopted as part of these Specifications where reference is made. Said Specifications will be hereinafter referred to as the "Standard Specifications". However, no portion of the Standard Specifications referring to Basis of Payment will be adopted as part of these Specifications.

1.9 CONTRACTOR'S FIELD OFFICE:

During the performance of this contract, the Contractor shall maintain a suitable office on the site of the work which shall be headquarters of a representative authorized to receive drawings, instructions, or other communication or articles. Any communication given to the said representative or delivered at the Contractor's office at the site of the work in his absence shall be deemed to have been delivered to the Contractor.

Copies of the Drawings, Specifications, and other Contract Documents shall be kept at the Contractor's office at the site of the work available for use at all times.

The Contractor may store material on site as space is available or shall be responsible for obtaining a location for stored materials/stockpile off site as required. The stored material shall be kept in an orderly fashion, and located in an area where its use by the Contractor will be in accordance with any area zoning requirements as applicable.

1.10 ENGINEER'S FIELD OFFICE:

For the use of the Engineer and other representatives of the Owner during the performance of this Contract, the Contractor shall provide and maintain at the site, at a location approved by the Engineer, a field office with a floor space of not less than 120 square feet and may be portable or other suitable type with 7-ft. minimum ceiling height. This office shall be of watertight construction with suitable windows and doors, properly screened, reasonably dustproof, electric lighting, heating and air conditioning, one desk minimum dimensions of 30" x 48", one plan rack, two 4-drawer filing cabinets with locks and two chairs.

The field office shall be supplied with electric service.

In cold weather the building shall be provided with adequate vented space heating facilities and fuel for heating. In hot weather the building shall be equipped with adequate air conditioning units.

If all-weather parking surface is not readily available adjacent to the office, the Contractor shall provide and maintain a 4-inch crushed rock surfaced parking lot of sufficient size to park two full size cars with enough driveway area to provide unrestricted access to each parking space. At the completion of the project, the parking area shall be removed and the site returned to its original condition.

The field office shall remain the property of the Contractor and shall be removed by him upon the completion of Work.

1.11 OPERATIONS AND MAINTENANCE MANUALS:

Four (4) copies, unless otherwise stated, of a manual containing Specifications, drawings and descriptions of each individual item of equipment; installation instructions; operating and maintenance instructions; and parts lists shall be provided. The manual shall be a single manual covering complete operating installation; separate sheets or brochures for equipment not manufactured by the major supplier shall all be included. These manuals shall be in addition to any instructions packed with the equipment and shall be submitted not later than the date of shipment of the equipment. Each manual shall be bound in a "notebook style" cover having indicated thereon the manufacturer's name and date of purchase.

1.12 SITE CONDITIONS:

Where connection to existing lines are shown on the Drawings, the work may be required to be done at night or at a time which will least interfere with the operation of the existing facility.

The tie to existing lines will be coordinated with the Owner and will be done at a time to least inconvenience their operation. The work may be required to be performed at night or weekends or both.

As available the existing lines have been noted on the drawings. There may be additional buried lines that are not shown and if such is encountered, said lines will be left in service. If said lines are broken by the Contractor, they shall be repaired as soon as possible.

Road Closings - The Contractor shall notify the owner of any public road at least forty-eight (48) hours prior to the time he intends to obstruct any portion of the road. If the Owner agrees to the street obstruction the Contractor shall notify the Fire Department, Police or Sheriff Department, ambulance service and news media twenty-four (24) hours prior to obstructing the road and shall keep the street in condition for unobstructed use by emergency vehicles. News media notification shall include at least one local newspaper and at least one local radio station

1.13 SURVEYS:

The Contractor shall provide all surveying and construction staking required to construct the project. The Contractor shall employ a surveyor licensed in the State of Oklahoma to provide said surveys and staking. The Owner will provide points for horizontal control and bench marks for elevation.

1.14 PERMITS AND REGULATIONS:

The Contractor shall secure and pay for all construction permits required to carry out the work unless otherwise specified and shall produce same upon demand of the Owner. The Contractor shall give all notices and pay all fees and shall, before starting work, ascertain whether the drawings and Specifications are at variance with any codes or regulations applying at the site. The Contractor shall obtain completion survey, certificate of completion or occupancy if required by local regulations.

All features of design and construction shall comply with the local building regulations and/or other lawful or public regulations which apply at the site. If any features of construction as shown on the Owner's plan, do not conform to the regulations, the Contractor shall notify the Owner of such discrepancy, and shall base his quotation and work on features of construction which do conform to the regulations.

If the Contractor performs any work contrary to such laws, ordinances, rules and regulations and without such notice to the Owner, he shall bear all costs arising there from.

1.15 INSPECTION:

The Contractor will provide access to the work site and facilities for representatives of the Environmental Protection Agency and Oklahoma Department of Environmental Quality and other agencies, as well as, Owner and Engineer, as required whenever the work is in progress.

1.16 SATURDAY, SUNDAY, HOLIDAY AND NIGHT WORK:

No work shall be done between the hours of 7:00 p.m. and 7:00 a.m., nor on Saturday, Sunday or legal holidays without the written approval or permission of the ENGINEER in each case, except such work as may be necessary for the proper care, maintenances and protection of work already done, or of equipment, or in the case of an emergency.

1.17 PROTECTION OF PROPERTY:

A. The protection of the State and Government monuments, street signs and other Owner's property is of prime importance, and if the same be damaged, destroyed or removed, they shall be repaired, replaced or paid for by the Contractor. Disturbance to this property must first be approved by the agency which controls it.

B. No valves or other control on any utility main or building service line shall be operated for any purpose by the Contractor.

C. At places where the Contractor's operations are adjacent to the plant of railway, telegraph, telephone, electric and gas companies, or water, sanitary sewers and storm sewers, damage to which might result in expense, loss or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been completed.

D. The contractor shall cooperate with the owners of any underground or overhead utility lines in their removal and rearrangement operations in order that these operations may progress in a reasonable manner and that services rendered by those parties will not be unnecessarily interrupted. The revision and crossings of the various types of lines shall be made as follows:

(1) Storm sewers and culverts may be removed at the time of crossing or may be adequately braced and held in position while the pipe is placed beneath them. If the storm sewer or culvert is removed, it shall be replaced with pipe of the same type and size as that removed and it shall be re-joined to the undisturbed line with a joint satisfactory to the Engineer. Backfill over the main up to and around the storm sewer shall be thoroughly compacted in order that no settlement will occur. The revision and crossing of said lines shall be at the expense of the Contractor.

(2) All overhead and buried telephone and electrical conduits, to be revised or crossed by the construction of this project shall be protected in accordance with the directions of the utility company owning the conduits and/or mains. The Contractor shall notify the companies and obtain their permission before making any crossing or revisions. The revision and crossing of said lines shall be at the expense of the Contractor. Any overhead cables or buried cables or conduits damaged by the Contractor shall be repaired at his expense to the satisfaction of the Engineer and of the Owner.

(3) The Contractor shall not remove any water or sanitary sewer lines except as directed by the Owner or as required by the Drawings and Specifications, and shall adequately brace and protect them from any damage during construction. Any existing water main or sewer main damage caused by the Contractor's operations will be repaired by the Contractor. The repairs will be made at the Contractor's expense.

E. In the event the Contractor in any way fails to comply with the requirements of protecting, repairing and restoring of any utility or utility service, the Owner may, upon forty-eight (48) hours written notice proceed to protect, repair, rebuild or otherwise restore such utility service as may be deemed necessary, and the cost thereof will be deducted from any money due or which may become due the Contractor pursuant to the terms of his contract.

1.18 ASSISTANCE BY ENGINEER:

It is understood and agreed that such assistance as the Engineer may render to the Contractor in connection with the interpretation of drawings and Specifications shall not relieve the Contractor from any responsibility for the work. Any work which proves faulty shall be corrected by the Contractor without delay. The failure of the Engineer, or Resident Project Representative to call the Contractor's attention to faulty work or work performed which is not in accordance with Drawings and Specifications shall not imply acceptance or exempt the Contractor for correcting the improper work.

1.19 INCIDENTAL WORK:

Work called for on the Drawings and/or Specifications and are not set forth in the Bid Schedule as pay items, shall be considered as incidental work and will not be paid for directly, but shall be included in the price bid for the various pay items.

1.20 SCHEDULES:

The Contractor shall provide the following relative to project schedules.

A. PROJECT SCHEDULE:

The Contractor shall furnish the Engineer with a tentative schedule, in a format approved by the Engineer, setting forth in detail the procedure he proposes to follow, and giving the dates on which he expects to start and to complete separate portions of the work. The schedule shall be updated and submitted to the Engineer on a monthly basis corresponding with the date of the monthly progress meetings. If at any time, in the opinion of the Engineer, proper progress is not being maintained, such changes shall be made in the schedule of operations which will satisfy the Engineer that the work will be completed within the period stated in the proposal, or extension thereof made as herein provided.

B. WEEKLY SCHEDULE OF WORK:

The Contractor shall submit to the Resident Project Representative a schedule of work to be done each week. The listing shall include the work to be done each day of the week and the locations. The schedule shall be submitted by the close of business on the Friday before the week covered by the schedule.

1.21 SAFETY STANDARDS AND ACCIDENT PREVENTION:

With respect to all work performed under this Contract the Contractor shall:

A. Comply with the safety standards provisions of applicable laws, building and construction codes and the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America, the requirements of the Occupational Safety and Health Act of 1970 (Public Law 91-596), and the requirements of Title 29 of the Code of Federal Regulations, Section 1910 or 1926, as applicable.

B. Exercise every precaution at all times for the prevention of accidents and the protection of persons (including employees) and property.

1.22 WATER USAGE:

Water usage by the Contractor for the purpose of backfill compaction, testing, etc. will be provided by the Owner. Water for construction shall not be charged to the Contractor unless wastage becomes excessive.

1.23 PROGRESS MEETINGS:

Contractor shall arrange and conduct regular project progress meetings on a monthly basis and at other times as requested by the Engineer or required by progress of the Work. Contractor, Engineer, and all subcontractors active on the site shall be represented at each meeting. Contractor may at his discretion request attendance by other parties involved in the project.

Contractor shall preside at the meetings. Meeting minutes will be prepared and distributed by Contractor. The purpose of the meetings will be to review the progress of the Work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.

1.24 SUBSTANTIAL AND FINAL COMPLETION:

When the work is substantially complete, Contractor shall notify the Owner and Engineer in writing that the entire work is substantially complete (operational or beneficial occupancy) and request that Engineer issues a certificate of substantial completion. Work which may remain uncompleted at substantial completion shall include only minor surface work relative to right-of-way restoration, sodding, seeding, pavement replacement, etc.

Upon written notice from Contractor to the Engineer and Owner that the entire work is complete within the time called out on the Bid the Engineer will make a final inspection with Owner and Contractor and will notify Contractor in writing all particulars of the project which are incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such work prior to final payment.

1.25 EXCAVATION:

No additional payment shall be made for encountering materials such as limestone, groundwater, or other natural formations.

Prior to any excavation work, Contractor shall contact OKIE (1-800-CALL-OKIE) as well as all utility Owners within the work site.

1.26 DISINFECTION OF WATER TREATMENT PLANT FACILITIES

All new or modified facilities at the water treatment plant shall be disinfected in accordance with AWWA C653 latest addition. The contractor shall submit a plan for filling, disinfecting and sampling all facilities.

I. GENERAL

1.1 The Contractor shall comply with the following and all applicable local codes, standards, rules and regulations of any Authority having jurisdiction over the Project Site or the Work to be performed.

1.1.1 Williams-Steiger Occupational Safety and Health Act (OSHA) Public Law 91-596 - Protection of life, health, and public welfare as it relates to execution of the construction contract is the responsibility of the Contractor. Neither the Owner nor the Engineer will provide observation, inspection, supervision, or any comment on plans, procedures, or actions employed at the Project as they relate to safety of life, health, or public welfare. If conditions are mental to safety, written notice shall be issued by the Contractor and a decision shall be returned to the Contractor for action prior to effecting any unsafe procedure or condition.

1.1.2 Oklahoma Department of Transportation (ODOT) - "Standard Specifications for Highway Construction", latest edition.

1.2. CONFLICTS - In case of conflict between applicable codes, the one having the more stringent requirements shall govern. Drawings and Specifications shall be followed where they are superior to code requirements.

1.3. ABBREVIATIONS - Reference to a technical society, institution, association, code, or governmental authority may be made in these Specifications in accordance with the following abbreviations:

AA	Aluminum Association
AASHTO	American Association of State Highway & Transportation Officials (Formerly AASHO)
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASTM	American Society for Testing & Materials
AWS	American Welding Society
AWWA	American Water Works Association
BOCA	Building Officials and Code Administrators International, Inc.
CRSI-WCRSI	Concrete Reinforcing Steel Institute
CS	U.S. Department of Commerce, Commercial Standard

EPA	United States Environmental Protection Agency
FS or Fed. Spec.	Federal Specification
MIL	Military Specifications
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Assoc.
NFPA	National Fire Protection Association
PS	U.S. Department of Commerce, Product Standard
SPR	U.S. Department of Commerce, Simplified Practice Recommendations
SSPC	Steel Structures Painting Council
UL	Underwriter's Laboratories, Inc.
ODEQ	Oklahoma Department of Environmental Quality
ODOT	Standard Specifications for Highway Construction - Oklahoma Department of Transportation

1. SHOP DRAWINGS, SAMPLES AND PRODUCT DATA

1.1 GENERAL - Refer to General Conditions, Paragraph 6.17 through 6.25 for responsibilities. Submittals on component parts forming a system, or that are interrelated, shall be submitted at one time as a single submittal in order to demonstrate that the items have been properly coordinated and will function as a unit.

1.2 Shop Drawings - Identify details by reference to sheet and detail numbers shown on Contract Drawings. Use same symbols wherever practicable. Reproductions of Contract Drawings are acceptable as shop drawings only when specifically authorized in writing by the Engineer.

1.3 Samples - Includes all required physical examples to illustrate materials, equipment or workmanship, which establish standards by which completed work is urged. Must be of sufficient size and clarity, and in sufficient quantity to clearly Illustrate functional characteristics and full range of colors, patterns, textures or other properties which will be actually produced.

1.4 Product Data - Includes manufacturer's schematic drawings, catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, test reports, certificates of compliance, and other descriptive data not included on shop drawings. Modify standard descriptive data to delete information which is not applicable, and clearly identify pertinent data.

1.5 SUBMISSION REQUIREMENTS - Submittals shall be made with a letter of transmittal to the Engineer by the Contractor, and not by subcontractors, suppliers or manufacturers.

1.6 Submit samples in number specified, or if not so specified, in triplicate.

1.7 Submit Project Data in sufficient quantity for required distribution and record, allowing two copies to be retained by Engineer.

1.8 Identify all submittals with the following information, as applicable:

Project title and Engineer's project number.
Name of Contractor, Engineer, originating subcontractor or supplier.
Submittal date, and all revision dates.
Identify each product or material submittal by reference to Specification section and page no., drawing no., or any other contract document reference applicable thereto.
Applicable conformance standards.

Include certification of Contractor review and conformity to contract requirements per General Conditions, Paragraph 6.25. Identify any deviations from Contract Documents. Provide 3" x 3" minimum space for Engineer's review stamp.

2. PROJECT RECORD DOCUMENTS

2.1 MAINTENANCE OF DOCUMENTS - Maintain at jobsite one record copy of Contract Drawings, Specifications, Addenda, approved Shop Drawings, Change Orders, other modifications to the Contract, field test records and other approved documents submitted by Contractor in compliance with Specification requirements.

2.2 Maintain documents at the project apart from documents used for construction. Do not use record documents for construction purposes. Maintain documents in clean, legible condition. Make documents available at all times for inspection of the Engineer and Owner.

2.3 RECORDING - Label each document "PROJECT RECORD COPY" in 2" high printed letters. Keep record documents current. Do not permanently conceal any work until required information has been recorded.

2.4 CONTRACT DRAWINGS - Legible mark most appropriate drawing to record, where applicable:

- Depths of various elements of foundation in relation to first floor level.
- Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
- Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.
- Field changes of dimension and detail made during construction process.
- Changes made by Change Order or Field Order.
- Details not on original Contract Drawings.
- Any change in location of facilities. Use City Survey Control System.

2.5 SPECIFICATIONS AND ADDENDA - Legibly mark up each Section to record:

-Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
-Changes made by Change Order or Field Order.
-Other matters not originally specified.

2.6 SHOP DRAWINGS - Maintain as record drawings. Legibly annotate shop drawings to record changes made after review. Use red felt tip marking pen for all recording.

2.7 SUBMITTALS- At completion of project, deliver record documents to the Engineer. Accompany submittal with transmittal letter, in duplicate, containing:

-Date, project title and number.
-Contractor's name and address.
-Title and number of each record document.
-Certification that each document as submitted is complete and accurate.
-Signature of Contractor or his authorized representative.

1. TESTS AND INSPECTIONS

1.1 The Owner shall employ and pay for the services of a qualified independent testing consultant, to perform specified testing services for the following:

Soils Compaction Control
Cast-In-Place Concrete
Asphalt Pavement
Concrete Pavement

The quality control testing shall include but not be limited to concrete cylinder test, soil density test, asphalt density and concrete coring. The Owner will not pay for any testing that may be required to obtain a sample mix or a submittal approved.

1.2 The Contractor shall schedule the quality control testing when requested by the Owner.

1.3 Contractor responsibilities- Provide access to the work and furnish casual labor and facilities to accommodate inspections and tests. When tests fail to meet specified requirements, the Contractor shall arrange for retesting after conditions have been corrected. All retesting will be paid for by the Contractor.

1. GENERAL

The Contractor will be responsible for providing or arranging with utility companies for temporary service, facilities and controls during the construction period.

1.1 TEMPORARY UTILITIES

1.1.1 WATER - The Contractor will be responsible for locating a source of water supply, adequate for use for construction, drinking, sanitation, and fire protection purposes, and for all connections, distribution facilities, and costs associated connection to such supply. Owner will furnish construction and drinking water at no cost to the Contractor.

1.1.2 ELECTRIC POWER AND LIGHTING - The Contractor will be responsible for locating a temporary source of electrical energy for use during the construction period, and for providing needed power at the site.

1.1.3 The Contractor will provide necessary transformers or other equipment, make necessary connections and provide necessary distribution lines for use by all trades during construction at locations so that power can be secured at any working area with no more than 100-foot extension.

1.1.4 The Contractor will provide and maintain temporary lighting for safe and adequate working conditions throughout all work areas, enclosures and stairways during the construction period.

1.1.5 Temporary electrical work will meet the requirements of the National Electrical Code (NFPA 70), latest edition.

1.1.6 Disconnect and remove all temporary equipment and materials upon completion of construction or conversion to permanent system, and repair all damage caused by temporary installations.

1.2 TEMPORARY HEAT AND PROTECTION - Contractor will provide and maintain temporary enclosures, weather barriers, heat and ventilation as necessary to properly protect and cure all portions of the work, whether or not permanently incorporated into the Project, at all times during the construction period. The use of solid fuel burning space heaters, or use or leave unattended equipment or apparatus which might create an unsafe condition will not be permitted.

1.3 SANITARY FACILITIES - Contractor will provide and maintain, throughout Project duration, adequate temporary toilet facilities in a neat and sanitary condition for all employees and authorized visitors at the site. Place facilities at approved locations near the work.

2. EXECUTION

2.1 Provide and maintain temporary fences, barriers, lights, guardrails and barricades as indicated in the Contract Documents, or as necessary to regulate vehicular and pedestrian traffic, to secure the work and adjacent property and to protect persons and property. Obtain necessary approvals and permits and provide temporary expedients as necessary to accommodate controls.

2.2 Provide foot bridges not less than 4 feet wide with handrails and uprights of dressed lumber. Maintain brides in place as long as the conditions of the work require their use for safety of the public.

2.3 Maintain temporary road surfaces by patching potholes, eliminate rutting, maintaining drainage and other irregularities that restrict access.

2.4 Provide temporary dust control on unpaved surfaces such as temporary detours, driveways, haul roads and parking areas as necessary to minimize air pollution from construction activities.

A. CLEARING AND GRUBBING:

1. This item shall consist of the clearing and/or grubbing, including the disposal of materials for all areas within the construction limits of work reflected on the plans and any other areas designated on the plans.

2. Clearing shall consist of the removal of all trees, brush, stumps, logs, or other objects in the designated area(s).

3. Grubbing shall consist of the removal of all stumps, roots, buried logs, brush, grass, and other unsatisfactory materials to a depth of at least 18 inches unless the object if left would be detrimental to the purpose of the site in which case the object shall be totally removed to at least a depth which would not be detrimental to the purpose of the site.

4. Depressions left from the clearing and grubbing operations shall be filled using suitable fill material. The fill operation shall be done in six inch lifts and compacted to 95% of maximum as determined by the Standard Density Test (ASTM D698).

B. EXCAVATION AND EMBANKMENT:

1. This item shall consist of the excavation, placement, compaction, and disposal of earth materials within the project area to the lines and grades shown on the plans. The contractor shall remove and dispose of excess excavation off site or provide borrow material from off site, both at his expense.

2. All excavation and embankment shall be unclassified with respect to pay purposes and shall be included in the lump sum contract price including rock excavation.

3. Before beginning excavation, grading and embankment operations in any area, the area shall be completely cleared and/or grubbed.

4. The suitability of material to be placed in embankments shall be subject to approval by the Engineer. Fill directly under or within 5 feet of a proposed buildings shall have a plasticity index between 7 and 18 and shall be placed in 9 inch layers and compacted to 95% standard density test per ASTM D-968. All unsuitable material shall be suitably disposed of by the Contractor. Waste areas shall be graded to allow positive drainage of the area and adjacent areas.

5. If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures the contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the contractor shall notify the Engineer, who shall arrange for their removal if necessary. The contractor shall, at his/her own expense, satisfactorily repair or pay the cost of all damage to such facilities or structures which may result from any of the contractor's operations during the period of the contract.

6. The contractor shall provide drains, pumps, well points or other equipment as necessary to dewater the site as required to perform the sitework.

7. Rock in size or quantities such that a well compacted embankment cannot be achieved will not be permitted.

   Stones or rocks in excess of four inches in their greatest dimension shall not be permitted in the top 24 inches of fill.

8. Blasting operation when required shall be performed in accordance with Section 9 of the Associate General Contractors of America "Manual of Accident Prevention in Construction".

   When blasting is required the Contractor shall keep a record of each blast fired, the date, time, location, and amount of explosive used.

   Seismograph records may be required where structural damage to nearby structures is a concern.

9. When an embankment is to be constructed on an existing grade, all sod and vegetation shall first be removed and the cleared surface scarified to a depth of one foot and compacted to the same density as the fill to be placed.

10. The Contractor shall provide all necessary water and equipment to assure optimum moisture of fill material.

C. TOPSOIL:

1. This item shall consist of the furnishing and placement of topsoil on embankments, excavations or areas directly or indirectly disturbed by the project work. If sufficient topsoil is not available on site the contractor shall obtain topsoil from offsite.

2. Topsoil shall be the surface layer of soil with no admixture of refuse or material toxic or inhibitive to plant growth and shall be reasonably free of sub-soil, brush,

roots, rocks, clay lumps, or similar objects.

The topsoil used from on site or otherwise furnished shall have a pH range of 5.5 to 7.6 when tested in accordance with the "Methods of Testing" of the Association of Official Agricultural Chemists. The organic content shall be not less than 3% nor more than 20% as determined by the Wet Combustion Method (chronic acid reduction). There shall be not less than 20% nor more than 80% of the material passing the 200 mesh sieve as determined by the Wash Test in accordance with AASHTO T11.

3. Immediately prior to dumping and spreading topsoil, the surface shall be loosened by disc to a minimum depth of two inches. Prior to placing topsoil the area shall be cleared of rocks in excess of 1½ inches in one dimension and any other debris or trash.

4. Topsoil shall be spread evenly on the prepared areas to a uniform depth of three inches after compaction.

   Spreading shall not be performed when ground conditions are too wet or otherwise in a condition detrimental to the work.

   After spreading clods shall be broken up and rocks in excess of two inches, and any debris shall be removed.

   After spreading and debris removal is complete, the topsoil shall be compacted by rolling with a cultipacker.

D. SEEDING:

1. General:

   This item shall consist of seedbed preparation, furnishing and planting seeds in those areas topsoiled of this specification.

2. Materials and Construction Methods:

   a. Seed - Seed shall be furnished in sealed bags with each "lot" in separate bags even though mixtures may be called for in this specification. All labeling shall be intact and legible.

      The contractor shall furnish the Engineer one (1) copy of the invoices for the seed. The invoice shall describe each specie by name, variety, and treatment (hulled, scarified, etc.) if any.

Each lot of seed furnished shall have been sampled and tested by the Oklahoma State Board of Agriculture, and one (1) copy of the report shall be supplied the Engineer by the Contractor. Each seed test shall have been completed not more than nine (9) months prior to delivery of the seed. The information furnished in the seed report for a particular "lot number" shall agree with information appearing on the seed tags having the same "lot number".

The seed and tags shall not be removed from the original tagged and sealed bag until approved by the Engineer. After approval, the seed may be mixed, sacked and batched as required to facilitate planting, but shall be tagged for identification and weight. The mixing or batching shall be performed in the presence of the Engineer.

Seed or seed mixture shall be of seed meeting the following specification:

Seed	PLS *Index (Min.)	Purity Min. (%)	Germination Min. (%)	Weed Seeds Max. (%)
Bermuda Grass (Common, Hulled)	82	-	-	0.2
Fescue, Tall	80			0.5

* The P.L.S. (Pure Live Seed) Index shall be calculated from information given on the seed tag as follows:

PLS Index = % Purity x (% Germination + % Firm Seed)/100
The pounds of seed to be applied is stated as pounds of bulk seed.

Seed shall be applied by the method herein after stated at the following rates.

If seeding operations fall in the months of June, July, or August, the seed shall be common Bermuda grass applied at the rate of 1.5 pounds 1,000 square feet.

If seeding operations fall in the months of September or October seed shall be tall Fescue applied at the rate of 1.5 pounds 1,000 square feet.

No seeding operations shall be carried out in other months of the year with the exception of temporary rye grass seeding.

b. Fertilizer - Fertilizer shall be applied in liquid form with the seed at a concentration to provide the equivalent of a 10-20-10 commercial fertilizer applied at the rate of two hundred (200) pounds per acre.

c. Seeding - Seeding shall be carried out by hydraulic seeding methods utilizing a hydraulic seeder meeting the following minimum requirements.

1. This equipment shall be factory designed and built with sufficient pump capacity to apply specified quantities. The tank shall hold a minimum of 1,000 gallons and be equipped with a mechanical agitation system with an operating capacity sufficient to suspend and homogeneously mix the seed and water. The distribution hoses shall be large enough to prevent clogging and be equipped with spray nozzles that will provide even distribution on designated areas.

2. The equipment shall be mounted on a traveling unit which may be either self-propelled or pulled, capable of getting the tank and nozzles within sufficient proximity of the area to be seeded without the wheels operating on the areas to be seeded.

d. Mulching - In areas where the finished slope exceeds 3% the contractor shall hydromulch the area with wheat straw by adhesive spray methods which shall be applied at the rate of two tons per acre. The cost of mulching shall be included in the lump sum price.

A. DESCRIPTION OF WORK

This Section includes the following:

Preparation of subgrade for building slabs and foundation.

Grading, excavation and fill for the site and building pad shall be performed by the contractor to the grades indicated on drawings. The site plan shows approximate existing and proposed finish grades and elevations.

Granular base for support of building slabs is included as part of this work.

Excavating and backfilling of trenches for underground mechanical and electrical utilities and buried mechanical and electrical appurtenances.

Undercut areas of subgrade that are spongy and yielding as designated by the engineer.

B. DEFINITIONS

1. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

2. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer shall be at Contractor's expense.

3. Additional Excavation: When excavation has reached required subgrade elevations, notify Engineer, who will make an inspection of conditions. If Engineer determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Engineer.

4. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular subbase, granular base, or topsoil materials.

5. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

C. SUBMITTALS

1. Product data for the following:

   Each type of plastic warning tape.

   Vapor barrier.

2. Samples of the following:

   20-lb samples, sealed in air-tight containers, of each proposed fill and backfill soil material from on-site or borrow including granular base.

3. Test reports: In addition to test reports required under field quality control, submit the following:

   Laboratory analysis of each soil and base course material proposed for fill and backfill from on-site and borrow sources.

   One optimum moisture-maximum density curve for each soil material.

   Report of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.

D. QUALITY ASSURANCE

1. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

2. Retesting of work: When initial testing indicates unacceptable work or materials, retesting will be paid for by the Contractor until acceptable results are achieved.

3. Codes and Regulations: All operations shall conform to applicable local and state codes and regulations including OSHA requirements.

E. PROJECT CONDITIONS

1. Site Information: A soil and foundation investigation is attached to the specifications.

2. Existing Utilities: It is the Contractor's responsibility to locate existing underground utilities in areas of excavation work prior to beginning the excavation. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations. The Contractor shall notify the appropriate utility for field location of all utilities.

3. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

4. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.

5. Provide minimum of 48-hour notice to Engineer, and receive written notice to proceed before interrupting any utility.

6. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active.

7. Use of Explosives: Do not bring explosives onto site or use in work.

8. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

9. Operate warning lights as recommended by authorities having jurisdiction. Construction within street right-of-way may require an approved barricade and maintenance of traffic plan.

10. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

11. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

F. SOIL MATERIALS

1. It is acceptable to utilize the on-site soil materials for subgrade construction not indicated to be "backfill or fill" if the material can be successfully proof-rolled with a 20,000 pound pneumatic tired roller or loaded dump truck without excessive rutting or "pumping".

2. Granular Base Course: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100% passing a 3/4" sieve and not more than 5% passing a No. 4 sieve. Acceptable material will include coarse aggregate for concrete. Washed Concrete sand may also be used.

3. Backfill and Fill Materials: Soil materials having a liquid limit less than 45 free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter is designated "satisfactory" and may be used for backfill and fill material.

4. Subbase Material: Soil material designated "satisfactory".

5. Vapor Barrier: Vapor Barrier required under all interior concrete slabs on grade and where noted in Drawings shall be polyethylene sheet, 6 mil thickness conforming to ASTM E-154.

G. EXCAVATION

1. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

2. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.

3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer. If unsuitable bearing materials are encountered at required elevations, carry excavation deeper and replace excavated material as directed by Engineer.

4. Additional Excavation: When excavation has reached required subgrade elevations, notify Engineer who will make an inspection of conditions.

5. Stability of Excavations:

   a. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

   b. Shoring and Bracing: Establish requirements for trench shoring and bracing to conform with local codes and authorities having jurisdiction. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

6. Trench and Excavation Safety Systems

   a. Description: This section covers trench and excavation safety system required for constructing improvements that necessitate open excavations on the project. All work under this item shall be in accordance with the current edition of the "Occupational Safety and Health Administration Standard for Excavation and Trenches Safety System", 29 CFR 1926, Subpart P.

   b. Notifications Required: The Contractor, prior to beginning any excavation, shall notify the State Department of Labor (Safety Division) that work is commencing on a project with excavations greater than five feet.

   c. The Contractor shall notify all Utility Companies and Owners in accordance with OSHA Administration 29 CFR 1926.651(b) (2) for the purpose of locating utilities and underground installations.

   d. Existing Structures and Utilities: Where the trench or excavation endangers the stability of a building, wall, street, highway, utilities or other installation, the Contractor shall provide support systems such as shoring, bracing, or underpinning to ensure the stability of such structure or utility. The Contractor may elect to remove and replace or relocate such structures or utilities with the written approval of the Owner of the structure of utility and the Project Owner.

H. DEWATERING

1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area. No fill shall be placed in water or upon saturated soils.

2. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

3. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

I. STORAGE OF EXCAVATED MATERIALS

1. Stockpile excavated materials satisfactory for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage.

2. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

3. Dispose of excess excavated soil material and materials not satisfactory for use as backfill or fill.

J. EXCAVATION FOR STRUCTURES

1. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.

2. Excavations for footings and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

K. TRENCH EXCAVATION FOR PIPES AND CONDUIT

1. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches of clearance on both sides of pipe or conduit.

2. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

3. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6-inch layer of crushed stone or gravel prior to installation of pipe.

4. For pipes or conduit less than 6 inches in nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

5. For pipes and equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90 degrees (bottom 1/4 of the circumference). Fill depressions with tamped sand backfill. At each pipe joint, dig bell holes to relieve pipe bell of loads ensure continuous bearing of pipe barrel on bearing surface.

L. BACKFILL AND FILL

1. General: Place satisfactory soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified herein.

2. Under building slabs, Provide satisfactory soils over an acceptable subbase material and provide a granular base immediately under slabs.

3. Under piping and conduit and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom 90 degrees of cylinder.

4. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.

5. Backfill trenches for utility and piping as required for the area adjacent to the trench.

6. Do not backfill trenches until tests and inspections have been made and accepted. Use care in backfilling to avoid damage or displacement of pipe systems.

7. Backfill excavations as promptly as work permits, but not until completion of the following:

   a. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.

   b. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.

   c. Removal of concrete formwork.

   d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.

   e. Removal of trash and debris from excavation.

   f. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

M. PLACEMENT AND COMPACTION

1. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

2. Proof roll all existing soil areas under pavements, buildings and other structural site improvements with a 20,000 pound pneumatic tired roller or loaded dump truck. Areas which can be successfully proof rolled without excessive rutting or "pumping" are acceptable. Where proof rolling cannot be successfully accomplished, scarify and compact to stable condition. If stable condition cannot be achieved, notify Engineer.

3. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

4. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

5. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

6. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Engineer if soil density tests indicate inadequate compaction.

    a. Under pavements, and exterior slabs, compact the upper portion of the natural subgrade soils and fill material to not less than 95 % of maximum Standard Proctor dry density (ASTM D-698). Compact select fill layer to not less than 95% of maximum modified Proctor dry density (ASTM D-1557).

    b. Under structures and building areas, compact upper 8" of natural subgrade soils; fill and backfill materials (each layer) to 98 percent of maximum modified Proctor dry density (ASTM D-1557).

7. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.

8. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

N. GRADING

1. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

2. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding.

3. Surface of fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grade within a tolerance of 1/2 inch when tested with a 10-foot straightedge.

O. BUILDING SLAB BASE

1. General: Building slab base consists of placement of vapor barrier and granular base in layers of indicated thickness, over subgrade surface to support concrete building slabs. Where thickness is not indicated, provide 6 inches compacted thickness.

2. Placing: Place granular base material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Compaction shall be by powered or hand tampers to 98% maximum density and then install vapor barrier.

P. FIELD QUALITY CONTROL

1. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.

2. If in opinion of Engineer, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, additional compaction and testing shall be performed at the Contractor's expense until specified density is obtained.

Q. EROSION CONTROL AND STORM WATER CONTROL

Provide erosion control and storm water runoff control methods in accordance with requirements of local and state authorities having jurisdiction. All disturbed areas shall be sodded with Bermuda solid slab sod.

R. MAINTENANCE

1. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

2. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

3. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

4. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

S. DISPOSAL OF EXCESS AND WASTE MATERIALS

Remove trash, debris, and waste materials and dispose of it off Owner's property.

A. GENERAL:

1. Scope:

This item shall consist of furnishing and erecting a chain-link fence in accordance with these specifications at the location(s) shown on the plans.

2. Submittals:

Shop drawings and certificates of compliance shall be submitted for items under this specification.

B. MATERIALS:

1. Fabric:

The fabric shall be woven with a 9-gauge, galvanized steel wire in a 2-inch (50 mm) mesh and shall meet the requirements of ASTM A392, Class II.

2. Posts, Rails and Braces:

Posts, rails, and braces furnished shall be of zinc-coated steel pipe conforming to the requirements of ASTM A120, Schedule 40, except the hydrostatic testing requirement is waived. Galvanizing shall be in accordance with ASTM A123.

3. Gates:

Gate frames shall consist of galvanized steel pipe and shall conform to the specifications for the same material under paragraph 3. The fabric shall be of the same type material as used in the fence.

Gate widths shall be as called for on the plans in lieu of the dimensions reflected on the Detail attached hereto.

4. Wire Ties and Tension Wire:

Wire fabric ties, wire ties, and tension wire shall be of the same material identified with the fabric type. The tension wire shall be 7-gauge coiled spring wire coated similarly to the wire fabric.

Wire fabric ties shall be hog rings, aluminum wire, or galvanized steel wire not less than 9 gauge.

All material shall conform to Fed. Spec. RR-F-191/4.

5. Miscellaneous Fittings and Hardware:

Miscellaneous steel fittings and hardware shall be of commercial grade steel or better quality, wrought or cast as appropriate to the article, and sufficient in strength to provide a balanced design when used in conjunction with fabric, posts, and wires of the quality specified herein. All steel fittings and hardware shall be protected with a zinc coating applied in conformance with ASTM A153. Barbed wire support arms shall withstand a load of 250 pounds applied vertically to the outermost end of the arm.

6. Concrete:

Concrete shall be of a commercial grade with a minimum 28-day compressive strength of 2500 psi (13 700 kPa).

7. Marking:

Each roll of fabric shall carry a tag showing the kind of base metal, kind of coating, the gauge of wire, the length of fencing in the roll, and the name of the manufacturer. Posts, wire, and other fittings shall be identified as to manufacturer, kind of base metal, and kind of coating.

C. INSTALLATION:

1. Clearing Fence Line:

All trees, brush, stumps, logs, and other debris which would interfere with the proper construction of the fence in the required location shall be removed a minimum width of 2 feet (60 mm) on each side of the fence centerline before starting fencing operations. The material removed and disposed of shall not constitute a pay item and shall be considered incidental to fence construction.

2. Installation Posts:

All posts shall be set in concrete at the required dimension and depth and at the spacing shown on the plans.

The concrete shall be thoroughly compacted around the posts by tamping or vibrating and shall have a smooth finish slightly higher than the ground and sloped to drain away from the posts. All posts shall be set plump and to the required grade and alignment. No materials shall be installed on the posts, nor shall the posts be disturbed in any manner within 7 days after the individual post footing is completed.

Should rock be encountered at a depth less than the planned footing depth, a hole 2 inches (50 mm) larger than the greatest dimension of the posts shall be drilled to a depth of 12 inches (300 mm). After the posts are set, the remainder of the drilled hole shall be filled with grout, composed of one part portland cement and two parts mortar sand. Any remaining space above the rock shall be filled with concrete in the manner described above.

In lieu of drilling, the rock may be excavated to the required footing depth. No extra compensation shall be made for rock excavation.

3. Installation Top Rails:

The top rail shall be continuous and shall pass through the post tops. The coupling used to join the top rail lengths shall allow for expansion. Nine gauge fabric ties shall be spaced at twenty-four inch maximum centers.

4. Installing Braces:

Horizontal brace rails, with 5/16" dia. Diagonal truss rods and turnbuckles, shall be installed at all terminal posts.

5. Installing Fabric:

The wire fabric shall be firmly attached to the posts and braced in the manner shown on the plans. All wire shall be stretched taut and shall be installed to the required elevations. The fence shall generally follow the contour of the ground, with the bottom of the fence fabric no less than 1 inch (25 mm) or more than 4 inches (100 mm) from the ground surface. Grading shall be performed where necessary to provide a neat appearance.

At locations of small natural swales or drainage ditches and where it is not practical to have the fence conform to the general contour of the ground surface, longer posts may be used and multiple strands of barbed wire stretched thereon to span the opening below the fence. The vertical clearance between strands of barbed wire shall be 6 inches (150 mm) or less.

6. Tension Wire:

Tension wire shall be 7 gauge high carbon steel coil spring wire installed along the bottom of the fence approximately 6" above grade.

A. GENERAL REQUIREMENTS

1. Scope

a. This specification addresses the implementation of temporary measures and devices to control erosion of soil from construction activities into waterways and drainage system.

b. The contractor shall prepare a Stormwater Pollution Prevention Plan (SWP3), submit a Notice of Intent (NOI) to the Oklahoma Department of Environmental Quality (ODEQ), remit the necessary fee to ODEQ, and obtain written authorization to discharge stormwater from the ODEQ. Copies of the SWP3, NOI and authorization shall be submitted to the Engineer prior to the initiation of any construction activities.

c. When a Stormwater Pollution Prevention Plan (SWP3) is prepared, the provisions of the SWP3, which resulted in the issuance of an authorization to discharge from ODEQ, shall govern.

B. PRODUCTS

1. Materials

The following storm water pollution prevention control measures shall be installed where called for in the SWP3, as directed by the Engineer, or as conditions warrant.

a. Silt Fence

Silt fence shall consist of a geotextile fabric of either woven or non-woven polyester, polypropylene, stabilized nylon, polyethylene, or polyvinylidene chloride. The fabric shall be a minimum of 14 inches high and shall not exceed 28 inches in height measured from the installed ground elevation, and will have a minimum tensile strength of 120 pounds when tested according to ASTM D-4632.

b. Erosion Control Mat

Plastic erosion control mat shall consist of a loosely woven, flexible structure of nylon or vinyl monofilaments bonded into a three-dimensional mat. The mat will have a minimum thickness of 0.4 in. and a minimum tensile strength of 20 lb/ft when tested according to ASTM D-1682. The mat materials shall be resistant to environmental, chemical and ultra-violet ray degradation. The mat shall be Enkamat 7010, or equal.

c. Straw Bales

Straw bales shall be standard rectangular size, approximately 18"x20"x36", and shall be securely bound with wire.

d. Straw Mulch

The contractor shall install straw mulch as directed. Mulch shall be applied at the rate of 1½ tons per acre. Mulch shall be securely anchored in place.

C. EXECUTION

1. Installation

a. Silt Fence shall be constructed along the downstream side of the excavated area of the trench or stockpile material. It shall also be constructed at the top and/or toe of all slopes, where adjacent areas need protection from sediment laden run-off, or as directed by the engineer. Silt fences shall be supported by either steel or wood supports at intervals as specified by manufacturer's installation practices. Silt fences shall be removed once the disturbed area is permanently stabilized and no longer susceptible to erosion.

b. All erosion control mats shall be installed according to the manufacturer's specifications. The Contractor shall arrange for a manufacturer's representative to be present during installation if requested by the Engineer.

1. The erosion control mat shall be rolled down from the top of the slope on top of the topsoil. The mat will be firmly staked in place with either 8-11 gauge steel wire U-staples or wood stakes. The steel staples shall be driven a minimum of 8 in. into the ground and shall be left flush with the top of the mat. If wood stakes are used, they shall be driven a minimum of 12 in. into the ground and left no more than 1 in. above the mat surface.

2. Mats shall be overlapped a minimum of 3 in. on the sides and 12 in. when joining one roll with another. The uphill roll shall always be left on top when joining two rolls on a slope. Stakes shall be placed at 3-ft 5-in. intervals along the side overlaps of each roll. Two stakes shall be placed in each joint with another roll.

3. A minimum of 1 in. of topsoil mixed with seed will be placed on the installed mat and worked into the voids of the mat.

4. Topsoil need not be placed under the fabric/grout type erosion control map.

c. Rows of straw bales shall be placed at 500 foot intervals on relatively flat grades and 200 foot intervals on grads over 5% along the downstream side of the excavated area of the trench or stockpile material. Bales shall be firmly anchored with wood or metal stakes approximately 3 feet long. A sediment sump shall be placed immediately upstream of each bale. Contractor shall clean and maintain sediment sumps throughout the maintenance period. Straw bales shall be removed once the disturbed area is permanently stabilized

2. Stabilization

The following stabilization practices and structural practices will be incorporated as short and long term goals in providing proper controls to minimize and/or eliminate storm water pollution to the receiving waters.

a. Temporary Stabilization

Topsoil stockpiles and disturbed portions of the site where construction activity temporarily ceases for at least 21 days will be stabilized with temporary seed and mulch no later than 14 days from the last construction activity in that area. The temporary seeding shall be Rye (grain) applied at the rate of 120 pounds per acre. Prior to seeding, 870 pounds of 10-20-10 fertilizer shall be applied to each acre stabilized. After seeding, each area shall be mulched with 4,000 pounds per acre of straw. The straw mulch is to be tacked into place by a disk with blades set nearly straight.

b. Permanent Stabilization

Disturbed portions of the site where construction activities permanently cease shall be stabilized as directed by plans and specifications no later than 14 days after the last construction activity.

3. Controls

a. Storm Water Management

The storm water drainage shall not be impacted by construction activities. All disturbed areas which are not paved (street, sidewalk or parking) shall be regarded to match existing grades and have permanent sodding or mulch seeding.

b. Waste Materials

All waste materials shall be collected and stored in a securely lidded metal dumpster rented from a licensed solid waste management company. The dumpster will meet all local and any state solid waste management regulations. All trash and construction debris from the site shall be deposited in the dumpster. The dumpster shall be emptied in a minimum of twice per week or more if necessary, and the trash shall be hauled to an approved landfill. No construction materials shall be buried onsite. The contractor's onsite representative (the individual who manages the day to day operations) shall be responsible for seeing that these practices are followed.

c. Hazardous Waste

All hazardous waste materials shall be disposed of in a manner specified by local or state regulation or by the manufacturer. Site personnel shall be instructed in these practices and the contractor's onsite representative shall be responsible for seeing that these practices are followed.

d. Sanitary Waste

All sanitary waste shall be collected from the portable units a minimum of three times per week by a licensed sanitary waste management contractor, as required by local regulation.

e. Offsite Vehicle Tracking

Pavement adjacent to any activity shall be swept daily to remove any excess mud, dirt, or rock tracked from the construction site. Dump trucks hauling material from the construction site shall be covered with a tarpaulin.

f. Site Discharges

Only storm water and non-storm water discharges associated with construction activities will be permitted. Non=storm discharges shall include pavement wash-waters (where no spills or leaks of toxic or hazardous material have occurred) and uncontaminated groundwater (from dewatering excavation). No other industrial activity discharges will be permitted.

4. Maintenance/Inspection and Control Procedures

The following are the inspection and maintenance practices that will be used to maintain erosion and sediment controls.

a. Inspection

All control measures will be inspected at least once each week and following any storm event of 0.5 inches or greater.

b. Maintenance

All measures shall be maintained in good working order, if a repair is necessary, it will be initiated within 24 hours of report.

c. Sediment Removal

Built up sediment will be removed from the silt fence and straw bales when it has reached one-third the height of the structure.

d. Straw Bales

Straw bales will be inspected for deterioration, washout, movement, and sediment depth. Deteriorated bales will be removed and replaced as needed.

e. Silt Fence

Silt fence will be inspected for depth of sediment, tears, and proper installment to see if the fabric is securely attached to the fence posts and wires, and to see that the fence posts are firmly anchored in the ground.

f. Seeding

Temporary seeding will be inspected for bare spots, washouts, and healthy growth.

g. Inspectors

The contractor's on-site representative will select three individuals who will be responsible for inspections, maintenance and repair activities.

h. Training

Personnel selected for inspection and maintenance responsibilities will be trained in all necessary maintenance practices necessary for keeping the erosion and sediment controls used onsite in good working order.

5. Material Management Practices

The following are the practices that will be used to reduce the risk of spills or other accidental exposure of material and substances to storm water runoff during the construction project.

a. Storage

The following requirements shall be met for the storage of products used during the work.

1. An effort will be made to store only enough product required to do the job.

2. All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.

3. Products will be kept in their original containers with the manufacturer's label.

b. Mixing Substances

Substances will not be mixed with others unless recommended by the manufacturer.

c. Disposal

The following requirements shall be met relative to the disposal of products used during the work.

1. Whenever possible, all of the product will be used before disposing of the container.

2. Manufactuer's or local and state recommended methods and sites for disposal will be followed if surplus product must be disposed of.

d. Inspection

The contractor's on-site representative will inspect daily to ensure proper use and disposal of materials on site.

e. Hazardous Materials

Products will be kept in original containers unless they are not re-sealable.

1. Original labels and material safety data will be retained.

2. If surplus product must be disposed of, manufacturers or local and state recommended methods and sits for proper disposal will be followed.

6. Product Specific Practice

The following product specific practices will be followed onsite.

a. Petroleum Products

All onsite vehicles will be monitored for leaks and receive regular preventative maintenance to reduce the chance of leakage. Petroleum products will be stored in tightly concealed containers which are clearly labeled. Any asphalt substances used onsite will be applied accordingly to the manufacturers directions.

b. Fertilizers

Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizers will be worked into the topsoil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.

c. Paints/Epoxies

All containers will be tightly sealed and stored when not required for use. Excess paint or epoxies will not be discharged to the storm sewer system but will be properly disposed of according to manufacturer's instructions or state and local regulations.

A. GENERAL

1. Description

a. This section includes demolition and removal of buildings, treatment structures and other structures shown on the plans.

2. Protection

a. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures.

b. Provide safeguards, including warning signs, barricades, temporary fences, and other similar items that are required for protection of all personnel during demolition and removal operations.

c. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

d. Prevent spread of particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to; ice, flooding, or pollution.

e. In addition to previously listed fire and safety rules to be observed in performance of work, including following:

1. No wall or part of wall shall be permitted to fall outwardly from structures.

2. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.

f. Before beginning any demolition work, the contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to

remain in place or to be reused, and any damaged items shall be repaired or replaced. The contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Provide new supports and reinforcement for existing construction weakened by demolition or removal works.

B. PRODUCTS (NOT USED)

C. EXECUTION

1. Demolition

   a. Refer to plan sheets for scope of demolition work and demolition notes.

2. Clean-Up

   a. On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Owner. Clean-up shall include disposal of all items and materials not required to remain property of the Owner as well as all debris and rubbish resulting from demolition operations.

   b. Topsoil, seed, and fertilize disturbed and restored areas per sitework specifications.

A. GENERAL

1. Standards:

   Concrete work shall conform to all requirements of ACI 301 "Specifications for Structural Concrete for Buildings", ACI 318 "Building Code Requirements for Reinforced Concrete" except as modified herein. All ASTM and ACI Standards shall be the latest editions.

2. Scope:

   Work consists of furnishing all plant, labor, materials, equipment and appliances, and performing all operations in connection with installation of the concrete work, complete, in strict accordance with the Specifications and Drawings.

3. Inspection:

   Embedded items must be inspected and tests for concrete and other materials shall have been completed and approved by the Engineer before concrete is placed.

4. Slab on Earth:

   Before proceeding to construct concrete slabs on earth, all pipes under concrete floor on earth shall have received the required tests. All backfill and fill material under slabs on grade shall be compacted in 6" layers to 95% maximum density as measured by AASHTO T99 test method. Unsuitable material encountered in subgrade shall be removed and replaced with material approved by the Engineer. Subgrade shall be brought to true, even plane and compacted to solid bearing. Gravel drainage fill shall be placed and compacted where shown on Drawings.

B. MATERIALS

All concrete materials shall conform to the latest revised ASTM Designations listed below and shall be subject to the approval of the Engineer:

1. Coarse Aggregate shall be crushed stone conforming to ASTM C-33 with a maximum size of 1".

2. Fine Aggregate shall conform to ASTM C-33 and shall be washed river sand composed of clean, uncoated grains of strong materials.

3. Cement shall be Portland cement conforming to ASTM Specification C-150, Type I, Type IA, Type III, or Type IIIA. Only one brand of cement shall be used for exposed concrete.

4. Water: Clean, fresh and free from oil, acids, alkali, vegetable, sewage, organic or other deleterious matter.

5. Cement reducing admixture may be used for all concrete at the contractor's option. Admixture shall be a cement dispersing agent used in conformance with manufacturer's directions. This shall be, or equal to, "No. 3 Pozzolith", as manufactured by Master Builder's Co. Contractor shall notify Engineer that he is taking this option. No other admixtures shall be used without the written permission of the Engineer.

6. Air-Entraining Admixtures shall conform to ASTM C-260.

7. Premolded Expansion Joint Filler Strips shall be non-extruding type conforming to the current AASHTO Designation M213.

8. Non-Shrink Grout shall be Pre-mixed "Embeco" as manufactured by Master Builder's, "Ferrolith G" as manufactured by Sonneborn-Contech, or approved equal. Type as recommended by the manufacturer for the particular applications.

9. Liquid Curing Compound/Sealer shall be "MC 429" as manufactured by Master Builder's, "Kure-N-Seal" as manufactured by Sonneborn-Contech, "Thompson's Water Seal" as manufactured by E. A. Thompson, Inc. or approved equal.

10. Granular Drainage Fill: Required under all interior building concrete slabs on grade and where noted on the drawings. It shall be either:

    a. Clean, washed gravel with particle sizes grading from maximum of 1" down to not more than 5% passing a No. 4 sieve.

    b. Clean, washed coarse sand with particular sizes ranging from pea gravel down to largest grains permitted in concrete sand.

11. Joint Waterproofing for existing structures or as required on the plans shall be Ironite (Metallic) Waterproofing as manufactured by the Ironite Company of Chicago, Illinois or approved equal.

12. Vapor Barrier required under all interior concrete slabs on grade and where noted in drawings shall be polyethylene sheet, 6 mil thickness conforming to ASTM E-154.

13. Liquid Chemical Hardener shall be the magnesium fluosilicate and zinc fluosilicate type "Lapidolith" as manufactured by Sonneborn-Contech, Inc., "Symons Quad Cure" as manufactured by Symons Corp., "Hornolith" as manufactured by W. R. Grace & Co., or approved equal.

14. Cementitious Waterproofing and Finish Compound shall be "Thoroseal Plaster Mix" with "Acryl 60" as manufactured by Standard Dry Wall Products or approved equal.

C. QUALITY AND CONTROL

1. Design:

Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate and water. All concrete shall be designed by an independent testing laboratory, approved by the Engineer, in accordance with the A.C.I. Standard "Recommended Practice for Selecting Proportions for Concrete" (ACI 211) to produce the strength for each class of concrete specified, and with slumps and maximum sizes of coarse aggregate in accordance with the requirements outlined below. The concrete shall be so designed that the concrete materials will not segregate and excessive bleeding will not occur. Submit laboratory trial mix designs and test results for each class of concrete to be used to the Engineer for approval before any concrete is placed. Any costs of the testing laboratory for designing concrete mixes shall be borne by the Contractor. Concrete strengths shall be as follows:

Class A Concrete - 4000 psi minimum @ 28 days (Air entrained) - six (6) sacks cement minimum

Class B Concrete - 3000 psi @ 28 days - five (5) sacks cement minimum

Class C Concrete - 2000 psi @ 28 days

Class D Concrete - 3000 psi @ 28 days (3/8" Max. Aggregate Size "Pea Gravel")

MAXIMUM SLUMPS FOR VARIOUS
TYPES OF CONSTRUCTION

Types of Construction	Hand Placed Maximum	High Frequency Vibrator Used - Maximum
Reinforced Foundation, Walls & Footings and Base Slabs of Tanks	5"	3"
Slabs, Beams and Reinforced Walls	6"	5"
Building Columns	5"	5"
Pavements	3"	3"

The slump shall not exceed the maximum specified above for the type of construction for which it is to be used. The 28 day compressive strength determined in accordance with current ASTM Specifications C-39 and C-31 and with specimens cured in accordance with C-31 shall not be less than that shown above for the specified class of concrete. No water will be added after the amount specified by the mix design.

2. Production of Concrete:

All ready-mix concrete shall be batched, mixed and transported in accordance with "Specifications for Ready-Mixed Concrete (ASTM C-94)". Plant equipment and facilities shall conform to the "Check List for Certification of Ready-Mixed Concrete Production Facilities" of the National Ready-Mixed Concrete Association. Site mixed concrete shall conform to the requirements of "Specifications for Structural Concrete" (ACI 301). The Contractor may elect to use either ready-mixed or site mixed concrete for this project provided he informs the Engineer of his choice.

3. Laboratory Testing:

The Owner shall engage an independent testing laboratory to conduct concrete tests. The laboratory shall be responsible for sampling concrete for test cylinders, recording, and delivering them to the laboratory, providing all materials required, and for making all slump tests in the field directed by the Engineer. All costs in connection with work performed by the laboratory will be paid by the Owner. The Contractor shall be responsible for the costs of work performed by the laboratory required for redesign of concrete proportions and additional testing of in place concrete when cylinders indicate low strength concrete has occurred.

At least one test shall be made on fresh concrete for each sixty (60) cu. yds. of each class of concrete (or fraction thereof) placed on any one day and in any event, not less than one test for each class of concrete each day it is used. Testing shall be done in accordance with the following ASTM Specifications, latest edition:

C172- Standard Method of Sampling Fresh Concrete

C31 - Standard Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Field

C39 - Standard Method of Test of Compressive Strength of Molded Concrete Cylinders

C143- Standard Method of Slump Test for Consistency of Portland Cement Concrete

Before any concrete is poured, the Contractor shall construct a storage box in accordance with ASTM Specification C31. Each set of tests shall consist of one slump test and four compression test cylinders. All cylinders shall be kept in the storage box for the first 24 hours. The four cylinders shall be laboratory cured and tested for adequacy of the design for strength of the concrete in accordance with ASTM Specification C31. One cylinder shall be tested at 7 days and two at 28 days.

The fourth cylinder will be retained for subsequent testing if required by the Engineer.

4. Failure of Concrete to Meet Strength Requirements: The concrete shall be considered acceptable if, for any one class of concrete, the average of all tests of any five consecutive sets is equal to or greater than the specified strength, provided that no more than one test in ten falls between 90% and 100% of the specified strength. The only cylinders to be used for determination of concrete acceptability will be those laboratory cured and tested at 28 days. When it appears the tests of laboratory-cured cylinders will fail to meet these requirements, the Engineer may require changes in the proportions of concrete for the remainder of the work in order to meet the strength requirements. In addition, the Engineer may also require additional curing on portions of the concrete already poured.

The Engineer may also require tests in accordance with Methods of Securing, Preparing and Testing Specimen from Hardened Concrete for Compressive and Flexural Strengths (ASTM Specifications C42) when the concrete cylinder tests fail to meet strength requirements. In the event there still is question as to the quality of the concrete in the structure, the Engineer may require load tests for that portion where the questionable concrete has been placed. Such load tests will be made as outlined in American Concrete Institute Building Code, (ACI 318), and shall be at the expense of the Contractor. In-place testing shall be at the expense of the Contractor.

5. Removal of Under Strength Concrete: If the above tests indicate that a particular batch of previously placed concrete is under strength, the Engineer may direct that the under strength batch be removed and replaced. The removal of the under strength concrete shall also include the removal of concrete that has obtained the required strength if the Engineer deems this necessary to obtain structural or visible continuity when the concrete is replaced.

   The removal, and replacement of any under strength concrete, shall be made at no additional cost to the Owner. This shall include any new formwork required or any reinforcing steel that may be required. The Owner shall not be charged any additional costs for any extra work that is required because of the failure of any concrete to meet the minimum test requirements.

6. Concrete Strengths: The various strengths of concrete shall be installed as follows:

   a. Class A, 4000 psi, Air-Entrained shall be used for all liquid containing structures, (footings, base slabs, walls and roofs.)

   b. Class B, 3000 psi shall be used for all non-liquid containing structures.

   c. Class C, 2000 psi shall be used for all non-structural fill concrete, mud slabs, over excavation concrete, etc.

   d. Class D, 3000 psi pea gravel concrete (maximum aggregate size of 3/8") shall be used for all masonry fill, masonry columns, and masonry bond beams.

D. INSTALLATION

1. Preparation Before Placing:

Water shall be removed from excavations before concrete is deposited. Hardened concrete, wood chips, shavings, and other debris shall be removed from interior of forms and inner surfaces of mixing and conveying equipment. Wood forms shall be oiled or, except in freezing weather, wetted with water in advance of pouring. Reinforcement shall be secured in position, inspected and approved by the Engineer before starting pouring of concrete.

2. Conveying:

Concrete shall be conveyed from mixer to forms as rapidly as practicable and by methods which will prevent segregation or loss of ingredients. It shall be deposited as nearly as practicable in its final position. Chutes used shall be such that concrete slides in them and does not flow. Chutes, if permitted, shall have a slope of less than 1 on 2. Where a vertical drop greater than five (5) feet is necessary, placement shall be through elephant trunks or similar devices to prevent segregation. Ready-mixed concrete shall be delivered with a load ticket showing mix proportions and the time mixing began for each load. The load ticket shall be furnished to the Engineer.

3. Placing:

Concrete shall be placed before initial set has occurred and in no event after it has contained its water content for more than 30 minutes for site mixed concrete or 1 hour for ready-mixed concrete. Unless otherwise specified, all concrete shall be placed upon clean, damp surfaces free from running water, or upon properly consolidated fills, but never upon soft mud or dry, porous earth. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section.

If a section cannot be placed continuously, provide construction joints as herein specified. The concrete shall be compacted and worked in an approved manner into all corners and angles of the forms and around reinforcement and embedded fixtures as to prevent segregation of the coarse aggregate. Construction of forms for the lifts of vertical walls shall be such as to make all parts of the walls easily accessible for the placement, spading, and consolidation of the concrete as specified herein.

4. Vibration:

All concrete shall be placed with the aid of mechanical vibration equipment as approved by the Engineer. Vibration shall be transmitted directly to the concrete; in no case shall it be transmitted through forms. The duration of vibration at any location in the forms shall be held to the minimum necessary to produce thorough compaction. Vibrations shall be supplemented by forking or spading by hand, and adjacent to the forms on exposed faces in order to secure smooth, dense and even surfaces, with particular care being taken to prevent coarse aggregate from becoming set too near any surfaces that are to receive rubbed finish.

5. Construction Joints:

Construction joints shall be formed as indicated on the drawings or as approved or directed by the Engineer. Contractor shall submit a joint location plan for each structure to the Engineer for approval 28 days prior to commencing concrete operations on that structure. Where indicated or required, dowel rods shall be used. All concrete at the joints shall have been in place not less than 12 hours, and longer if so directed by the Engineer, before concrete resting thereon is placed. Before placing is resumed, or commenced, excess water and latence shall be removed, and concrete shall be cut away, where necessary, to insure a strong dense concrete at the joint. In order to secure adequate bond, the surface of concrete already in place shall be cleaned, roughened, and then spread with a one-half (½) inch layer of mortar of the same cement-sand ratio as is used in the concrete, immediately before the new concrete is deposited. The unit of operation is not to exceed 40 feet in any horizontal direction, unless otherwise required by the Drawings. Construction joints, if required, shall be located near the mid-point spans for slabs, beams or girders. Joints in columns or piers shall be made at the underside of the deepest beam or girder at least five (5) hours before any overhead work is placed thereon. Joints not shown or specified shall be so located as to least impair strength and appearance of work. Vertical joints in wall footings shall be reduced to a minimum. Placement of concrete shall be at such a rate that surfaces of concrete not carried to joint levels will not have attained initial set before additional concrete is placed thereon.

Girders, beams and slabs shall be placed in one operation. To insure a level straight joint in exposed vertical surfaces, a strip of dressed lumber may be tacked to the inside of the forms at the construction joint. The concrete shall be poured to a point one (1) inch above the underside of the strip. The strip shall be removed one (1) hour after concrete has been placed and any irregularities in the joint line leveled off with a wood float and all latence removed. Waterstops shall be installed in all construction joints below grade or in liquid containing structures

as noted on the Plans. Install as per SECTION 3.3, CONSTRUCTION JOINTS, EXPANSION JOINTS, & WATERSTOPS.

6. Patching:

Any concrete which is not formed as shown on the Plans, or for any reason is out of alignment or level or shows a defective surface shall be considered as not conforming with the intent of these Specifications and shall be removed from job by Contractor at his expense, unless the Engineer grants permission to patch defective area, which shall be done in accordance with the following procedure. Permission to patch any such area shall not be considered a waiver of the Engineer's right to require complete removal of defective work if patching does not, in his opinion, satisfactorily restore quality and appearance of surface. Suitable non-shrink, latex or epoxy mortar shall be used for patching and repairing defective surface if permitted by the Engineer.

After removing forms, all concrete surfaces shall be inspected and any poor joints, voids, stone pockets, all tie holes, or other defective areas shall be patched, if permitted by the Engineer. Where necessary, defective areas shall be chipped away to a depth of not less than one (1) inch with edges perpendicular to the surface. Area to be patched and a space at least six (6) inches wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar. A grout of equal parts Portland cement and sand, with sufficient water to produce a brushing consistency, shall then be well brushed into the surface followed immediately by the patching mortar. The patch shall be made of the same material and of approximately the same proportions and shall not be richer than 1 part cement to 3 parts sand. White Portland cement shall be substituted for a part of the gray Portland cement to match color of the surrounding concrete. The proportion of white and gray cements shall be determined by making a trail patch. The amount of mixing water shall be as little as consistent with the requirements of handling and placing. The mortar shall be retempered without the addition of water by allowing it to stand for a period of one (1) hour during which time it shall be mixed occasionally with a trowel to prevent setting.

The mortar shall be thoroughly compacted into place and screened off so as to leave patch slightly higher than surrounding surface. It shall then be left undisturbed for a period of 1 to 2 hours to permit initial shrinkage before being finally finished. The patch shall be finished in such a manner as to match the adjoining surface. On surfaces where unlined forms have been used, the final finish shall be obtained by striking off the surface with a straightedge spanning the patch and held parallel to the direction of the form marks.

Tie holes left by withdrawal of rods or the holes left by removal of ends of ties shall be filled solid with mortar after first being thoroughly wetted.

E. SLAB FINISHES

1. Exterior Concrete Walks:

After thoroughly consolidating the concrete the top surface shall be struck off with a straight edge and tamped or vibrated sufficiently to bring mortar to the surface. Finish with a wood float to a smooth, even surface and lightly broomed to provide "slip resistant" surface. Edges shall be rounded with a 1/4" radius.

2. Interior slabs to receive grout fill or mortar setting bed shall be finished by tamping concrete with special tools to force coarse aggregate below the surface, and screened with straightedges to bring surface to finish plane with a tolerance not exceeding 1/8" in 2 feet. Surface shall be left roughened sufficiently to produce good bond with topping material. Use stiff brushes, brooms or rakes as necessary to provide 1/8 inch deep grooves at maximum of ½ inch on center.

3. Top and bottom slabs of all structures and water carrying conduits except as noted otherwise on the Plans shall be finished as follows: The top of the slab shall be screened to grade and cross section; lightly tamped as required to bring up a good bed of mortar for finishing and re-screened as necessary. The surface shall then be finished with a wood float and leveling darby. No further finish will be required on top slabs of structures or conduits which are to be buried. In the case of all exposed top slabs of structures and conduits, they shall be given a final wood float and a lightly broomed, slip resistant finish to a uniform surface which conforms with accuracy to required shape, slope and grade. Slabs shall be edged as appropriate. No liquid hardener is to be applied to these surfaces.

4. Interior floor slabs that are not to receive any finish floor covering shall be "slip resistant finish" as follows: The top surface shall be steel troweled and have a final finish applied by brushing lightly with a soft bristle brush to form a slightly roughened surface.

5. Liquid Hardener shall be applied to the floors where scheduled to be exposed concrete. Concrete surfaces to be treated must be thoroughly set and dry, clean and free of dust. Three applications of the liquid hardener are required, using one gallon per 100 square feet for the complete treatment. Apply hardener strictly according to the manufacturer's printed instructions. Liquid floor hardener is not required when a minimum of two (2) coats of Thompson's Waterseal or equal has been used as a curing and/or separating compound. Submit material and method to be used for Engineer's approval.

F. FINISH OTHER THAN SLABS

1. All top surfaces, other than slabs, not covered by forms, and which are not to be covered by additional concrete or fill shall receive a wood float finish without additional mortar. Care shall be taken that no excess water is present when the finish is made. Other surfaces shall be brought to finished elevations and left true and regular. All exposed top surface interior concrete shall be grouted smooth and given a cement wash of one part light colored Portland cement and two parts fine aggregate mixed with water to consistency of thick paint. Grout shall be cork or wood floated to fill all pits, air bubbles, and surface holes. Excess grout shall be scraped off with a trowel and rubbed with burlap to remove any visible grout film. Surface shall be kept damp during setting period. The finish for any area shall be completed in the same day and the limits of a finished area shall be made at natural breaks in finished surface. Painting of exposed-to-view concrete surfaces is specified under SECTION 9.1 - PAINTING of these Specifications.

2. Rubbed Finish:

   Unless otherwise indicated, all faces (except top surfaces of slabs) exposed to view, such as walls, grade beams, columns, beams, walls of water carrying conduits to a point 1'-0" below normal water level, canopy soffits and fascias, etc. shall be finished as follows:

   Forms shall be removed, as specified in SECTION 3.4 - CONCRETE FORMWORK, and all fins removed, off-sets leveled, damaged places and depressions resulting from the removal of metal ties or other causes shall be carefully pointed with a mortar of sand and cement in the proportion which has been employed for the particular class of concrete treated. The surface film of all such pointed places shall be carefully removed before setting occurs. After the point has set sufficiently to permit it, all exposed surfaces shall be dampened and rubbed with a No. 16 Carborundum stone, to a smooth even plane. Final rubbing shall be done with a No. 30 Carborundum stone, or an abrasive of equal quality, to obtain an entire surface of a smooth texture and uniformity in color. Mortar or grout worked up during rubbing shall be promptly removed by sacking with burlap or other suitable means so that no visible grout film or paste will remain. A cement wash or plaster coat shall not be used. All surfaces shall be finished uniformly smooth and washed clean. The rubbed finish for any area shall be completed in the same day and the limits of a finished area shall be made at natural breaks in the finished surface. If the Contractor does not provide suitable surface finish using Carborundum stones specified above, the Engineer, without additional cost to the Owner, may require the use of a power operated grinding machine or other methods to produce the desired finish.

3. Cementitious Waterproofing and Finish:

As an option to the rubbed finish, as specified herein, all faces (except top surfaces of slab) exposed to view, such as walls, grade beams, columns, beams, canopy soffits and facias, etc., shall be finished using "Thoroseal" coating or approved equal as described in the following paragraphs.

a. General

Forms shall be removed, as specified in SECTION - CONCRETE FORMWORK, and all fins removed, off-sets leveled, damaged places and depressions resulting from the removal of metal ties or other causes shall be carefully pointed with a mortar of sand and cement in proportion which has been employed for the particular class of concrete treated. The surface film of all such pointed places shall be carefully removed before setting occurs. After the point has set sufficiently to permit it, all exposed surfaces shall receive the following treatment.

b. Mixing

Thoroseal plaster mix shall be prepared using a solution composed of not less than one part Acryl 60 (approximately two quarts Acryl 60 per bag) and three parts of clean, potable water (for ceilings, use 1 part Acryl 60 to 2-1/2 parts of the water). This solution shall then be added to the Thoroseal plaster mix slowly in sufficient quantity so that the mixture is the consistency of a heavy batter suitable for application by method specified. Color to be selected by the Owner.

c. Application

At Contractor's option, one of the following methods of application shall be selected:

1. Sprayed-on finish should be applied with plaster-type spray gun, not high pressure paint type. Spray on evenly distributed coat of Thoroseal plaster mix. To spot-fill deep holes, float or brush first coat before starting second spray application.

Thoroseal plaster mix shall be applied on average surfaces in two coats at the rate of 5 to 6 lbs. per square yard for concrete walls, 6 to 9 lbs. per square yard for masonry walls; but sufficient material shall be applied to fill all holes and voids.

2. Trowel and float finish - Apply light trowel coat of Thoroseal plaster mix over entire surface to be treated. The workman shall make sure the material is firmly pressed into all voids and leveled. Allow this coat to cure thoroughly before applying the regular trowel application. When surface is set so it will not roll or lift, float uniformly using a sponge float.

   Thoroseal plaster mix shall be applied on average surfaces at the rate of 4 to 6 lbs. per square yard for concrete walls, 6 to 9 lbs. for masonry walls. If concrete is rough or untrue, 6 to 9 lbs. per square yard may be required, but sufficient material shall be applied to fill and seal all pores and voids. This application will be approximately 1/8" thick. Leveling uneven surfaces will require more material per square yard.

   To prevent shadowing of struck or deep masonry joints, or areas of unequal absorption (like some form marks), after key coat has cured for 5 days, apply a light trowel coat of Thoroseal plaster mix with Acryl 60 in the mixing water over the entire surface to be treated. Allow this coat to set thoroughly before applying the regular trowel application as outlined above.

   Do not apply when temperatures are 40°F or due to fall below 40°F within 24 hours or to frozen or frost-filled surfaces.

G. CURING

1. General:

   Immediately following placing, all Class A and Class B concrete shall be protected from premature drying, hot and cold temperatures, rain, flowing water and mechanical injury. Maintain above 50°F and in moist condition for at least seven (7) days after placing for normal concrete and three (3) days for high early strength concrete. Comply with "Recommended Practice for Curing Concrete" ACI 308, unless otherwise indicated. Curing compound of satisfactory composition and characteristics may be used except on surfaces to which new concrete is to be bonded or surfaces scheduled to be painted or to receive other coating and provided such compound does not stain or discolor any surface which will be exposed. Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

2. Cold Weather Procedures:

Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306, "Cold Weather Concreting", and as herein specified.

a. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50°F, and not more than 80°F at point of placement.

b. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

c. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

d. Contractor shall obtain and keep on the Project site a copy of the current edition of ACI 306, "Recommended Practice for Cold Weather Concreting", for reference during all concrete operations in cold weather.

3. Hot Weather Procedures:

When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305, "Hot Weather Concreting", and as herein specified.

a. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing.

b. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

c. Wet forms thoroughly before placing concrete.

d. Do not use retarding admixtures unless otherwise accepted in mix designs.

e. Contractor shall obtain and keep on the project site a copy of ACI 305R, "Hot Weather Concreting" for reference during all concreting operations in hot weather.

4. Protection from the Sun:

All concrete shall be adequately protected from injurious action of sun in a manner satisfactory to the Engineer.

5. Temperature Control:

During and at the conclusion of the specified curing period, means shall be provided to insure that the temperature of the air immediately adjacent to the concrete does not fall more than 3°F in any 1 hour nor more than 30°F in any 24 hours.

H. NON-SHRINKING GROUT

Where non-shrinking grout is called for on the Plan, it shall be mixed in strict accordance with the manufacturer's directions. It shall be of a type as recommended by the manufacturer for the particular application.

A. SCOPE

The extent of concrete reinforcement is shown on the drawings and in schedules.

The work includes fabrication and placement of reinforcement for cast-in-place concrete, including bars, welded wire fabric, ties and supports.

B. QUALITY ASSURANCE

1. Codes and Standards:

Comply with requirements of the latest edition of the following codes and standards, except as herein modified:

American Welding Society (AWS), AWS D1.4 "Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction".

Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice". (Current Ed.)

American Concrete Institute (ACI), ACI 318 "Building Code Requirements for Reinforced Concrete".

2. Mill Certificates; Concrete Reinforcement:

Submit steel producer's certificates of mill analysis, tensile and bend tests for reinforcing steel.

C. DELIVERY, HANDLING AND STORAGE

Deliver reinforcement to the project site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or excessive rust.

D. MATERIALS

1. Steel reinforcement shall conform to the "Specification for Deformed Billet Steel Bars for Concrete Reinforcement," ASTM A615, Grade 60.

2. Wire fabric reinforcement shall conform to the current "Specifications for Welded Steel Wire Fabric for Concrete Reinforcement," ASTM A-185, or "Specifications for Welded Deformed Steel Wire Fabric for Concrete Reinforcement," ASTM A-497.

3. Supports for Reinforcement shall be bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place. Use only wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.

E. SPLICES

No splices of bars, except when shown on the Plans, will be permitted without the approval of the Engineer. Minimum lap splice shall be 48 bar diameters unless specifically detailed or noted otherwise on drawings. Splices in adjacent bars shall be staggered a minimum distance equal to the lap splice length. Bars shall be rigidly clamped or wired at all splices in a manner approved by the Engineer. Welding may not be used except with the specific approval of the Engineer. Welding, when approved, shall conform to the AWS D1.4. Welded wire fabric shall be lap spliced a minimum of 2 inches plus the wire spacing at edge laps and end laps.

F. DETAILING & FABRICATION

Furnish Shop Detail and Field Placing Drawings for all reinforcing steel for approval of the Engineer. Shop Drawings shall include reinforcing, placing plans and details indicating size, location, arrangement, splice locations, bending diagrams, placing sequence, etc. Placing Drawings shall be in sufficient detail to allow field personnel to accurately place reinforcing. Shop and Placing Drawings shall be prepared in accordance with "Manual of Standard Practice for Detailing Reinforced Concrete Structures" ACI 315, current edition. Photographic copies of engineering drawings shall not be used as placing drawings.

Reinforcement bars shall be bent cold to the shapes indicated on the Plans. Fabrication tolerances, fabrication, and detailing of steel reinforcement shall conform to the "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI-315).

Steel reinforcement shall be of the type and size, cut to lengths and bent to shapes as indicated on the Plans. Unless otherwise indicated, hooks, lap splices, embedment lengths, and other details of reinforcement shall be provided as set forth in the ACI Building Code (ACI 318) to develop the full tensile strength of the bar.

G. PLACING REINFORCEMENT

All reinforcement at the time concrete is placed shall be free from mud, oil, paint, excessive rust and excessive mill scale or any other coating that would destroy or reduce its bond with the concrete.

All reinforcement shall be secured in place true to lines and grades indicated by use of metal or concrete supports, spacers, or ties as approved by the Engineer. The bars and mesh shall be tightly secured against displacement by ties of annealed wire, or suitable clips at intersections. Wall reinforcement shall be supported and held securely against displacement in its proper position clear of the forms as indicated on the Plans. Placing tolerance shall conform to ACI 318.

Nails shall not be driven into the wall forms to support reinforcement nor shall any other device used for this purpose come in contact with the form on the liquid side of any liquid containing structure. Metal devices used to provide the required clear distances from reinforcing steel to liquid side of concrete surfaces shall be galvanized, or shall be as approved by the Engineer.

The main reinforcement of slabs in contact with the ground shall be supported in its proper position, as indicated on the Plans, by means of precast cement mortar blocks, of approved dimensions, resting on the slabs' subbase. Such precast blocks shall be made of mortar composed of 1 part cement to 2 parts sand and shall have a loop of No. 16 black annealed wire cast into each block. The length of the wire loop shall be sufficient to allow the block to be tied to the reinforcement. Blocks shall be spaced at the intervals required to maintain the reinforcement in its required position in the slab during the placing of the concrete. The slab reinforcement shall not be used to support planking or runways used in placing concrete.

Bending of bars embedded in hardened concrete will not be permitted except when specifically approved by the Engineer for the field condition encountered. Field cutting of bars will only be permitted when specifically approved by the Engineer.

In the case of exposed finish surfaces of floor slabs, galleries, deck slabs, and beams, metal chairs, spacers and other metal accessories necessary to provide the required clear distances and proper alignment and spacing between bars shall be galvanized or shall have plastic protective covering over portions in contact with forms.

H. CONCRETE PROTECTION FOR REINFORCEMENT

Steel reinforcement shall be placed and held in position so that the concrete cover, as measured from the surface of the bar shall be the following, except as otherwise shown, on the drawings:

Slabs:

1½ inches, in general, top and bottom.
1½ inches at surfaces troweled as floor finish, walkway, or driveway.
2 inches on bottom for slabs over water and where exposed to the weather.

Footings:

2 inches at top of footings.
3 inches at bottom, sides, and end of footings.

Walls:

2 inches on surfaces against earth.
1 inches on interior surfaces.
2 inches on interior surfaces contacting water.

Beams and Girders in Contact with Water:

2 inch minimum to stirrup steel.
2½ inch minimum to main longitudinal steel.

Columns:

2 inches, in general, to main vertical reinforcement.
2½ inches, to main reinforcement on surfaces in contact with water.

Beams and Girders: General:

1½ inch minimum to stirrup steel.
2 inches minimum to longitudinal steel.

A. GENERAL

This section covers construction joints, expansion joints, and the placing of waterstops where such are indicated on the plans.

Construction joints shall be of the type indicated on the drawings and shall be located as shown on the plans unless otherwise approved by the Engineer. Contractor shall submit a joint location plan as specified in SECTION 3.1 - CAST-IN-PLACE CONCRETE.

B. WATERSTOPS

Waterstops shall be installed in construction joints as required by the Plans. All waterstops shall be continuous throughout their length.

The waterstops shall be heavy duty polyvinyl waterstop conforming to Corps of Engineers Specification CRD-C-572, latest edition, as manufactured by Serviced Products Division of W.R. Grace and Company: Vinylstops by Sonneborn- Contech; Sealtight Duo-PVC Waterstops by W. R. Meadows, Inc.; Vinylex Corporation; "labyrinth" waterstop, Type B-2 as manufactured by Water Seals, Inc.; or an approved equal of the same type and material and approximately equal in dimensions and weight but not necessarily of exactly the same shape. Waterstops shall be of the size and type designated on the Plans.

"Rib Type" waterstops shall be of ribbed construction with a center bulb, 6" wide, capable of resisting a maximum pressure load of 65 feet of water.

All waterstops shall be installed so that one-half its width will be embedded on one side of the joint and one-half on the other. The Contractor shall employ a method of holding the waterstop in position for the first pour that is satisfactory to the Engineer. The method selected must insure that the waterstop will be held securely in true vertical or horizontal position and in straight alignment in the joint.

Care shall be exercised to insure that the waterstop is completely encompassed in good mortar.

1. Preformed Plastic Waterstops:

Preformed Plastic Waterstop, when approved by the Engineer, shall meet or exceed all requirements of Federal Specifications SS-S-00210, "Sealing Compound, Preformed Plastic for Expansion Joints", Type I or Type II. Such plastic waterstop shall be equal or approved equal to SYNKO-FLEX as manufactured by Synko-Flex Products Company, Houston, Texas, or "CenSeal

GS-231" by Concrete Sealants, Inc., New Carlisle, Ohio and shall meet the following requirements:

The plastic waterstop shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler, and shall contain no solvents, irritating fumes or obnoxious odors. The plastic waterstop shall not depend on oxidizing, evaporating or chemical action for its adhesive or cohesive strength. It shall be supplied in extruded form of suitable cross-section and of a size to seal the joint areas of concrete sections. The plastic waterstop shall be protected by a suitable removable two-piece wrapper. The two-piece wrapper shall be so designed that one-half may be removed longitudinally without disturbing the other half, to facilitate application of the sealing compound.

C. JOINTS IN WATERSTOPS

All waterstops shall be continuous and so joined at all points of contact in the same plane, or at intersections with waterstops in different planes, as to form a complete barrier to the passage of water through any construction or contraction joint.

Joints in the waterstops, whether made for the purpose of continuity in a straight strip or for the purpose of securing a watertight junction between strips in different planes, shall be made by heat welding as hereinafter specified.

Joints in PVC waterstops shall be made by heating the two surfaces to be jointed until the material has softened to the point where it is just short of being fluid and then bringing the two softened surfaces together with a slight rubbing motion followed by firmly pressing them together so that a solid and tight bond is made.

The joints in strips of waterstop made in the above manner shall be such that the entire cross section of the joint shall be dense, homogeneous and free of all porosity. All finished joints shall have a tensile strength of not less than 75 percent of the material of the strip as extruded.

The heating of the surfaces to be joined shall be done by means of an electric splicing iron designed for the specified purpose and controlled by means of a voltage regulator.

In use, the heat of the hot plate shall be so regulated as to prevent too rapid melting and accompanying charring of the waterstop material.

The use of makeshift hot plates will not be permitted nor will other means of heating the strips to be joined be allowed except in a case of emergency, as determined by the Engineer.

The Contractor shall provide such jigs as will assist in making the joints in a proper and workmanlike manner and in holding the strips so that the alignment of jointed strips is correct and angles are true to those required.

Prior to embedment all joints in the waterstop strips will be inspected by the Engineer and any found defective shall be remedied without delay.

D. PROTECTION OF WATERSTOP BETWEEN POURS

The Contractor shall take such steps as are necessary to protect exposed waterstops in the interim period between concrete pours.

E. EXPANSION JOINTS

Expansion joints of the size and type shown on the plans, or specified herein, shall be placed in concrete pavement or structure as shown on the plans.

1. Materials:

a. Preformed Asphalt Fiber Joint Material

Asphalt fiber sheet filler shall consist of preformed strips of inert material impregnated with asphalt. It shall be of the thickness shown on the Plans or indicated in these Specifications.

The sheet filler shall conform to the requirements of AASHTO Specification M-213 with the following additional provisions.

The sheet filler shall be of such character that it will not be deformed by ordinary handling during hot weather nor become hard and brittle in cold weather. It shall be of a tough, resilient, durable material not affected by weathering.

b. Hot Poured Rubberized Tar Joint Sealer

Hot poured rubberized mastic joint sealer shall consist of a mixture of durable, elastic rubber, coal tar pitch and other materials which will form a resilient and adhesive compound capable of effectively sealing concrete joint surfaces against repeated expansion and contraction. The material shall be installed in accordance with the manufacturer's directions. Hot poured tar sealer shall be used for pavement and sidewalk expansion joints.

2. Joint Surface Preparation:

Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant or caulking compound.

For all sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with Paragraph 4.3.9 of FS TT-S-00227, has successfully demonstrated that sealant bond is not impaired by coating or treatment. If laboratory test has not been performed, or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.

Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5% solution of muriatic acid; neutralize with diluted ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.

3. Installation:

Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

Prime or seal joint surfaces where shown or recommended by sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

Employ only proven installation techniques, which will insure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

Install sealants to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead.

For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, and neither more than 5/8" deep nor less than 3/8" deep.

For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than ½" deep nor less than 1/4" deep.

Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either primer/sealer or the sealant.

Remove excess and spillage of compounds promptly as the work progresses. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes.

4. Cure and Protection:

Cure sealants in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Do not cure in a manner which would significantly alter material's modules of elasticity or other characteristics.

Installer shall advise Contractor of procedures required for curing and protection of sealants during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of Owner's acceptance.

A. SCOPE

Work in this section includes all labor, plant and material necessary to furnish and install all concrete formwork required by the project. Concrete formwork shall conform to all requirements of current editions of ACI 301 "Specifications for Structural Concrete for Buildings" and ACI 318 "Building Code Requirements for Reinforced Concrete" and ACI 347 "Recommended Practice for Concrete Formwork" and ACI 350 "Concrete Sanitary Engineering Structures" except as modified herein.

B. MATERIALS

1. Forms shall be of wood, metal, highly water resistant plywood, or other material approved by the Engineer. Forms for sections greater than 18" thick shall be of wood. Form surfaces shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed surfaces. Bolts and rods used for internal ties shall be so arranged that, when the forms are removed, all metal will not be less than two (2) inches from any concrete surface. Wire ties will not be permitted where concrete surface will be exposed to weathering, and discoloration would be objectionable. Exposed concrete shall have approved form liners of Masonite or plywood, or shall be constructed of smooth surfaced plywood.

2. Corner forms forming 3/4 inch chamfers or as otherwise specified on plans, shall be used on all outside corners that are to be exposed in the finished structure. Chamfer forms shall be of molded plastic or polyvinyl chloride chamfer strips. Use one style of form throughout the project. The type to be used shall be submitted to the Engineer for approval.

3. Rustication and Score Line Strips shall be a non-absorbent material such as extruded polyvinyl chloride, plastic, fiberglass or metal or they may be milled from a good quality lumber and well sealed to prevent moisture absorption, wood strips may not have protruding splinters which may become embedded in the concrete. Sealing wood shall be accomplished by emersion or brushing on two coats of form coating.

4. Form Ties for concrete shall have an approved waterstop barrier to prevent seepage of moisture along the ties. The ends of the metal after breaking off shall be minimum of 2 inches from the finished wall face. Submit samples to the Engineer for review.

5. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

6. Cylindrical Columns and Supports: Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

7. Inserts: Provide metal inserts, anchor bolts and other embedded items for anchorage of materials or equipment to concrete construction, not supplied by other trades and as required for the work.

8. Provide sheet metal reglets formed of the same type and gauge as the flashing metal to be built into the reglets, unless otherwise indicated. Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 26 gauge galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

9. Stay-in-Place Corrugated Steel Forms: Fabricate of galvanized steel sheets complying with AISC "Specification for Design of Light Gauge Cold-Formed Steel Structures". Depth of ribs and metal gauge as indicated or, if not indicated, not less than 22 ga. unless heavier gauge required due to project conditions.

10. Side forms of footings may be omitted and concrete placed directly against excavation only when requested by Contractor and accepted by Engineer. When forms are omitted, provide additional concrete required beyond the minimum design profiles and dimensions of the footings as indicated to provide minimum concrete coverage for reinforcement. Contractor shall maintain the earth form to proper alignment with no sloughing of material into the minimum design profile shown on the drawings.

11. Dovetail Anchor Slots at surfaces to receive masonry veneer to be Heckman #100 or equal.

C. EXECUTION

1. Forms shall be built true to line and grade, and be mortartight and sufficiently rigid to prevent displacement or sagging between supports. All formwork and shoring shall be designed for the construction loads to be placed on them, and the design and construction of said forms shall be in accordance with ACI Standard "Recommended Practice for Concrete Formwork" (ACI 347). The structural adequacy of the formwork shall rest with the Contractor. All forms shall be so constructed that they can be removed without hammering or prying against the concrete.

2. Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.

3. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

4. Provide temporary openings in wall forms, columns forms and at other locations necessary to permit inspection and clean-out.

D. EMBEDDED ITEMS

Before placing concrete, care shall be taken to determine that any embedded metal or wood parts are firmly and securely fastened in their correct location as indicated. Use setting drawings, diagrams, instruction and directions provided by suppliers of items attached thereto. They shall be thoroughly clean and free from coating, rust, scale, oil, or any foreign matter. Embedding of wood in concrete shall be avoided whenever possible, metal being used instead. If wood is allowed, it shall be thoroughly wetted before concrete is placed.

E. FORM REMOVAL

Forms shall not be removed without approval of the Engineer. Forms shall not be removed before the minimum times given below, or longer if job control tests indicate the concrete has not attained strength specified below, except when specifically authorized by the Engineer.

Beams and Slabs	14 days
Walls up to 12" Thick and Vertical Surfaces	1 day if minimum daily temperature is above 50EF, 3 days otherwise
Columns	5 days
Walls greater than 12" Thick	3 days if minimum daily temperature is above 50EF, 7 days otherwise.

In general, forms or shores for supported slabs and beams shall not be removed until the concrete, so supported, has acquired 70% of its design strength; except where loads other than the dead weight of the concrete are added, the shores shall not be removed until 24 hours after the concrete has obtained 90% of its design strength. Forms shall be removed immediately after expiration of the lapsed times specified above or sooner, if required by the Engineer, where concrete is to receive a rubbed finish.

A. GENERAL:

1. Scope: The work includes the furnishing and installation of manholes as shown on the drawings and specified herein. Manholes shall be precast concrete with precast bases unless approved the by Owner and Engineer.

2. Quality Assurance: The manufacturer furnishing manholes under this specification shall be prepared to show proof that the manholes and components proposed meet the ASTM specifications as listed under Section B Materials of this specification.

3. Submittals: Shop drawings shall be submitted for all monolithic and segmentally pre-cast concrete manholes showing invert elevations, pipe sizes, angular locations, height, lids and frames and special items.

4. Product Delivery, Storage and Handling:

   a. Deliver, store and handle manholes, components and assemblies in a manner to prevent damage. Keep all components and assemblies identified and under adequate cover until incorporated into the work.

   b. All damaged, broken, or otherwise defective materials will be rejected.

B. MATERIALS:

1. Precast units shall be in accordance with ASTM C-478. Manholes shall gave an inside diameter of not less than four feet or as shown on the drawings.

   Wire fabric reinforcement for pre-cast concrete shall consist of wire conforming to ASTM A-185.

   Bar reinforcement shall conform to ASTM A-15, intermediate grade.

2. Cast iron frames, covers, wall sleeves, etc., shall conform to the requirements of gray iron castings, ASTM Designation A48.

3. Preformed mastic shall be used between manhole sections. Preformed mastic shall be EZ-STIK Preformed Joint Sealant as manufactured by Press-Seal Gasket Corporation, or approved equal. The gasket material shall have cross section dimensions of approximately 3/4" x 3/4". The material shall be applied in two concentric rows at each joint to be sealed. Installation shall follow the manufacturer's recommendations particularly with regards to low temperature application.

4. Water proofing for the exterior of all precast and cast-in-place manholes shall be 15 mils of Kop-Coat Bitumastic 300-M, or approved equal. All coating damaged during the delivery or construction process shall be field repaired with the same material prior to backfill.

C. INSTALLATION:

1. Excavation: In order to permit the proper compaction of the backfill material, the excavation shall be made to a diameter of at least two feet greater than the outside diameter of the structure.

2. Sub-base Preparation: Adequate foundation for all manhole structures shall be obtained by removal and replacement of unsuitable material.

3. Base: A well graded granular bedding course, not less than eight inches in thickness and extending to the limits of the excavation, shall be firmly tamped and made smooth and level to assure uniform contact and support of the pre-cast element. The pre-cast base section shall be carefully placed on the prepared bedding so as to be fully and uniformly supported in true alignment and making sure that all entering pipes can be inserted on proper grade. Unattached pre-cast concrete bases or pads will be approved only where poor trench conditions warrant their use.

4. All openings in the barrel of the new manhole being placed over an existing pipe at a point of entry shall be sealed and grounded as shown in the plans.

5. The invert of the manhole shall be shaped and smoothed so that no projections will exist and flow channels are formed in the invert so that the manhole will be self-cleaning and free of areas where solids may be deposited as sewage flows through the manhole.

6. Manhole Barrel: The manhole barrel forms or pre-cast sections may be set into position on the base as soon as the concrete base has cured sufficiently to support the forms. The manhole barrel form shall be of such construction so that the finished manhole will have an inside diameter at the base of four (4) feet zero (0) inches and an inside diameter at the top of the barrel of not less than twenty-four (24) inches.

   a. Pre-cast sections shall be placed and aligned to provide vertical alignment. The completed manhole shall be rigid, true to dimensions and shall be watertight.

   b. All lift holes on pre-cast elements shall be completely filled with an approved bitumastic material.

7. Construction Details:

   a. Inlet and Outlet Pipes shall be joined to the manhole with a Z-LOK flexible watertight connection that allows differential settlement of the pipe and manhole wall to take place.

   b. Placing Castings: Castings placed on concrete surface shall be set on two rows of mastic. Castings shall be set accurately to the finished elevation.

8. Backfill:

   The space between the sides of the excavation and the outer surfaces of the manhole shall be backfilled with aggregate if the manhole is in pavement or if the nearest point of the excavation for the manhole fall within two feet of the paved edge.

9. Cleaning:

   All newly constructed manholes shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind and shall be free of such accumulations at the time of final inspection.

A. SCOPE

This section covers the furnishing and installation of all miscellaneous metals, including stainless steel, cast iron, and aluminum items not covered in other sections of the Specifications. Work generally included but is not limited to ladders, gratings, handrails and railings, anchorage devices, metal fabrications, and metal stairs.

B. GENERAL

Furnish all miscellaneous items such as anchor bolts, tie down bolts, nuts and washers, supports, connections, expansion and toggle bolts, etc., required by the work. Supplementary parts necessary to complete each item, though such work is not definitely shown or specified, shall be included. Furnish to appropriate trades all anchors, sockets or fastenings required for securing metal work to other constructions and wood items to concrete. Details and specifications of items for which standard products are available are representative guides of requirements for such items. Standard products generally meeting such requirements, will be accepted. Welding shall be continuous along entire area of contact, except where tack welding is permitted. Tack welding will not be permitted on exposed surfaces. All exposed welds shall be ground smooth. Riveting, where exposed, shall be flush type.

C. QUALITY ASSURANCE

Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting wherever taking field measurements before fabrication might delay work.

Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

D. SUBMITTALS

Submit for Engineer's review, 4 sets of shop drawings for fabrication and erection of miscellaneous metal items. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others. Submit duplicate samples of all prefinished or shop finished items for approval of finishes.

E. MATERIALS AND COMPONENTS

1. Metal Surface, General:

For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

2. Ferrous Metals:

Except as otherwise specified herein or noted on the Plans, stainless steel and wrought metals shall meet the requirements of the following standards (current edition):

Gray Iron Castings: ASTM A 48, Class 30.

Malleable Iron Castings: ASTM A 47, grade as selected.

Stainless Steel Plates, Shapes, Bars, Tubes shall be AISI Type 304 (18-8) mill finish.

Stainless Steel Castings shall be AISI Type 304 conforming to ASTM A 296, Iron-Chromium-Nickel Alloy.

3. Non-Ferrous Metals:

Aluminum Bar Grating: ASTM B 221, Alloy 6061 or 6063-T6 for bearing bars; ASTM B 221 or B 210 for cross bars or bent connecting bars.

Aluminum Extrusions: ASTM B 221; alloy 6063-T5, except alloy 6005-T5 for pipe; unless otherwise indicated.

Clear anodized finish AA-M21C11A41, unless otherwise indicated.

Aluminum Sheet or Plate: ASTM B 209; alloy 6061-T4; unless otherwise indicated. Mill finish.

4. Fasteners:

General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Provide AISI Type 303, stainless steel fasteners where exposed to liquids of treatment process, for connecting aluminum or where noted to be stainless steel. Select fasteners for the type, grade and class required.

Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.

Machine Screws: Cadmium plated steel, FS FF-S-92.

Plain Washers: Round, carbon steel, FS FF-W-92.

Concrete & Masonry Anchorage Devices: Expansion shields, FS FF-S325, Galvanized or Stainless Steel. Wedge type expansion anchors take "Kwik-Bolt" by HILTI Tulsa, Oklahoma or equal, size as noted on the Drawings. Length shall provide minimum embedment in concrete as specified by manufacturer's literature.

Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.

Lock Washers: Helical spring type carbon steel, FS FF-W-84.

F. FABRICATION, GENERAL

Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using industry proven details of fabrication and support. Use type of materials shown or specified for various components of work.

Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, use Phillips flat-head (countersunk) screws or bolts.

Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

G. PAINTING

All aluminum surfaces that will be in contact with concrete, steel or other dissimilar material shall be coated with asphaltic paint or aluminum impregnated caulking compound or other approved permanent insulation to prevent electrolytic action.

H. CHECKERED PLATE

Shall be standard checkered aluminum plate complete with angle frames and fasteners of thickness shown and located where shown on the drawings.

I. LADDERS

All ladders unless otherwise indicated, shall have flat bar side rails with eased edges spaced 20" o.c. with 3/4" diameter bar rungs welded to siderails at 12" o.c. maximum vertical spacing. Ladders shall be securely attached to supporting construction and extend at least 42" above top rung except where prohibited by overhead or other construction. Where steel ladders are required by the drawings, provide galvanized anchor bolts or expansion anchors. Where aluminum ladders are required by the drawings provide stainless steel anchor bolts or expansion anchors.

J. GRATING

1. General:

Use materials of the size and thickness shown, or if not shown, of the size recommended by NAAMM tables. Work to the dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use the type of materials shown or specified for the various components of the work. Comply with NAAMM "Metal Bar Grating Manual" and as herein specified.

Except where noted otherwise, provide removable grating sections with end-banding bars for each panel, 4 saddle clip anchors designed to fit over 2 bearing bars, and 4 stud bolts with washers and nuts, unless otherwise indicated.

Notch gratings for penetrations as indicated. Layout units to allow grating removal without disturbing items penetrating grating. All grating to be removable unless otherwise noted.

Provide banding for openings in grating separated by more than 4 bearing bars, of same material and size as bearing bars, unless otherwise indicated.

Notching of bearing bars at supports to maintain elevations will not be permitted.

Weld stud bolts to receive saddle clip anchors to supporting metal members.

2. Aluminum Grating:

All aluminum grating shall be "Rectangular Pressure locked", KPL-19-4 Series, type as manufactured by Klemp Corporation; or equal. Bearing bar shall be 1¼" deep x 1/8" thick minimum spaced at 1-3/16" centers unless noted otherwise on the drawings. Provide aluminum clip anchors and stud bolts where grate is supported by aluminum members and stainless steel slip anchors and stud bolts where grade is supported by steel members. Coat surfaces in contact with concrete or steel with asphaltic paint or aluminum impregnated caulking compound or other approved permanent insulation. Stair treads to have checkered plate or abrasive nosings.

3. Aluminum Grating Treads: All aluminum grating treads shall be pressure-locked rectangular bar "KPL-19-4" as manufactured by "Klemp Corp." or approved equal. Bearing bars shall be 1-1/2" x 3/16" minimum unless noted otherwise on drawings. Treads shall have cast aluminum abrasive nosings.

4. To be considered equal a grating or tread must have the same load capacity as the size grating noted on the drawings. One type of grating shall be used throughout the job. The depth may vary from that shown on the drawings, provided adequate provisions are made to make modifications to the bearing and anchorage details.

K. PIPE RAILINGS

1. General:

Fabricate pipe railings to dimensions and details shown, with smooth rounded bends and welded joints ground smooth and flush.

Adjust railings prior to anchoring to ensure matching alignment at butting joints. Space posts not more than 6'-0" on centers, unless otherwise shown. Plumb posts in each direction. Secure posts and rail ends to supporting construction as follows:

Anchor posts and rail ends into concrete with epoxy grout as detailed.

Provide removable railing sections as indicated. Furnish slip-fit metal socket or sleeve for casting into concrete. Accurately locate sleeves to match post spacing.

Secure single rail handrails to walls with wall brackets and end fittings. Provide brackets with not less than 3" clearance from inside face of handrail to the finish wall surface. Drill wall plate portion of bracket to receive bolt, unless indicated for concealed anchorage. Locate brackets as indicated or, if not indicated, at not more than 6' - 0' o.c. Provide flush-type wall return fittings with same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to supporting construction as follows:

For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.

For hollow masonry anchorage, use toggle bolts having square heads.

2. Aluminum Pipe Railings:

Pipe handrails of aluminum shall be installed in the locations shown on the drawings.

Horizontal aluminum handrails shall be 1 ½" schedule 40 pipe of aluminum alloy 6005-T5. Vertical posts to be 1 ½" schedule 80 pipe 6005-T5. Fittings shall be attached to the posts by internal welding. The various pieces of the rail shall be joined together by welding. Pipe railing shall have a mill finish.

Contractor may submit, for approval, 1 ½" square tube section handrail of the same strength as the 1 ½" pipe. Contractor shall be responsible for design of modifications to handrail anchor details to fit tube handrail. Submit modifications for approval of the Engineer.

L. STAIR NOSINGS

Provide cast iron or cast aluminum abrasive nosings for all concrete stairs. All nosings are to be three (3) inches wide and have a one (1) inch lip. Nosings shall be the length of the tread less 3" at each end.

Abrasive is to be #20 aluminum oxide (AL203), integrally cast into the walking surface to a minimum depth of 1/32". Fastener screws shall not protrude above that tread surface. Cross-hatching and fluting shall be 1/16" deep minimum and shall be clean, sharp, well-defined and free from washes, scabs, buckles, blow holes, knots, cuts, cracks and pin-holes. Abrasive cast aluminum to have sand blasted finish. Abrasive cast iron to have one coat of shop black paint.

M. CONSTRUCTION CASTINGS

Provide cast iron manhole ladder rungs as detailed. See drawings for locations, sizes, types and details. Unless otherwise indicated, units shall be McKinley Iron Works, or Neenah Foundry Co, castings or approved equal.

A. GENERAL

1. Work Included

a. Work of this section covers the design, fabrication and erection of a low rise, modular, rigid frame type, engineered metal building system of dimensions and heights indicated on the drawings.

b. Building components specified herein include structural framing, roof panels, wall panels, framed openings, flashings, gutters and downspouts, bracing, fasteners, and accessories as indicated or specified.

2. References

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 326 (1985) Voluntary Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI - 01 (1987) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A36/ASTM A36M - Structural Steel

ASTM A653 (1994) Steel Sheet, Zinc-Coated (G-90 Galvanized) by Hot-Dip Process, Structural (Physical) Quality.

ASTM A475 (1995) Extra High Strength Grade Cable

ASTM A529/A529M - High-Strength Carbon-Manganese Steel of Structural Quality

ASTM A570 (1996) Steel, Sheet and Strip, A572 Hot-Rolled Structural Quality

ASTM 572/A 572M – High-Strength Low-Aooly Columbium-Vanadium Steel.

ASTM A 792/A 792M - Steel Sheet, Aluminum-Zinc Alloy Coated by Hot-Dip Process

ASTM B117 (1996) Salt Spray (Fog) Testing

ASTM D523 Specular Gloss

ASTM D4214 (1989) Evaporating Degree of Chalking of Exterior Paints

ASTM D968 (1993; Rev 1986) Abrasion resistance of Organic Coatings by Falling Abrasive

ASTM D2244 (1993) Calculation of Color Differences from Instrumentally Measured Color Coordinates

ASTM D2247 (1994) Testing Water Resistance of Coatings in 100% Relative Humidity

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 - Structural Welding Code-Steel

FEDERAL SPECIFICATIONS (FS)

FS TT-P-664 Protective Coatings for Fabricated Structural Members

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA-01 - Low Rise Building Systems Manual

UNDERWRITERS LABORATORIES, INC (UL)

UL 580 -Test for Uplift Resistance of Roof Assemblies

3. Quality Assurance

   a. Manufacturer Qualifications: Manufacturing company regularly engaged in the fabrication of metal building systems for a minimum of 10 consecutive years and a member of the Metal Building Manufacturer's Association.

   b. Certified by American Institute of Steel Construction (AISC) Metal Building Certification Program (MB).

   c. All structural mill sections and welded up plate sections shall be designed in accordance with the AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", and all cold-formed steel

structural members shall be designed in accordance with AISI "Specifications for the Design of Cold-Formed Steel Structural Members".

d. All roof and wall panels shall be designed in accordance with the AISI "Specifications for the Design of Light Gauge Cold-Formed Steel Structural Members".

e. All welding shall be in accordance with the AWS "Structural Welding Code", D1.1.

f. The application of loads and the design of all other components shall be as specified in the Metal Building Manufacturers Association's "Recommended Design Practices Manual".

g. The design of all elements and components of the building shall also conform with the applicable national building code (or applicable State Building Codes) and local building codes having jurisdiction, and the requirements of such building codes shall take precedence if exceeding the requirements of the aforementioned standards.

4. Submittals

a. Certifications: Provide a letter of design certification for the structural framing system, signed and sealed by an engineer registered by the state where the jobsite is located.

b. Shop Drawings: Submit anchor bolt layouts, framing plans, elevations and necessary sections and details.

c. Provide erection drawings bearing a seal by a Professional Engineer registered by the state where the jobsite is located.

d. Provide layouts of roofing and siding panels, edge conditions, panel joints, corners, trims and flashings.

e. Foundation Reactions: Submit foundation reactions and anchor bolt sizes. It is the responsibility of the owner's foundation design engineer to size the footing and length of anchor bolts for reactions provided.

5. Design Criteria

a. Structural Steel Building Frame: The structural steel building frame is an engineered system designed, manufactured and erected by the metal building contractor. The drawings, details and dimensions shown on these documents are representative of the architect's requirements for the

appearance of the final product. The foundation drawings are indicative of the expected loadings transmitted by this system. The metal building manufacturer is allowed to adjust the sizes and shapes in order to design the most efficient system for their product within these guidelines. Changes must be approved by the architect in writing. No additional compensation will be allowed for changes. The foundations are designed for pinned bases.

b. Design loads shall be developed using procedures contained in MBMA-01 and shall be in accordance with the latest editions of the AISC Allowable Stress Designs Specification for Steel Buildings, AISC Code of Standard Practices for Steel Buildings and Bridges, and the AISI Specification for the Design of Cold Formed Steel Structural Members.

c. Wind Loads shall be in accordance with IBC, Exposure C, Importance factor 1.15 and a wind velocity of 90 MPH.

d. Live Load, including snow, shall be 20 PSF minimum with tributary reduction not allowed as applicable per code.

e. Dead Load shall be the weight of the metal building materials.

f. Auxiliary Design Loads shall be 5 PSF to cover the dead load imposed by fire protection systems, ceilings and lighting, plus the actual weight of equipment or mechanical units located on or attached to the building. Refer to drawings for location of equipment and mechanical units. Contract Documents must be reviewed by the pre-engineered building engineer to identify any loads that may exceed the 5 PSF limit. Incorporate the necessary structure to carry these loads.

g. Minimum deflection criteria is to be L/240 for primary framing members and L/180 for secondary members and coverings.

h. Frame sidesway shall be H/120.

i. Seismic Loads shall be based on Seismic Zone 1 as per code application.

j. For purposes of assessing wind, snow and seismic loads the building shall be designed with an importance factor of 1.15.

6. Warranties

a. Provide building manufacturer's warranty guaranteeing the building system against defects in material for one year from the date of acceptance

and shall provide for replacement material as required within that time period.

b. Roof Panel Integrity: Provide manufacturer's standard twenty year warranty against perforation of metal panels due to corrosion under normal weather and atmospheric conditions.

c. Wall and Roof Panel Finish: Provide manufacturer's standard twenty year warranty against cracking, peeling and color fade. The following are the color fade and chalking limitations:

d. Color Retention: No color change in excess of an average of 5 NBS Units when measured in accordance with the procedure set forth in ASTM D2244.

e. Chalking: Minimum of 8 rating when tested in accordance with ASTM D659.

B. PRODUCTS

1. Description

a. The building shall be a sloped building of steel rafters and columns, with building width, length and bay spacing, eave height and roof slope as indicated on the drawings.

2. Primary Framing

a. The engineered structure shall be a rigid frame "RF" manufactured of solid web members having tapered or uniform depth rafters, rigidly connected to tapered or uniform depth columns.

b. The materials used in the fabrication of the primary framing shall be designed utilizing standard practices, generally in compliance with the AISC code.

c. Structural flat plate, strip and/or bar stock generally shall conform to the physical requirements of ASTM A570/A 570M, ASTM A572/A572M, ASTM A529/A 529M or ASTM A36/A 36M Modified 50, with minimum yield strength of 50,000 psi (345 MPa).

d. Hot Rolled Steel Shapes: W, M and S shapes, angles, rods, channels and other shapes; ASTM A 500, ASTM A 572/A 572M or ASTM A 36/A 36M as applicable; with minimum yield strengths required for the design.

e. Round pipe sections shall be of material conforming to the physical requirements of ASTM A53 grade B and shall have a minimum yield strength of 36,000 psi.

f. Members fabricated from plate or bar stock materials shall have flanges and webs joined on one side of the web by a submerged arc continuous weld process.

3. Endwall Framing

a. Endwall framing shall include the corner columns, endwall columns and endwall rafters, and shall be manufactured of cold-formed light gage sections, welded plate sections and/or structural shapes. Expandable Endwall Refer to Drawings.

b. Materials used in the fabrication of endwall framing systems shall be designed utilizing standard practices, generally in compliance with the applicable sections of AISC and AISI.

c. Cold-formed members shall be fabricated of material conforming to the physical requirements and shall have a minimum yield strength of 55,000 psi.

d. Structural shapes shall be of material conforming to the physical requirements of ASTM A36/A 36M as applicable and shall have a minimum yield strength of 50,000 psi.

e. Members fabricated from plate or bar stock materials shall have flanges and webs joined on one side of the web by a submerged arc continuous weld process.

4. Secondary Framing

a. Secondary framing shall be the structural members which distribute the loads to the primary framing systems, and shall include the eave struts, purlins, girts, wind bracing and other miscellaneous structural members. They shall be manufactured of cold-form light gage sections, welded plate sections and/or structural shapes.

b. Eave struts shall be nominal 8", 10" or 12" deep "cee" shaped members, and shall be designed as simple span for the specified loads.

c. Purlins and girts shall be nominal 8", 10", or 12" deep "zee" or "cee" shaped members, and shall be designed as simple span, partially continuous or continuous for the specified loads.

d. Wind bracing shall be a system of diagonal cable bracing, portal, fixed base or diaphragm bracing designed for the specified loads in accordance with standard design practices.

e. Miscellaneous structures shall normally be those members such as base angles, flange braces, jambs, headers, etc., and shall be designed to be supportive of the framing system.

f. Materials used in the fabrication of secondary framing shall be designed utilizing standard practices, generally in compliance with the applicable sections of AISC and AISI.

g. Cold form members shall be fabricated of material conforming to the physical requirements of ASTM A570 and shall have a minimum yield strength of 55,000 psi.

h. Cable bracing shall be fabricated of material conforming to the physical requirements of ASTM A475-78 for extra strength grade.

5. Structural Painting

b. Primer: After fabrication, all components fabricated from welded plate sections, structural shapes or round pipe shall be prepared equal to the standards of SSPC-SP2 or SSPC-SP3 Hand or Powertool Cleaning and primed with one shop coat of red primer, which meets or exceeds the end performance of Tnemec Series 10-99. Primer shall be applied to a dry film thickness of 2.0-3.0 dry mils.

Material used for components fabricated by cold form process shall be precoated by a commercial coated using a preparation process equal to SSPC-SP10/NACE 2 Near White Blast Cleaning and after oven heating, apply a red oxide primer which meets or exceeds the end performance of Tnemec Series 10-99 or Master Touch 92R16 Red Oxide. Primer shall be applied to a dry film thickness of 2.0-3.0 dry mils. Thoroughly clean primer before applying field paint.

c. All structural components shall be field painted prior to the installation of wall and roof panels with Tnemec Series 27WB or approved equal as the first field applied coat at 4.0 – 5.0 dry mils by rolling or brushing followed by a top coat of Tnemec Series 66 or approved equal by brushing or rolling to a thickness of 4.0 – 5.0 dry mils.

Before applying Tnemec Series 27WB or approved equal all components shall be surface prepared using the following standard:

Pressure wash all surfaces to be coated using a solution of hot water and TSP at a minimum of 3500 psi and a minimum flow rate of 3.0 gallons per minute. For mildewed surfaces, add chlorine bleach and allow to dry on the surface. Rinse all surfaces with clean water. Clean all failed and resting areas as per SSPC-SP2 to SP3 Hand or Power Tool Cleaning. Feather all edges smooth. Surface must be clean and dry.

6. Roof Covering

   a. Roof panels shall be Standing Seam panels, their attachments, trim and sealants for use on the exterior of the roof and shall be equal to Alliance Seam 24 (or approved equal), continuous from ridge to eave. Roof panels shall be 24 gauge and shall be assembled with screws.

7. Wall Panels, Roof Panels, and Trim

   a. Siding and trim coverings shall consist of PBR wall panels, their attachments and trim or flashings for use on the exterior of the walls and/or attachment to the roof covering. Siding shall be equal to Alliance Steel as described in the following:

   b. Siding coverings consisting of profile "PBR" shall provide a 36" net coverage. Sidelaps shall be one major rib. Panels shall be continuous from eave to sill/base attachment point until length exceeds 40'.

   c. Material used in the fabrication of wall panels shall be a minimum of 24 gage having a minimum yield strength of 80,000 psi. Exterior finish shall be precision coated, commercial coated grade Kynar/Flouropon by Valspar Corporation. Colors shall be as selected by the owner from the manufacturer's standard colors.

   d. Material used in the fabrication of flashing and trim for the gutters and downspouts, corners, wall openings, etc. shall be of the same thickness and finish as the wall panel. Colors shall be selected by the owner from the manufacturer's standard colors.

   e. Provide interior 24 gage wall panels as shown on the plans.

8. Insulation

   a. Insulation in walls and roof shall be 3" fiberglass with LAMTEC WMP – VR-R Plus Face with a minimum R value of 10.

9. Accessories

a. FRAMED OPENINGS IN WALLS shall normally be an opening framed with 16 gage minimum, cold-formed members designed to meet the specified loads. Openings shall be trimmed with closure pieces to accept aluminum framing for windows.

C. EXECUTION

1. Preparation

a. Erection of the engineered building shall be preformed by a company regularly engaged in the erection of metal buildings for a minimum of 5 years.

b. Work shall be coordinated with work of other trades so that construction work of all trades can be properly completed.

c. Before proceeding with the erection and in time to permit correction of defective setting, the owner shall verify the location and elevation of all anchor bolts for column bases.

d. Erection practices shall conform to the MBMA "Code of Standard Practices". Section 5.

2. Erection

a. Erect building in accordance with the building manufacturer's erection drawings and written instructions.

b. Field modifications shall not be made to structural members except as authorized by the building manufacturer.

c. Erect building and all components plumb, true and level to lines and profiles indicated.

d. Framing: Level base plates to a true even plane with full bearing to supporting structures.

e. Purlins and Girts: Locate and space girts to suit door and window arrangements and heights. Secure purlins and girts to structural framing and hold rigidly to straight line with temporary shoring until secured by exterior sheeting.

f. Bracing: Provide diagonal cable bracing (or other bracing as required by design) in roof and sidewalls as indicated on the erection drawings.

g. Siding and Roofing: Arrange and nest side-lap joints so prevailing winds blow over lapped joints. Apply panel and associated items for neat and weather tight enclosure. Avoid panel creep or applications not true to line. Protect factory finishes from damages.

   a. Field cutting of panels by torch is not permitted.

   b. Install weatherseals as per manufacturer's instruction.

h. Sheet Metal Accessories: Install gutters, downspouts, curbs, trim and other sheet metal accessories in accordance with manufacturer's recommendations for positive anchorage to building and weathertight anchorage.

i. Insulation: Install concurrently with wall and roof panels. Install blankets straight and true with both sets of tabs sealed to provide a complete vapor barrier. Install insulation at eave and base to prevent wicking of water from gutter and sheeting notch.

A. GENERAL

Work under this section consists of furnishing and installing all metal doors and frames.

B. SHOP DRAWINGS

Submit six (6) blue-line prints of shop drawings covering metal doors and frames, and borrow light frames for review by the Engineer.

C. HOLLOW METAL DOORS AND FRAMES

Materials: All hollow metal doors shall be 1-3/4" thick doors as manufactured by the Ceco Corporation, Chicago, Illinois; Republic Builders Products, McKenzie, Tennessee; Steelcraft Manufacturing Co., Cincinnati, Ohio, or approved equal. Door types shall be as follows:

"HD" (Heavy Duty) doors shall be 1-3/4" flush type, Ceco "Regent"; or approved equal. HD doors shall have 18 gauge face sheet reinforced with a structural honeycomb urethane core and with 16 gauge flush top and bottom channels.

Hollow metal doors shall be of sizes and type shown on the Drawings, and shall have louvers and vision panels where shown on the Drawings. All edges of all metal doors shall be flush. Doors shall be given a coat of gray rust inhibitive primer. Doors shall be mortised, drilled, tapped and reinforced for all hardware to templates furnished by hardware manufacturer.

Double doors shall be furnished with a standard astragal.

Doors, where noted on the Drawings, shall have hollow metal frames. Furnish and install combination steel bucks and frames. Metal frames shall be of designs, profiles and sizes required by the Drawings.

Steel hollow metal frames and transoms shall be same manufacturer as hollow metal doors, and shall be as detailed on the Drawings. Frames shall be set up and arc-welded at miters and ground smooth. Frame shall be of 16 gauge steel.

Provide metal glass stops around perimeter of glass in doors. Glass stops shall be metal stops as manufactured by door frame manufacturer, and shall be neatly cut to lengths required.

Frames shall be furnished with not less than three (3) 16 gauge adjustable anchors per jamb for securing to masonry and/or suitable anchors for anchoring to other construction.

Sill clips shall be provided for anchoring frames to floor. All frames shall be prepared and reinforced for hardware in accordance with templates furnished by hardware manufacturer. Frames shall be given one (1) coat of gray rust inhibitive metal primer.

Frames shall be supplied with factory-installed rubber bumpers, three (3) per strike jamb for single doors and two (2) per head for pairs of doors. Frames shall have welded and ground corners.

Removable transom frames shall be fabricated so that removal can only be accomplished from the interior of building.

D. INSTALLATION

Metal Doors, Frames and Transoms - Shall be installed in locations, and to detail shown on the Drawings. Door frames in masonry walls shall be grouted solid. Install a minimum of three (3) masonry anchors per jamb (a minimum of four (4) in 4'-0" wide single doors and in frames over 8'-0" high), in metal frames attached to masonry. Install door silencers on lock jamb of all hollow metal frames.

Required hardware items shall be as specified in SECTION 8.4- FINISH HARDWARE of these Specifications.

Glazing shall comply with recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual" and "Sealant Manual"

Plastic Glazing: Shall be ¼" thick "LEXAN" as manufactured by General Electric Co., Pittsfield, Massachusetts; "Lucite L" cast acrylic sheet by E. I. Dupont de Nemours & Co., Inc., Wilmington, Delaware, or approved equal. Install where noted on Drawings.

Clear Glass Glazing: Shall be 1/4" thick clear float glass type I, class I, quality q3. Install where glass shown on drawings and in doors.

E. WEATHERSTRIPPING

Heads and jambs of all exterior hollow metal doors will be provided with spring bronze weatherstripping, fit around hardware and at corners to provide continuous protection. Adjustable bottom rail weatherstripping will be installed on each exterior hollow metal door. Provide and install a Zero 11A drip on the frame over the door.

F. PROTECTION

After erection, all doors shall be protected from damage by other trades. All factory finished and aluminum surfaces shall be protected from contact with lime, acid or other harmful compounds.

G. CLEANING

All factory finished surfaces shall be cleaned with plain water, with mild soap or detergent. No abrasive agents shall be used.

A. SCOPE

Provide complete operating insulated overhead door assemblies including door curtains, guides, counterbalance mechanism, hardware, operators, and installation accessories for chain operated or motorized operating doors as shown on the drawings.

Field painting is specified elsewhere.

Electrical connections for powered operators and accessories are specified in Electrical Specification and drawings.

B. SUBMITTALS

Product Data: Submit manufacturer's product data, roughing-in diagrams, and installation instructions for each type and size of overhead coiling door. Provide operating instructions and maintenance information, and complete information describing fire release system including electrical rough-in instructions.

Shop Drawings: Submit shop drawings for special components and installations which are not fully dimensioned or detailed on manufacturers data sheets.

C. QUALITY ASSURANCE

Furnish each overhead coiling door as a complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components.

Furnish overhead coiling door units by one manufacturer for entire project.

Wind Loading: Design and reinforce overhead coiling doors to withstand a 25 lb. per sq. ft. wind loading pressure unless otherwise indicated.

Manufacturers

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Ceco/Windsor Door, The Ceco Corp.
2. Overhead Door Corp.

Door Curtain Materials and Construction

Door Curtain: Fabricate overhead coiling door curtain of interlocking slats designed to withstand required wind loading, of continuous length for width of door without splices. Unless otherwise indicated, provide slats of material gauge recommended by door manufacturer for size and type of door required, and as follows:

Steel Door Curtain Slats: Structural quality, cold-rolled galvanized steel sheets complying with ASTM A 446, Grade A, with G90 zinc coating, complying with ASTM A 525, and phosphate treated before fabrication. Furnish manufacturer's standard "flat-face" slats.

Endlocks: Malleable iron castings galvanized after fabrication, secured to curtain slats with galvanized rivets. Provide locks on alternate curtain slats for curtain alignment and resistance against lateral movement.

Bottom Bar: Consisting of 2 angles, either galvanized or stainless steel extrusions to suit type of curtain slats.

Provide a replaceable gasket of flexible vinyl or neoprene between angles as a weather seal and cushion bumper for manually operated doors unless shown as an overlapping joint.

Curtain Jamb Guides: Fabricate curtain jamb guides of steel angles, or channels and angles with sufficient depth and strength to retain curtain loading. Build-up units with minimum 3/16" thick steel sections, galvanized after fabrication. Slot bolt holes for track adjustment.

Secure continuous wall angle to wall framing by 3/8" minimum bolts at not more than 30" o.c., unless closer spacing recommended by door manufacturer. Extend wall angles above door opening head to support coil brackets, unless otherwise indicated. Place anchor bolts on exterior wall guides so they are concealed when door is in closed position. Provide removable stops on guides to prevent over-travel of curtain, and continuous bar for holding windlocks.

Weather Seals: Provide vinyl or neoprene weatherstripping for exterior exposed doors. At door heads, use 1/8" thick continuous sheet secured to inside of curtain coil hood. At door jambs, use 1/8" thick continuous strip secured to exterior side of jamb guide.

D. COUNTERBALANCING MECHANISM

Counterbalance doors by means of adjustable steel helical torsion spring, mounted around a steel shaft and mounted in a spring barrel and connected to door curtain with required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

Counterbalance Barrel: Fabricate spring barrel of hot-formed structural quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support roll-up of curtain without distortion of slats and limit barrel deflection to not more than 0.03" per ft. of span under full load.

Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast steel barrel plugs to secure ends of springs to barrel and shaft.

Fabricate torsion rod for counterbalance shaft of case-hardened steel, of required size to hold fixed spring ends and carry torsional load.

Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate with bell mouth guide groove for curtain.

Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head, and act as weather seal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface- mounted hoods, and any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.

Fabricate steel hoods for doors of not less than 24 gauge hot-dip galvanized steel sheet with G 90 zinc coating, complying with ASTM A 525. Phosphate treat before fabrication.

E. PAINTING

Shop clean and prime ferrous metal surfaces, exposed and unexposed, except faying and lubricated surfaces and galvanized metal, with door manufacturer's standard rust inhibitive primer.

F. MANUAL DOOR OPERATORS

Provide chain hoist operators.

Chain Hoist Operator: Provide manual chain hoist operator consisting of endless steel hand chain, chain pocket wheel and guard, and geared reduction unit with maximum 35 lbs. pull for door operation. Design chain hoist with self-locking mechanism allowing curtain to be stopped at any point in its travel and to remain in position until movement is reactivated. Furnish alloy steel hand chain with chain holder secured to operator guide.

G. LOCKING

Provide hand chain locking bracket for padlocking chain on chain hoist doors.

H. INSTALLATION

Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with final shop drawings, manufacturer's instructions, and as specified herein.

Upon completion of installation including work by other trades, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion and fitting weathertight for entire perimeter.

A. SCOPE

The work of this section shall include the furnishing of all finish hardware and related items as specified herein or necessary for the completion of the project. Provide locks for all doors, gates and overhead doors.

B. SAMPLES, SUBMITTALS AND APPROVAL

A complete and detailed hardware schedule shall be prepared and submitted, in quadruplicate to the Engineer. The Engineer's approval must be received before shipment.

The schedule shall list all locations requiring hardware and shall include the names of manufacturer's, items specified, catalogue numbers and finishes of each item specified.

The finish hardware supplier shall be responsible for furnishing correct quantities of each item. A sample of each item of hardware shall be submitted to the Engineer if other than the item specified. Samples will be retained for comparison with materials delivered to job and returned to the Contractor.

C. TEMPLATES

After approval of finish hardware schedule, the finish hardware supplier shall furnish templates to all related trades and manufacturers concerned for the preparation of fabrication of their products.

D. GUARANTEE

The finish hardware supplier shall guarantee that all materials furnished by him shall be free from defects, blemishes and workmanship and shall perform satisfactorily all uses and functions for which intended for a period of one (1) year after installation and acceptance. Any item proven to be defective under above conditions shall be replaced at the finish hardware supplier's expense.

E. KEYING

Furnish two (2) keys per lock. Key locks alike on each building. Key locks to existing Master Key System.

F. FINISHES

The finish in general shall be US26D and US32D unless otherwise specified.

G. MANUFACTURER'S INDEX

Hardware matching the numbers scheduled from the following manufacturers are acceptable:

Stanley Hardware Co.	Hager Hinge Co.
Russwin Hardware Div.	National Guard Products, Inc.
Sargent & Co., Division of	Norton Security Products Div.
Walter Kidde & Co., Inc.	Scovill, Inc.
Pemko Weatherstripping Co.	Brookline Industries, Inc.
The H.B. Ives Co.	Schlage Lock Co.

H. PACKING AND MARKING

All finish hardware shall be properly packed and marked for the opening for which it is intended. Furnish all necessary attachments, fastenings and installation instructions.

I. DOOR SILENCERS

All doors shall be equipped with rubber silencers. Provide a minimum of 3 silencers on strike face of each door stop. Silencers shall be No. 20 by H.B. Ives Co.; No. 33 by Russwin Hardware Division, Emhart Industries, Inc., or approved equal. Silencers are not included in Hardware Schedule.

J. HARDWARE SETS

The numbering of the various hardware sets listed below corresponds to the set numbers indicated in the Door Marks on the Drawings for the various openings. The quantities listed in each set are those required for each opening listed in the Door Schedule (single door or pari of doors, as the case may be) unless noted otherwise.

Manufacturer's Index of abbreviations to key in Schedule as follows:

(S)	Sargent & Co.
(I)	HB. Ives Co.
(NG)	National Guard Products
(H)	Hagar

In the following list of product catalogue numbers the words "or equal" are understood to apply.

Hardware Set	Item	Supplier Code	Item No./Or Description
HW-1	1 ½ pr. Butts 1 Lock Set 1 Closer 1 Threshold 1 Set Weatherstrip	H S S NG NG	BB1191 - 4' x 4' x US32D 7743-0B x US32D EN1104 513 x length required 160 DKB
HW-2	1 ½ pr. Butts 1 Lock Set 1 Set Weatherstrip 1 Threshold	H S NG NG	BB1191 - 4' x 4' x US32D 7715-0B x US32D 160 DKB 513 x length required
HW-3	3 pr. Butts 1 Lock Set 2 Flush Bolts 2 Stops	H S I I	BB1191 - 4' x 4' x US32D 7743-0B x US32D 458-F2C 436-B26D
HW-4	1½ pr. Butts 1 Lock Seat 2 Flush Bolts 2 Stops	H S I I	BB191- 4' x 4' x US32D 7715-OB x US32D 458-F2C 436-B26D

A. GENERAL:

The work to be performed under this section of the Specifications shall consist of furnishing all labor, materials, and equipment necessary for painting all new pumps, exposed pipe, valves and fittings, hangers, supports, electrical conduits, metal work, structural steel, miscellaneous steel, concrete block, and equipment as specified herein. Existing facilities shall be repainted where specified on the plans.

All metal surfaces to be painted shall be sound, clean and free of harmful scale, rust, dirt, oil, grease, moisture, or any other foreign matter which might, in any way, lessen the life or usefulness of the coating.

All metal shall be smooth and free from blisters, rough corners, pits, dents or other imperfections before painting. Pits and dents shall be filled and the metal ground smooth where required.

Shop coated surfaces shall be thoroughly cleaned before the application of subsequent paint coats in the field.

Paints and similar materials shall be mixed in vessels of adequate capacity. All paints shall be thoroughly stirred before being taken from the containers, shall be kept stirred while using, and all ready-mixed paints shall be applied exactly as received from the manufacturer without addition of any kind of a drier or thinner except as permitted or directed by the Engineer.

All painting at the site of the work is hereby defined as field painting and shall be under the observation of the Engineer to the extent that he shall determine where and when painting meets specification. All surfaces to be painted shall have their readiness for painting approved by the Engineer before work is started.

In all cases, paints and coatings shall be applied according to manufacturer's recommendations.

Surfaces of exposed members inaccessible after erection shall be cleaned and painted before erection.

No painting shall be done when the temperature is below 50°F, when rain is falling, during fog, or until moisture on the surfaces to be painted has completely disappeared.

Painting found defective shall be removed and the surface repainted as directed by the Engineer.

Aluminum and galvanized members shall not be painted except where specifically noted on drawings and specifications.

B. SHOP PAINTING

Certain items which will be subjected to immersion in water or sewage in the finished work as described and set out hereinafter shall not receive a shop coat of primer or paint but shall receive in the field the specified surface preparation, primer, and finish paint coats. Items so specified for painting entirely in the field, but delivered to the job site already primed, shall be sandblasted to remove any coatings applied in the shop and then receive the coatings specified.

Items specified for shop priming shall receive one (1) shop coat of the primer specified. In all cases, shop primer shall be compatible with the field coat specified and be from the same manufacturer.

C. SURFACE PREPARATION FERROUS METALS, PROCESS EQUIPMENT

Surface preparation of all ferrous metal to be primed in the shop shall have all rust, dust and scale, as well as all other foreign substances, removed by sandblasting or pickling. Cleaned metal shall be primed or pretreated immediately after cleaning to prevent new rusting. All ferrous metals not primed in the shop shall be sandblasted in the field prior to application of the primer, pretreatment or paint. Grades of sandblasting shall be as indicated for the specific application below and shall conform to the following definitions:

White Meal Blast	-NACE No. 1 or SSPC-SP-5
Near White Metal Blast	-NACE No. 2 or SSPC-SP-10
Commercial Blast	-NACE No. 3 or SSPC-SP-6
Brush Off Blast	-NACE No. 4 or SSPC-SP-7

Unless otherwise specified, surface preparation shall be equivalent to NACE No. 3.

D. SURFACE PREPARATION - ARCHITECTURAL AND STRUCTURAL MATERIALS

1. General:

Listing below does not necessarily imply that each and every substrate condition listed will be encountered in this Project.

Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.

Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.

Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.

2. Cementitious Materials:

Prepare cementitious surfaces of concrete, concrete block, cement plaster and cement-asbestos board to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils and by roughening as required to remove glaze.

Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint.

Do not paint over surfaces where the moisture content exceeds 8%, unless otherwise permitted in the manufacturer's printed directions.

3. Structural and Miscellaneous Ferrous Metals (Non Process)

Clean non-galvanized, ferrous surfaces that have not been shop-coated of all oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning, complying with Steel Structures Painting Council (SSPC) - SP3.

Touch-up shop-applied prime coats which have damaged or bare areas. Wire-brush, solvent clean, and touch-up with the same primer as the shop coat.

4. Galvanized Surfaces:

Clean free of oil and surface contaminants with an acceptable non-petroleum based solvent. Approximately 24 hours before application of prime coat (and immediately after cleaning), chemically treat surfaces with a phosphoric acid or copper sulphate solution, applied according to directions of manufacturer of paint being used.

E. PAINTS

The paints and paint products listed below are as manufactured by Tnemec Company, Inc. or Sherwin Williams, and are intended to establish standards of quality. Paint products for this project shall be equal or approved equal in all respects to the products listed. No request for substitution will be considered which decreases the film thickness designated and/or the number of coats to be applied, or which offers a change from the generic type of coating specified. Any request for substitution shall contain the full name of each product, descriptive literature, directions for use, generic type, nonvolatile content by volume, and a list of at least ten (10) water treatment plants where each of the coatings has been used on new construction and has rendered satisfactory service for at least three (3) years. Submitted paint system shall be used throughout entire project.

1. Tnemec Company Paints

a. Series 27 F.C. Typoxy; 3 mils/coat.
b. Series 114 H.B. Tneme-Tufcoat; 3 mils/coat.
c. Series 36 undercoater; 2 mils/coat.
d. Series 46H-413 Tneme-Tar; 10 mils/coat.
e. Series 54-562 Modified Epoxy Masonry Filler; 10 mils/coat.
f. Series 66 Hi-Build Epoxoline; 4 mils/coat.
g. Series 181 W. B. Tneme-Crete; 5 mils/coat.
h. Series 74 Endura-Shield; 2 mils/coat.
i. Series 104 H.S. Epoxy; 4 mils intermediate/9 mils final.
j. Series 113 Tneme Tufcoat: 4 mils/coat.

2. Sherwin Williams Paints

a. BY3A200 W/B Tile Clad Epoxy Primer
b. B71-100Series with the V100 Hardener Pro Industrial high build W/B Epoxy
c. Y24W8981 PrepRite Quick Seal 350HS
d. B69B40 High-Mill Sher-Tar
e. B42W400 Kem-Cati-Coat Epoxy block Filler
f. B58W600Series Macropoxy Epoxy

g. A44W800Series Ultra Crete med texture coating
h. B65-600Series Acrolon 218 HS Polyurathane
i. B62-80Series Tank Clad HS
j. B71-100Series with the V110 Hardener Pro Industrial High Build W/B Epoxy

Each coat shall have the minimum dry film thickness indicated above. All coats of paint for any particular surface shall be from the same manufacturer.

3. Drywall and Wood Surfaces

The contractor shall use the following paint systems manufactured by Sherwin Williams or Tenemec for the interior drywall and wood surfaces scheduled to be painted.

Paint System 1 – Drywall General
Texture – Apply a texture to the drywall (Orange Peal Texture)
Primer – Preprite High Build Interior Latex Primer/Surface, (1 coat) – 4.0 mils wet; 0.8 mils dry
Finish Coat – ProMar 200 Low Sheen Eg-shel Enamel (2 coats) – 4 mils wet; 1.5 mils dry per coat.

Paint System 2 – Wood Trim around Windows
Stain – Sher-Wood BAC Wiping Stain
Finish – Wood Classics, Waterborne Polyurethane Varnish

Paint System 3 – Existing Painted Surfaces
Finish Coat – ProMar 200, Low Sheen Eg-Shel Enamel (2 coats) – 4 mils wet; 1.5 mils dry per coat.

F. PAINTING SCHEDULE

The number of coats shall be not less than called for hereunder. Letter designations of various coats of paint refer to the same letter designation of paints given in the preceding subsection. Colors to be selected by the Owner from the standard color line of each particular paint type and manufacturer.

Water plant piping shall be painted in accordance with the following color codes.

Water Treatment Plant Piping Color Code	
WATER LINES:	
Type	**Color**
Raw	Olive Green
Settled or Clarified	Aqua
Finished or Potable	Dark Blue
CHEMICAL LINES:	
Type	**Color**
Alum	Orange
Ammonia	White
Carbon Slurry	Black
Caustic Soda	Yellow with Green Band
Chlorine (Gas and Solution)	Yellow
Chlorine Dioxide	Yellow with Blue Band
Fluoride	Light Blue with Red Band
Lime Slurry	Light Green
Ozone	Yellow with Orange Band
Phosphate Compounds	Light Green with Red Band
Polymer	Orange with Green Band
Potassium Permanganate	Violet
Soda Ash	Light Green with Orange Band
Sulfur Dioxide	Light Green with Yellow Band
WASTE LINES:	
Type	**Color**
Backwash Waste	Light Brown
Residuals	Dark Brown
Sewer (Sanitary or Other)	Dark Gray
OTHER LINES:	
Type	**Color**
Compressed Air	Dark Green
Natural or LPG Gas	Red
Other Lines	Light Gray

Surface areas to be painted include, but are not limited to, the following items:

1. Not Used

2. Pump Motors: Manufacturer's Standard Paint System.

3. All indoor exposed Iron Pipe, Valves, Fittings and Appurtenances: Field sandblast to NACE No. 3; Field coat - two (2) coats of (f).

4. All outdoor exposed Iron Pipe, Valves, Fittings and Appurtenances: Field Sand Blast to NACE No. 3; Field coat - one (1) coat of (f) and two (2) coats of (h).

5. All Submerged Iron Pipe: Field Sand Blast NACE No. 2; Field coat - two (2) costs of (d).

6. Exterior Hollow Metal Doors and Frames and Miscellaneous Steel Items: Shop coat - one (1) coat of (a) and two (2) coats of (f).

7. Interior Hollow Metal Doors and Frames and Miscellaneous Steel Items: Shop coat - one (1) coat of (a) and two (2) coats of (f).

8. Interior Concrete Block Masonry General Areas: One (1) coat of (e) and two (2) coats of (b).

9. Exterior Surfaces All Concrete Block Masonry: Two (2) coats of (g).

10. Submerged Steel Surfaces: Sand Blast NACE No. 2; Shop coat - one (1) coat of (i) primer (4.0 miles) and one (1) coat of (i) finish coat (9.0 mils).

11. Exterior Steel Surfaces: Sand Blast NACE No. 2; One (1) coat of (i) primer (4.0 mils) and one (1) coat of (i) finish coat (9.0 mils).

12. Existing and New Wood Siding and Trim (Fascia Board): One (1) coat of (c) two (2) coats of (j). Color to match existing, clean siding and trim as required before priming and painting.

G. PAINT APPLICATION - ARCHITECTURAL AND STRUCTURAL MATERIALS

1. General:

   a. Apply paint with brush, roller, spray or other acceptable practice in accordance with the manufacturer's directions. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by the paint manufacturer for material and texture required.

b. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried. San between each enamel or varnish coat application with fine sandpaper.

c. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to insure that all surfaces, including edges, corners, crevices, welds and exposed fasteners receive a film thickness equivalent to that of flat surfaces.

d. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only.

e. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint, before final installation of equipment.

f. Paint the back sides of access panels, removable or hinged covers to match the exposed surfaces.

g. Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

2. Brush Application:

a. Brush-out and work all brush coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable. Neatly draw all glass and color break lines.

b. Brush apply all primer or first coats, unless otherwise permitted to use mechanical applicators.

3. Mechanical Applicators:

a. Use mechanical methods for paint application only when permitted by governing ordinances and trade union regulations. If permitted, limit to only those surfaces impracticable for brush applications.

b. Limit roller applications (generally) to interior wall and ceiling finishes for second and third coats. Apply each roller coat to provide the equivalent hiding as brush-applied coats.

c. Confine spray application (generally) to metal framework, siding, decking, wire mesh and similar surfaces where hand brush work would be inferior and other surfaces specifically recommended by paint manufacturer.

d. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building up film thickness of two coats in one pass.

4. Required Condition of Completed Work:

Must match approved samples for color, texture and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

5. Protection:

a. Protect work of other trades, whether to be painted or not, against damage by the painting and finishing work. Correct any damages by cleaning, repairing or replacing and repainting, as acceptable to the Engineer.

b. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

6. Clean-up:

a. During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

b. Upon completion of painting work, clean all paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

c. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

A. BUILDING PLAQUE

Furnish and install on the new laboratory/control building, one 24" x 24" or equivalent area cast aluminum building plaque with textured back ground, double lined border and classic style letters. The plaque shall read as follows:

WATER SYSTEM IMPROVEMENTS

WATER TREATMENT PLANT EXPANSION

SHAWNEE MUNICIPAL AUTHORITY

XXXXXXXXXXXXXXXX, CHAIRMAN

MEMBERS

XXXXXXXX	XXXXXXXX
XXXXXXXX	XXXXXXXX
XXXXXXXX	XXXXXXXX

CHANCE ALLISON - MANAGER
BRAD SCHMIDT - UTILITY DIRECTOR
XXXXXXX - PLANT SUPERVISOR

ENGINEER
HOLLOWAY, UPDIKE AND BELLEN, INC.
MUSKOGEE – BROKEN ARROW

CONTRACTOR'S NAME
CITY, STATE

DATE

SECTION 13300

INSTRUMENTATION AND CONTROLS – GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall procure the services of a single System Integrator to furnish all materials, equipment, labor and services, required to achieve a fully integrated and operational system as specified herein and in other Specification Sections listed below.

B. Auxiliary and accessory devices necessary for system operation or performance, such as transducers, relays, signal amplifiers, intrinsic safety barriers, and signal isolators, to interface with existing equipment or equipment provided by others under other Sections of these specifications, shall be included whether they are shown on the Drawings or not.

C. Substitutions on functions or type of equipment specified shall not be acceptable unless specifically noted. In order to confirm compatibility between all equipment, coordinate all interface requirements with mechanical and electrical systems and furnish any signal isolation devices that might be required.

D. Equipment shall be fabricated, assembled, installed and placed in operating condition in full conformity with the project Specifications, Drawings, engineering data, instructions, and recommendations of the equipment manufacturer as approved by the Engineer.

E. To facilitate the Owner's future operation and maintenance, similar products (e.g., differential pressure transmitters, SCADA I/O cards) shall be supplied from the same manufacturer.

F. All equipment and installations shall satisfy applicable Federal, State and local codes.

1.02 QUALITY ASSURANCE

A. The System Integrator shall be regularly engaged in the design and the installation of instrumentation systems and their associated subsystems as they are applied to the municipal water and wastewater industry.

1.03 NOMENCLATURE AND IDENTIFICATION

A. Field Instrument Tags

1. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as indicated in the Drawings, shall be provided on each piece of equipment supplied under this Section. Equipment shall be tagged before shipping to the site.

2. Provide 1/8-in by 3/8-in, Type 316 stainless steel button head machine screws.

3. All supplied field instrument transmitters and field instrument transmitter elements shall have a stainless steel identification tag attached to each transmitter and element prior to shipment. Tag shall be attached via stainless steel chain or stainless steel wire (24 gauge min) to a non-removable part of the device. The tag size shall be a minimum of 1.5 square inches. Tag shall include the ISA alphanumeric instrument number as indicated in the P&ID, loop, and detail drawings. The alphanumeric instrument number shall be stamped into the tag and shall have a minimum of 3/16-in high alphanumeric characters.

1.04 PROJECT/SITE REQUIREMENTS

A. Temperature:

1. Outdoor areas' equipment shall operate between -30 to 50 C degrees ambient.

2. Equipment located in indoor locations shall operate between 10 to 35 C degrees ambient minimum.

3. Storage temperatures shall range from 0 to 50 C degrees ambient minimum.

4. Additional cooling or heating shall be furnished if required by the equipment as specified herein.

B. Relative Humidity. Air conditioned area equipment shall operate between 20 to 95 percent relative, non-condensing humidity. All other equipment shall operate between 0 to 100 percent relative, condensing humidity.

PART 2 PRODUCTS

2.01 PRODUCTS GENERAL

A. All instrumentation and electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and epoxy or equal coating to prevent contamination by dust, moisture and fungus. The field mounted equipment and system components shall be designed for installation in dusty, humid and slightly corrosive service conditions.

B. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks unless otherwise noted. Fasteners for securing control panels and enclosures to walls and floors shall be either hot-dipped galvanized after fabrication or stainless steel.

C. All indicators shall be linear in process units, unless otherwise noted. All transmitters shall be provided with indicators in process units, accurate to two percent or better.

D. All equipment, cabinets and devices furnished shall be heavy-duty type, designed for continuous industrial service. The system shall contain similar products of a single manufacturer, and shall consist of equipment models, which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.

E. All electronic/digital equipment shall be provided with radio frequency interference protection.

F. Electrical

1. Equipment shall operate on a 60 Hertz alternating current power source at a nominal 120 volts, plus or minus 10 percent, except where specifically noted. Regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

2. With the exception for field device network connected devices, all electronic instrumentation shall utilize linear transmission signals of isolated 4 to 20 mA DC (milliampere direct current) capable of driving a load up to 750 ohms, unless specified otherwise. However, signals between instruments within the same panel or cabinet may be 1-5 VDC (volts direct current).

3. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero based signals will be allowed.

4. All switches shall have double-pole double-throw contacts rated at a minimum of 600 VA, unless noted otherwise.

5. Switches and/or signals indicating an alarm, failure or upset condition shall be wired fail-safe to the SCADA system. A fail-safe condition is an open circuit when in an alarm state.

6. Materials and equipment shall be UL approved. Where components are not available with UL approval, integrate the device with ground fault protective devices, isolation transformers, fuses, or other protective equipment necessary to achieve compliance with UL 508 requirements.

7. Equipment shall be constructed so that when a power interruption occurs, the equipment specified hereunder resumes normal operation without manual resetting when power is restored unless otherwise noted.

8. All transmitter output signals shall include signal and power source isolation.

2.02 LIGHTNING/SURGE PROTECTION

A. General - Lightning/Surge protection shall be provided to protect the electronic instrumentation system from induced surges propagating along the signal and power supply lines from lightning, utility, or the internal plant electrical distribution system. The protection systems shall be such that the protective level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level. Protection shall be maintenance free and self-restoring. Ground wires for all instrumentation device surge protectors shall be connected to a good earth ground.

B. Field Instrumentation Protection - Provide individual device protection for the 4-20 mA signal and, if 4 wire field instrument, the power supply of each field instrument mounted

outside of the building or facility housing the control panel. Instruments mounted within the structure as the associated control panel shall not require surge protection. Instruments shall be housed in a grounded metallic case. Device surge protectors shall be mounted within the instrument enclosure or a separate junction box coupled to the enclosure. Provide gas tube or metal oxide varisters (MOVs) surge protection devices as manufactured by Phoenix Contact, EDCO, Emerson Network Power Control Concepts, or equal.

C. Control Panel Power Feed – Provide protection of all 120 VAC power feeds into the control panels. Source voltage to cabinets/panels regardless of location (indoor or outdoor), shall be protected by isolation transformers and surge suppressors. Provide gas tube surge suppressors or metal oxide varisters (MOVs) located at the point where the 120V source supply enters the enclosure. Install the surge device to in strict compliance with the manufacturer's recommendation for maximum allowable circuit length between protective device and incoming circuit. Provide signal surge suppression devices as manufactured by Phoenix Contact, EDCO, Emerson Network Power Control Concepts, or equal.

D. 4-20 mA Signal Lines and Non-Fiber Based Data Highway Circuits – Provide protection on all signal and data highway circuits that leave a building or are routed external to a building. Provide gas tube surge arrestors, and Zener diode protectors. Circuit protection shall be provided at both ends of the signal or data highway lines within the control panel at one end and as close to the instruments or termination device as possible. Provide signal surge suppression devices as manufactured by Phoenix Contact EDCO, Emerson Network Power Control Concepts, or equal.

E. Inductive Loads – At a minimum, provide coil surge suppression devices, such as varistors, or interposing relays on all process controller outputs or switches rated 120 VA or less that drive solenoid, coil, or motor loads.

F. Telephone Circuits - At a minimum, provide Telephone Company approved line protection units for all telephone lines used for telemetry or SCADA system use under this Contract.

2.03 TUBING AND FITTINGS

A. All instrument air header takeoffs and branch connections less than 2-in shall be 316 stainless steel.

B. All instrument shut-off valves and associated fittings shall be supplied in accordance with the piping specifications and all instrument installation details. The materials for fittings and valves shall be compatible with process fluids. Where metallic fittings and valves are compatible, wetted materials shall be Type 316 stainless steel.

C. The materials for instrument tubing shall be compatible with process fluids. Where metallic tubing is compatible, tubing shall be fully annealed ASTM A269 Seamless 316 grade free of OD scratches having the following dimensional characteristics as required to fit the specific installation:

1. 1/4-in to 1/2-in O.D. by 0.035 wall thickness.

2. 5/8-in to 1-in O.D. by 0.049 wall thickness.

3. 1-in O.D. by 0.065 wall thickness.

4. 1-1/4-in O.D. by 0.065 wall thickness.

5. 1-1/2-in O.D. by 0.083 wall thickness.

6. 2-in O.D. by 0.095 wall thickness.

D. All process connections to instruments shall be annealed 1/2-inches O.D. stainless steel tubing, Type 316.

E. All tube track shall be supported by stainless steel and installed as per manufacturer's installation instructions.

2.04 SPARE PARTS

A. Spare parts of the type and quantity as recommended by the manufacturer shall be furnished for all devices furnished under these sections.

B. All spare parts shall be wrapped in bubble wrap, sealed in a polyethylene bag complete with dehumidifier, then packed in cartons and labeled with indelible markings. Complete ordering information including manufacturer's part number, part ordering information including manufacturer, part number, part name, and equipment name and number(s) for which the part is to be used shall be supplied with the required spare parts. The spare parts shall be delivered and stored in a location directed by the Engineer.

C. As a minimum, furnish the following spare parts for control panels:

1. Timers - Five of each type installed.

2. Relays - Five of each type installed.

3. Fuses and circuit breakers - 10% (minimum of 10 fuses and 2 circuit breakers) of each type and size installed.

4. Light bulbs - 10% (minimum of 10) of each type installed.

5. Power supplies - one of each type installed.

6. Manufacturer's cables - one of each type installed.

7. Selector switches/pushbuttons - Two of each type installed including 5 contact blocks.

8. Surge protection devices - One of each type installed.

9. Provide one quart of touch-up paint, for each type and color used for all RTU cabinets, panels, and consoles supplied.

D. PLC components

1. One spare CPU of each type supplied
2. Two spare I/O modules of each type supplied
3. One spare specialty interface module of each type supplied
4. One spare remote I/O communication module of each type supplied
5. One spare communications module of each type supplied.
6. One spare power supply of each type supplied
7. One spare type of each communication cable supplied

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters, alarms and similar devices indicated are approximate only. Exact locations of all devices shall be as approved by the Engineer during construction. Obtain in the field, all information relevant to the placing of process control equipment and in case of any interference with other work, proceed as directed by the Contractor and furnish all labor and materials necessary to complete the work in an approved manner at no additional cost to the Owner.

B. The P&IDs and Drawings indicate the intent and not the precise nature of the interconnection between the individual instruments. Where indicated on the P&IDs or Drawings as not requiring installation, provide the instruments suitably packaged for storage.

C. Unless specifically indicated, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands. All instrumentation connections shall be provided with shutoff and drain valves. For differential pressure transmitters, 5-valve manifolds for calibration, testing and blow down service shall also be provided. For chemical or corrosive fluids, diaphragm seals with flushing connections shall be provided.

D. All piping and tubing to and from field instrumentation shall be provided with necessary unions, calibrations and test tees, couplings, adaptors, and shut-off valves. Process tubing shall be installed to slope from the instrument toward process for gas measurement service and from the process toward the instrument for liquid measurement service. Provide drain/vent valves or fittings at any process tubing points where the required slopes cannot be maintained.

E. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed as shown and not interfere with any other equipment.

F. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded at only one ground point for each shield.

G. Installation of fiber optic cable within control panel and console assemblies. Refer to cable manufacturer's specifications for bend radius. Use cable breakout assembly as recommended by the cable manufacturer. Provide wire basket, strain relief as required to meet manufacturer's strain requirements.

H. Provide local electrical shutoffs and disconnects for all 4-wire field instruments requiring 120 VAC power. Electrical disconnects shall be suitably rated disconnect switches or manual motor starters as specified under Division 16.

I. Provide sunshades for equipment mounted outdoors in direct sunlight. Sunshades shall include standoffs to allow air circulation around the cabinet. Orient equipment outdoors to face to the North or as required to minimize the impact of glare on LED, LCD, or other digital readouts.

1. Loop Tuning - All electronic control stations incorporating PID controllers shall be tuned following device installation but prior to commencement of the field tests.

2. Optimal loop tuning shall be achieved either by auto-tuning software or manually by trial and error, Ziegler-Nichols step-response method, or other documented process tuning method. Assigning common PID factors for identical loops following field tuning of a single typical loop is acceptable

3. Determine and configure optimal tuning parameters to assure stable, steady state operation of final control elements running under the control of field mounted, dedicated PID controllers or software based PID controllers residing as part of the programmable logic controller system. Each control loop that includes anti-reset windup features shall be adjusted to provide optimum response following startup from an integral action saturation condition.

4. Tune all PID control loops to eliminate excessive oscillating final control elements. Loop parameters shall be adjusted to achieve 1/4 amplitude damping or better. In addition, loop steady state shall be achieved at least as fast as the loop response time associated with critical damping.

5. Loop performance and stability shall be verified in the field following tuning by step changes to setpoint. Submit loop tuning methodology and verification as part of the final system documentation as specified in Part 1.

6. For cascade loops, tune both sets of controllers so that the cascade loop achieves the loop tuning characteristics specified herein.

END OF SECTION

SECTION 13306

I&C – APPLICATIONS ENGINEERING SERVICES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Provide all applications programming and services required to achieve a fully integrated and operational control system. Coordinate the control system for proper operation with related equipment and materials furnished by other suppliers under other Sections of these specifications and with related existing equipment.

B. **All new control panels and equipment shall be fully integrated into the existing plant SCADA system such that all data from new equipment is viewable/controllable from local panel being installed in this contract as well as existing plant HMI.**

C. Auxiliary and accessory programming structures necessary for proper system operation and performance shall be included whether or not they are shown on the contract drawings.

1. All equipment shall be controlled in full conformity with the contract drawings, process control descriptions, specifications, engineering data, instructions, and recommendations of the equipment manufacturer.

2. All work shall be coordinated with plant operating personnel to minimize impacts on daily operation. Delays caused for any reason shall be noted and formally submitted to the engineer and the owner in the form of a letter.

3. To facilitate the Owner's future operation and maintenance, all applications programming shall utilize system software standards and conventions as agreed upon by the Owner and Engineer.

PART 2 PRODUCTS [NOT USED]

PART 3 EXECUTION

3.1 SYSTEM CONFIGURATION GUIDELINES

A. The System Integrator is responsible for providing all applications programming and configuration services to accomplish the control and monitoring functions as described herein and the contract documents.

3.2 GRAPHIC DISPLAYS - GENERAL

A. All displays shall contain and continuously update the displayed process variables, date and time of day. All process values shall be displayed in engineering units. All displays shall incorporate references to both instrumentation tag numbers and plant equipment numbers.

B. The system shall allow the operator to control equipment such as pumps and valves as defined in the control loop drawings and control loop descriptions. All control actions require a two step action.

C. Unless specifically noted, all timers, setpoints, alarm actuation levels, etc., shall be adjustable from the operator interface.

D. Index displays: Display shall be provided as a guide to the available display options. The index displays shall be a complete and logical listing of the names and number of all screens.

E. Graphic displays: The display shall depict basic the process diagrams with representative symbols for pumps, tanks, etc., combined with real time process variables or conditions. The displays shall be dynamic (i.e., symbols for a pump shall change color indicating run or stop or alarm, the volume of tanks shall be indicated by varying the height of the interior color of the tank symbol, etc.). All of the current data in the database shall be available for graphic displays. All process variables shall be displayed on their associated display(s) with correct engineering units. Process variables shall display their associated data quality flags.

F. Alarm summary display: The display shall consist of all points currently in alarm and shall include the tag number, description, time of occurrence, and present status (high, low, normal, etc.). The alarm summary shall identify alarm points by severity by utilizing distinct colors for each severity category.

G. System diagnostic displays: The displays shall summarize the error status of all system devices capable of reporting errors (i.e., PLCs, computers, network equipment, printers, communication devices, etc.). The display shall indicate if an error is detected or a failure occurs. Status of primary and backup devices shall be indicated on display.

H. Trend displays: The trend display shall display the value of a maximum of eight assigned points versus time. The intent is to depict the type of plot produced on an analog recorder on the CRT. Each point shall be trended in a different color. Each of the assigned points shall have a point identification number, point name, point description, current value, and instrument range displayed in the color used for its trend. The time period shall be selected and be either current or historical. The time period selected and time and date of start shall be displayed. The values displayed on a historical trend shall consist of the stored values for each variable trended. Current trends shall be updated at the scan frequency of the variable. A trend display shall not be considered a graphic display.

I. Printouts should include the station location name, event, date, time, priority of event if applicable, and description.

J. All alarms and events should be displayed on the screen and archived.

K. Security levels of "display only", "operator mode", "supervisor mode", and "engineer mode" shall be available through assignable passwords. On system startup, the "display only" security level shall automatically be entered. In the "display only" mode, information is available to be displayed on the screen but no changes may be made. In the "operator mode", changes may be made to process set points, times, etc.; however, the overall control concepts may not be modified. In the "supervisor mode", all operator

functions can be modified and any special reports or critical process set points (data can be modified; however, the overall control concepts may not be modified). In the "engineer mode" level, all user modifiable parameters of the system shall be available for modification.

L. The system shall show field conditions with text that can alternate (i.e. OPEN/CLOSE, START/STOP, HIGH/LOW) and change color correspondingly. Field devices that are tri state must be represented in three conditions.

M. User defined menus shall be available allowing the user to view predetermined summaries and graphics with simple keystrokes and mouse directions.

N. Conditions of field devices shall cause the corresponding graphic symbol to change color and provide a blinking image to alert the operator viewing the graphic.

O. All operator commands related to controlling field devices or system attributes shall require multiple keystrokes or mouse actions to protect against inadvertent operations

P. The operator shall receive confirmation of the selected point to be controlled, at which time a cancellation of the control can be affected

Q. Trend data shall be available for a minimum of 100 days before being archived.

R. All analog inputs shall be checked for out of range (via high and low limit checks).

S. Provide Maintenance screens for each analog value. These shall display the raw value for each analog and digital I/O point in the system. They shall also allow the operators/maintenance personnel to enter a value for an analog value that is used by the system instead of the value read from the input card / communications link.

T. HMI displays shall be provided to show details of network status as well as the communication status of every device attached to the network.

U. Conditions in the field designated as alarm conditions shall report to the operator terminal, actuate an audible alarm, and provide a visual blinking image on the associated graphic page.

V. Alarm and event printing shall occur automatically should any of the following sequences or events occur:

1. Date/Time entry
2. Limit changes
3. Any commanded or uncommanded change of any point
4. Alarm conditions
5. PLC activation or deactivation
6. Operator login or logout activity

3.3 SPECIFIC GRAPHIC DISPLAYS

A. Process graphic displays, shall be based on the P&ID's, site plan drawings, mechanical drawings and electrical drawings included in these contract documents. The graphic displays shall depict process flow streams, process structures, and all major items of process equipment and control devices in a schematic format.

B. Animation shall be provided to mimic level changes in tanks or vessels, and to mimic rotation of rotating equipment when running. Valve colors shall change when opened and closed.

C. Color coding for equipment status and alarms shall be as follows (coordinate with owner):

1. Red for on or open.

2. Green for off or closed.

3. Flashing red for alarm.

4. Yellow for acknowledged alarm.

D. At a minimum, provide the number of screen displays required below. In addition, provide pop-up screens as appropriate to allow control of individual equipment items.

E. All main graphical screens shall include a title bar, main graphic area, navigational buttons, and alarm summary bar. Title bar shall be displayed on the top of each screen and include display name, description and time/date. The main graphical area shall contain primary screen data in graphical format. Navigational buttons shall include a minimum of main menu, trends, main alarm summary, and security log in. The alarm summary bar shall display the last three valid alarms on the bottom of each screen. The following types of displays shall be included as a minimum:

1. Plant Overview screen shall include a site plan representation, indicating the geographic location of each process, and each building.

2. Main menu screen shall be developed to connect to all screens and process areas.

3. Overall process block flow diagram screen shall show all major processes in block form with flow arrows. Each block shall include a text description of key individual treatment processes. Navigational buttons to the individual treatment processes shall be performed by pressing on the text description.

4. Individual treatment process screens shall graphically display key process variables and equipment. No operator entries shall be done from these screens. Individual process flow screens for each process shall include all process components, including tanks, pumps, blowers, mixers, drives, flow meters, valves, mechanical devices, as well as manual shutoff and isolation valves. These diagrams shall be generally depicted from the P&ID's and there shall be at least 1 screen per P&ID on average.

5. Individual unit process screens depicted from the P&ID's are used for control and display of each major item of process equipment, process variables, and control devices, including pumps, blowers, valves, gates, mixers, drives etc. Navigational buttons shall consist of the P&ID's flow arrows to other individual unit processes. The unit process screens shall provide the ability for the operator to go to individual equipment popup screens. These diagrams shall be generally depicted from the P&ID's and there shall be at least 2 screens per P&ID on average.

6. Popup screens shall be provided for each piece of equipment to start/stop equipment, open / close valves, implement automatic control, adjust set points, establish and adjust tuning parameters, set alarm limits and initiate a sequence.

7. PLC system diagnostic displays, showing the operational status, and fault conditions of all PLC components, including processors, I/O modules, OIT's, power supplies and UPS units.

8. Communications diagnostic displays, showing the operational status and fault conditions of all major components including Operator Work Stations, peripheral devices and network components.

9. Maintenance screens to display the raw status of every I/O point on an I/O card basis and will allow the operators/maintenance personnel to enter a value for an analog point that will used by the system instead of the value read from the input card / communications link.

10. Trend screens with the capability to display up to eight, operator assigned, analog and or digital process variables. Each analog value will be shown on a trend screen.

11. The main alarm summary screen shall display the following information on each alarm: Time, tag name, description, alarm type, current value and status. An acknowledge alarm button shall acknowledge all new unacknowledged alarms. The acknowledged and unacknowledged alarms shall be different colors. Acknowledged alarms shall clear automatically after the condition is corrected.

12. Analog variable screens showing a tabular summary of all plant process variables, in operator assigned groupings.

3.4 ALARM/EQUIPMENT STATUS REPORTING

A. The alarm log shall display all alarms as they occur. The alarm message shall include the time of occurrence, tag name, tag number, and whether it is a low, high, or failure alarm. When the point in alarm returns to normal, the time, point identification number, and return to normal shall be displayed. All reports shall include the plant equipment number of the associated device.

B. The equipment status shall be logged whenever a change in status occurs (i.e., start, stop). The equipment status log shall include the time, equipment name, tag number, and the particular change in status.

3.5 HISTORICAL DATA MANAGEMENT

A. The following features shall be provided for processing and storage of system historical data:

1. Each system point (analog or digital, real or pseudo) shall have the capability of being historically logged. A point shall have the capability of being deleted from historical log at any time. It shall be easy to add or delete system points using minimal keystrokes.

2. Data Processing: The real time instantaneous values shall be stored in a historical log file on the hard disk at defined sampling rates.

3.6 REPORT REQUIREMENTS

A. The system shall be able to generate reports from on-line historical data files or prompt the user for the appropriate archived data files.

B. Reports shall be initiated automatically based upon time of day or manually upon operator request.

C. User interface displays for report generation shall be developed with easy recall of reports by entering time:day:year target values.

D. User interface displays shall allow the operator to define the destination of the report (e.g., display, printer, computer file, etc.) and when it is to be printed (e.g., immediately, on demand, or automatically at a specified time).

E. It shall be possible to print quality tags alongside the value.

F. Operational Report Types. The following operational report types shall be provided with the system:

1. Shift Operation Summary Report:

a. An operator-adjustable time interval Shift Operation report shall summarize plant operation from midnight through the last complete hour of operation. The operator shall be capable of adjusting the time-stamp resolution of data (i.e., secondly, hourly, monthly, etc.).

b. The report format shall consist of the following:

i. correct date

ii. plant name

iii. report name

iv. page number

v. group headings

vi. subheadings

vii. point identification

viii. engineering units

c. This report shall be printed on demand from any operator work station for any point in the system.

2. Daily Operation Summary Report

a. The daily operation report shall summarize plant operation for the previous day. The report shall be generated, on demand, after the previous days' laboratory analysis results have been entered. The printed information shall be the stored values (not averages) including scanned, lab, and manually entered data using an operator-defined time-stamped resolution.

b. The report format shall consist of the following:

i. correct date

ii. plant name

iii. report name

iv. page number

v. group headings

vi. subheadings

vii. point identifications

viii. engineering units

c. The daily minimum, average, maximum, and total where applicable shall also be calculated and printed for each point and stored.

d. Values for which there are no data available shall be identified with a special character. Thus, only values which are actually zero shall be printed as such.

e. The daily operation summary report shall be available for printing on demand, as often as preferred.

3. Monthly Operation Summary Report:

a. The monthly operation summary report shall summarize plant operation for the previous calendar month. The report shall be generated on demand from the operator work station, usually after all laboratory results for the previous month have been entered. The report format shall be arranged so that the first several

pages shall conform to the requirements of the state regulatory agencies and may be separated from the rest of the monthly operation report for transmittal to the regulatory agency.

b. The report format shall be similar to the daily operation summary report and shall consist of the following:

i. month and year

ii. plant name

iii. report name

iv. page number

v. group headings

vi. sub-headings

vii. point identifications

viii. engineering units

ix. Monthly minimum, average, maximum, and totals, where applicable, shall also be printed for each column of points printed.

c. The monthly operation summary report shall be available for printing on demand.

4. Annual Operation Summary Report:

a. The annual operation summary report shall summarize plant operation for the previous calendar year. The report shall consist of scanned data, lab data, and manually entered data using an operator-adjustable time-stamped resolution.

b. The format of the report shall be identical with the monthly operation summary report except for replacing month with year in the heading and replacing date with calendar month.

3.7 FIELD TESTING:

A. Functional Test.

1. Prior to leaving the site, the System Integrator shall use the Owner's programming computer to monitor all PLC processors online, make on-line changes, upload and download the processor to ensure programming software version compatibility.

END OF SECTION

SECTION 13311

PLC HARDWARE AND SOFTWARE

PART 1 GENERAL

1.1 SCOPE OF WORK

A. This Section includes Programmable logic controllers for control of process equipment, process oriented machinery, and process systems.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer shall be capable of providing training, parts, and coordination of emergency maintenance and repairs.

B. The programmable controller and all of the corresponding components within the family of controller products shall be manufactured by a company who regularly manufactures and services this type of equipment.

C. The manufacturer shall comply with ISO9001 standards for "Quality Systems- Model for Quality Assurance in Design/Development, Production, Installation, and Servicing".

D. The manufacturer shall provide complete technical support for all of the products. This shall include factory or on-site training, regional application centers, local or factory technical assistance, and a 24/7/365 technical support phone service.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver PLC components in packaging designed to prevent damage from static electricity and physical damage.

B. Store PLC equipment according to manufacturer requirements. At a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. Protect PLCs from exposure to dirt, fumes, water, corrosive substances, and physical damage. Also, protect the PLC from all forms of electrical and magnetic energy that could reasonably cause damage.

1.4 NOMENCLATURE AND IDENTIFICATION DEFINITIONS

A. AI: Analog Input

B. AO: Analog Output

C. Fixed I/O: A PLC style consisting of a fixed number of I/O, a processor, and a power supply all in one enclosure. Some fixed PLCs have limited expansion ability.

D. CPU: Central Processing Unit

E. DI: Discrete Input

F. Distributed I/O: Hardware specially designed to function as Remote I/O.

G. DO: Discrete Output

H. HMI: Human-Machine Interface

I. I/O Input and/or Output

J. Modular: A PLC style consisting of cards that are assembled to comprise a complete unit. All I/O, CPU, and Power Supply are dedicated cards. Typically, these cards are inserted into a chassis.

K. Master/Slave: Communication between devices in which one device, the master, controls all communications. The other devices, the slaves, respond only when queried by the master. Typically used in a Remote I/O application.

L. Peer to Peer: Communication between two or more devices, typically PLC's, in which each device can control the communication exchange.

M. PID: Control action, proportional plus integral plus derivative.

N. PLC: Programmable Logic Controller

O. Remote I/O: I/O that is located remotely from the processor. Remote I/O can communicate over a variety of communication protocols and can use standard rack based I/O, or special Remote I/O hardware referred to as Distributed I/O.

P. SCADA: Supervisory Control and Data Acquisition

1.5 SPARE PARTS

A. Supply spare parts equal to the greater of 25 percent or one field-replaceable system components unless noted otherwise.

B. At a minimum, provide the following:

1. Processors: Provide spare processor unit(s) for each unique processor installed.

2. Memory Cards: Provide spares for each type of card installed.

3. I/O Cards: Provide spares for each unique I/O module type installed. Provide two or 25 percent of installed quantity, whichever is greater.

4. Network interface and communication modules: Provide spare communication modules for each unique communication module installed.

5. Specialty Modules: Provide as a minimum a spare of each type of module identified

6. PLC Power supplies: Provide spare power supplies for each unique power supply installed.

7. Chassis: Provide spare chassis for each unique chassis installed.

8. Fixed PLCs: Provide spares for each unique type of PLC installed.

9. Miscellaneous components (including cables): Provide spares for each unique component installed.

10. Manufacturer recommended spares: Supply spare parts equal to at least one set.

C. All spare parts shall be packaged to prevent damage during long-term storage. Identified all packages with indelible markings on the exterior describing contents.

D. Provided complete ordering information including manufacturer, part number, part name, hardware and software revision levels, and equipment for which the part is to be used.

1.6 SPARE I/O

A. Each I/O drop and I/O location shall include at least 20 percent (minimum of four) points of each type (AI, AO, DI, and DO) for future use, regardless of whether any of those point types are used in that drop or location or not. The spares shall be the same type of I/O modules supplied.

B. Spare output points that require the use of an external relay shall be supplied with the external relay.

C. Regardless of the spare requirement, all installed unused points on all I/O modules shall be wired to terminal blocks in the order that they occur on the I/O modules. Unwired spares shall not be acceptable.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide Programmable Logic Controller equipment with the required memory and functional capacity to perform the specified sequence of operation with the scheduled input and output points.

B. Processor Systems shall include processor, power supply, input/output modules, communication modules, redundancy modules, and remote interface modules as required to meet system requirements.

C. Furnish products listed and classified by Underwriters Laboratories (UL), CSA, or FM approval as suitable for purpose specified and indicated.

D. All equipment and devices furnished hereunder shall be designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models that are currently in production.

E. All equipment furnished shall be designed and constructed so that in the event of power interruption the systems shall go through an orderly shutdown with no loss of memory, and resume normal operation without manually resetting when power is restored.

F. The PLCs shall communicate between the operator workstation and field-mounted transducers, switches, controllers, and process actuators. Communications protocol shall be completely transparent to process operators at the Human Machine Interface (HMI).

G. The PLC shall be capable of stand-alone operation in the event of failure of the communication link to the HMI subsystem.

H. Agency and environmental specifications:

1. Electrical supply voltage to the PLC shall be 120 Vac, plus or minus □15 percent, 48-63Hz. PLC system power supplies shall be fused for overload protection.

2. Vibration: 3.5 mm Peak-to-Peak, 5-9 Hz: 1.0G, 9-150\Hz. The method of testing is to be based upon IEC 68-2-6 and JIS C 0911 standards for vibration. The system is to be operational during and after testing. Vibration Rating of 2.0G maximum peak acceleration for 10 to 500Hz. in accordance with at least one of the following:

   a. Installed rating: DIN rail mounted PLC: 10-57 Hz, amplitude 0.075 mm, acceleration 25-100 Hz, and

   b. Panel or plate mounted PLC: 2-25 Hz, amplitude 1.6mm, acceleration 25-200 Hz.

   c. In compliance with IEC 60068 and IEC 61131.

3. Shock: 15G, 11 msec. The method of testing is to be based upon IEC 68-2-27 and JIS C 0912 standards for shock. The system is to be operational during and after testing.

4. Temperature: All PLC hardware shall operate at an ambient temperature of 0 to +55 degrees C (+32 to +140 degrees F), with an storage ambient temperature rating of -25 to +70 degrees C (-40 to +185 degrees F).

5. Relative Humidity: The Programmable Controller hardware shall function continuously in the relative humidity range of 30 percent to 95 percent non-condensing.

6. Noise Immunity: The Programmable Controller system shall be designed and tested to operate in the high electrical noise environment of an industrial plant as governed by the following regulations: IEEE 472, IEC 801, MILSTD 461B, IEC 255-4, NEMA ICS 2-230.40, and ANSI/IEEE C-37.90A-1978.

7. Altitude:

   a. Operation: 0-6,500 feet

   b. Storage: 0-9,800 feet

8. Degree of protection: NEMA 1 (IP20)

9. All products shall have corrosion protection.

I. All major assemblies and sub-assemblies, circuit boards, and devices shall be identified using permanent labels or markings indicating:

1. Modules product type such as analog or digital
2. Modules catalog number
3. Modules major revision number
4. Modules minor revision number
5. Module manufacturer vendor
6. Module serial number

J. All necessary cables shall be included. All cables and connectors shall be as specified by the manufacturer. Cables shall be assembled and installed per the manufacturer recommendations.

K. MANUFACTURERS

1. Provide all PLCs from a single manufacturer. If the PLC manufacturer has authorized third party vendors to provide modules that are compatible with their platforms, then products manufactured by these authorized third party vendors will be acceptable.
2. Provide the PLC system by one of the following:
   a. Rockwell Automation Allen Bradley CompactLogix
   b. Rockwell Automation Allen Bradley ControlLogix

L. Central Processing Unit (CPU)

1. The CPU shall be, at a minimum, a 16-bit microprocessor that provides system timing and is responsible for scheduling I/O updates, with no user programming required to ensure discrete or analog update. It shall execute user relay ladder logic programs, communicate with intelligent I/O modules, and perform on-line diagnostics. The CPU shall consist of a single module which solves application logic, stores the application program, stores numerical values related to the application processes and logic, and interfaces to the I/O.
2. The CPU shall sample all the discrete and analog inputs and outputs including internal coils and registers, and service special function modules every scan. The CPU shall process the I/O with user program(s) stored in memory, then control the outputs based on the results of the logic operation.
3. Supply the CPU with a battery-backed time of day clock and calendar.
4. The CPU family shall allow for user program transportability from one CPU model to another.

M. Diagnostics

1. All diagnostic information shall be accessible to the host communications interfaces and to the PLC program.

2. The PLC shall have indicators and on board status area to indicate the following conditions:

   a. CPU run

   b. CPU error or fault

   c. I/O failure or configuration fault.

   d. Battery good

   e. Communications indicator

N. Memory

1. The user program and data shall be contained in non-volatile battery backed memory.

2. Type: CMOS RAM program memory.

3. Memory Backup: lithium battery backup or Flash memory system capable of retaining all memory for a minimum of three months.

4. Backup Battery: The backup battery shall be capable of being replaced without disrupting memory integrity. Provide a visual indication of low battery voltage and a low battery alarm contact.

5. Flash Memory: Upon power loss, the PLC shall transfer internal memory to flash memory before the PLC powers down.

6. The operator should be able to backup volatile memory, including data and program logic onto a personal computer storage disk.

7. The operating system shall be contained in non-volatile firmware. The memory containing the operating system shall be field updateable via a separate update tool.

O. Programming Environment

1. Programming port: The PLC shall utilize a serial USB or Ethernet port for programming.

2. On-Line programming: Application programs may be modified or stored while the CPU is running, with minimal impact on the scan time.

3. Online programming including runtime editing

4. Supply all hardware and software necessary to program the CPU in these languages.

P. Communication Ports

1. The CPU shall be expandable and supplied with additional modules to support the required communication interfaces.

2.2 POWER SUPPLIES

A. The PLC shall have chassis mounted power supplies to power the chassis backplane, and provide power for the processor and applicable modules.

B. Power supplies shall have a clearly visible LED to indicate that the incoming power is acceptable and the output voltage is present.

C. Power supplies shall feature over-current and over-voltage protection and should be designed to operate in most industrial environments without the need for isolation transformers.

D. Power supplies shall be sized to accommodate the anticipated load plus 30%.

E. DC power supplies shall be capable of handling ripple up to 2.4V peak to peak.

F. AC Line Voltage rating of 85 to 265Vac, 47-63Hz

G. The power supplies shall allow for brown outs of at least ½ of a cycle, a harmonic rate of 10%, and will sustain continuous operation through momentary interruptions of AC line voltage of 10ms or less.

H. Automatically shut down the Programmable Controller system whenever its output power is detected as exceeding 125% of its rated power

I. Provide surge protection, isolation, and outage carry-over up to 2 cycles of the AC line

2.3 CHASSIS

A. Medium and large PLC models shall be chassis based.

B. All system and signal power to the CPU and support modules shall be distributed on the backplane. No interconnecting wiring between these modules via plug-terminated jumpers shall be acceptable.

C. All system modules, main and expansion chassis shall be designed to provide for free air flow convection cooling. No internal fans or other means of cooling, except heat sinks, shall be permitted.

D. All system modules including the processor shall be removable from the chassis or inserted in to the chassis while power is being supplied to the chassis without faulting the processor or damaging the modules.

E. Modules shall be designed to plug into a chassis and to be keyed to allow installation in only one direction. The design must prohibit upside down insertion of the modules as well as safeguard against the insertion of a module into the wrong slot or chassis via an electronic method for identifying a module. Electronic keying shall perform an electronic check to insure that the physical module is consistent with what was configured.

2.4 DISCRETE INPUT AND OUTPUT MODULES

A. General

1. Digital input and output modules shall provide ON/OFF detection and actuation.

2. The I/O count and type shall be as required to implement the functions specified plus an allowance for active spares, as noted below.

3. Modules shall be designed to be installed or removed while chassis power is applied.

4. Modules shall have indicators to display the status of communication, module health and input / output devices.

5. Each module shall have the following status indicators.

   a. The On/Off state of the field device.

   b. The module's communication status.

6. I/O modules shall contain a maximum of 16 points per module.

B. Module Specifications (120Vac Isolated Input Module)

1. Nominal Input Voltage of 120V ac

2. On-State Current of 15mA @132V ac, 47-63Hz maximum

3. Maximum Off-State Voltage of 20V

4. Maximum Off-State Current of 2.5mA

C. Module Specification (120Vac Isolated Output Module)

1. Each triac type discrete output shall have an associated interposing relay located in the same control panel. 120 VAC power for relay outputs shall be provided from the associated motor starter control circuit (when used with motor starters) or other 120 VAC source (when I/O is not associated with a particular motor starter).

2. Output Voltage Range of 74-265V ac, 47-63Hz

3. Output Current Rating:

   a. Per Point - 2A maximum @ 30 degrees C; 1.0A maximum @ 60 degrees C; Linear Derating

b. Per Module - 5A maximum @ 30 degrees C; 4A maximum @ 60 degrees C; Linear Derating

4. Surge Current Per Point of 20A for 43ms each, repeatable every 2s @ 60 degrees C

5. Minimum Load Current of 10mA per point

6. Maximum On-State Voltage Drop of 1.5V peak @2.0A and 6V peak @load less than 50mA

7. Maximum Off-State Leakage of 3mA per point

D. Module Specifications (Contact Output Module)

1. Output Voltage Range of 10-265V ac, 47-63Hz

2. Output Current Rating:

a. Resistive - 2A @ 125V ac

b. Inductive - 2A Steady State, 15A make @125V ac

3. Power Rating (Steady State) of 250VA maximum for 125V ac inductive output

4. Maximum Off-State Leakage of 0 mA per point

5. Configurable States

a. Fault Per Point - Hold Last State, ON or OFF

b. Program Mode Per Point - Hold Last State, ON or OFF

2.5 ANALOG INPUT AND OUTPUT MODULES

A. General

1. Analog input modules shall convert an analog signal that is connected to the module's screw terminals into a digital value. The digital value representing the magnitude of the analog signal shall be transmitted on the backplane. Analog output modules shall convert a digital value that is delivered to the module via the backplane into an analog signal on the module's screw terminals.

2. Modules shall be designed to be installed or removed while chassis power is applied.

3. Modules shall have indicators to display the status of communication, module health and input / output devices.

4. Each analog module shall provide both hardware and software indication when a module fault has occurred. Each module shall have an LED fault indicator and the programming software shall display the fault information.

5. Analog modules shall be software configurable through the I/O configuration portion of the programming software.

6. The following status shall be capable of being examined in ladder logic

   a. Module Fault Word – Provides fault summary reporting.

   b. Channel Fault Word – Provides under-range, over-range and communications fault reporting.

   c. Channel Status Words – Provides individual channel under-range and over-range fault reporting for process alarm, rate alarms and calibration faults.

7. The 24 VDC power for analog instrument loops shall be provided as a part of the system. The 24 VDC power supply shall be derived from the 120 VAC input power circuit to the PLC. The field side of the 24 VDC power sources(s) shall have individual or grouped (of logically associated circuits) fusing and be provided with a readily visible, labeled blown fuse indicator.

B. Isolated Analog Input Module

1. Input Range of 0-20 mA

2. Resolution of approximately 16 bits across range

3. Input Impedance of Greater than 249 Ohms

4. Overvoltage Protection: 8V ac/dc with on-board current resistor

5. Normal Mode Rejection of 60dB at 60Hz

6. Common Mode Noise Rejection of 120dB at 60Hz, 100dB at 50Hz

7. Isolation Voltage

   a. Channel to Channel - 100% tested at 1700V dc for 1s based on 250V ac

   b. User to System - 100% tested at 1700V dc for 1s based on 250V ac

C. Isolated Analog Output Current Module

1. Output Current Range of 4 to 20 mA

2. Current Resolution of 12 bits across 20 mA

3. Open Circuit Detection – None

4. Output Overvoltage Protection - 24V ac/dc maximum

5. Output Short Circuit Protection – 20 mA or less (electronically limited)

6. Calibration Accuracy - Better than 0.1% of range from 4mA to 20 mA

7. Calibration Interval - 12 months typical

2.6 COMMUNICATION INTERFACES

A. The PLC will be capable of the following communication protocols as shown on the drawings:

1. 10BASE-T/100BASE-TX Ethernet communication.

2. Modbus (RTU and ASCII) for up to 247 slaves

B. When required provide an Communications Interface Module mounted in the chassis or the equivalent port directly on the CPU.

2.7 PLC SOFTWARE

A. The integrator shall provide a PLC configuration and application development software package complete with documentation and disks. The PLC software package and associated licensing and/or activation shall be installed on the computers shown on the drawings.

B. The software package shall allow on-line/off-line program development, annotation, monitoring, debugging, uploading, and downloading of programs to the PLCs.

C. All required hardware (including cables, cable adapters, etc.) for connection to PLCs shall be furnished.

D. All software licenses required to achieve the functionality described in the Specifications shall be provided.

E. The software package shall include a software license agreement allowing the Owner the right to use the software as required for any current or future modification, documentation, or development of the PLCs furnished for this project.

F. The software shall be Microsoft Windows-based and run on the supplied computers.

G. The software shall include a security feature to prevent unauthorized personnel from modifying and downloading the programs.

H. Provide an I/O simulator which allows the PLC application load program to be tested on a PC with simulated analog and digital inputs and outputs, allowing I/O testing and debugging to be performed in a safe, isolated environment without the need for running the PLC CPU and process I/O boards.

2.8 OPERATOR INTERFACE TERMINALS (OIT)

A. OITs shall be mounted on control panels and shall run interface software separate from the HMI software.

B. Manufacturers

1. Provide operator interface terminals (OIT) from one of the following:

    a. Allen-Bradley PanelView 5000 19",

    b. Or equal

1. The integrated OIT software shall have the following features

    a. Trending

    b. Data Logging

    c. Alarms

    d. Graphic Symbols

    e. Animation

    f. Web Publishing

    g. Remote desktop

C. I/O Ports and Devices

    a. The OIT shall have a minimum of one Ethernet 10/100 Mbps for connectivity or programming.

    b. The OIT shall have a minimum of one Serial RS232 port.

    c. The following communication expansion modules shall be available for the selected OIT:

    d. ControlNet, DeviceNet, RIO, DH+, DH485, Modbus Plus and PROFIBUS

    e. GE Fanuc Genius, DeviceNet Slave and PROFIBUS Slave

    f. Compact flash ports shall be Type 2.

    g. The OIT shall have a minimum of one USB port.

D. Display

    a. The OIT display size be a minimum of 15" minimum.

    b. The type of display for the OIT shall be 32 Level Grayscale, Color Active Matrix TFT, or Monochrome Passive Matrix FSTN.

    c. The display resolution shall be a minimum of 1024 x 768 pixels.

    d. Display shall support touch screen input.

E. Environmental

a. Rating: OIT shall be rated to maintain the rating of the control panel it will be mounted in.

b. Temperature: Operating temperature range of the OIT shall range 0-50 degrees C.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION

A. Maintain area free of dirt and dust during and after installation of programmable controller products.

B. Anchor PLCs within enclosures as recommended by the PLC manufacturer.

C. Ventilation slots shall not be blocked, or obstructed by any means.

D. Examine areas, surfaces, and substrates to receive PLCs for compliance with requirements, installation tolerances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

E. Install in accordance with manufacturer's instructions.

F. Unload, unpack and transport equipment to prevent damage or loss.

G. Replace damaged components as directed by Engineer.

3.2 PANEL LAYOUT

A. Coordinate size and configuration of enclosure to meet project requirements. Drawings indicate maximum dimensions for PLCs, minimum clearances between PLCs, and adjacent surfaces and other items.

B. Comply with indicated maximum dimensions and clearances, or with PLC vendors required distances if they are greater then the distances indicated.

C. Provide spacing around PLC as required by the PLC manufacturer to insure adequate cooling. Insure that the air surrounding the PLC has been conditioned to maintain the required temperature and humidity range.

1. Wires entering and exiting PLC components shall be sized to comply with the PLC manufacturers requirements. Doors on all components shall be able to be fully closed when all the wires are installed.

2. For chassis mounted PLCs, no wiring, wire ducts, or other devices shall obstruct the removal of cards from the rack.

3. PLC lights, keys, communication ports, and memory card slots shall be accessible at all times. Lights shall be visible at all times when enclosure door is opened.

D. Control panel designer shall provide independent line fuses or circuit breakers, per the PLC manufacturer recommendation, for each power supply, input module, output module, and other modules with separately derived power requirements.

E. Control panel designer shall insure that communication signals, 4-20mA signals (including those with embedded HART), are properly conditioned for the PLC and protected from all sources of radiated energy or harmonics.

F. Each PLC (including all I/O) shall be powered from the UPS power conditioning system.

G. Provide all required cables, cords, and connective devices for interface with other control system components.

END OF SECTION

SECTION 13315

HMI SYSTEM SOFTWARE

PART 1 GENERAL

1.1 SCOPE OF WORK

A. This Section describes the requirements for the Human Machine Interface (HMI) software for all new control panels.

PART 2 PRODUCTS

2.1 HUMAN MACHINE INTERFACE (HMI) SOFTWARE REQUIREMENTS

A. General Requirements

1. The HMI software for all new control panels shall match and be compatible with the existing HMI system currently in use at the WTP.

END OF SECTION

SECTION 13320

CONTROL AND DATA NETWORK EQUIPMENT

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor and materials required and installed. Complete as shown on the Drawings and as specified herein.

B. The System Integrator shall furnish the labor and materials required to install and bring into operation the control and data network as shown on the Drawings and specified herein.

C. The network shall be capable of supporting communications between all servers, operator workstations, PLCs, RTUs, and other communication devices as shown on the system architecture block diagram(s). The System Integrator shall furnish all necessary cables, face plates, connectors, modems, transceivers, repeaters, modules; splice kits, etc. required for a complete and operational network. The system architecture diagram(s) are for network understanding only. Some communication devices maybe required for network operation, which may not be explicitly shown on the Drawings. The system shall be designed to accommodate an increase of 100 percent of network nodes.

PART 2 PRODUCTS

1.2 GENERAL

A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

1.3 UNMANAGED ETHERNET SWITCHES

A. General

1. Provide unmanaged Ethernet switch(s) for connection to the control network backbone as shown in the Drawings and specified herein.

B. Physical Features

1. Copper ports: 4 – 10/100 TX RJ45 ports, minimum

2. Operating temperature: 32 to 130 degrees f

3. Power: 24 VDC

4. Enclosure: Metal case, DIN-rail mountable

5. Rating: UL Class 1, Division 2 Groups A, B, C, and D

C. Network Features

1. Auto sensing duplex and speed

2. LED link/activity status indication

D. Acceptable Manufacturers

1. Phoenix contact

2. N-Tron

3. Moxa

4. Or equal

1.4 ETHERNET MEDIA CONVERTERS

A. General

1. Provide Ethernet media converter(s) as shown in the Drawings and specified herein.

B. Physical Features

1. RJ45 ports: 10/100BaseTX to 100BaseTX

2. Fiber uplinks: 100BaseTX to 100BaseFX (ST/SC connectors)

3. Fiber optics: Multi- or single-mode capability as shown in the Drawings

4. Operating temperature: 32 to 130 degrees f

5. Power: 24 VDC

6. Enclosure: DIN-rail mountable

C. Acceptable Manufacturers

1. Phoenix Contact

2. N-Tron

3. Moxa

4. Or Equal

1.5 WIRES AND CONNECTORS

A. Ethernet 10/100/1000 BASE-T/TX Cable.

1. The unshielded twisted pair cable shall be designed for use with a high speed (10/100/1000 Mbps) Ethernet 10/100/1000 BASE-T/TX communications network.

The twisted pair cable shall have a nominal impedance 100 ohms at one MHz, a maximum attenuation of 8 dB per 1000 feet at one MHz. The twisted pair cable must have frequency tested up to 250 MHz or more. The twisted pair cable shall be plenum rated and shall have a minimum of four 23 AWG solid copper conductor pairs. All 10/100/1000 BASE-T/TX (RJ-45) terminations on the twisted pair cable shall be done in a professional and workman like manner. Terminations shall provide for proper strain relief on the cable jacket. Strain relief on the wire and/or wire insulation shall not be acceptable.

PART 3 EXECUTION

END OF SECTION

SECTION 13330

CONTROL PANELS AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install control panels and equipment as specified herein and shown on the Drawings.

PART 2 PRODUCTS

2.01 CONTROL PANEL GENERAL REQUIREMENTS

A. The dimensions within this Section and on the Contract Drawings are for general reference only. Ensure that final enclosure sizing and panel arrangements accommodate all required equipment for a fully integrated and operational system as specified herein and in the Contract Documents.

B. All panel doors shall have a lock installed in the door handle, or a hasp and staple for padlocking. Locks for all panels provided under this Contract shall be keyed alike.

C. The devices designated for rear-of-panel mounting shall be arranged within the panel according to respective panel drawings and in a manner to allow for ease of maintenance and adjustment. Heat generating devices such as power supplies shall be located at or near the top of the panel.

D. The panels shall be completely fabricated, instruments and devices installed and wired at the System integrators facility.

E. All components shall be mounted in a manner that shall permit servicing, adjustment, testing, and removal without disconnecting, moving, or removing any other component. Components mounted on the inside of panels shall be mounted on removable plates and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required otherwise by the manufacturer to protect equipment from vibration. Component mounting shall be oriented in accordance with manufacturer's recommendations. The internal components shall be identified with suitable plastic or metal engraved nametags mounted adjacent to (not on) each component identifying the component in accordance with the drawing, specifications, and System Integrator's data.

F. All exterior panel mounted equipment shall be installed with suitable gaskets, faceplates, etc. required to maintain the NEMA rating of the panel.

G. Nameplates

1. All panels and panel devices shall be supplied with suitable nameplates, which identify the panel and individual devices as required. Unless otherwise indicated, each device nameplate shall include up to three lines with the first line containing

the device tag number as shown on the drawings, the second line containing a functional description (e.g., Recirculation Pump No. 1), and the third line containing a functional control description (e.g., Start).

2. Unless escutcheon plates are specified or unless otherwise noted on the Drawings, nameplates shall be 3/32-inch thick, black and white, Lamicoid with engraved inscriptions. The letters shall be Black against a White background unless otherwise noted. Edges of the nameplates shall be beveled and smooth. Nameplates with chipped or rough edges will not be acceptable.

3. Nameplate fasteners and mounting shall be epoxy adhesive or stainless steel screws for cabinet mounted nameplates

4. For every panel, provide a panel nameplate with a minimum of 1" high letters. Provide legend plates or 1-in by 3-in engraved nameplates with 1/4-in lettering for identification of door mounted control devices, pilot lights, and meters.

5. Single lamicoid nameplates with multiple legends shall be used for grouping of devices such as selector switches and pilot lights that relate to one function.

H. Mounting Elevations

1. ISA Recommended Practice RP60.3 shall be used as a guide in layout and arrangement of panels and panel mounted components. Dimensions shall account for all housekeeping pads that panels will sit on once they are installed.

2. Centerline of indicators and controllers shall be located no lower than 48-inches or higher than 66-inches above the floor on a panel face.

3. Centerline of lights, selector switches, and pushbuttons shall be located no lower than 32-inches or higher than 70-inches above the floor on a panel face.

4. Tops of annunciators shall be located no higher than 86-inches above the floor on a panel face.

5. Installation of panel components shall conform to component manufacturers' guidelines.

2.02 PANEL MATERIALS AND CONSTRUCTION

A. Structure and Enclosure

1. Panels shall be of continuous welded-steel or FRP construction as shown on the Panel Schedule. Provide angle stiffeners as required on the back of the panel face to prevent panel deflection under instrument loading or operation. Internally the panels shall be supplied with a structural framework for instrument support purposes and panel bracing. The internal framework shall permit panel lifting without racking or distortion. Provide removable lifting rings designed to facilitate simple, safe rigging, and lifting of the control panels during installation.

2. Each panel shall be provided with full height, fully gasketed access doors where shown. Doors shall be provided with a three-point stainless steel latch (except for NEMA 4X panels) and heavy duty stainless steel locking handle. Rear access doors (if included) shall be conveniently arranged and sized such that they extend no further than 24-inches beyond the panel when opened to the 90-degree position. Front and side access doors shall be as shown. Panel access doors shall be provided with full length, continuous, piano type stainless steel hinges with stainless steel pins. Front access doors with mounted instruments or control devices shall be of sufficient width to permit door opening without interference from flush mounted instruments.

3. The panels, including component parts, shall be free from sharp edges and welding flaws. Wiring shall be free from kinks and sharp bends and shall be routed for easy access to other components for maintenance and inspection purposes.

4. The panel shall be suitable for top and bottom conduit entry as required by the Electrical Drawings. For top mounted conduit entry, the panel top shall be provided with nominal one-foot square removable access plates, which may be drilled to accommodate conduit and cable penetrations. All conduit and cable penetrations shall be provided with ground bushings, hubs, gasketed locknuts, and other accessories as required to maintain the NEMA rating of the panel and electrical rating of the conduit system.

5. All panels in indoor, dry, non-corrosive environments shall be NEMA 12 unless otherwise noted. All panels in outdoor, wet, and non-chemically corrosive environments shall be NEMA 4 unless otherwise noted. Panels in chemically corrosive environments shall be NEMA 4X unless otherwise noted. All panels located in a hazardous location shall be rated for the type of hazard (e.g., NEMA 7 for Class 1, Division 1).

B. Freestanding and Floor-Mounted Vertical Panels

1. Freestanding and floor-mounted vertical panels shall meet the NEMA classification as shown on the drawings or specified herein. The panels shall be constructed of 12 gauge sheet steel, suitably braced internally for structural rigidity and strength. All NEMA 4X rated panels shall be constructed of 316 stainless steel, unless FRP is specifically indicated to be provided. Front panels or panels containing instruments shall be not less than 10 gauge stretcher leveled sheet steel, reinforced to prevent warping or distortion.

C. Wall and Unistrut Mounted Panels

1. All wall and Unistrut mounted panels shall meet the NEMA classification as shown on the drawings or specified herein. The panels shall be constructed of not less than USS 14 gauge steel, suitably braced internally for structural rigidity and strength. All NEMA 4X rated wall mounted panels shall be constructed of 316 stainless steel, unless FRP is specifically indicated. FRP panels shall be used in chlorine areas. All FRP panels located in direct sunlight shall be provided with a protective coating and sun shield to prevent discoloration and cracking.

D. Finish Requirements

1. All sections shall be descaled, degreased, filled, ground and finished. The enclosure when fabricated of steel shall be finished with two rust resistant phosphate prime coats and two coats of enamel, polyurethane, or lacquer finish which shall be applied by either the hot air spray or conventional cold spray methods. Brushed anodized aluminum, stainless steel, and FRP panels will not require a paint finish.

2. The panels shall have edges ground smooth and shall be sandblasted and then cleaned with a solvent. Surface voids shall be filled and ground smooth.

3. Immediately after cleaning, one coat of a rust-inhibiting primer shall be applied inside and outside, followed by an exterior intermediate and top coat of a two-component type epoxy enamel. A final sanding shall be applied to the intermediate exterior coat before top coating.

4. Apply a minimum of two coats of flat white lacquer on the panel interior after priming.

5. Unless otherwise noted, the finish exterior colors shall be ANSI 61 gray with a textured finish.

E. Print storage pockets shall be provided on the inside of each panel. The storage pockets shall be steel, welded on to the door, and finished to match the interior panel color. The storage pocket shall be sufficient to hold all of the prints required to service the equipment, and to accommodate 8.5 inch by 11 inch documents without folding.

2.03 ENVIRONMENTAL CONTROL

A. All panels shall be provided with louvers, sun shields, heat sinks, forced air ventilation, or air conditioning units as required to prevent temperature buildup inside of panel. The internal temperature of all panels shall be regulated to a range of 45 Deg F to 104 Deg F under all conditions. Under no circumstances shall the panel cooling or heating equipment compromise the NEMA rating of the panel.

B. Except for panels mounted with their backs directly adjacent to a wall, louvers shall be in the rear of the panels, top and bottom, and shall be stamped sheet metal construction.

C. For panels mounted with their backs directly adjacent to a wall, louvers shall be on the sides.

D. Forced air ventilation fans, where used, shall provide a positive internal pressure within the panel, and shall be provided with washable or replaceable filters. Fan motors shall operate on 120-volt, 60-Hz power.

E. For panels with internal heat that cannot be adequately dissipated with natural convection and heat sinks, or forced air ventilation, an air conditioner shall be provided.

2.04 CORROSION CONTROL

A. Panels shall be protected from internal corrosion by the use of corrosion-inhibiting vapor capsules as manufactured by Northern Technologies International Corporation, Model Zerust VC ; Hoffman Model AHCI; or equal.

2.05 CONTROL PANEL - INTERNAL CONSTRUCTION

A. Internal Electrical Wiring

1. All interconnecting wiring shall be stranded, type MTW, and shall have 600 volt insulation and be rated for not less than 90 degrees Celsius. Wiring for systems operating at voltages in excess of 120 VAC shall be segregated from other panel wiring either in a separate section of a multi-section panel or behind a removable Plexiglas or similar dielectric barrier. Panel layout shall be developed such that technicians shall have complete access to 120 VAC and lower voltage wiring systems without direct exposure to higher voltages.

2. Power distribution wiring on the line side of fuses or breakers shall be 12 AWG minimum. Control wiring on the secondary side of fuses shall be 16 AWG minimum. Electronic analog circuits shall utilize 18 AWG shielded, twisted pair, cable insulated for not less than 600 volts.

3. Power and low voltage DC wiring systems shall be routed in separate wireways. Crossing of different system wires shall be at right angles. Different system wires routed parallel to each other shall be separated by at least 6-inches. Different wiring systems shall terminate on separate terminal blocks. Wiring troughs shall not be filled to more than 60 percent visible fill.

4. Terminations

a. All wiring shall terminate onto single tier terminal blocks, where each terminal is uniquely and sequentially numbered. Direct wiring between field equipment and panel components is not acceptable.

b. Multi-level terminal blocks or strips are not acceptable.

c. Terminal blocks shall be arranged in vertical rows and separated into groups (power, AC control, DC signal). Each group of terminal blocks shall have a minimum of 25 percent spares.

d. Terminal blocks shall be the compression type, fused, unfused, or switched as shown on the Contract Drawings or specified elsewhere in Division 13.

e. Discrete inputs and outputs (DI and DO) shall have two terminals per point with adjacent terminal assignments. All active and spare PLC and controller points shall be wired to terminal blocks.

f. Analog inputs and outputs (AI and AO) shall have three terminals per shielded pair connection with adjacent terminal assignments for each point. The third terminal is for shielded ground connection for cable pairs. Ground

the shielded signal cable at the PLC cabinet. All active and spare PLC and controller points shall be wired to terminal blocks.

g. Wire and tube markers shall be the sleeve type with heat impressed letters and numbers.

h. Only one side of a terminal block row shall be used for internal wiring. The field wiring side of the terminal shall not be within 6-inches of the side panel or adjacent terminal or within 8-inches of the bottom of free standing panels, or within 3-inches of stanchion mounted panels, or 3-inches of adjacent wireway.

i. Circuit power from the SCADA cabinet out to field devices (switches, dry contacts etc.) that are used as discrete inputs to the PLC input cards shall be isolated with an isolating switch terminal block with flip cover that is supplied with a dummy fuse. Isolation switch block shall be an Allen Bradley Model 1492-H7 or equal. One isolating switch terminal block per loop numbered piece of equipment and one per spare I/O point is acceptable.

j. All PLC discrete outputs to the field shall be isolated with an isolating fuse switch terminal block with a flip cover and a neon blown fuse indicator. The single circuit fusible terminal block shall be an Allen Bradley 1492-H4 or equal.

5. All wiring to hand switches and other devices, which are live circuits independent of the panel's normal circuit breaker protection, shall be clearly identified as such.

6. All wiring shall be clearly tagged and color coded. All tag numbers and color coding shall correspond to the panel wiring diagrams and loop drawings prepared by the System Integrator. All power wiring, control wiring, grounding, and DC wiring shall utilize different color insulation for each wiring system used. The color coding scheme shall be:

   a. Incoming 120 VAC Hot - Black

   b. 120 VAC Hot wiring downstream of panel circuit breaker – Red

   c. 120 VAC Hot wiring derived from a UPS system – Red with Black stripe

   d. Three phase power – Brown, Orange, Yellow, and Green ground or as specified in Division 16.

   e. 120 VAC neutral - White

   f. Ground - Green

   g. DC power or control wiring – Blue

   h. DC analog signal wiring – Black (+), White (-)

   i. Foreign voltage – Yellow

7. Provide surge protectors on all incoming power supply lines at each panel per the requirements of Section 13300.

8. Provide redundant 24 VDC power supplies to power field instruments and panel devices. Twenty-four VDC power supplies shall be as specified in this Section.

9. Wiring trough for supporting internal wiring shall be plastic type with snap-on covers. The side walls shall be open top type to permit wire changing without disconnecting. Trough shall be supported to the subpanel by stainless steel screws. Trough shall not be bonded to the panel with glue or adhesives.

10. Each panel shall have a single tube, fluorescent light fixture, 20 Watt in size, mounted internally to the ceiling of the panel. Light fixture shall be switched and shall be complete with the lamp.

11. Each panel shall have a specification grade duplex convenience receptacle with ground fault interrupter, mounted internally within a stamped steel device box with appropriate cover. Convenience receptacle shall not be powered from a UPS and shall be protected by a dedicated fuse or circuit breaker.

12. Each panel shall be provided with an isolated copper grounding bus for all signal and shield ground connections. Shield grounding shall be in accordance with the instrumentation manufacturer's recommendations.

13. Each panel shall be provided with a separate copper power grounding bus (safety) in accordance with the requirements of the National Electrical Code.

14. Each panel shall have control, signal, and communication line surge suppression in accordance with Section 13300.

15. All microprocessor-based electronic devices in the panel that are powered by 120VAC shall be powered by the UPS.

16. Each panel shall be provided with a circuit breaker to interrupt incoming power. Provide a minimum of two (2) spare 20-amp breakers.

17. Additional electrical components including transformers, motor starters, switches, circuit breakers, etc. shall be in compliance with the requirements of Division 16.

B. Relays not provided under Division 16 and required for properly completing the control function specified in Division 13, Division 16, or shown on the Drawings shall be provided under this Section.

C. The orientation of all devices including PLC and I/O when installed shall be per the manufacturer's recommendations. No vertical orientation of PLC racks shall be allowed unless specifically indicated by the manufacturer as an acceptable mounting alternative and also approved by the engineer.

2.06 ELECTRICAL COMPONENTS

A. The main circuit breaker shall be a thermal-magnetic molded case breaker, by Square D Company, or equal. Provide a flange mounted main power disconnect operating handle with mechanical interlock having a bypass that will allow the panel door to open only when the switch is in the OFF position.

B. A mechanical disconnect mechanism, with bypass, shall be installed on each motor circuit protector, capable of being locked in the "OFF" position to provide a means of disconnecting power to the motor.

C. Auxiliary contacts shall be provided for remote run indication and indication of each status and alarm condition. Additional controls shall be provided as specified herein and as required by the detailed mechanical equipment requirements, the P&IDs (Division 13), the Control Wiring Diagrams (Division 16) and as shown on the Drawings.

D. All operating control devices and instruments shall be securely mounted on the exterior door. All controls shall be clearly labeled to indicate function and shall be in accordance with the electrical area classification indicated on the Electrical Contract Drawings.

E. A six digit, non-resettable quartz time base elapsed time meter shall be connected to each motor starter. Meter shall be Hobbs 98000 Series, Redington Model 722, Cramer Model ETI-635 G, or equal.

F. The control panel shall be provided with a lightning and surge protection unit on the line side of the main circuit breaker. Unit shall be 600 Volt, 3 Phase, General Electric "Tranquell" Series, or equal.

G. Where required by Specifications, an alternator shall be provided to sequence motors. Alternator shall be Catalog No. 008-120-13SP or 009-120-23AP by Stacon; Square D, Class 9039, Type HG-21 or equal.

H. Panel mounted timers shall be flush mounted, plug-in type, Eagle Signal Bulletin 125 cycle-flex, Idec SR6P-MO8G or equal, with ranges as shown on the Drawings, or as required by the detailed mechanical equipment specifications.

I. Specific control devices, control descriptions and other data are specified under the detailed specification for the mechanical equipment with which the control panel is supplied.

2.07 GENERAL PURPOSE RELAYS AND TIME DELAYS

A. Type:

1. General purpose plug-in type.

B. Functional:

1. Contact arrangement/function shall be as required to meet the specified control function; Mechanical life expectancy shall be in excess of 10 million.

2. Duty cycle shall be rated for continuous operation; Units shall be provided with integral indicating light to indicate if relay is energized.

3. Solid state time delays shall be provided with polarity protection (DC units) and transient protection.

4. Time delay units shall be adjustable and available in ranges from .1 second to 4.5 hours.

C. Physical:

1. For 120 VAC service provide contacts rated 10 amps at 120 VAC, for 24 VDC service provide contacts rated 5 amps at 28 VDC, for electronic (milliamp/millivolt) switching applicator provide gold plated contacts rated for electronic service; relays shall be provided with dust and moisture resistant covers.

D. Options/Accessories Required:

1. Provide mounting sockets with pressure type terminal blocks rated 300 volt and 10 amps.

2. Provide mounting rails/holders as required.

E. Manufacturer(s):

1. IDEC.

2. Allen Bradley.

3. Potter & Brumfield.

4. Equal.

2.08 SIGNAL ISOLATORS/BOOSTERS/CONVERTERS

A. Type:

1. Solid state, ASIC technology; electronic type.

B. Functional:

1. Accuracy: 0.15 percent.

2. Inputs: Current, voltage, frequency, temperature, or resistance as required.

3. Outputs: Current or voltage as required.

4. Isolation: There shall be complete isolation between input circuitry, output circuitry, and the power supply.

5. Adjustments: Zero and span adjustment shall be provided.

6. Protection: Provide RFI protection.

C. Physical:

1. Mounting: DIN Rail.

D. Manufacturer(s):

1. Action Instruments Slim Pak.

2. Acromag.

3. Equal.

2.09 24 VDC POWER SUPPLIES

A. Provide a 24 VDC power supply in the control panel to power field instruments, panel devices, etc., as required. Equip the power supply with a power on/off circuit breaker.

B. The 24 VDC power supply shall meet the following requirements:

1. Input power: 115 VAC, plus or minus 10 percent, 60 Hz.

2. Output voltage: 24 VDC.

3. Output voltage adjustment: 5 percent.

4. Line regulation: 0.05 percent for 10 volt line change.

5. Load regulation: 0.15 percent no load to full load.

6. Ripple: 3 mV RMS.

7. Operating temperature: 32 to 140 degrees Fahrenheit.

C. Size the 24 VDC power supply to accommodate the design load plus a minimum 25 percent spare capacity.

D. If power supply on/off status signal is shown, provide a relay contact (internal to the power supply or external if the power supply is not so equipped) to indicate on/off status of the power supply.

E. Provide output overvoltage and overcurrent protective devices with the power supply to protect instruments from damage due to power supply failure and to protect the power supply from damage due to external failure.

F. Mount the 24 VDC power supply such that dissipated heat does not adversely affect other panel components.

G. Manufacturer(s):

1. Acopian.

2. PULS.

3. Lambda.

4. Equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. The panels shall be installed at locations as shown on the Contract Drawings.

B. Refer to Section 13300.

3.02 TESTS

A. Refer to Section 13300.

END OF SECTION

SECTION 13340

INSTRUMENTATION AND CONTROLS – ANALYTICAL DEVICE

PART 1 GENERAL

1.1 SCOPE OF WORK

A. This section covers the furnishing, installation, and services for the field-mounted analyzers as detailed on the Drawings.

1.2 MAINTENANCE

B. Accessories

1. All mounting hardware required for pipe stand, surface, or other mounting shall be provided.

2. Each instrument shall be provided with a manufacturer installed stainless steel tag identifying the instrument tag number.

PART 2 PRODUCTS

2.1 LOW-RANGE TURBIDIMETER

A. Type:

1. Microprocessor-based, continuously flowing, light refractive type turbidimeter capable of transmitting turbidity data on a network.

B. Function/Performance:

1. Accuracy: plus or minus 2 percent of reading from 0 to 40 NTU; and plus or minus 5 percent of reading from 40 to 100 NTU.

2. Repeatability: plus or minus 1 percent of reading or plus or minus 0.002 NTU, whichever is greater.

3. Resolution: 0.001 NTU

4. Range: 0 to 100 NTU.

5. Environmental Conditions: 0 to 40 degrees C and 0 to 95 percent relative humidity, non-condensing.

6. Analyzer Isolated Output: 4-20 mA outputs adjustable over the full instrument range, and at least 2 SPDT alarm contacts rated for 5A at 230 VAC, which can be adjusted to trip at any point in the instrument range.

7. Display: Digital indicator displaying turbidity in NTUs.

C. Physical:

1. Suitable for surface or pipe stand mounting.

2. Power: 120 VAC/60 Hz.

3. NEMA 4X (IP65) enclosure.

D. Accessories Required:

1. A factory calibrated optical device for verification of calibration without the use of consumables.

2. One year supply of consumables for calibration.

3. All cables, connectors, and tubing required for a fully operational turbidimeter.

E. Manufacturer(s):

1. Hach Model 1720E with sc200 Controller.

2. GLI Model Accu4 with T53 Analyzer.

3. Equal.

2.2 CHLORINE RESIDUAL ANALYZER

A. Type:

1. Microprocessor based electronic transmitter/converter a flow through sample cell.

2. Measures free or total chlorine. Analyzer to be configured or specified for free or total chlorine as indicated on the Drawings or the Instrument Device Schedule.

3. Utilizes amperometric methods.

B. Function/Performance:

1. Accuracy: plus or minus 1 percent of full scale or 0.002 mg/l, whichever is greater, below 20 mg/l; plus or minus 5 percent of reading between 20 and 50 mg/l.

2. Resolution: 0.001 mg/l (<10 mg/l) and 0.01 mg/l (10 to 20 mg/l).

3. Range: 0-50 mg/l.

4. Environmental Conditions: The instrument shall operate over an ambient temperature range of 2-50 degrees C.

5. Output: Isolated 4-20 mA output and 3 programmable alarm contacts rated for 5A at 230 VAC.

6. Display: Dot matrix or LCD type displaying chlorine residual in ppm.

7. Temperature Compensation: Compensated for sample temperatures over the temperature range of the instrument.

8. Diagnostics: On screen instructions and self diagnostics.

9. Response: 90 percent of full scale within 2 minutes.

10. Physical:

    a. Analyzers shall be suitable for surface mounting.

11. Power Requirements: 120 VAC/60 Hz.

12. Electronics enclosure shall be NEMA 4X.

13. Sensor shall have three electrodes and shall have an automatic cleaning mechanism.

14. Accessories Required:

    a. Provide one year's supply of consumables and one spare electrode.

15. Manufacturer(s):

    a. Capital Controls Series CL1000.

    b. Wallace & Tiernan Micro 2000.

    c. Equal.

2.3 PH ANALYZER

A. Sensor

1. Type:

    a. pH-sensitive glass membrane electrode, double or triple-junction reference electrode and ground electrode with integral preamplifier.

    b. For submersion or flow-through application as indicated on the Drawings or in the Instrument Device Schedule.

2. Function/Performance:

    a. Range: 0 to 14.

    b. Temperature Compensation: Temperature element integral to sensor for temperature compensation.

3. Physical:

    a. Flat glass or shrouded pH electrode.

b. Sensor assembly constructed of PVDF, Tefzel, or similar material.

c. Sealed electrodes.

4. Accessories Required:

a. Manufacturer's cable for connection of sensor to transmitter. Length as required by installation indicated on drawings.

b. One year's supply of consumables for calibration.

c. Handrail mounting kit where indicated on the Drawings to be required.

5. Manufacturer(s):

a. GLI PD Series.

b. Rosemount Model 389.

c. Foxboro 871A.

d. Equal.

B. Transmitter

1. Type:

a. Microprocessor-based, intelligent transmitter compatible with sensor provided.

2. Function/Performance

a. Accuracy (including sensor): plus or minus 0.05 pH.

b. Repeatability (including sensor): plus or minus 0.01 pH.

c. Range: 0 to 14.

d. Environmental conditions: 0 to 55 degrees C and 5 to 95 relative humidity.

e. Output: One 4-20 mA output adjustable over the range of 0 to 14. Two alarm contacts rated for 5A at 230 VAC, configurable over the output range.

f. Temperature Compensation: Compensation over a temperature range of 0 to 85 degrees C.

g. Diagnostics: On screen instructions and display of self diagnostics.

h. Display: Digital indicator displaying pH.

3. Physical:

a. Transmitter shall be suitable for surface or pipe stand mounting.

b. Enclosure shall be NEMA 4X (IP65).

c. Power requirements: 120 VAC/60 Hz.

4. Manufacturer(s):

a. GLI P53.

b. Rosemount Model 1055 pH.

c. Foxboro 873.

d. Equal.

PART 3 EXECUTION

END OF SECTION

SECTION 13342

INSTRUMENTATION AND CONTROLS - LEVEL DEVICES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor and materials required and installed complete as shown on the Drawings and as specified herein.

B. This Section covers the furnishing, installation, and services for the field-mounted instruments as detailed on the Drawings.

C. Accessories

1. All mounting hardware required for pipe stand, surface, or other mounting shall be provided.

2. Each instrument shall be provided with a manufacturer-installed stainless steel tag identifying the instrument tag number.

PART 2 PRODUCTS

2.1 ULTRASONIC LEVEL/DIFFERENTIAL LEVEL METER

A. Transducer

1. Type

a. Non-contact, ultrasonic level transducer.

2. Function/Performance

a. Measuring Range: Transducer range shall be suitable for the installation indicated on the Drawings, up to 50 ft (15m).

b. Temperature Range: –20 to 60 degrees C.

c. Relative Humidity: Zero to 100 percent.

d. Temperature Compensation: Transducers shall be provided with integral temperature sensors for temperature compensation at temperature ranges from -50° to 150° C.

3. Physical

a. Transducers shall be potted/encapsulated in a Kynar or other chemical and corrosion-resistant housing. Where indicated on the Drawings, transducers shall be approved for installation in Class I, Division 1, Groups C and D (Zone 0) environments.

b. The surface of transducers shall be Teflon-coated where mounted on chemical tanks and exposed to vapors in the tanks that are not compatible with the transducer material.

c. Transducers shall be capable of being completely submerged without damage.

d. Transducers shall be suitable for surface, pipe, or flange mounting as indicated on the Drawings or Instrument Device Schedule. Appropriate mounting hardwired shall be provided. Flanges shall be six inch (150 mm) and resistant to attack by the medium being metered or, where required, shall be protected by corrosion- resistant coatings and facings.

4. Options/Accessories Required

a. Transducers located in areas where freezing condensation may occur shall be provided with special heaters or other type of transducer protection designed to prevent sensor icing.

b. Signal cable as recommended by the manufacturer, for installation between the transducer(s) and the transmitter. Length, up to 1200 feet (365 m), shall be as required by installation indicated on the Drawings.

5. Manufacturer(s)

a. Siemens-Milltronics.

b. Or Equal.

B. Transmitter/Converter

1. Type

a. Microprocessor based compatible with the transducer(s) provided.

2. Functional/Performance

a. Resolution (including transducer): Plus or minus 0.1 percent of range or 0.08 inches (2 mm), whichever is greater.

b. Accuracy (including transducer): Plus or minus 0.25 percent of range or 0.24 inches (6 mm).

c. Range: As required by the installation indicated on the Drawings.

d. Temperature Range: -20 to 50 degrees C.

e. Output: Two isolated 4-20 mA output and one, three, or six alarm contacts adjustable to trip at any point in the instrument range. Output contacts shall be rated 5 A at 230 VAC.

f. Temperature Compensation: Compensation over the temperature range of the sensor.

g. Display: Digital indicator displaying level/differential level or volume in engineering units or percent as indicated on the Drawings or in the Instrument Device Schedule.

h. Diagnostics: On-screen instructions and display of self- diagnostics.

i. Loss of Signal: Transmitter shall ignore momentary loss-of-echo signals and shall indicate loss of echo on the transmitter unit.

j. Configuration Protection: Programmable parameters shall be protected using E2PROM. Battery backup protection is not acceptable.

3. Physical

a. Transmitter shall be suitable for surface or pipe stand mounting.

b. Enclosure shall be NEMA 4X (IP65).

c. A/C power will be as specified in Section (40 9000) (13300).

4. Accessories Required

a. Hand-held programmer where required for configuration and calibration of the instrument.

5. Manufacturer(s)

a. Siemens Model HydroRanger 200

b. Or Equal.

2.2 FLOAT SWITCHES

A. Type

1. Ball float switch.

B. Function/Performance

1. Differential: Less than one inch.

2. Switch Rating: 520 amps at 120VAC, 10 amps at 240VAC.

C. Physical

1. Float: 316 stainless steel, Teflon-coated, 5 1/2-in diameter.

2. Totally encapsulated switch.

3. Cable shall be heavy-duty, PVC-jacketed integral to float.

D. Options/Accessories Required

1. Provide stainless steel hardware.

2. Lead wire shall be a waterproof cable of sufficient length so that no splice or junction box is required in the vault.

3. Provide cast-aluminum weatherproof junction box outside the sump pit with terminals for all floats and tapped as required for conduit connections.

E. Manufacturer(s)

1. US Filter Model 9G-EF.

2. Contegra FS 90.

3. Approved equal.

PART 3 EXECUTION

END OF SECTION

SECTION 13343

INSTRUMENTATION AND CONTROLS – PRESSURE DEVICES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. This section covers the furnishing, installation, and services for the field-mounted instruments as detailed on the Drawings.

B. Accessories

1. All mounting hardware required for pipe stand, surface, or other mounting shall be provided.

2. Each instrument shall be provided with a manufacturer installed stainless steel tag identifying the instrument tag number.

PART 2 PRODUCTS

2.1 DIFFERENTIAL PRESSURE TRANSMITTERS

A. Type:

1. Microprocessor based, intelligent type.

B. Function/Performance:

1. Range: Range of the transmitter shall be the standard range of the manufacturer closest to the differential pressure range to be metered.

2. Accuracy: 0.075 percent of span (linear output).

3. Operating Temperature: -20 to 80 degrees C.

4. Temperature Effect: Combined temperature effects shall be less than 0.2 percent of maximum span per 28 degrees C temperature change.

5. Static Pressure Effect: Effect on accuracy due to static pressure changes shall be negligible.

6. Output: 4-20 mA DC adjustable over the instrument range, with HART protocol. Output shall be linear for differential pressure applications. For flow metering applications, the output shall be proportional to the square root of the input differential pressure.

7. Stability: 0.05 percent of upper range limit for 1 year.

8. Display:

a. Digital indicator displaying differential pressure or flow in the engineering units indicated in the Instrument Device Schedule.

9. Diagnostics:

a. Self-diagnostics with transmitter failure driving output to above or below out of range limits.

b. Simulation capability for inputs and loop outputs.

c. Test terminals available to ease connection for test equipment without opening the loop.

d. Registers to record minimum and maximum pressure and temperatures transmitter has been exposed to shall be available.

10. Over Range Protection: Provide positive over range protection to 150 percent of the maximum pressure of the system being monitored by the instrument.

C. Physical:

1. Enclosure: NEMA 4X (IP66), explosion proof, approved for Class I, Division 1, Groups C and D (EEx d IIC T5).

2. Process Wetted Parts: Isolating diaphragm and other wetted metal parts shall be 316L stainless steel, unless otherwise indicated in the device schedule. Gaskets and O rings shall be Teflon.

3. Power Supply: 24 VDC loop power.

4. Sensor Fill Fluid: Silicone.

D. Accessories Required:

1. Provide span and zero adjustment at each transmitter and through the handheld programming unit.

a. Configuration of the transmitter may be accomplished using the local display and pushbuttons without the use of an external programming device.

NOTE: Siemens, ABB and Foxboro have this capability.

2. For each transmitter provide a three valve manifold. The manifold shall be 316 stainless steel. Manifolds may be mounted directly to the instrument or separately mounted. Manifolds shall be by the instrument manufacturer or by D/A Manufacturing or Anderson Greenwood.

E. Manufacturer(s):

1. Smar LD301D.
2. ABB 264DS
3. Rosemount 3051CD.
4. Foxboro IDP10.
5. Siemens DS III
6. Equal.

2.2 DIAPHRAGM SEAL - THREADED

A. Type:

1. Thread attached.
2. Welded Metal Diaphragm.

B. Function/Performance:

1. Maximum Pressure: Two times the maximum process pressure.
2. Operating Temperature: -40 to 100 degrees C.

C. Physical:

1. All 316L stainless steel construction.
2. Teflon gaskets and O rings on process connection.
3. Bleeding connection provided.

D. Accessories Required:

1. Stainless steel armored capillary tubing as required for the installation.

E. Manufacturer(s):

1. Rosemount.
2. Ashcroft.
3. Ronningen-Petter Company.
4. Siemens 7MF4861
5. Equal.

2.3 GAUGE PRESSURE OR PRESSURE SENSING LEVEL TRANSMITTERS

A. Type:

1. Microprocessor based, intelligent type.

B. Function/Performance:

1. Range: Range of the transmitter shall be the standard range of the manufacturer closest to the pressure range to be metered.

2. Accuracy: 0.075 percent of span.

3. Operating Temperature: -20 to 80 degrees C.

4. Temperature Effect: Combined temperature effects shall be less than 0.2 percent of maximum span per 28 degrees C temperature change.

5. Output: 4-20 mA DC linear with pressure or level, with HART protocol. Zero adjustable over the range of the instrument provided calibrated span is greater than the minimum calibrated span.

6. Stability: 0.05 percent of upper range limit for 1 year.

7. Display: Digital indicator displaying pressure or level in the engineering units indicated in the Instrument Device Schedule.

8. Diagnostics:

a. Self-diagnostics with transmitter failure driving output to above or below out of range limits.

b. Simulation capability for inputs and loop outputs.

c. Test terminals available to ease connection for test equipment without opening the loop.

d. Registers to record minimum and maximum pressure and temperatures transmitter has been exposed to shall be available.

e. Run-time clock available to determine usage for warranty purposes. 5-year warranty on this clock reading is included.

9. Over Range Protection: Provide positive over range protection to 150 percent of the maximum pressure of the system being monitored by the instrument.

10. If required to meet the range or suppression/elevation requirements, a differential pressure transmitter shall be provided.

C. Physical:

1. Enclosure: NEMA 4X (IP66), explosion proof, approved for Class I, Division 1, Groups C and D (EEx d IIC T5).

2. Process Wetted Parts: Isolating diaphragm and other wetted metal parts shall be 316L stainless steel, unless otherwise indicated in the device schedule. Gaskets and O rings shall be Teflon.

3. Power Supply: 24 VDC loop power.

4. Sensor Fill Fluid: Silicone.

D. Accessories Required:

1. Provide span and zero adjustment at each transmitter and through the handheld programming unit.

a. Configuration of the transmitter may be accomplished using the local display and pushbuttons without the use of an external programming device.

2. For each transmitter provide a 316 stainless steel block & bleed shut off valve. Valves may be mounted directly to the instrument or separately mounted. Valves shall be by the instrument manufacturer or by D/A Manufacturing or Anderson Greenwood.

E. Manufacturer(s):

1. Smar LD301M.

2. ABB 264HS

3. Rosemount 3051CG.

4. Foxboro IGP20.

5. Siemens 7MF4033 or 7MF8023

6. Equal.

PART 3 EXECUTION (NOT USED)

END OF SECTION

A. GENERAL

1. Scope:

   The work for this section includes furnishing all material, labor and equipment necessary to construct plant piping as indicated on the plans.

2. Planning and Execution of Work:

   a. The construction work included under these specifications shall be so planned and executed that the various portions of the work will be carried on concurrently and the whole completed within the time allowed. The work shall be so planned that the water production will not be interrupted without prior approval of the Owner.

   b. Piping shall be ductile iron with push on joints and mechanical joint fittings unless otherwise shown on the plans.

   c. Site piping materials shall be as shown on the site piping plan and profile sheets.

3. Quality Assurance - By Certificate Submission:

   a. Polyvinyl Chloride (PVC)-Gravity:

      Polyvinyl chloride (PVC) for gravity line shall be certified to meet the requirements of ASTM C-3034 with pipe material meeting ASTM C-1784 and a minimum DR of 35.

   b. Polyvinyl Chloride (PVC) Potable Water:

      PVC for potable water lines 4" and larger shall be certified to meet the requirements of AWWA C900 and shall be DR 18. Fittings for PVC Pipe 4" and larger shall be mechanical joint ductile iron.

      PVC for potable water lines 3" and smaller shall be Class 200 DR 21.

   c. Ductile Iron Pipe:

      Dimensions, weights and tolerances for ductile iron pipe shall be certified to meet the requirements of AWWA C151.

d. Gas Pressure Pipe

Dimensions, weights, and tolerances for thermoplastic gas line shall comply with ASTM D-2513.

4. Testing:

a. Gravity Lines:

1. One Hundred percent (100%) of all new gravity lines (except for drain roof drain lines) shall be tested for exfiltration and for deflection.

2. Tests for exfiltration shall be made by the Contractor in the presence of the Engineer. Any section of pipe failing either test shall be examined immediately by the Contractor to determine the cause of such failure. Failure of the Contractor to repair such defects which caused the test to fail shall be cause for issuance of work stoppage of the entire contract until the repairs are made.

3. The Contractor shall conduct the exfiltration test on each segment of sewer lines between manholes. The first line between manholes laid by new crews or using different pipe or joint material, shall be tested before backfilling, and before any sewer pipe is installed for the remainder of the work.

4. Exfiltration tests shall be conducted by blocking off other openings in the upper manholes and plugging the line where it enters the lower manholes or the reach to be tested. The line and manholes shall then be filled with water and the water required to keep the manhole full shall be measured. Tests shall not be started until, in the opinion of the Engineer, that the pipe surface has become completely saturated. Total exfiltration shall not exceed two hundred (200) gallons per inch of nominal pipe diameter per mile of pipe per day. The exfiltration test shall be maintained on each reach of pipe for at least one hour, and as much longer as necessary if, in the opinion of the Engineer, additional time is required to determine the amount of leakage.

5. The Contractor shall at his own expense, provide all the necessary piping between the sewer reach to be tested and his source of water supply. The contractor shall furnish all equipment and materials required for the test, including water necessary for testing. The

method used in the time of conducting the test shall be subject to the approval of the Engineer.

6. The Contractor may at his option, in lieu of the exfiltration test, perform an air test on each section of line.

   The air test shall be performed in accordance with ASTM C828-80 "Low Pressure Air Test of Vitrified Clay Pipe Lines".

7. All flexible pipe shall be tested for deflection using a mandrel in accordance with ODEQ construction standards for wastewater facilities. Deflection shall not exceed 5% of the pipe diameter.

b. Pressure Lines:

   1. One hundred percent (100%) of all new pressure lines shall be tested for leakage.

   2. Pressure Lines shall be tested to a pressure one hundred percent (100%) in excess of the working pressure. The leakage shall be measured by pumping into the line with a pump capable of maintaining the pressure for a period of three (3) hours. The test when so conducted, shall indicate a leakage of not more than ten (10) gallons per inch of pipe diameter per mile per day and no leaks shall become apparent on the surface of the ground. Should surface leaks become apparent or should the leakage exceed that specified the leaks shall be located and repaired and the line retested until it fulfills the above requirements.

   3. Product Delivery, Storage and Handling:

      a. Transport, deliver, unload, store and handle all pipe and fittings in a manner to prevent damage to the materials and/or the work.

      b. All damaged, broken or otherwise defective materials will be rejected.

      c. Store all circular rubber gaskets and special lubricants in packaged materials with the manufacturer's name brand and all other applicable data plainly marked thereon.

d. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. All pipe shall be loaded an unloaded piecemeal by hand or in bundles by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

c. Gas and Air Lines:

1. After completion of work and before backfilling, the entire system shall be tested to an air pressure of 125 PSI for gas and 150 PSI for air supply lines for a period of 2 hours and proved tight by inspection and to satisfaction of the governing agency. Results of the tests, signed by Contractor, shall be furnished to Engineer.

d. Disinfection of Potable Waterlines

1. General – Flush and disinfect potable waterlines in accordance with the procedure set forth in AWWA C651 Disinfecting Water Mains. Provide all temporary blow-offs, pumps, chlorination equipment, chlorine and all other necessary apparatus required.

2. Pipe Cleaning – If the pipe contains dirt or heavy encrusted matter that cannot be removed by flushing, clean and swab the interior of the pipe with a 5 percent (50,000 ppm) chlorine solution.

3. Preliminary Flushing – Flush pipeline prior to disinfection, except when the tablet method is used, to remove all remaining foreign material. The flushing operation shall develop a minimum velocity of 2.5 ft/sec.

4. Chlorine Application – In general, chlorine shall be applied using the continuous feed method. However, on large diameter lines where this method is not practical, the slug method may be substituted.

5. Continuous Feed Method – Introduce water in to the line at a constant rate while adding chlorine at a minimum concentration of 50 mg/l. Maintain the chlorinated water in the pipeline for a minimum of 24 hours after which period the treated water shall contain no less than 25 mg/l or chlorine throughout the entire

length. Repeat the above procedure if the residual at the end of the 24 hours fails to meet the minimum concentration.

6. Slug Method – Introduce water with a minimum chlorine concentration of 300 mg/l at a constant measured rate into the pipeline. Apply the chlorine for a sufficient length of time to develop a solid column or slug of chlorinated water that will, as it passes along the line, expose all interior surfaces for a period of 3 hours. Check the application at the upstream end of the line.

7. Final Flushing – After the required retention time, flush all heavily chlorinated water from the main until the chlorine concentration is no higher than that prevailing in the system, or less than 1 mg/l. All chlorinated water flushed from the system shall be dechlorinated or discharged to the existing drain system and routed to the backwash/sludge lagoons. The discharge of chlorinated water will not be permitted.

8. Bacteriologic Tests – After completion of the final flushing and prior to placing the pipeline in service, collect samples from the end of the line and test for bacteriologic quality to show the absence of Coliform organisms. The number and frequency of samples shall conform to the requirements of the public heath authority having jurisdiction but in no case shall the number be less than two for chlorinated supplies collected over two consecutive days. Collect samples in sterile DEQ approved sampling bottles from a standard corporation stop furnished and installed by the Contractor in the main. Do no collect samples using a hose or fire hydrant.

9. Repetition of Procedure – If the original disinfection fails to produce satisfactory samples, repeat the disinfection procedure at no additional expense to the Owner until specified results are obtained.

B. MATERIALS

All iron and steel products used in this project for the construction, alteration, maintenance or repair of a public water system or water treatment plant shall be produced in the United States in accordance with the Safe Drinking Water Act, Section 1452(a)(4). Such products include lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete and construction materials.

1. Polyvinyl Chloride (PVC) Gravity Sewer Pipe:

   a. PVC pipe for gravity lines shall be unplasticized polyvinyl chloride (PVC) pipe with integral wall bell and spigot joints manufacturer in accordance with ASTM D-3034. The pipe shall be made from clean, virgin, approved class 11332-B PVC compound conforming to ASTM Resin Specification D1784. Standard joint length shall be twenty (20) feet. Twelve and one half (12 ½) foot joints may be used for ease of installation in areas where cuts exceed 10 feet. The pipe shall have a minimum SDR of 35. PVC gravity sewer pipe shall be allowed only if specified in the proposal.

   b. Provisions must be made for contraction and expansion at each joint with factory installed rubber ring. The bell shall consist of an integral wall section stiffened with two (2) PVC retainer rings which securely lock the solid cross section rubber ring into position. Manhole rings shall be used to insure a water tight connection where the pipes pass through a manhole wall.

   c. Fittings and Wyes - All fittings, wyes and accessories shall be as manufactured and furnished by the pipe supplier and have bell and spigot configurations identical to that of the pipe.

   d. Physical and Chemical Requirements - Pipe shall be designed to pass all tests at
   73°F. (+/-3°F).

   e. Pipe Stiffness - Minimum "pipe stiffness" at five (5) percent deflection shall be forty-five (45) for all sizes when calculated in accordance with ASTM Designation D-2412, External Loading Properties of Plastic Pipe by Parallel-Plate Loading.

   f. Size and Minimum Wall Thickness - The nominal size and minimum wall thickness shall be as follows:

Nominal Size	Minimum Wall Thickness
4"	.125
6"	.180
8"	.240
10"	.300
12"	.357

2. Polyvinyl Chloride (PVC) Force Main:

   a. PVC force mains shall be unplasticized polyvinyl chloride (PVC) pipe with integral wall bell and spigot joints. Pipe shall meet the requirements of AWWA C900 (4" to 12") and AWWA C905 (larger than 12") shall be the DR specified on the plans.

   b. The pipe shall be furnished in twenty (20) foot lengths with fifteen (15) percent random lengths minimum ten (10) feet long. The nominal diameter of the pipe shall be as shown on the plans or shall be as listed in the proposal.

3. Ductile Iron Pipe and Fittings:

   a. Ductile iron pipe where indicated on the plans shall be centrifugally cast and shall be in accordance with AWWA C151. Pipe shall have minimum pipe classes of 350 for sizes 4" through 12", 250 for sizes 14" through 20" and 150 for 24" and above. Pipe classes for site piping shall be as shown on the site piping plan.

   b. The weight of any single pipe shall not be less than the tabulated weight by more than 4 percent.

   c. Cast iron pipe (non-ductile) shall not be less than the tabulated weight by more than 4 percent.

   d. Joints:

      1. Push on rubber gasket type joints conforming with ANSI Specifications A21.11 shall be used except where restrained joints are used in lieu of thrust blocking or where otherwise specified or shown on the plans.

      2. Restrained joints shall be used in pipe joints adjacent to fittings, bends and terminal points as well as fitting joints and where shown on the plans or where utilized in A21.10 and with A21.11. The contractor shall receive prior approval from the Engineer for utilization of restrained joints in lieu of thrust blocking.

      3. Mechanical joints shall be used where specified or shown on the plans and may be used in lieu of push-on-rubber gasket joints and shall be in conformance with ANSI A21.11.

4. Flanged joints shall be used where shown on the plans and shall conform to ANSI A21.15 for 125 pounds flange with appropriate bolts per standard ASA specifications for each flange size.

e. All fittings for pipes 4" and larger shall be ductile iron. Fittings shall be in accordance with AWWA C110 or compact fitting conforming to AWWA C153.

f. Coatings and Linings:

1. A bituminous outside coating one mil thick shall be provided in accordance with AWWA C151.

2. Cement mortar linings shall be in accordance with AWWA C104. Omit cement mortar lining on all air lines.

3. Furnish and install polyethylene encasement for all buried ductile iron pipe per AWWA C105.

g. The weight, class or nominal thickness, and sampling period shall be shown on each pipe. The manufacturer's mark, the year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe. All required markings shall be clear and legible, and all cast marks shall be on or near the bell.

4. Pipe Bedding:

a. Pipe bedding shall be ODOT Specification No. 701.06 coarse aggregate No. 67 and shall be installed in strict accordance with the details shown on the plans.

5. Polyethylene Gas Pipe:

a. Pipe shall be polyethylene (HDPE) conforming to the latest revision of the following specifications.

1. ASTM D-2513 "Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings".

2. ANSI B31-8 "Gas Transmission and Distribution Piping System".

3. AGA "Plastic Pipe Manual for Gas Service".

b. Fittings:

1. 2" and larger. Butt fused fittings.

2. 1 – ½" and smaller: Compression or socket fused fittings.

6. Air and Fuel Pipe:

a. Underground pipe shall be HDPE (DR 11) conforming to ASTM F714 "Standard Specification for Polyethylene Plastic Pipe". Fittings 2" and larger shall be butt fused smaller fittings shall be compression or socket fused fittings.

The contractor shall also be allowed to use galvanized steel pipe with threaded fittings. All steel pipe and fittings shall be schedule 40.

b. Above ground pipe shall be steel pipe (schedule 40) conforming to ASTM A106 "Standard Specification for Seamless Carbon Steel Pipe".

7. Underground Warning/Detection Tape:

a. Metal Pipe (Electrical Conduit, Steel or Cast Iron Piping) - The Contractor shall install underground warning tape on all buried electrical conduit and steel or cast iron piping. The tape shall be place 12"-18" above the top of the pipe. The tape shall be a low density polyethylene (150 mm wide x 0.10 mm thick) with preprinted wording identifying the type of pipe or conduit buried.

b. Non-metal Pipe - The Contractor shall install underground warning tape with a detectable stainless steel wire on all buried non-metal piping unless otherwise specified. The tape shall be place 12"-18" above the top of the pipe. The tape shall be a low density polyethylene (150 mm wide x 0.10 mm thick) with preprinted wording identifying the type of pipe or conduit buried. The tape must contain one or more stainless steel wires laid in a sinusoidal pattern and laminated between two layers of rot resistant polyethylene equivalent to "Wavelay" as manufactured by Boddingtons Ltd. Or approved equal. The wire shall have a tensile strength of 680N/mm2. To ensure a continuous signal along the detectable tape, the contractor shall use stainless steel wire crimps and crimping tools approved by the tape manufacturer. The contractor shall use care in covering the tape to prevent damage or separation of the tape.

c. Plastic cable protection covers for protecting underground cables and pipes shall be installed as necessary. These cable covers should be laid over high voltage power cables or other buried services which require protection.

d. Detection Pits – The Contractor shall locate access points as necessary to allow a pipe locating transmitter to be attached to the detectable warning tape. The Contractor shall be responsible for checking each tape installation for continuity in the detection of the tape. Grounding rods shall be installed at the end of each installation per the manufacturer's recommendation. See typical detail for detection pit installation.

C. INSTALLATION

1. General:

a. All installations shall conform to the materials, size and pressure rating as shown on the plans or as accepted in the proposal with construction to lines and grade as shown on the drawings. Valves and special fittings shall be placed where shown on the drawings unless their location is changed by the Engineer. In the event field conditions dictate deviation from the drawings, no change shall be made without written authorization of the Engineer.

b. No pipe shall be laid in water or when, in the opinion of the Engineer, trench conditions are unsuitable. When work is stopped at night or for any other reason, water tight plugs shall be used to exclude dirt, water and small animals.

c. All pipe, fittings, and accessories shall be carefully placed into the trench by suitable equipment in such a manner as to prevent damage to pipe and fittings.

2. Excavation for Sewer Lines:

a. All excavation shall be carried accurately to the line and grade shown on the Plans, and/or established by the Engineer. When excavation is carried below or beyond that required, the space shall be filled with selected gravel thoroughly tamped and compacted or with concrete, in accordance with Engineer's instructions. No claim for additional compensation shall be made for such backfilling or excess excavation. It shall be the Contractor's responsibility to check elevations on all reference points furnished by the Engineers prior to commencing excavation on any section

of the work to assure himself that all grades and elevations are satisfactory.

b. All excavation shall be dewatered before any construction is undertaken therein. Concrete shall be placed only upon dry, firm foundation material and pipe shall be installed only in dry trenches.

c. In order to avoid superimposed loading in excess of the design and specified pipe strength and to provide sufficient room for proper installation and bedding of sewer pipe, the trench width for pipe sizes used shall be kept within the limits specified in the following:

Nominal Pipe Diameter	Minimum Width of Trench at Center of Pipe	Maximum Width of Trench 24" Above Outside Top of Pipe
6" - 8"	20"	30"
10" - 12"	24"	36"
15" - 18"	30"	42"
21" - 24"	36"	48"
27" - 30"	42"	54"
36" - 40"	66"	72"

If it becomes necessary to reduce the earth load on the trench bank to prevent sliding and caving, it will be permissible to cut the trench banks back on a slope above an elevation two (2) feet above the outside top of the pipe. Under no circumstances, however, shall the specified maximum width of 24" above the outside top of the pipe be exceeded, except at points where combined superimposed earth and live loads on the pipe are sufficiently low to permit an increase in the specified maximum trench width, and then only where such an increase in trench width is approved by the Engineer.

d. The excavation shall be carried out to a depth of six (6") inches below the final grade elevation. This additional depth shall be backfilled with a minimum of six (6") inches of granular bedding material conforming to the plans and accurately graded in such a manner that the pipe will be in continuous and uniform contact with, and have a longitudinal bearing on the bedding for the full length of the pipe, except for such distance as is necessary for bell holes and the proper sealing of the pipe joints. The pipe bedding shall be accurately graded prior to excavating bell holes. The accuracy of the finished grade of the pipe shall be obtained in preparation of the subgrade. Each bell hole shall be prepared by the pipe layer

immediately prior to placing the pipe. Bell holes shall be of such depth that the pipe bell will not come in contact with the bottom of the bell hole. All trench shall so graded that the spigot end of the pipe will be accurately centered in the adjacent pipe bell when laid, without raising or lowering the pipe after installation in the trench.

e. If the soil at the bottom of the trench is mucky or in such condition that it cannot be properly shaped and graded, or if the subgrade material is too soft to properly support the pipe, the Contractor shall excavate below the normal subgrade elevation a sufficient distance to allow for gravel subgrade.

Wherever excavation is carried below the specified subgrade, the Contractor shall provide and install a fill of gravel bedding thoroughly tamped in place up to an elevation sufficient to prepare the subgrade as specified in the preceding paragraph.

f. Where water occurs in trenches, the trench shall be excavated to a depth of approximately six (6) inches below the subgrade and backfilled with gravel bedding conforming to ODOT Type 67 or other approved porous material to an elevation sufficient to prepare the subgrade as specified above. Pumps shall be installed and kept operating, taking suction below the gravel or porous material, so as to hold the water level well below the bottoms of all bells until the pipe has been properly backfilled so that the re-entry of water will not damage the pipe. Where water occurs in sufficient quantities so that trenches cannot be excavated properly to maintain the required maximum trench width at a point two (2) feet above the top of the pipe, a well point system shall be used to dewater the area prior to commencing excavation. Well point systems shall remain in operation until the backfill material has been placed to a point so that the well point system can be safely removed without damaging the pipe. Where special bedding material such as crushed stone or concrete cradles are required in areas being well pointed, the well point system shall be operated and a dry trench maintained for sufficient periods of time for the special bedding material to cure and the backfill placed to a point so that the well point system may be removed without injuring the pipe.

g. Where the Contractor considers it necessary to protect his employees, the work of adjacent property, or where required by safety codes, he shall provide and install a trench bracing. Such bracing shall remain in place until the backfill has proceeded to a point where it can be removed safely, except that, if in the opinion of the Contractor, damage is liable to result from withdrawing the bracing, it may remain in place.

h. Where shoring is required to maintain trench width requirements to protect the pipe from excessive loads, it shall be furnished and installed. After the pipe has been laid, backfilled and tamped to a point two feet above the top of the pipe the shoring may be removed. However, if the shoring cannot be safely removed from a point two (2) feet above the top of the pipe, it may remain in place.

i. Trenches for force mains shall be of the width and depth necessary for proper installation of the pipe. All force mains shall be laid in trenches of such depth as to provide a minimum of thirty (30) inches cover over the pipe unless otherwise shown on the Plans. The bottom of trenches for force mains shall be accurately graded so that the pipe will be in continuous and uniform contact and have a longitudinal bearing on undisturbed soil for the full length of pipe, except for such distance as necessary for adequate bell holes or coupling and proper sealing of the pipe joints. If the soil at the bottom of the trench is mucky or if the subgrade is too soft to properly support the force mains, the Contractor shall stabilize the subgrade with gravel bedding material as specified previously.

j. The excavation of trenches for sewer line or force main shall not advance more than one hundred (100) feet ahead of the completed pipe work and backfill, except by permission of the Engineer.

3. Backfill:

a. All trenches and excavation shall be backfilled immediately after the pipe is laid using methods which will not disturb the pipe. Material for backfilling shall consist of excavation or borrow of sand, gravel or other materials approved by the Engineer, and shall be free of trash, lumber or other debris.

b. Bedding: After the pipe work has been approved, trenches shall be backfilled with granular bedding material. This material shall be carefully deposited in layers of not to exceed four inches in thickness on both sides of the pipe and thoroughly and carefully tamped to 85% standard proctor density around the pipe until the backfill has been brought up to the spring line, or one-half (½) the internal diameter of the pipe. The backfill shall then continue by hand to a point six (6) inches above the top of the pipe or to a point where the pipe is safe. The remainder of the backfill may then be placed by any approved method which will not injure or disturb the pipe.

c. Backfilling in unimproved areas from an elevation of one foot above the top of the pipe to the surface of the ground may be deposited by equipment. Depositing in layers or tamping will not be required. Sufficient surplus excavated material shall be neatly rounded over the trench to compensate for later settlement.

d. Backfilling under any existing and/or proposed roads, parking areas or other improved surfaces shall be entirely aggregate for trench backfill. From a depth of one foot above the top of pipe to the surface, aggregate for trench backfill may be deposited in uniform layers not to exceed 12 inches loose measure and compacted to 95% standard density. A temporary gravel surface shall be provided and maintained by the Contractor.

e. Backfilling shall not be done in freezing weather without the permission of the Engineer, and it shall not be made with frozen materials. No backfill shall be made where the materials already in the trench are frozen.

f. It is the intent of this specification that all trenches shall be backfilled, settled, and the ground restored to its original condition as soon as possible after the pipe is installed. Any unnecessary delay in restoring trenches to their original condition shall constitute just cause for stopping all other work until the trenches are so restored. It is also the intent of this specification that the Contractor shall be responsible for all settlement of backfill in trenches occasioned by the work covered herein. He shall refill trenches as often as necessary to bring them back to original grade and during the period when settlement is occurring. Where settlement occurs in streets, driveways, road or parking areas, the Contractor shall use gravel and refill the areas frequently enough to maintain traffic without hazard at all times.

g. All excavated material which is unsuitable or not needed for backfill shall be wasted or disposed of the satisfaction of the Engineer. It shall be the Contractor's responsibility to provide areas to deposit waste material and rock. Surfaces shall be cleaned up, all hummocks and piles smoothed down, and the surface left neat and workmanlike. Where existing drainage ditches are disturbed or obstructed with excavated material, such material shall be entirely removed and the ditch left to original line and grade.

4. Laying of Sewer Pipe:

a. Proper implements, tools (jack-type tool and bell sling) and facilities satisfactory to the Engineer shall be provided and used by the Contractor.

b. Before any length of pipe is placed in the trench, a careful inspection shall be made of the interior of the pipe to see that no foreign material is in the pipe. In order to properly remove any foreign material, a swab of necessary length is to be available at all times.

c. Each pipe shall be thoroughly inspected before laying. Any pipe found to be cracked or damaged shall be plainly marked in such a manner that the marking will not rub or wash off and shall subsequently be removed from the site.

d. Before laying the pipe, the bottom of the trench shall be carefully graded and prepared and bell holes excavated so the pipe shall have a uniform support along at least three-fourths (3/4) its length. All sewer pipe shall be laid with the bell upgrade. Each pipe shall be laid to the line and grade provided by the Engineer, using batter boards or an approved laser beam light system. Except by special permission, no pipe shall be laid except in the presence of the Engineer's project representative. Each pipe as laid shall be plumbed for line with a plumb bob and graded with a grade stick or elevation unless the laser beam light system is used.

The accuracy of the finished line and grade of the pipe shall be obtained in preparation of the subgrade. All pipe shall be lowered carefully into the trench, properly aligned and properly jointed by use of suitable tools and equipment, in such a manner as to prevent damage to sewer line or water line materials and protective coatings and linings.

e. Laying and backfilling of all sewer lines laid in trenches shall follow the excavation of trenches as closely as practicable. Not more than one hundred (100) feet of trench shall be opened in advance of pipe laying without authorization by the Engineer. Water shall not be allowed to accumulate in trenches while pipe is being laid. Work on sewers crossing roads shall be performed such that minimal interference with the movement of traffic occurs.

The Contractor shall arrange for suitable detours, which shall be adequately marked. The Contractor shall provide flashers, signs, barricades and other traffic control devices required for traffic control during the construction.

f. The work must be water tight at all joints and special care shall be taken to insure that the joints are continuous around the circumference of the pipe spigot. Any joint which has been disturbed in any way after being laid shall be repaired by taking up the pipe, cleaning the joint and properly relaying the pipe. Leaks causing any sewer to fail the test as specified in this section shall be repaired such that the exfiltration or air test falls within the allowable limits.

g. Open ends of pipe and branches shall be temporarily plugged at the end of each days work.

h. All lumps, blisters and excess coating shall be removed from the joint of each pipe; and the outside and inside of all joints shall be wire brushed and wiped clean and dry and free from oil and grease before the pipe is laid.

i. If PVC pipe must be cut in the field, the cut end shall be conditioned so that it can be used to make up the next joint. Bevel the outside of the cut 3/16-inch to 1/4 inch at an angle of approximately 30 degrees to prevent damage to the gasket.

5. Jointing:

a. Removal all foreign matter from the socket, making sure the gasket seat is clean.

b. The gasket shall be wiped clean with a clean cloth, flexed and properly placed in the socket for a snug fit in the retainer seat.

c. Apply lubricant furnished by the pipe manufacturer on the surface of the gasket, which will come in contact with the plain end of the pipe to be laid.

d. Clean the plain end of the pipe and apply a thin film of lubricant about one inch back from the end. Keep pipe free of ground or trench sides to avoid foreign matter from clinging to the lubricant.

e. The plain end of the pipe should be aligned and carefully centered into the socket until it just makes contact with the gasket.

f. Joint assembly should then be completed by jacking the plain end of the entering pipe past the gasket until it makes contact with the bottom of the socket. A system of marking the pipe shall be used to make certain the assembled joint is at the proper depth.

6. Thrust Blocking for Pressure Lines:

   a. Wherever the pipe line changes direction, as at tees, elbows, bends deflecting 11-1/4 degrees or more, stops, dead ends, etc., where thrust forces may be expected, joints shall be restrained by thrust blocking to prevent slippage of the joints unless megalugs or other restraining devices are called for on the plans.

   b. Poured concrete blocking consisting of Class "B" concrete after piping in a section is in place shall be used for thrust blocking. The concrete shall be poured against undisturbed soil and against the fitting or pipe. Care being taken that no joints are covered. The concrete shall be allowed to set at least 24 hours before filling with water or subjecting to any pressure.

   c. Where plastic pipe (PVC) is used, the pipe and fittings shall be carefully wrapped with membrane or flexible paper that will prevent the concrete from coming in direct contact with the plastic (PVC) material.

   d. All thrust blocking for pipes of 2 inches diameter or less must have a thrust bearing area of 0.90 sq. ft. For pipe sizes in excess of 2 inches diameter, the net bearing area of the reaction surface of poured blocking shall conform to the table in the plans.

7. Water and Sewer Line Separation:

   Wherever sewer lines and water lines must cross, or are adjacent to each other, special precautions shall be taken as follows:

   a. Parallel Water and Sewer Lines: water lines must, if possible, be located a minimum of ten (10) feet from any existing or proposed sewer line measured from outside edge to outside edge.

   b. Locate water mains at least 5 feet horizontally from an existing or proposed storm sewer, raw water line, petroleum product lines, natural gas lines, and other buried utility lines. Locate ductile iron water lines at least 10 feet from any gasoline storage tank and lines and PVC lines at least 50 feet from these facilities. Locate water lines at least 15 feet from all parts of septic tanks and absorption fields or other sewage treatment and disposal systems.

c. Crossing Water and Sanitary Sewer Lines:

Whenever water lines must cross sanitary sewer lines, the water line shall be laid so that there is a minimum vertical distance of 24 inches between the water and sewer lines. Arrange the piping so that joints will be equial distance from the sewer line.

Sewers crossing water mains shall be laid to provide a minimum vertical distance of 24 inches between the outside of the water main and the outside of the sewer. The crossing shall be arranged so that the sewer joints are equidistant and as far as possible from the water main joints. No sewer line joint shall be less than 10 feet (3.0 m) from a water line.

8. Gas Pipe Installation

a. Pipe shall have a minimum of 30" ground cover to finished grade and may conform to surface profile, but should be graded as uniformly as practicable between pronounced high and low points. Supporting pipe on blocks (wood, brick or concrete) to produce uniform grade is prohibited. Pipe shall be free of all foreign matter before lowering into trench. Openings of pipe are to be closed with a suitable plug at all times except during actual progress of the work. Stub ends and fittings installed for future connections shall be securely closed with metal caps, and marked by a ground marker.

b. Installation of all piping, fittings, valves, etc. shall be in strict accordance with pipe manufacturer's instructions, local gas utilities' rules and local codes.

c. Rough-in as required (if indicated to occur within the scope of this work) to accommodate utility-company-furnished motor and regulator setting from the utility company. Furnish and install regulators of the size as scheduled on the drawings with an internal relief valve.

d. All metal shall be carefully wrapped with an electrically insulating polyethylene tape to provide continuous protection between factory-applied protective coating.

e. Before any pipe is backfilled, the piping shall be inspected for any damage to protective coating. Any damaged areas of coating shall be repaired in accordance with the manufacturer's recommendations.

f. Provide tape and copper wire over entire length of piping or detectable tape per specification.

A. GENERAL

1. Scope

a. Furnish and install all gate valves, plug valves, check valves, butterfly valves, miscellaneous valves, valve boxes and appurtenances required by the plans and this section. Filter function valves are not included in this section.

b. Valves shall be same size as pipeline in which installed, with type joints similar to those in respective pipeline unless otherwise shown; flanges faced and drilled to United States of America standard class 125 pattern; bell and spigot of mechanical joints for class 150 pipe; screwed joints for USA standard threads. Valves shall be factory tested to double working pressure. Working pressure and manufacturer's name shall be cast on the valve body.

2. Submittals

Shop drawings and certificates of compliance shall be submitted as specified elsewhere herein.

B. MATERIALS

All iron and steel products used in this project for the construction, alteration, maintenance or repair of a public water system or water treatment plant shall be produced in the United States in accordance with the Safe Drinking Water Act, Section 1452(a)(4). Such products include lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete and construction materials.

1. Gate Valves

Gate valves shall be installed at locations shown on the plans. Gate valves shall have a working pressure of not less than 150 psi and shall be iron bodied, bronze mounted, non-rising stems, with resilient seat and shall conform to AWWA Standard Specifications C509. All valves inside of structures shall be provided with wheels. Valves outside of structures shall be provided with operating nuts and valve boxes of the telescoping type and of a length to suit the amount of cover.

Gate valves smaller than 24" shall be Mueller No. A-2380, M&H, or approved equal with "O" ring seals for sizes four (4) inches and larger.

2. Plug Valves

Plug valves shall be of the tight-closing resilient-faced plug type and shall be of eccentric construction such that the opening movement of the closing member (plug) results in the closing member rising off the body seat contact. Port areas shall be equal to at least 80 percent of the nominal size pipe area. Valves inside structures shall be flanged. Buried plug valves shall be mechanical joint.

Valves shall be drop tight at rated pressure of 150 psi and shall be satisfactory for applications involving throttling service and/or frequent operation and for applications involving open-close valve operation. After long periods of inactivity, the valve closing member (plug) shall rotate approximately 90E from the full-open position to the tight shut position. Fully adjustable stops shall be provided.

Valves shall be equipped with operating nuts and valve boxes of the telescoping type.

Valve bodies shall be constructed of cast iron. The valve body shall be fitted with a bolted bonnet or cover that permits visual examination of the packing without removing operator. The lower trunnion shall be cast integral with the valve body.

The valve plug shall be constructed of cast iron. The plug shall have a cylindrical seat surface which is eccentrically off-set from the center of the plug shafts. The plug shafts shall be integral. The plug shall have a synthetic rubber bonded to all surfaces except shafts and thrust bearing surface.

Valve body seats shall be constructed of a welded-in overlay of not less than 90 percent pure nickel on all body seat surfaces in contact with the plug face.

Valves shall be fitted with sleeve type bearings. Bearings shall be corrosion resistant and constructed of Teflon fiber.

Thrust bearings shall be provided at the top and bottom faced surfaces of the plug. Thrust bearings shall be woven Teflon fiber.

3. Check Valves

Check valves shall be counter-weighted, non-slam checks with "O" ring seals designed for working pressure of not less than 150 psi, and shall be similar or equal to heavy duty check valves as manufactured by M&H Company, Mueller Valves Co., Clow Corporation or approved equal. Check valve shall have external levers.

4. Butterfly Valves

Butterfly valves shall conform to AWWA C504.

Buried butterfly valves shall have mechanical joint ends and shall be Groundhog or approved equal as manufactured by Pratt of Aurora, Illinois or approved equal. Above ground butterfly valves shall be flanged with hand wheel operators unless otherwise shown on the plans.

Butterfly valves on air lines shall be designed for temperatures up to 150°F.

5. Valve Accessories

a. Valve Boxes. Cast iron extension type, of suitable length and diameter for individual location, complete with removable cast iron cover. Minimum 3/16-inch thickness of metal at any point. Factory painted inside and out with good quality asphalt paint. Boxes shall be installed on all underground valves, with top flush with or slightly above ground surface.

a. Extension Stems. Standard extension stem of dimensions required to extend valve stem to required elevation; designed to operate respective valve; complete with coupling and operating nut. Extension stems for underground valves equipped with valve boxes shall be of such length as to extend within 18 to 24 inches from top of valve box and shall be provided with washers or centering plates to facilitate use of operating wrenches.

A. GENERAL

1. Scope of Work

   a. This specification section covers the labor and materials necessary to furnish and install three (3) complete, operable vertical turbine pumps to be utilized as high service water supply.

   b. Vertical turbine pump system components shall be of the same manufacturer or supplier to obtain standardization of performance, operation, spare parts, maintenance and manufacturer's services.

2. Delivery, Storage, Handling

   a. Equipment shall be delivered to the jobsite completely factory assembled except for motor and head shaft. Individual equipment components shall be crated in structurally adequate packing containers to prevent damage during shipping, facilitate ease of handling and to provide suitable protection from weather for extended storage at the jobsite prior to installation. Packing containers shall be permanently labeled with appropriate equipment identification, shipping address and return address and packing list shall be provided with equipment at time of delivery.

   b. Electrical motors and components shall be kept thoroughly dry at all times and shall be stored indoors. Equipment storage shall be protected and maintained in accordance with the manufacturer's recommendations. Equipment shall not be stored directly on the ground.

   c. Contractor shall utilize equipment and tools of adequate size suitable for unloading, transporting, storing and supporting the equipment during installation. Caution shall be employed to prevent equipment damage resulting from abrupt contact with other materials or equipment.

3. Quality Assurance

   a. The vertical turbine pumps furnished under this contract shall be as manufactured by Peerless Pump Company, Fairbanks Morse Pump Co, or approved equal.

   b. Manufacturer's regularly engaged in the manufacturer of the type of equipment specified and can demonstrate equipment of their manufacture in actual service for a period of not less than 15 years will be considered as an acceptable manufacturer will not be required to pre-submit detailed equipment information prior to the bid

date. Manufacturers not name in the specifications meeting the minimum experience time requirement must submit to the engineer 15 working days prior to the bid date detailed information describing the equipment proposed to furnish. The detailed information shall be included but not limited to dimensional data, materials of construction and an installation list with address, telephone number, and an individual's name directly employed by the owner of the equipment. Plan holders will be notified of approved manufacturers by addendum 5 working days prior to bid date.

c. The pump assemblies and motors furnished under this contract shall comply with the applicable provisions of the hydraulic institute, ASTM, ANSI and NEMA mg 1.

d. The pump manufacturer shall submit to the contractor for Engineer's review, certified copies of factory hydraulic pump test results for each pump. Test results shall be submitted prior to shipment upon Engineer's request and shall show compliance with specified performance requirements.

4. Warranty

a. The manufacturer shall warrant the equipment to be of quality construction, free from defects in materials and workmanship. The warranty shall become effective upon acceptance by the owner or owner's authorized agent, or twelve (12) months after date of shipment, whichever occurs first.

b. The equipment, apparatus, and parts furnished shall be warranted from a period of one (1) year, excepting only those items that are normally consumed in service, such as oil, grease, gaskets, o-rings, etc. The manufacturer shall be solely responsible for the warranty of the equipment and all components.

c. Upon request from the Engineer and/or the owner, the manufacturer shall demonstrate proof of financial responsibility with respect to performance and delivery date. In addition, the manufacturer shall provide proof of evidence of facilities, equipment, and skills required to produce the equipment specified herein and provide technical service and replacement parts.

d. Components failing to perform as specified by the engineer, or as represented by the manufacturer, or proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without cost of parts or labor to the owner.

e. It is not intended the manufacturer assume liability for consequential damages or contingent liabilities arising out of failure of any product or parts thereof to operate properly, however caused by or resulting from or arising out of defects in design or manufacture, delays in delivery, replacement, or otherwise.

5. Factory Test

a. Factory test certified by the pump manufacturer's test representative shall be performed on the pumps actually furnished, and written notice of same shall be furnished to the Engineer. Information required to be furnished at the time of test is as necessary to show conformance to specified performance. Tests shall conform to AWWA E101.

b. Motor, commercial tests shall be made, including no-load current at rated voltage, high potential, and locked rotor current.

c. Certified copies of test reports on actual pumps and motors being supplied shall be provided to Engineer for review.

6. Description

a. Quantity

Vertical Turbine Pumps	-	Three (3)

b. Dimensional information

1. Vertical Turbine Pump

Column pipe	-	12"
Line Shaft	-	1-11/16"
Discharge head	-	12 inch discharge by 12 inch column pipe by 20 inch motor base diameter
Motor	-	250 Horse Power

c. Design Requirements

1. Vertical Turbine Pump

Liquid Pumped	-	Potable Water
Design Flow Rate	-	2800 GPM
Total Dynamic Head	-	264 feet
Minimum Efficiency at Design	-	81%
BHP at Design	-	234 HP
Minimum Shut-Off Head	-	355 feet
Maximum NPSH Required (at Design)	-	22 feet
Maximum Pump Speed	-	1785 RPM
# Stages	-	Three (3)

d. Factory Painting

Bowl assembly, column pipe, discharge head-prime painted to be compatible with finish coating as specified elsewhere.

Motor - Manufacturer's standard enamel finish coating furnish touch-up paint to repair field damages.

B. PRODUCTS

1. Materials

a. Vertical Turbine Pumps

Suction Manifold or Bell - A48 Class 40 Cast Iron
Bowl - A48 Class 40 Cast Iron
Impeller – Stainless steel
Bowl Bearings - B505 Alloy 93200 Bronze
Bowl Sand Collar - B505 C93200 Bronze
Impeller Tapered Lock Bushing - 303 stainless steel
Bowl Flange Cap Screw or Stud and Nuts- 303 stainless steel
Impeller Shaft - 416 stainless steel
Column Pipe - ASTM A53, grade A, schedule 20 steel pipe
Column Shafting - AISI 1045 Steel or SS
Column Shaft Retainer Bearing - B584 C83600 Bronze
Column Shaft Bearing - Neoprene
Column Shaft Bearing Retainer Ring - A564 Alloy 632 stainless steel

Discharge Head - ASTM A53 steel
Packing Container - Class 30 Cast Iron
Packing Washer - Brass
Packing - Synthetic
Packing Gland - A48 Class 30 cast iron
Packing Gland T-Bolt - AISI 304 Steel
Packing Gland Clamp - 302 Stainless Steel
Packing Gland Nut - 18-8 Stainless Steel
Packing Gland Gasket - F104 Tag Board
Packing Gland Cap Screw - Steel
Top Shaft - AISI 1045 Steel
Top Shaft Seal Ring - Neoprene
Top Shaft Coupling - 410 Stainless Steel

2. Vertical Turbine Pump

a. Pump suction case shall be fitted with an extra-long bearing to insure additional strength and rigid support of the lower end of the pump shaft. The bearing shall be permanently packed with water resistant lithium - based grease. The ratio of length to diameter of the bearing shall be 5 to 1 or greater. A plug shall be placed at the bottom of the suction case to prevent water from flowing through the tail bearing. The bearing shall be protected from abrasive wear by a sand collar locked to the impeller shaft.

b. Pump bowls shall be free from blow holes, sand holes, and any other faults and accurately machined and fitted to close dimensions. Integrally cast vanes designed to match impellers utilized and guide water to the next stage with minimum losses and maximum efficiency shall be provided. Sand lugs shall be built into the bowl to eliminate rotation and vortexing of water borne abrasives along the bowl surfaces. Each bowl shall be fitted with an impeller seal lateral bowl wear ring to provide an additional sealing surface in the horizontal plane. Dual bowl bearings shall be furnished for each bowl utilizing fluted rubber and bronze. The top bowl shall be furnished with two (2) extra-long bronze bearings, one (1) rubber bearing and a sand collar secured to the impeller shaft.

c. Impeller shall be of the enclosed radial or semi-open flow type, accurately machined, finished and mechanically balanced. Impellers shall be securely fastened to the impeller shaft with a tapered bushing. Impeller vanes and guide passages shall be hand finished. Impeller skirts will be extra long to insure long life primary sealing and extra thick for secondary sealing and machinable for wear rings.

d. Pump column pipe shall be threaded and coupled in interchangeable sections not over five (5) feet in length. The total length of the column pipe shall be as shown on the plans. The top of the column pipe shall be flanged or threaded as required to connect to the bottom of the discharge head. The column pipe assembly shall be furnished with accurately machined retainer bearing for concentricity at each coupling located between the butted ends of the column pipe. Bearing retainers shall contain a fluted, cutless rubber bearing designed for water lubrication.

e. Column shafting shall be of the open type and furnished in interchangeable sections not over five (5) feet in length. Shafting shall be turned, ground, polished and of ample size to operate the pump without distortion or vibrations. Shafting shall be connected with couplings machined from solid bar stock material. A relief hole shall be provided in the center of the coupling to allow escape of air and excess thread compound when the shaft ends are butted together. The top shaft shall be furnished in a two-piece configuration to allow removal of the motor without lifting over the shafting.

f. The discharge head shall be steel above-ground discharge type with machined mounting surface pedestal designed for standard NEMA 1 flange motor, the discharge flange shall be furnished with 125-pound ANSI drilling. The motor pedestal shall be fitted with a packing container designed for lubrication with the pumped liquid. A threaded connection shall be provided to allow the lubrication liquid collected in the interior ring of the discharge head to be piped to a local drain. A seal ring shall be provided to prevent the lubrication liquid from leakage up onto the motor bearings. Hand-hole openings large enough to provide easy access to all adjustable components shall be furnished. Lifting lugs adequately designed to support the entire weight of the pump assembly shall be integrally cast into the motor pedestal.

g. Steel sole plate with gasket and cap screws shall be furnished to provide a water tight seal between concrete base and pump and to allow for removal of pump from base without permanently damaging the water tight seal.

h. Drive Motor

1. The motor shall be the squirrel-cage induction alternating current type. The motor nameplate horsepower rating shall not be exceeded at any head capacity point on the pump curve. The motor shall conform to the following:

Synchronous Speed	1,800 RPM
Slip	3 percent maximum at full load
Voltage, phase, & Frequency	460 volts, 3 phase, 60 Hz
Mounting	Vertical, hollow shaft
Enclosure	Weather protected, Type I
Service Factor	1.15
Duty Cycle	Continuous
Ambient Temperature Rating	40 degrees C
Starting Method	VFD
Bearing Lubrication	Manufacturer's standard
Bearing Bio Life	Bio Life-Average 25 Years, minimum 5 years.

2. The motor shall be provided with the following modifications:

   a. Thermal protection system consisting of three thermostats embedded in the coils, one in each phase, protecting the stator windings from damaging temperatures resulting from motor overload, too-frequent starting, blocked air passages, and locked rotor current. The thermostats shall open on abnormally high thermistor temperature, and close automatically when the winding temperature has returned to a non-damaging level. Manual reset will be provided at the motor starter.
   b. Shaft ground ring and insulated bearing for inverter-duty service

i. A 16-gauge stainless steel identification plate shall be securely mounted on each pump in a readily visible location. The plate shall be a ¼-inch die stamped with the following information:

   1. Manufacturer
   2. Design Flow Rate
   3. Design Field Head
   4. Serial Number

C. EXECUTION

1. Installation

   a. The general contractor shall assume full responsibility for coordination of the entire project, including verification that all structures, piping, coating systems and equipment components be compatible. The general contractor shall initially operate each equipment system, and shall make all necessary adjustments so that each system is placed in proper operation condition.

   b. Equipment and materials utilized for this project must be approved by the Engineer prior to installation. Approval for installation or incorporation in this project will be made only after submittal of manufacturer's shop and installation drawings, test results or other data as specified herein.

   c. Installation of equipment shall be in full conformance with the manufacturer shop drawings and requirements as approved by the Engineer. Wherever a conflict arises between manufacturer's instructions and the contract documents, the contractor shall follow the Engineer's decision at no additional cost to the owner.

2. Workmanship

   a. Handle carefully and protect the pump and appurtenances to avoid damage. If the pump and column are laid down, support them with blocks to prevent damage.

   b. Mount pump and driver on concrete base as shown on the Drawings. The size of the concrete bases shall be in accordance with the details shown.

   c. Install pump with the shaft pump. Level sole plate by means of steel wedges (steel plates and steel shims). Wedge taper shall not be greater than 1/4-inch per foot. Use double wedges to provide a level bearing surface for the pump and/or driver base. Secure each pair of wedges in their final positions with one tack weld on each side after leveling is complete. Accomplish wedging so that there is no charge of level or springing of the baseplate when the anchor bolts are tightened. Install the pump so that connections may be made to the discharge header without any springing or otherwise forcing either the pump or the header. Anchor bolt size shall be as required by the pump manufacturer. Coat bolt thread projections with lubricant to facilitate future nut removal. Provide double nuts to prevent accidental loosening.

d. Adjust pump assembly such that the driving unit is properly aligned, plumb, and level with the driven unit and the interconnecting shaft and coupling. Flexible coupling shall not be considered to compensate for misalignment.

e. After the pump and driver have been set in position, aligned and shimmed to the proper elevation, grout the space between the bottom of the sole plate and the concrete foundation with a dry, tamped-in, non-shrinking grout, prepared and installed in accordance with Section 03300: CONCRETE. The arrangement of the column shall be straight and vertical when the installation is complete.

f. Any evidence of pump or driver misalignment, noisy operation, or other signs of improper setting shall be corrected by the Contractor. Care during storage, installation and lubrication shall be in strict accordance with the manufacturer's recommendations.

3. Anchorage

a. Anchor bolts shall be furnished for each item of equipment. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Two nuts shall be furnished for each bolt.

b. Unless otherwise shown on the manufacturers or Engineers drawings or specified, anchor bolts for items of equipment mounted on base plates shall be long enough to permit 2 inches of grout beneath the baseplate, and to provide adequate anchorage into structural concrete.

c. Types of anchorage:

1. All cast-in-place anchorage, not submerged, shall be hot dipped galvanized.
2. Anchorage utilized in submerged or humid location shall be constructed from type 304 stainless steel.
3. Drill-in anchorage shall be epoxy adhesive type.

4. Lubrication

a. Equipment shall be adequately lubricated by a system which does not require more than once-a-week operator attention, does not require attention during start-up or shutdown and does not waste lubricants.

b. The contractor shall provide lubricants of the type recommended by the equipment manufacturer in sufficient quantity to fill all lubricant reservoirs and to replace all consumption during equipment initial operation, performance testing and operation prior to acceptance of equipment by the owner.

5. Field Painting

a. All ferrous materials which are not non-corrosive shall be painted with epoxy paint systems. Items to be painted which will be exposed to submerged or wet conditions shall be painted with the coal-tar epoxy paint system. Paint systems in contact with water to be used for potable public water supply systems shall be approved by the FDA for this application.

b. Minor defects in the hot-dipped galvanized coating caused by shipping, handling or installation shall be repaired after equipment installation. The defects shall be thoroughly cleaned and wire-brushed to remove all foreign substances, wiped clean with a damp rag, thoroughly dried, and coated with at least 6 mils of zinc-rich compound.

6. Manufacturer's Services

a. The Contractor shall require the manufacturer to furnish the services of a qualified field engineer to perform the following functions in the designed periods of time. These services are to be performed at the job-site.

1. Check-out of installation, start-up of equipment and initial operator instruction. This service shall take place after all mechanical equipment associated with the control system is installed and mechanically operable.
2. After equipment is fully operational, and before Owner will assume responsibility for the operation of the equipment, the equipment manufacturer's operation specialists shall instruct the Owner's operating personnel in the care, maintenance and proper operation of the equipment.

b. Field Test

1. Prior to plant startup, all equipment described herein shall be inspected for proper alignment, quiet operation, proper connections, and satisfactory performance by means of a functional test.
2. The pump and motor assembly shall be field tested to verify vibration is not in excess of the limits stated in the latest revision of Hydraulic Institute and NEMA MG 1.

3. The pumps, motors, and controls shall be given an operational test in accordance with the standards of the Hydraulic Institute. Recordings of the test shall substantiate the correct performance of the equipment at the design head, capacity, suction lift, speed and horsepower as herein specified.
4. Units apparently failing to meet the Specifications to the satisfaction of the Engineer must be more accurately tested in accordance with Hydraulic Institute Standards. If the pump fails the second test, the unit will be rejected, and the Contractor shall furnish a unit that will be rejected, and the Contractor shall furnish a unit that will perform as specified.

c. Instructions for installation of the pump and related appurtenances shall be written and furnished by the manufacturer.

d. Operation and Maintenance Materials

1. The pump manufacturer shall be responsible for supplying written instruction, which shall be sufficiently comprehensive to enable the operator to operate and maintain the pump and all equipment supplied by the manufacturer. Instructions shall assume that the operator is familiar with pumps, motors, piping, valves, and controls, but that he has not previously operated and/or maintained the exact equipment supplied.
2. The instruction shall be prepared as a system manual applicable solely to the pump and equipment supplied by the manufacturer to these specifications, and shall include those devices and equipment supplied by him.
3. Operation and maintenance instruction shall be specific to the equipment supplied in accordance with these specifications.

e. Manufacturer's Costs: All costs for the above manufacturer functions including travel, lodging, meals, and incidental shall be considered to have been included in the Contractor's lump sum bid price.

A. GENERAL

1. Scope of Work

a. This specification covers the furnishing of one (1) rapid flash mixer in the new concrete tank as shown on the drawings and furnishing one spare motor and gear reducer. The contractor shall prepare his bid on the basis of the materials and equipment listed herein.

2. Prequalification of Alternate Equipment

a. The contractor may submit other manufacturer's equipment for consideration as an alternative to the equipment specified. An addendum will be issued at least five days before the bid date naming alternate suppliers that conform with the specifications and are approved to bid equipment for the project. To qualify alternate equipment, the contractor shall provide the following information to the Engineer at least 15 days prior to the bid date:

1. Drawings, specifications, and product literature with adequate detail to determine that what is proposed will meet the requirements of the plans and specifications.

2. A list of 25 installations of similar type and size with plant addresses and telephone numbers. The engineer and owner may contact these installation sites to determine experience.

3. Evidence of manufacturing capability including a description of facilities, the number and professional qualifications of personnel, and quality control practices. The alternate equipment supplier shall identify major outside fabricators for the purpose of determining experience.

4. Evidence of technical capability to design and check out the complete alternate system, including modifications which will be required in structures, foundations, and equipment provided by others.

5. Evidence of financial responsibility adequate to complete the project and assure viability of equipment warranty.

6. A complete listing of changes which will be required in the contract plans and specifications to accommodate the alternate equipment.

b. Alternate bidders shall guarantee, in writing, signed by an officer of the company, that the equipment offered will provide comparable or superior features, performance quality, and materials of construction as the equipment specified. Prior approval of the alternate equipment shall not constitute final approval of specific equipment, but rather constitute only approval of the respective equipment manufacturers to provide price quotations based on equipment meeting the specifications. Alternate equipment manufacturers shall modify their standard products as necessary to meet all provisions of the specifications without exception.

c. A photocopy of the alternate equipment manufacturer's quotation must be attached to the bid documents, to assure that the alternate equipment bid is in accordance with the equipment which has been pre-qualified.

d. The cost of any changes incidental to installation of the alternate equipment such as electrical wiring, relocation of piping, engineering supervision, as-built drawings, etc., shall be borne by the contractor with no additional expense to the Owner.

e. If after installation the alternate equipment does not perform in accordance with the specifications or other deficiencies are noted, the owner will require the modification or replacement of such equipment to meet the specifications at no additional expense.

3. Delivery, Storage, Handling

a. Equipment shall be delivered to the jobsite completely factory assembled. Individual equipment components shall be crated in structurally adequate packing containers to prevent damage during shipping, facilitate ease of handling and to provide suitable protection from weather for extended storage at the jobsite prior to installation. Packing containers shall be permanently labeled with appropriate equipment identification, shipping address and return address and packing list shall be provided with equipment at time of delivery.

b. Electrical motors and components shall be kept thoroughly dry at all times and shall be stored indoors. Equipment storage shall be protected and maintained in accordance with the manufacturer's recommendations. Equipment shall not be stored directly on the ground.

c. Contractor shall utilize equipment and tools of adequate size suitable for unloading, transporting, storing and supporting the equipment during installation. Caution shall be employed to prevent equipment damage resulting from abrupt contact with other materials or equipment.

4. Warranty

   a. The manufacturer shall warrant the equipment to be of quality construction, free from defects in materials and workmanship. The warranty shall become effective upon acceptance by the Owner.

   b. The equipment, apparatus, and parts furnished shall be warranted for a period of twelve (12) months excepting only those items that are normally consumed in service, such as oil, grease, gaskets, o-rings, etc. The manufacturer shall be solely responsible for the warranty of the equipment and all components.

   c. Upon request from the Engineer and/or the owner, the manufacturer shall demonstrate proof of financial responsibility with respect to performance and delivery date. In addition, the manufacturer shall provide proof of evidence of facilities, equipment, and skills required to produce the equipment specified herein and provide technical service and replacement parts.

   d. Components failing to perform as specified by the engineer, or as represented by the manufacturer, or proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without cost of parts or labor to the owner.

   e. It is not intended the manufacturer assume liability for consequential damages or contingent liabilities arising out of failure of any product or parts thereof to operate properly, however caused by or resulting from or arising out of defects in design or manufacture, delays in delivery, replacement, or otherwise.

5. Manufacturer

   a. The flash mixers shall be Model MBX-54 as manufactured by Hayward-Gordon, Inc. or approved equal.

B. MATERIALS

1. A total quantity of 1 Rapid Mixer(s) is required. Each basin is 10'9" wide, by 10'9" long with a side water depth of 20 ft. and with a distance from the water surface to the mounting surface of the mixer of 1.5 ft. The units will be designed to meet the following requirements.

Minimum Flow per Basin	2.0 MGD
Normal Flow per Basin	4.0 MGD
Maximum Flow per Basin	10.0 MGD

Mean Velocity Gradient "G"..... 620 Sec^{-1}
Design Water Temperature..... 20 ^0C

Each mixer assembly shall consist of a heavy-duty gearbox, electric motor connected by a flexible coupling, baseplate, mixing shaft and mixing impeller. Mixers shall be model MBX-54 manufactured by Hayward Gordon or approved equal.

2. The mixing impeller shall be of the pitch blade design with a minimum impeller diameter of 33.5 inches and a maximum operating speed of 155 RPM. The impeller shall be constructed of 316ss material with the blades bolted to the hub and with the hub fixed to the shaft with a hook key and set screws for maximum security. An extended keyway shall be provided which will allow vertical adjustment of the impeller +/- 12" in 3" increments. The impeller shall be located 160 inches off-bottom (lowest impeller positioning).

   The maximum combined stress in any impeller component shall not exceed 11,000 psi under maximum operating loads. The shaft/impeller design shall be such that its operating speed shall not exceed 70% of its first lateral critical speed. Upon request, stress and critical speed calculations supporting shaft and impeller design are to be supplied with the submittal package.

3. The mixer gear reducer must be built in accordance with current AGMA standards. The reducer shall be a right angle design with horizontal input shaft and vertical output shaft. Speed reduction to be accomplished by use of a double reduction gearbox with high speed helical gearing and low speed spiral bevel gearing. The maximum ratio for any one gear set will be 6.2:1. Efficiency shall be no less than 98.5% efficiency per gear mesh. The housing shall be fabricated steel. The housing shall have an enlarged low speed bore to allow for assembly and adjustment of the low speed bevels without disturbing the high-speed gearing.

   The housing shall have a removable high-speed end for easy ratio change and assembly/disassembly of the high-speed end without disturbing the low speed gearing. Each unit will be provided with an integral or separate baseplate suitable for mounting as shown on the drawings.

   All gearing shall be lubricated by means of oil splash or immersion into the oil bath. The drive shall be equipped with a dipstick and/or an oil level sight glass to check the oil level. The drives must incorporate a drywell feature at the output shaft, with the top of the drywell terminating above the normal operating oil level to eliminate the possibility of oil leakage down the shaft. The use of single or multiple lip seals on the output shaft or leakage sumps located below the gearbox, as the method of preventing oil leakage shall not be acceptable. Selected bearings may be grease lubricated provided they include a high quality seal to retain the grease and have a purgeable grease cavity to allow removal of abrasive contaminants.

The drive's minimum AGMA service factor, based on motor nameplate horsepower, will be 3.0. Upon request, documentation supporting gear ratings are to be supplied with the submittal package. Thermal ratings shall be calculated for continuous operation per AGMA standards based on a maximum sump temperature of 200^0F and an ambient temperature of 100^0F.

All drive bearings shall be of the antifriction type, ball or roller bearings. All bearings within the drive, including the output shaft bearings, shall have a minimum L-10 bearing life of 100,000 Hrs. when operating at full motor nameplate horsepower at the designed speed. Upon request, documentation supporting bearing life will be supplied with the submittal package.

4. The mixing shaft shall be coupled to the gearbox output shaft by means of a rigid flanged coupling. Mating coupling faces shall have a male/female piloted connection for accurate concentricity and shall not require match marking for alignment.

   The mixing shaft and coupling half shall be constructed of 316ss material. The shaft shall be designed such that the maximum combined stress does not exceed 9,000 psi under maximum operating loads. Minimum acceptable shaft diameter is 2.75". It shall be of overhung design – the use of underwater steady bearings is not permitted. Shaft straightness and rigid coupling squareness must be such that the maximum total indicated runout at the lower end of the shaft does not exceed 0.125" for every 10' of shafting, as measured when turning over by hand.

5. The electric motor shall be rated for continuous duty in a humid corrosive environment. Insulation shall be class F with a Class B temperature rise at 40^o C ambient at 1.0 service factor. Service factor will be 1.15.

   The motor shall be 20 hp TEFC squirrel cage induction type for operation on 3 PH, 60 HZ, 460 V. Synchronous speeds shall be 1800 RPM. All motors shall be designed with applicable IEEE, NEMA, and ANSI standards.

   Motors shall be connected to the reducer's input shaft with an easily accessible torsionally resilient flexible coupling protected by an OSHA coupling guard.

6. Upon installation, each unit shall be run to demonstrate its ability to operate without overloading, jamming or excessive vibration during normal operation.

7. Spare parts to consist of one spare MBX-54 gearbox and motor assembly fully assembled.

C. INSTALLATION

1. General

a. The general contractor shall assume full responsibility for coordination of the entire project, including verification all structures, piping, coating systems and equipment components are compatible. The general contractor shall initially operate each equipment system, and shall make all necessary adjustments so that each system is placed in proper operating condition.

b. Equipment and materials utilized for this project must be approved by the Engineer prior to installation. Approval for installation or incorporation in this project will be made only after submittal or manufacturer's shop and installation drawings, test results or other data as specified herein.

c. Installation of equipment shall be in full conformance with the manufacturer's shop drawings and requirements as approved by the Engineer. Wherever a conflict arises between manufacturer's instructions and the contract documents, the contractor shall follow the Engineer's decision at no additional cost to the Owner.

2. Workmanship

a. Handle carefully and protect the equipment and appurtenances to avoid damage.

b. The equipment shall be safely secured to the floor in accordance with the Engineer's design drawings. All electrical shall be in accordance with state and federal codes to ensure proper operation of the mixing system, as well as the safety of plant personnel.

c. Any evidence of improper installation shall be corrected by the Contractor. Care during storage, installation and startup shall be in strict accordance with manufacturer's recommendations.

3. Manufacturer's Services

a. The Contractor shall require the manufacturer to furnish the services of a qualified field engineer to perform the following functions in the designated period of time. These services are to be performed at the jobsite.

1. Check-out of installation, start-up of equipment and initial operator instruction. This service shall take place after all mechanical equipment associated with the flocculation system are installed and mechanically operable.

2. After equipment is fully operational, and before Owner will assume responsibility for the operation of the equipment, the equipment manufacturer's operation specialists shall instruct the Owner's operating personnel in the care, maintenance and proper operation of the equipment.

b. Field Test

1. During plant start-up all equipment described herein shall be inspected for proper connections and satisfactory performance by means of a function test.

2. The equipment system and associated accessories shall be field tested to verify adequate performance.

3. Units apparently failing to meet the Specifications must be corrected to provide proper service. Should the problem persist due to a flaw in material and/or in the design of the equipment, new equipment must be provided by the Contractor to meet the specifications.

c. Instructions for installation of the equipment system and related appurtenances shall be written and furnished by the manufacturer.

d. Operation and Maintenance

1. The equipment system manufacturer shall be responsible for supplying written instruction, which shall be sufficiently comprehensive to enable the operator to operate and maintain all equipment supplied by the manufacturer. Instructions shall assume the operator is familiar with water treatment systems and mixing equipment, but he/she has not previously operated and/or maintained the exact equipment supplied.

2. The instruction shall be prepared as a system manual applicable solely to the equipment supplied by the manufacturer, and shall include those devices and equipment supplied by him.

3. Operation and maintenance instruction shall be specific to the equipment supplied in accordance with these specifications.

A. GENERAL

1. Scope:

a. Description of Work

1. The Contractor shall furnish and install four (4) high rate pulsating sludge blanket clarifiers as described in these specifications and in strict compliance with the plans.

2. The pulsating clarifier shall be installed in a concrete basin and consist of a vacuum chamber complete with associated equipment, vacuum pump, raw water distribution pipes, settling plates and supports, clarified water collectors, sludge concentrators, sludge removal piping tube modules and all necessary valves and controls to comprise a complete operational system.

b. System Description

Raw water, following rapid mixing and chemical addition, flows into a sealed vacuum chamber that controls flow into the clarifier's distribution duct. The coagulated water flows to distribution laterals that are evenly spaced over the clarifier floor. Vacuum pumps create a vacuum in the vacuum chamber and cause the water level to rise. A timer-actuated vent valve vents the vacuum chamber to atmosphere. As the water level falls in the vacuum chamber, a pulse of water uniformly expands the entire surface area of the sludge blanket, which is comprised of previously formed solids. Contact with the blanket drives the flocculation reactions towards completion. The clarified effluent is collected in evenly spaced laterals that span the clarifier surface and connect to the effluent collection channel. Sludge concentrators, which also act as internal weirs, control the height of the sludge blanket and collect sludge. The concentrators are periodically emptied via sludge collection piping that is controlled by timed openings of sludge blowdown valves.

2. Qualifications:

a. The manufacturer of the high rate pulsating sludge blanket clarifier must have at least ten (10) years experience in the design and manufacture of the type of process proposed and must be able to refer to at least twenty (20) similar installations, at least half of which have been in operation successfully five years or more and of which six must be operating in the State of Oklahoma.

3. Product Handling:

a. All materials and equipment shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability or appearance as specified herein.

b. The equipment shall be stored in a clean, dry location, free from construction dust, precipitation and excess moisture. If stored for more than two weeks, the equipment shall receive all maintenance considerations required by the Manufacturer for proper storage of the equipment. At no time shall the treatment modules; including all associated equipment, media and appurtenances; be stored outdoors, uncovered and/or unprotected.

4. Responsibility for Equipment:

a. The contractor shall be responsible for furnishing, installing, testing, and placing in satisfactory operation all mechanical equipment, instruments, monitoring devices, appurtenant process equipment, piping, electric and manual operated valves, control instrumentation and equipment, and accessories. The Contractor shall coordinate all work with the manufacturer to guarantee a complete, operating and satisfactory system.

b. The complete clarification system shall be provided by a single supplier, who shall bear sole responsibility for the supplied components. The contractor shall coordinate the work of the system supplier's service personnel during construction, testing, startup, calibration and acceptance of the system, and operator training.

c. The system supplier shall have in his steady employ, during the entire project period, capable personnel for administration; detailed engineering and drafting; coordination; procurement and expediting; scheduling; construction inspection; testing, startup assistance; and final commissioning. The system supplier shall also have available, for the duration of the specified warranty period, capable personnel for all necessary administration, engineering, and/or service.

d. The system design shall provide for complete operation of all signals from point to point, and shall assure complete compatibility of all instrumentation and equipment.

e. The system supplier shall have available supervisory service during construction to review and advise the contractor on the method of mounting, piping and wiring of each device, and advising protective measures, if needed for the equipment, prior to placing it into service.

5. Equipment Warranty:

a. The manufacturer shall warrant the equipment being supplied, to the Owner, against all defects in workmanship and materials for a period of one (1) year from the date of acceptance of the project by the Owner.

b. The manufacturer shall replace or repair any part or parts which are determined to be defective during the warranty period, provided that the defects are not a result of misuse or neglect.

6. System and Equipment Patents:

The bid price shall include all royalty and license fees for use of patented devices or systems and shall protect the owner and engineer from patent infringement litigation thereon.

B. MATERIALS

1. General:

Each of four (4) high rate pulsating clarifier units shall each have an average design capacity of 1750 gpm at a design rise rate over the flocculation zone of <1.50 gpm/ft^2.

2. Sludge Blanket:

a. The sludge blanket depth shall be held constant at all flow rates. Sludge shall move to the sludge concentrator from the top of the blanket. The sludge shall be automatically discharged from the sludge concentrator in amounts proportional to raw water flow or based on time. The concentrator design shall be such that it shall not be possible to withdraw slurry from the sludge blanket.

b. Pulsations in the sludge blanket shall be created cyclically by establishing a hydraulic head in the vacuum chamber by the vacuum pump.

c. The water distribution and collection systems shall be designed and arranged so that all flow in the sludge blanket and clarification zones shall be truly vertical and evenly distributed over the total clarifier area.

3. Vacuum Chamber Equipment:

a. Each vacuum chamber shall be equipped with a vent valve assembly consisting of a 6-inch vacuum release eccentric plug valve with pneumatic operator and 4-way solenoid actuator. 304SS piping, fittings and vent screens for the installation of the vacuum release valve shall be provided. The vent wall sleeve shall be provided by Others.

b. Vortexing and turbulence in the vacuum chamber shall be minimized through the installation of a 20" diameter vortex breaker on the top of the vertical influent pipe. The 20" influent transfer pipe and wall sleeve shall be furnished by Others.

c. One (1) aluminum safety ladder inside each vacuum chamber shall be provided for each chamber.

d. One (1) 30-inch aluminum square airtight manway/access hatch with frame shall be provided for each chamber.

e. A sight tube assembly shall be supplied for each vacuum chamber consisting of *3/4"* Sch 80 clear pipe, threaded fittings and wall sleeves.

4. Vacuum Pumps and Piping:

   a. There shall be furnished a total of six (6) vacuum pumps (centrifugal type), including a common spare. Each vacuum pump shall have a minimum capacity of 191 scfm at 40" water column, complete with outlet silencer and a 5.0-hp TEFC motor for 460-volt, 3-phase, 60-Hz. Motors shall have a 1.15 service factor rating.

   b. There shall be provided 2-inch 304SS steel piping and fittings to interconnect the vacuum pumps, air bleed valve and the vacuum chambers. 2-inch manual butterfly valves (general service butterfly) shall be supplied in order to isolate each vacuum pump. Flexible connectors shall be furnished between the piping and vacuum pumps. Two (2) 2-inch air bleed valve shall be furnished to regulate the speed at which the vacuum is pulled on the vacuum chamber.

   c. All interconnecting piping and valves shall be shipped loose for installation by the contractor.

5. Raw Water Distribution Piping

   a. There shall be furnished 12" diameter perforated laterals per unit on 3.33- ft centers for raw water distribution. The pipe lateral shall be furnished in 13.5-ft sections of Schedule 40 PVC pipe complete with end caps. The pipes shall be supported as recommended by the equipment manufacturer. PVC couplings shall be incorporated as wall fittings to receive the distribution laterals. All mounting hardware shall be 304SS

6. Settling Plates and Tube Modules

   a. A series of inclined plate modules positioned over the distribution laterals shall be spaced 13-inches apart. Horizontal deflectors shall be attached to the underside of the plates to generate a vortical flow pattern within the settling plate modules.

   b. The plate modules shall be manufactured of 1/16" thick FRP of suitable stiffness to be self-supporting when placed on horizontal support angles which also act as deflectors. Plate modules fabricated of stainless steel or other materials shall be not be acceptable.

   c. The horizontal support angles shall be manufactured of aluminum and be supported by aluminum angles at the side walls that shall be attached to the side walls with 304 SS anchor bolts. The fiberglass plates are attached to the horizontal support angles with rubber grommets and stainless steel self-tapping screws. All plate assembly items shall be shipped loose for field installation by the contractor.

d. Access to the area under the settling plates, for maintenance and periodic cleaning, shall be achieved through the installation of a section of removable settling plates.

e. Above the inclined plates tube modules shall be provided and installed. The tube settling modules shall be fabricated from PVC, ABS or polystyrene sheets, vacuum formed to give a corrugated cross section. The sheets shall be welded together to form a strong and integral module. In addition, settling tube support assemblies consisting of aluminum angle, plate and flatbar shall be provided.

Additionally, one aluminum viewing port per unit shall be provided as an integral part of the settling tube support.

7. Clarified Water Collectors:

a. There shall be furnished 12-inch diameter clarified water collectors 6'-10" on center supported as shown on the drawings. The collectors shall consist of Sch 40 PVC pipe with a series of submerged orifices. PVC pulsating clarifier couplings shall be incorporated as wall fittings to receive the collection laterals. All mounting hardware shall be 304SS.

8. Sludge Withdrawal:

a. The sludge extraction system shall consist of 4-inch diameter header/lateral draw-off pipes of Schedule 80 PVC with appropriate joints and fittings inside the basin and carbon steel pipe with appropriate manual and automatic valves outside the basin.

b. Four (4) sludge draw-off laterals per unit inside the basin proper shall run with the sludge concentrators and shall be supported off the concentrators using appropriate 304 stainless steel wall brackets and/or pipe hangers. Sludge headers shall penetrate the wall using an appropriate wall fitting.

c. Four (4) pneumatically operated plug valves per unit for sludge draw-off and four (4) manual isolating plug valves per unit shall be furnished for each clarifier for a total of eight (8) valves for each clarifier.

d. The piping inside the basin, pipe support brackets and/or hangers, automatic and manual isolating valves shall be supplied as loose items for assembly and installation at the jobsite by the installing contractor.

e. A programmable logic controller (PLC) shall automatically control the frequency of the sludge extraction based on one of two operator selectable parameters. The first is time between extractions, which is monitored by an operator adjustable timer in the PLC. The second is in proportion to the raw water flow and is calculated by an integrator in the PLC. The setpoint for this function is also operator adjustable. When the preset value has been reached, the extraction

sequence shall be initiated. The PLC shall control the timer-based sequence by opening one draw-off valve at a time with a slight delay in between valve openings. The sludge extraction is terminated at the completion of the timer-controlled sequence.

9. Basin Sampling:

   a. There shall be provided the necessary 3/4" diameter hi-impact, Sch 80 PVC piping and fittings for three (3) sampling points on each clarifier with a manual ball valve at each location. These lines shall terminate a manhole as shown on the plans.

10. Control Panel:

   a. One (1) wall-mounted, NEMA 4X (FRP) control panel shall be furnished for the entire system. The control panel shall contain door mounted Allen Bradley, or approved equal, lights, switches, and operator interface terminal along with an Allen Bradley MicroLogix 1500 PLC or approved equal mounted inside the enclosure. The PLC shall be programmed to monitor and control the automatic pulsing cycle and the frequency and duration of sludge extraction. The Allen Bradley Microview operator interface terminal shall allow the operator to adjust preset times and flow setpoints. The PLC shall have inputs and outputs sufficient to interface with all panel and field mounted devices including a customer provided 4- 20rnA signal for influent flow rate. A communication port shall be provided to connect to the data highway (DH485, Modbus, or Ethernet) as required for the SCADA interface.

11. Anchor Bolts, Wall Fittings and Wall Penetrations:

   a. All anchor bolts and nuts shall be adequately sized for the service intended and shall be 304 stainless steel. Anchor bolts shall be provided for ID1 equipment only.

12. Weirs and Stop Gates:

   a. Four (4) sets of 304SS channel weir plates, channel guide, gaskets and anchor bolts for influent flow splitting shall be provided.

   b. Provide four (4) 304SS stop gate with channel guides and handles at the end of the effluent collection channels for clarifier bypass.

13. Air Compressor

   a. Provide two (2) air compressors for the pneumatic operation of the vent valves. Air compressors shall be an FF-210AD-Dual head (Quincy or approved equal) with 60-gallon ASME tanks. Air flow shall be 45 CFM at 100 psig per unit.

b. Motors shall be 1.5-HP, 460 volt, 3 phase, 60 hertz provided with a NEMA 4 (indoor use) or NEMA 4X (outdoor use) enclosure with a 480 volt to 120 control transformer.

c. Air compressors shall be supplied with a refrigerated drier, pressure gauge, relief valve, tank drain, shutoff valve, inlet filter and drier and belt guard.

d. Air compressor manufacturer shall supply all the necessary controls to start, stop and show alarms. Manufacturer shall be responsible for providing a full voltage non-reversing motor starter.

C. INSTALLATION

1. Installation by the Contractor:

a. Contractor Performance:

All materials and equipment shall be installed in a neat, workmanlike manner.

1. All wiring of the equipment shall be as specified under the electrical section of these specifications and shall terminate at diagram connection points for devices and panels.

2. All equipment specified herein shall be installed in accordance with the Manufacturer's recommendations and the contract drawings.

3. There anchor bolts and other parts in concrete are required, such parts shall be furnished by Contractor.

4. Prior to startup and field testing, all foreign matter shall be removed from the equipment, inside the control panel, and interconnecting piping. Spillage of lubricants used in servicing the equipment shall be cleaned from pumps, piping, and concrete surfaces.

2. Manufacturer's Services:

a. Installation and Startup Assistance

1. The manufacturer shall provide field services for inspection, start-up, and training. All costs for services furnished by the water treatment system Manufacturer shall be included in the total price, with no additional compensation provided. Services shall be provided for ten (10) days.

2. The service times specified shall be considered as full eight (8) hour working days and do not include travel time.

A. GENERAL

1. Scope of Work

a. There shall be furnished and installed as shown on the plans and specified herein, filtration equipment for eight (8) gravity filters, each cell size 18'-0" x 20'0". The equipment shall be Wes Tech Engineering or approved equal, and shall include all associated equipment in accordance with the following equipment schedule and detailed specifications.

2. Delivery, Storage, Handling

a. Individual equipment components shall be crated in structurally adequate packing containers to prevent damage during shipping, facilitate ease of handling and to provide suitable protection from weather for extended storage at the jobsite prior to installation. Packing containers shall be permanently labeled with appropriate identification, shipping address and return address. Packing list shall be provided with equipment at time of delivery.

b. Equipment storage shall be protected and maintained in accordance with the manufacturer's recommendations. Equipment shall not be stored directly on the ground. Electrical equipment shall be kept thoroughly dry at all times and shall be stored indoors.

c. Contractor shall utilize equipment and tools of adequate size suitable for unloading, transporting, storing and supporting the equipment during installation. Caution shall be employed to prevent equipment damage resulting from abrupt contact with other materials or equipment.

3. Warranty

a. The manufacturer shall warrant the equipment to be of quality construction, free from defects in materials and workmanship. The warranty shall become effective upon substantial completion of the Project.

b. The equipment, apparatus, and parts furnished shall be warranted for a period of one (1) year from acceptance of the project by the Owner, excepting only those items that are normally consumed in service, such as reagent, charts, grease, gaskets, O-rings, light bulbs, fuses, etc. The manufacturer shall be solely responsible for the warranty of the equipment and all components.

c. Upon request from the Engineer and/or the Owner, the manufacturer shall demonstrate proof of financial responsibility with respect to performance and delivery date. In addition, the manufacturer shall provide proof of evidence of facilities, equipment, and skills required to produce the equipment specified herein and provide technical service and replacement parts.

d. Components failing to perform as specified by the Engineer, or as represented by the Manufacturer, or proven defective in service during the warranty period, shall be repaired, or satisfactorily modified by the manufacture within fifteen days or replaced without cost of parts or labor to the Owner.

4. Description

a. The 8-cell filter system shall have a designed capacity of 11,520 GPM when filtering at a rate of 4.0 gpm/sq. ft., of filter area.

b. The filtration system shall be complete and operable as installed by the Contractor. Without exception, the contract prices are to include all royalties and costs arising from patents and licenses associated with furnishing the specified filtration equipment. All materials shall be designed to withstand stresses. Equipment shall be of corrosion resistant materials or shall be suitably protected by the Contractor. The Contractor shall financially reimburse the Engineer completely for any and all redesign work resulting from a proposal to substitute equipment of a different configuration or design from that specified.

c. Schedule of Equipment and Material:

1. Filter Function Valves
2. Filter Underdrain System
3. Filter Media
4. Outlet Weirs

5. Reference Standards

a. The filtration equipment components shall comply with applicable provisions and recommendations of the following recognized standards, except as otherwise shown or specified:

1. ASTM A 35, Structural Steel

2. ASTM A 276, Stainless and Heat Resisting Steel Bars and Shapes
3. ASTM A 307, Carbon Steel Externally and Internally Threaded Standard Fasteners
4. AWS D1.1, Structural Welding Code
5. AISC, Code of Standard Practice for Steel Bridges and Buildings
6. AISC, Specifications for the Design, Fabrication, and Erection of Structural Steel and Buildings
7. AISC, Manual of Steel Construction
8. ASTHMA Standard 440.000, Practice for Single and Double Reduction Cylindrical and Helical Worm Speed Reducers
9. OSHA

B. MATERIALS

1. Filter Function Valves

a. The following filter function valves shall be furnished by the filtration equipment manufacturer.

Four (4) Influent Valves, Size 12”
Four (4) Outlet/Backwash Supply Valves, Size 24”
Four (4) Filter to Waste Valves, Size 10"
Four (4) Backwash Waste Valves, Size 20"
Four (4) Filter Air Wash Valves, Size 6"

b. Filter function valves shall be as specified under Filter Butterfly Valve Section.

2. Filter Underdrain System

a. The filter cells shall be equipped with a "Multicrete II" underdrain system by Wes Tech Engineering or approved equal. The filter underdrain system shall consist of a false bottom in each filter cell supported above the true bottom of the filter. The underdrain system shall be constructed on-site using, high impact, corrosion resistant plastic underdrain forms, ABS plastic media-retaining underdrain nozzles with air wash tail pipes, cylindrical PVC pier forms and cast-in-place concrete. Plastic concrete insert shall be provided which shall be field installed in the underdrain forms with PVC solvent. They shall be provided with plastic end protectors which shall prevent concrete from entering the concrete insert and which shall be removed after the concrete has set so that plastic media retaining nozzles may be screwed into place.

b. Underdrain forms shall be nominally 24" square and designed to interlock with the pier forms. They shall be designed to support the weight of the wet concrete and remain in place after the concrete has set. Concrete shall have a minimum compressive strength of 4,000 psi. Pier form shall be 6" diameter Schedule 40 PVC pipe notched to accept the underdrain form. Reinforcement details for the piers and the monolithic slab shall be submitted to the Engineer for approval.

c. Underdrain forms, concrete inserts, underdrain nozzles, insert end protector caps, pier forms and general arrangement drawings shall be provided with the equipment manufacturer/supplier. Reinforcing bars and concrete shall be provided by the contractor.

d. The plastic inserts shall be equipped with Model 16 MCA distributors constructed of high strength erosion resistant plastic. The plastic distributors shall be of the slotted type wherein the slots lie in a horizontal plane so that the backwash water is uniformly discharged horizontally into the filter media. The slot dimensions shall be approximately 0.014" and shall be designed to present sharp edges to the retained media. The slots in the distributor shall be designed to get progressively larger toward the inside of the distributor assembly to prevent lodging of media in the slot. Any hardware required for the distributor shall be stainless steel and this shall be limited to bolts, nuts, washers and shall not be in contact with the distributor opening. The distributors shall be equipped with a plastic tail pipe having perforations located at the bottom of the underdrain plate to admit air for air scour.

e. The filter underdrain system shall permit air scour at 2 cfm/sq. ft. of bed area and water backwashing at 15 gpm/sq. ft. of bed area.

f. To provide primary distribution of air flow beneath the underdrain an air distribution header with riser pipes shall be furnished as shown on the plans. The header pipe and risers shall be fabricated from minimum SCH 5 Type 304SS. All supports, brackets, and hardware such as bolts, nuts and anchors shall be stainless steel.

g. Vertical rebar anchors shall be tested to assure that they will not pull out, causing underdrain failure. All costs associated with the basic testing program described herein will be paid for by the installing contractor. All costs associated with any additional testing, as required and as specified shall be paid for by the installing contractor.

h. Approximately 10% of all anchors randomly selected in each cell will be tested. Each anchor to be tested will be loaded to 3,600 lb. tension in 900 lbs. increments. Data required for a load vs. displacement graph will be recorded. After reaching 3,600 lb., the anchor shall hold this load for a minimum of 2 minutes. Any anchor, which fails to reach 3,600 lb. or whose graph indicates a slip or yielding of the anchor, will be considered a failure.

i. In the event of failure of any anchor in any cell, all anchors within that cell shall be tested by the procedure described and all failed anchors shall be replaced and re-tested. Any anchor, which fails, shall be drilled out and replaced with a 3/4" diameter "Hilti Adhesive Anchor" or approved equal. The cost of the 100 percent cell testing and the re-testing of replacement anchors shall be borne by the installing contractor.

3. Primary Backwash Water Distribution

a. A distribution flume shall be provided to collect effluent during filtration and to distribute backwash water uniformity across the filter cells. The manufacturer shall be responsible for the design of the number, size and spacing of openings required for each filter cell.

4. Backwash Collection System

a. The backwash collections system shall consist of three (3) 304 stainless steel wash troughs in each of the eight (8) filter cells as shown on the plans. The backwash collection system shall be located immediately above the top of the filter media as shown on the plans. The washtroughs within each filter cell shall each have a capacity of 2,200 gallons per minute with a freeboard of at least 2".

b. The washtroughs shall be designed for the following load conditions while deflections and stress remain within the stated limitations.

1. Gravity Load: Vertical load down shall include the unbuoyed metal weight of the trough and any attachments, such as weirs and spreaders, together with the weight of water to fill the trough. Any additional loads which may be imposed, such as piping, shall also be considered.

2. Buoyant Load: The buoyant load shall act vertically upward if the filter cell is filled from below with the trough empty. The magnitude is equal to the weight of water displaced by the trough (ignoring the submerged weight of the metal).

3. Lateral Load: Differential water loads acting on the trough sides. The maximum loads occurring when the trough is empty and the filter cell is full to the trough lip elevation or when the cell is empty and the trough is full.

4. Backwashing Load: Vertical load down during cell backwash shall include the metal weight of the trough and any attachments, such as weirs and spreader (ignoring buoyancy due to 2" lower inside water depth). However, any additional loads which may be imposed, such as surface washers and pipings, shall also be considered.

5. Deflection Limitations: Maximum vertical deflection under full buoyant load or full gravity load shall not exceed 1/8" in 10'. Deflection shall be measured at mid-point between trough supports.

6. Stress Limitations: The maximum bending stress and shear stress under the most sever load conditions shall not be greater than 11,400 psi respectively. The trough shall be designed to accommodate temperature induced stresses resulting from differences in thermal expansion between trough and supports.

7. Stability: The troughs and trough system shall resist oscillations caused by flow of water over the trough edges or by operation of appurtenant surface washers. Stabilizers based on one or more of the following methods shall be furnished:

    a. Trough-to-trough structural members.
    b. Trough-to-filter wall structural members.
    c. Support system location and rigidity.
    d. Torsional trough stiffness.

8. Calculations: Troughs shall be designed in accordance with AISI specifications and designed calculations shall be submitted with approval drawings.

c. All spreaders, hangers, support rods, and appurtenant items such as fasteners or weirs shall be Type 304 stainless steel.

d. A water stop shall be provided on the trough at any location where trough is grouted into a wall.

e. Trough shape shall have a round or polygonal bottom. Flat bottom troughs are not acceptable.

5. Multiwash Baffle

a. Each washtrough shall be provided with media separator baffles to prevent loss of media during combined air and water backwash. In order to assure uniform collection and prevention of media loss, a double baffle design with plastic localized velocity dissipation devices included between the upper and lower baffles shall be used. Baffles shall be attached to the basin walls and to the wash troughs using stainless steel bolts and supports. The baffles shall be designed to resist oscillations caused by flow of water over the trough edges. Baffle to baffle and trough to baffle stabilizers shall be furnished as required by the manufacturer. The baffle system along with all spreaders, hangers, support rods and appurtenant structural items shall be Type 304 stainless steel.

6. Filter Media

a. Material Layers

1. Top Layer
20.0 inches of anthracite coal 0.90-1.10 mm effective size, UC 1.65 or less.

2. Next Lower Layer
12.0 inches of silica filter sand 0.45-0.55 mm effective size, UC 1.65 or less.

3. Next Lower Layer
4.5 inches of garnet sand 0.15-0.35 mm effective size, UC 1.65 or less.

b. Anthracite Coal

Specific Gravity:	1.6 minimum
Effective Size:	0.9 to 1.10 mm
Hardness on Moss Scale:	2.5 minimum
Uniformity Coefficient:	1.65 or less

Coal shall be anthracite coal for potable water filters. The media shall conform with the latest AWWAB100 Standards for filter materials.

c. Silica Sand

Specific Gravity:	2.6 Minimum
Uniformity Coefficient:	1.65 Minimum
Effective Size:	0.45 mm to 0.55 mm

d. Garnet Sand

Specific Gravity:	4.0 Minimum
Uniformity Coefficient:	1.65 Minimum
Effective Size:	0.15 - 0.35 mm

e. Filter Sand

Sand shall be silica and garnet sand for potable water filters. The media shall consist of clean, hard, durable particles in conformance with the current AWWA B100 standard for filter materials.

f. At least 5 percent excess material of the total bed volume shall be furnished to replace possible losses due to removal of fines and on-site processing required to meet above specifications.

7. Outlet Weirs

a. The backwash rate shall be determined by the elevation of the outlet weirs relative to the washtrough lip. A total of four (4) outlet weir assembly shall be provided. The weir assembly shall be constructed of stainless steel. Weir assembly shall consist of support frame, sliding adjustable weir, glide strips, adjustment mechanism and stainless steel anchor bolts. The weir height shall be readily adjustable over an 18" range through the use of a single threaded adjustment rod with positioning nut. Weir assemblies that require addition or removal of individual components to raise or lower the weir are not acceptable. Weir assembly shall not require cast in guides and shall be adjustable from above the weir chamber.

8. Tools, Spare Parts, and Maintenance Materials

a. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, arm location until transferred to the Owner.

b. Any special tools or spare parts that are removed and/or used by the Contractor or manufacturer's representative prior to transfer to the Owner shall be replaced at no expense to the Owner.

C. INSTALLATION

1. Installation of equipment shall be in full conformance with the manufacturer shop drawings and requirements as approved by the Engineer.

2. Before installation of the media, the Contractor shall vacuum clean the underdrain area, all cell isolation piping, the weir box, and all surfaces that come into contact with the backwash supply water. This cleaning must be approved by the Engineer before the Contractor can begin placement of the filter media.

3. Filter Media

a. Clean the filter tanks before any media is placed and keep them clean throughout the placing operation. Remove media made dirty in any way and replace with clean media.

b. Place the bottom layer carefully by hand to avoid movement to the underdrain system and to assure free passage of water from the orifices.

c. Complete each media layer before the next layer above is started. Do not permit workmen to walk or stand directly on media or other materials at any time, which are less than 1/2 inch in diameter. Use boards which will sustain the weight or workers without displacing the media. Remove all media that becomes mixed and replace in layers as specified.

d. Obtain the correct thickness of each layer before the media is placed and mark to top of each layer on the side of the filter. Level the top of each layer against a water surface held at the appropriate mark. None of the particles shall be less than half submerged, and there shall be no places where additional media can be placed without the particles extending more than 1/2 their volume above the water surface.

e. Backwash each of the media layers individually after installation (except supporting gravel) a minimum of three times, and remove the top 1/2" of surface fines by scraping as required. Replace the scraping by new material to the required depth as specified above.

f. The manufacturer shall provide the services of a qualified technical representative to direct the placement of media and supporting gravel of the first filter cell. On-site technical direction for a period of two (2) days shall be required to observe that materials are installed properly.

g. Disinfect the media after installation is completed, using HTH. The media shall be submerged in a 50 PPM chlorine solution for a minimum of eight (8) hours. The chlorine solution shall be removed by the normal backwash procedure.

4. Wash Troughs:

a. The manufacturer of the stainless steel wash troughs shall provide complete written installation instructions with drawings.

b. No field welding shall be required or allowed for installation of the troughs.

c. Troughs shall be protected during on-site storage and during installation for contamination with grease, oil, paint, coatings, or rusty water from other metal objects.

d. The wash troughs are to be cast into the gullet wash and supported from the filter end wall. Furnish end supports to consist of a clip angle with wall anchor bolts and support rods. The troughs are to be leveled using the adjustable support rods.

5. The Contractor shall coordinate the provisions of field instruments and sensors supplied with the associate Filter Control System to ensure compatibility and proper interfacing and operation of the system components.

D. MANUFACTURER SERVICES

1. The Contractor shall require the manufacturer to furnish the services of a qualified field engineer to perform the following functions in the designated periods of time. These services are to be performed at the job site.

a. Instruct Contractor in the installation of the filter equipment and control equipment, and supervise and assist installation as required.

b. The supplier shall inspect the installation of the first underdrain.

c. Check-out of installation, start-up of equipment and initial operator instruction. This service shall take place after all mechanical equipment associated with the control system is installed and mechanically operable.

d. Inspection and detailed check-out of the installed filter control system instruments, components, and Main Control Panel including calibration of all instruments and sensors provided by the filter manufacturer.

e. Final system check-out and training of Owner personnel in the operation and maintenance of the filters and the filter control system.

2. Instruction of Owner's Operating Personnel:

a. Initial Instruction Course: After equipment is fully operational, and before Owner will assume responsibility for the operation of the equipment, the equipment manufacturer's operating specialists shall instruct the Owner's operating personnel in the care, maintenance and proper operation of the equipment.

b. Final Instruction Course: After continuous operation of the equipment for a period of thirty (30) consecutive calendar days, retain a qualified representative of the manufacturer for the minimum time period specified in Paragraph A above to instruct Owner personnel in the fundamentals, operation, troubleshooting and maintenance of the filter system equipment, controls and accessories specified herein.

3. Manufacturer's Installation Report: prepare manufacturer's installation reports and submit within thirty (30) days after completion of field testing and operation instruction. The reports shall include the following:

a. Field repair work performed on equipment.

b. Field testing reports.

c. Description of installation deficiencies not resolved to the manufacturer's and/or Owner's satisfaction.

d. Description of problems or potential problems.

A. GENERAL

1. SCOPE OF WORK

a. This specification covers the work necessary to furnish and install the various butterfly valves as specified herein and as shown on the plans.

b. To obtain standardization of performance, operation, spare parts, maintenance, and Manufacturer's service, it is the intent of these specifications that all valves of like type be furnished by a single Manufacturer.

2. DELIVERY, STORAGE AND HANDLING

a. Individual equipment components shall be packaged in structurally adequate packing containers to prevent damage during shipping, facilitate ease of handling and to provide suitable protection from weather for extended periods at the jobsite prior to installation. Packing containers shall be permanently labeled with appropriate equipment identification, shipping address and return address. Packing list shall be provided with equipment at time of delivery.

b. Electrical equipment shall be kept thoroughly dry at all times and stored indoors. Equipment storage shall be protected and maintained in accordance with the Manufacturer's recommendations. Equipment shall not be stored directly on the ground and kept from flooding.

c. Contractor shall utilize equipment and tools of adequate size suitable for unloading, transporting, storing and supporting the equipment during installation. Caution shall be employed to prevent equipment damage resulting from abrupt contact with other materials or equipment.

3. QUALITY ASSURANCE

a. The valves furnished under this contract shall be AWWA C504 Class 150 B as manufactured by Dezurik or approved equal.

b. Manufacturers regularly engaged in the manufacture of the type of equipment specified and can demonstrate equipment of their manufacture in actual service for a period of not less than 15 years will be considered as acceptable Manufacturer if able to comply with the specifications.

4. WARRANTY

a. The Manufacturer shall warrant the equipment to be of quality construction, free from defects in materials and workmanship.

b. The equipment, apparatus, and parts furnished shall be warranted for a period of one (1) year from the state of operation, expecting only those items that are normally consumed in service such as packing, grease, gaskets, O-rings, etc. The Manufacturer shall be solely responsible for the warranty of the equipment and all non-consumable components.

c. Components failing to perform as specified by the Engineer, or as represented by the Manufacturer, or proven to be defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the Manufacturer without cost of parts or labor to the Owner.

5. FACTORY PAINTING

a. All external ferrous metal surfaces shall be shop primed and field finished coated unless otherwise specified. Internal surfaces shall be factory coated as per AWWA C504 with black asphaltic varnish.

b. Shop priming and field painting shall be in accordance with the requirements of Section 9.1 – Painting.

B. PRODUCTS

1. MATERIALS OF CONSTRUCTION

a.

Body:	Cast Iron
Seat:	Buna N
Shaft Seal:	Chevron type self adjusting permanent packing
Disc:	Cast iron with non transferred arc welded 316 stainless steel edge being a minimum width of the disc edge. Rolled wire compression fit edges are unacceptable.
Bearings:	Nylatron chemically inert self lubricating maintenance free
Shaft:	304 Stainless Steel

2. COMPONENTS

a. Filter function butterfly valves shall be AWWA wafer style valves with electric motor operators as described herein.

b. The disc shall be attached to the shaft with Stainless Steel squeeze pins. The rubber seat on 2-20" valve sizes shall be on body and contained in a recessed pocket with the leading edge protected from hydraulic line forces.

c. Each valve to be provided with the appropriate flange seals to be utilized during installation.

3. MANUAL VALVE OPERATORS

a. Operator mounting arrangements and handwheel positions shall be as shown on the plans or as directed by the Engineer.

b. Each valve operator, except buried or submerged operators, shall have a visual valve disc position indicator mounted on the valve operator.

c. Manual Gear Operators, unless otherwise specified by the Engineer, shall include a direction of rotation of the handwheel indicating either "OPEN" or "CLOSED" rotation direction with an arrow pointing said direction as applicable. Industry standard practice of "clockwise to close" is to be followed. Actuators shall have mechanical stops which can withstand without damage an input torque of 450 ft. lbs. against these stops.

4. ELECTRIC MOTOR OPERATORS

a. General: The electric actuator shall include the electric motor, reduction gearing, valve stem drive nut/bushing, position limit switches, mechanical overload torque switches, ductile iron gear case and automatic de-clutchable handwheel. Actuators shall be Limitorque, Pratt Positron, EIM M2CP or approved equal.

b. Gears: Motor speed reduction shall be by means of a gear train consisting of hardened steel spur gears and self-locking worm and worm gear set. The worm shall be heat treated alloy steel and have worm thread surface rolled or ground. The worm gear shall be bronze. Non-metallic gears in the power train are not acceptable.

c. Rotating Components: All gearing and shafting shall be supported on anti-friction bearings. All thrust components shall be supported by use of tapered roller bearings.

d. Manual Override Drive: The actuator shall be furnished with a manual override handwheel or crank located in a 90 degree plane from the actuator output drive, with a maximum rim pull requirement of 80 pounds for valve travel loads. An external manual declutch lever shall be included to place actuator in the manual mode. The lever shall not require more than a 10 pound force to engage even when the valve has been tightly sealed. The declutch lever is to be padlockable in either handwheel or motor mode. Operation by motor shall not cause the manual override to rotate, or operation of the manual override shall not cause the motor to rotate. Manual override shall operate in the clockwise direction to close.

e. Lubrication: All gearing and bearings shall be grease lubricated and suitable for year-round service based on prevailing ambient temperature conditions.

f. Electric Motors: Electric motors shall be specifically designed for valve actuator service, and be totally enclosed non-ventilated(TENV). The enclosure shall meet NEMA 4 as required for the project. Motor shall be capable of operation under maximum specified loads when voltage to the motor is +/- 10% of the nominal voltage. Motor shall have class F insulation with thermal overload sensors imbedded in the motor windings. Motors shall be of the voltage and phase shown on the plans.

g. Limit Switches: Limit switches shall be geared to the drive mechanism and in step with actual valve position at all times, whether operation is by electric power or manual operation mode. Switches shall be activated by a rotor type design. Contacts shall be silver and have a rating of 10 Amps at 120 VAC. A minimum of three (3) N.O. and three (3) N.C. contacts shall be provided for each direction of travel. The limit switch gear mechanism shall be enclosed to prevent entrance of foreign matter or wire entanglement.

Torque Switches: The actuator shall include an adjustable torque switch to interrupt the motor power circuit when an obstruction is encountered in either direction of travel or when torque seating of valves is required for tight shut-off. The torque switch shall have a calibrated dial for adjustment and have means to ensure maximum actuator rating is not exceeded. Contacts shall be same construction and rating as limit switches. Mechanical torque springs for load control shall be field replaceable without need of actuator dismantling or removal of the worm assembly.

h. Position Indication: Local position indication for quarter turn valves shall be by indicator dial located on the gear operator and graduated in 25 percent increments. Local position indication for multi-turn valves shall be by a mechanical dial position indicator driven by the limit switch gearing and in step with the actual valve position at all times, whether operation is by electric power or manual operation mode.

i. Electrical Controls for Open/Close Service:

1. The controls shall be built-in and supplied as an integrated modular package, completely wired and easily removable or replaceable by removal of four (4) captivate screws. Motor leads and power supply leads will be terminated to the terminal strips located on the modular package. Power supply terminals and control supply terminal shall be physically isolated from each other to protect against transient voltages. The terminal strips shall be completely shrouded with high impact resistant plastic to avoid accidental terminal contact by personnel. The module shall include fused control voltage protection for switches and electronic modules from voltage surges. All electrical components of the modular package, such as reversing contactor, transformer, etc., shall be unidirectional plug and hard wired connected to provide easy removal and replacement without concerns for proper wiring connections. All PC boards must be temperature rated -40 to +70 degree C.

2. Reversing Contactor: Control voltage shall be 120 VAC, 60 Hz. Normally open seal-in contacts for momentary contact pushbutton control and normally closed contacts for electrical interlock shall be supplied. The contactor shall be both electrically and mechanically interlocked. It shall be completely wired as an assembly and hard wired or plug connected to the modular package.

3. Control Power Transformer: The transformer assembly shall provide 115 VAC for control power and 12 VAC for LED indicator lights. It shall be epoxy impregnated and encapsulated to prevent moisture incursion and shall be completely wired as an assembly and plug connected to the modular package.

4. Selector Switch: Each actuator shall be supplied with selector switches for open, stop, close, local, and remote furnished integrally mounted. Selector switches shall be double o-ring sealed and include a protective silicon boot. Seal material shall be resistant to ozone and ultraviolet light. The selector switches shall be able to be operated when the enclosure is open or closed.

5. Indicating Lights: The actuator shall include two (2) long life high intensity LED type pilot lights to indicate open(red), closed(green), and intermediate valve position(both lights on). These lights shall be shown when the enclosure is closed.

6. Selector Switches: The actuator shall include a 3-position selector switch for local(hand)-off-remote(auto) control and 2-position for open/close.

7. The motor actuator shall be a model L120 by Limitorque, Pratt Positron, M2CP-001 Series 2000 as manufactured by EIM Controls, or approved equal.

j. Extended Bonnets: Provide manual or motor operator extensions bonnets where shown on the drawings.

C. INSTALLATION

1. The Contractor shall assume full responsibility for coordination of the entire project, including verification that all structures, piping, coating systems and equipment components are compatible. The Contractor shall initially operate each equipment system, and shall make all necessary adjustments so that each system is placed in proper operating condition.

2. Equipment and materials utilized for this project must be approved by the Engineer prior to installation. Approval for installation or incorporation in this project will be made only after submittal of Manufacturer's shop and installation drawings, test result certificates or other data as required and specified herein.

3. Installation of equipment shall be in full conformance with the Manufacturer's shop drawings and requirements as approved by the Engineer. Wherever a conflict arises between Manufacturer's instruction and the contract documents, the Contractor shall follow the Engineer's decision at no additional cost to the Owner.

4. The Contractor shall install equipment and materials in a workmanlike manner utilizing craftsmen skilled in the particular trade. The finished installation shall portray a neat and plumb appearance.

5. Before installation, carefully clean valves of all foreign material, and inspect valves in the OPEN and CLOSED positions. Install valves in accordance with the applicable portions of the Specifications. Unless otherwise indicated, install valves with the shaft vertical. Valves provided with chainwheel manual operators are to be installed with the shaft vertical, and the manual operator located below the piping. This should provide the operator with a clear view of the visual position indicator. Mount horizontal valves in such a manner that adequate clearance is provided for operation. Installation practices shall conform to Manufacturer's recommendations.

6. Prior to installing valves, the mating flange faces shall be thoroughly cleaned. After cleaning, insert the flange seals and valves and tighten the flange bolting progressively and in a uniform manner. Flanges should be pulled down tight against the valve / flange seals evenly. If flanges leak under pressure, loosen the bolting, reseat or replace the flange seals, re-tighten the bolting, and retest the connection. Flanged joints must be watertight at test pressures before acceptance.

D. MANUFACTURER'S SERVICES

1. Provide the services of a representative of the manufacturer of the valves to assist in adjusting and testing the equipment, to supervise initial operation, and to assist in making final adjustments and the tests specified, or which may be necessary to assure the Engineer the equipment is in satisfactory operating condition.

A. GENERAL

1. SCOPE OF WORK

a. This specifications section covers the work necessary to furnish complete, operable magnetic flowmeters in the locations and sizes as shown on the plans.

2. DELIVERY STORAGE, HANDLING

a. Equipment shall be delivered to the jobsite completely factory assembled. Individual equipment components shall be crated in adequate packing containers to prevent damage, facilitate ease of handling and to provide suitable protection from weather for extended storage at the jobsite prior to installation. Packing containers shall be permanently labeled with appropriate equipment identification, shipping address and return address. Packing list shall be provided with equipment at time of delivery.

b. Electrical equipment shall be kept thoroughly dry at all times and shall be stored indoors. Equipment shall be stored directly on the ground.

3. QUALITY ASSURANCE

a. The magnetic flow meters furnished under this contract shall be as manufactured by ABB.

b. Only manufacturers regularly engaged in the manufacture of the type of equipment specified and that can demonstrate equipment of their manufacture in actual service for a period of not less than 15 years will be considered.

B. PRODUCTS

1. MAGNETIC FLOW METERS

a. The electromagnetic flow meter shall consist of a flow sensor based on Faraday's Law of Electromagnetic Induction and microprocessor-based signal converter.

b. Sensor

1. Operating principle: Utilizing Faraday's Law of Electromagnetic Induction, the flow of liquid through the sensor induces an electrical voltage that is proportional to the velocity of the flow.

2. Construction: The sensor flow tube and liner material shall be constructed of nitrile, which is a hard rubber composite elastomer, surrounded by two integral coils. Measurement and grounding electrodes shall be 316stainless steel. Connecting flanges shall be carbon steel. Wetted materials shall be NSF approved for drinking water service.

3. Installation: A minimum of 5 pipe diameters up stream and 3 pipe diameters down-stream.

4. Operating Temp: -20 to +200 degrees F.

c. Signal converter:

1. Enclosure: NEMA 4X enclosure

2. Display: Background illuminated alphanumeric 3 line, 20 character display to indicate flow rate, totalized values, settings and faults and 6-key keypad. (A blind transmitter version of the 5000 is available)

3. Power supply: 115/230 VAC or 11-24VDC.

4. Operating temp: -5 to 120 degrees F.

5. Output: 0-20mA or 4-20mA into 800 ohms max. 1 relay rated at 42VAC/2A, 24DC/1A.

6. NOTE: MAGNETIC FLOWMETER TUBES INSTALLED IN VAULTS SHALL BE EQUIPPED WITH REMOTE MOUNTED SIGNAL CONVERTERS. THE FLOWMETER SUPPLIER WILL PROVIDE REQUIRED SIGNAL CABLE BETWEEN THE METER TUBE AND SIGNAL CONVERTER.

d. Sensor and converter/transmitter performance

1. Flow Range: 1.5 fps to 33 fps for accuracies stated below.

2. Accuracy: 0.50% of actual.

3. Separation: Maximum distance of 900 feet between converter and sensor without the use of any additional equipment.

4. Bi-directional flow capabilities shall be standard.

e. Totalizer

1. Two integral eight digit counters programmable for forward, net or reverse flow.

2. The totalizers may be programmed as non-resettable or resettable.

f. Each flow sensor shall be wet calibrated and all of the calibration information and factory settings matching the sensor shall be stored in an integrally mounted SENSORPROM memory unit. The SENSORPROM shall store sensor calibration data and signal converter settings for the lifetime of the product. At initial commissioning, the flow meter commences measurement without any initial programming. Any customer specified settings are downloaded to the

SENSORPROM. Should the signal converter need to be replaced, the new signal converter will upload all previous settings and resume measurement without any need for reprogramming or rewiring. A certificate of calibration shall accompany each flow sensor.

g. The following signal converter functions shall be provided

1. All programming shall be accomplished through an integral keypad and all programming shall be protected by a user-defined password.

2. The signal converter shall be integrally mounted or remotely mounted using a remote-mount kit provided by the manufacturer.

3. The signal converter shall provide a 0/4-20 mA DC signal proportional to flow rate into 800 ohms max. Output selectable as uni-directional or bi-directional.

4. The relay shall be programmable as error indicator, limit alarm or pulsed output.

5. The signal converter system shall be equipped with an error and status log with 4 groups of information.

a. Information without a functional error involved.

b. Warnings which may cause malfunction in the application

c. Permanent errors, which may cause malfunction in the application.

d. Fatal error, which is essential for the operation of the flow meter.

6. A system error shall be indicated by a flashing icon on the display or activation of the relay when set as an error alarm.

7. The first nine standing errors shall be stored in the error pending log. A corrected error is removed from the error pending log. A status log shall be provided to store the last 9 error messages received for 180 days regardless of correction.

C. EXECUTION

1. INSTALLATION

a. The Owner shall assume full responsibility for coordination of the entire project, including verification that all electronic systems and equipment components are compatible.

b. Equipment and materials utilized for this project must be approved by the Engineer prior to installation. Approval for installation or incorporation in this project will be made only after submittal of manufacturer's shop and installation drawings, test results or other data as required and as specified herein.

c. Installation of equipment shall be in full conformance with the manufacturer shop drawings and requirements as approved by the Engineer.

2. WARRANTY

a. The manufacturer shall warrant the equipment to be of quality construction, free from defects in materials and workmanship. The warranty shall become effective upon Final Acceptance of the entire project by the Owner.

b. The equipment, apparatus, and parts furnished shall be warranted for a period of one (1) year.

c. Components failing to perform as specified by the Engineer, or as represented by the manufacturer, or proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without any cost to the Owner.

3. FUNCTION OF MANUFACTURER

a. Provide the services of a qualified representative of the meter manufacturer to assist in adjusting and testing the equipment, to supervise initial operation, and to assist in making final adjustments and the tests specified, or which may be necessary to assure the Engineer that the equipment is in satisfactory operating conditions.

b. Operation and Maintenance Materials

1. The meter and recorder manufacturer shall be responsible for supplying written instruction, which shall be sufficiently comprehensive to enable the operator to service, program, and operate the meter and all equipment supplied by the manufacturer.

2. Operation and maintenance instruction shall be specific to the equipment supplied in accordance with these specifications. Instruction manuals applicable to many different configurations and meters, and which require the operator to selectively read portions of the instructions shall not be acceptable.

c. All costs for the above ultrasonic flow meter manufacturer functions including travel, lodging, meals, and incidentals shall be considered to have been included in the Manufacturer's lump sum bid price and will be at no additional cost to the Owner.

A. GENERAL

1. Summary

The contractor shall install two (2) rotary-lobe positive-displacement blower packages built by a qualified manufacturer. All components shall be furnished by a single manufacturer who shall be responsible for the performance and compatibility of the system.

2. References

American National Standards Institute (ANSI) B16.1, B40.1
American Society of Mechanical Engineers (ASME) PTC 9
American Gear Manufacturers Association (AGMA)
American Society of Testing and Materials (ASTM)
Anti-Friction Bearing Manufacturers' Association (AFBMA) 9, 11
American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
Institute of Electrical and Electronics Engineers (IEEE)
Mechanical Power Transmission Association
National Electrical Code (NEC)
National Electrical Manufacturers Association (NEMA) MG 1, ICS 6
National Fire Protection Association (NFPA) 70
Occupational Safety and Health Administration (OSHA)
Rubber Manufacturers Association (RMA)
Steel Structures Painting Council (SSPC)
Underwriters Laboratories (UL)

3. Submittals

The submittals shall consist of a bill of material listing all components the blower system manufacturer will deliver; component Manufacturer's catalog cut sheets listing materials of construction, performance curves/charts, standards of design, warranty statement; prime/paint coating system plus the following information:

a. Blower

1. BHP at: normal system operating conditions

2. Discharge temperature at ambient temperature and normal system operating conditions.

3. L10 bearing life calculations for each bearing.

b. Motor

1. 1/2, 3/4, full load efficiencies and power factors

2. L10 bearing life calculations for each bearing.

c. Silencers

1. An attenuation performance curve for each type of silencer.

d. Pressure Relief Valve

1. Set pressure

e. Shop drawings of assembled system stating what items will be shipped to the job site assembled and those shipped loose for field assembly.

f. V-belt Coupling drive calculations.

g. A list of all exceptions and an explanation of each non-compliance with the specifications.

4. Quality Assurance

a. The blower system(s) will be built by a blower system supplier who has units at 50 or more waste water treatment plants, the same size or larger than those specified below, that have been in successful operation for fifteen or more years.

b. All components shall be furnished by a single supplier who shall be responsible for the performance and compatibility of the system.

c. The blower system manufacturer shall be an authorized warranty service center for the bare blower provided.

d. Unnamed manufacturers shall provide a complete technical submittal to the engineer for review at least 15 days prior to the published bid date noting all project specific system performances, curves, drawings, maintenance requirements, and any non-compliances with the specification to qualify for use on the project.

e. Blowers, motors, and all primary components shall be manufactured in the United States with replacements and parts available from multiple sources within the United States.

e. Blower package suppliers must submit an authorization letter from the blower manufacturer, of the blower proposed to be installed, to the project engineer at least 10 workings days before the bid opening for his package to qualify for use on the project. The letter shall state the packager is qualified to design and build blower packages for wastewater treatment plants plus be authorized to perform warranty work.

5. Storage & Handling

a. Care must be taken during unloading and handling of equipment to ensure against undue strain to the blower and motor. Do not use lifting straps or chains under the blower or motor. Lift from under the main frame, base or use base mounted lifting lugs.

b. In storage blowers shall be kept clean, free of moisture and rotated a minimum of 20 revolutions each week to maintain warranty. For storage in excess of four months, or in a damp or corrosive environment see the manufacturer's operation and maintenance manual.

6. Conditions of Service

APPLICATION:	
NUMBER OF PACKAGES:	2
SITE ELEVATION, FASL:	774
MAXIMUM INLET TEMPERATURE, °F:	100
MAXIMUM RELATIVE HUMIDITY, %:	36
SCFM ± 4 %:	430
DIFFERENTIAL PRESSURE, PSIG:	4.5
MAX BHP REQUIRED:	15
RPM LIMIT AT ABOVE SCFM:	1690
GEAR TIP FPM LIMIT AT ABOVE SCFM:	2850
SOUND LIMIT REQ. @ 3FT IN FREE FIELD:	69

B. PRODUCTS

1. Manufacturers

a. The blower package(s) shall be manufactured by Universal Blower Pac, Inc., Noblesville, Indiana or approved equal.

B. PRODUCTS

1. Manufacturers

a. The blower system(s) shall be manufactured by Universal Blower Pac, Inc., Noblesville, Indiana.

2. Construction

a. Blower

IMPELLERS:	Involute design; cast or ductile iron; static and dynamically balanced; operate without rubbing, liquid seals or lubrication.
SHAFTS:	One piece steel that pass through the impellers or stub shaft cast integrally with the impellers.
TIMING GEARS:	Spur or helical tooth; alloy steel; held by taper pins, wedge rings, or bolted to timing hubs spline mounted to the shafts.
LUBRICATION:	Gear end oil splash, other end grease or oil splash.
SEALS:	Labyrinth or lip on each bearing with air vents between seals and impeller chamber.

b. Attenuation

1. It is the intention of this section of the contract documents to procure an acoustical enclosure for the specified blower system. The Enclosures shall be designed, assembled and inspected by Universal Blower Pac, Inc. at the manufacturing site with documentation provided to verify the noise reduction demanded in these documents. Noise attenuation shall be provided as necessary to reach the specified sound limit requirement at a distance of 1 meter from the operating equipment in a free field environment. All readings shall be taken by personnel experienced in the field of sound attenuation.

2. The enclosure herein specified shall be designed and manufactured by the blower system manufacturer specifically for the equipment supplied. Units shall be designed to be picked up by a fork truck. Each acoustical enclosure shall be shipped completely assembled. Each enclosure shall ship installed on the blower system when feasible. No field assembly shall be permitted

3. Absorption of sound waves shall be the basis of design for the enclosure. Where feasible, only the blower shall be enclosed to meet the demanded sound level. Where necessary, the complete blower system will be enclosed to meet the level specified. With absorption considered, perforated metal inner skin retaining devices shall not be considered acceptable.

4. Outer skin shall be a minimum 1/8" Aluminum. Lesser gauges shall not be acceptable.

5. Absorption media shall be a nominal 2-inch thick resilient material capable of returning to its original form after compression. Media shall have an overall weight of not less than 1.6 pounds per cubic foot. Media sheets shall have an upper oil resistant layer a minimum of three mils in thickness to protect the integrity of the media. Absorption media shall be interior and be fitted to each exterior facet and show contact at all points. Media shall be snug fit, be complete with pressure sensitive adhesive and held in place with washers, studs and cap nuts manufactured from corrosive resistant materials. All adhesives used in anchoring studs or other items in structure shall be high temperature industrial material rated for the application. Any acoustical material used shall conform to the following:

COLOR:	Charcoal Grey
DENSITY:	1.6 lbs/ft3 (24.03 kg/m3) per ASTM D3574-86 test A
TEAR STRENGTH:	2.0 ppi (3.5 N/cm) per ASTM 3574-86 test F
TENSILE STRENGTH:	20 psi (135 kPa) per ASTM 3574-86 test E
ELONGATION:	110 % per ASTM D3574-86 test E
COMPRESSION:	Max. 10% ASTM D3574-86 test D

HEAT RESISTANCE:	Per ASTM D3574-86 test K
HUMIDITY:	Per ASTM D3574-86 test J
FLAMMABILITY:	MVSS 302 UL-94 HBF and SAES - 369(b)
SERVICE TEMPERATURE:	–40 degrees F to +212 degrees F cont. (250 int)
THERMAL CONDUCTIVITY:	BTU-in/ft2h degrees F 0.25 per ASTM C 177

6. Any access plates installed on enclosure for venting or screening shall be installed with self-starting, self-locking zinc plated screws to promote tightness. Rivets or loose fitting panels which can loosen during operation will not be accepted. Slide-in panels showing a loose fit shall provide grounds for rejection. Panels shall be constructed as to compress media on installation providing tightness and maximum sound absorption.

7. Each enclosure will have service doors, covering at least 80 percent of each side. Hinges for the doors shall be full length and designed for the weight of the door provided. Door shall have a minimum 180 degree swing. All surfaces and edges shall be free of burs and sharp edges. The doors shall lock closed using ½ turn telescoping "T" handles.

8. Each enclosure will be fitted with a weather hood covered acoustical intake vent rated for the SCFM listed in the "service" section and discharge pipe openings with sound seal.

9. Oil fills and drain extensions, and weather/sound seals will be fitted on all enclosure penetrations as needed

10. A cooling fan with acoustical vent shall be supplied installed on the enclosure. To ensure adequate cooling at all speeds the cooling fan will not be connected to the blower or motor shaft in any way.

c. Motor

DESIGN:	B, squirrel-cage, induction per NEMA MG1 & IEEE standards
HP:	Nameplate greater than the brake horsepower at 10% above the relief valve set pressure as described in 1.03 D 2.
RPM:	1800
TYPE:	totally-enclosed fan-cooled
POWER:	(460) volt, 3 phase, 60 Hertz
INSULATION:	Class F with class B rise
SERVICE FACTOR:	1.15 (or 1.0 if used in conjunction with VFD) at power voltage and site elevation listed above
EFFICIENCY:	"premium efficient" per latest edition of NEMA MG1

d. V-Belt

1. High-capacity type, oil and heat resistant, static-dissipating drive belts selected to have a 1.4 or higher service factor above the required blower brake horsepower. Sheaves shall mount to the blower and motor shafts with QD type bushings. A jack-shaft or drive coupling shall be used if recommended by the system manufacturer.

e. Drive Guard

Top, sides and bottom made of 14 gauge sheet steel with expanded metal front and back. Designed to allow ample ventilation for the drive, have an easy access cover and conform to applicable safety codes.

f. Base

1. A foot-mounted steel angle or channel skeleton-frame base with continuous welded joints shall be supplied. Bare base weight shall equal 50% or more of the blower's weight, but not less than 100 pounds. The blower, motor, drive and

drive guard shall be shipped assembled on the base with everything else shipped loose for field installation.

g. Accessories

1. Inlet Filter

- Each blower shall have a filter with a paper media that removes 99.5% of 2 micron particles. The maximum pressure drop across the clean element and housing shall be less than 2-inches of water column.

- Filter shall be shipped installed on the inlet silencer and positioned for indoor service. Filter shall be Universal Silencer CF or equal.

2. Silencers

- Silencers 3" and smaller shall be of the premium, straight-through absorptive type. Larger silencers shall be of the multiple-chamber design. Silencers will have acoustically packed nozzle next to blowers operating above transition speed. Silencers with threaded connections shall have ports on each end and those with flanged connections will have ports on the side and end. Multi-chamber silencer attenuation performance shall be at least 18 dB at 63 hertz, 23 dB at 125 hertz, 27 dB at 250 hertz and 31 dB at 500 hertz.

- Each blower shall have an inlet silencer with an air velocity of 4000 to 5700 feet per minute. Silencer shall be Progentex, Inc. series DS, RSI, DRSI, Universal Silencer, Inc. series U5, URB, RIS, Burgess Manning series CA, BMAI, BMSI Stoddard series L/C21, D13/L41, L61/63 or equal. Combination type inlet filter/silencers shall not be permitted.

- Each blower shall have a discharge silencer. Based on inlet CFM air velocity shall be 5500 to 7000 feet per minute. Silencer shall be Progentex, Inc. series DS, RS, DRS, Universal Silencer, Inc. series U5, URB, SD, Burgess Manning series CA, BMA, BMSS, Stoddard series L/C21, D13, D32/33 or equal. Combination type discharge silencer/base frames shall not be permitted.

3. Discharge Silencer

- Silencers 3" and smaller shall be of the premium, straight-through absorptive type. Larger silencers shall be of the multiple-chamber design. Silencers will have acoustically packed nozzle next to blowers operating above transition speed.

- The discharge silencer shall be sized on inlet CFM air velocity shall be 5500 to 7000 feet per minute. Silencer shall be Progentex, Inc. series DS, RS, DRS, Universal Silencer, Inc. series U5, URB, SD, Burgess Manning series CA, BMA, BMSS, Stoddard series L/C21, D13, D32/33 or equal.

4. Flexible Joint

- Each blower shall have an inlet and discharge flexible joint that matches the blower ports' size and type of connection. The joint's elastomer must be rated higher than the maximum expected service temperature and pressure.

- Each blower shall have an external discharge flexible joint that matches the blower discharge silencer size. The joint's elastomer must be rated higher than the maximum expected service temperature and pressure. The flexible joint shall ship installed on the system.

h. Valves

1. Pressure Relief Valve

Each blower shall be protected by a stacked weight type pressure relief valve preset to start opening at half a PSIG above the PSIG listed in the "service" section, be full open at not more than 10% above the set pressure, and rated for the SCFM and PSIG listed in the "service" section.

2. Check Valve

Each blower shall have a discharge check valve with wafer connection, cast-iron body, cast-iron split discs and seal rated above the maximum anticipated discharge temperature. Valve shall be shipped installed on the system.

i. Instruments

1. Filter Restriction Gauge

Each inlet filter shall have a filter restriction gauge that progressively measures vacuum in the filter element. A visual indicator, with a manual reset, shall lock at the current vacuum when the blower is shut off.

2. Pressure Gauge

Each blower shall have a 2 1/2" diameter, stainless steel case, brass bourdon tube, liquid filled, 1/4 NPT connection pressure gauge with a 0-15 PSIG scale on systems operating up to 10 PSIG and 0-30 PSIG for higher pressures. Gauge shall have a 1/4" brass snubber and isolation valve. Gauge shall be Winters 800 or equal.

3. Replacement Parts

Each blower shall be furnished with the following spare parts:
One spare filter element
One set of spare V-belts
Lubricants for start-up

j. Coatings

All equipment shall be cleaned to SSPC-SP 3 and receive a 2-3 mil DFT shop coat of phenolic alkyd, zinc-chromate, red iron oxide, rust inhibitive universal primer. The blower systems shall then receive a finish coat of Coronado Alkyd Enamel, 139 series, 50% gloss, high temperature paint. The coat shall be 2-3 mil DFT.

k. Manuals

One operation and maintenance manual shall be provided for each size of blower.

C. EXECUTION

1. Erection/Installation Application

a. Blowers are recommended to be installed on a non-moving foundation with the industry standard depth of twice the blower gear diameter or a pad 2 times the total mass of all rotating components, whichever depth is greater.

If these recommendations cannot be accommodated, the following points must be followed to ensure an adequate installation:

b. The blower pad must be located on the equivalent of compacted soil substructure, which will allow the pad to remain flat, rigid, and free of resonant frequencies within the operating range of the equipment.

c. The blower must be anchored using bolts intended specifically for dynamic loading.

d. The area between the base and pad must be filled with 1" minimum non-shrink grout.

e. The unit must be installed and leveled per the manufacturer's instructions supplied in the O&M manual.

2. Start-Up and Testing

a. The blower system supplier shall provide the services of a factory trained technician to check installation, verify proper operation and train the owner's personnel in proper maintenance procedures. Start-up services shall be a minimum of one day.

A. INTRODUCTION

Cabot proposes to design and provide a clean, compact, and reliable Porta-PAC™ system and spare parts or approved equal that shall dose up to 225 pounds per hour of Powdered Activated Carbon (PAC) from a bulk bag into the raw water supply.

B. GENERAL DESCRIPTION

The PAC unit shall consist of three (3) pieces of equipment; the lower tower section, which contains the carbon dosing equipment; the upper tower section, which contains the bulk bag hoisting equipment and a lifting cross which shall be utilized to lift the bulk bags evenly. The upper and lower tower sections shall be provided with mating flanges, which allows the upper section to be set on top of the lower tower section and bolted in place. The lower tower section shall be provided with base plates suitable for anchoring the tower to a concrete foundation with anchor bolts.

The PAC system shall be designed to accurately meter a predetermined amount of carbon, in a dust-free manner, into a motive water stream via hydraulic eduction. The system shall be accurate, yet simple enough to be very reliable. Cabot takes advantage of the natural tendency of fine powders to flow with liquid-like properties when fluidized by a gas, normally air, to move the PAC within the system. By separating the individual carbon particles with a gas, the normal resistance to bulk flow is greatly reduced and the PAC shall easily flow from the bulk bag into the feeder hopper. Final feed rate control of the PAC shall be accomplished by utilizing a volumetric screw type auger feeder with variable speed control.

An electric chain hoist/trolley shall be utilized to raise and position a 900 lb net bulk bag of PAC within the support structure. The bulk bag discharge chutes, both inner and outer, shall then be positioned inside and outside of the hopper connection opening. The outer bag chute shall be connected to the hopper inlet opening using an adjustable clamp to form a dust-tight connection. The PAC can then be released into the volumetric feeder hopper by releasing the retainer strap around the discharge chutes. A fluidization nozzle shall be positioned inside the mouth of the feeder hopper to assist the flow of carbon into the hopper. Fluidization shall be initiated locally utilizing the FLUIDIZING CYCLE selector for instantaneous pulses or automatically on a timed basis when the feeder is in operation.

PAC shall feed directly from the bulk bag into the feeder hopper, where it shall be stored until conveyed by the feeder screw into the mouth of the eductor. A tuning fork type level switch shall be located in the feeder hopper and shall initiate an alarm when the bulk bag is empty or if the PAC fails to feed from the bulk bag.

PAC shall be metered from the feeder hopper by a volumetric auger-type variable speed feeder. The SYSTEM MODE selector on the Control Panel HMI shall select whether the feeder runs at a constant rate or follows an ethernet signal via SCADA. The SYSTEM OPERATION selector on the Control Panel HMI, shall select whether the system may be started and stopped via local selection on the HMI or remotely by energizing a relay inside the PAC Control Panel.

Upon receipt of a start signal, the drain valve shall close and the motive water valve and slurry valve shall open allowing water to pass through the eductor to transport the dosed PAC as it is fed from the feeder auger, through the drop tube and into the vortex vessel. A side stream of the motive water shall be used to form a vortex to wash the interior of the vortex vessel. The motive water pressure and the wash water pressure shall be monitored by pressure indicators and pressure switches that shall stop the feeder when insufficient water pressure is available.

A programmable logic controller (PLC) and Human Machine Interface (HMI), with input from remote sensors, shall control the sequences of events throughout the system and also provide alarms to enunciate problems and interlocks to protect the system. The system shall be configured to feed a constant pounds per hour of carbon or to vary the dosing rate via an analog signal provided form a remote source. During normal operation, operator attention shall not be required, as the system shall operate automatically once the mode of operation and the feed rate has been selected.

A complete system is proposed, requiring only foundations, a compressed air supply, motive water supply, power supply, discreet control interfaces and piping interfaces.

The system shall be designed to meet an unclassified area electrical classification.

C. SCOPE OF WORK

The manufacturer shall provide the following management, design, equipment, and support:

1. GENERAL

   a. The design, fabrication, assembly, and check-out of a complete, fully functional Porta-PAC™ dry carbon dosing system as described in detail herein.

   b. Capable of feeding Powdered Activated Carbon (PAC) from 900 pound bulk bags and shall include a volumetric feeder, eductor package, bulk bag lifting equipment, support tower, controls and instrumentation.

   c. The system shall be pre-assembled, pre-wired and tested to the maximum extent practical at the factory and delivered to the site ready for installation and start-up.

   d. All system components shall be located inside the boundary of the structural support tower frame.

2. PROJECT MANAGEMENT

   The manufacturer shall provide the services of a representative to oversee the project including the following activities:

   a. Project scheduling.

b. Development of project submittals.

c. Coordination focal point between Purchaser and Cabot for system details.

d. Procurement of equipment.

e. Supervision of shop fabrication of sub-assemblies.

f. Technical support during all phases of the project.

g. Development of the system O&M Manual.

3. DESIGN

The manufacturer shall provide the following design documents and drawings:

a. Process and instrumentation diagram.

b. General arrangement drawings.

c. Equipment arrangement drawings.

d. Electrical wiring schematics.

e. Ladder logic diagrams.

4. PROJECT DOCUMENTS

a. Project Submittal

The manufacturer shall provide an electronic copy of the following drawings and information to the Purchaser for approval prior to purchase of equipment by Cabot.

1. Written Description of System Operation and Maintenance.

2. System P&ID.

3. System General Arrangement Drawings.

4. Electrical Wiring Diagrams.

5. Control Panel Layout Drawings.

6. PLC Ladder Logic.

7. Equipment Cut Sheets.

b. O&M Manuals

The manufacturer shall provide an electronic copy of the O&M manual prior to start-up of the equipment. The O&M Manual shall contain, as a minimum, the following information:

1. Written Description of System Operation and Maintenance.
2. System P&ID.
3. System General Arrangement Drawings.
4. Electrical Wiring Schematics.
5. Control Panel Layout Drawings.
6. PLC Ladder Logic.
7. Equipment Operation & Installation Manuals.

5. TECHNICAL SUPPORT

The manufacturer shall provide the services of one (1) qualified technician for on-site installation support, check-out, start-up, functional testing and operator training.

D. EQUIPMENT

1. MECHANICAL EQUIPMENT

a. Hoist

An electric chain hoist with an electric trolley shall be provided to lift the bulk bags from the floor and to position and hold the bulk bags above the feeder hopper inlet connection. The chain hoist shall be rated for one-ton capacity, driven by a ½ hp single speed electric motor. All bearings shall be heavy duty, permanently sealed with lifetime lubrication.

The trolley shall be driven by a single speed ¼ hp electric motor.

A single pendent push-button control station with push-buttons to control all operations of the hoist and the trolley shall be provided. The pendent control station shall be easily accessible from the operating floor.

b. Volumetric Feeder

An Acrison model 105Z auger type volumetric feeder shall be installed to meter the PAC from the feeder hopper into the drop tube. The volumetric feeder shall be equipped with a three (3) cubic foot stainless steel supply hopper with a level switch to indicate low PAC level in the hopper. All wetted surfaces of the feeder and the supply hopper shall be fabricated from stainless steel.

The feeder shall be driven by a 1 hp variable speed 3-Phase AC induction motor and controlled by a Variable Frequency drive via the HMI located in the door of the control panel. The VFD shall allow a 20:1 turndown ratio providing a wide range of dosing levels. The feeder controller shall be programmed to allow feeding of the carbon at a constant rate in pounds per hour.

c. Drop Tube

The feeder discharge shall be equipped with a stainless-steel removable drop tube, located between the volumetric feeder outlet and the inlet to the wetting cone, which shall guide the PAC from the feeder discharge tube into the wetting cone.

d. Wetting Cone

A stainless-steel wetting cone shall be installed to promote down-flow into the mouth of the eductor. The wetting cone shall be mounted between the drop tube discharge and the eductor. Water shall be added tangentially to the wetting cone, which shall form a vortex to sweep the inner surfaces of the wetting cone, preventing bridging and subsequent blockages. The wetting cone assembly shall have a piped overflow equipped with a conductivity switch which shall immediately trip the PAC dosing system if the presence of a fluid is sensed, indicating a high-water level in the wetting cone.

e. Eductor

A 1½" eductor shall be installed to mix and convey the PAC slurry to the Purchaser's utilization point. The unit will require a minimum of 40 gpm of motive water at 90 psig to move the dosed carbon from the wetting chamber to the final injection point. The pressure and quantity of motive water required to wet and convey the carbon slurry shall be ultimately dependent on the configuration (which relates to back pressure) of the Purchaser's slurry transport piping system and the injection point pressure.

f. Air Fluidization Nozzle

A fluidization nozzle shall be placed in the feeder hopper inlet duct to promote reliable flow of PAC from the bulk bag. Air fluidization shall be controlled by a solenoid valve.

2. VALVES & PIPING

a. Pneumatic Actuated Ball Valves

Three (3) each 3-piece 1½" pneumatically actuated stainless-steel ball valves shall be installed to control the flow of liquids within the system. Individual valves shall control the flow of motive water, the discharge of the carbon slurry and drain the system. The valves shall be pneumatically actuated and will require a minimum air supply of 100 psig of clean dry compressed air to operate effectively. Two brass body, electric solenoid valves shall be installed to control operation of the pneumatic ball valves.

b. Wash Water Regulator

A pressure regulating valve shall be provided to maintain a relatively constant flow of wash water into the wetting cone.

c. Solenoid Valves

Solenoid valves shall be brass body, soft-seated, with 120V AC solenoid coil. Solenoid operators shall be molded coil in NEMA 4 enclosure.

d. Air Pressure Regulators

Two (2) pressure regulators shall be installed to insure acceptable compressed air pressure to the various subsystems.

e. Piping

Compressed air tubing and instrument sensing lines shall be black polyethylene tubing and fittings.

Motive water and slurry piping shall be schedule 40 stainless steel, threaded or socket welded, minimum of ANSI 150# class. Valves shall be stainless steel or bronze ball valves, threaded, minimum of ANSI 150# class.

3. INSTRUMENTATION

a. Pressure Switch

Pressure switches shall be installed to monitor the motive water pressure and the wash water pressure.

b. Pressure Indicators

Pressure indicators shall be installed to monitor the supply/motive water pressure, the slurry discharge pressure and the wash water pressure.

c. Point Level Switch

A point level probe shall be installed to sense the PAC level in the feeder hopper and to provide an alarm signal when the level falls below the probe. The probe shall be of the tuning fork type and shall have local indicating LED lights to indicate when the switch is energized and the state of the switch. The unit shall mount through 1½" half coupling and can be easily removed. The tuning fork type of level probe uses no moving parts and has proven to be highly reliable in PAC service applications.

d. Vortex Water Level Switch

An ultrasonic level switch shall be installed to monitor the water level in the wetting cone. The switch shall be mounted in the wetting cone overflow and shall provide an alarm signal if the water level covers the probe.

4. CIVIL/STRUCTURAL

a. Equipment Support Structure

The PAC system tower shall consist of two (2) fabricated sections, each section approximately eight (8) feet tall, which can be bolted together to form the complete unit. The PAC system structure (tower) shall be fabricated from 3" A-36 square tubing and structural steel members and shall be designed to handle bulk bags weighing up to 900 pounds. The tower dimensions shall be approximately 6 x 10 x 16 feet.

The PAC system feed equipment with associated piping and instruments shall be mounted in the lower tower section and the monorail and hoist equipment shall be mounted in the upper tower section. The lower tower section shall be equipped with base plates for anchoring.

b. Lifting Adapter

A bulk bag lifting cross shall be provided to lift and position the bulk bags. The unit shall be designed to suspend a bulk bag indefinitely above the dosing module.

c. All external carbon steel surfaces shall be blasted per SSPC SP6 commercial blast to obtain a 1.5 mil average profile, prime coated with Sherwin Shalliams Dura-Plate Multi-Purpose Epoxy Primer (4-8 mils DFT) and finish coated with Sherwin Shalliams Acrolon 218 HS Acrylic Polyurethane (3-6 mils DFT) in black.

5. CONTROL PANEL

a. The PAC system controls shall be contained within a dedicated control panel, including PLC, power supply, control relays, Human Machine Interface (HMI), terminal blocks, switches, etc.

b. Control wiring philosophy shall meet the following requirements:

1. The control wiring philosophy shall be such that all field control devices utilize normally closed contacts during normal operating condition.

2. A contact opening or an open circuit shall result in an alarm condition for the specific device.

3. Loss of power to a control device shall result in an alarm condition.

6. PANEL FEATURES

The control panel shall be provided with the following items and/or features:

a. Panel shall be rated NEMA 4X.

b. Terminal blocks shall be installed for termination of all Purchaser installed cables.

c. Terminal blocks for voltage of 120 volts and less shall be equal to A/B 1492-W10.

d. All wiring shall be installed in Panduit or similar wireways and separate into categories to the extent practical. All terminal strips for all wiring terminations shall be numbered.

e. Wiring shall be stranded copper, THHN insulated, extra flexible type. As a minimum wire size shall be #12 AWG for all power wiring, #14 AWG for all external control wiring, #16 AWG for all control panel internal control wiring and #18 AWG twisted shielded pair for analog signal conductors. Wiring shall be color coded as follows:

1. Ground wiring shall be green.

2. 120 volt AC, 600 volt AC and 90 volt DC power wiring shall be black.

3. Neutral wiring shall be white.

4. 120 volt AC control wiring shall be red.

f. Wiring at all terminals within panels, junction boxes, and field devices shall be numbered with shrink fit, machine printed labels.

7. CONTROL COMPONENTS.

   a. Programmable Logic Controller
   The PLC for control of the system. (manufacturer varies)

   b. Human Machine Interface
   (manufacturer varies)

   c. Feeder Speed Controller
   The screw drive for the volumetric feeder shall be controlled by a Variable Frequency Drive providing finite local adjustment of the PAC feeding rate. (manufacturer varies)

8. STATUS & ALARMS

   a. The following status and alarms shall be shown on the HMI:

      1. Feeder Malfunction.
      2. Vortex Water Level High.
      3. Motive Water Pressure Low.
      4. Wash Water Pressure Low.
      5. Feeder Hopper PAC Level Low.

   b. The following control switches shall be located on the control panel:

      1. System Stop pushbutton switch.

   c. The following control functions shall be on the HMI:

      1. Local Start PAC System.
      2. Local Stop PAC System.
      3. Feeder Off/Auto selector.
      4. Alarm Acknowledge.
      5. System Operation Local/Remote selector.
      6. System Mode Non-Paced/Paced selector.
      7. Fluidization System On/Off/Auto selector.
      8. Trip Reset selector.
      9. PAC feed rate selection.

E. SYSTEM OPERATION

The PAC system dosing system shall consist of two (2) independent control loops: (1) feeder hopper filling and level monitoring and (2) water flow/carbon dosing.

1. FEEDER HOPPER FILLING

   a. To fill the feeder hopper, move a bulk bag of PAC directly under the end of the Porta-PAC™ trolley monorail beam. Move the trolley to position the hook directly over the bulk bag. Lower the hoist hook and connect it to the eyelet on top of the lifting cross.

   b. Connect the bulk bag to the lifting cross using all four (4) of the bag straps.

   c. Raise the bulk bag to clear the safety shield and carefully move it to the center of the structure using the hoist trolley. Lower the bulk bag to within approximately 6" of the safety shield.

   d. Untie the outer draw string and extend the inner and outer chutes on the bottom of the bulk bag. Open the bag chute clamp assembly to position the inner and outer chutes on the hopper inlet opening.

   e. Place the inner liner chute inside the hopper inlet connection and place the outer chute around the outside of the hopper inlet connection. Pull the outer chute tight around the hopper inlet to eliminate as many folds as possible and place the bag clamp around the outer chute. Level the clamp and tighten in place, approximately ½ inch below the top of the hopper inlet chute.

   f. Release the strap that is in place around the bulk bag inner and outer liners which shall release the PAC to flow into the feeder hopper.

   g. Slowly raise the bulk bag to tighten the sidewalls of the bag and the discharge chute to aid in establishing flow from the bag.

   h. The PAC shall normally start to flow from the bulk bag within a few minutes however fluidizing the PAC in the bulk bag shall assist in carbon discharge. Placing the fluidizing selector on the FLUIDIZING screen in the ON mode shall provide a single pulse of fluidizing air to the PAC (the selector shall automatically return from the ON selection to the OFF mode).

   i. After a bulk bag has been installed, the FLUIDIZING selector may be switched from the OFF mode to the AUTO mode. Placing the selector in the ON mode shall provide a single pulse of fluidizing air to the PAC (the selector shall automatically return from the ON selection). Placing the selector in the AUTO mode shall provide a pulse of fluidizing air to the PAC on a set time interval when the feeder is running.

   j. The level in the volumetric feeder supply hopper shall be monitored by a level switch. When the level probe is uncovered, a signal shall be sent to the PLC and a LOW HOPPER LEVEL alarm shall be initiated. The alarm shall not affect operation of the PAC dosing.

2. WATER FLUSH

   Water flow through the PAC system shall be established as a permissive to operate the feeder (feeding PAC) and it is sometimes desirable to flush the pipelines or to calibrate some portion of

the system without feeding PAC. The system may be operated in the flush (water only) mode simply by placing the FEEDER selector in the OFF mode. Operation in the flush mode is described below.

a. Place the FEEDER selector and the FLUIDIZING CYCLE selector in the OFF mode and place the SYSTEM OPERATION selector in the LOCAL position.

b. Select the LOCAL START mode on the HMI to initiate water flow through the unit. The drain valve shall close and the motive water supply valve and the discharge valve shall open allowing motive water to flow through the eductor and wash water to flow into the wetting cone to establish a vortex.

c. The motive water supply pressure to the eductor shall be monitored by a pressure switch to insure that adequate flow is established through the eductor. The switch shall be adjusted to actuate at the minimum allowable supply water pressure. The motive water pressure shall be a permissive to operate the feeder and if adequate pressure is not established within ten (10) seconds, a LOW MOTIVE WATER PRESSURE alarm shall be initiated.

d. The wash water supply pressure to the vortex vessel cone shall be monitored by a pressure switch to insure that adequate flow is established through the vortex vessel. The switch shall be adjusted to actuate at the minimum allowable supply water pressure. The wash water pressure shall be a permissive to operate the feeder and if adequate pressure is not established within ten (10) seconds, a LOW WASH WATER PRESSURE alarm shall be initiated.

e. The water level in the wetting cone shall be monitored by a level switch located in the overflow pipe line to insure that a high water level in the wetting cone does not flood the volumetric feeder. If the level switch probe is covered for one (1) second, a HIGH VORTEX LEVEL alarm shall be initiated, stopping operation of the system.

f. To stop the system simply select the LOCAL STOP mode on the HMI and the motive water supply and discharge valves shall close and the drain valve shall open to drain the water trapped between the motive water valve and discharge valve.

3. CARBON FEED

a. Prior to feeding PAC, the feed rate must be set. Select the FEEDER screen on the HMI. After selecting the Feeder Output input box enter a number between the minimum and maximum pounds per hour [kg per hour], and press the ENTER push button.

b. To initiate carbon feed, simply place the FEEDER selector in the AUTO mode and select the LOCAL START mode on the HMI. The water system shall start as described above and the feeder shall begin operation in 30 seconds. If the water system is already operating in the flush mode, carbon feed may be initiated simply by selecting the FEEDER AUTO mode on the HMI.

c. Thirty (30) seconds after water flow has been established, the volumetric feeder shall begin feeding PAC into the drop tube. The drop tube may be removed to view the PAC being fed into wetting cone.

d. Changing the PAC feed rate shall be accomplished simply by depressing the SPEED SET function key on the FEEDER screen of the HMI, entering the desired feed rate and depressing the ENTER function key. The feed rate may be changed with the feeder in operation. The VFD varies the speed of the feeder drive motor between 100 and 2000 RPM to match the required feed rate. The drive motor speed may be monitored on the FEEDER screen of the HMI.

e. The system shall inject PAC into the motive water stream until stopped by selecting the LOCAL STOP mode on the HMI, when the system is in the LOCAL control mode, or by sending a stop signal provided by the Purchaser when the system is in the REMOTE control mode. Either method for terminating system operation shall immediately stop operation of the feeder, however the system shall continue to operate in the flush mode for thirty (30) seconds to clean all PAC from the transport pipe lines.

f. Restart of the system after a manual shutdown shall be accomplished by depressing the LOCAL START pushbutton switch or by providing a remote start signal. Restart of the system after a system trip and all alarms have been cleared shall be accomplished in the same manner.

4. OPERATING MODES

a. With the NON-PACED system mode selected, the operator can manually set a fixed PAC feed rate in pounds per hour via the HMI. The HMI feeder screen shall display the feed rate in pounds per hour.

b. With the PACED system mode selected, the feeder controller shall vary the PAC dosing rate based on the SCADA ethernet signal to the PLC (provided by the Purchaser). The HMI feeder screen shall display the feed rate in pounds per hour.

c. With the REMOTE system operational mode selected, starting and stopping of the system shall be only from a remote signal which energizes control relays installed in the control panel.

5. ALARMS.

The alarm sequence shall operate essentially the same for all alarms. When an alarm is initiated, the corresponding alarm shall be displayed on the HMI ALARM SCREEN and the alarm horn on the control panel shall sound until the alarm is acknowledged by depressing the ACKNOWLEDGE key (F4) on the HMI keypad. When the alarm acknowledge is pressed, the alarm horn shall be silenced but the alarm shall continue to be displayed on the ALARM SCREEN until the alarm is cleared. For critical alarms system operation shall be "locked out" until the alarm is cleared and the alarm reset key is depressed.

a. LOW HOPPER LEVEL - When the carbon level in the feeder hopper drops below the point level probe, an alarm shall sound at the control panel to indicate the need to change the bulk bag. However, feeder operation shall not be affected. When this alarm sounds ample time shall be available to install a full bulk bag before all of the PAC in the feeder hopper is used. The alarm shall automatically clear when the level probe is covered with PAC.

b. LOW MOTIVE WATER PRESSURE - The low motive water pressure alarm shall be initiated when the motive water pressure falls below a pre-set value. Operation of the feeder shall be stopped when the alarm is initiated, however, water flow shall not be stopped and the alarm shall be automatically cleared when adequate water pressure is established. Feeder operation shall be automatically restored when the alarm is cleared.

c. HIGH VORTEX LEVEL – The high vortex level alarm shall be initiated when the vortex level probe located in the wetting cone overflow is covered with water, which indicates that the vortex vessel has been flooded with water. Operation of the feeder shall be stopped immediately. The motive water and the discharge valves shall be closed and the drain valve shall be opened immediately. Operation of the system shall not be resumed until the alarm is cleared by depressing the ACKNOWLEDGE key and the ALARM RESET key.

d. LOW WASH WATER PRESSURE - The low wash water pressure alarm shall be initiated when the wash water pressure falls below a pre-set value. Operation of the feeder shall be stopped when the alarm is initiated, however, water flow shall not be stopped and the alarm shall be automatically cleared when adequate water pressure is established. Feeder operation shall be automatically restored when the alarm is cleared.

F. PURCHASER'S SCOPE OF WORK

The following items are not included in this offering and shall be supplied by the following:

1. INSTALLATION
   The manufacturer will provide the equipment as described herein. The Contractor shall receive, install and make all connections necessary for a functioning system.

2. FOUNDATIONS
   The manufacturer will provide equipment anchor bolt loading, which shall allow the Contractor to design and install the equipment foundation(s).

3. MOTIVE WATER
   The Owner will provide a minimum of forty (40) gpm of clean motive water at a minimum of forty (40) psig (dynamic) to the PAC system battery limits.

4. COMPRESSED AIR SUPPLY
   The Owner will provide an instrument quality compressed air source capable of delivering 2 scfm at 90 psig with a minimum 38 °F pressure dew point to the PAC system battery limits.

5. ELECTRICAL POWER SUPPLY
   The Owner will provide a 20 amp, 120 volt, single (1) phase, 60 Hz electrical power supply to the Seller's control panel located on the PAC system frame.

6. DRAINAGE SYSTEM
   The Purchaser will provide the means to collect and dispose of system drainage, wash-down and any other wastes generated through operation of the dosing system.

7. INTERCONNECTING PAC TRANSPORT PIPING & SUPPORTS
   The Owner will provide the slurry discharge piping that shall have a maximum back pressure of 20 psig (dynamic) for 40 GPM from the PAC system battery limits to the Owner's point of usage.

8. INTERCONNECTING CABLE & CONDUIT
   The Owner shall provide and install all interconnecting cable and conduit (including fittings) between the PAC system control panel and the plant DCS system or for remote control.

9. POWDERED ACTIVATED CARBON (PAC)
   The Owner shall provide Powdered Activated Carbon for start-up.

A. GENERAL

1. SUMMARY

a. Furnish one (1) polymer preparation system designed to meter, wet (dilute), mix, age and activate dry emulsion polymer. The equipment shall include dry feeder, wetting system, three-compartment tank for mixing, aging, storing with one hour total retention time, automatic control system and spare parts.

2. SYSTEM DESCRIPTION

a. Furnish one (1) polymer preparation system designed to store, metering, wet, mix and age dry polymer and 2 feed pumps.

b. The polymer preparation system is a critical part of the process and must be designed to provide optimal performance and reliability under all operating conditions.

c. Design Criteria
   1. Polymer Type: Dry
   2. Polymer Activity (percent active):
      a. Dry: 100%
   3. Make-down Solution Concentration Range: 0.1% to 1%.
   4. Minimum Aging Time: 60 minutes.
   5. Polymer Production Capacity:
      a. 0.8#/Hour – 38#/Hour
   6. Accurate within 5% of set feed rate.

3. SUBMITTALS

a. Product Data:
   1. One (1) electronic copy of submittal data will be supplied for the system.

b. Shop Drawings:
   1. Component data and shop drawings of the system will be supplied, including dimensions, weight, and parts list.
   2. Control panel elevation, control schematics and component data will be supplied.

c. Record Documents:
   1. Manufacturer's warranty form in which manufacturer agrees to repair or replace components that fails in materials or workmanship within specified warranty period.

d. Provide detailed Operations and Maintenance Manuals including storage, installation start-up and operating instructions. Provide safety precautions and warnings of all hazards operating equipment.

4. QUALITY ASSURANCE

   a. Manufacturer shall have minimum five years' experience in manufacturing polymer activation and feed systems.

   b. All equipment provided under this section shall be obtained from a single supplier or manufacturer who shall assume full responsibility for the completeness and proper installation of the polymer activation and feed system.

   c. To ensure quality and unit responsibility, the polymer activation and feed system must be assembled and tested by the manufacturer at its facility and be a standard regularly marketed product of that manufacturer. The manufacturer must have a physical plant, technical and design staff, and fabricating personnel to complete the work specified.

   d. Prior to shipment the system shall be inspected for quality of construction verifying all fasteners and fittings are tight, all wires are secure and connection whisker-free. The system shall be tested under pressure for a minimum of one hour at 100 psi. If leaks are found they shall be fixed and a new test shall be conducted for one hour at 100 psi until the plumbing system is verified to be leak free.

5. DELIVERY & STORAGE

   a. Packaging: The Contractor is to assume responsibility for packaging to prevent damage during site storage

6. WARRANTY

   a. Polymer feed system shall be warranted for a period of 12 months from the date of start-up by authorized technician.

7. MAINTENANCE

   a. Provide one complete set of special tools, if required.

B. PRODUCTS

1. MANUFACTURERS
   a. Acceptable Manufacturers:
      1. ProMinent Fluid Controls, Pittsburgh, PA or equal
         a. UltraMat model ULFa400 or equal

2. IDENTIFICATION
   a. Provide a name plate securely affixed to the unit providing Manufacturer with phone number, model number, serial number.

3. MATERIALS
   a. General:
      1. Polymer feed system shall be of welded polypropylene for corrosion resistance.
      2. Hardware shall be Type 18-8 stainless steel.

3. Any components in contact with polymer shall be constructed of stainless steel or an inert plastic unless otherwise specified.
4. Any components in contact with water shall be constructed of brass, stainless steel, or an inert plastic unless otherwise specified.
5. Mixing impellers shall be constructed of stainless steel. Plastic, brass or bronze impellers are not acceptable.
6. Pressure gauges shall be 2-1/2" stainless steel, liquid filled
7. Pressure switches shall be rated NEMA 4 at a minimum.
8. Non-Mechanical Seals shall be graphite or Teflon.
9. Mechanical seals shall be stainless steel, ceramic and carbon.
10. Enclosures shall be NEMA 4X.
11. All panel mounted control components shall be NEMA 4X.

4. EQUIPMENT

a. Dry Material Storage:

1. A polymer storage hopper shall be provided having a minimum capacity of 1.7 cu. Ft.

2. The hopper shall have a vacuum conveyor system for dust free filling of polymer powder directly from a polymer bag or sack to the storage hopper including:

   a. A 304ss vacuum conveyor fitted to the top of the powder hopper with 10ft hose and suction nozzle.
   b. 22-33lbs/min of polymer transfer capacity.
   c. Control switch and motor starter in the control panel. Motor is 460V /60 Hz, 1.6hp.

3. The hopper shall be fabricated of welded polypropylene with the lower portion of the hopper tapering to facilitate flow of the dry product to the ensuing screw feeder.

b. Volumetric Screw Feeder:

1. Provide a volumetric screw feeder to meter dry polymer into the dry polymer feed funnel.
2. The screw feeder shall be fitted with a dry powder level sensor to alarm upon low powder level.
3. The screw feeder shall be a direct drive design incorporating a variable speed motor and gear reducer.
4. The removable screw type auger shall have solid volutes welded to an inner shaft, fabricated from 304 stainless steel. Pigtail (open auger) shall not be allowed.
5. The screw feeder shall be of rugged designed for long life under continuous use. The auger housing shall be constructed of 304 stainless steel.
6. The motor shall be not less than ¼ H.P.

c. Dry Polymer Wetting System:

1. Provide a jet type wetting system specifically designed to thoroughly wet dry polymer with minimal maintenance. The wetting system shall include a funnel, and wetting jet. The wetting jet shall create a vacuum effect to prevent polymer dust or build-up.
2. Construction: the feed funnel and wetting system shall be constructed of PVC or PP.
3. The wetting system shall be rated from 10 GPM of dilution water flow.
4. Systems that merely meter dry polymer into the mix tank and therefore fail to wet each individual polymer particle shall not be acceptable.

d. Tanks System:

1. The tank system shall be a three-chamber, horizontal baffled design with a mixing, aging, and storage chamber. Each zone shall be separated by an underflow and over flow baffle. The tank design and process shall create plug flow through the tank system to prevent short circuiting of newly prepared and fully aged polymer in the final feed chamber. Systems without a minimum of three chambers will not be acceptable. Systems vertical chambers shall not be acceptable.
2. Each chamber shall be externally manifolded with manual shutoff valves to allow complete utilization of the polymer.
3. Tank shall be rectangular and constructed of welded polypropylene.
4. The three chambered, baffled tank shall have a total usable capacity of not less than 100 gallons.
5. The tank system shall provide a minimum of 60 minutes of aging and shall effectively and thoroughly mix the polymer solution without damaging the polymers molecular structure prior to transfer to the feed tank.
6. fittings:
   a. 1" drain with ball valve in each baffled section with a manifold to provide one common drain connection.
   b. 1-1/2" solution metering pump suction connection with isolation valve
7. Provide a level sensor to control the batch process.

e. Tank Mixers:

1. Provide two (2) tank mixers to ensure adequate agitation of the polymer solution in the first and second chambers, before transfer to the feed chamber. The mixers shall be 900 RPM in design. The run time of each mixer shall be controlled by the polymer system PLC. The mixer shall have a 316 stainless steel shaft and high efficiency impeller.
2. The mixers shall be driven by a TEFC, 0.25 H.P. motor.

f. Control Panel:

1. A control panel integral to the system skid shall be provided. The enclosure shall be rated NEMA 4X. The control panel shall include all programmable controllers, digital displays, switches, timers, lights, relays, motor controllers and

other control devices required for a complete operable system. Power shall be 460 VAC, 3PH, 60 Hz. The control panel and all components shall be industrial duty. All skid mounted electrical components interconnected to the control panel shall terminate at numbered and labeled terminal blocks. The control panel shall be positioned such that there are no obstructions in front of the control panel per related NFPA requirements. Control features shall include the following:

2. Operator Interface:
    a. Main Power ON/OFF selector switch
    b. Process Controller:
        1) Siemens S7-1200 PLC
        2) Controls shall be capable of Modbus/TCP communications.
        3) System MANUAL / AUTO selection on HMI:
            a) In MANUAL mode the water solenoid valve, volumetric feeder and tank mixers can be controlled regardless of tank level via manual selector switches.
            b) In AUTO mode the volumetric feeder, water solenoid, and tank mixers operate based on level in the feed section of the tank, automatically preparing polymer solution upon demand. The volumetric feed rate of polymer is controlled proportionally to water flow to prepare the desired polymer solution concentration set by the operator.
    c. Manual HMI Selectors ~~switches~~ include:
        1) Water solenoid valve OPEN / CLOSED
        2) Volumetric feeder ON/OFF
        3) Tank mixer #1 ON/OFF
        4) Tank mixer #2 ON/OFF
        5) Volumetric feeder manual control: pushbuttons
3. Status / Alarm Indicators (on HMI):
    a. Main Power ON
    b. Mode display
    c. Water rate display
    d. Solution concentration display
    e. Low Water Pressure Alarm
4. Special Features:
    a. Semi-Auto calibration of volumetric feeder
    b. Water flow meter K-Factor adjustment
    c. Tank feed chamber level calibration
5. Inputs: NONE
6. Outputs:
    a. Low water pressure alarm (discrete dry contact)
    b. Low feed chamber level alarm

5. FIELD SERVICES:

    a. The manufacturer or manufacturer's representative shall provide the services of an experienced, authorized representative the equipment specified herein who shall be present at the jobsite and/or classroom designated by the Owner for the minimum man-days listed for the services shown below time travel excluded

b. One man-day per site for inspection, start-up, functional testing and certificate of proper installation.

c. One man-day per site for training and commissioning.

END OF SECTION

A. GENERAL REQUIREMENTS

1. Scope of Work

The contractor shall furnish and install one (1) - factory built, factory delivered, below ground meter station/ control valve station, in a steel welded capsule with all necessary internal piping, fittings, supports, meters, and other necessary appurtenances as shown on the plans and specified herein.

The below grade meter station shall be complete when delivered and will not require internal contractor construction except to install the power service through the service conduit provided for that purpose and to connect the main water service to the required points and other work as may be listed in the Section for CONTRACTORS INSTALLATION REQUIREMENTS.

2. Contractor Installation Requirements

The contractor shall be required to provide a crane and spreader bars to set the station on the foundation designed by the engineer shown in the plan set. The foundation shall be built by the contractor and as directed by the engineer. Following setting of the station, the contractor will be required to anchor the station to the foundation. The contractor shall supply the anchor bolts.

The contractor will be responsible for installing the ship loose hatch extension, hatch and ladder assembly. The units will be shipped loose with the proper gasket and sealant material. Great care must be taken to ensure the flanges of the mating surfaces remain clean and free of debris.

The Meter Station shall be provided with built-up DI OD pipe ends to adapt the carbon steel piping to contractor supplied ductile iron as shown on the drawings. The contractor is responsible for the supply and installation of the pipe connection and restraint devices.

3. Contractors Recognition of a Valid Equipment Proposal

To avoid a displacing of responsibility, the Pumping Station manufacturer alone shall propose to contractors on the assembled equipment covered by this section of these contract documents. Said manufacturer's proposal must be signed by an officer of the manufacturing company.

Bidding Contractors will be instructed NOT to accept or base their bid on equipment proposals from a representative, third party agent or intermediary.

The Contractors shall provide electronically to the Engineer of Record an un-priced Equipment Proposals from any proposing manufacturers, doing so to ensure those proposals are direct from and signed by each proposing manufacturer.

4. Manufacturer's Responsibility for Performance

The Specifications and Drawings for the Factory-built equipment do not necessarily include all the details for the design and fabrication for the factory-built equipment. The Drawings are generally schematic but the specifications do call out strict requirements to known methods, components and assemblies that must be in a full, complete and functional pumping station. As such, the Manufacturer shall accept and hold complete responsibility for the functionality of the pump station and its workings.

5. Basis of Design Manufacturer

The basis of design station equipment is by Engineered Fluid, Inc. having been deemed to represent the minimum level of quality, performance and service acceptable for this equipment. Engineered Fluid, Inc. is represented by Mr. Brent Hutchins of Brad Greer & Associates, telephone 918-360-6674.

Alternate Manufacturers

Alternate manufacturers may propose on the equipment set forth in these documents provided these alternate manufacturers take no exceptions to the contract documents and these manufacturers provide the PRE-BID SUBMITTAL information so listed in this specification.

Alternate manufacturers are eligible to provide contractor proposals for this equipment. However, these listed manufacturers must have provided a PRE-BID SUBMITTAL to the Engineer of Record at least ten (10) days prior to the bid date.

Pre-Bid Submittal Documents

Along with the requirements for post bid submittal documents provided for elsewhere in these documents, all alternate manufacturers offering equipment proposals, without exception, for this equipment shall provide at least ten (10) days before the bid date the below-listed PRE-BID SUBMITTAL documents for the pump station and containing at a minimum:

1. "D" sized only, station mechanical drawing sheets fully to scale and fully annotated showing;
   a. A PLAN VIEW of all mechanical equipment, piping and devices necessary to system operation and with NEC Electrical Clearances;
   b. A lengthwise SECTION VIEW;
   c. A Sidewise SECTION VIEW;
   d. A complete STRUCTURAL PLAN VIEW of the steel base for the pump stations.
2. "D" sized only sheets showing;
   a. A POWER ONE LINE DIAGRAM annotated and showing all power components;
   b. A PROCESS & INSTRUMENTATION DIAGRAM (P&ID) showing all components, devices and circuit for the controls and instrumentation for the control and monitoring equipment including the PLC equipment.

3. A detailed drawing of the buildings to be used to house the station including anchoring and assembly methods.

4. An affidavit signed by an officer of the station manufacturer attesting to the fact that the buried capsule shall be constructed with the specified lap seam joint for joining the side sheet to the top sheet and bottom sheets of the capsule.

PRE-BID SUBMITTAL documents will not be accepted after the date set so it is the Bidding Contractors responsibility to determine which of the listed manufacturers have turned in their PRE-BID SUBMITTAL documents.

The Engineer of Record shall review the PRE-BID SUBMITTALS for adherence to the contract documents.

The PRE-BID SUBMITTAL shall be provided in One (1) hard paper copy bound in a three ring binder with a Table of Contents and tabs for each individual pump station and with One (1) electronic copy on CD placed inside the three ring binder in a suitable pocket.

The manufacturers that are approved for proposing on the specified equipment, the approval of their PRE-BID SUBMITTAL in no way excuses them from providing a full set of submittal documents being in full conformance to the contract documents for detailed review by the Engineer post bid.

6. Post Bid Submittal

Equipment submittals shall be bound and in a minimum of two (2) hard paper copy bound and two (2) electronic copies on CD. The submittals shall contain a minimum of two (2) full size drawings, size 24" x 36"; one (1) each covering the booster pump station and the electrical control schematic. The booster pump station drawing shall be specific to this project, in at least three (3) different views, be to scale and illustrate the National Electrical Code (NEC) clearances per Section 110-26 of the Code. The submittal booklets will be complete with data sheets covering all major components that make up the booster pump station and the UL/ETL file number under which the manufacturer is listed, service department personnel statement as detailed in the specifications and be complete with the manufacturer's formal warranty policy. The submittal booklets shall be complete with a full size photocopy of the manufacturer's combination UL/manufacturer logo Packaged Pumping Systems label.

Two (2) submittal reviews of this item will be accomplished at no cost to the submitting contractor. However, all subsequent reviews will be charged to the submitting contractor at the design engineer's standard hourly billing rate.

7. Quality Assurance

The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the contract drawings and operated per manufacturer's recommendations.

8. Third Party Inspection Listing (Stations 600V Max.)

The station manufacturer shall be required to affix to the station an UNDERWRITERS LABORATORIES (UL) LABEL attesting to the compliance of the station equipment under the PACKAGED PUMPING SYSTEMS (QCZJ) UL Listing Category and/or INTERTEK TESTING SERVICES (ETL) LABEL attesting to the compliance of the station equipment under PACKAGED PUMPING SYSTEMS. The ETL label shall state the station conforms to UL STD 778 and is certified to CAN/CSA STD C22.2 NO. 108.

9. Shipping and Delivery

The specified equipment shall be delivered by the manufacturer FOB DESTINATION and thereby the station manufacturer shall hold the full responsibility for the condition and completeness of the equipment upon its delivery.

The Engineer shall hold the right to inspect the equipment prior to unloading and setting so as to assure the quality and condition of the equipment is in no way deficient.

If in the view of the Engineer or Engineer's inspector, the equipment is deficient when delivered, delivery shall be refused.

10. Specified Components

Within the body of this specification and on the drawings, certain components are listed by name and/or model number for at least One (1) manufacturer's specific product. As such, no "OR EQUAL" is listed or allowed where at least the one manufacturer is listed.

These listed components have been chosen because of the Engineer's and Owner's knowledge of and experience with these listed components.

No other components other than those listed are acceptable.

11. Factory Start-Up and Training Service

Without exception, the station manufacturer is directly responsible for station start-up and operator training. Third party contractors, agents or representatives are not to be allowed to start up the station nor the equipment therein. As such;

1. Start-up Factory Service Technician shall be a regular employee of the station manufacturer.

2. The manufacturer shall provide two (2) copies of the complete Operation & Maintenance Manual in electronic form.

12. Manufacturer's Warranty

The warranty is the sole responsibility of the station manufacturer and that manufacturer's warranty shall be provided in written form, being placed in both the Submittal documents covering the specified equipment and the O&M manuals provided with that equipment.

It is required the station warranty provide the Owner with a single source responsibility for all components specified herein and the system as a whole. That single source shall be none other than the station manufacturer. Third party suppliers, service contractors, "Pass-through" warranties and service by the representative are not acceptable.

Said manufacturer's warranty shall at a minimum cover:

1. A period of one (1) year commencing upon successful start-up, after authorized manufacturer's start-up, not to exceed eighteen (18) months from the date of shipment.

2. The warranty period shall be inviolate regardless of any component manufacturer's warranty for equipment and components within the station.

3. The manufacturer's warranty shall cover all equipment, components and systems provided in or with the station by the manufacturer of the station, exclusive of those components supplied by and/or installed by others independent of the manufacturer of record for this station.

4. The warranty shall provide for the station manufacturer to bear the full cost of labor and materials for replacement and/or repair of faulty or defective components so there shall be no cost incurred by the Owner for this work during the warranty period.

5. The manufacturer's warranty policy is amended only by the items considered consumable, i.e., light bulbs, pump seals, pump packing, lubricants and other maintenance items consumed by usage.

6. No assumption of contingent liabilities for any component failure during manufacturer's warranty is made.

7. The warranty pertains only where the equipment has been operated in strict accordance with the manufacturer's instructions and requirements. Evidence of misuse or modification to the equipment voids the warranty.

If the submitted written manufacturer's warranty does not meet the minimum requirements set forth above, that submittal will forthrightly be rejected.

13. General Liability Insurance

The water distribution station manufacturer shall furnish premises/operations and products/completed operations general liability insurance from an insurance company with a rating of A-V according to the most recent Best's Key Rating Guide, in an amount equal to $10,000,000 per occurrence.

The insurance certificate must be included with the manufacturer's submittal. The coverage must be provided by an insurance carrier licensed and admitted in the state of manufacture.

B. PRODUCTS AND COMPONENTS

1. Equipment Capsule Design Standards

The equipment capsule shown is suitable by construction and materials for direct burial with water-tight integrity.

The size shown for the capsule is appropriate for National Standard mandated clearances and for proper clearances above, below and around equipment to provide for safe servicing, removal and reinstallation of that equipment.

The entrance man way in the locations shown shall be sized to provide eventual removal and replacement of any component within the station without altering the station to accomplish that task.

The drawings for this equipment illustrates equipment centerline and clearance/maintenance dimensions about the major equipment items. These dimensions are minimum.

2. Equipment Capsule - Construction

The plate steel employed throughout the capsules shall be 3/8" for the side sheets and 3/8" for the top and bottom sheets as minimum thickness and meet or exceed the requirements for ASTM A-36.

The structural shapes, channels and angles used shall be of the thickness/weight as shown on the plans for this item and shall meet or exceed the requirements for ASTM A-36.

3. Capsule Dimensions

The capsule shall be a rolled, vertical cylinder steel capsule of sealed welded construction with top and bottom and side sheets and with appropriate supporting structure.

The capsule shall be sized as shown on the drawings.

4. Capsule Reinforcement

The top, bottom and sides of the equipment capsules shall be supported and reinforced by a combination of standard structural shapes of the sizes and weights as shown on the plans for this item.

The structural rectangular or square tubing shall be of the wall gauge as shown on the plans for this item and shall meet or exceed the requirements for ASTM A-500 Grade.

The capsule designs shall be reviewed and stamped by a Register Professional Engineer licensed in the State of Oklahoma.

5. Plate/Sheet Capsule Joints – Lap Seam Weld

The construction of the capsule as a buried system requires construction techniques necessary to ensure a long service life. The side sheet – top sheet joint construction is specified to provide maximum coating effectiveness and minimal corrosion potential by the elimination of sharp edges or abrupt transitions where coating process cannot maintain full film thickness and so promote corrosion and undercutting.

The plate forming the top and bottom of the capsules shall be rolled edge, cold formed prior to assembly so as to form a lap joint with the side wall.

The lap joint shall be continuously full fillet welded on the capsule interior by hand and the exterior by machine to form an airtight seal.

The lower side wall continuous weld shall be an average 1-1/2 inches above the capsule floor. Capsules without lap joints will not be accepted.

6. Tank Sheet Penetration Welds

Any ferrous metal device, namely water transmission piping and conduits passing through the capsule wall shall be welded fully long its circumference or length, being welded on both sides of the capsule wall using a metal-added, MIG shielded arc welding process.

7. Lifting Plates And Equipment Lifting Eyes

Four (4) lifting plates of 3/8 inch minimum thickness shall be placed about the perimeter of each capsule to facilitate the lifting and handling of the station.

Interior lifting eyes shall be placed over each piece of equipment in excess of 60 pounds in weight.

8. Floor Sump

The capsules will be complete with a sump. The sump shall be a minimum of eighteen (18) inches in diameter x eight (8) inches deep; the sump shall be provided with a four (4") inch plugged outlet for gravity outflow as required.

9. Hatchway Extension

There shall be provided below the manway cover, a fabricated steel extension extending from the top of the capsule structure to below and supporting the hatch assembly.

The extension shall be of certain height to meet the dimensions for pipe depth and grade, as shown on the drawings.

The hatch shall be bolted to a hatch extension of the capsule. Bolted connection should stay above the surface of the finished grade to allow changing out the hatch. Non-shrink closed cell foam gasket shall be used to make positive seal between the top of the hatch extension and the bottom flange on the hatch.

10. Entrance Man-Ways - Raised Mounted Scuttles

The entrance man-ways shall be Bilco Model SS-50 roof scuttle, with a minimum clear inside opening of Sixty (60) inches by sixty (60") inches.

The scuttle covers shall be made of 11 gauge aluminum on the exterior. The scuttle covers shall be insulated with a minimum of one (1) inch of fiberglass insulation, covered and protected by an 18 gauge aluminum liner.

The entry locks shall be flush mounted, in the scuttle riser in position to be protected from the elements by the cover skirt as detailed on Bilco Drawing 6184. The locks will be of the pin tumbler type, dead bolt, with an inside safety release. Two (2) keys will be provided for each station, on a key ring complete with the manufacturer's identification. No locking devices or other penetrations of the cover shall be allowed.

The hatch shall be bolted to a hatch extension of the capsule. Bolted connection should stay above the surface of the finished grade to allow changing out the hatch. Non-shrink closed cell foam gasket shall be used to make positive seal between the top of the hatch extension and the bottom flange on the hatch.

11. Access Ladder

An all-aluminum access ladder will be provided for each station. The ladders shall be a Type 1A with 300 lbs. load rating and meet ANSI A14.3 fixed ladder standard. The ladders will have serrated rungs with 3" full I-Beam side rails.

The uppermost ends of the side rails will be protected by plastic caps bolted into place. The complete access ladder will be bolted into place at a minimum of two (2) points both top and bottom so as to be easily removable to facilitate equipment maintenance.

12. Ladder Assist Device

A Bilco Model LU-1 ladder-up safety post shall be installed on the vertical centerline of each ladder.

13. Capsule Cathodic Protection

The station manufacturer shall furnish for the Contractor's proper installation two (2) seventeen-pound packaged magnesium anodes for cathodic protection.

The anodes shall be H-1 alloy cast to meet ASTM B-80, alloy AZ-63. The anode lead wires shall be silver soldered and potted to be waterproof.

The anodes shall be buried equally spaced around the station and connected by heavy copper wire to lugs on the station provided for that purpose.

14. Anode Test Station

An anode test station shall be furnished consisting of individual pushbutton switches for each of the magnesium anode installed around the perimeter of the steel capsule.

The Test Station pushbutton switches will allow current to flow between the respective anode and the steel capsule passing through a Test Station Milliammeter, mounted on the Test Station door, so, that when the pushbutton is held in the depressed position, the operator can observe needle deflection or lack thereof.

The milliammeter shall have a range of 0-30 mA.

Wire leads each anode shall enter the capsule through one or several watertight, compression fittings in the capsule wall or in the hatch extension wall. The separate leads shall be run in conduit to the Test Station mounted on the capsule wall as shown.

A station capsule cathodic system lug shall be provided as required to complete the system circuit to the anodes.

15. Safety Floor Matting

The walkway areas (that space from the entrance ladder to the control panel and the entire NEC clearance area) shall be covered with a rubber drainage runner. The runner shall be medium duty, 1/2 inch minimum thickness of open slot design allowing fluids to drain understanding or walking surfaces. The runner shall have a tread design to promote sure footing. The underside of the runner shall have a raise knob design to permit aeration and drainage, and to reduce runner fatigue. The runner shall not be glued to the floor.

16. Piping-Transmission

Piping shall be steel and conform to material specification ASTM A-53(CW) for nominal pipe size four (4) inch and smaller and ASTM A-53(ERW) Grade B for nominal pipe size five (5) inches and larger. Steel butt-welding fittings shall conform to material specification ASTM A-234 Grade WPB and to the dimensions and tolerances of ANSI Standards B16.9 and B16.28 respectively.

Forged steel flanges shall conform to material specification ASTM A-105 Class 60 and/or ASTM A-181 for carbon steel forgings and to the dimensions and tolerances of ANSI Standards B16.5 as amended in 1992 for Class 150 and Class 300 flanges.

The piping sizes shall be as shown on the drawing.
Size 10 inch and below - Schedule 40
Size 12 inch thru 20 inch - Standard weight (.375" wall)
Size 24 inch and above - Standard weight (.500" wall)

17. Pipe Welding

All pipe welds shall be performed by certified welders employed by the pump station manufacturer. As part of the equipment submittal, the pump station manufacturer shall provide copies of the welding certificates of the employees who are to perform the pipe welds.

Shop welders shall be certified in accordance with ASME BPVC Section IX or AWS D1.1. Certification shall be done by an independent testing laboratory giving certification for the weld positions for which the tests were performed.

18. Pipe Surface Preparation

All piping inside and outside surfaces shall be prepared by grit blasting, or other abrasive blasting, prior to any welds taking place to minimum SP-6 finish.

19. Pipe Cutting

Piping of 4" diameter and smaller may be cut by saw.

Piping of 6" diameter and larger shall be bevel cut, and Oxyfuel or Plasma-arc cutting techniques shall be used to assure and facilitate bevel pipe cuts.

20. Saddle Cuts and Welds

Saddle cuts in pipe made in preparation for a saddle weld of a pipe at an angle to a pipe shall be made with numerically controlled, plasma cutting machines. Similarly, saddle end cuts to pipes to make a saddle mating piece shall be done with the same numerically controlled plasma cutting equipment.

When the two saddle cut pieces are mated and welded with the MIG process, the internal finished weld shall be smooth and free of inclusions, crevices and other corrosion sites.

21. Pipe Welding Techniques

Pipe welds shall be performed by metal added, inert gas shielded arc welding (MIG) techniques wherein the weld heat settings, the wire feed speed and the traverse speed of the work below the welding are numerically set to assure proper weld fusion and penetration and repeatable welds.

In all cases, short circuit transfer, spray transfer or pulse-arc transfer modes of the gas metal arc welding process shall be used.

When utilizing the short circuit mode, shielding gas consisting of 50% carbon dioxide and 50% argon gas shall be used. When utilizing the spray or pulse-arc transfer modes, a shielding gas consisting of 5% carbon dioxide and 95% argon shall be used.

In all cases, welding wire with a minimum tensile strength of 70,000 psi shall be employed.

All flange welds and butt welds of equal size pipe shall be a single continuous nonstop weld around the complete circumference of the pipe. Whenever possible, vertical up weld passes will be applied to all pipe welds. No vertical down weld passes will be allowed.

Completed pipe welded assemblies shall create no internal obstruction, restriction or create any unintended sources of water deflection.

Piping of six (6) inch diameter and larger shall require a minimum of two (2) weld passes to complete each weld. The first pass, or root pass, shall be applied at the bottom of the bevel cut using the short circuit transfer welding mode, and the second pass, or cap pass, shall be applied over the root pass using the spray or pulse arc transfer welding modes to insure that at a minimum the total weld thickness shall be equal to thinnest of the two pieces being welded together.

The pipe shall be sand blasted, as specified elsewhere, before pipe weld and after pipe weld, before fusion bonded epoxy is applied.

22. Weld Standoffs

No welding shall be performed on fusion bonded coated piping after the coating process has been performed.

Where any piping is to be welded after the application of fusion bonded epoxy coating to the inside of the pipe, at the point of the weld, a weld standoff must be welded to the pipe prior to the coating. The weld shall be made to the standoff and not onto the pipe.

23. Tank/Wall Penetration Coating Protection Sleeve

Where a fusion bonded epoxy interior coated pipe passes through the steel tank shell or a steel wall section, prior to fusion bonded coating of that pipe, a pipe sleeve shall be welded over the pipe in the area where the pipe passes through the steel sheet.

The sleeve shall be one-half (1/2") inch thickness and fit closely over the transmission pipe. The sleeve shall be seal welded to the transmission pipe at each end with a full and continuous fillet weld.

Following the welding of the sleeve to the transmission piping, the sleeve welds and the sleeve shall be grit blasted to an SP-6 finish so the pipe is prepared for fusion bonded epoxy coating by the process specified elsewhere in these documents.

24. Pipe Supports

Pipe supports by minimum sizing for:

- 8" and smaller piping shall be 2" x 3" x 3/16" wall rectangular tubing;
- 10" and larger piping shall be 3" x 4" x 1/4" wall rectangular tubing;

- 6" and larger piping shall be provided with "kick" bracing projecting fully from the underside of the pipe to the floor at an angle of no less than 15E from vertical out at a right angle to the run of the pipe being supported. These "kick" braces shall be in addition to the vertical pipe supports called out above.

Pipe supports are to be fully welded at both end points to the pipe and steel floor where required.

Where components are to be supported and may require disassembly at some time, the supports for these components shall be welded at the bottom and bolted at the top by use of a bolt yoke welded to the top of the support and bolted into the flange connection picking up at least three bolts.

25. Riser Pipe Vertical Supports

All of the inlet and outlet vertical riser pipes shall be provided each with, two (2) structural steel, angle pipe support welded to the weldment plates on the vertical riser pipe to down to the floor. These supports shall be opposed by at least 120 degrees around the pipe. The minimum member size for these supports shall be 3" x 4" x 1/4" tubular steel.

26. Fusion Bonded Epoxy Internal Pipe Coating

The internal surfaces of piping to be fusion bonded coated shall be grit blasted to an SP-10 finish with the finish profile required by the coating material manufacturer.

The internal, wetted surfaces of the steel transmission piping shall have applied to it a Fusion Bonded Epoxy Coating on the interior pipe surface. The coating shall be applied and meet the testing requirements of Table 1 and Table 2 with the exception of Table 2 section 7 per AWWA C-213.

The powder coating product shall be National Sanitation Foundation (NSF) Standard 61 certified material.

Prior to shipment of the station, the station manufacturer shall provide in writing to the Engineer certification that the fusion bonded epoxy coating has been applied to all internal surfaces of the steel piping using the proper method. Said certification shall show under the station manufacturer's letterhead:

- Date of application;
- Material manufacturer and product designation including a product data sheet for the coating;
- Applier of the fusion bonded coating, name, address and phone number;
- Notarized signature of an officer of the station manufacturing company stating the fusion bonded epoxy coating was applied to AWWA Standard C213-91 or the latest revision.

27. Coatings - Corrosion Protection

All interior and exterior surfaces of the exposed steel structure, transmission piping, and fittings shall be gritblasted equal to commercial blast cleaning (SSPC-SP6). Following fabrication all exposed surfaces of the station, interior and exterior, shall be coated according to the following requirements.

Weldment Prime Coating

All weldments will be pretreated by hand to provide additional corrosion protection using the same product as the base coat. Following the pretreatment full coating application shall take place.

Base Coating

The base coating shall take place immediately after surface preparation. The protective coating shall consist of a two-component, high solids, high build, fast drying epoxy system for protection and finishing of steel and having excellent corrosion resistant properties. The epoxy system shall be self-priming and require no intermediate coatings.

Top Coating

Following the base coating application, a full finish coating application shall take place. The protective coating shall consist of a two-component, high solids, high build, fast drying epoxy system for protection and finishing of steel and having excellent corrosion resistant properties. The epoxy system shall be self-priming and require no intermediate coatings. The base and finish coats shall provide a total dry mil thickness of 8.0 mils.

Post-Assembly Coating

Following assembly and just prior to shipping, there shall take place a thorough cleaning of the floor of the station followed by a rolled on coating of the two part epoxy coating to cover over any scuffing or scaring that might have occurred during assembly.

28. Floor Coating and Corrosion Protection System

The exposed surfaces of the steel floor shall have a non-skid coating of a two-component, 100% high performance aromatic polyurea spray elastomer system with zero VOC (Volatile Organic Compounds), 100% solid. The coating shall offer outstanding performance and superior elastomeric protection for various substrates. The coating shall be designed as a user-friendly product for moisture insensitive applications because of its pure polyurea chemistry, and offer exceptional adhesion properties for properly prepared substrates. The high-performance formulation shall produce an excellent skin formation for chemical resistance and moisture protection.

Both the Iso "A" Side and Resin "B" Side shall be preconditioned between 70-90°F before application. Iso "A" and Polyol "B" components must be pumped by low-pressure transfer pumps to a suitable high-pressure proportional pumping system.

Temperature Settings:	
Iso "A" Block Heater:	140-160°F
Resin "B" Block Heater:	140-160°F
Hoses (Iso and Polyol)	140-150°F
Hydraulic Pressure Setting:	
Equipment Hydraulic Presure:	2,000-2,500PSI

CHEMICAL TECHNICAL DATA:	
Mix Ratio by Volume: Gel Time:	1A:1B 6-9 Sec
Tack Free Time:	9-12 Sec
Viscosity (cps) @ 77°F	
"A" Iso Side:	1,000±100
"B" Resin Side:	370±50
Material Density (lbs/gal) @ 77°F "A" "A" Iso Side:	9.5 lbs/gal
"B" Resin Side:	8.4 lbs/gal.

BASIC PHYSICAL PROPERTIES:		
All tests are performed by OCM Test Laboratories.		
• ISO 17025 Certified		
• American Association for Laboratory Accreditation (A2LA)		
Test Name	Test Methods	Value
Hardness Shore D	ASTM D2240	60±1
Coefficient of Friction	ASTM D1894	
Static		0.305
Kinetic		0.127
Dielectric Const.	ASTM D150	3.6
Dissipation Factor	ASTM D150	0.031
Volume Resistance	ASTM D257	2.3x1014 ohm cm
Elongation	ASTM D412	162%
Flexural Strength ASTM D790		2,630 PSI
Flexural Modulus	ASTM D790	0.056 MSI
Fungus Test	MIL-STD 810F	Pass
Pull-off Test–Adhesion	ASTM C297	
To Metal – No Primer		1,800 PSI
To Metal – XPM Primer		1,910 PSI
To Metal – LXSF515 Primer		1,870 PSI
Taber Abrasion	ASTM D4060	0.06980
(gm Loss/1000 cycles)		
Tear Strength	ASTM D624	783 ppi
Tensile Strength	ASTM D412	3,432 PSI
Water Vapor Trans.	ASTM E96	0.499 Grains/Hr Sq.Ft.

The chemical resistance testing for the coating shall be per ASTM D543 for immersion in fluids methods. Additional product certifications shall include USFDA Coatings for Incidental Food Contact Applications Certified by Keller and Heckman LLP and MIL-STD-810F.

29. Service Connections on Internal Piping

All plumbed devices within the station eventually requiring service, such as meters, control valves, pumps and like equipment, shall be easily removed from the piping by the presence of appropriately placed and sufficient quantity of adaptors and couplings as shown on the drawings; no less than the quantity of couplings and adaptors shown shall be allowed.

30. Restraining Points

The main inlet and outlet piping to the station shall each be provided with four (4) restraining points as welded on "eyes" or similar device welded to the the capsule wall adjacent to the pipe penetration as shown to facilitate the attachment of joint restraint tie rods or other device to be used in retarding any pipe movement at the connections. It is acceptable to include a stiffening plate on the exterior of the station if needed for pipe restraint to the capsule wall.

31. Compression Couplings

The station piping shall include a variety of compression type, flexible coupling to prevent binding and facilitate removal of associated equipment. These couplings are to be where shown on the plans. In lieu of a compression coupling, a flanged coupling adapter (FCA) may be used.

Grooved fittings may not be used under any circumstance.

All compression couplings or flanged coupling adapters (FCA), and flexible connectors/expansion joints shall include a minimum of two (2) zinc coated steel threaded rods across the joint with appropriate bolted restraining points.

32. Elastomer Pipe Connector

The inlet side of each booster pump shall include an elastomer connector to help isolate vibration and noise in the piping system. The elastomer connector shall be of single sphere design, constructed of neoprene and nylon with bias-ply tire reinforcing cord to provide a 225 psi working pressure rating to a minimum of 120 degrees F. The elastomer connector shall pass through the plate steel flanges designed to grip the connector so the connector seals without gaskets when the flange bolts are drawn up.

A control joint limiting pipe connector movement shall be supplied with each pipe connector.

33. Line Pressure Gauges

Combination pressure gauges shall have a built-in pressure snubber and have 4-1/2" minimum diameter faces and turret style case, black fiberglass-reinforced thermoplastic with a clear acrylic window with Buna-N gasket. The movement shall be rotary; the bourdon tube shall be copper alloy C-type. The gauge shall have a 1/4" MNPT lower mount process connection and contain a 0.6mm copper alloy restrictor. Combination pressure gauge range and scale graduations shall be in psi and feet of water as follows:

Gauge ranges shall be established by the Engineer for each of the suction and discharge gauges for each pump station.

All gauges will be panel mounted off the pipeline and be connected to their respective sensing point. The gauge trim tubing shall be complete with both isolating and vent valves and the tubing shall be so arranged as to easily vent air and facilitate gauge removal. Gauges mounted directly to the pipeline or at the sensing point will not be accepted.

Gauge ranges, markings and gauge location shall be identified in the submittal documents.

34. Static and Sensing Lines

All gauge, switch and transmitter sensing lines shall be minimum 1/4" OD white polypropylene tubing run from the sensing point and a ball valve to the point of device mounting.

The pilot tubing shall be run in a workmanlike manner with elastomeric/stainless steel mounting straps to securely hold the tubing to be free of stress and vibration. The alignment and organization of the sensing lines shall be continuously rising.

35. Sample Tap

A single, right angle outlet, smooth nose, brass sample tap shall be affixed to the manual vent ball valve for the low suction lockout and suction pressure gauge assembly.

36. Hose Bibb with Vacuum Breaker

There shall be provided a standard hose bibb with valve and vacuum breaker on the suction piping. The hose bibb connection shall be through a pressure regulator if the header pressure would exceed 60 psi.

37. Ball Valves

The ball valves will be 2-piece, full-port design with blow-out proof stem. The seats, packing and seal shall be PTFE. Ball valves shall be provided with an adjustable stem packing nut. The body and retainer shall be lead free brass (DZR). The ball shall be lead free brass (DZR), chrome plated for sizes ¼"-1" and 316SS for sizes 1-1/4"-4". The handle shall have a distinctive white "lead free" handle grip and blue "lead free" hanging tag. The valves

will be NPTxNPT threaded pattern. Maximum working pressure shall be 600 psi up to 2" and 400 PSI for sizes 2-1/2" to 4".

38. Magnetic Flow Meter

The magnetic flow meter will a maintain an accuracy of ±0.5% of flow rate for velocities of 1-30 feet per second when mounted as close as five pipe diameters upstream and two diameters downstream from the flange of the magmeter.

The electrodes shall be 316L stainless steel or Hastelloy C, electrolytic polished with non-stick self-cleaning finish. Up to and including 24" meter sizes, 150-pound ANSI raised-face flanges unless otherwise noted. For 30" and larger meter sizes, AWWA C207 Table 2 Class D flanges will be provided.

All meters must be equipped with a NEMA 4X enclosure rating as standard or optionally, IP68 and NEMA6P and submersible to 10 feet in water.

The converter shall have non-invasive keypad and a display that configures using a self-prompting menu without exposing the converter internals to the surrounding atmosphere. The converter housing must be NEMA 4X rated and made of corrosion resistant materials with the terminal block isolated from the electronics of the unit.

The meter shall be capable of switching between forward/reverse flow. The meter shall be capable of bi-directional flow without requiring any re-zeroing, however 5 upstream and downstream diameters from the meter flange shall be utilized.

The meter shall have: High, low, empty pipe, limit alarms, change of rate, self-diagnostics and data checking, over-range flow, under-range flow, over totalize, under totalize, range change, preset output, adjustable low flow cutoff, totalizer preset value reached, reverse flow, converter failure alarms, and drive output to zero as standard.

Outputs/inputs shall be a selection of one of the following: one (1) 4-20mA analog, two (2) Digital HART, or three (3) scalable pulse. One (1) 4-20 mA shall be provided as standard unless otherwise noted.

The meter shall be supplied with a polyurethane rubber liner and be certified by NSF on NSF/ANSI Standard 61, Drinking Water System Components – Health Effects.

The magnetic flowmeter shall be the 8750W series flow tube as manufactured by Rosemount, or equal.

39. Proper Meter Installation

The meter used in this design is a Rosemount, 8750W designed to hold the stated accuracy limits with no more than five (5) upstream and two (2) downstream pipe diameters of straight pipe length approaching and leaving the meter from the meter flanges. In installations requiring reverse flow applications, it is advisable to install the meter with five (5) upstream and five (5) downstream pipe diameters from the meter flange. Installations

with reduced upstream and downstream runs are possible and reported flow rates will be highly repeatable, however they may not meet the absolute accuracy specifications in the reduced pipe diameter situations.

Substituting another manufacture's meter with different and more upstream-downstream straight pipe run diameters being required will change flow meter accuracy to below the stated accuracy limits.

40. PRESSURE TESTING

When the station plumbing is completed, the pressure piping within the station (including valves, pumps, control valves, and fittings), connections as make up the entire system shall be hydrostatically tested at a pressure of 150 psi or a pressure equal to the lowest test pressure rating of the equipment within the tested system, whichever is lesser pressure. The test pressure shall be applied for a minimum of 20 minutes, during which time all joints, connections and seams shall be checked for leaking. Any deficiencies found shall be repaired and the system shall be retested.

The results of this testing shall be transmitted in writing to the Engineer prior to shipment of the station and shall note test pressure, time at full pressure and be signed by the Quality Control Manager or test technician.

41. ELECTRICAL DESIGN, ASSEMBLY & TEST

The electrical apparatus and control panel design, assembly, and installation, and the integration of component parts will be the responsibility of the manufacturer of record for this booster pumping equipment. That manufacturer shall maintain at his regular place of business a complete electrical design, assembly and test facility to assure continuity of electrical design with equipment application. Control panels designed, assembled or tested at other than the regular production facilities or by other than the regular production employees of the manufacturer of record for this booster pumping equipment will not be approved.

42. CONFORMANCE TO BASIC ELECTRICAL STANDARDS

The manufacturer of electrical control panels and their mounting and installation shall be done in strict accordance with the requirements of UL Standard 508A and the National Electrical Code (NEC), NFPA 70 latest revision so as to afford a measure of security as to the ability of the eventual owner to safely operate the equipment.

No exceptions to the requirements of these codes and standards will be allowed; failure to meet these requirements will be cause to remove the equipment and correct the violation.

43. U.L. LISTING

All service entrance, power distribution, control and starting equipment panels shall be constructed and installed in strict accordance with Underwriter's Laboratories (UL) Standard 508A "Industrial Control Equipment." The UL label shall also include an SE "Service Entrance" rating stating that the main distribution panel is suitable for use as service entrance

equipment. The panels shall be shop inspected by UL, or constructed in a UL recognized facility. All panels shall bear a serialized UL label indicating acceptance under Standard 508A and under Enclosed Industrial Control Panel or Service Equipment Panel.

A photocopy of the UL labels for this specific project shall be transmitted to both the project engineer and the contractor for installation within their permanent project files, prior to shipment of the equipment covered under these specifications.

44. E.T.L. LISTING

All control panels shall be E.T.L. Listed by Interek Testing Services (ITS) under the Industrial Control Panel (ICP) Category. Each completed control panel shall bear an ETL listing label stating that the panel conforms to UL STD 508A and is certified to CAN/CSA STD C22.2 NO. 14. The listing label shall include the station manufacturer's name, address and telephone number. The station manufacturer shall have quarterly inspections performed by ETL at the manufacturer's facility to ensure that the products being listed comply with the report and procedural guide for that product.

45. EQUIPMENT GROUNDING

Each electrical equipment item in the station shall be properly grounded per Section 250 of the National Electrical Code. Items to be grounded include, but are not limited to, pump motor frames, control panel, transformer, convenience receptacles, dedicated receptacle for heater, air conditioner, dehumidifier, lights, light switch, exhaust fans and pressure switches.

All ground wires from installed equipment shall be in conduit and shall lead back to the control panel to a copper ground buss specific for grounding purposes and so labeled. The ground buss shall be complete with a lug large enough to accept the installing electrician's bare copper earth ground wire. The bus shall serve as a bond between the earth ground and the equipment ground wires.

46. PANEL MOUNTING HARDWARE

Metal framing channel and hangers shall be used exclusively for mounting of electrical panels and electrical components except for those specifically designated otherwise.

When mounting panels in buildings with ¾" plywood interior sheathing, certain panels and components may be mounted by screwing these devices into the wall, The maximum weight of a panel mounted with four lag screws cannot exceed 250#. The lag screws must either be 5/16" or 3/8" diameter and be fully threaded.

47. ELECTRICAL SERVICE

The electrical service provided for this station will be 240-volt, 1 phase, 60 Hertz, 3 wire.

48. CIRCUIT BREAKER (LIGHTING) PANEL

All secondary circuit breakers shall be incorporated into one (1), separate NEMA 1 circuit breaker panel.

There shall be provided, thermal-magnetic trip circuit breakers as follows:

One (1) Transformer Breaker, Secondary Side, 60 amps;
Nine (9) Auxiliary Circuit Breakers, as follows:

1. 1p,15amp Controls
2. 1p,15amp Telemetry
3. 1p,15amp Lights
4. 1p,15amp Convenience Outlets
5. 1p,15amp Dehumidifier
6. 2p,20amp Heater
7. 1p,15amp Ventilation Fan
8. Spare
9. Spare

49. TELEMETRY CONTROL INTERFACE PANEL

It will be the responsibility of the station manufacturer to provide the following as an adjunct to the supplied telemetry equipment.

1. 1" telemetry entrance conduit complete to telemetry panel.
2. Size 12" x 12" NEMA 1 telemetry interface panel.
3. Separate 120 volt single phase power circuit in conduit to the telemetry interface panel.
4. Telemetry control circuits made up and in conduit from main control panel to telemetry interface panel terminal strip.
5. Metal framing channel to mount telemetry equipment.

50. ALARMS CONDITION AND OUTPUTS

The following alarms/status points shall be included within the booster pump station and wired back to the interface panel:

1. Water Within Station - The water alarm shall be a 120 volt AC circuit driven by a float switch wall-mounted within the equipment capsule. The float switch shall be of the magnetic float type with the float moving up and down a guide tube. One half (1/2) inch of float movement shall actuate the SPST reed type switch inside the guide tube. The switch shall be so mounted that when water reaches a point one (1) inch above the sump the float switch will activate the alarm. The alarm will be sealed in through an auxiliary relay and will be manually reset via a push button station.

2. Unauthorized entry alarms on hatches and doors - The unauthorized entry alarm shall be a 120 volt AC circuit driven by a hatch-mounted limit switch. The limit switch shall be the

adjustable arm, roller contactor type which makes an internal SPST micro switch. The switch will be so mounted as to active anytime the entrance man way hatch/door is opened.

3. Station Pressure – The station pressure shall be provided by the pressure transmitter. The station transmitter will need to be powered by the SCADA provider of the station.

4. High Station Temperature Alarm – The station high temperature alarm shall be provided by a 120 volt AC relay controlled by a thermostat in the station.

5. Low Temperature Alarm – The station low temperature alarm shall be provided by a 120 volt AC relay controlled by a thermostat in the station.

51. SURGE PROTECTION DEVICE

A secondary surge arrester shall be provided. Housing shall be Noryl and be ultrasonically sealed. Valve blocks shall be metal oxide with an insulating ceramic collar. Gap design shall be annular. The lead wire shall be permanently crimped to the upper electrode forming part of the gap structure.

Arresters shall be UL and CSA listed Lightning Protective Devices.

52. ELECTRICAL CONDUIT AND WIRING

All service entrance conduits power and signal, shall be rigid steel conduit, individually sized to accept the inbound service conductors and telemetry/telephone/radio cables.

These service entrance conduits shall be installed from the main power or control panel through the capsule steel sidewall or the building floor and terminate exterior to the equipment enclosure as a thread hub. The service entrance exterior conduit connection points shall be capped or plugged for shipment.

All wiring within the equipment enclosure and outside of the panel enclosures shall be run in conduit except where watertight flexible conduit is properly used to connect pump drivers, fan motors, solenoid valves, limit switches, etc., where flexible connections are best utilized.

Devices and appliances where furnished by the original manufacturer and being equipped with a UL approved rubber cord and plug, may be plugged into a receptacle.

Equipment enclosure conduits shall be rigid, heavy wall, Schedule 40 PVC with solvent weld moisture-proof connections, in minimum size 3/4" or larger, sized to handle the type, number and size of equipment conductors to be carried.

The conduiting shall be in compliance with Article 347 of the National Electrical Code and NEMA TC-2, Federal WC-1094A and UL-651 Underwriters Laboratory Specifications.

Where flexible conduit connections are necessary, the conduit used shall be Liquid-tight, flexible, totally nonmetallic, corrosion resistant, nonconductive, U.L. listed conduit sized to handle the type, number and size of equipment conductors to be carried - in compliance with Article 351 of the National Electrical Code.

Motor circuit conductors shall be sized for load. All branch circuit conductors supplying a single motor of one (1) horsepower or more shall have an ampacity of not less than 125 percent of the motor full load current rating, dual rated type THHN/THWN, as set forth in Article 310 and 430-B of the National Electrical Code, Schedule 310-13 for flame retardant, heat resistant thermoplastic, copper conductors in a nylon or equivalent outer covering.

Control and accessory wiring shall be sized for load, type MTW/AWM (Machine tool wire/appliance wiring material) as set forth in Article 310 and 670 of the National Electrical Code, Schedule 310-13 and NFPA Standard 79 for flame retardant, moisture, heat and oil resistant thermoplastic, copper conductors in compliance with NTMA and as listed by Underwriters Laboratories (AWM), except where accessories are furnished with a manufacturer supplied UL approved rubber cord and plug.

53. Instruments

Gauge Pressure Transmitter

A Pressure transmitter shall be supplied to measure station pressure. The transmitter shall sense gauge pressure and transmit a 4-20 mA dc signal. The instruments shall measure pressure of a predetermined span. Range is to be fully adjustable throughout using allowable span and range limits. The accuracy shall be ±0.20% of span.

Each transmitter shall provide an analog output and include a standard LCD with pushbuttons to provide Intelligent transmitter configuration directly from the on-board pushbuttons. The two-line digital indicator shall display the measurement in any selected units. The pushbuttons shall provide calibration of zero and span, setting of linear output, forward or reverse direction, external zero enable or disable, damping, failsafe action and local display including upper and lower range value selection.

All process-wetted parts of each instrument shall be Type 316L stainless steel. The transmitter shall be protected by a gasketed, weatherproof NEMA 4X enclosure. The transmitter shall be approved for use in hazardous locations (Nonincendive for Class 1 and Class II, Division 2 locations; intrinsically safe or explosion-proof for Class 1 and Class II, Division 1 locations).

The transmitter shall have 1/2 inch NPT female threaded tapping ports.

Gauge Pressure Transmitter manufacturer:

A. Foxboro Series IGP10
B. Rosemount 2088G2S22A1M7B4S5.

Electrical Devices

Multi-position switches including Hand-Off-Automatic switches shall be oil tight, 3-position maintained and be located on the main control panel door.

Indicating lights shall be oil tight, with a full voltage pilot light.

Nameplates shall be furnished on all panel front mounted switches and lights.

Switches, lights and pushbuttons shall be Schneider Electric, Series XB, 22 mm, Die Cast Chrome plated devices. Pilot lights shall be with protected LED's for 120 Vac operation as XB4BVG,pushbuttons shall be non-illuminated, momentary contact, extended lens as ZB4BL and the switches shall be 2 position maintained, 2 position right-to-left, 3 position maintained, 3 position momentary-to-center, 3 position momentary from left to center, and 3 position momentary from right to center with standard black lever as ZB4BD.

Switches

1. Exhaust Fan, 2-position;

The control panel door shall be complete on the interior with a stick-on transparency containing an "as-built" reproduction of the electrical control panel schematic. The wiring diagram shall be a corrected "as-built" copy & contain individual wire numbers, circuit breaker numbers, switch designation & control function explanations.

54. Facilities Equipment

Station Interior Lighting

There shall be one or more two-strip, electronic start, enclosed and gasketed, forty-eight (48) inch minimum length LED light fixtures installed within the equipment enclosure, as shown on the plan for this item. The light switch shall be of the night glow type and be located conveniently adjacent to the door.

Open fluorescent or incandescent fixtures **will not** be accepted.

Dehumidifiers

1. One (1) each, installed as shown.
2. Capacity 30 pints per 24 hours.
3. Compressor rated 115 volts, 60 Hz, 4.3 operating amps.
4. 106 CFM fan, 2 fan speed.
5. Humidity range 35 to 80% RH, ambient temperature range of 41 to 95 F, Type R410A refrigerant.
6. Washable filter.
7. Condensate piped direct to drain.
8. UL listed rubber cord.

Heaters

1. One (1) each, wall mounted as shown.
2. Rating - 10,239 BTU/HR - 3000 watts, 240 volt.
3. Enclosed resistance wire within steel finned element.
4. Control - thermostat.
5. UL listed.
6. Fan forced.
7. Hard wired in conduit per UL 400-1.

Exhaust Fan

1. One (1) each, installed as shown.
2. Capacity each 230 cfm at .2-inch static pressure.
3. Shaded pole motor - squirrel cage blower.
4. Hard wired in conduit-to-conduit box on motor per UL 400-1.
5. 120-volt A.C. operation from wall mount thermostat and HAND/AUTO switch on main control panel.
6. Hatch installed limit switch to activate exhaust fan whenever the entrance hatch is open.
7. Exhaust air piping - **3** inch minimum.
8. Air return piping - **3** inch minimum.
9. Exhaust and return piping protected by 180° PVC return bend with removable insect screen.

Sump Pump

1. One (1) each, installed as shown.
2. Capacity 19 gpm at 15 feet TDH.
3. Vortex type Impeller - plastic, glass filled with metal insert.
4. Cast iron motor shell, switch case and pump housing.
5. UL listed submersible oil filled motor - UL listed rubber power cord – 120-volt AC operation.
6. Float operated, submersible (NEMA 6) mechanical switch.
7. Completely submersible, hermetically sealed.
8. Auto reset thermal overload protection.
9. PVC pump discharge piping 1 1/2" x 1 1/4" with single check valve - union both sides.
10. Provision for dewatering drain system for freeze protection.

SECTION 15000 - NATURAL GAS SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers the complete natural gas system installation, within and to five (5) feet beyond building perimeter unless noted otherwise on Contract Drawings, including but not limited to piping, regulators, unions, valves, installation, testing and other normal parts that make the systems complete, operable, code compliant and acceptable to the authorities having jurisdiction.

1.2 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

D. 2015 Edition of the International Fuel Gas Code.

E. Latest Edition of NFPA 54, National Fuel Gas Code.

1.3 QUALITY ASSURANCE

A. All materials, equipment and Work shall meet or exceed all applicable federal, state and local requirements and conform to codes and ordinances of authorities having jurisdiction.

B. Valves: Manufacturer's name, size, standards compliance and pressure rating clearly marked on outside of valve body.

C. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.

1.4 SUBMITTALS

A. Product Data:

B. Provide code and standards compliance verification, manufacturer's product data and ratings on pipe materials, pipe fittings, regulators, valves and accessories.

1.5 DELIVERY, STORAGE and HANDLING

A. Accept valves on Site in shipping containers with labeling in place, inspect for damage and store with a minimum of handling. Store plastic piping under cover out of direct sunlight. Do not store materials directly on the ground.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work and isolating parts of completed system.

1.6 EXTRA MATERIALS

A. Provide one (1) plug valve wrench for every ten (10) plug valves sized 2 inches and smaller, minimum of one. Provide each plug valve sized 2-1/2 inches and larger with a wrench incorporating a setscrew.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. Natural gas pressures shall not exceed five (5) pounds per square inch gauge on Owner's side of the meter.

C. Pipe joint compound shall be lead-free, non-toxic, non-hardening, insoluble in the presence of natural gas and compliant with ANSI/NSF 61 and Federal Specification TT-S-1732. Temperature service range of -15 degrees F to +400 degrees F, manufactured by Hercules "MegaLoc" or approved equal by Rectorseal, La-Co or Oatey.

2.2 PIPING

A. Buried Piping Outside of Building:

B. Polyethylene, SDR-11, ASTM D2513 pipe and fittings with heat fusion socket joints.

C. Polyethylene pipe and fitting materials shall be compatible and by same manufacturer to ensure uniform melting and a proper bond. Fabricated fittings shall not be used.

D. Provide connection between buried plastic gas service piping and metallic riser in accordance with the gas code. Provide metallic riser consisting of HDPE fused coating on steel pipe for connection to above ground building distribution piping. Underground horizontal metallic portion of riser shall be at least twenty four inches in length before connecting to the plastic service pipe. An approved transition fitting or adaptor meeting design pressure rating and plastic pipe manufacturers recommendations shall be used where the plastic joins the metallic riser.

E. Above Ground Piping Outside of Building (Including roof):

F. Piping 2 inches and smaller shall be seamless Schedule 40 black steel, ASTM A106 or ASTM A53 Type "S", Grade A or B, with Class 150 black malleable iron threaded fittings conforming to ASME B16.3.

G. Piping 2½ inches and larger shall be Type "S" seamless or Type "E" electric resistance welded Schedule 40 black steel, ASTM A53, Grade A or B, with Schedule 40 wrought carbon steel fittings, ASTM A 234 and butt weld joints.

H. Provide factory-applied, three-layer coating of epoxy, adhesive, and PE or field applied primer and epoxy paint coating on all pipe and fittings. Field applied coating is restricted to fittings and short sections of pipe necessarily stripped for threading or welding. Field coating shall be manufactured by Amercoat Type 240 or approved equal and applied in accordance with manufacturer's recommendations. Galvanizing shall not be considered adequate protection.

2.3 UNDERGROUND WARNING TAPE

A. Minimum 3 inch wide polyethylene detectable type marking tape. The tape shall be resistant to alkalis, acids and other destructive agents found in soil and impregnated with metal so that it can be readily recognized after burial by standard locating equipment.

B. Lamination bond of one (1) layer of Minimum 0.35 mils thick aluminum foil between two (2) layers of minimum 4.3 mils thick inert plastic film.

C. Minimum tensile strength: 63 LBS per 3 IN width.

D. Minimum elongation: 500 percent.

E. Provide continuous yellow with black letter printed message repeated every 16 to 36 inches warning of pipe buried below (e.g.: "CAUTION GAS LINE BURIED BELOW").

F. Manufactured by Reef Industries "Terra Tape" or approved equal.

2.4 VALVES

A. All valves shall be designed, manufactured and approved for natural gas service.

B. Line Shut-off Valves sizes 2 inches and smaller shall be iron body lubricated plug valve conforming to ASTM-A-126, U.L. Listed and A.G.A. Approved for natural gas service with threaded ends, wrench operation, rated for 200 WOG service pressure and –20 to 200 degrees F., manufactured by Resun Model R-1430, Nordstrom Model 142, or approved equal.

C. Line Shut-off Valves sizes 2½ inches and larger shall be iron body lubricated plug valve conforming to ASTM-A-126, U.L. Listed and A.G.A. Approved for natural gas service with flanged ends, wrench operation, rated for 200 WOG service pressure and –20 to 200 degrees F., manufactured by Resun Model R-143, Nordstrom Model 143, or approved equal.

D. Appliance/Equipment Shut-off Valves at local connections sizes 2 inches and smaller shall be bronze body, full port ball or butterfly type, U.L. Listed and A.G.A. Approved for natural gas service with threaded ends, quarter turn lever handle operation, rated for 175 W.O.G. service pressure and 30 to 275 degrees F., manufactured by Nibco Model T585-70-UL, Model T580-70-UL, Milwaukee Model BB2-100, or approved equal.

E. Manual Emergency Shut-off Valves sizes 2 inches and smaller shall be bronze body, full port ball or butterfly type, U.L. Listed and A.G.A. Approved for natural gas service with threaded ends, quarter turn lever handle operation, rated for 175 W.O.G. service pressure and 30 to 275 degrees F., manufactured by Nibco Model T585-70-UL, Model T580-70-UL, Milwaukee Model BB2-100, or approved equal.

F. Automatic Emergency Shut-off Valves shall be U.L. Listed F.M. Approved for natural gas service, 2-way electrically tripped solenoid type; fail safe closed; manual reset; Type 1 solenoid enclosure; NBR seals and disc; stainless steel core tube and springs; copper coil; manufactured by ASCO Red Hat Series 8044, or approved equal.

2.5 PRESSURE REGULATORS

A. All pressure regulators shall be designed, manufactured and approved for natural gas service.

B. Pressure regulators for individual service lines shall be capable of reducing distribution line pressure to pressures required for users. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulator shall have a single port with orifice diameter no greater than that recommended by manufacturer for the maximum gas pressure at the regulator inlet. Regulator vent valve shall be of resilient materials designed to withstand flow conditions when pressed against valve port. Regulator shall be capable of limiting build-up of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Commercial grade diaphragm type with internal relief valve, vent valve, cast iron body, Buna-N diaphragm. Manufactured by Rockwell or Fisher.

C. Install pressure gauge adjacent to and downstream of each line pressure regulator.

2.6 UNIONS

A. Unions in 2 inches and smaller in ferrous lines shall be right and left hand nipple/coupling assembly, or ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends, 2-1/2 inches and larger shall be ground flange unions. Companion flanges on lines at various items of equipment, machines and pieces of apparatus may serve as unions to permit disconnection of piping.

B. Unions connecting ferrous pipe to copper or brass pipe shall be dielectric type.

C. Above grade flexible stainless steel appliance/equipment connectors shall conform with AGA under the ANSI Z21.69 Standard. Hose shall be braided stainless steel with a polyolefin heat-shrink tubing with high flame-retardant qualities. Hose shall be equipped with malleable iron unions and spring loaded brass quick-link couplings. An easily accessible manual shut-off valve shall be installed ahead of all hose connections. Specify T&S Brass "Safe-T-Link" or approved equal.

2.7 FLANGES

A. All 150 lb. and 300 lb. ANSI flanges shall be domestically manufactured, weld neck forged carbon steel, conforming to ANSI B16.5 and ASTM A-181 Grade I or II or A-105-71. Slip on flanges shall not be used. Each fitting shall be stamped as specified by ANSI B16.9 and, in addition, shall have the laboratory control number stenciled on each fitting for ready reference as to physical properties and chemical composition of the material. Flanges shall have the manufacturer's trademark permanently identified in accordance with MSS SP-25. Bolts used shall be carbon steel bolts with semi-finished hexagon nuts of American Standard Heavy dimensions. Bolts shall have a tensile strength of 60,000 psi and an elastic limit of 30,000 psi. Flat-faced flanges shall be required to match flanges on check valves, strainers, and other valves and devices. Only one manufacturer of weld flanges will be approved.

B. All flanges shall be gasketed. Contractor shall place gasket between flanges of flanged joints. Gaskets shall fit within the bolt circle on raised face flanges and shall be full face on flat face flanges. Gaskets shall be cut from 1/16 inch thick, non metallic, non asbestos gasket material suitable for operating temperatures from -150 degrees F to +75 degrees F, Klingersil C-4400, Manville Style 60 service sheet packing, or equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe ends and remove cutting burrs. Bevel plain end ferrous pipe.

B. Remove cutting oil, scale and dirt, on inside and outside of piping, before assembly.

3.2 EQUIPMENT CONNECTIONS

A. Provide specified connections, shutoff valves, regulators and unions at each and every appliance and piece of equipment requiring natural gas.

B. Provide and install union type connections at all equipment to permit removal of service piping.

C. Gas service connections shall have a diameter at least one pipe size larger than that of the inlet connection to the equipment as provided by the manufacturer and be of adequate size to provide the total input demand of the connected equipment.

D. Provide listed and labeled appliance connectors complying with ANSI Z21.69 and listed for use with food service equipment having casters, or that is otherwise subject to movement for cleaning, and other large movable equipment. Connectors shall have listed and labeled quick-disconnect devices and shall have retaining cables attached to structures and equipment. Connectors shall not be concealed within or extended through wall, floor or partition and shall be located entirely in the same room as the connected equipment. Provide an accessible shut-off valve not less than the nominal size of the equipment connector, immediately ahead of the connector.

E. Rigid metallic pipe and fittings shall be used at service connections to all stationary equipment.

3.3 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer's published recommendations.

C. Provide support for and connections to natural gas service meter in accordance with requirements of the utility company, when so indicated on the Drawings.

D. All installation shall be in accordance with manufacturer's published recommendations.

E. Distribution piping shall be as short and as direct as practicable between the point of delivery and the outlets.

F. Do not install underground piping when bedding is wet or frozen.

G. Bury all underground piping at least 3 feet below finished grade. Provide a continuous detectable warning tape on tamped backfill, 12 inches above all buried non-metallic gas lines.

H. Do not install gas piping in the same trench with other utilities. The minimum horizontal clearance between gas pipe and parallel utility pipe shall be 2 feet. Do not install gas pipe through catch basins, vaults, manholes or similar underground structures.

I. Install and support all polyethylene piping in accordance with manufacturer's recommendations. All heat fusion welds shall be performed by welders qualified to the manufacturer's procedures.

J. Polyethylene piping shall not be installed above ground.

K. Provide connection between buried plastic gas piping and metallic riser in accordance with the gas code.

L. All above ground gas piping shall be electrically continuous and bonded to electrical system ground conductor in accordance with NFPA 70.

M. Provide and install union type fittings at proper points to permit dismantling or removal of pipe. No unions will be required in welded lines except at equipment connections. Where union type fittings are necessary for piping dismantling purposes, right and left nipples and couplings shall be used. Flanges, ground-joint unions or approved flexible appliance connectors may be used at exposed fixture, appliance or equipment connections.

N. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment, such as dielectric coupling or dielectric flange fitting.

O. Valves, regulators, flanges, union type fittings and similar appurtenances shall be accessible for operation and servicing and shall not be located above ceilings, within chases, walls/partitions, spaces utilized as return air plenums or non-accessible locations.

P. Route piping in orderly manner and maintain gradient. Install piping to conserve building space. Group piping whenever practical at common elevations.

Q. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

R. Make service connections at the top of the main, whenever the depth of the main is sufficient to allow top connections. When service connections cannot be made at the top of the main, they shall be made on the side of the main no lower than the horizontal midpoint of the gas main.

S. Close nipples, bushing and cross type fittings shall not be installed in any gas piping system.

T. Slope piping and arrange to drain at low points. Install drip/sediment traps at points where condensate and debris may collect. Locate drip/sediment traps where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing. Construct drip/sediment traps using tee fitting with capped nipple connected to bottom outlet. Use minimum-length nipple of 3 pipe diameters, but not less than 4 inches long, and same size as connected pipe. Cap shall be screwed pattern, black, standard weight, malleable iron. Install with adequate space for removal of cap.

U. Install valves for shut off and to isolate equipment, parts of systems, or vertical risers. All valves shall be located such that servicing and operation is possible. All flanged valves shown in horizontal lines with the valve stem shall be positioned so that the valve stem is inclined one bolt hole above the horizontal position. Screw pattern valves placed in horizontal lines shall be installed with their valve stems inclined at an angle of a minimum of 30 degrees above the horizontal position. All valves must be true and straight at the time the system is tested and inspected for final acceptance.

V. Install line shut-off valve at each branch connection to riser.

W. Provide adequate clearance for access to and operation of all valves.

X. Install valves with stems upright or horizontal, not inverted unless required otherwise by the valve manufacturer.

Y. Pipe vents from gas pressure reducing valves and pipe casing sleeves to the exterior of the building and terminated with outlet turned down and capped with corrosion resistant insect screen. Vent terminations shall be at least seven feet above grade or pedestrian traffic and a minimum three (3) feet above or twenty-five (25) feet horizontally from all air intakes or building openings.

Z. Above ground horizontal natural gas and encasement piping shall be supported at intervals of no greater than 6 foot for 1/2 inch piping, 8 foot for 3/4 inch and 1 inch piping and 10 foot for 1-1/4 inches and larger piping. Vertical piping shall be supported at each floor level and at intervals as specified for horizontal piping.

AA. Extension bars shall not be used for supporting gas or encasement piping. Gas or encasement piping shall not be used to support any other piping or component.

BB. Provide piping and valve identification in accordance with Project Specification Section 20 05 53.

3.4 INSTALLATION OF WELDED PIPING

A. Welding of pipe in normally occupied buildings is prohibited. Off-Site welding is acceptable. Should welding be required in a normally occupied building for connecting to an existing welded system, obtain written approval from the Owner and comply with Owner's fire and life safety requirements.

B. Piping and fittings shall be welded and fabricated in accordance with ASME/ANSI the latest editions of Standard B32.1 for all systems from the Code for Pressure Piping. Machine beveling in shop is preferred. Field beveling may be done by flame cutting to recognized standards.

C. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Maintain inside of fittings free from globules of weld metal. All welded pipe joints shall be made by the fusion welding process, employing a metallic arc or gas welding process. All pipes shall have the ends beveled 37-½ inch degrees and all joints shall be aligned true before welding. Except as specified otherwise, all changes in direction, intersection of lines, reduction in pipe size and the like shall be made with factory-fabricated welding fittings. Mitering of pipe to form elbows, notching of straight runs to form tees, or any similar construction will not be permitted.

D. Align piping and equipment so that no part is offset more than 1/16 inch. Set all fittings and joints square and true and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

E. Contractor shall not permit any weld to project within the pipe so as to restrict it. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welded during welding operation.

F. Do not split, bend, flatten or otherwise damage piping before, during or after installation.

G. Remove dirt, scale and other foreign matter from the inside of piping, by swabbing or flushing, prior to the connection of other piping sections, fittings, valves or equipment.

H. In no cases shall Schedule 40 pipe be welded with less than three passes including one stringer/root, one filler and one lacer. Schedule 80 pipe shall be welded with not less than four passes including one stringer/root, two filler and one lacer. In all cases, however, the weld must be filled before the cap weld is added.

3.5 TESTING

A. All natural gas systems shall be inspected, tested, purged and placed into operation in accordance with NFPA 54 and as required herein.

B. All necessary apparatus for conducting tests shall be furnished by the Contractor and comply with the requirements of NFPA 54.

C. All new rough-in distribution piping and affected portions of existing systems connected to, shall be subjected to a pneumatic test pressure utilizing clean, dry air and must be demonstrated to be absolutely tight when subjected to the pressures and time durations listed herein. All equipment and components designed for operating pressures of less than the test pressure shall not be connected to the piping system during test.

D. Systems on which the normal operating pressure is less than 0.5 pounds per square inch gauge (psig), the test pressure shall be 5.0 psig and the time interval shall be 30 minutes.

E. Systems on which the normal operating pressure is between 0.5 psig and 5.0 psig, the test pressure shall be 1.5 times the normal operating pressure or 5.0 psig, whichever is greater, and the time interval shall be 30 minutes.

F. Systems on which the normal operating pressure is 5.0 psig or greater, the test pressure shall be 1.5 times the normal operating pressure, and the time interval shall be one (1) hour.

G. After testing is complete, the entire gas system shall be purged with dry nitrogen to eliminate all air, debris and moisture from the piping before natural gas is introduced into the system.

H. After successful results of pressure test and purging have been completed, a leakage test shall be performed in accordance with NFPA 54 Appendix D.

I. Connect, inspect and purge gas utilization equipment, lab hook-ups and outlets, and place into operation only after successful results of pressure test, leakage test and purging have been completed and accepted.

J. Testing operations shall be repeated until gas-piping systems are absolutely tight at the pneumatic test pressures indicated above.

K. Pressure test gas piping sleeve system with clean, dry compressed air at 15 psig by temporarily sealing all openings between gas carrier pipe and sleeve and vent openings. Sleeve systems must be demonstrated to be absolutely tight when subjected to this pressure for a period of four hours.

END OF SECTION

SECTION 16000

ELECTRICAL - GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment required and install complete and make operational, electrical system as shown on the Drawings and as specified herein.

B. The work shall include the following:

1. Coordinate the electrical service requirements with the power company and provide the electrical service(s) from the Power Company at the locations indicated.

2. Provide conduit, wire and field connections for all motors, motor controllers, control devices, control panels and electrical equipment furnished under Divisions 1, 11, 13 and 15.

3. Provide conduit, wiring and terminations for variable frequency drives, reactors, harmonic filters, transformers and power factor correction capacitors furnished and mounted under other related Divisions.

C. Each bidder or their authorized representatives shall, before preparing their proposal, visit all areas of the existing buildings and structures in which work under this sub-bid is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that their representative has visited the buildings and structures and noted the locations and conditions under which the work will be performed and that he/she takes full responsibility for a complete knowledge of all factors governing his/her work.

1.02 SUBMITTALS

A. As a minimum all equipment specified in each Section of Division 16 shall be submitted at one time. As an example all lighting fixtures shall be submitted together, all motor control centers shall be submitted together, etc. Submittals that do not comply will be returned disapproved.

B. Mark submittals to clearly identify proposed equipment including accessories, options, and features and to exclude parts not applicable to the project. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submittal piece of literature and each submittal drawing shall clearly reference the Project Specification and/or Contract Drawing that the submittal is to cover. General catalogs will not be accepted as cut sheets to fulfill submittal requirements.

C. Check shop drawings for accuracy prior to submittal. Shop drawings shall be stamped with the date checked and a statement indicating that the shop drawings conform to this Section and the Drawings. This statement shall also list all exceptions to this Section and the Drawings. Mark submittals to identify proposed equipment including accessories, options and features being

proposed for approval and exclude parts not to be used. Shop drawings not so checked and noted shall be returned marked NOT APPROVED.

D. The Engineer's check shall be for conformance with the design concept of the project and compliance with this Section and the Drawings. Errors and omissions on approved shop drawings shall not relieve the Contractor from the responsibility of providing materials and workmanship required by this Section and the Drawings.

E. All dimensions shall be field verified at the job site and coordinated with the work of all other trades.

F. Material shall not be ordered or shipped until the shop drawings have been approved. No material shall be ordered or shop work started if shop drawings are marked "APPROVED AS NOTED - CONFIRM," "APPROVED AS NOTED - RESUBMIT" or "NOT APPROVED."

G. Operation and Maintenance Data

1. Submit operations and maintenance data for equipment furnished under this Division, in accordance with Section 01730. The manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists including replacement part numbers, to instruct operating and maintenance personnel unfamiliar with such equipment.

2. Manuals shall include the following as a minimum:

   a. A complete "As-Built" set of approved shop drawings.

   b. A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.

   c. Detailed service, maintenance and operation instructions for each item supplied.

H. Exceptions for Submittals

1. Exceptions to the Specifications or Drawings shall be clearly defined by the Electrical Subcontractor in a separate section of each submittal package. The submittal shall contain the reason for the exception, the exact nature of the exception and the proposed substitution so that a proper evaluation may be made by the Engineer. The acceptability of any device or methodology submitted as an "or equal" or "exception" to the Specifications shall be at the sole discretion of the Engineer.

2. Submittals for certain major items such as generators, automatic transfer switches, and Variable Frequency Drives (100 hp and up) shall include a complete copy of their specification section with each paragraph and sub-paragraph noted with the comment "compliance", "deviation", or "alternate".

   a. By noting the term "compliance", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.

b. By noting the term "deviation", it shall be understood that the manufacturer prefers to provide a different component in lieu of the one specified and in so doing, takes full responsibility for making the equipment work as specified and will provide any and all ancillary components to make the equipment work at no extra cost to the Owner.

c. By noting the term "alternate", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner and in so doing, takes full responsibility for making the equipment work as specified and will provide any and all ancillary components to make the equipment work at no extra cost to the Owner. The alternate method shall be fully described with schematic diagrams and one-line diagrams as applicable.

I. Submittals will be returned to the Contractor under one of the following codes.

Code 1 -"APPROVED" is assigned when there are no notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.

Code 2 -"APPROVED AS NOTED" - This code is assigned when a confirmation of the notations and comments IS NOT required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.

Code 3 -"APPROVED AS NOTED/CONFIRM" - This combination of codes is assigned when a confirmation of the notations and comments IS required by the Contractor. The Contractor may, at his own risk, release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This confirmation shall specifically address each omission and nonconforming item that was noted. Confirmation is to be received by the Engineer within 10 calendar days of the date of the Engineer's transmittal requiring the confirmation.

Code 4 -"APPROVED AS NOTED/RESUBMIT" - This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the package. This resubmittal is to address all comments, omissions and non-conforming items that were noted. Resubmittal is to be received by the Engineer within 15 calendar days of the date of the Engineer's transmittal requiring the resubmittal.

Code 5 -"NOT APPROVED" is assigned when the submittal does not meet the intent of the Contract Documents. The Contractor must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the Contract Documents.

Code 6 -"COMMENTS ATTACHED" is assigned where there are comments attached to the returned submittal which provide additional data to aid the Contractor.

Code 7 -"RECEIPT ACKNOWLEDGED" - This code is assigned to acknowledge receipt of a submittal that is not subject to the Engineer's review and approval; and, is being filed for informational purposes only. This code is generally used in acknowledging receipt of *means*

and methods of construction work plan, field conformance test reports, and Health and Safety plans.

Codes 1 through 5 designate the status of the reviewed submittal with Code 6 showing there has been an attachment of additional data.

1.03 REFERENCE STANDARDS

A. Electric equipment, materials and installation shall comply with the National Electrical Code (NEC).

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 PRIORITY OF THE CONTRACT DOCUMENTS

A. If, during the performance of the work, the Contractor finds a conflict, error or discrepancy between or among one or more of the Sections or between or among one or more Sections and the Drawings, furnish the higher performance requirements. The higher performance requirement shall be considered the equipment, material, device or installation method which represents the most stringent option, the highest quality or the largest quantity.

B. In all cases, figured dimensions shall govern over scaled dimensions, but work not dimensioned shall be as directed by the Engineer and work not particularly shown, identified, sized, or located shall be the same as similar work that is shown or specified.

C. Detailed Drawings shall govern over general drawings, larger scale Drawings take precedence over smaller scale Drawings, Change Order Drawings shall govern over Contract Drawings and Contract Drawings shall govern over Shop Drawings.

D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents will take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the Contractor, unless otherwise directed by the Engineer.

E. In accordance with the intent of the Contract Documents, the Contractor accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way, the Contractor's responsibility to comply with all Laws and Regulations at all times

1.05 ENCLOSURE TYPES

A. Unless otherwise required, electrical enclosures shall be NEMA Types as follows:

1. NEMA 4 in outdoor locations, rooms below grade including basements and buried vaults and "WET" locations shown on the Drawings.

2. NEMA 4X in "CORROSIVE" locations shown on the Drawings.

1.06 SERVICE AND METERING

A. Service will be obtained at 480 Volts, 3Phase, 4Wire, 60 Hz.

B. The Contractor shall be responsible for the following work:

1. Obtain an estimate from the power company for the work described above and include the cost of the power company work in the Bid Price.

2. Make all arrangements with the power company for obtaining electrical service, pay all power company charges.

1.07 CODES, INSPECTION AND FEES

A. Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction.

B. Obtain all necessary permits and pay all fees required for permits and inspections.

1.08 INTERPRETATION OF DRAWINGS

A. Unless specifically stated to the contrary, the Drawings do not show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.

B. Install each 3 phase circuit in a separate conduit unless otherwise shown on the Drawings.

C. Conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed. Unless otherwise indicated install branch circuit conduits exposed in process/ industrial type spaces and concealed in finished spaces.

D. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation. Where home-runs indicate conduit is to be installed concealed or exposed the entire branch circuit shall be installed in the same manner.

E. Verify the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

F. Except where dimensions are shown, the locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the Contractor and approved by the Engineer during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

G. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials to install and place in satisfactory operation all power, lighting and other electrical systems shown.

H. Redesign of electrical or mechanical work, which is required due to the Contractor's use of an alternate item, arrangement of equipment and/or layout other than specified herein, shall be done by the Contractor at his/her own expense. Redesign and detailed plans shall be submitted

to the Engineer for approval. No additional compensation will be provided for changes in the work, either his/her own or others, caused by such redesign.

I. Raceways and conductors for low voltage (120 Volts) thermostats controlling HVAC unit heaters, exhaust fans and similar equipment are not shown on the Drawings. Provide raceways and conductors between the thermostats, the HVAC equipment and the motor starters for a complete and operating system. Raceways shall be installed concealed in all finished space and may be installed concealed or exposed in process spaces. Refer to the HVAC drawings for the locations of the thermostats.

1.09 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which electrical equipment furnished under Division 16 must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.

B. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.

1.10 RECORD DRAWINGS

A. As the work progresses, legibly record all field changes on a set of Project Contract Drawings, hereinafter called the "Record Drawings."

1.11 MATERIALS AND EQUIPMENT

A. Materials and equipment furnished under this contract shall be new.

B. Material and equipment of the same type shall be the product of one manufacturer and shall be UL listed.

1.12 EQUIPMENT IDENTIFICATION

A. Identify equipment, disconnect switches, separately mounted motor starters, control stations, etc. furnished under Division 16 with the name of the equipment it serves. Motor control centers, control panels, panelboards, switchboards, switchgear, junction or terminal boxes, transfer switches, etc, shall have nameplate designations as shown on the Drawings.

B. Nameplates shall be engraved, laminated plastic, not less than 1/16-in thick by 3/4-in by 2-1/2-in with 3/16-in high white letters on a black background.

C. Nameplates shall be screw mounted to NEMA 1 enclosures. Nameplates shall be bonded to all other enclosure types using an epoxy or similar permanent waterproof adhesive. Two sided foam adhesive tape is not acceptable. Where the equipment size does not have space for mounting a nameplate the nameplate shall be permanently fastened to the adjacent mounting surface.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 LEEVES AND FORMS FOR OPENINGS

A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all slots for electrical work and form before concrete is poured.

B. Exact locations are required for stubbing-up and terminating concealed conduit. Obtain shop drawings and templates from equipment vendors or other subcontractors and locate the concealed conduit before the floor slab is poured.

C. Where setting drawings are not available in time to avoid delay in scheduled floor slab pours, the Engineer may allow the installations of such conduit to be exposed. Requests for this deviation must be submitted in writing. No additional compensation for such change will be allowed.

3.02 CUTTING AND PATCHING

A. Cutting and patching shall be done in a thoroughly workmanlike manner and be in compliance with modifications and repair to concrete as specified. Saw cut concrete and masonry prior to breaking out sections.

3.03 INSTALLATION

A. Work not installed according to the Drawings and Specification shall be subject to change as directed by the Engineer at Contractor's expense.

B. Electrical equipment shall be protected against mechanical and water damage. Store all electrical equipment in dry permanent shelters. Do not install electrical equipment in place until structures are weather-tight.

C. Damaged equipment shall be replaced or repaired by the equipment manufacturer, at the Engineer's discretion and at the Contractor's expense.

D. Repaint any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer.

3.04 WORK SUPERVISION

A. The Contractor shall designate in writing the qualified electrical supervisor who shall provide supervision to all electrical work on this project. The minimum qualifications for the electrical supervisor shall be a unlimited electrical journeyman as defined by the Oklahoma Construction Industries Board. The supervisor or his appointed alternate possessing at least a journeyman electrician license shall be on site whenever electrical work is being performed. The qualifications of the electrical supervisor shall be subject to approval of the Owner and the Engineer.

END OF SECTION

SECTION 16015

ELECTRICAL SYSTEMS ANALYSIS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Provide both a preliminary and a final short circuit, selective coordination and arc flash study of the complete electrical distribution system as specified herein and as shown on the Drawings.

B. Obtain and pay for the services of the Low Voltage Equipment manufacturer, subject to the approval of the Engineer, to provide a complete fault current, distribution protective devices selective coordination and Arc Flash study. The selective coordination study shall begin with the utility company's feeder protective device and include all of the electrical protective devices down to and including the largest feeder circuit breaker and motor starter in the all low voltage motor control centers and power distribution panelboards. The study shall also include variable frequency drives, harmonic filters, Uninterruptible Power Supplies (UPS), power factor correction equipment, transformers and protective devices associated with emergency and standby generators, and the associated paralleling equipment and distribution switchgear. The arc flash study shall begin with the utility company's feeder protective device and include all of the electrical distribution equipment down to and including low voltage motor control centers and power distribution panelboards and lighting panels. All information required to perform the study shall be obtained by the entity performing the study.

C. Submit the preliminary short circuit, selective coordination and prior to submittal of 480 Volt equipment and panelboards shop drawings. The aforementioned shop drawings will not be reviewed until the preliminary power system study is approved by the Engineer. No exceptions will be allowed. The preliminary study shall include but not limited to:

1. Short circuit, protective device coordination, arc flash study, shall be performed on nationally recognized computer software such as SKM System Analysis, EDSA, ETAP, or approved equal.

2. Obtain and verify with the utility company all information needed to conduct the study. Obtain and verify with the Owner ratings of existing electrical equipment that shall be included in the study.

3. Current transformers' ratio and burden calculations shall be based on a 10 percent maximum ratio error per ANSI C57.13. Identify current transformers that will not allow the protective devices to operate within acceptable ANSI error margins and recommend corrective action.

4. The preliminary study shall verify equipment is being applied within their design ratings and electrical protective devices will coordinate.

5. Recommend changes and/or additions to equipment as required providing adequate protection and coordination based on the actual equipment supplied and the results of the

short circuit and protective device selective coordination studies. Submit any such changes and additions as a part of the study. Field settings of devices, adjustments, and minor modifications to equipment that are required to accomplish conformance with the approved short circuit and protective device selective coordination studies shall be carried out by the Contractor at no additional cost to the Owner.

D. After release of electrical equipment by the manufacturer, but prior to energizing the electrical equipment, submit the final short circuit study, protective device selective coordination study, and arc flash study including all calculations, tabulations, protective devices coordination graphs, etc. as specified herein.

1. Provide a complete short circuit study, protective device selective coordination study, and arc flash study for both the utility power distribution system and the emergency/standby power distribution system under the scope of this study. The study shall include but shall not be limited to:

a. Full compliance with applicable ANSI and IEEE Standards.

b. Preformed on nationally recognized computer software such as EDSA, SKM System Analysis, ETAP, or equal.

2. Provide a report summarizing the short circuit study, protective device selective coordination study, and arc flash study including: one-line diagram of the system, relay and breaker setting tabulation, coordination curves, relay curves, circuit breaker curves, motor starting/running curves, protective device coordination and short circuit calculation, all prepared by the specialty firm.

3. Recommend changes and/or additions to equipment as required providing adequate protection and coordination based on the actual equipment supplied and the results of the short circuit study, protective device selective coordination study, and arc flash studies. Submit any such changes and additions as a part of the study. Field settings of devices, adjustments and minor modifications to equipment that are required to accomplish conformance with the approved short circuit study, protective device selective coordination study, and arc flash study shall be carried out by the Contractor at no additional cost to the Owner.

1.02 SUBMITTALS

A. Submit, in accordance with Section 01300, the following:

1. The number of years the specialty firm has been in the business of performing coordination studies.

2. Identification of each of the three qualifying projects for each of the past three years including:

a. A brief description of each study.

b. Name of owner of installation on which study was performed with address, telephone number, and contact person.

c. Date of study.

d. Any other information indicating the firm's experiences and ability to perform the work and business status.

B. Preliminary Short Circuit and Coordination Study Report shall include but not limited to:

1. The coordination study report shall be bound in a standard 8-1/2-in by 11-in size report.

2. Electrical distribution system one-line diagram.

3. Electrical distribution system impedance diagrams.

4. Provide current transformers' ratio and burden calculations to confirm that the current transformers will not saturate prior to operation of the protective relays and confirming the current transformers used with differential protection will not saturate under any fault condition.

5. Tabulation of each protective device, its short circuit rating, the available fault current available at the device and an indication whether or not the device is adequately rated for the available fault current and voltage at which it is applied.

6. Preliminary graphic time-current curves showing how the protective devices proposed by the equipment suppliers will coordinate as being applied.

C. Final Short Circuit and Selective Coordination Study Report shall include but not limited to:

1. The coordination study report shall be bound in a standard 8-1/2-in by 11-in size report. The selection of all protective relays types, current transformers, fuse types and ratings, shall be the responsibility of the manufacturer and shall be based on the preliminary coordination study, which shall be submitted prior to the equipment shop drawings in accordance with Section 01300. The complete study shall be approved by the Engineer before any equipment is shipped. The report shall include the following sections and information:

2. An executive summary outlining the distribution system, the information received from the power company, assumptions made to complete the report, statement of the adequacy of the distribution equipment to safely clear any fault currents, the adequacy of the distribution equipment to close in on a fault, identify any problem areas with recommendations for resolving the problem.

3. Electrical distribution system one-line diagram.

4. Electrical distribution system impedance diagrams.

5. Provide current transformers' ratio and burden calculations to confirm that the current transformers will not saturate prior to operation of the protective relays and to confirm the current transformers used with differential protection will not saturate under any fault condition.

6. Transformer differential protection calculations including current transformer mismatch relay setting and charts. Provide differential current transformer wiring schematics including polarity and wiring connections based on the winding configuration of the actual power transformers being supplied.

7. Tabulation of all protective devices, circuit breakers, fuses, current transformers, etc. The tabulation shall indicate the device, manufacturer, catalog number, recommended setting, etc.

8. Industry standard graphic time current, protective relay and protective device curves, showing equipment and material damage curves, relay, circuit breaker, fuse curves, available fault currents at the equipment, transformer inrush currents, etc, for each piece of equipment.

9. Tabulation of each protective device, its short circuit rating the available fault current available at the device and an indication whether or not the device is adequately rated for the available fault current and voltage at which it is applied.

10. Calculations and required documentation

D. Preliminary Arc Flash Study Report shall include but not limited to:

1. The Arc Flash study report shall be bound in a standard 8-1/2-in by 11-in size report

2. An executive summary outlining the distribution system, the information received from the power company, assumptions made to complete the report and recommendations to reduce the arc flash values.

3. Recommendations to reduce the arc flash incident energy levels

E. The Final Arc Flash Study report shall be bound in a standard 8-1/2-in by 11-in size report. The report shall include the following sections and information:

4. An executive summary outlining the distribution system, the information received from the power company, assumptions made to complete the report and recommendations to reduce the arc flash values.

5. Provide a detailed bus label for each fault location. Each label shall include a listing of the protective device settings and incident energy at several different working distances.

6. Provide A NFPA 70 E work permit form for each fault location.

7. Provide A bus label for each fault location. The label shall include a summary of the flash boundary, incident energy, PEE classification and the Limited, Restricted and Prohibited Approach boundaries based on the nominal system voltage.

8. PPE Table – Provided a PPE table that defines the Personnel Protective Equipment classes and clothing descriptions identified in the reports and labels.

1.04 REFERENCED STANDARDS

A. Institute of Electrical and Electronic Engineers, Inc. (IEEE):

1. Standard 141, Recommended Practice for Electrical Power Distribution for Industrial Plants

2. Standard 241, Recommended Practice for Electrical Power Systems in Commercial Buildings

3. Standard 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Systems

4. Standard 399, Recommended Practice for Industrial and Commercial Power System Analysis

B. American National Standards Institute (ANSI):

1. Standard C37.90, IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus

2. Standard C37.91, IEEE Guide for Protective Relay Applications to Power Transformers

3. Standard C37.95, IEEE Guide for Protective Relaying of Utility-Consumer Interconnections

4. Standard C37.96, IEEE Guide for AC Motor Protection

5. Standard C57.12.59, IEEE Guide for Dry-Type Transformer Through-Fault Current Duration

6. Standard C57.13, IEEE Standard Requirements for Instrumentation Transformers

7. Standard C57.109, IEEE Guide for Liquid-Immersed Transformer Through-Fault-Current Duration

1.05 QUALITY ASSURANCE

A. All electrical studies shall be stamped and signed by a professional electrical engineer.

1.06 SHORT CIRCUIT STUDY

A. Perform a short circuit study in accordance with ANSI Standards C37.010 and C37.13 to check the adequacy and to verify the correct application of circuit protective devices and other system components within the construction package. The study shall address the case when the system is being powered from the utility source as well as from the on-site generating facilities, normal and alternate (bus tie closed) modes of operation. Minimum and maximum possible fault conditions shall be covered in the study.

B. Consider the fault contribution of all motors operating during the maximum demand condition of the motors.

C. Calculate short-circuit momentary duties and interrupting duties on the basis of an assumed bolted 3 phase short circuit at each high and medium voltage switchgear bus and controller, low voltage switchgear bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard and other significant locations throughout the systems. The short circuit tabulations shall include X/R ratios, asymmetry factors, KVA and symmetrical fault-current. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance diagram. Include in tabulations fault impedance, X/R ratios, asymmetry factors, motor contribution, short circuit KVA, and symmetrical and asymmetrical fault-currents.

D. The studies shall include representation of the site power system, the base quantities selected, impedance source data., calculation methods and tabulations, one-line and impedance diagrams, conclusions and recommendations.

E. Provide the following:

1. Overall system impedance diagram. The diagram shall include the power companies impedance and X/R ratio, circuit element impedances (e.g. transformers, generators, motors, VFDs, feeders, distribution buses, etc.).

2. The available fault current at each bus within the limits of the study shall be identified and listed.

3. The momentary and interrupting rating of all elements of the distribution system shall be listed. The maximum available fault current available at each element shall be calculated.

4. Determine the adequacy of the electrical protective devices to withstand the maximum available fault at the terminals of the equipment. Provide an equipment list, the equipment rating (both momentary and withstand), the maximum available fault rating and the adequacy of the equipment to withstand the fault. Equipment that does not have adequate ratings shall be identified immediately and brought to the attention of the Engineer.

5. The short circuit portion of the report shall include:

   a. Separate positive, negative and zero sequence impedance diagrams for the utility and emergency/standby distribution systems.

b. Executive summary describing the distribution system, the procedures used to develop the study, utility related information furnished by the utility company including the name and telephone number of the individual supplying the information, identify all assumptions made in the preparation of the study, identify any problem areas and provide a definitive statement concerning the adequacy of the distribution system to interrupt and withstand the maximum possible fault current.

c. Computer printout of the input data.

d. Computer printouts for the three phase and ground fault studies. Printouts shall indicate the fault current available at each major equipment, distribution bus within the high, medium and low voltage distribution systems.

e. Table listing all the electrical distribution and utilization equipment (including VFDs), the equipment interrupting and withstand ratings, the available fault current at the terminals of the equipment and the ability of the equipment to interrupt and/or withstand the fault.

f. The short circuit study shall be prepared using approved computer software and must include complete fault calculations as specified herein for each proposed and ultimate source combination. Source combinations may include present and future Power Company supply circuits, large motors, or generators.

F. Automatic Load Transfer

1. Provide a detailed study demonstrating the interrupting capacity of automatic transfer bus ties and switches, as well as the fault withstand capabilities. The following shall be considered:

a. X/R ratio fault-current of circuit at point of transfer.

b. X/R ratio and fault-current rating of the transfer device.

c. Length of time fault may persist prior to protective device opening.

d. Magnetic stress withstand rating.

e. I^2t withstand rating.

f. Transfer device maximum interrupting duty compared to load interrupting duty.

1.07 PROTECTIVE DEVICE COORDINATION

A. Provide a protective device time-current coordination study in accordance with ANSI/IEEE Std. 242, with coordination plots of protective devices plus tabulated data, including ratings and settings selected. In the study, balance shall be achieved between the competing objectives of protection and continuity of service for the system specified, taking into account the basic factors of sensitivity, selectivity and speed.

B. Provide separate plots for each mode of operation: (1) "double-ended mode" (double-ended substation with bus tie open); (2) “singled ended mode” (single incoming utility feeder energized all switchgears single ended with bus ties closed); (3) “stand-by mode” (on-site generation solely providing power to the system; (4) "peak shaving modes" (a.) (double-ended substation with bus tie open with on-site generation paralleled) and (b) (single-ended with bus ties closed with on-site generation paralleled). Show maximum and minimum fault values in each case. Multiple power sources shown in one plot is not acceptable.

C. Each primary protective device required for a delta-to-wye-connected transformer shall be selected so the characteristic or operating band is within the transformer parameters, which, where feasible, shall include a parameter equivalent to 58 percent of the ANSI C37.91 withstand curve to afford protection for secondary line-to-ground faults. Separate low voltage power circuit breakers from each other and the associated primary protective device, by a 16 percent current margin for coordination and protection in the event of line-to-line faults. Separate the protective relays by a 0.3-second time margin for the maximum 3 phase fault conditions to assure proper selectivity. The protective device characteristics or operating bands shall be terminated to reflect the actual symmetrical and asymmetrical fault-currents sensed by the device. Provide the coordination plots for 3 phase and phase-to-ground faults on a system basis. Include at least all devices down to largest branch circuit and largest feeder circuit breaker in-each motor control center and/or power distribution panelboard. Include all adjustable setting ground fault protective devices.

D. Select relay types (i.e. inverse, very inverse, extremely inverse, over current with or without voltage restraint, timers, etc), current transformer ratings and types, fuse, residually or zero sequence connected ground faults protection, etc, that will allow the system to be protected to within the equipment fault ratings and provide the maximum possible coordination between the protective devices.

E. Generator Protective Devices

1. The study shall address all of the protective devices provided for generator protection.

2. Protective relays requiring settings shall be included.

3. The Electrical Contractor shall obtain all necessary generator information to perform this study.

F. Motor Protection and Coordination

1. Provide a complete and independent set of current-time characteristic curves for all motors 25 Hp and above indicating coordination between the protective relays and the thermal and starting characteristics of the motor.

2. The Contractor shall obtain from the motor supplier the necessary information to perform the study. Certified curves for "Safe Time vs. Current at 100% Voltage" and "Accelerating Time vs. Current at 100% Voltage" are necessary and shall become part of the final report.

G. Call discrepancies to the attention of the Engineer in the conclusions and recommendations of the report.

H. The Time current Characteristic Curves shall include:

1. The coordination plots shall graphically indicate the coordination proposed for the several systems centered on full-scale log forms. The coordination plots shall include complete titles, representative one-line diagrams and legends, associated upstream power system relays, fuse or system characteristics, significant motor starting characteristics, significant generator characteristics, complete parameters for power, and substation transformers, complete operating bands for low voltage circuit breaker trip devices, fuses, and the associated system load protective devices. The coordination plots shall define the types of protective devices selected, together with the proposed coil taps, time-dial settings and pick-up settings required. The short-time region shall indicate the relay instantaneous elements, the magnetizing inrush, and ANSI transformer damage curves, the low voltage circuit breaker and instantaneous trip devices, fuse manufacturing tolerance bands, and significant symmetrical and asymmetrical fault-currents.

2. No more than six devices shall be shown on one coordination plot. Of these six curves, two (the largest upstream device and the smallest downstream device) shall repeat curves shown on other coordination plots in order to provide cross-reference. Give each curve in the study a study-unique number or letter identifier to permit cross-reference between plots.

3. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings. A tabulation shall include settings for every overcurrent protective device, timer, power system relays (e.g. ANSI 25, 27, 32, 67, 87, etc), circuit breaker, recommended fuse and current transformer ratings, etc. Include C.T. ratio, burden and all other calculations required for the determination of settings. Provide recommended settings for all protective devices furnished under Division 16 and furnished with those furnished with Variable Frequency Drives and associated transformers, generators and associated paralleling and distribution switchgear.

1.08 ARC FLASH

A. Provide an arc flash study that utilizes the fault current values calculated in the short circuit study and the minimum clear times of the upstream protective device selected in the coordination study to calculate the incident energy at each fault location.

B. The Arc Flash study shall be in accordance with the procedure outlined in IEEE Standard 1584.

C. Calculate the incident energy levels at each faulted bus for each mode of operation: (1) "double-ended mode" (double-ended substation with bus tie open); (2) “singled ended mode” (single incoming utility feeder energized all switchgears single ended with bus ties closed); (3) “stand-by mode” (on-site generation solely providing power to the system; (4) "peak shaving modes" (a.) (double-ended substation with bus tie open with on-site generation paralleled) and (b) (single-ended with bus ties closed with on-site generation paralleled). Determine arc flash incident energy values for both maximum and minimum fault values in each case.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 QUALITY ASSURANCE

A. Adjust relay and protective device settings according to values established by coordination study. Setting shall be made in accordance with Section 16950.

B. Make minor modifications to equipment as required to accomplish conformance with the short circuit and protective device coordination studies.

C. Notify Consulting Engineer in writing of any required major equipment modifications.

END OF SECTION 16015

SECTION 16110

RACEWAYS, BOXES, FITTINGS AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install complete raceway systems as shown on the Drawings and as specified herein.

B. Home runs indicated are to assist the contractor in identifying raceways to be installed concealed or exposed. Raceways identified to be installed exposed on the Drawings shall be run near the ceilings or along the walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes and hoists, lighting fixtures, doors and hatches. Raceways indicated to be run concealed shall be run in the center of concrete floor slabs, in partitions, or above hung ceilings, as required.

PART 2 PRODUCTS

2.01 RACEWAYS AND FITTINGS

A. Steel Conduit and Fittings

1. Rigid metal conduit (GRS), couplings, factory elbows and fittings shall be heavy wall steel tubing with a hot-dipped galvanized finish inside and out after threading and shall comply with ANSI C 80.1 and UL/6.

2. Intermediate metal conduit (IMC), couplings, factory elbows and fittings shall be medium wall steel tubing with a hot-dipped galvanized finish inside and out after threading and shall comply with UL/1242.

3. Electrical metallic tubing (EMT), factory elbows and fittings shall be thin wall steel tubing with an electrically galvanized finish after fabrication and comply with ANSI C80.3 and UL/797.

4. Acceptable manufacturers:

   a. Allied Tube & Conduit Corp.

   b. LTV Steel Tubular Products Corp.

   c. Triangular PWC Inc.

   d. Or equal.

5. Rigid metal and intermediate metal conduit fittings shall be of the threaded type, and shall be steel or malleable iron, with a hot-dipped galvanized finish. Threadless fittings and split couplings are not allowed except in specific applications as approved by the Engineer.

6. Electrical metallic tubing fittings shall be of the rain tight, concrete tight, compression type with malleable iron or pressure cast steel body, steel hex type compression nut and electrically galvanized finish.

7. Acceptable manufacturers:

   a. Appleton Electric Co.

   b. O-Z Gedney Co.

   c. RACO Inc.

   d. Gould/Efcor

   e. Steel City

   f. Or equal

B. PVC Coated Rigid Steel Conduit and Fittings

1. PVC coated rigid steel conduit shall be heavy wall steel tubing with a hot-dipped galvanized finish inside and out after threading with a minimum 0.040-in thick, polyvinyl chloride coating permanently bonded to it and an internal chemically cured urethane or enamel coating. The rigid steel conduit shall comply with ANSI C80.1 and UL/6 prior to coating.

2. PVC coated couplings, factory elbows and fitting shall be furnished with a PVC coating bonded to steel the same thickness as used on the PVC coated conduit. The ends of all couplings, fittings, etc. shall have a minimum of one pipe diameter in length of PVC overlap.

3. Acceptable manufacturers:

   a. "OCAL" as manufactured by Thomas & Betts

   b. "Plasti-Bond Red" as manufactured by Robroy Industries

   c. Triangle PWC Inc

   d. Or equal

C. Non Metallic Conduit and Fittings

1. PVC conduit shall be rigid polyvinyl chloride schedule 40. Rigid PVC conduit up to trade sizes 3-1/2-in shall comply with NEMA TC-2 and UL/651 and shall be sunlight resistant, rated for use with 90 degree C conductors in exposed, direct burial or concrete encased applications. Underground utility duct, 4-in trade size and above, shall be polyvinyl chloride (PVC).

2. Connectors, couplings, fittings and ancillary materials shall be supplied by the conduit manufacturer. Connectors, fittings and ancillary materials shall be rated for the environment for which they are installed.

3. Acceptable manufacturers:

   a. Carlon Corp.

   b. Certained Corp.

   c. Conux Pipe Systems, Inc.

   d. Or equal.

D. Liquid-tight Flexible Metal Conduit, Couplings and Fittings

1. Liquid-tight flexible metal conduit shall be square locked, galvanized steel flexible conduit with a moisture proof, flame resistant, polyvinyl chloride jacket, for use with rigid metal conduit systems. Sealtite, Type UA, manufactured by the Anaconda Metal Hose Div.; Anaconda American Brass Co.; American Flexible Conduit Co., Inc.; Universal Metal Hose Co. or equal.

2. Liquid-tight conduit fittings shall be hot-dipped mechanically galvanized, positive grounding, screw in type. Provide external bonding lugs on sizes 1-1/4-in and larger. Box connectors shall have insulated throats as manufactured by the Thomas & Betts Co.; Crouse-Hinds Co. or equal.

3. Acceptable Manufacturers:

   a. American Flexible Conduit Co.

   b. Anaconda Metal Hose/ANAMET Inc.

   c. Electri-flex Co.

   d. Thomas & Betts

   e. O-Z Gedney

   f. Or equal

2.02 BOXES AND FITTINGS

A. Dry and Damp Location Boxes and Fittings

1. Outlet boxes shall be zinc-galvanized, extra depth, pressed steel with knockouts and of size and type suitable for the intended application.

2. Boxes that are less than 100 cubic inches in size used for junction or pull boxes shall be zinc galvanized pressed steel not less than 14 USS gauge with appropriate blank covers, minimum size 4-11/16-in square by 2-1/8-in deep.

3. Boxes that are 100 cubic inches and larger shall be constructed of hop dip galvanized sheet steel without knockouts. Covers shall be secured with round head brass machine screws. All joints shall be welded and ground smooth.

4. Terminal cabinets shall be NEMA 12 sheet steel unless otherwise shown on the Drawings. Boxes shall be painted and have continuously welded seams. Welds shall be ground smooth and galvanized. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Terminal boxes shall be furnished with latching hinged doors, terminal mounting straps and brackets. Terminal blocks shall be rated not less than 20A, 600V.

5. Acceptable Manufacturers:

    a. Appleton

    b. Raco

    c. Steel City

    d. Hoffman

    e. Electromate Division of Robroy Ind.

    f. Wiegmann

B. Wet Location Boxes and Fittings

1. NEMA 4 terminal boxes, junction boxes, pull boxes, etc, shall be sheet Type 316 stainless steel unless otherwise shown on the Drawings. Boxes shall have continuously welded seams and mounting feet. Welds shall be ground smooth. Boxes shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Covers shall be gasketed and fastened with stainless steel clamps. Terminal boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20 Amps, 600 Volt.

2. Cast or malleable iron device boxes shall be Type FD. Boxes and fittings shall have cadmium-zinc finish with cast covers and stainless steel screws.

3. Cast aluminum device boxes shall be Type FD. Boxes and fittings shall be copper free aluminum with cast aluminum covers and stainless steel screws

4. Acceptable Manufacturers:

    a. Appleton

    b. Crouse-Hinds

    c. Steel City

    d. Hoffman

    e. Electromate - Division of Robroy Ind.

    f. Or equal

2.03 HARDWARE

A. Conduit Mounting Equipment

1. Stainless steel channel with stainless steel hardware shall be used in ALL indoor areas and in outdoor locations.

2. Furnish any and all necessary supports, brackets, conduit sleeves, racks and bracing as required. All boxes and hardware shall be stainless steel.

B. Conduit Supports

1. Trapezes

a. In dry indoor areas, beams, channels, struts, hangers, bracing, rods, beam clamps, accessories and components shall be stainless steel.

b. Stainless steel beams, channels, struts or fiberglass beams, channels, struts with stainless steel hangers, bracing, rods, beam clamps, accessories and components shall be used in all areas.

2. Conduit Racks

a. In dry indoor areas, conduit racks, accessories and components shall be stainless steel.

b. Stainless steel conduit racks with stainless, accessories and components shall be shall be used in all areas.

PART 3 EXECUTION

3.01 RACEWAY APPLICATIONS

A. Refer to Table 16110-1 for specific raceway application requirements.

B. All conduit of a given type shall be the product of one manufacturer.

3.02 BOX APPLICATIONS

A. Terminal boxes, junction boxes and pull boxes shall have NEMA ratings suitable for the location in which they are installed.

B. All conduit bodies and pulling outlets shall comply with NEC wire bending space requirements. Mogul type fittings shall be used for sizes 2-1/2-in and larger.

TABLE 16110-1 *Raceway Application Guidelines*	
Location/Circuit Type	***Raceway Type***
All locations ▪ Class 2 and 3 signal wiring and 4-20 mA instrumentation cables, non-fiber (copper) data highway.	▪ Exposed - Galvanized rigid steel (GRS) conduit. Use PVC coated rigid steel conduit in corrosive areas. ▪ Concealed - Galvanized rigid steel (GRS) conduit. ▪ Underground - PVC duct (as specified) in duct bank. ▪ Use PVC coated steel conduit for single conduit direct burial applications.
Clean, dry finished areas - offices, administrative areas, lobbies, control room, lunch room, toilets, and laboratories, etc.	▪ Conceal raceways in walls above hung ceilings in rooms and areas that have finished interiors. Surface raceway for multiple receptacle, voice, and data outlets in labs and control rooms or in offices where specified. ▪ 3/4 or 1-in electrical metallic tubing (EMT) for lighting, switch, and receptacle circuits exposed above hung ceilings or concealed in partition walls. Galvanized rigid steel (GRS) above 1-in.
Clean, dry non-finished areas - electrical rooms, generator rooms, mechanical rooms, shops, dry storage, etc.	▪ Exposed conduit for power wiring, lighting, switch, and receptacle circuits - Galvanized rigid steel (GRS). ▪ Concealed conduit for power wiring, lighting, switch, and receptacle circuits - Schedule 40 PVC conduit when embedded within concrete floor slabs. GRS when embedded within masonry block walls.
Process areas - non-corrosive, non-hazardous locations designated as DAMP or WET on the Drawings.	▪ Exposed conduit for power wiring, lighting, switch, and receptacle circuits - Galvanized rigid steel (GRS). ▪ Concealed conduit for power wiring, lighting, switch, and receptacle circuits - Schedule 40 PVC conduit when embedded within concrete floor slabs. GRS when embedded within masonry block walls.
Corrosive areas - chemical storage and handling areas, underground vaults, within tanks or clearwells, filter pipe galleries and locations where designated corrosive on the Drawings.	▪ Exposed conduit for power wiring, lighting, switch, and receptacle circuits – PVC coated steel. ▪ Concealed conduit for power wiring, lighting, switch, and receptacle circuits - Schedule 40 PVC conduit when embedded within concrete floor slabs or structures. ▪ Seal end of conduit in all corrosive locations as

TABLE 16110-1 *Raceway Application Guidelines*	
Location/Circuit Type	***Raceway Type***
	required by this specification.
Outdoor areas - all locations.	▪ Exposed conduit for power wiring, lighting, switch, and receptacle circuits - Galvanized rigid steel (GRS). PVC conduit shall not be used exposed. ▪ Concealed conduit for power wiring, lighting, switch, and receptacle circuits - Schedule 40 PVC conduit when embedded within concrete structures.

3.03 FITTINGS APPLICATIONS

A. Combination expansion-deflection fittings shall be used where exposed conduits cross structure expansion joints or in straight runs where expansion is anticipated. Combination expansion-deflection fittings shall be installed where embedded conduits cross structural expansion joints. Refer to Structural Drawings for expansion joint locations. Provide bonding jumpers around fittings.

B. All underground conduit penetrations at walls or other structures shall be sealed watertight. Conduit wall seals and sleeves shall be used in accordance with the manufacturer's installation instructions and the details shown on the Drawings.

C. Conduit sealing bushings shall be used to seal conduit ends exposed to the weather and at other locations shown on the Drawings.

D. Insulated throat grounding bushings shall be used where specified herein and where conduits stub up into electrical equipment such as MCC's, switchgear, etc.

3.04 INSTALLATION

A. No conduit smaller than 3/4-in electrical trade size shall be used, nor shall any have more than the equivalent of three 90 degree bends in any one run. Pull boxes shall be provided as required by the NEC after every 270 degrees of bends and for straight run not to exceed 200 feet or as directed.

B. All conduit which may under any circumstance contain liquids such as water, condensation, liquid chemicals, etc, shall be arranged to drain away from the equipment served. If conduit drainage is not possible, conduit seals shall be used to plug the conduits. The ends of all conduits shall be temporarily plugged to exclude dust, moisture and debris from entering during construction.

C. Conduit ends exposed to the weather shall be sealed with conduit sealing bushings.

D. Conduits noted as spare shall be capped or plugged at both ends with easily removable fittings.

E. Conduit terminating in NEMA 3R, 4, 4X enclosures shall be terminated with Myers type conduit hubs.

F. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.

G. Conduits containing equipment grounding conductors and terminating in sheet steel boxes shall have insulated throat grounding bushings.

H. Conduits shall be installed using threaded fittings except for PVC or EMT.

I. The use of running threads is prohibited. Where such threads are necessary, a 3-piece union shall be used.

J. All conduits entering or leaving a motor control center, switchboard or other multiple compartment enclosure shall be stubbed up into the bottom horizontal wireway or other manufacturer's designated area, directly below the vertical section in which the conductors are to be terminated. The 3-in extension of conduit above the floor slab or concrete equipment pad may be reduced to a dimension that suits the equipment manufacturer's installation requirements if the 3-in stub-up interferes with the equipment being provided.

K. Rigid galvanized steel conduits buried in earth shall be completely painted with bitumastic.

L. Rigid galvanized steel conduits which have been field cut and threaded shall be painted with cold galvanizing compounds.

M. PVC coated rigid galvanized steel conduit shall be used for elbows at risers at the utility pole for electrical and telephone service conduits. Rigid galvanized steel conduit shall be used at utility pole for electrical and telephone service and fire alarm conduits to a height of 10-ft above finished grade. Furnish and install weather heads at service pole riser if required by utility company.

N. Liquid-tight flexible metal conduit shall be used for all motor terminations, the primary and secondary of transformers, generator terminations and other equipment where vibration is present or may require removal. Non-metallic flexible conduit can be used with rigid PVC conduit systems.

O. Flexible couplings shall be used in hazardous locations for all motor terminations and other equipment where vibration is present.

P. PVC coated rigid steel conduit shall be used as a transition section where concrete embedded conduit stubs out of floor slabs or through below grade walls or where conduit installed under building slabs on grade stub out of floors. The PVC coated rigid steel conduit shall extend a minimum of 3-in into and out of the floor slab, concrete pad, or wall to allow for proper threading of the conduit.

Q. Expansion fittings shall be used on exposed runs of PVC conduit where required for thermal expansion. Installation and number of fittings shall be as recommended by manufacturer.

R. Conduit supports, other than for underground raceways, shall be spaced at intervals not exceeding the distance required by the NEC to obtain rigid construction.

S. Single conduits shall be supported by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on fabricated channel trapeze type racks with steel horizontal members and threaded hanger rods. The rods shall be not less than 3/8-in diameter. Surface mounted panel boxes, junction boxes, conduit, etc, shall be supported by spacers to provide a minimum of 1/2-in clearance between wall and equipment.

T. Conduit Supports (Other than Underground Raceways)

1. Trapezes

   a. Conduit support trapezes shall be vertically supported every 10-ft or less, as required to obtain rigid conduit construction.

   b. Lateral seismic restraints (Sway Bracing) shall be spaced 30-ft or less.

   c. Horizontal seismic restraints shall be spaced at 40-ft or less. There shall be at least one horizontal restraint per horizontal run.

   d. Attachment to structural steel shall be by beam clamps or welded beam attachment. C-clamps will not be allowed for vertical hangers. Side beam clamps with beam hooks shall be used for seismic restraint only.

   e. Attachment to concrete shall be cast-in-place inserts, cast-in place welded plates with welded studs or stainless steel adhesive anchors.

2. Flush Mounted Supports

   a. Support shall be spaced 10-ft or less, as required to obtain rigid conduit construction.

   b. Attachment to concrete shall be with cast-in-place inserts, cast-in place welded plates with welded studs or stainless adhesive anchors.

3. Conduit Racks

   a. Support shall be spaced 10-ft or less, as required to obtain rigid conduit construction.

   b. Horizontal seismic restraints shall be spaced at 30-ft or less, with welded studs or stainless adhesive anchors.

4. Conduit Hangers

   a. Conduit hangers shall be vertical supported 10-ft or less, as required to obtain rigid conduit construction.

   b. Lateral seismic restraints (Sway Bracing) shall be spaced 20-ft or less.

   c. Horizontal seismic restraints shall be spaced at 30-ft or less. There shall be at least one horizontal restraint per horizontal run.

d. Attachment to structural steel shall be by beam clamps or welded beam attachment. C-clamps will not be allowed for vertical hangers. Side beam clamps with beam hooks shall be used for seismic restraint only.

e. Attachment to concrete shall be cast-in-place inserts, cast-in place welded plates with welded studs or stainless steel adhesive anchors.

5. All reinforcing bars shall be located by the Electrical Subcontractor with the use of a rebar locator prior to installing adhesive capsule type anchors. Mark the location of all reinforcing bars in an area bounded by a line drawn at least 18-in from the edge of the support bearing/weld plates on all four sides of the bearing/weld plates prior to fabricating and installing bearing/weld plates.

6. Where interference occurs, adjust anchor locations to clear reinforcing bars and alter support configuration at no additional cost to the Authority.

U. Miscellaneous steel for the support of fixtures, boxes, transformers, starters, contactors, panels and conduit shall be furnished and installed. Channel supports shall be ground smooth and fitted with plastic end caps.

V. Steel channels, flat iron and channel iron shall be furnished and installed for the support of all electrical equipment and devices, where required, including all anchors, inserts, bolts, nuts, washers, etc, for a rigid installation. Channel supports shall be ground smooth and fitted with plastic end caps.

W. 3/16-in polypropylene pull lines shall be installed in all new conduits noted as spares or designated for future equipment. Conduit noted as spare shall be capped or plugged at both ends with easily removable fittings

X. Where no type or size is indicated for junction boxes, pull boxes or terminal cabinets, they shall be sized in accordance with the requirements of NEC Article 314. Enclosure type and material shall be as specified herein.

Y. Pull or junction boxes shall be furnished and installed where shown on the Drawings, in every 200 feet of straight conduit runs or in runs where more than the equivalent of four 90 degree bends occur or at any point necessary for wire pulling and splicing. Splices shall not be made in pulling elbows.

END OF SECTION

SECTION 16120

WIRES AND CABLES (600 VOLT MAXIMUM)

PART 1 GENERAL

1.01. SCOPE OF WORK

A. Furnish, install and test all wire, cable and appurtenances as shown on the Drawings and as specified herein.

1.02. DELIVERY, STORAGE AND HANDLING

A. Carefully handle all conductors to avoid kinks and damage to insulation.

PART 2 PRODUCTS

2.01. GENERAL

A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper.

B. All conductors shall be stranded, except that lighting and receptacle wiring may be solid.

C. Except for control, signal and instrumentation circuits, wire smaller than No. 12 AWG shall not be used.

D. Wire shall have 600 Volt insulation except where indicated otherwise.

2.02. BUILDING WIRE

A. Wire for lighting, receptacles and other circuits not exceeding 150 Volts to ground shall be NEC type THHN/THWNas manufactured by General Cable.; American Insulated Wire Corp.; Southwire Co.;or equal.

B. Wire for circuits over 150 Volts to ground within buildings and structures shall be NEC type THHN/THWN as manufactured by General Cable.; American Insulated Wire Corp.; Southwire Co.; or equal.

C. Wire for circuits over 150 Volts to ground used underground or for service entrance shall be NEC type THHN/THWN as manufactured by General Cable.; American Insulated Wire Corp.; Southwire Co.; or equal.

D. Bare copper ground wire shall be stranded, annealed copper wire ASTM-B3 alloy coated soft copper electrical wire ASTM B189.

E. Equipment grounding conductors shall be NEC Type THW green and sized in accordance with NEC Table 250-122. Ground grid conductors shall be insulated unless shown otherwise on the Drawings.

2.03. CONTROL, STATUS AND ALARM WIRE

A. Wire shall be No.14 AWG NEC type THHN/THWN stranded as manufactured by The Okonite Co.; General Cable.; American Insulated Wire Corp.; Southwire Co.; or equal.

2.04. INSTRUMENTATION WIRE

A. Wire for process instrumentation signals (i.e. 1-5 VDC, 4-20 mADC), R.T.D., potentiometer and similar signals shall be:

1. Single pair cable:

a. Conductors: 2 No. 16 stranded and twisted on 2-in lay

b. Insulation: XLP with 600 Volt, 105 degrees C rating

c. Shield: 100% Aluminum/polyester foil with drain wire

d. Jacket: PVC with UL Subject 13, UL 1581 and manufacturers' identification

e. Max overall diameter: 0.262-in

f. Miscellaneous: UL Listed as Instrument Tray Cable for use in accordance with Article 727 and Article 725 of the NEC.

g. Manufacturers: Belden; Manhattan; General Cable; The Okanite Co.;or equal

2. Area Network (LAN) Ethernet cable shall be designed for use with a high-speed (100 Mbps/Gbps) Ethernet communications network. The twisted pair cable shall have nominal impedance of 100 ohms at 1 Mhz and a maximum attenuation of 10 dB per 1000 feet at 1 Mhz. The twisted pair cable shall be plenum rated and shall have a minimum of four 24 AWG solid copper conductor pairs. All RJ-45 terminations on the twisted pair cable shall be done as specified by the manufacturer. Terminations shall provide strain relief on the cable jacket. Strain relief on the wire and /or wire insulation shall not be acceptable. Cable and connections shall meet or exceed Category 6A ratings and upon completion of the network installation, the system shall be tested to Category 6A standards. Category 6A cable shall be as manufactured by Belden; Phoenix; Digital; Seicor, or equal.

2.05. SPLICES (POWER CONDUCTORS)

A. Unless otherwise indicated on the Drawings, splices shall not be made in the cables without prior written approval of the Engineer. Where splicing is approved by the Engineer, splicing materials for all 600 Volt splices shall be made with long barrel, tin plated copper compression (hydraulically pressed) connectors and insulated with heavy wall heat shrinkable tubing. The conductivity of all completed connections shall be not less than that of the uncut conductor. The insulation resistance of all completed connections of insulated conductors shall be not less than that of the uncut conductor.

B. Wire lugs shall be tin plated copper, long barrel compression type (hydraulically pressed) for wire sizes No. 8 AWG and larger. Lugs for No. 10 AWG and smaller wire shall be locking spade type with insulated sleeve. Lugs shall be as manufactured by the Thomas and Betts Co.; Burndy; Amp; or equal.

C. Compression type connectors shall be insulated with a heat shrink boot or outer covering and epoxy filling. Splice kits shall be as manufactured by Raychem (Tyco); Ideal Industries; 3M Co. or equal.

D. Solderless pressure connectors shall be self-contained, waterproof and corrosion-proof units incorporating prefilled silicone grease to block out moisture and air. Connectors shall be sized according to manufacturer's recommendations. The connectors shall be UL listed and CSA approved, as manufactured by King Innovation; Ideal Industries, Inc., or equal.

2.06. MOTOR CONNECTIONS

A. Motor connections shall be ring type mechanical compression terminations installed on the branch circuit wires and the motor leads and secured with bolt, nut and springwasher. Connections shall be insulated with a Raychem Type RVC, roll-on stub insulator; Thomas & Betts, Shrink-Kon MSCV20; or equal. For wire sizes N0. 8 and larger, long barrel, tin plated copper compression (hydraulically pressed) type connections Burndy Co., or equal) shall be installed on the branch circuit wires and the motor leads. Connections shall be insulated with heavy duty heat shrinkable material (Raychem Corp., or equal.

2.07. TERMINATION AND SPLICES (CONTROL, STATUS AND ALARM CONDUCTORS)

A. Termination connectors shall be of the locking fork-end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

B. Insulated compression type connectors shall be of the expanded vinyl insulated parallel or pigtail type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

C. Solderless pressure connectors shall be self-contained, waterproof and corrosion-proof units incorporating prefilled silicone grease to block out moisture and air. Connectors shall be sized according to manufacturer's recommendations. The connectors shall be UL listed and CSA approved, as manufactured by King Innovation; Ideal Industries, Inc or equal.

2.08. TERMINATIONS (INSTRUMENTATION CABLES)

A. Termination connectors shall be of the locking fork-end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

2.09. WIRE AND CABLE MARKERS

A. Wire and cable markers shall be "Omni-Grip" as manufactured by the W.H. Brady Co.; Thomas & Betts Co., SMS; 3M Co., STD-TAG; or equal.

B. Wire and cables with diameters exceeding the capacity of the "Omni-Grip" shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by the W.H. Brady Co.; Panduit Corp.; 3M Co.; or equal.

PART 3 EXECUTION

3.01. INSTALLATION

A. Uniquely identify all wires, cables and each conductor of multi-conductor cables (except lighting and receptacle wiring) at each end and in all manholes, hand holes and pull boxes with wire and cable markers.

B. Use lubrications to facilitate wire pulling. Lubricants shall be UL approved for use with the insulation specified.

C. Provide multi-conductor control and signal cables within the underground system. Cables shall be installed continuous from building to building without splices. Individual control conductors and twisted shielded pairs signal cables will not be allowed in underground systems.

D. The crimping tools used in securing the conductor in the compression type connectors or terminal lugs shall be those made for that purpose and for the conductor sizes involved. The crimping tool shall be the ratchet type which prevents the tool from opening until the crimp action is completed. Such tools shall be a product of the connector manufacturer.

E. Install an equipment grounding conductor in all raceways.

F. Seal openings in slabs and walls through which wires and cables pass.

G. Pull cables from the direction that requires the least tension. Use a feed-in tube and sheave designed for cable installation. Use sheaves with radii that exceed the cable manufacturer's recommended minimum bending radius. Use a dynamometer and constant velocity power puller. Velocity should not be less than 15-ft./min. or more than 50-ft./min. Do not exceed the cable manufacturer's maximum recommended tension.

H. If cable can not be terminated immediately after installation, install heat shrinkable end caps.

I. Fireproof exposed cables in manholes, vaults, pullboxes, switchgear and other areas not protected by conduit where medium voltage cables are present. Use fire-proofing tape and glass tape in accordance with the manufacturer's instructions. Fire-proofing tape shall be installed with one half-lapped layer of Scotch Brand 77 Electric Arc and Fireproofing Tape (3M Corp., or equal). Tape shall be secured with a two-layer band of Scotch Brand 69 Glass Electrical Tape (3M Corp., or equal) over the last wrap.

3.02. WIRE COLOR CODE

A. All wire shall be color coded or coded using electrical tape in sizes where colored insulation is not available. Where tape is used as the identification system, it shall be applied in all junction boxes, manholes and other accessible intermediate locations as well as at each termination.

B. The following coding shall be used:

System	Wire	Color
240/120 Volts	Neutral	White

Single-Phase, 3 Wire	Line 1	Black
	Line 2	Red
208Y/120, Volts	Neutral	White
3 Phase, 4 Wire	Phase A	Black
	Phase B	Red
	Phase C	Blue
240/120 Volts	Neutral	White
3 Phase, 4 Wire	Phase A	Black
delta, center tap	Phase B (High)	Orange
ground on phase	Phase C	Blue
coil A-C		
480Y/277 Volts	Neutral	White
3 Phase, 4 Wire	Phase A	Brown
	Phase B	Orange
	Phase C	Yellow

C. Neutral or ground wires that terminate in a Panelboard and require color tape shall have the color tape extend at least 6-in from the termination point.

3.03. TERMINATIONS AND SPLICES

A. Power conductors: Unless otherwise indicated on the Drawings, no splices may be made in the cables without prior written approval of the Engineer. Where splicing is approved, terminations shall be die type or set screw type pressure connectors as specified. Splices (where allowed) shall be die type compression connector and waterproof with heat shrink boot or epoxy filling for copper conductors # 4 AWG and larger. Splices shall be solderless pressure connectors with insulating covers for copper conductors # 6 AWG and smaller. Aluminum conductors (where specified) shall employ terminations and splices specifically designed for aluminum conductors.

B. Control Conductors: Termination on saddle-type terminals shall be wired directly with a maximum of two conductors. Termination on screw type terminals shall be made with a maximum of two spade connectors. Splices (where allowed) shall be made with insulated compression type connectors.

C. Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): terminations same as for control conductors. Splices allowed at instrumentation terminal boxes only.

D. Except where permitted by the Engineer no splices will be allowed in manholes, handholes or other below grade located boxes.

E. Splices shall not be made in push button control stations, control devices (i.e., pressure switches, flow switches, etc), conduit bodies, etc.

3.04. INSTRUMENTATION CABLES

A. Instrumentation cables shall be installed in rigid steel raceways as specified. All circuits shall be installed as twisted pairs or triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever three wire circuits are required.

B. Terminal blocks shall be provided at all instrument cable junction and all circuits shall be identified at such junctions.

C. Shielded instrumentation wire, coaxial, data highway, I/O and fiber optic cables shall be run without splices between instruments, terminal boxes, or panels.

D. Ground shielding on instrumentation wires at one end only as recommended by the instrument manufacturer and isolated at all other locations. Terminal blocks shall be provided for inter-connecting shield drain wires at all junction boxes. Where individual circuit shielding is required, each shield circuit shall be provided with its own block.

E. Install shielded instrumentation wire in conduit and pull boxes that contain only shielded instrumentation wire. Instrumentation cables shall be separated from all other (i.e. power, control, etc.) cables in manholes by enclosing them within rigid steel raceways and boxes.

F. Shielded cable terminations at each end shall be provided with heat shrinkable tubing placed over the exposed shield and conductors. The tubing shall extend 1-in minimum over the jacket end and extend 0.5-in minimum from the jacket end over the exposed conductors.

3.05. FIELD TESTING

A. Test all 600 Volt wire insulation with a megohm meter after installation and prior to termination. Make tests at not less than 1000 Volts DC. Test duration shall be one minute. Submit a written test report of the results to the Engineer. Notify the Engineer in writing 48 hours prior to testing.

B. Field testing and commissioning shall be done in accordance with the latest revision of the "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems" published by the International Electrical Testing Association (NETA Standard ATS-1999)unless otherwise modified by this Section. Minimum wire insulation resistance shall not be less than 250 Megohms.

END OF SECTION

SECTION 16141

WIRING DEVICES

PART 1 PART 1 GENERAL

1.01. 1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and install wiring devices as shown on the Drawings and as specified herein.

B. Provide all interconnecting conduit and branch circuit wiring for receptacle circuits in accordance with the NEC.

1.02. REFERENCE STANDARDS

A. Wiring devices shall comply with the requirements of the National Electric Code (NEC) and shall be Underwriters Laboratories (UL) labeled.

PART 2 PART 2 PRODUCTS

2.01. MATERIALS

A. Wall switches shall be heavy duty, specification grade, toggle action, flush mounting quiet type. All switches shall conform to the latest revision of Federal Specification WS 896. Wall switches shall be suitable for the area classification indicated and shall be of the following types and manufacturer:

1. Single pole, 20 Amp, 120/277 Volt - Cooper Wiring Devices; Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

2. Double pole, 20 Amp, 120/277 Volt - Cooper Wiring Devices; Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

3. Three way, 20 Amp, 120/277 Volt - Cooper Wiring Devices, Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

4. Four way, 20 Amp, 120/277 Volt - Cooper Wiring Devices; Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

B. Receptacles shall be heavy duty, specification grade of the following types and manufacturer or equal. Receptacles shall conform to Fed Spec WC596-F.

1. Duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire; Cooper Wiring Devices; Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

2. Weatherproof/corrosion resistant single, 20 Amp, 125 Volt, 2 Pole, 3 Wire, with cover; Crouse-Hinds Co., "weatherproof while in use"; Appleton Electric; Pass & Seymour or equal.

3. Weatherproof/corrosion resistant duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire, with cover; Crouse-Hinds Co "weatherproof while in use"; Appleton Electric; Pass & Seymour or equal.

4. Ground fault interrupter, duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire, GFCI feed thru type with "test" and "reset" buttons. Cooper Wiring Devices; Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

C. Device Plates

1. Plates for indoor flush mounted devices shall be of the required number of gangs for the application involved and shall be as follows:

a. Administration type buildings: Smooth, high impact nylon of the same manufacturer and color as the device. Final color shall be as selected by the Architect.

b. Where permitted in other areas of the plant, flush mounted devices in cement block construction shall be Type 302 high nickel (18-8) stainless steel of the same manufacturer as the devices.

2. Plates for indoor surface mounted device boxes shall be cast metal of the same material as the box, Crouse-Hinds No. DS23G and DS32G; Appleton FSK1DRC, FSK1TSEC; Pass & Seymour or equal.

PART 3 EXECUTION

3.01. INSTALLATION

A. Switch and receptacles outlets shall be installed flush with the finished wall surfaces in areas with stud frame and gypsum board construction, in dry areas with cement block construction or when raceways are shown as concealed on the Drawings.

B. Do not install flush mounted devices in areas designated DAMP, WET or WET/CORROSIVE on the Drawings. Provide surface mounted devices in these areas.

C. Provide weatherproof devices covers in areas designated WET or WET/CORROSIVE on the Drawings.

D. Convenience outlets shall be 15-in above the floor unless otherwise required.

E. Convenience outlets installed outdoors and in rooms where equipment may be hosed down shall be 18-in above floor or grade.

F. Switches and dimmer controls for lighting shall be mounted 48-in above the finished floor unless otherwise noted or required.

G. The location of all devices is shown, in general, on the Drawings and may be varied within reasonable limits so as to avoid any piping or other obstruction without extra cost, subject to the approval of the Engineer. Coordinate the installation of the devices for piping and equipment clearance.

END OF SECTION

SECTION 16191

MISCELLANEOUS EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install all miscellaneous equipment as shown on the Drawings and as specified herein.

1.02 EQUIPMENT LIST

A. This Section provides the requirements for miscellaneous equipment typically employed in a facility, however, not all components specified in this Section are necessarily utilized on this project.

PART 2 PRODUCTS

2.01. MATERIALS

A. Disconnect Switches

1. Disconnect switches shall be heavy-duty, quick-make, quick-break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange mounted operating handle. All current carrying parts shall be copper

2. NEMA 4 enclosures shall be stainless steel.

3. NEMA 4X enclosures shall be stainless steel.

4. Switches shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer, or equal.

B. Horsepower Rated, Toggle Switch Type Disconnect Switch

1. Toggle type disconnect switches shall be manufactured of thermoplastic materials with screw-type terminals. The switches shall be rated 600 VAC and 20A at 600 VAC.

2. Toggle type disconnect switches shall be similar to a manual non-reversing starter without overloads and shall be 3 Pole, capable of "on-off" control of a 10 horsepower motor at 460 VAC.

3. Enclosure shall be provided with lock off provisions.

4. NEMA 4 enclosures shall be die-cast zinc.

5. Switches shall be as manufactured by the Square D Co.; Siemens Electrical Products; Cutler-Hammer or equal.

C. Kitchen Hoods

1. All equipment located under and/or served by kitchen hoods shall be powered via shunt-trip circuit breaker.

2. Kitchen Hood supply fans and/or Make-Up Air Units (MAU) shall be powered via shunt-trip circuit breaker.

3. Contractor shall furnish and install wiring from output switches on kitchen hood control panel to shunt trip circuit breakers and make all final connections. When the kitchen hood fire suppression system is activated, all equipment under the hood and the supply fan and/or MAU shall shut-off.

4. Contractor shall install junction box and 1/2" conduit from Manual Pull-station location to control panel on kitchen hood equipment. Coordinate with mechanical drawings for pull-station location.

D. Combination Magnetic Motor Starters

1. Motor starters shall be a combination motor circuit protector and contactor, 2 or 3 Pole, single or 3 Phase as required, 60 Hz, 600 Volt, magnetically operated, full voltage non-reversing unless otherwise shown on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings. Minimum size shall be NEMA size 1. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall be current limiting type, with additional current limiters if required.

2. Multi-speed and reversing starters shall include two motor rated contactors mechanically and electrically interlocked so that only one device may be energized at any time.

3. Reduced voltage starters: Auto-transformer type with closed circuit transition. Auto-transformers shall be dry type with 50, 65 and 80 percent voltage taps and over-temperature protection. Timing relays shall be pneumatic, adjustable. Relay settings shall be approximately 75 percent of relay range.

4. Reduced voltage starters: Solid state, six SCR, full wave type with adjustable current limit and voltage ramp to control starting torque, automatic load sensing circuit to minimize energy consumption, line and load side surge protection and noise suppression and controlled deceleration adjustment to reduce the effects of surges caused by centrifugal pump loads. Provide heat sinks and ventilation to remove heat from the structure. Each starter shall include a motor horsepower rated isolation contactor to positively disconnect the line voltage when the SCR control is off.

5. Each motor starter shall have a 120 Volt operating coil and control power transformer. Transformer primaries and secondaries shall be equipped with time-delay fuses. Three phase starters shall have three overload relays. One normally open and one normally closed auxiliary contact shall be provided as spares in addition to contacts shown on the Drawings.

6. Overload relays shall be adjustable, ambient compensated and manually reset.

7. NEMA 4 enclosures shall be stainless steel.

8. NEMA 4X enclosures shall be stainless steel.

9. Combination magnetic motor starters shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer, or equal.

E. General Purpose Dry Type Transformers

1. Transformers shall be dry type, two-winding with kVA and voltage ratings as shown on the Drawings. Transformer shall incorporate a 220 degree C insulation system and be designed not to exceed 150 degrees C temperature rise above a 40 degree C ambient full load

2. Four full capacity taps shall be furnished, two 2-1/2 percent above and two 2-1/2 percent below rated primary voltage.

3. Windings shall be copper.

4. Transformers shall be built in accordance with ANSI C89.2 and NEMA ST-20 shall be UL listed and suitable for non-sinusoidal current loads with a K-factor of 4.

5. Transformers, other than K-rated units, shall meet the efficiency levels contained in Tables 4.1 and 4.2 of NEMA Standard TP1-1996 and shall contain an EPA "Energy Star" label. Efficiency shall be tested in accordance with TP1-1996.

6. Transformers shall have common core construction with low hysteresis and eddy current losses. The core flux density shall be below the saturation point to prevent overheating caused by harmonic distortion.

7. Transformer impedance shall be a minimum of 3 percent and a maximum of 5 percent.

8. Provide vibration isolators for transformers rated 112.5 kVA and higher.

9. Provide ground lug on frame and strap ground core assembly to frame of enclosure.

10. The neutral bus shall be sized and configured for 200 percent of secondary full load current.

11. Transformers shall be manufactured by Square D Co.; General Electric Co.; Cutler-Hammer, or equal.

F. Transformer-Panel Assembly

1. Manufacturers

a. Cutler-Hammer, Mini-Power Center

b. Square D, Mini-Power Zone

c. General Electric, Servicenter

d. or equal

2. Ratings

   a. kVA and voltage ratings shall be as shown on the Drawings.

   b. Units shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.

   c. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings.

3. Construction

   a. Each TPA shall include a main primary breaker, an encapsulated dry-type transformer, and a secondary panelboard with main breaker.

   b. Main primary, secondary, and feeder breakers shall be enclosed with a padlockable hinged door.

4. Bus

   a. Panelboard bus shall be copper sized to NEMA 65 degrees C rise.

5. Wiring/Terminations

   a. All interconnecting wiring between the primary breaker and transformer, secondary main breaker and transformer, and distribution section shall be factory installed.

   b. All transformers shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring.

6. Main Devices

   a. Each TPA shall include a main primary breaker with an interrupting rating of 22 kA at 480 Volts; and a secondary panelboard with main breaker rated 10 kA interrupting rating at 240 Volts.

7. Feeder Devices

   a. The secondary distribution section shall accommodate one inch, bolt-on breakers with 10 kA interrupting capacity.

8. Enclosure

   a. he enclosure shall be made of heavy-gauge steel and the maximum temperature of the enclosure shall not exceed 90 degrees C.

   b. The enclosure shall be totally enclosed, non-ventilated, NEMA Type 3R, with lifting eyes.

G. Wireway

1. NEMA 1 wireway shall be painted steel with screw covers.

2. NEMA 4 and 4X wireway shall be stainless steel with gasketed screw covers and stainless steel screws.

3. NEMA 1 wireway shall be Square-Duct as manufactured by the Square D Co.; NEMA 4 and 4X shall be Bulletin F-22 as manufactured by the Hoffman Engineering Co.; Appleton; Killark, or equal.

H. Control Relays

1. Control relays shall be heavy duty machine tool type, with 10 Amp, 300 Volt convertible contacts. Number of contacts and coil voltage shall be as shown on the Drawings. General use relays shall be General Electric Co., Catalog No. CR120B; similar by Square D Co.; Allen-Bradley Co., or equal. Latching relays shall be General Electric Co., Catalog No. CR120BL; similar by Square D Co.; Allen-Bradley Co. or equal.

2. Time delay relays shall be pneumatic, 600 Volt, 20 Amp contacts, with calibrated knob operated adjustment. On delay and off delay types and timing ranges shall be as shown on the Drawings. Relays shall be Agastat Model 7012 or 7022; similar by Square D Co.; Cutler-Hammer, or equal.

I. Detectable Warning Tape

1. Each duckbank section shall be marked by means of a detectable warning tape (tracer tape) as shown on the Drawings. The detectable warning tape shall be capable of being detected or located by either conductive or inductive location techniques.

2. The detectable warning tape shall consist of 5 mil (.005-in) overall thickness; five-ply composition; ultra-high molecular weight; virgin polyethylene; acid; alkaline and corrosion resistant; with 150 pounds of tensile break strength minimum per 6-in width.

3. The top side of the tracer tape shall be color banded red for electrical and high voltage lines, and orange for signal, communication, telephone and fire alarm lines. Tracer tape shall be 4-in wide with four color bands. The tape shall be inscribed with the warning message for the utility such as "CAUTION – ELECTRICAL LINED BURIED BELOW". Tape shall be as manufactured by Mutual Industries, Inc.; Terra Tape, Div. of Reef Industries Inc. or equal.

J. Terminal Blocks

1. Terminal blocks shall be NEMA type rated at 20 amperes minimum, 600 Volt, channel mounted, with tubular screw and pressure plate.

2. Terminal blocks shall be Bulletin 1492 as manufactured by the Allen-Bradley Co.; ABB; Kukla, or equal.

K. Photocells

1. The photocells shall be suitable for power duty with individual fixtures or for pilot duty with contactors as detailed on the Drawings. Enclosure shall be NEMA 3R or 4. Contacts shall be rated for 2,000 watts continuous at 120 Volts. The unit shall turn on at 1.5 footcandles and off at 5.5 footcandles.

2. Photocells shall be Tork, Model 2101; Intematic; Paragon, or equal.

L. Equipment Identification Nameplates

1. All field mounted electrical equipment such as disconnects, push button stations, etc, shall be provided with a weather resistant engraved laminoid equipment identification nameplate screwed or bolted adjacent to the device. Nameplate shall identify the mechanical equipment controlled exactly as shown on the electrical singleline drawings (i.e, P-95 Cooling Water Pump No. 1).

M. Arc Flash Protection Warning Signs

1. Provide field-affixed arc flash warning labels on all switchboards, panelboards, industrial control panels, and motor control centers in accordance with National Electrical Code Article 110.16.

2. As a minimum, warning signs shall state "WARNING: Arc Flash and Shock Hazard, Appropriate PPE required", and shall be designed in accordance with ANSI Z535.4-1998. Where available from the equipment manufacturer, additional information including Flash Hazard boundary, incident energy, voltage shock hazard, PPE required, etc. shall be provided.

PART 3 EXECUTION

3.01. INSTALLATION

A. A. Mounting Stands

1. Field mounted disconnects, pushbutton control stations, alarm panels, enclosed starters and circuit breakers, transformers, automatic transfer switches, wireways, contactors, terminal boxes, junction and pull boxes shall be mounted on galvanized or stainless steel stands as specified. Where clearance requirements for stands may not be maintained, the Engineer may direct electric control equipment to be wall-mounted adjacent to the driven equipment, but in no case shall the distance from the drive motor to the control station exceed 3-ft, all at no additional cost to the Owner.

2. Channel supports shall be ground smooth and fitted with plastic end caps.

B. All panelboards located in pedestal cabinets or outdoors and panelboards that have branch circuits feeding exterior to the building shall be equipped with lightning arresters and surge capacitors.

3.02. FIELD TESTING

A. Before supplying power to the alarm panels, the following tests shall be done: Verify that all wiring connection interfaces that are required are present. Check for secure connections. Using a continuity device, verify that all discrete inputs and output to and from the control panel are wired in correct polarity and are operating in the correct state of operation (normally open or closed state). Check for any direct short circuits across all voltage supply sources. As each of the above tests are performed, the Electrical Contractor shall highlight and initial each circuit that is tested. This set of prints shall be signed and left inside the enclosure.

B. Check mechanical interlocks for intended operation. Make any adjustments required.

C. In the event of an equipment fault in the panel, notify the Engineer immediately. After the cause of the fault has been identified and corrected, a joint inspection of the equipment shall be conducted by the Contractor and Engineer. Repair or replace the equipment as directed by the Engineer prior to placing the equipment back into service at no additional cost to the Owner.

END OF SECTION

SECTION 16289

SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes both field-mounted SPDs and integrated SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.2 DEFINITIONS

A. $I_{(n)}$: Nominal discharge current rating.

B. MCOV: Maximum continuous operating voltage.

C. Protection Modes: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.3 SUBMITTALS

A. Product Data:

1. For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Provide verification the SPD is listed or recognized through Underwriters Laboratories to the latest Safety Standard, ANSI/UL 1449 3rd Edition.
3. Operations and Maintenance Data: SPDs to include operation, and maintenance manuals.
4. Warranties: Sample of special warranties.

1.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or repair SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Ten years.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by Underwriters Laboratories, and marked for intended location and application.

B. Comply with Underwriters Laboratories ANSI/UL 1449 3rd Edition – Surge Protective Devices.

C. Comply with Underwriters Laboratories ANSI/UL 1283 5th Edition – Electromagnetic Interference Filters. (Applies to Type 2 SPDs)

D. Designed in accordance with ANSI/IEEE C62.41.1-2002, C62.41.2-2002 and C62.45-2002

E. SPDs manufacturer shall be ISO-9001 certified.

F. MCOV of the SPD shall not be less than 115% for 480Y/277V and 125% for 208Y/120V nominal RMS system voltages.

G. SPDs shall be installed internal to the distribution equipment and shall be of the same manufacturer as the equipment. The equipment shall be fully tested and certified to the following UL standards:

UL 67 = Panelboards
UL 845 = Motor Control Centers
UL 857 = Busway
UL 891 = Switchboards
UL 1558 = Low Voltage Switchgear

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide SquareD Surgelogic branded Surge Protection, or comparable product by one of the following:

1. Square D by Schneider Electric
2. Cutler-Hammer
3. Siemens
4. GE

2.3 SERVICE ENTRANCE SUPPRESSOR

A. SPDs: Comply with UL 1449 3rd Edition.

1. SPD Type – All SPDs installed on the line side of the service entrance OCPD shall be Type 1 SPDs. SPDs installed on the load side of the service entrance OCPD shall be either Type 1 or Type 2 SPDs.

2. Type 2 SPDs shall also comply with ANSI/UL 1283.

B. SPDs shall be provided with the following features and accessories:

1. Integral disconnect switch.

2. Internal fusing design capable of disconnecting the SPD before any damaging external effects to the suppressor or surroundings occur.

3. Indicator light(s) display for power and protection status.

4. Audible Alarm with silencing switch.

5. Form-C contacts- One normally open and one normally closed for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

6. Surge counter with reset switch.

C. Surge Current Rating: The surge current rating of the SPD shall be dependent of its Category/Location:

Category/Location	Application	Per Phase	Per Mode
C	Service Entrance	240 kA	120 kA
B	Distribution	160 kA	80 kA

Protection modes: UL 1449 **VPR** for grounded WYE configured circuits shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	800 V	1200 V	1500 V
L-L	1200 V	2000 V	2500 V

Protection modes: UL 1449 **VPR** for Delta configured circuits shall not exceed the following:

Modes	240D	480D	600D
L-G; N-G	1200 V	2000 V	2500 V

D. SCCR: Per NEC 285.6, the short circuit current rating of the SPD shall be equal to or greater than the available short circuit current at the point on the system where installed.

E. Nominal Discharge Current Rating: 20 kA $I_{(n)}$

Note: Surge Protective Devices must carry a minimum Nominal Discharge Current Rating of 20kA to meet the requirements for UL96A – Installation Requirements for Lightning Protection Systems.

2.4 PANELBOARD SUPPRESSORS

A. SPDs: Comply with UL 1449 3rd Edition.

1. Type 1 or Type 2 SPD

2. Type 2 SPDs shall also comply with UL 1283.

B. SPDs shall be provided with the following features and accessories:

1. Indicator light(s) for power and protection status.

2. Internal fusing design capable of disconnecting the SPD before any damaging external effects to the suppressor or surroundings occur.

3. Audible Alarm with silencing switch.

4. Form-C contacts - One normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

5. Surge counter with reset switch.

C. Surge Current Rating: The surge current rating of the SPD shall be dependent of its Category/Location:

Category/Location	Application	Per Phase	Per Mode
B	Distribution	160 kA	80 kA
B	Branch	120 kA	60 kA

Protection modes: UL 1449 **VPR** for grounded WYE configured circuits shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	800 V	1200 V	1500 V
L-L	1200 V	2000 V	2500 V

Protection modes: UL 1449 **VPR** for Delta configured circuits shall not exceed the following:

Modes	240D	480D	600D
L-G; N-G	1200 V	2000 V	2500 V

D. SCCR: Per NEC 285.6, the short circuit current rating of the SPD shall be equal to or greater than the available short circuit current at the point on the system where installed.

E. Nominal Discharge Current Rating: Minimum of 10 kA $I_{(n)}$

2.5 ENCLOSURES

A. Enclosure shall meet or exceed the ratings for the environment to be installed as indicated on drawings.

1. Indoor Enclosures: NEMA 250, Type 3R

2. Outdoor Enclosures: NEMA 250, Type 3R, 4X

PART 3 - EXECUTION

3.1 INSTALLATION

A. SPD devices at distribution panels or switchboards shall be mounted integral to the equipment with leads as short as possible (not to exceed 24-in) and the lead size shall be a minimum of 6 AWG or larger. The SPD shall include an integral disconnect switch which has been tested to the surge current rating of the SPD and shall match or exceed the fault current rating of the board. The disconnect switch shall switch the phases and neutral.

B. SPD devices at branch panels shall be direct bus-to-bus connected with leads as short as possible (not to exceed 24-in) and lead size shall be a minimum of 6 AWG or larger.

C. Install SPD devices at the service entrance in accordance to NFPA 70. All SPDs installed on the line side of the service entrance OCPD shall be Type 1 SPDs. All SPDs installed on the load side of the OCPD shall be either Type 1 or Type 2 SPDs.

D. Follow manufacturers recommended installation practices.

1. Provide a minimum 30 Amp circuit breaker as a dedicated disconnecting means for the SPD unless otherwise indicated.

2. Install SPDs with properly rated conductors between suppressor and points of attachment as short and straight as possible; adjust circuit-breaker positions to achieve shortest and straightest leads.

3. Do not splice and extend SPD leads unless specifically permitted by manufacturer.

4. Twist input conductors together to reduce the input inductance.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.

2. Inspect anchorage, alignment, grounding, and clearances.

3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass inspections.

C. Prepare inspection reports.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect all wires, including neutral of the SPD before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

END OF SECTION

SECTION 16431

PAD MOUNTED TRANSFORMER(S)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install the outdoor, liquid filled, pad mounted transformer(s) as shown on the Drawings and as specified herein.

1.02 RELATED WORK

1.03 SUBMITTALS

A. Submit shop drawings and product data, for the following:

1. Equipment sectional and plan views, bottom plan showing conduit openings and anchor bolt pattern, bushing arrangement, dimensions, weight and construction details.

2. Winding and core arrangement, materials, ratings and insulation details.

3. Transformer diagrammatic nameplate information.

4. Itemized bill of materials for accessories.

5. Certified shop test reports.

6. Field test reports.

7. Installation and maintenance manuals.

1.04 REFERENCE STANDARDS

A. Transformer(s) shall be designed, built and tested in accordance with the following standards:

1. ANSI C57.12.00 - Standard General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers.

2. Western Underground Committee Guide 2.13 for vandal resistance.

3. NEMA Standard TRI - Transformers, Regulators and Reactors.

4. IEEE Sta. 462A, B-1978 "Short Circuit Requirements Supplement to ANSI C57.12.00-1973".

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. The equipment furnished under this Section shall be the product of a manufacturer who has produced this same type of equipment for a period of at least 10 consecutive years.

B. Transformer(s) shall be designed, assembled and tested by the manufacturer of the core and coil assemblies used in the transformer.

1.06 SYSTEM DESCRIPTION

1.07 DELIVERY, STORAGE AND HANDLING

1.08 PROJECT/SITE REQUIREMENTS

1.09 MAINTENANCE

1.10 WARRANTY

1.11 MANUFACTURERS

A. Acceptable Manufacturers:

1. ABB - ASEA Brown Boveri

2. Cooper Power Systems (RTE)

3. Square D

4. General Electric

PART 2 PRODUCTS

2.01 RATINGS

A. Transformer self cooled kVA rating(s) shall be as shown on the Drawings. Winding temperature rise shall not exceed 65 degrees C above a 30 degree C average ambient temperature, with a maximum ambient not to exceed 40 degrees C, operating at full rated kVA load.

B. Primary windings shall have the following ratings:

1. Voltage: 2400 Volts, 3 Phase, 60 Hz

2. Connection: Delta

3. Basic Impulse Level (BIL): 60 kV

C. Secondary windings shall have the following ratings:

1. Voltage: 480/277

2. Connection: Grounded wye

3. Basic Impulse Level (BIL): 30 kV

D. Transformer impedance shall range between 2.6 and 5.4 percent for 500 kVA units and smaller.

E. Transformer(s) shall be designed to supply the specified kVA rating without exceeding its nameplate temperature rise. The transformer "K" factor shall be K4 or better.

2.02 CONSTRUCTION

A. Transformer(s) shall be compartmental type, liquid filled, self-cooled, tamper resistant, weatherproof and suitable for mounting on a concrete pad.

B. Transformer tank(s) shall utilize welded steel construction, sealed to withstand an internal pressure of up to 7 psi without distortion, and top oil temperatures ranging from 50 to 105 degrees C. Tank cover shall be designed to permit access to internal components for inspection or repair. Heavy duty, non-removable lifting lugs and jacking pads shall be provided. When required, welded cooling panels or radiators shall be provided on the back and sides of the tank.

C. The high and low voltage compartments shall be located side-by-side separated by a steel barrier. When facing the transformer, the low voltage compartment shall be on the right. Terminal compartments shall be full height, air filled with individual doors. The high voltage door fastenings shall not be accessible until the low voltage door has been opened. The low voltage door shall have a 3-point latching mechanism with vault type handle having provisions for a single padlock. The doors shall be equipped with lift-off type stainless steel hinges and door stops to hold the doors open when working in the compartments. The front sill of the compartment shall be removable to allow the transformer to be rolled or skidded into position over conduit stubs. ANSI tank grounding provisions shall be furnished in each compartment.

D. The core shall be five-legged. Windings and internal leads shall be aluminum, insulated and braced to prevent phase flashovers during fault conditions. Transformers with wye connected primary and secondary windings shall have the primary neutral insulated from the secondary neutral and brought out into the primary compartment through a separate bushing. Both neutral bushings shall be externally connected to the tank with removable copper straps.

E. Insulating oil shall be free of P.C.B. contamination or any E.P.A. listed toxic chemical. The transformer manufacturer shall test the insulating oil for P.C.B. after filling the tank.

F. Furnish a no load, externally operated, lockable, five-position primary winding tap changer located in the secondary terminal compartment. Tap setting must be clearly visible with the compartment door in the open position. Tap adjustments shall be as follows:

1. For 208Y/120 Volt secondary: (4) - 2.5 percent taps below rated primary voltage.

2. For 480Y/277 Volt secondary: (2) - 2.5 percent taps above and below rated primary voltage.

G. Terminations

1. High voltage primary terminations shall be arranged for dead front loop feed and conform to ANSI C57.12.26 requirements. Provide one piece integrated bushings for use with elbow terminators and parking stands for disengaged elbows. Bushings or wells shall be externally clamped to allow external replacement. The transformer manufacturer shall furnish 600 Amp non load-break elbow terminators for each bushing in accordance with ANSI C119.2.]

2. Tie connections between primary loop feed bushings shall be rated for 600 Amps.

3. Low voltage secondary bushings shall be externally clamped, molded epoxy, spade type with NEMA standard four or six hole arrangement. Neutral shall be brought out through an insulated bushing and grounded to the tank wall with a removable grounding strap.

2.03 HIGH VOLTAGE PRIMARY SWITCHING AND PROTECTIVE EQUIPMENT

A. Furnish an oil immersed, three phase, gang operated, four position loop feed load break primary switch, mounted inside the transformer tank. An external, hook stick type switch operator and index plate shall be mounted in the high voltage primary terminal compartment. Switch positions shall be clearly marked. Minimum switch ratings shall be as follows:

1. 15 kV, 600 Amps continuous.

2. Momentary and fault close: 10,000 Amps symmetrical.

3. One minute 60 Hz withstand: 50 kV

C. Primary Fuse Arrangement

UP TO 500

1. Furnish oil immersed, dead front, externally removable, hot stick operated, load-break type, individual fused disconnect devices located in the high voltage compartment above the primary bushings, to permit fuse replacement without opening the tank. Fuse elements shall be partial range current limiting fuses in series with cartridge type expulsion fuses.

2. The CLF and expulsion fuses shall be properly coordinated such that the CLF protects for fault values above the expulsion fuse interrupting rating, the expulsion fuse protects the CLF for current values below the CLF interrupting capability and the CLF will not operate for low side faults beyond secondary terminals.

D. Lightning Arresters

1. Furnish three distribution class lightning arresters mounted in the high voltage primary compartment for surge protection.

2.04 ACCESSORIES

A. Each transformer shall be furnished with the following accessories:

1. Nameplate in the low voltage compartment.

2. 1-in drain plug (75 to 500 kVA) or 1-in drain valve with sampling device (750 to 5000 kVA).

3. 1-in upper filter press and filling plug.

4. 1-in drain valve with sampling device (75 to 500 kVA).

5. Dial type thermometer with maximum temperature indicator, mounted in a sealed drywell in the low voltage compartment.

6. Auxiliary, sealed, dry contact in thermometer for remote indication of high temperature alarm.

7. Pressure-vacuum gauge mounted in the low voltage compartment.

8. Pressure relief valve.

9. Pressure relief diaphragm.

10. Sudden pressure relay.

11. Magnetic liquid level gauge located in the low voltage compartment at the 25 degree C level mark.

12. Auxiliary, sealed, dry contact in the level gauge for remote indication of low oil level alarm.

13. Mounting provision for voltage and current metering transformers.

2.05 SURFACE PREPARATION AND SHOP COATINGS

A. All welds shall be ground smooth and all metal surfaces cleaned of oil, grease and weld spatter using a hot phosphate chemical treatment. A zinc-rich, heat cured epoxy primer shall be applied to inhibit rust.

B. The equipment shall receive an intermediate coat of heat cured epoxy finish color, followed by an air dried finish coat of Outdoor green, Munsell No. 7GY3.29/1.5. After finish painting, all bottom surfaces, and sides up to a minimum of 1-in above the ground shall be protected against corrosion by an epoxy tar coating.

2.06 SHOP TESTING

A. Perform manufacturers standard production testing and inspection in accordance with ANSI Test Code C57.12.90 and/or NEMA TR1. Testing shall include the following as a minimum:

1. Resistance measurements of all windings on the rated voltage connection of each unit and at the tap extremes of one unit only of a given rating on this project.

2. Ratio tests on the rated voltage connection and on all tap connections.

3. Polarity and phase-relation tests on the rated voltage connections.

4. No-load loss at rated voltage on the rated voltage connection.

5. Exciting current at rated voltage on the rated voltage connection.

6. Impedance and load loss at rated current on the rated voltage connection of each unit and on the tap extremes of one unit only of a given rating on this project.

7. Temperature Test or tests shall be made on one unit only of a project covering one or more units of given rating. Tests shall not be required when there is available a record of a temperature test on an essentially duplicate unit.

8. Applied potential test.

9. Induced potential tests.

10. Toxic chemical (e.g. P.C.B.) test.

11. Short circuit capability of transformer design.

B. Manufacturer shall certify compliance with transformer coating performance per ANSI C57.12.28.

C. Results of the above tests including no load loss data shall be submitted with final drawings in the form of certified test reports.

PART 3 EXECUTION

3.01 PREPARATION

3.02 INSTALLATION

A. The equipment shall be leveled and anchored directly to a concrete equipment pad as shown on the Drawings. Provide hardware and metal shims for installation. Anchor bolts shall be 1/2-in galvanized steel.

B. Install the equipment in accordance with the manufacturer's instructions.

C. Remove temporary packing and shipping braces. Touch-up damaged paint finishes.

3.03 FIELD TESTING

A. Engage the services of an independent testing firm to inspect and test the installed equipment prior to energization. The testing firm shall provide all material, labor, equipment and technical supervision to perform the tests and inspection. Notify the [Owner] [Engineer] at least 2 weeks prior to scheduling any testing.

B. Equipment testing and inspection shall be performed in accordance with NETA Standard ATS and shall include the following:

1. Visual and mechanical inspection.

2. Ground resistance test.

3. Insulation resistance tests, winding-to-winding and winding-to-ground, using a megohmmeter, at nominal tap position with all cables disconnected.

C. In the event of an equipment fault, notify the [Engineer] [Owner] immediately. After the cause of the fault has been identified and corrected, a joint inspection of the equipment shall be conducted by the Contractor, the [Engineer] [Owner] and the equipment manufacturer's factory service technician. Repair or replace the equipment as directed by the [Engineer] [Owner] prior to placing the equipment back into service.

3.04 ADJUSTMENT

3.05 CLEANING

A. Remove all rubbish and debris from inside and around the equipment. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint-free rags. Do not use compressed air.

END OF SECTION

SECTION 16470

PANELBOARDS

PART 1 GENERAL

1.01. SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all panelboards as shown on the Drawings and as specified herein.

1.02. REFERENCE STANDARDS

A. Panelboards shall be in accordance with the Underwriter Laboratories (UL) "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code (NEC).

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.03. MANUFACTURERS

A. 120/240 Volt, single phase, 3 Wire and 120/208 Volt, 3 Phase, 4 Wire panelboards shall be Sentron Type P1 as manufactured by Siemens; Type NQOD by Square D Co.; Type Pow-R-Line C by Cutler-Hammer; or Type AQ as manufactured by the General Electric Co.

B. 277/480 Volt, 3 Phase, 4 Wire panelboards shall be Sentron Type P1or P2 as manufactured by Siemens; Type NF by Square D Co.; Type Pow-R-Line C by Cutler-Hammer or Type AE as manufactured by the General Electric Co.

C. 480 Volt, 3 Phase, 3 Wire Power panelboards shall be Sentron Type P3 as manufactured by Siemens; Type NF by Square D Co.; Type Pow-R-Line C by Cutler-Hammer; or Type AD by General Electric Co.

D. 480 Volt, 3 Phase, 3 Wire Distribution panelboards shall be Sentron Type P4 or P5 as manufactured by Siemens; I-Line series by Square D Co. or Spectra Series by General Electric Co.; Type Pow-R-Line C by Cutler-Hammer, or equal.

E. NEMA 3, 4 and 12 panelboards shall be similar to those specified above with appropriate enclosure modifications as required by voltage application. Panel enclosures shall be provided as specified in Section 16000 and 16110.

PART 2 PRODUCTS

2.01. GENERAL

A. Rating

1. Panelboard ratings shall be as shown on the Drawings. All panelboards shall be rated for the intended voltage.

2. Circuit breaker panelboards shall be fully rated for the specified circuit breaker fault current interrupting capacity. Series connected short circuit ratings will not be acceptable.

2.02. MATERIALS (NEMA 1)

A. Interiors

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, etc. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated.

2. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.

3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.

4. A nameplate shall be provided listing manufacturer's name, panel type and rating.

B. Buses

1. Bus bars for the mains shall be of copper. Full size neutral bars shall be included. Phase bussing shall be full height without reduction. Cross connectors shall be copper.

2. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

3. Spaces, provision for future breakers, shall have bus straps bolted onto the bus so that future breakers can be bolted into the panel.

4. Equipment ground bars shall be furnished.

C. Boxes

1. Recessed or flush mounted boxes shall be made from galvanized code gauge steel having multiple knockouts, unless otherwise noted. Boxes shall be of sufficient size to provide a minimum gutter space of 4-in on all sides.

2. Surface mounted boxes and trims shall have an internal and external finish as specified in Paragraph 2.04D4 below. Surface mounted boxes shall be field punched for conduit entrances.

3. At least four studs for mounting the panelboard interior shall be furnished.

D. Trim

1. Hinged doors covering all circuit breaker handles shall be included in all panel trims.

2. Doors shall have semi flush type cylinder lock and catch, except that doors over 48-in in height shall have a vault handle and 3-point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Furnish two keys for each lock. All locks shall be keyed alike; directory frame and card having a transparent cover shall be furnished on each door.

3. The trims shall be fabricated from code gauge sheet steel.

4. All exterior and interior steel surfaces of the panelboard shall be properly cleaned and finished with ANSI Z55.1, No. 61 light gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.

5. Trims for flush panels shall overlap the box by at least 3/4-in all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

6. Door-in-door type construction shall be provided so that trim may be opened to access wire ways without removing the trim from the panel

2.03. CIRCUIT BREAKERS

A. Panelboards shall be equipped with circuit breakers with frame size and trip settings as shown on the Drawings.

B. Circuit breakers shall be molded case, bolt-in type.

C. Circuit breakers shall be as manufactured by the panelboard manufacturer.

PART 3 EXECUTION

3.01. INSTALLATION

A. Mount boxes for surface mounted panelboards so there is at least 1/2-in air space between the box and the wall.

B. Connect panelboard branch circuit loads so that the load is distributed as equally as possible between the phase busses.

C. Type circuit directories giving location and nature of load served. Install circuit directories in each panelboard.

D. Install markers on the front cover of all panelboards which identify the voltage rating. Markers shall be made of self sticking B-500 vinyl cloth printed with black characters on an Alert Orange background, 2-1/4-in high by 9-in wide, Style A as manufactured by W.H. Brady Co. or equal.

E. Install a 1-in by 3-in laminated plastic nameplate with 1/4-in white letters on a black background on each panelboard. Nameplate lettering shall be as shown on the Drawings. Nameplates shall be stainless steel screw mounted.

END OF SECTION

SECTION 16480

MOTOR CONTROL CENTER

PART 1 GENERAL

1.01. SCOPE OF WORK

A. Furnish, install and test the motor control center as shown on the Drawings and as specified herein.

1.02. REFERENCE STANDARDS

A. Motor control centers shall be designed, built and tested in accordance with NEMA Standard ICS-2 and Underwriters Laboratories (UL) Standard No. UL-845. Equipment shall conform to ANSI C19.3 test standards and the requirements of the National Electric Code (NEC).

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.03. QUALITY ASSURANCE

A. The motor control center shall be the product of a manufacturer who shall also be the manufacturer of all the circuit breakers, fused switches and motor starters included in the motor control center and who has produced the same type of equipment for a period of at least 15 consecutive years.

B. Motor control center[s] shall be designed, assembled and tested by the manufacturer of the motor control equipment included in the control center assembly.

C. C. All units and sections shall be UL labeled. Motor control centers containing service entrance equipment shall be UL labeled "Suitable For Use As Service Equipment."

1.04. MANUFACTURERS

A. The general arrangement of thE motor control center is shown on the Drawings. Motor control center shall be one of the following products or equal:

1. Cutler-Hammer, “Freedom 2100 Series".

2. General Electric Co., "8000-Line".

3. Square D Corp., "Model 6".

4. Siemens, “Model 95 Plus”.

PART 2 PRODUCTS

2.01. CONSTRUCTION

A. Enclosure

1. Enclosure type shall as noted on the Drawings.

B. Structure

1. Motor control center shall consist of a series of metal enclosed, free-standing, dead front vertical sections bolted together to form double wall construction between sections. Individual vertical sections shall be nominally 90-in high, 20-in wide and 20-in deep unless otherwise shown on the Drawings. Bottom channel sills shall be mounted front and rear of the vertical sections extending the full width of each shipping split. Top of each section shall have removable plates with lifting angle. Make provisions for field installation of additional sections to each end and provide full depth cover plates (rodent barriers) at each end of the motor control center channel sills.

2. 2. Provide continuous top and bottom horizontal wireways extending the full width of the line-up, isolated from the horizontal bus. Provide a 4-in wide, full height, vertical wireway in each section, equipped with a hinged door and cable supports. Vertical wireway shall be isolated from the bus and device compartments. Wireway openings shall have rolled edges or protective grommets.

3. 3. Provide individual, flange formed, pan type door with concealed hinges and quarter turn latches for each device compartment and future space. Doors shall be removable. Door removal shall not be required to withdraw starter units or feeder tap devices.

4. Motor control center shall be designed for against-the-wall mounting. All wiring, bus joints and other mechanical parts requiring tightening or other maintenance shall be accessible from the front or top.

C. Unit Compartments

1. Provide individual compartments for each removable combination starter and feeder tap device unit. Each vertical section shall accommodate a maximum of six compartments. Steel barriers shall isolate the top, bottom and sides of each compartment from adjacent units and wireways. Removable units shall connect to the vertical bus in each section with tin plated, self-aligning, pressure type copper plug connectors. Size 5 and larger starter units may be wired directly to the bus. Removable units shall be aligned in the structure on guide rails or shelves and secured with a cam latch mechanism or racking screw.

2. Provide individual, isolated compartments for fixed mounted devices such as circuit breakers, cable lugs, metering, relaying and control devices. Main and bus tie circuit breakers shall be wired directly to the main horizontal bus. All bus connections shall be fully rated.

3. Provide the following features:

   a. Provision to padlock removable units in a partially withdrawn TEST position, with the bus stabs disengaged.

   b. Provision to padlock unit disconnect handles in the OFF position with up to three padlocks.

   c. Mechanical interlock with bypass to prevent opening unit door with disconnect in the ON position, or moving disconnect to the ON position while the unit door is open.

   d. Mechanical split-type terminal blocks for disconnecting external control wiring.

   e. Auxiliary contact on unit disconnect to isolate control power when fed from an external source.

   f. Disconnect operating handles and control devices mounted on the removable units.

   g. Compartments containing motor starters shall have wiring diagrams and heater tables fastened to the compartment door. Compartments containing panelboards shall have circuit directories fastened to the compartment door. Diagrams, tables and directories shall consist of two ply laminated plastic, with black face and white core.

D. Bus Systems

1. Main horizontal bus: Tin plated copper, bolted joints, accessible from the front of the structure, fully rated throughout the lineup.

2. Vertical section bus: Tin plated copper, full height, totally insulated and isolated by glass polyester barriers with shutters to cover stab openings when units are withdrawn. Provide fishtape barriers to isolate bottom wireways from lower ends of vertical bus.

3. Vertical buses used for a tie circuit breaker or tie feeder lugs shall be rated for a continuous capacity equivalent to the main horizontal bus rating.

4. Horizontal ground bus: Provide a tin plated copper ground bus in each section equipped with lugs for termination of feeder and branch circuit ground conductors. Connect to ground bus in adjacent sections with splice plates.

E. Wiring

1. Wiring: Stranded copper, minimum size No. 14 AWG, with 600 Volt, 90 degree C, flame retardant, Type MTW thermoplastic insulation, NEMA Class II-S, Type B. Line side power wiring shall be sized for the full rating or frame size of the connected device.

2. Identification: All wires shall be numbered with type written heat shrinkable wire markers at each termination point, color coding per NEMA standards and the NEC. Foreign voltage control wiring shall be yellow.

2.02. COMPONENTS

A. General

1. The Drawings indicate the approximate horsepower and intended control scheme of the motor driven equipment. Provide the NEMA size starter, circuit breaker trip ratings, control power transformers and thermal overload heater element ratings matched to the motors and control equipment actually supplied, in compliance with the NEC and the manufacturers' heater selection tables. All variations necessary to accommodate the motors and controls as actually furnished shall be made without extra cost to the Owner.

B. Circuit Breakers

1. Power circuit breakers (400 Amp and larger): 100 percent equipment rated, 600 Volt, molded case circuit breakers with integral fully adjustable solid state trip device. Trip device shall be temperature insensitive and have the following characteristics and functions:

a. Independently adjustable long time pick-up and delay.

b. Independently adjustable short time pick-up and delay with I2t in and out switch.

c. Adjustable instantaneous.

d. Independently adjustable ground fault pick-up and delay.

e. Trip mode targets for over load, short circuit and ground fault.

f. Long time pick-up light.

2. Circuit breakers (less than 400 Amps): Thermal-magnetic trip type, 600 Volt, 2 or 3 Pole as required, labeled in accordance with UL 489. Provide integral current limiting fuses as required to meet the specified equipment short circuit rating. Provide independently adjustable magnetic trips on 225 Amp frame breakers and larger.

C. Branch Circuit Feeder Breakers (Non-motor loads)

1. Molded case circuit breakers: Thermal-magnetic trip type, 600 Volt, 2 or 3 Pole as required, labeled in accordance with UL 489. Circuit breakers shall be fully rated to meet the specified equipment short circuit rating. Provide independently adjustable magnetic trips on 225A frame breakers and larger.

D. Fusible Switches

1. Fused switches: Heavy duty, quick make, quick break, 3 Pole, 600 Volt with visible break contacts, equipped with Class R fuse clips and current limiting fuses.

E. Combination Starter Units

1. Combination starters shall include a motor circuit protector (MCP) in series with a motor controller and an overload protective device. The MCP shall have an adjustable magnetic

trip range up to 1000 percent of rated continuous current and a trip test feature. MCP's shall be labeled in accordance with UL489.

2. Motor starters: 3 Pole, 600 Volt, electrically operated, of the types shown on the Drawings. Provide NEMA sizes as required for the horsepowers shown on the Drawings. Minimum size shall be NEMA Size 1. Fractional size starters are not acceptable. IEC rated starters shall have continuous current ratings equal to or greater than the continuous current ratings listed in Table 2-321-1 of NEMA Standard Publication ICS 2. Starters shall have 120 Volt encapsulated operating coils; individual control power transformers with primary and secondary fuses and silver cadmium oxide renewable line contacts.

3. Multi-speed and reversing starters shall include two motor rated contactors mechanically and electrically interlocked so that only one device may be energized at any time.

4. Reduced voltage starters: Auto-transformer type with closed circuit transition. Auto-transformers shall be dry type with 50, 65 and 80 percent voltage taps and over-temperature protection. Timing relays shall be pneumatic, adjustable. Relay settings shall be approximately 75 percent of relay range.

5. Wye-delta starters shall be closed circuit transition for use with 6 or 12 lead motors.

6. Contactors: Electrically held, 120 VAC coil operator, suitable for tungsten, ballast, or resistive non-motor loads, with over current protection, control transformer and contact ratings and poles as shown on the Drawings.

7. Motor overload protection: Ambient compensated, adjustable, 3 Pole, thermal bi-metallic or melting alloy type, with push-to-test feature. Overload relays for submersible pump motors shall be ambient compensated, quick trip, Class 10. Overload relays shall be manually reset from outside the enclosure by means of an insulated pushbutton. Provide auxiliary alarm contacts where shown on the Drawings.

8. Auxiliary contacts: Form C, NEMA A600 rating, as required by the control schemes on the Drawings. Provide 1-normally open and 1-normally closed spare contacts on each starter. Additional auxiliary contacts shall be furnished as shown on the Drawings or as required by the control schematic and this Section.

9. Control power transformers: Two winding type, 120 VAC secondary, fused in accordance with the NEC. Provide extra capacity as required or where shown on the Drawings.

F. Variable Speed Drives

1. AC Adjustable Frequency Drives: Sine-coded pulse width modulated (PWM), transistorized inverter designed for use with standard induction motors constant or variable torque as required for the load application, with current limiting input fuses, line reactors, circuit breaker disconnect, motor isolation contactor, control transformer overload relays and process signal follower card. Drives shall be UL listed.

2. Service Conditions

   a. Input power: 460 VAC, plus 10 percent, minus 5 percent, 3 Phase, 60 Hz.

b. Input frequency: 57 to 63 Hz.

c. Ambient temperature: 0 to 40 degrees C (Enclosed).

d. Elevation: Up to 3300 feet above mean sea level.

e. Relative humidity: Up to 90 percent non condensing.

f. Enclosure Type 12 air conditioned enclosure

3. Minimum Drive Efficiency: 95 percent or better at 4/4 motor base speed and rated torque.

   a. Efficiencies shall be based on a centrifugal load condition with current proportional to the square of the speed and shall include all control power and cooling system losses associated with the drive.

4. Displacement Power Factor: 0.95 or better at any speed, measured at drive input terminals.

5. Drive Output: 100 percent rated current continuous, suitable for operation of the driven equipment over a 30:1 speed range without overloading or low speed cogging. Drives shall be capable of a continuous overload up to 110 percent rated current and a maximum 150 percent overload for 1 minute. Starting torque shall be matched to the load.

6. Voltage Regulation: plus or minus 1 percent of rated value, no load to full load.

7. Output Frequency Drift: No more than plus or minus 0.5 percent from setpoint.

8. Drives shall withstand five cycle transient voltage dips of up to 15 percent of rated voltage without an undervoltage trip or fault shutdown, while operating a variable torque load.

9. Protection of power semiconductor components shall be accomplished without the use of fast acting semiconductor output fuses. Subjecting the controller to any of the following conditions shall not result in component failure or the need for fuse replacement.

   a. Short circuit at controller output

   b. Ground fault at controller output

   c. Open circuit at controller output

   d. Input undervoltage

   e. DC bus overvoltage

   f. Loss of input phase

   g. AC line switching transients

   h. Instantaneous overload

i. Sustained overload exceeding 115 percent of controller rated current

j. Overtemperature - responsive to a thermal switch in the motor or an overload relay

10. The controller electronics shall contain light emitting diodes (LED's) to monitor and indicate the following conditions.

a. Undervoltage

b. Overvoltage

c. Ground Fault

d. Instantaneous Overcurrent

e. Overtemperature

f. Power UP Delay/Reset

g. Drive Enabled

h. Bus Capacitors Charged

11. Make provisions to accept a remote dry contact closure to start and stop the drive(s) with the drive control system in the AUTO mode.

12. Make provisions to accept a 4-20 mADC input signal for remote speed control. Input shall be isolated at the drive and active with the drive control system in the AUTO mode.

13. Provide a 4-20 mADC isolated output signal proportional to speed for remote speed indication.

14. Provide two sets of Form C auxiliary dry contacts for remote indication of VFD running status.

15. Provide two sets of Form C auxiliary dry contacts for remote indication of VFD fault.

16. Following an over or undervoltage trip, the drive shall automatically restart after a short time delay after the incoming line voltage is within the specified range.

G. Instrumentation and Metering

1. Instrumentation transformers: Indoor, 600 Volt, butyl-rubber molded, metering class designed in accordance with ANSI and NEMA standards. Window type current transformers, with burden capacity as low as 50 VA, may be used where such capacity is sufficient. Current transformer accuracy ratings shall be at least equal to NEMA standard requirements for the particular application.

2. Instrument transducers: Inputs matched to the corresponding metering circuit, 4-20 mADC output, 0.5 percent accuracy, as manufactured by Rochester Instrument Systems or equal.

3. Elapsed time hour meters: Five digit, non-reset type, with 120 Volt synchronous motor.

4. Indicating meters: 2-1/2-in, 2 percent accuracy panel type. Meter types as shown on the Drawings.

5. Instrument control switches: 600 Volt switchboard type, rated 20 Amps continuous, with black molded phenolic escutcheon plates, white characters, General Electric, Type SB-1 or equal.

6. Provide micro-processor based metering units where indicated on the Drawings. Meters shall display all digital values of power such as voltage, current, phases, power factor, kW demands, etc. Meters shall be manufactured by one of the following:

   a. Allen-Bradley - Bulletin 1403LM

   b. Cutler-Hammer - Electronic Company Data Plus series

   c. Square D Company - Power Logic series

   d. Siemens Energy & Automation - Model 4700 series

   e. Or equal

7. Watt-hour meters: Three element, polyphase, drawout type with built-in testing facilities, 15 minute demand attachment, potential indicator lamps, General Electric Type DS, or Cutler-Hammer, Type D4B.

H. Relays and Timers

1. Control relays and timers: 300 Volt, industrial rated, plug-in socket type, housed in a transparent polycarbonate dust cover, designed in accordance with UL Standard 508 for motor controller duty. Continuous contact rating shall be 10 Amps resistive, 1/4 Hp, at 120 VAC, operating temperature minus 10 to plus 55 degrees C. Relays shall be Potter & Brumfield, KRP Series or equal with neon coil indicator light. Timers shall be Agastat, SCC Series or equal, with calibrated timing knob.

2. Panel mounted timers (Provide as noted on the Drawings): Flush mounted, plug-in type, Eagle Signal, Bulletin 125 Cycle-Flex or equal, with ranges as shown on the Drawings.

I. Pilot Devices

1. Control operators: Heavy duty, full size, oiltight, with NEMA A600 contact rating. Types and quantities as shown on the Drawings.

2. Indicator lights: Full size, oiltight, low voltage, with push-to-test feature. Colors and quantities as shown on the Drawings.

J. Miscellaneous Units

1. Bus connected surge protection: Provide "Control Guard" industrial grade suppression filter system as manufactured by Current Technologies, Inc.; Lightning Eliminators and

Consultants, Inc., or equal. The unit shall be designed to occupy a NEMA size 1 MCC compartment, and shall have the following ratings and features:

a. 200 KA single pulse surge capacity per phase.

b. UL 1449 high performance suppression system

c. UL 1283 high frequency extended range power filter

d. UL 845 listed

e. Minimum No. 6 AWG copper conductor in the surge suppression path

f. Maximum Continuous Operating Voltage (MCOV) 115 percent of nominal

g. Status and disturbance indicators

h. Integral fused disconnect switch

2. Power factor correction capacitors: 600 Volt, 3 Phase, with current limiting fuses, discharge resistor, sized to correct motor power factor to approximately 0.95.

3. General purpose transformers: Open, dry-type, with primary and secondary overcurrent protection in accordance with the NEC, size and voltage ratings as shown on the Drawings. Refer to Section 16191 for additional requirements.

4. Lighting and Distribution Panelboards: Main lug only, factory wired to transformer, bolt-on branch circuit breakers, size and voltage rating as shown on the Drawings. Refer to Section 16470 for additional requirements

2.03. SURFACE PREPARATION AND SHOP COATINGS

A. All non-current carrying metal parts of the control center assembly shall be cleaned of all weld spatter and other foreign material and given a heat cured, phosphatized chemical pre-treatment to inhibit rust.

B. Indoor equipment shall be finish painted with one coat of manufacturers' standard electrocoated, heat cured enamel. Color shall be ANSI 49 or 61 light gray.

2.04. SHOP TESTING

A. Perform manufacturers' standard production testing and inspection in accordance with NEMA and ANSI standards. Submit certified copies of the test results and reports.

PART 3 EXECUTION

3.01. INSTALLATION

A. Motor control center floor sill shall be bolted directly to the finished floor or equipment pad. Structure shall be leveled and plumb. Provide hardware and shims for installation.

B. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported so that circuit terminations are not stressed.

C. In general, all conduit entering or leaving a motor control center shall be stubbed up into the bottom horizontal wireway directly below the vertical section in which the conductors are to be terminated, or shall enter the motor control center from the top. Conduits shall not enter the motor control center from the side unless approved in writing by the Engineer.

D. Housekeeping pads shall be included for the motor control centers as detailed on the Drawings with the exception of motor control centers which are to be installed adjacent to an existing unit. Housekeeping pads for these (if used) should match the existing installation.

E. Install the equipment in accordance with the manufacturer's instructions.

F. Remove temporary lifting angles, lugs and shipping braces. Touch-up damaged paint finishes.

G. Make wiring interconnections between shipping splits.

H. Install bus splice plates and torque connections.

I. No operator devices shall be located over 6-ft-6-in above the finished floor. Circuit breaker operation handles more than 6-ft-6-in above the finished floor shall have operating arm extensions.

3.02. FIELD TESTING

A. Make the following minimum tests and checks before the manufacturer's representative is called in for testing and adjustment.

1. Megger incoming line terminals and buses, phase-to-phase and phase-to-ground after disconnecting devices sensitive to megger voltage.

2. Remove current transformer shunts after completing secondary circuit. Check polarity and continuity of metering and relaying circuits.

3. Check mechanical interlocks for proper operation.

4. Test ground connections for continuity and resistance.

5. Adjust unit compartment doors.

6. Check control circuit interlocking and continuity with starters in the TEST position. Provide external source of control power for this test.

7. Adjust motor circuit protectors and voltage trip devices to their correct settings.

8. Install overload heaters or adjust relays for actual motor nameplate currents. If capacitors are installed between starter and motor, use overload relay heaters based on measured motor current.

3.03. CLEANING

A. Remove all rubbish and debris from inside and around the control center. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint-free rags. Do not use compressed air.

END OF SECTION

SECTION 16481
ENGINE GENERATOR

PART 1 GENERAL

1.1 Summary

A This section includes the following items from a single supplier:
1. Engine Generator Set.
2. Enclosure
3. Related Accessories as specified

B Related Requirements
1. It is the intent of this specification to secure an engine-driven generator set that has been prototype tested, factory built, production-tested, and site-tested together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein.
2. Any exceptions to the published specifications shall be subject to the approval of the engineer and submitted minimum 10 days prior to the closing of the bid with a line by line summary description of all the items of compliance, any items that have been are omitted or have been taken exception to, and a complete description of all deviations.
3. It is the intent of this specification to secure a generator set system that has been tested during design verification, in production, and at the final job site. The generator set will be a commercial design and will be complete with all of the necessary accessories for complete installation as shown on the plans, drawings, and specifications herein. The equipment supplied shall meet the requirements of the National Electrical Code and applicable local codes and regulations.
4. All equipment shall be new and of current production by an international, power system manufacturer of generators, transfer switches, and paralleling switchgear. The manufacturer shall be a supplier of a complete and coordinated system. There will be single-source responsibility for warranty, parts, and service through a factory-authorized representative with factory-trained technicians.

1.2 Submittals

A Action Submittals
1. Product Data
   a The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied; schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required interconnection between the generator set, the transfer switch, and the remote annunciator panel if it is included elsewhere in these specifications.

B Informational Submittal
1. Certificates
   a The generator set shall be listed to UL 2200 or submitted to an independent third party certification process to verify compliance as installed.
2. Test and Evaluation Reports

C Closeout Submittal
1. Maintenance Contracts
2. Operation And Maintenance Data
3. Warranty Documentation
4. Record Documentation

1.3 Quality Assurance

A Regulatory Agency

1. The generator set shall conform to the requirements of the following codes and standards:
   a CSA C22.2, No. 14-M91 Industrial Control Equipment.
   b EN50082-2, Electromagnetic Compatibility-Generic Immunity Requirements, Part 2: Industrial.
   c EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
   d IEC8528 part 4, Control Systems for Generator Sets.
   e IEC Std 61000-2 and 61000-3 for susceptibility, 61000-6 radiated and conducted electromagnetic emissions.
   f IEEE446 Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
   g NFPA 70, National Electrical Code, Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
   h NFPA 99, Essential Electrical Systems for Health Care Facilities.
   i NFPA 110, Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit. Component level type tests will not substitute for this requirement.

2. Qualifications
   a The equipment shall be produced by a manufacturer who is ISO 9001 certified for the design, development, production and service of its complete product line.
   b The power system shall be produced by a manufacturer who has produced this type of equipment for a period of at least 10 years and who maintains a service organization available twenty-four hours a day throughout the year.

3. Manufacturers
   a The power system shall be furnished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system. The entire system shall be installed as shown on the plans, drawings, and specifications herein.
   b The basis of design is a Kohler model KD1000. If the supplier wishes to propose equivalent equipment as manufactured by Caterpillar, all additional costs associated with re-engineering and mechanical & electrical modifications to the installation will be at the contractor's expense. The contractor must also supply the details below with his proposal:

      - A line-by-line clarification of the specification marked with "D" for deviation; "E" for exception, and "C" for comply.
      - The weight & outline dimensions of the proposed equipment.

      Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification. No exceptions to the specifications shall be allowed or included in the certification.

1.4 Warranty

A. Manufacturer's Warranty

1. The generator set shall include a standard warranty covering three (3) year unlimited hours whichever occurs first, to guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from the date of initial startup.
2. The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall regularly engage in maintenance contract programs to

perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions; adjustment to the generator set, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and functional tests performed on all systems.

PART 2 PRODUCTS

2.1 Equipment

A Equipment

1. The generator set shall be a Kohler model KD1000 with a KH04070 alternator. It shall provide 1250 kVA and 1000 kW when operating at 277/480 volts, 60 Hz, 0.80 power factor. The generator set shall be capable of a 130°C Standby rating while operating in an ambient condition of less than or equal to 77 °F and a maximum elevation of 500 ft above sea level. The standby rating shall be available for the duration of the outage.

B Engine

1. The minimum 27 liter displacement engine shall deliver a minimum of 1494 HP at a governed engine speed of 1800 rpm, and shall be equipped with the following:
   a. Electronic isochronous governor capable of 0.25% steady-state frequency regulation
   b. 24-volt positive-engagement solenoid shift-starting motor
   c. 140-ampere automatic battery charging alternator with a solid-state voltage regulation
   d. Positive displacement, full-pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain
   e. Dry-type replaceable air cleaner elements for normal applications
   f. Engine-driven or electric fuel-transfer pump including fuel filter and electric solenoid fuel shutoff valve capable of lifting fuel
   g. The turbocharged engine shall be fueled by diesel
   h. The engine shall have a minimum of 12 cylinders and be liquid-cooled
2. The engine shall be EPA certified from the factory
3. The generator must accept rated load in one-step.

C Cooling System

1. The engine shall be liquid-cooled by a closed loop, unit mounted radiator rated to operate the generator set at full load at an ambient temperature of 50 degrees C (122 degrees F). The radiator fan and other rotating engine parts shall be guarded against accidental contact.

D Standard Air Cleaner

1. The air cleaner shall provide engine air filtration which meets the engine manufacturer's specifications under typical operating conditions.

E Battery

1. Each generator set is provided a quantity of two AGM batteries that meets the engine manufactures' specifications for the ambient conditions specified in Part 1 Project Conditions and shall comply with the NFPA requirements for engine cranking cycles. Each battery shall be rated according to SAE Standards J-537 with a minimum cold cranking amp of 1110 amps and a minimum reserve capacity of 380 minutes at 80°F. The battery will contain two handles to aid in lifting and the case must be constructed of polypropylene to resist breakage and extend service life. AGM battery technology utilize an Absorbed Glass Mat and protects the battery's internal components by acting like a shock absorber and blocking vibration and other possible damaging movement.

2. Battery rack and battery cables capable of holding the manufacturer's recommended batteries shall be supplied.

F Housing

1. Level 1 Sound Attenuated Enclosure Weather Enclosure

a The generator set shall be supplied with a Sound Attenuated Enclosure, providing a sound pressure of 77 dB(A) while the generator is operating at 100% load at 7 meters (23 feet) – free field – using acoustic insulation and acoustic-lined inlet hoods, constructed from a minimum of 0.125 inch thick formed heavy duty aluminum panels. The acoustic insulation used shall meet UL 94 HF1 flammability classification. The enclosure shall be manufactured from bolted panels to facilitate service, future modifications, or field replacement. The enclosure shall use external vertical air inlet and outlet hoods with 90 degree angles to discharge air up and reduce noise. The enclosure shall have an integral rodent guard and skid end caps and shall have bracing to meet 241 kph (150 mph) wind loading.

b The enclosure components and skid shall be cleaned with a two-stage alkaline cleaning process to remove grease, grit, and grime from parts. Components shall then be subjected to a Zirconium-based conversion coating process to prepare the metal for electrocoat (e-coat) adhesion. All enclosure parts shall receive an 100% epoxy primer electrocoat (e-coat) with high-edge protection. Following the e-coat process, the parts shall be finish coated with powder baked paint for superior finish, durability, and appearance with a Power ArmorTM industrial finish that provides heavy duty durability in harsh conditions, and is fade-, scratch- and corrosion-resistant.

c The enclosure must surpass a 3,000 hour salt spray corrosion test per ASTM B-1117.

d Enclosures will be finished in the manufacturer's standard color.

e The enclosures shall allow the generator set to operate at full load in an ambient temperature of 50°C with no additional derating of the electrical output of the generator set.

f Enclosures shall be equipped with sufficient side and end doors to allow access for operation, inspection, and service of the unit and all options. Minimum requirements are two doors per side. When the generator set controller faces the rear of the generator set, an additional rear facing door is required. Access to the controller and main line circuit breaker shall meet the requirements of the National Electric Code.

g Doors shall be fitted with hinges, hardware, and the doors shall be removable.

h Doors shall be equipped with lockable latches. Locks shall be keyed alike. Door locks shall be recessed to minimize potential of damage to door/enclosure.

i A duct between the radiator and air outlet shall be provided to prevent re-circulation of hot air.

j The complete exhaust system shall be internal to the enclosure.

k The critical silencer shall be fitted with a tailpipe and rain cap.

l The generator set enclosure shall be furnished with two-(2) DC lights powered by the starting battery on a fused circuit with a 0-60 minute "No-Lock-On" timer.

m The generator set enclosure shall be furnished with the battery charger wired into the load center.

n Basic Electrical Panel –The generator set enclosure shall be furnished with a load center 120/208/240VAC single phase, 100 amp max w/ main and 12 branch circuits. (1) switch control, (3) AC lights vapor tight and gasketed, and (2) duplex GFI receptacles.

o The generator set enclosure shall be furnished with the block heater wired into the load center.

G Fuel oil storage

1. Double Wall Secondary Containment Sub-base Fuel Tank

a The generator set shall be supplied with a sub-base fuel tank of sufficient capacity to hold a minimum of 24 hours of fuel at 100% loading. No less than 1749 gallons of diesel fuel.

b The sub-base fuel system shall be listed under UL 142, subsection entitled Special Purpose Tanks EFVT category, and will bear their mark of UL Approval according to their particular classification.

c The above ground steel secondary containment rectangular tank for use as a sub base for diesel generators is manufactured and intended to be installed in accordance with the Flammable and Combustible Liquids Code—NFPA 30, the Standard for Installation and Use of Stationary Combustible Engine and Gas Turbines—NFPA 37, and Emergency and Standby Power Systems—NFPA 110.

d The primary tank shall be rectangular in shape and constructed in clam shell fashion to ensure maximum structural integrity and allow the use of a full throat fillet weld.

e Steel Channel Support System. Reinforced steel box channel for generator support, with a load rating of 5,000 Ibs. per generator mounting hole location. Full height gussets at either end of channel and at generator mounting holes shall be utilized.

f Exterior Finish. The sub-base tank exterior finish shall be Power Armor PlusTM, a polyurea-textured rubberized coating.

g Normal venting shall be sized in accordance with the American Petroleum Institute Standard No 2000, Venting Atmospheric and Low Pressure Storage Tanks not less than 1-1/4" (3 cm.) nominal inside diameter.

h The emergency vent opening shall be sized to accommodate the total capacity of both normal and emergency venting and shall be not less than that derived from NFPA 30, table 2-8, and based on the wetted surface area of the tank. The wetted area of the tank shall be calculated on the basis of 100 percent of the primary tank. The vent is to be spring-pressure operated: opening pressure is 0.5/psig and full opening pressure is 2.5 psig. The emergency relief vent is to be sized to accommodate the total venting capacity of both normal and emergency vents.

i There shall be a 2" NPT opening within the primary tank and lockable manual fill cap.

j A direct reading, UL listed, magnetic fuel level gauge with a hermetically sealed, vacuum tested dial, to eliminate fogging, shall be provided.

k A float switch for remote or local annunciation of a (50% standard) low fuel level condition shall be supplied.

l Inner Tank Leak Alarm Kit – Includes one light, one horn remote annunciator panel, leak alarm switch and wiring. This kit is intended when the inner tank has leaked into the outer tank, thus indicating a need for a replacement tank.

H Controller

1. Advanced Power Management 603 (APM603) Generator Set Controller
   a. The generator set controller shall be a microprocessor-based control system that will provide automatic starting, system monitoring, and protection.
   b. The controller shall be mounted on the generator set and shall have integral vibration isolation. The controller shall be prototype and reliability tested to ensure operation in the conditions encountered.
2. Codes and Standards
   a. The generator set controller shall meet NFPA 110 Level 1 requirements and shall include an integral alarm horn as required by NFPA.
   b. The controller shall meet NFPA 99 and NEC requirements.
   c. The controller shall be UL 6200 recognized.
   d. The controller shall meet ASTM B117 (salt spray test).
3. Applicability
   a. The controller shall be a standard offering in the manufacturer's controller product line.
   b. The controller's environmental specification shall be: -40°C to 70°C operating temperature range and 5-95% humidity, non-condensing.
   c. The controller front face shall meet an environmental rating of IP65 when mounted properly on the generator.
4. Controller Buttons, Display, and Components
   a. The generator set controller shall include the following features and functions:

1 Master Control Push Buttons – the buttons shall be tactile-feel membrane with an indicator light to initiate the following functions:
    1. Run Mode – when in Run mode the generator set shall start.
    2. Off/Reset Mode – when in Off/Reset mode, the generator set shall not accept any remote start commands and shall be capable of resetting all faults, allowing for the restarting of the generator set after a shutdown.
    3. Auto Mode – when in Auto mode, the generator set shall be ready to accept a signal from a remote device.
2 Control Panel shall include:
    1. Emergency Stop Switch – the latch type stop switch shall be red in color with a "mushroom" type head. Depressing the stop button will immediately stop the generator set and lockout the generator set for any automatic remote starting.
3 Display – the display shall be a 7.5" TFT color touchscreen.
4 Fault Light – the controller shall have an annunciator fault light that glows red for faults and yellow for warnings. The warning light will also illuminate when not in Auto.
5 Alarm Horn – the controller shall provide an alarm horn that sounds when any faults or warnings are present. The horn shall also sound when the controller is not in the Auto mode.
6 Alarm Silence/Lamp Test Button – when this button is held, it shall test all controller lamps. This button will also silence the alarm horn when the unit is not Auto or has a fault.
7 USB Connection – the controller shall have a USB connection port for a storage device that is accessible on the front of the control panel without having to open any electrical enclosure panels on the generator. This connection shall allow for updating of all software and firmware. This connection shall allow for downloading of controller parameter settings and the event log. This connection shall allow for data logging storage. This connection shall allow the ability to capture screenshots.
8 Mini-USB Connection – the controller shall have a mini-USB connection port for a PC connection that is accessible on the front of the control panel without having to open any electrical enclosure panels on the generator. This connection shall allow a certified technician to service the generator controller using a dedicated PC program. The program shall allow for servicing of generator set parameters, faults diagnostics and viewing of controller information. The program shall allow for uploading of software and firmware as well as downloading of parameter settings and the event log.

5. The controller shall have three user level access
    a. User Level – no password required, and user can view all metered values and settings
    b. Operator Level – password required to adjust settings that do not impact the generator
    c. Technician Level – password required to adjust all settings
6. Overview and Favorites
    a. Overview – User shall be able to customize up to 16 gauges for a personalized Home screen that will allow for immediate access to site specific critical data.
    b. Favorites – User shall be able to create their own menu set up with parameters for easy viewing.
7. Load Management
    a. Programmable outputs included to command the connect and disconnect of loads based on generator or paralleling system state:
        1 Under frequency
        2 Start up
        3 Generators online
        4 Priority demands
    b. Supports up to 16 loads per system

1 Can be used on a single generator system
2 Can be combined in a paralleling system for a total system load control capability

c. Simplified load management system view from any generator controller in the system
d. Load control requires the 4 input/15output module (see available options)

8. Controller Engine Control Features and Functions
    a. User-programmable time delay for engine start.
    b. User-programmable time delay engine cool down.
    c. Capability to start and run at user-adjustable idle speed during warm-up for a selectable time-period until engine reaches preprogrammed temperature, or as supported by ECM (Engine Control Module) equipped engine.
    d. The idle function including engine cooldown at idle speed.
    e. Real-time clock and calendar for time stamping of events.
    f. Output with adjustable timer for an ether injection starting system.
    g. Programmable cyclic cranking that can adjust on time, off time, and number of cycles.
9. Controller Alternator Control Features and Functions
    a. Patented High-speed RMS Digital Voltage Regulation – the system shall have integral microprocessor-based voltage regulator system that provides +/- 0.25% voltage regulation no-load to full load with three phase sensing. A separate voltage regulator is not acceptable. The digital voltage regulator shall be applicable to single- or three-phase systems. The system shall be prototype tested and control variation of voltage to frequency. The voltage regulator shall be adjustable at the controller with maximum +/-10% adjustable of nominal voltage.
    b. Alternator Thermal Overload Protection – the system shall have integral alternator overload and short circuit protection matched to each alternator for the particular voltage and phase configuration.
    c. Overcurrent Protective Device– the system shall have a thermal trip, instantaneous trip and maintenance mode per NEC240.87.
10. Other Control Features and Functions
    a. Event Logging – the controller keeps a record of up to 3,000 events with date and time locally for warning and shutdown faults. This event log can be downloaded onto a USB storage device or onto a PC through the service program.
        1 Event Snapshot – the control system shall capture 15 seconds of critical data around the time a fault or warning. This data shall be viewable on the controller and downloadable.
    b. Data Logging – the controller shall allow customized parameters to be logged based on a start trigger from the controller interface.
        1 The parameters are selectable from all monitored parameters.
        2 The sample period shall be configurable from 1 second to 2 hours.
        3 The collected data shall be stored on the controller or on a USB storage device plugged into the control panel.
        4 The collected data shall be displayed on the screen and available for analysis.
11. Control Monitoring Requirements
    a. The generator set shall have alarms and status indication lamps that show non-automatic status, warning, and shutdown conditions. The controller shall indicate with a warning lamp and or alarm and on the digital display screen any shutdown, warning, or engine fault condition that exists in the generator set system. The following alarms and shutdowns shall exist as a minimum:
        1 All monitored functions must be viewable on the control panel display
        2 The following generator set functions shall be monitored:
            1. All output voltages - single phase, three phase, line to line, and line to neutral, 0.25% accuracy
            2. All single phase and three phase currents, 0.25% accuracy
            3. Output frequency, 0.25% accuracy
            4. Power factor by phase with leading/lagging indication

5. Total instantaneous kilowatt loading and kilowatts per phase, 0.5% accuracy
6. kVARS total and per phase, 0.5% accuracy
7. kVA total and per phase, 0.5% accuracy
8. kW hours
9. A display of percent generator set duty level (actual kW loading divided by the kW rating)

3 Engine parameters listed below shall be monitored: (*are adjustable)
1. Engine Speed*
2. Oil Pressure
3. Coolant Temperature
4. Runtime Hours
5. Fuel Pressure
6. Fuel Consumption Rate

4 Operational records shall be stored in the control beginning at system startup
1. Total Run Time Hours
2. Total Loaded Hours
3. Total Unloaded Hours
4. Total kW Hours
5. Controller Hours
6. Controller Run Time Hours
7. ECM Run Time Hours
8. Number of Starts
9. Number of Crank Attempts
10. Last Crank Duration
11. Last Start Runtime Duration
12. Last Start Time of Day
13. Last Start Date (Day)
14. Last Start Date (Month)
15. Last Start Date (Year)
16. Last Stop Time of Day
17. Last Stop Date (Day)
18. Last Stop Date (Month)
19. Last Stop Date (Year)

5 The following operational records shall be resettable for maintenance purposes:
1. Total Run Time Since Maintenance
2. Loaded Hours Since Maintenance
3. Unloaded Hours Since Maintenance
4. kW Hours Since Maintenance
5. Reset Maintenance Records

6 For maintenance and service purposes, the controller shall store and display on demand the information:
1. Generator Model
2. Generator Serial Number
3. ECM Serial Number
4. Alternator Part Number
5. Engine Model Number
6. Engine Serial Number
7. Controller Serial Number
8. Firmware Version

7 The controller shall support a variety of maintenance parameters including:
1. Last Start Time o Day
2. ScreenshotCount
3. ECM Runtime Hours
4. Controller Runtime Hours

5. Last Stop Date (Month)
6. Last Start Time of Day
7. Last Stop Date (Day)
8. Last Start Date (Day)
9. Number of Starts
10. Last Stop Time of Day
11. Last Stop Time of Day
12. Controller Hours
13. Number of Crank Attempts
14. Last Crank Duration
15. Last Start Runtime Duration
16. Last Start Time of Day
17. Last Start Time of Day
18. Last Start Date (Month)
19. Last Start Date (Year)
20. Last Stop Time of Day
21. Last Stop Time of Day
22. Last Stop Date (Year)

12. Generator Set Warning, Shutdown Alarm and Status
    a. The generator set shall have alarms and status indication lamps that show Non-Automatic Status, Warning, and Shutdown conditions. The controller shall indicate with a warning lamp and/or alarm, and on the digital display screen any shutdown, warning, or engine fault condition that exists in the generator set system. The following alarms and shutdowns shall exist as a minimum:
        1 OverCrank Shutdown
        2 UnderFrequency Shutdown
        3 OverFrequency Shutdown
        4 OverPower Shutdown
        5 Low Oil Pressure Shutdown
        6 High Coolant Temperature Shutdown
        7 Local Emergency Stop Shutdown
        8 Remote Emergency Stop Shutdown
        9 OverSpeed Shutdown
        10 Loss ECM Comms Shutdown
        11 ECM Mismatch Shutdown
        12 High Oil Temperature Shutdown
        13 Alternator Protection Shutdown
        14 Protective Relay Shutdown OverPower
        15 Protective Relay Shutdown OverCurrent
        16 Protective Relay Shutdown Reverse VAR
        17 Protective Relay Shutdown ReversePower
        18 UnderVoltage Shutdown (L-L, L-N, each phase)
        19 OverVoltage Shutdown (L-L, L-N, each phase)
        20 OverCurrent Shutdown
        21 Excitation Overvoltage Shutdown
        22 Low Fuel Level Shutdown
        23 Low Coolant Level Shutdown
        24 Generator Over Power Shutdown
    b. Conditions resulting in generator warning (generator will continue to operate):
        1 UnderFrequency Warning
        2 OverFrequency Warning
        3 OverPower Warning
        4 Low Oil Pressure Warning
        5 Low Coolant Temperature Warning

6 High Coolant Temperature Warning
7 Low Battery Voltage Warning
8 High Battery Voltage Warning
9 Battery Charger Fault Warning
10 High Oil Temperature Warning
11 GFCI Warning
12 UnderVoltage Warning (L-L, L-N, each phase)
13 Overvoltage Warning (L-L, L-N, each phase)
14 OverCurrent Warning
15 High Fuel Level Warning
16 Low Fuel Level Warning
17 Critically Low Fuel Level Warning
18 Generator Over Power Warning

13. Inputs and Outputs
    a. Standard Dedicated User Inputs – the controller shall have dedicated inputs for:
        1 Two-Wire Input
            1. Remote Engine Start
        2 Digital Input
            1. Auxiliary Fault (Shutdown)
            2. Auxiliary Warning
            3. Battery Charger Fault
            4. Breaker Close
            5. Breaker Trip
            6. Coolant Temperature
            7. Excitation Over Voltage
            8. Fuel Level
            9. Fuel Leak Alarm
            10. Low Fuel Level Switch
            11. Ground Fault Relay
            12. Remote Emergency Stop
            13. Local Emergency Stop
        3 Analog Voltage Input – Scalable Up To +- 10 VDC
            1. Speed Bias
            2. Voltage Bias
    b. Standard Dedicated User Outputs – the controller shall have dedicated inputs for:
        1 Relay Driver Output
            1. Run
            2. Crank
            3. Horn
            4. Common Failure
            5. Common Warning
            6. High Coolant Temperature
            7. Close Breaker
            8. Trip Breaker
    c. Optional Configurable User Inputs and Outputs
        1 User Configurable Inputs
            1. 2 Analog, 0-5 VDC
            2. 4 Dry Contact Digital
        2 User Configurable Relay Outputs
            1. 14 NO/NC Relays
            2. 1 Common Fault Relay
    d. PLC-like capability for applying logic to customize generator system behavior.

14. Communications
    a. CAN
        1 If the generator set engine is equipped with an ECM, the controller shall communicate with the ECM for control, monitoring, diagnosis, and meet SAE J1939 standards.
    b. Modbus®
        1 Non-isolated for RSA III
        2 Isolated for Modbus devices
        3 Isolated for paralleling communication
        4 RJ45 for Modbus TCP, SNMP, and BACnet
    c. Simple Network Management Protocol (SNMP)
        1 Industry standard SNMP communication shall be available.
        2 The controller shall support SNMP communication via an RJ-45 Ethernet connection.
    d. BACnet®
        1 Industry standard BACnet® communication shall be available.
        2 The controller shall support BACnet® communication via an RJ-45 Ethernet connection.
    e. Communication Connections
        1 All communication connections shall be accessible in a dedicated customer connection area that is separated from factory wiring into the controller to prevent field connections from interfering with factory wiring.
        2 The controller shall not require any additional hardware to support Modbus®, SNMP or BACnet® communication.
15. Generator Management
    a. Allows the start and stop of generators based on load demand or state of other generators including:
        1. Start Power
        2. Stop Power
        3. Start Accumulator
        4. Stop Accumulator
        5. Total Online Capacity
        6. Total Available Capacity
        7. Total Bus Power
        8. Total Bus Capacity
        9. Negotiated Order
        10. Stopped by Gen Management
        11. Start Command
    b. The controller shall have a programmable disconnect point (kW) below which point the controller shall automatically trip the generator circuit breaker.
16. Protective Relays
    a. The controller shall provide a standard set of protective relay functions with programmable limits and time delays
        1 Over Voltage (59)
            1. User adjustable range – 100% to 130%
            2. User adjustable range time delay – 0 to 120 seconds
        2 Under Voltage (27)
            1. User adjustable range – 70% to 100%
            2. User adjustable time delay – 0 to 120 seconds
        3 Over Frequency (81O)
            1. User adjustable range – 100% to 140%
            2. User adjustable time delay – 0 to 120 seconds
        4 Reverse Power (32R)
            1. User adjustable range – 0% to 50%

2. User adjustable time delay – 0 to 120 seconds

5 Over Power (32O)
   1. User adjustable range – 90% to 150%
   2. User adjustable time delay – 0 to 120 seconds

6 Loss of Field (40 Reverse VARS)
   1. User adjustable range – 10% to 100%
   2. User adjustable time delays – 0 to 120 seconds

7 Over Current with Voltage Range
   1. User adjustable range – 100% to 200%
   2. User adjustable time delay – 0 to 120 seconds

I Generator Overcurrent and Fault Protection

1. The generator shall be provided with a factory installed, 100% rated line circuit breaker rated at 1500 amperes that is UL489 listed. Line circuit breakers shall be sized for the rated ampacity of the loads served by the breaker per the NEC.
2. The circuit breaker(s) shall incorporate an electronic trip unit.
3. Load side lugs shall be provided from the factory. Load side breaker connections made at the factory shall be separated from field connections.
4. The shunt trip device shall be connected to trip the generator breaker when the generator-set is shut down by other protective devices.

J Alternator

1. The alternator shall be salient-pole, brushless, 2/3-pitch, with 4 bus bar provision for external connections, self-ventilated, with drip-proof construction and amortisseur rotor windings, and skewed for smooth voltage waveform. The ratings shall meet the NEMA standard (MG1-32.40) temperature rise limits. The insulation shall be class H per UL1446 and the varnish shall be a vacuum pressure impregnated, fungus resistant epoxy. Temperature rise of the rotor and stator shall be limited to 130°C Standby. The PMG based excitation system shall be of brushless construction controlled by a digital, three phase sensing, solid- state, voltage regulator. The AVR shall be capable of proper operation under severe nonlinear loads and provide individual adjustments for voltage range, stability and volts-per-hertz operations. The AVR shall be protected from the environment by conformal coating. The waveform harmonic distortion shall not exceed 5% total RMS measured line-to-line at full rated load. The TIF factor shall not exceed 50.
2. The alternator shall have a maintenance-free bearing, designed for 40000 hour B10 life. The alternator shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.
3. The generator shall be inherently capable of sustaining at least 300% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current-support devices.
4. Motor starting performance and voltage dip determinations shall be based on the complete generator set. The generator set shall be capable of supplying 3774 LRKVA for starting motor loads with a maximum instantaneous voltage dip of 35%, as measured by a digital RMS transient recorder in accordance with IEEE Standard 115. Motor starting performance and voltage dip determination that does not account for all components affecting total voltage dip, i.e., engine, alternator, voltage regulator, and governor will not be acceptable. As such, the generator set shall be prototype tested to optimize and determine performance as a generator set system.

K Vibration Isolation

1. Vibration isolators shall be provided between the engine-alternator and heavy-duty steel base.

2.2 Accessories

A. The generator set shall be supplied with a 20-ampere automatic float/equalize battery charger capable of charging lead-acid, nickel-cadmium, and VRLA (gel-cell and AGM) type batteries, with the following features:
   1. Automatic 3-stage charge cycle for up to three independent batteries simultaneously per charger
   2. Load regulation of less than +/- 0.5%
   3. LCD Digital Display: AC Input Voltmeter, DC Output Voltmeter and Ammeter (1%)
   4. LED lamp indicator for: Current Limit, AC ON, and Charger Fail
   5. Filtered output for gel-cell and AGM batteries
   6. Temperature compensation with ambient operating conditions of -40°C to 50°C and derated up to 70°C
   7. LED alarm indicator for charger failure with form "C" dry type relay contacts
   8. Redundant chargers will double the standard configuration
   9. UL 1236 Listed
   10. Meets ANSI C62.41

B. CE Certified Battery rack and battery cables capable of holding the manufacturer's recommended batteries shall be supplied.

C. The air cleaner restriction indicator shall indicate the need for maintenance of the air cleaners.

D. The generator shall be equipped with a crankcase vent. The fumes coming from the vent (Blow-by) will need to be contained with the solids being separated and collected while the gases are being released back into the engine.

E. The generator set shall be furnished with rodent guards to prevent rodent intrusion and protect internal components.

F. The exhaust piping shall be gas proof, seamless, stainless steel, flexible exhaust bellows and includes the flex exhaust tube and the mounting hardware.

G. Block Heater - The block heater shall be thermostatically controlled, 6000 watt, 240 VAC - single phase, to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA 99 and NFPA 110, Level 1.

H. Supply flexible fuel lines to provide a flexible connection between the engine fuel fittings and the fuel supply tank piping and for the fuel return lines from the injector pump per engine manufacturer's recommendations. Flex line shall have a protective steel wire braid to protect the hose from abrasion.

2.3 Source Quality Control

A. Non-Conforming Work

1. To ensure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

a. **Design Prototype Tests.** Components of the emergency system, such as the engine/generator set, transfer switch, and accessories, shall not be subjected to prototype tests because the tests are potentially damaging. Rather, similar design prototypes and preproduction models shall be subject to the following tests:
   i. Maximum power (kW)
   ii. Maximum motor starting (kVA) at 35% instantaneous voltage dip.
   iii. Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-32.6.
   iv. Governor speed regulation under steady-state and transient conditions.
   v. Voltage regulation and generator transient response.

vi. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
vii. Three-phase short circuit tests.
viii. Alternator cooling air flow.
ix. Torsional analysis to verify that the generator set is free of harmful torsional stresses.
x. Endurance testing.

b. **Final Production Tests.** Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
   i. Single-step load pickup
   ii. Safety shutdown device testing
   iii. Rated Power @ 0.8 PF
   iv. Maximum power
   v. Upon request, a witness test, or a certified test record sent prior to shipment.

c. **Site Tests.** The manufacturer's distribution representative shall perform an installation check, startup, and building load test. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:
   i. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
   ii. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery chargers, alternator strip heaters, remote annunciators, etc.
   iii. Generator set startup under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during operation, normal and emergency line-to-line voltage and frequency, and phase rotation.
   iv. Automatic start by means of a simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator set voltage, amperes, and frequency shall be monitored throughout the test.
   v. Load bank testing. The test shall consist of four hours of continuous operation using a portable resistive load bank. Adjust the load bank load to provide one half hour each at zero load, 25 percent, 50 percent, and 75 percent of full load. Followed by two hours of operation at rated standby load. Furnish the portable load bank, all connecting cables, metering equipment, and other equipment or devices required to perform the on-site testing. During the test, readings shall be taken every 15 minutes showing % load, voltage, amps, oil pressure, water temperature, and battery charge.

END OF SECTION

SECTION 16500

LIGHTING SYSTEM

PART 1 GENERAL

1.01. SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install a complete lighting system ready for operation as shown on the Drawings and as specified herein.

1.02. REFERENCE STANDARDS

A. All lighting fixtures shall be in accordance with the National Fire Protection Association (NFPA) NFPA 70 "National Electrical Code" (NEC) and shall be constructed in accordance with the latest edition of the Underwriters Laboratories (UL) "Standards for Safety, Electric Lighting Fixtures."

B. All lighting fixtures shall be UL labeled. Lighting equipment shall comply with UL standards pertaining to luminaires including: UL 1570 Fluorescent Lighting Fixtures; UL 1598 HID Lighting Fixtures; UL 1029 HID Ballasts; UL 542 Lampholders, Starters and Starter Holders for Fluorescent Lamps and UL 844 Standard for Electric Lighting Fixtures for Use in Hazardous (Classified) Locations

PART 2 PRODUCTS

2.01. MATERIALS

A. Luminaires (Lighting Fixtures)

1. Luminaire types shall be furnished as required by the "Lighting Fixture Schedule" on the Drawings. The catalog numbers are given as a guide to the design and quality of fixture desired.

PART 3 EXECUTION

3.01. INSTALLATION

A. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for connection to the branch circuit wires at the outlet.

B. All flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.

C. Fixtures noted to be installed flush in suspended ceilings shall be of mounting types suited for the type ceiling involved. It shall be the responsibility of the electrical contractor to verify the ceiling types prior to ordering fixtures.

D. Flexible fixture hangers shall be used for all pendant mounted fixtures. Fixtures 2-ft long and larger shall be supported with a minimum of two fixture hangers.

E. Conduit run in areas with hung ceilings shall be installed in the space above the hung ceiling as close to the structure as possible. Conduits shall be supported from the structure.

F. Exterior lighting poles shall be mounted plumb.

G. Fixture locations are shown on the Drawings in approximate locations; however exact locations shall be coordinated so as to avoid conflicts with HVAC ducts, equipment and other obstacles.

H. Where the Drawings state a particular mounting height, it shall imply that the bottom of the fixture shall be mounted at the stated mounting height above the finished floor, unless specifically noted otherwise.

I. The minimum mounting height for the bottom of lights and exit signs shall be 80-in above the finished floor in compliance with Americans with Disabilities Act (ADA).

3.02. CLEANING UP

A. Plastic dust cover bags to be provided with new parabolic reflector lighting fixtures shall be removed after all construction activity that may cause dust formation on reflector surfaces has been completed.

B. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

END OF SECTION

SECTION 16600

UNDERGROUND SYSTEM

PART 1 GENERAL

1.01. SCOPE OF WORK

A. Furnish and install a complete underground system of raceways, manholes and handholes as shown on the Drawings and as specified herein.

B. All underground systems shall be encased as shown on the drawings.

C. The Contractor shall be responsible for setting manholes and handholes at the proper elevation such that the pitch of raceways will be towards manholes and handholes and away from structures, vaults and buildings.

D. Where referred in this Section, raceways are underground conduits – Ductbanks are a collection of underground raceways. Underground system is the collection of underground raceways, manholes and handholes.

E. Ductbanks shall be constructed as shown on the drawings up to the building, structure, vault, manhole and handhole.

1. Ductbank, manhole and handhole depths vary. Coordinate with other utilities, yard piping, yard structures and field conditions to determine required depths and install raceways, manholes and handholes at that required depth at no additional cost to the Owner.

2. Ductbank routing and manhole/handhole locations shown on the Drawings are diagrammatically depicted. Coordinate with other utilities, yard piping, yard structures and field conditions to determine required paths and depths at no additional cost to the Owner.

PART 2 PRODUCTS

2.01. MATERIALS

A. Raceways shall be polyvinyl chloride conduit.

B. Cable racks, supports, pulling-in irons, manhole steps and hardware shall be galvanized steel as manufactured by Line Materials Co.; Underground Devices, Inc.; Chance or equal.

C. Precast manholes and handholes shall be designed as specified below for precast concrete structures.

1. Provide lifting lugs in each precast section for handling.

2. All sections, flat slab tops and grade rings shall conform to ASTM C478.

3. Base, riser and transition top sections shall have tongue and groove joints.

4. Compressive strength for shipping shall be 4000 psi.

5. Design precast concrete base, riser, transition top, flat slab top and grade ring for a minimum H-20 loading plus earth load. Earth load shall be calculated from the future grade indicated as final grade with a unit weight of 130 pcf.

6. The date of manufacture, name and trademark of manufacturer shall be marked on the inside of each precast section.

7. Provide integrally cast knock-out panels in precast concrete manhole and handhole sections at locations indicated and with sizes indicated. Knock-out panels shall have no steel reinforcing.

8. Seal tongue and groove joints of precast manhole and handhole sections with rubber O-ring gasket. O-ring gasket shall conform to ASTM C443. In lieu of the O-ring gasket, a flexible joint sealant may be used. Sealant shall be Kent Seal No. 2; Con Seal No. 2; Ram-Nek or equal. Completed joints shall withstand 15 psi internal water pressure without leakage or displacement of gasket or sealant.

9. Dampproofing shall be Hydrocide 648 by Sonneborn Building Products; Dehydratine 4 by A.C. Horn, Inc.; RIW Marine Liquid by Toch Bothers, or equal.

D. Handholes shall be precast concrete, heavy-duty type, designed for a Class H-20 wheel load and conform to ASTM C478. Precast units shall be as manufactured by Chase Precast Corp.; Rotondo; American Precast Co. or equal and constructed to dimensions as shown on the Drawings.

E. Manhole and handhole frames and covers shall be cast iron, heavy duty type for Class H-20 wheel loading as manufactured by Neenah; LeBaron; Vulcan or equal. Covers shall be marked and sized as shown on the Drawings.

F. Ground rods and other grounding materials and methods shall be as specified.

G. Bell ends and plastic duct spacers shall be as manufactured by Carlon; Underground Devices Inc. or equal.

H. Pull line for spare conduits shall be 1/8-in nylon rope.

I. Detectable Warning Tape

1. Each duckbank section shall be marked by means of a detectable warning tape (tracer tape) as shown on the Drawings. The detectable warning tape shall be capable of being detected or located by either conductive or inductive location techniques.

2. The detectable warning tape shall consist of 5 mil (.005-in) overall thickness; five-ply composition; ultra-high molecular weight; virgin polyethylene; acid; alkaline and corrosion resistant; with 150 pounds of tensile break strength minimum per 6-in width.

3. The top side of the tracer tape shall be color banded red for electrical and high voltage lines, and orange for signal, communication, telephone and fire alarm lines. Tracer tape shall be 4-in wide with four color bands. The tape shall be inscribed with the warning

message for the utility such as "CAUTION – ELECTRICAL LINED BURIED BELOW". Tape shall be as manufactured by Mutual Industries, Inc.; Terra Tape, Div. of Reef Industries Inc. or equal.

PART 3 EXECUTION

3.01. INSTALLATION

A. Install raceways to drain away from buildings. Raceways between manholes or handholes shall drain toward the manholes or handholes. Raceway slopes shall not be less than 3-in per 100-ft.

B. Use plastic spacers located not more than 4-ft apart to hold raceways in place. Spacers shall provide not less than 2-in clearance between raceways and edge of envelope.

C. The minimum cover for raceway banks shall be 24-in unless otherwise permitted by the Engineer.

D. Raceway terminations at manholes shall be with end bells for PVC conduit and insulated throat grounding bushings for steel conduit.

E. Where bends in raceways are required, use long radius elbows, sweeps and offsets.

F. Swab all raceways clean before installing cable.

G. Plug and seal spare raceways watertight at all manholes, buildings and structures.

H. Seal the ends of raceways and make watertight at all manholes, buildings and structures.

I. Install pulling-in irons opposite all raceway entrances to manholes.

J. Train cables in manholes and handholes and support and restrain them on racks and hooks. Furnish inserts on all manhole and handhole walls for mounting future racks as well as racks required for present installation.

K. PVC Coated Rigid galvanized steel conduit shall be used for elbows and risers at the utility pole for electrical and telephone service conduits.

L. PVC coated rigid galvanized steel elbows shall be used for pad-mounted transformer stub-ups and all stub-ups through concrete floors, walls and slabs.

M. A pull line shall be installed and left in all spare raceways.

N. Install detectable warning tape in all ductbanks as shown on the Drawings. Where trench exceeds 24-in width, provide additional detectable tape runs to mark each side of the ductbank in addition to the one in the center.

O. Manhole and Handhole Installation

1. Place bases on bed of 12-in screened gravel. Set base grade so that a minimum grade adjustment of 4-in of brickwork is required to bring the manhole and handhole frame and cover to final grade.

a. Use precast concrete grade rings or brick and non-shrink mortar to adjust frame and cover to final grade.

2. Set precast sections plumb with a 1/4-in maximum out-of-plumb tolerance. Seal joints of precast sections with either a rubber O-ring set in a recess or a flexible joint sealant used in sufficient quantity to fill 75 percent of the joint cavity. Fill the outside and inside joint with non-shrink grout and finished flush with the adjoining surfaces. Caulk the inside of leaking barrel section joints with lead wool or non-shrink grout. If leaks appear in the manholes or handholes the inside joints shall be cleaned out and remade in a manner that will result in a watertight joint.

3. Allow joints to set for 24 hours before backfilling. Backfilling shall be performed by bringing the fill up evenly on all sides.

4. Plug holes in concrete with non-shrink grout or non-shrink grout in combination with concrete plugs. Finish flush on the inside.

5. Cut holes in precast sections to accommodate conduits prior to setting manhole and handhole sections in place.

3.02. CLEANING

A. All new manholes and handholes shall be thoroughly cleaned of all silt, debris and foreign matter prior to final inspection.

END OF SECTION

SECTION 16660

GROUNDING SYSTEM

PART 1 GENERAL

1.01. SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code NEC.

B. All raceways, conduits, ducts and multi-conductor cables shall contain equipment grounding conductors sized in accordance with the NEC. Minimum sizes shall be No. 12 AWG.

1.02. A supplemental grounding conductor shall be provided from each switchgear, switchboard, motor control center, power panelboard, lighting panelboard, to the buried ground grid. Supplemental grounding conductors shall be installed in PVC Schedule 80 conduit.

PART 2 PRODUCTS

2.01. MATERIALS

A. Conduit shall be as specified under Section 16110.

B. Wire shall be as specified under Section 16120.

C. Ground rods shall be 3/4-in by 10-ft copper clad steel and constructed in accordance with UL 467. The minimum copper thickness shall be 0.25 mm. Ground rods shall be Copperweld; Blackburn; Erico, Inc. or equal.

D. Grounding conduit hubs shall be malleable iron type, and of the correct size for the conduit, as manufactured by Thomas & Betts Co.; Catalog No. 3940 Series, similar by Burndy; O.Z. Gedney Co. or equal.

E. Water pipe ground clamps shall be cast bronze saddle type, and of the correct size for the pipe, as manufactured by Thomas & Betts Co. Cat. No. 2 (1/2-in, 3/4-in, or 1-in size), similar by Burndy; O.Z. Gedney Co. or equal and of the correct size for the pipe.

F. Buried grounding connections shall be by Cadweld process, or equal exothermic welding system.

1. Molds, cartridge materials and accessories shall be provided in kit form and selected per the manufacturer's written instructions for specific types, sizes and combinations of conductors and connected items. Molds and powder shall be furnished by the same manufacturer.

PART 3 EXECUTION

3.01. INSTALLATION

A. Run grounding electrode conductors in rigid steel conduits. Bond the protecting conduits to the grounding electrode conductors at both ends. Do not allow water pipe connections to be painted. If the connections are painted, dis-assemble them and re-make them with new fittings.

B. Install equipment grounding conductors with all feeders and branch circuits.

C. Bond all steel building columns in new structures together with ground wire in rigid conduit and connect to the distribution equipment ground bus, as shown on the Drawings.

D. Ground wire connections to structural steel columns shall be made with exothermic welds.

E. Metal conduits stubbed into a motor control center or floor mounted electrical enclosure shall be terminated with insulated grounding bushings and connected to the motor control center or electrical enclosure ground bus. Bond boxes mounted below motor control centers to the motor control center ground bus. Size the grounding wire in accordance with NEC Table 250-122, except that a minimum No. 12 AWG shall be used.

F. Liquid tight flexible metal conduit in sizes 1-1/2-in and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled) and fastened with plastic tie wraps.

G. Ground transformer neutrals to the nearest available grounding electrode with a conductor sized in accordance with NEC Article 250-66.

H. Drive grounding electrodes as shown on the Drawings.

I. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel and all other equipment and materials required by the NEC to be grounded, shall be grounded and bonded in accordance with the NEC.

J. Seal exposed connections between different metals with No-Oxide Paint Grade A or equal.

K. Ground metal poles supporting outdoor lighting fixtures to a supplemental grounding electrode (rod) in addition to the separate equipment grounding conductor run with the supply branch circuit.

L. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate in accordance with NEC Paragraph 250.52 using a minimum of 20-ft of bare copper conductor not smaller than No. 4 AWG. Where base of foundation is less than 20-ft in length, coil excess conductor within base of concrete foundation. Extend grounding conductor below grade and connect to building grounding grid, ground loop, or grounding electrode external to concrete.

M. Install driven ground rods in manholes and handholes close to wall and set rod depth so 4-in will extend above finished floor. Protect ground rods with double wrapping of pressure-sensitive tape or heat shrunk insulating sleeve from 2-in above to 6-in below concrete floor.

Seal floor opening with waterproof, non-shrink grout. Where ground rods are installed outside of manhole or handhole, provide a No. 4/0 AWG bare, tinned copper conductor from ground rod into manhole or handhole through a waterproof sleeve in the wall.

3.02. INSPECTION AND TESTING

A. Inspect the grounding and bonding system conductors and connections for tightness and proper installation.

B. Use Biddle Direct Reading Earth Resistance Tester or equivalent test instrument to measure resistance to ground of the system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

C. Resistance to ground testing shall be performed during dry season. Submit test results in the form of a graph showing the number of points measured (12 minimum) and the numerical resistance to ground.

D. Testing shall be performed before energizing the distribution system.

E. Test all grounded cases and metal parts associated with the electrical equipment for continuity with the ground system.

F. Notify the Engineer immediately if the resistance to ground for any building or system is greater than five ohms.

END OF SECTION

Appendix No. 1

Geotechnical Report

GEOTECHNICAL ENGINEERING REPORT
PROPOSED NEW PROCESS BUILDING
800 SOUTH KICKAPOO STREET
SHAWNEE, OKLAHOMA

PROJECT NO. G2020022

March 16, 2020

GFAC ENGINEERING INC.

8157 East 46th Street

Tulsa, Oklahoma 74145

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March 16, 2020
Project No.: G2020022

Mr. Jay Updike, P.E.
Holloway, Updike and Bellen, Inc.
818 East Side Boulevard
Muskogee, Oklahoma 74402

Subject: Geotechnical Engineering Report
Proposed New Process Building
800 South Kickapoo Street
Shawnee, Oklahoma

Dear Mr. Updike:

GFAC Engineering Inc. has completed the authorized geotechnical engineering evaluation for the above-referenced project. The purpose of the geotechnical study was to explore and evaluate the subsurface conditions at one location on the site and develop geotechnical design and construction recommendations for the project. The attached GFAC Engineering Inc. report contains a description of the findings of our field exploration and laboratory testing program, our engineering interpretation of the results with respect to the project characteristics, and our geotechnical site development and foundation design recommendations as well as construction guidelines for the planned project.

Recommendations provided herein are contingent on the provisions outlined in the ADDITIONAL SERVICES and LIMITATIONS sections of this report. The project Owner should become familiar with these provisions in order to assess further involvement by GFAC Engineering Inc. and other potential impacts to the proposed project.

We appreciate the opportunity to be of service and are prepared to provide the recommended additional services. Please call us if you have any questions concerning this report.

Respectfully submitted,
GFAC ENGINEERING INC
Certificate of Authorization #6389; Exp. 6/30/2020

Brian K. Marick, P.E.
Oklahoma: 21240

LICENSED PROFESSIONAL ENGINEER
BRIAN K. MARICK
No. 21240
3/16/20
OKLAHOMA

Dale L. Kelley II, P.E.
Senior Project Engineer

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Plate 1 – Site Vicinity Map
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GEOTECHNICAL ENGINEERING REPORT
PROPOSED NEW PROCESS BUILDING
800 SOUTH KICKAPOO STREET
SHAWNEE, OKLAHOMA
GFAC ENGINEERING INC. PROJECT NO. G2020022
EXECUTIVE SUMMARY

Site:

- The project site is located at the existing water treatment plant at 800 South Kickapoo Street in Shawnee, Oklahoma.
- The subsurface conditions consist of existing fill material extending to approximate depths ranging from 9.4 to 20.3 feet (Elevation 1012.2 to 1015.8 feet). Existing fill materials consisted of various combinations of lean clay, sandy lean clay, sandy silt, and silty sand.
- Wood, asphaltic concrete, broken concrete, concrete with reinforcing steel, was encountered within the existing fill material in all of the borings.
- Sandstone and shale bedrock was encountered at an approximate depth ranging from 13.1 to 27.9 feet (Elevation 1006.87 to 1014.64 feet) below the existing ground surface level.
- Groundwater was encountered in Borings, BH-1, BH-2, and BH-4 at depths of 7.6, 17.9, and 9.4 feet (respectively) below the existing ground surface.

Foundations:

- The site is suitable for support of the proposed structure on a shallow foundation system bearing in/on sandstone and shale bedrock.
- Allowable foundation bearing pressure: 7,500 psf in/on sandstone and shale bedrock.

The information stated above is a brief summary of the recommendations presented within this report. The report should be reviewed in its entirety for proper implementation of the recommendations.

GEOTECHNICAL ENGINEERING REPORT
PROPOSED NEW PROCESS BUILDING
800 SOUTH KICKAPOO STREET
SHAWNEE, OKLAHOMA

1. INTRODUCTION

1.1 GENERAL

GFAC Engineering Inc. has completed the authorized geotechnical engineering evaluation for the proposed New Process Building to be constructed at the existing facility located at 800 South Kickapoo Street in Shawnee, Oklahoma. This report includes our recommendations related to the geotechnical aspects of the project design and construction. Conclusions and recommendations presented in the report are based on the subsurface information encountered at the location of our exploration and the provisions and requirements outlined in the ADDITIONAL SERVICES and LIMITATIONS sections of this report.

1.2 PROPOSED CONSTRUCTION

It is our understanding that two new structures will be constructed at the site. Specific information pertaining to the structures have not been provided. It is our understanding that the north structure (Borings BH-1 and BH-2) will have a finished floor elevation of approximately 1012 feet, and the south structure (Borings BH-3 through BH-6) will have a finished floor elevation of 1008 feet. The proposed structures will have shallow foundations, and cast-in-place below grade concrete walls. The super structure is anticipated to have a steel frame and masonry and metal exterior.

A grading plan was not available at the time this proposal was prepared. Information regarding proposed grades at the site was not provided. We anticipate that maximum cuts and fills on the order of 2 feet will be required to achieve finish grades at the project site.

Recommendations related to the design of pavements, retention/detention basins, retaining walls, embankment slopes, and slope stability are beyond the scope of services for this study.

The scope of the engineering evaluation for this study, as well as the conclusions and recommendations in this report, were based on our understanding of the project as described above. If pertinent details of the project have changed or otherwise differ from our descriptions, we must be notified and engaged to review the changes and modify our recommendations, if needed.

2. SITE CONDITIONS

2.1 SITE DESCRIPTION

The project site is located at 800 South Kickapoo Street in Shawnee, Oklahoma. The project site is bounded by South Kickapoo Street on the west, the existing water treatment plant on the north, east and south sides.

No readily available evidence of existing utilities in the immediate vicinity of the proposed buildings was noted, however a storm sewer line was noted to the east. Water lines and above and below grade electric lines were noted along South Kickapoo Street.

2.2 SUBSURFACE CONDITIONS

The following presents a general summary of the major strata encountered at the project site during our subsurface exploration. Specific subsurface conditions encountered at the boring locations are presented on the boring logs in APPENDIX A. The stratification lines shown on the logs and cross section represent the approximate boundaries between material types; in situ, the transitions may vary or be gradual.

Surface Materials: A 2 to 3-inch thick layer of topsoil was encountered at the boring locations. Exposed soil was noted at the ground surface in other areas of the site.

Existing Fill Materials: Existing fill material was encountered at all of the boring locations and extended to approximate depths ranging from 9.4 to 20.3 feet (Elevation 1012.2 to 1015.8 Feet) below the existing ground surface. The existing fill consisted of various combinations of lean clay, sandy lean clay, silty sand and sandy silt. Varying amounts of wood, asphaltic concrete, broken concrete, and concrete with reinforcing steel were noted within the fill materials.

Native Soils: Native soils consisting of lean clay and silty clayey sand were encountered below the existing fill material in the borings except BH-1 and BH-4 and extended to the top of bedrock.

Bedrock: Sandstone and shale bedrock was encountered below the native soils and existing fill material, and continued to the bottom of the borings at an approximate depth ranging from 23.9 to 38.7 feet. Table 2.2 indicates the approximate depth and elevation of the bedrock at the boring locations.

Table 2.2 – Bedrock Depth and Elevation

Boring No.	Ground Surface Elevation (feet)	Bedrock Depth (feet)	Bedrock Elevation (feet)
BH-1	1034.77	20.3	1014.47
BH-2	1034.89	20.6	1014.29
BH-3	1026.58	17.8	1008.78
BH-4	1026.32	12.6	1013.72
BH-5	1025.24	10.6	1014.64
BH-6	1025.67	13.1	1012.57

2.3 GENERAL SITE GEOLOGY

According to the "Engineering Classification of Geologic Materials – Division Three" from the Oklahoma Highway Department, 1970, the project site appears to be located near the interface of the Alluvium (Qas) and the Terrace Deposits (Qts). The Alluvium and Terrace Deposits are likely underlain by the Fallis Subunit (Pfa).

Alluvium (Qas): These are deposits of sand, silt, clay, gravel, and/or combinations of materials. Alluvium is found along the flood plains (bottom land) of streams and is normally present at places along all streams. The geologic unit maps outline many deposits, but all of these deposits are not shown.

Terrace Deposits (Qts): These materials consist of sand, silt, clay, gravel, and/or mixtures of these. Terrace materials occur adjacent to or near streams at higher

elevations than the flood plain (bottom land). Like alluvium, these deposits are not all shown on the geologic unit maps.

The engineering properties of the unconsolidated materials are normally the same as the "C" horizon of the overlying soil. Refer to Chapter III, Soils. Most Terrace deposits will have seepage where the underlying geologic material is less pervious.

The underlying bedrock unit consists of the **Fallis Subunit (Pfa):** The Fallis Subunit consists of a "zone" of sandstones and shales. The lower most sandstone's outcrop is geologically mapped in Division 3 north of the Canadian River.

The sandstones are generally orange to red, fine-grained, massive, moderately soft, and vary in thicknesses from about 5 feet to a maximum of 40 feet. The shales are mostly red and platy to blocky.

2.4 GROUNDWATER OBSERVATIONS

Groundwater observations were made both during and after completion of drilling operations. Table 2.3 presents the observed groundwater levels within the borings at the time of the field exploration.

Table 2.3 – Groundwater Observations

Boring No.	Ground Surface Elevation (feet)	Water Depth During Drilling (feet)	Water Depth at End of Drilling (feet)
BH-1	1034.77	7.6/1027.17	19.3/1015.47
BH-2	1034.89	17.90/1016.99	15.2/1019.69
BH-3	1026.58	Dry	Dry*
BH-4	1026.32	9.40/1016.92	21.1/1005.22
BH-5	1025.24	Dry	Dry*
BH-6	1025.67	Dry	Dry*

* Indicates water level depth was measured at completion of drilling. Extended water level measurements were not taken.

The materials encountered in the borings have a wide range of hydraulic conductivity and observations over an extended period of time may show the presence of groundwater. Use of piezometers would be required to better define current groundwater conditions and groundwater level fluctuations with time. Fluctuations of groundwater levels can occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the boring was performed. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

3. ANALYSIS AND DISCUSSION

3.1 GENERAL

GFAC Engineering was requested to evaluate the subsurface conditions at the proposed water storage tank location. Based on the results of our evaluation and the proposed finished floor elevations for the structures, it is our professional opinion that the proposed structures could be supported by shallow foundations bearing in/on sandstone or shale bedrock.

3.2 SITE DEVELOPMENT

3.2.1 Demolition

It is our understanding that the proposed structure locations are located within areas that were previously developed. The thoroughness of the demolition of previous structures is not known. Demolition should include removal of any former floor slabs, foundations, and below grade walls. All debris resulting from the demolition process should be removed from the site.

3.2.2 Stripping

Site development should commence with the stripping of any vegetation, organic soils, and associated root systems from planned construction areas. Care shall be taken to thoroughly remove all root systems from the construction areas. Materials disturbed during stripping operations should be stabilized in place or undercut and replaced with structural fill.

3.2.3 Proposed Utilities

All underground utility lines for the proposed project should be located outside the zone of influence of proposed foundations; that is a zone extending from the bottom edge of the footing at a slope of 1 Horizontal to 1 Vertical, 1(H):1(V).

3.2.4 Subgrade Evaluation

Following demolition, site stripping, and cutting to the proposed finished floor subgrade elevations, the exposed subgrade should be evaluated. The entire subgrade areas should consist of weathered and unweathered bedrock. Areas where bedrock is not exposed, additional undercutting and replacement with dense aggregate base material should be performed.

3.2.5 Proofrolling

In areas to receive fill, following moisture conditioning and prior to placement of structural fill, the exposed grade should be proofrolled. Proofrolling of the subgrade aids in identifying soft (lower consistency/loose) or disturbed areas. Unsuitable areas identified by the proofrolling operation should be: 1) undercut and replaced with structural fill, 2) scarified, aerated, and recompacted, 3) stabilized in place with shot/crushed rock with a maximum diameter of 6 inches, or 4) spanned through the use of bi-axial geogrid, depending upon the nature/location of the unstable/disturbed area. Proofrolling can be accomplished through use of a fully-loaded, tandem-axle dump truck or similar equipment providing an equivalent subgrade loading.

Proofrolling of bedrock is not required.

3.2.6 Sand and Silt Content

A portion of the soils encountered at the project site have a high sand and/or silt content. These types of soils are highly moisture sensitive and may become unstable with minor variations in moisture content or when subjected to repeated construction traffic. If these soils are unstable at the time of construction, they will need to be undercut and replaced with structural fill or be stabilized in place. Close moisture control during compaction operations will be required to reduce the potential for pumping of these soils.

3.3 EXCAVATIONS

3.3.1 General

All excavations must comply with applicable local, state and federal safety regulations. ***The responsibility for excavation safety and stability of temporary construction slopes lies solely with the contractor.*** We are providing this information below solely as a service to our client. Under no circumstances should this information provided be interpreted to mean that GFAC Engineering Inc. is assuming responsibility for construction site safety or the contractors activities, such responsibility is not being implied and should not be inferred.

3.3.2 Foundation and Utility Excavations

It is anticipated that excavations for the proposed structure and shallow utilities will generally be in existing fill, native soils, sandstone bedrock, and shale bedrock. The excavation of the soil material may be accomplished using conventional excavation equipment, such as large backhoes/excavators equipped with a soil bucket.

Excavations extending below an approximate depth of 10.6 to 20.6 feet will encounter sandstone and shale bedrock. The highly weathered to weathered sandstone and shale bedrock with a Standard Penetration Resistance (N) value of less than 25 blows per foot can generally be excavated with conventional heavy equipment such as backhoes, scrapers, loaders, etc. Excavation of harder materials may require the use of single-tooth rippers mounted on large tractors such as a Caterpillar D-8 or larger, rock buckets or hammer attachments mounted on backhoes/trackhoes, or other rock excavating techniques to complete the excavations. Excavation of these materials in confined excavations will likely be difficult.

Groundwater was encountered within Borings BH-1, BH-2, and BH-4. Typical dewatering measures are anticipated to be sufficient to remove the groundwater that is encountered, however, fluctuations in the groundwater levels will likely occur from that

encountered at the site at the time of the field exploration. These fluctuations may necessitate the use of more sophisticated dewatering methods/equipment.

3.3.3 Excavation Slopes and Construction Considerations

Excavations should be cut to a stable slope or be temporarily braced, depending upon the excavation depths and the subsurface conditions encountered. ***Temporary construction slopes should be designed in strict compliance with the most recent governing regulations.*** Stockpiles should be placed well away from the edge of the excavation and their heights should be controlled so they do not surcharge the sides of the excavation. Surface drainage should be carefully controlled to prevent flow of water into the excavations. Construction slopes should be closely observed for signs of mass movement: tension cracks near the crest, bulging at the toe, etc. If potential stability problems are observed, a geotechnical engineer should be immediately contacted.

3.4 STRUCTURAL FILL

Based on the conditions encountered in the borings and the results of the laboratory testing, the on-site soils and bedrock are suitable for use as structural fill. Additional testing and observation at the time of construction is recommended to further evaluate these materials prior to use as structural fill. **All imported material shall meet the requirements as outlined in Section 4.3.**

We anticipate that the softer, more highly weathered bedrock could be moisture conditioned and placed in a manner similar to soil. Harder, less weathered bedrock could also be considered for use as fill. The use of the unweathered bedrock would require substantial effort to prepare the material for placement as structural fill. The less weathered bedrock would require moisture conditioning and higher compactive effort to process into suitable fill material. The bedrock should be broken down to a material with a maximum 3-inch size and to develop sufficient fines to completely fill void spaces between the larger particles. Mixing of the broken bedrock with onsite soils may facilitate moisture conditioning and compaction.

3.5 FOUNDATIONS

3.5.1 General

Based on the subsurface conditions encountered at the site and the proposed finished floor elevations, the proposed structures could be supported by shallow foundations bearing in/on sandstone or shale bedrock.

3.5.2 Estimated Settlements

We estimate that settlements will be 1 inch or less for foundations bearing in/on sandstone or shale bedrock. Settlement of the foundation will depend upon the variations within the subsurface profile, the structural loading conditions, and the quality of the installation.

3.5.3 Construction Considerations and Observations

The foundation excavation should be clean and free of water, loose, soft, or disturbed material prior to placement of concrete. Placement of a "mud mat" at the bottom of the excavation to reduce the possibility that the bearing surface becomes disturbed should be considered. Concrete should be placed as soon as possible after excavating so that disturbance of the bearing materials does not occur.

The foundation excavation should be evaluated and tested by the geotechnical engineer prior to placement of any required reinforcing steel and prior to placement of concrete. Unsuitable areas identified should be corrected. Corrective procedures may include deepening of the foundation element or undercutting of unsuitable materials and replacement with controlled structural fill or lean concrete.

3.6 CONCRETE SLABS SUPPORTED ON-GRADE

Based upon the proposed finished floor elevation of the structures, the subgrade is anticipated to consist of sandstone and shale bedrock. To provide more uniform support for the floor slabs, it is recommended that the proposed bedrock be undercut 12 inches below the proposed floor slab subgrade elevation and backfilled with dense

graded aggregate base material. If a more uniform subgrade support is not provided, "hard" points may be present that provide differential support which could result in cracking of the floor slab. Recommendations outlined in Sections 4.2 and 4.3 of this report are intended to develop subgrades that are suitable for support of the building floor slabs. These recommendations include that all material imported to the project site meet the requirements outlined in Section 4.3.

If the building pads are constructed as recommended, potential vertical movement of the slab on grade is anticipated to be 1 inch or less.

Depending upon subsurface conditions at the proposed finished floor slab subgrade elevation, a combination of bedrock and soil may be exposed at the proposed finished floor slab subgrade elevation for the proposed structures. If a combination of bedrock and soil is exposed at the proposed finished floor subgrade elevation, the bedrock should be undercut a sufficient depth to allow for placement of 12 inches of dense graded aggregate base (ODOT Type A Aggregate Base). The intent of the undercut is to allow for more uniform support of the proposed slab on grade and to reduce the potential of the floor slab from cracking at the transition from bedrock to soil support.

Subsurface moisture and moisture vapor naturally migrate upward through the soil and, where the soil is covered by a building, this subsurface moisture will collect. To reduce the impact of this subsurface moisture and the potential impact of future induced moisture (such as landscape irrigation or precipitation) a vapor retarder is sometimes utilized below the compacted crushed limestone layer. This membrane typically consists of visquene or polyvinyl plastic sheeting. It should be noted that although vapor retarder systems are frequently utilized, this system may not be completely effective in preventing floor slab moisture problems. These systems will not necessarily assure that floor slab moisture transmission rates will meet floor covering manufacturer standards and that indoor humidity levels will be appropriate to inhibit mold growth. The design and construction of such systems are totally dependent on the proposed use and design of the proposed building and all elements of building design and function should be considered in the slab-on-grade floor design. Building design and construction may

have a greater role in perceived moisture problems since sealed buildings/rooms or inadequate ventilation may produce excessive moisture in a building and affect indoor air quality.

Various factors such as surface grades, adjacent planters, the quality of slab concrete and the permeability of the on-site soils affect slab moisture and can influence future floor and moisture conditions. In many cases, floor moisture problems are the result of either improper curing of floor slabs or improper application of floor adhesives. We recommend contacting a flooring consultant experienced in the area of concrete slab-on-grade floors or the floor covering manufacturer for specific recommendations regarding your proposed flooring applications.

Special precautions must be taken during the placement and curing of all concrete slabs. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could lead to excessive shrinkage, cracking or curling of the slabs. High water-cement ratio and/or improper curing also greatly increase the water vapor permeability of the concrete. We recommend that all concrete placement and curing operations be performed in accordance with the American Concrete Institute (ACI) Manual.

3.7 BELOW GRADE WALLS/RETAINING WALLS

Both of the proposed structures will require below grade walls to achieve finished floor grades. The excavations are anticipated to primarily be in existing fill, native clay, silty clayey sand, and bedrock. It has been assumed that the below grade walls will be constructed of cast-in-place concrete. The following information is provided to aid in the design of the below grade walls.

3.7.1 Lateral Earth Pressures

Walls should be designed to resist lateral earth pressures equivalent to those induced by the surcharge of adjacent structures and the appropriate soil material. In most cases, lateral earth pressure can be assumed to increase linearly with depth and may

be represented as the effective unit weight of the soil times the appropriate coefficient of lateral earth pressure times the thickness of the overlying soil. The parameters listed in Table 4.7 may be used for determining lateral earth pressures at this site.

The parameters for granular fill listed in Table 4.7 should be used only if laboratory tests have confirmed the internal friction angle of the fill material. If these criteria are not met, the appropriate parameters of the natural soil should be used.

Below grade/retaining walls that are laterally supported and can be expected to undergo only a slight amount of deflection (i.e., less than 0.1 percent of wall height for granular soils or less than 1.0 percent of wall height for clay soils) should be designed for lateral loadings based on lateral earth pressure computed using the at-rest lateral earth pressure coefficient.

Below grade/retaining walls that can deflect sufficiently to mobilize the full active earth pressure condition should be designed for smaller active lateral earth pressure computed using the active and passive lateral earth pressure coefficient. Walls designed for such loading must be detailed and specified such that the hydrostatic pressure cannot develop and the compactive effort used on backfill is limited to that required to achieve 90 to 95 percent of the standard Proctor maximum dry density.

3.7.2 Wall Drainage

To prevent hydrostatic loading on below grade walls, it is recommended that a perforated drain line be installed at the base of the walls. The drain line should extend to a sump where water can be collected and removed, or day lighted where water can drain by gravity. The drain line should be wrapped with filter fabric to prevent intrusion of fines. The drain line should be backfilled with free draining granular material extending vertically to intersect the capillary moisture break below the floor slabs. The capillary moisture break could be graded to allow drainage into the granular section behind the below grade walls. Seepage from rock cut slopes may occur at the site. An

adequate drainage system for collection and diversion of the water will be required for below grade walls at the project site.

4. RECOMMENDATIONS

4.1 GENERAL

Based on the results of our evaluation, it is our professional opinion that the proposed structures can be supported by a shallow foundation system bearing in/on sandstone and shale bedrock. Recommendations regarding geotechnical aspects of the project design and construction are presented below.

The recommendations submitted herein are based, in part, upon data obtained from our subsurface exploration. The nature and extent of subsurface variations that may exist at the proposed project site will not become evident until construction. If variations appear evident, then the recommendations presented in this report should be evaluated. In the event that any changes in the nature, design, location or depth of the proposed structure are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and our recommendations modified in writing.

4.2 SITE PREPARATION

We recommend the following for site preparation:

1. Demolition of any existing structures located within the building footprint may be required as part of the project. Areas disturbed during demolition should be thoroughly evaluated by the geotechnical engineer prior to placement of structural fill. Undercutting and replacement of soils disturbed during demolition prior to placement of fill will be required.

2. All vegetation and topsoil shall be stripped from the site. Care shall be taken to thoroughly remove all root systems.

3. Following demolition and stripping, the exposed subgrade should be scarified, moisture conditioned, and recompacted to a depth of 8 inches. Scarification and recompaction of bedrock is not required.

4. In areas to receive fill, the exposed subgrade should be proofrolled with a fully loaded, tandem-axle dump truck. Unsuitable areas identified by the proofrolling operation should be: 1) undercut and replaced with structural fill, 2) scarified, aerated, and recompacted, 3) stabilized in place with shot/crushed rock with a maximum diameter of 6 inches, or 4) spanned through the use of bi-axial geogrid, depending upon the nature/location of the soft areas. The method in which unsuitable areas are corrected would depend upon the location of the unsuitable areas and the conditions encountered at the site at the time of construction. Proofolling of bedrock is not required.

4.3 STRUCTURAL FILL

We recommend the following for structural fill:

1. **ON-SITE MATERIALS** – Based on the conditions encountered in the borings and the results of the laboratory testing, the on-site soils minus construction debris and bedrock are suitable for use as structural fill. Additional testing and observation at the time of construction is recommended to further evaluate these materials prior to use as structural fill.

2. **OTHER IMPORTED MATERIAL** – We recommend the following criteria for imported materials to be used outside of the building area:

    a. The material should consist of approved materials, free of organic matter (organic content less than 4 percent) and debris. Approved materials are defined as those soils classified by ASTM D 2487 as CL, GC, SC, and SP.

b. A maximum Liquid Limit of 45 and a maximum Plasticity Index (PI) of less than 30.

3. All fill material should have a maximum particle size of 3 inches.

4. All fill should be placed in lifts having a maximum loose lift thickness of 9 inches.

5. All fill shall be compacted to a minimum of 95 percent of the material's maximum dry density as determined by ASTM D 698, standard Proctor compaction.

6. The moisture content of the clay fill (Plasticity Index > 10) at the time of compaction should be within a range of 0 to 4 percent above optimum moisture content as defined by the standard Proctor compaction procedure.

7. For clay fills having lower plasticities (Plasticity Index < 10) and sand, it may be necessary to use a moisture range of 2 percent below to 2 percent above optimum moisture content.

4.4 SEISMIC HAZARDS DETERMINATION

Based on the subsurface information, the project site would be characterized as a Site Class "C" per the 2009 International Building Code (IBC). In addition, there is no significant risk of liquefaction or mass movement of the on-site soils due to a seismic event.

4.5 SHALLOW FOUNDATIONS

The site is suitable to support the proposed structures on a shallow foundation system bearing in/on sandstone and shale bedrock. We recommend the following design criteria for these foundations:

1. Foundations may be proportioned for a maximum allowable bearing pressure presented in the following table. The allowable bearing pressure is based on a

minimum factor of safety of approximately three (3) with respect to shear failure of the foundation bearing materials.

Table 4.5 – Allowable Bearing Pressure

Bearing Material	Allowable Bearing Pressure (psf)	Estimated Settlement (inches)
Sandstone and Shale Bedrock	7,500	1 inch or less

2. The bearing surface should be free of all loose/unstable material.

3. Loose/soft/unstable materials encountered within the foundation excavation should be undercut and replaced with controlled structural fill.

4. Consideration could be given to placing a "mud mat" in the bottom of the foundation excavation to minimize disturbance of the bearing materials.

5. For sliding friction, an ultimate coefficient of friction of 0.50 could be assigned to the base of the foundation bearing in/on the sandstone or shale bedrock. The recommended sliding friction does not include a factor of safety.

4.6 CONCRETE SLABS SUPPORTED ON-GRADE

Following the recommendations for site preparation, the site would be suitable for grade supported floor slabs. We recommend the following provisions for design and construction of the floor slab:

1. All material placed within the building footprint should meet the requirements listed in Section 4.3.

2. All utility trench backfill and foundation backfill should be placed in accordance with the requirements of structural fill.

3. A granular leveling course, having a minimum thickness of 4 inches, should be used below the building floor slab. The granular section provides a capillary moisture break and acts as a leveling course. The granular leveling course should consist of clean, crushed limestone gravel with a nominal size of ½ to ¾ inch.

4. Immediately prior to construction of the building floor slabs, it is recommended that the exposed subgrade be evaluated to determine whether moisture contents are within the recommended range and to identify areas disturbed by construction operations. Unsuitable or disturbed areas should be reworked prior to placement of the granular leveling course and construction of the floor slab.

5. Following required cuts and undercutting, if the floor slab subgrade consists of a combination of bedrock and soil, it is recommended that the bedrock and soil material be undercut a sufficient depth to allow for placement of 12 inches of dense graded aggregate base (ODOT Type A Aggregate Base) material.

4.7 BELOW GRADE/RETAINING WALLS

Below grade/retaining walls associated with the new buildings may be constructed at the project site. The following has been recommended for the design of the below grade walls/retaining walls:

Table 4.6: Lateral Earth Pressure Parameters

LATERAL EARTH PRESSURE PARAMETERS							
Material Type	Total Stress (Undrained) Parameters (1)			Effective Stress (Drained) Parameters (1)			Unit Weight (1) γ, pcf
	C_u, psf	Φ, degrees	Lateral Earth Pressure Coefficients	C', psf	Φ', degrees	Lateral Earth Pressure Coefficients	
Natural Clays or Controlled Structural Fill	1,500	0	$K_a = 1.0$ $K_p = 1.0$ $K_o = 1.0$	300	22	$K_a = 0.45$ $K_p = 2.2$ $K_o = 0.63$	105
Fine Granular Fill	0	28	$K_a = 0.35$ $K_p = 2.75$ $K_o = 0.55$	0	28	$K_a = 0.35$ $K_p = 2.75$ $K_o = 0.55$	110
Coarse Granular Fill	0	35	$K_a = 0.27$ $K_p = 3.69$ $K_o = 0.42$	0	35	$K_a = 0.27$ $K_p = 3.69$ $K_o = 0.42$	125

(1) Based on previous experience with materials of this classification
C = Cohesion
Φ = Internal Friction Angle
γ = Effective Unit Weight above Groundwater Table
K_a = Active Earth Pressure Coefficient
K_p = Passive Earth Pressure Coefficient
K_o = At-Rest Earth Pressure Coefficient

1 For concrete foundations poured in good contact with the bedrock material, an ultimate coefficient of friction of 0.5 could be used. A factor of safety has not been used for this parameter.

2 Either a chimney drain with a width of 2 feet encapsulated in filter fabric (to minimize intrusion of fines) or a drainage blanket should be installed to prevent hydrostatic loading on the below grade wall. The drainage material should be connected to drain line installed at the base of the below grade wall. The drain line should extend to a sump or day lighted where the water can drain by gravity.

5. ADDITIONAL SERVICES

5.1 PLANS AND SPECIFICATIONS REVIEW

We recommend that GFAC Engineering Inc. conduct a general review of the final plans and specifications to evaluate that our foundation recommendations have been properly interpreted and implemented during design. In the event GFAC Engineering Inc. is not retained to perform this recommended review, we will assume no responsibility for misinterpretation of our recommendations.

5.2 CONSTRUCTION OBSERVATION AND TESTING

We recommend that all earthwork and foundation installation procedures be monitored by a representative of GFAC Engineering Inc. or other qualified geotechnical engineering firm. These observations should include site preparation, placement of all engineered fill and trench backfill, and all foundation excavations. The purpose of these services would be to provide GFAC Engineering Inc. the opportunity to observe the soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.

6. LIMITATIONS

Recommendations contained in this report are based on our field observations and subsurface explorations, limited laboratory tests, and our present knowledge of the proposed construction. It is possible that subsurface conditions could vary between or beyond the points explored. If subsurface conditions are encountered during construction that differ from those described herein, we should be notified immediately in order that a review may be made and any supplemental recommendations provided. If the scope of the proposed construction, including the proposed loads or structural locations, changes from that described in this report, our recommendations should also be reviewed.

We have prepared this report in substantial accordance with the generally accepted geotechnical engineering practice as it exists in the site area at the time of our study. No warranty is expressed or implied. The recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be conducted by GFAC Engineering Inc. during the construction phase in order to evaluate compliance with our recommendations. The scope of our services did not include any environmental assessment or exploration for the presence of hazardous or toxic materials in the soil, surface water, groundwater or air, on, below or around this site.

This report may be used only by owner and only for the purposes stated, within a reasonable time from its issuance, but in no event later than three years from the date of report. Land use, site conditions (both on-site and off-site), regulations, or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify GFAC Engineering Inc. of such intended use. Based on the intended use of the report, GFAC Engineering Inc. may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release GFAC Engineering Inc. from any liability resulting from the use of this report by any unauthorized party and client agrees to defend, indemnify and hold harmless GFAC Engineering Inc. from any claim or liability associated with such unauthorized or non-compliance.

APPENDIX A

PLATE 1 – SITE VICINITY MAP
PLATE 2 – BORING LOCATION DIAGRAM
CROSS SECTION
BORING LOGS

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FIELD EXPLORATION PROGRAM

The fieldwork for this study was performed on February 21, 2020. The exploration consisted of six (6) borings extending to an approximate depth on the order of 23.9 to 38.7 feet. Representatives of GFAC established the boring locations in the field. These locations were identified in the field by measuring distances from the existing site features to the respective boring locations. Right angles were estimated. Elevations at the boring locations were determined through use of an engineer's level and were referenced to the rim on the storm drain manhole cover (see Plate 2, labeled BM). The elevation of the temporary benchmark was taken to be 1033.23 feet. Locations and elevations of the borings should be considered accurate only to the degree implied by the methods used to obtain them.

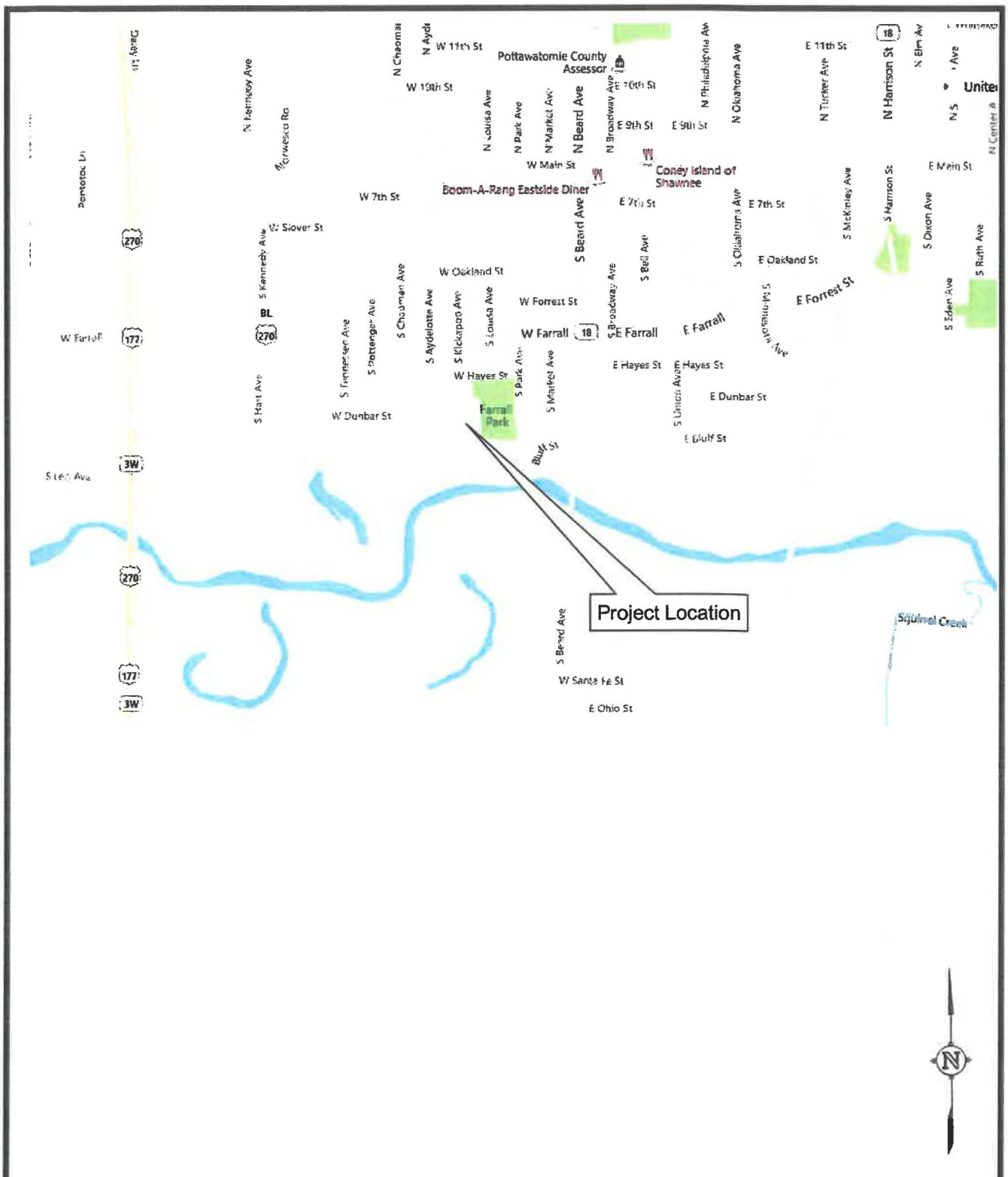
The borings were drilled with a truck-mounted (CME 55), rotary drill using solid stem augers to advance the borings. Representative samples were obtained utilizing the split-barrel sampling procedures in general accordance with ASTM D 1586. The split-barrel sampling procedure utilizes a standard 2-inch O.D. split-barrel sampler that is driven into the bottom of the boring with a 140-pound auto-hammer falling a distance of 30 inches. The number of blows required to advance the sampler the last 12 inches of a normal 18 inch penetration is recorded as the Standard Penetration Resistance Value (N). These "N" values are indicated on the boring logs at their depth of occurrence and provide an indication of the consistency and hardness of the material.

Boring logs included in this appendix, present such data as soil and bedrock descriptions, consistency, and bedrock hardness evaluations, depths, sampling intervals and observed groundwater conditions. Conditions encountered in each of the borings were monitored and recorded by the field engineer. Field logs included visual classification of the materials encountered during drilling, as well as drilling characteristics. Our final boring logs represent the engineer's interpretation of the field logs combined with laboratory observation and testing of the samples. Stratification boundaries indicated on the boring logs were based on observations during our

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fieldwork, an extrapolation of information obtained by examining samples from the borings and comparisons of soils with similar engineering characteristics. Locations of these boundaries are approximate, and the transitions between soil types may be gradual rather than clearly defined.

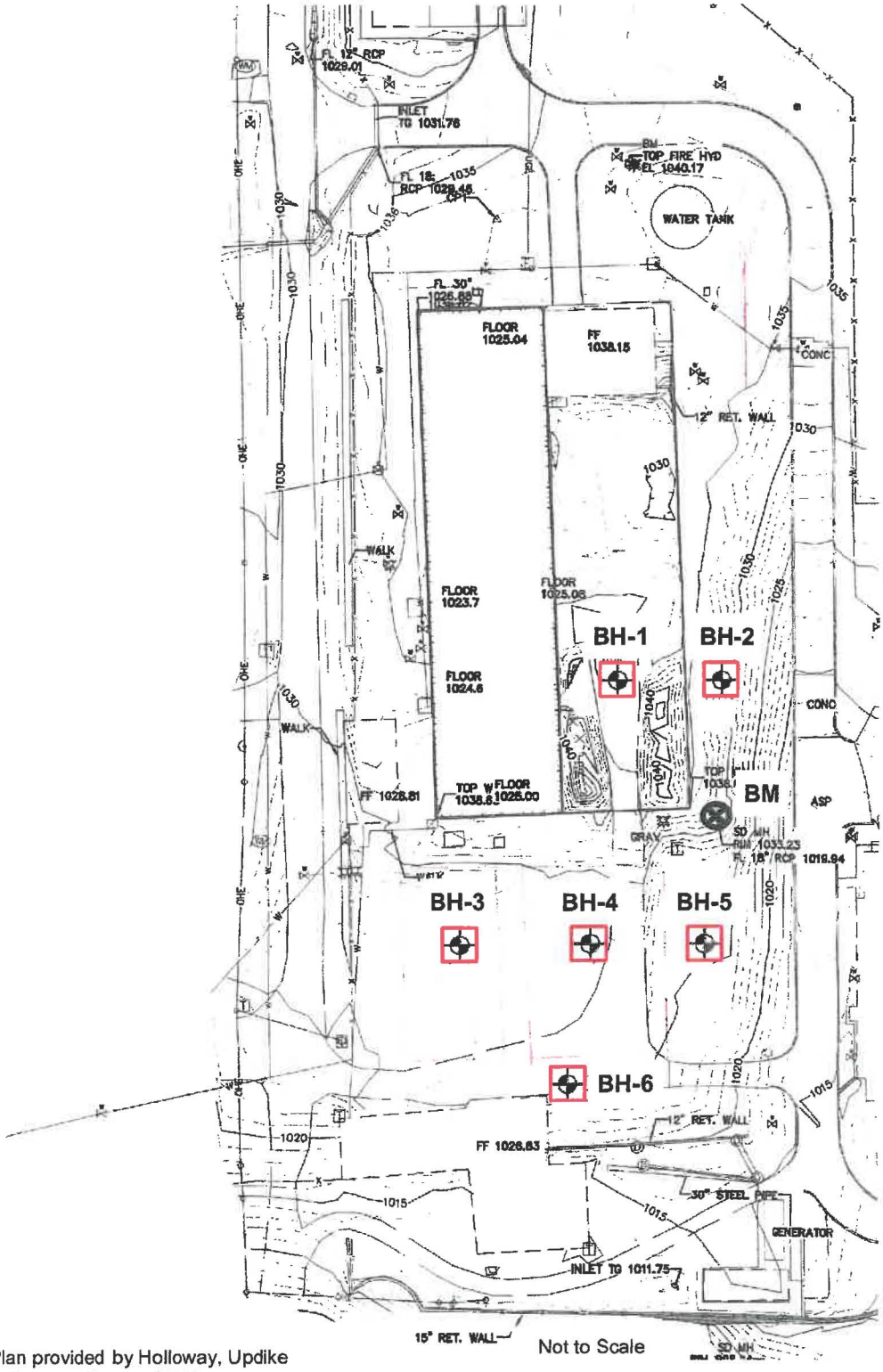
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Site Vicinity Map

Proposed New Process Building
800 South Kickapoo Street
Shawnee, Oklahoma
Project No. G2020022 March 4, 2020

Plate 1



Not to Scale

Site Plan provided by Holloway, Updike and Bellen modified by GFAC.

GFAC ENGINEERING

Boring Location Diagram

Proposed New Process Building
800 South Kickapoo Street
Shawnee, Oklahoma
Project No. G2020022 March 4, 2020

Plate 2

GFAC Engineering Inc
PO Box 472201
Tulsa OK 74147
Telephone: 918-622-7021

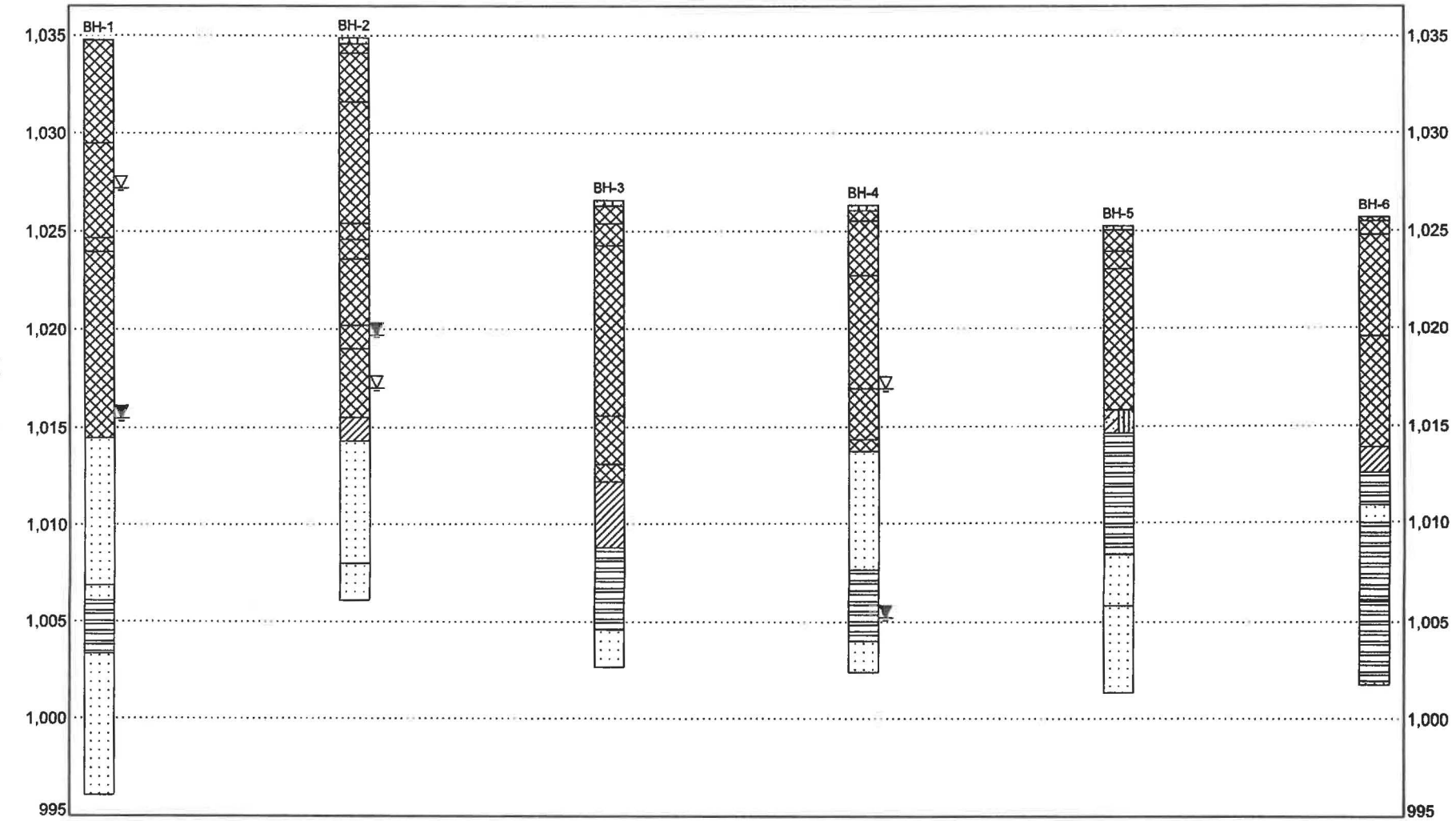
SUBSURFACE DIAGRAM

CLIENT Holloway, Updike and Bellen, Inc

PROJECT NAME Proposed New Process Building

PROJECT NUMBER G2020022

PROJECT LOCATION 800 South Kickapoo Street, Shawnee, OK



STRATIGRAPHY & GW - A SIZE - GINT STD US LAB.GDT - 3/4/20 07:31 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\G2020022 SHAWNEE WWTP.GPJ

GFAC Engineering Inc
PO Box 472201
Tulsa OK 74147
Telephone: 918-622-7021

BORING NUMBER BH-1

CLIENT Holloway, Updike and Bellen, Inc
PROJECT NAME Proposed New Process Building
PROJECT NUMBER G2020022
PROJECT LOCATION 800 South Kickapoo Street, Shawnee, OK
DATE STARTED 2/21/20 **COMPLETED** 2/21/20
GROUND ELEVATION 1034.77 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR GFAC
GROUND WATER LEVELS:
DRILLING METHOD CFA 6"
AT TIME OF DRILLING 7.60 ft / Elev 1027.17 ft
LOGGED BY PWV **CHECKED BY** DLK
AT END OF DRILLING 19.30 ft / Elev 1015.47 ft
NOTES
AFTER DRILLING —

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	Texas Cone Penetrometer	BLOW COUNTS (N VALUE)	Uncon. Strength (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FILL - Lean Clay with sandstone gravel, moist, red, brown	SS 1	44		2-8-5 (13)			10				
			SS 2	56		0-4-5 (9)			10	28	10	18	
5		FILL - Lean Clay with broken concrete and broken asphalt, moist, dark gray, olive	SS 3	44		2-2-1 (3)			21				
		▽	SS 4	0		0-0-0 (0)			18				
10		CONCRETE with reinforcing bars											
		FILL - Sand with silt, fine grained, moist, tan, orange brown	SS 5	56		3-4-4 (8)			15	25	25	NP	7
15													
		▼	SS 6	67		8-12-13 (25)			16				
20		SANDSTONE with shale seams, poorly cemented, red, gray, brown											
			SS 7	89		14-23-41 (64)			10				
25		SANDSTONE, cemented, red trace gray											
		SHALE, moderately hard, red, brown	SS 8	100		50/ 4"			9				
30		SANDSTONE, cemented, red, gray											
			SS 9	100		50/ 2.5"			16				
35													

(Continued Next Page)

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GFAC Engineering Inc
PO Box 472201
Tulsa OK 74147
Telephone: 918-622-7021

BORING NUMBER BH-1

CLIENT Holloway, Updike and Bellen, Inc

PROJECT NAME Proposed New Process Building

PROJECT NUMBER G2020022

PROJECT LOCATION 800 South Kickapoo Street, Shawnee, OK

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	Texas Cone Penetrometer	BLOW COUNTS (N VALUE)	Uncon. Strength (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
35		SANDSTONE, cemented, red, gray *(continued)*											
		Bottom of borehole at 38.7 feet.	SS 10	100		50/ 2"			16				

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GFAC Engineering Inc
PO Box 472201
Tulsa OK 74147
Telephone: 918-622-7021

BORING NUMBER BH-2

CLIENT Holloway, Updike and Bellen, Inc
PROJECT NAME Proposed New Process Building
PROJECT NUMBER G2020022
PROJECT LOCATION 800 South Kickapoo Street, Shawnee, OK
DATE STARTED 2/21/20 **COMPLETED** 2/21/20
GROUND ELEVATION 1034.89 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR GFAC
GROUND WATER LEVELS:
DRILLING METHOD CFA 6"
AT TIME OF DRILLING 17.90 ft / Elev 1016.99 ft
LOGGED BY PWV **CHECKED BY** DLK
AT END OF DRILLING 15.20 ft / Elev 1019.69 ft
NOTES
AFTER DRILLING —

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	Texas Cone Penetrometer	BLOW COUNTS (N VALUE)	Uncon. Strength (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		TOPSOIL											
		FILL - Sandy Lean Clay, moist, brown	SS 1	78		2-1-1 (2)			11				
		FILL - Silty Sand, fine grained, moist, brown	SS 2	78		1-2-2 (4)			11				19
5		FILL - Silty Sand, fine grained, moist, brown, tan, trace orange, gray	SS 3	89		2-3-3 (6)			10				
			SS 4	78		1-2-6 (8)			15				
10		FILL - Silty Sand, fine grained, wet, brown											
		CONCRETE with reinforcing bars											
		FILL - Silty Sand, fine grained, moist, brown											
			SS 5	89		3-4-3 (7)			35				
15		FILL - Fat Clay with sand, moist, red, brown											
		FILL - Sand with silt, fine grained, moist, brown											
			SS 6	100		1-3-5 (8)			24				51
20		LEAN CLAY with sand, moist, stiff, red, gray											
		SANDSTONE, poorly cemented, maroon											
			SS 7	100		50/ 5"			13				
25													
		SANDSTONE, cemented, red, gray											
			SS 8	100		50/ 4"			11				
		Bottom of borehole at 28.8 feet.											

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GFAC Engineering Inc
PO Box 472201
Tulsa OK 74147
Telephone: 918-622-7021

BORING NUMBER BH-3

CLIENT Holloway, Updike and Bellen, Inc
PROJECT NAME Proposed New Process Building
PROJECT NUMBER G2020022
PROJECT LOCATION 800 South Kickapoo Street, Shawnee, OK
DATE STARTED 2/21/20 **COMPLETED** 2/21/20
GROUND ELEVATION 1026.58 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR GFAC
GROUND WATER LEVELS:
DRILLING METHOD CFA 6"
AT TIME OF DRILLING — Dry
LOGGED BY PWV **CHECKED BY** DLK
AT END OF DRILLING — Dry
NOTES
AFTER DRILLING —

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	Texas Cone Penetrometer	BLOW COUNTS (N VALUE)	Uncon. Strength (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		TOPSOIL											
		FILL - Sandy Lean Clay, moist, brown	SS 1	89		0-4-5 (9)			20				
		FILL - Sandy Silt, Broken Concrete, Broken Asphalt, moist, brown											
		FILL - Sandy Silt, Silty Sand, Broken Concrete, Broken Asphalt, Wood Pieces, moist, dark gray	SS 2	56		3-2-2 (4)			26				
5			SS 3	44		4-4-4 (8)			17				
			SS 4	44		1-7-26 (33)			13				
10		FILL - Sandy Silt, moist, brown, gray											
		FILL - Broken Asphalt	SS 5	100		50/ 1"							
15		LEAN CLAY with sand, moist, stiff, red, brown, trace gray											
		WEATHERED SANDY SHALE, very soft, red, trace orange	SS 6	89		11-19-28 (47)			14				
20		SANDSTONE with shale seams, poorly cemented, red, brown											
		Bottom of borehole at 23.9 feet.	SS 7	100		50/ 5"			8				

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GFAC Engineering Inc
PO Box 472201
Tulsa OK 74147
Telephone: 918-622-7021

BORING NUMBER BH-4

CLIENT Holloway, Updike and Bellen, Inc
PROJECT NAME Proposed New Process Building
PROJECT NUMBER G2020022
PROJECT LOCATION 800 South Kickapoo Street, Shawnee, OK
DATE STARTED 2/21/20 **COMPLETED** 2/21/20
GROUND ELEVATION 1026.32 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR GFAC
GROUND WATER LEVELS:
DRILLING METHOD CFA 6"
▽ **AT TIME OF DRILLING** 9.40 ft / Elev 1016.92 ft
LOGGED BY PWV **CHECKED BY** DLK
▼ **AT END OF DRILLING** 21.10 ft / Elev 1005.22 ft
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	Texas Cone Penetrometer	BLOW COUNTS (N VALUE)	Uncon. Strength (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		TOPSOIL											
		FILL - Sandy Lean Clay, moist, dark brown, brown	SS 1	78		10-10-3 (13)			15				
		FILL - Sandy Silt, Silty Clayey Sand, Broken Concrete, Broken Asphalt, moist, brown, dark gray	SS 2	56		0-1-0 (1)			18				
5		FILL - Sandy Silt, wet, gray, brown	SS 3	83		0-0-0 (0)			26	25	25	NP	
10		▽ FILL - Sandy Lean Clay, moist, orange, brown	SS 4	78		0-0-0 (0)			28				
		CONCRETE											
		SANDSTONE, poorly cemented, maroon, gray	SS 5	89		14-28-44 (72)			12				
15													
20		WEATHERED SHALE, very soft, red, trace maroon, gray	SS 6	100		16-28-34 (62)			13				
		▼											
		SANDSTONE, poorly cemented, red trace gray, maroon											
			SS 7	100		50/ 5"			8				
		Bottom of borehole at 23.9 feet.											

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GFAC Engineering Inc
PO Box 472201
Tulsa OK 74147
Telephone: 918-622-7021

BORING NUMBER BH-5

CLIENT Holloway, Updike and Bellen, Inc
PROJECT NAME Proposed New Process Building
PROJECT NUMBER G2020022
PROJECT LOCATION 800 South Kickapoo Street, Shawnee, OK
DATE STARTED 2/21/20 **COMPLETED** 2/21/20
GROUND ELEVATION 1025.24 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR GFAC
GROUND WATER LEVELS:
DRILLING METHOD CFA 6"
AT TIME OF DRILLING — Dry
LOGGED BY PWV **CHECKED BY** DLK
AT END OF DRILLING — Dry
NOTES
AFTER DRILLING —

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	Texas Cone Penetrometer	BLOW COUNTS (N VALUE)	Uncon. Strength (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		TOPSOIL											
		FILL - Silty Sand, fine grained, moist, brown	SS 1	33		3-4-4 (8)			7	19	15	4	34
		FILL - Silty Sand, Broken Concrete, moist, brown											
		FILL - Silty Sand with sandstone gravel and broken concrete, moist, brown, tan	SS 2	56		4-3-3 (6)			9				
5			SS 3	78		1-2-2 (4)			12				
			SS 4	22		2-2-3 (5)			15	19	13	6	39
10		SILTY CLAYEY SAND, fine grained, moist, loose, red, brown											
		WEATHERED SHALE, very soft, maroon, gray											
			SS 5	100		14-29-38 (67)			9				
15													
		SANDSTONE, poorly cemented, red trace gray											
			SS 6	94		50/ 4.25"			6				
20		SANDSTONE, poorly cemented, maroon											
			SS 7	100		50/ 5"			8				

Bottom of borehole at 23.9 feet.

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GFAC Engineering Inc
PO Box 472201
Tulsa OK 74147
Telephone: 918-622-7021

BORING NUMBER BH-6

CLIENT Holloway, Updike and Bellen, Inc
PROJECT NAME Proposed New Process Building
PROJECT NUMBER G2020022
PROJECT LOCATION 800 South Kickapoo Street, Shawnee, OK
DATE STARTED 2/21/20 **COMPLETED** 2/21/20
GROUND ELEVATION 1025.67 ft **HOLE SIZE** 6 inches
DRILLING CONTRACTOR GFAC
GROUND WATER LEVELS:
DRILLING METHOD CFA 6"
AT TIME OF DRILLING — Dry
LOGGED BY PWV **CHECKED BY** DLK
AT END OF DRILLING — Dry
NOTES
AFTER DRILLING —

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	Texas Cone Penetrometer	BLOW COUNTS (N VALUE)	Uncon. Strength (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FILL - Broken Asphalt and Limestone Gravel											
		FILL - Aggregate Base and Milled Asphalt	SS 1	83		5-5-5 (10)			12				
		FILL - Silty Sand, fine grained, moist, red, brown	SS 2	56		2-2-2 (4)			13				31
5			SS 3	89		1-0-0 (0)			13	25	25	NP	32
		FILL - Silty Sand with sandstone gravel, fine grained, moist, red											
10			SS 4	56		0-0-0 (0)			15				
		LEAN CLAY with sand, moist, very stiff, red											
		WEATHERED SHALE, very soft, red, brown	SS 5	89		12-28-40 (68)			12				
15		WEATHERED SANDSTONE with shale seams, poorly cemented, maroon trace gray											
		WEATHERED SHALE, very soft, red trace gray	SS 6	94		18-42-50/ 4"			11				
20		SHALE, very soft, red trace gray											
		SANDSTONE with shale seams, poorly cemented, maroon trace gray	SS 7	91		50/ 5.5"			7				
		Bottom of borehole at 23.9 feet.											

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APPENDIX B

LABORATORY TESTING PROGRAM

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LABORATORY TESTING PROGRAM

GENERAL

Laboratory tests were performed on select, representative samples to evaluate pertinent engineering properties of these materials. We directed our laboratory testing program primarily toward measuring the unconfined compressive strength of the limestone bedrock encountered in the borings. Laboratory tests were performed in general accordance with applicable standards, and the results are presented on the respective boring logs. The laboratory testing program consisted of the following:

- **Moisture content tests** ASTM D 2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- **Atterberg limits tests** ASTM D 4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- **Visual classification** ASTM D 2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)

CLASSIFICATION

All samples were examined in field by a geotechnical engineer using visual and manual procedures. The samples were classified in general accordance with the Unified Soil Classification System, and are shown on the boring logs.

Bedrock units encountered in the borings were described based on visual classification of disturbed auger cuttings and recovered samples, as well as drilling characteristics. Core samples may reveal other rock types.

Copyright 2020 *GFAC ENGINEERING INC.*

Appendix No. 2

Asbestos Survey

8/27/2020

Holloway, Updike & Bellen, Inc.
818 East Side Blvd
Muskogee, OK 74403

Project: Old Shawnee Water Treatment Plant, 800 S Kickapoo, Shawnee, OK

Dear Mr. Updike:

We performed an asbestos survey at the above referenced property.

The only asbestos materials detected were some gasket material. The gasket material that is present in existing piping may remain in place if the demolition contractor simply cuts to each side of the valve or fitting. This will allow the material to remain undisturbed during demolition. There are some gaskets present in a locker on the lower level. This material shall require removal prior to demolition.

No asbestos building materials were detected in the Chemical Bldg.

If during the course of demolition any additional suspect materials are encountered, work should cease until the material can be analyzed and identified.

Thanks,

Daryl L. Lessin
Management Planner License #133585
Expiration 8/6/2021

Earth Tech Enterprises, Inc.
5409 E 15th St
Tulsa, OK 74112
918-712-9163

08/26/20

Holloway, Updike and Bellen, Inc.
818 East Side Boulevard
Muskogee, OK 74403

Project: Old Shawnee Water Treatment Plant
800 S. Kickapoo
Shawnee, OK

Sample No.	Color	Asbestos Content	Non Asbestos Content
0101 Exterior Plaster	Gray	None Detected	3% Cellulose 97% Silicates
0102 Exterior Plaster	Gray	None Detected	3% Cellulose 97% Silicates
0103 Exterior Plaster	Gray	None Detected	3% Cellulose 97% Silicates
0201 Engine Oil Filter Gasket	Brown	None Detected	100% Cellulose
0202 Engine Oil Filter Gasket	Brown	None Detected	100% Cellulose
0203 Engine Oil Filter Gasket	Brown	None Detected	100% Cellulose

Earth Tech Enterprises, Inc.
5409 East 15th Street
Tulsa, OK 74112
918-712-9163

Project: Old Shawnee Water Treatment Plant
800 S. Kickapoo
Shawnee, OK

Sample No.	Color	Asbestos Content	Non Asbestos Content
0301 Fresh Water Cooler Gasket	Gray	70% Chrysotile	30% Non Fibrous Material
0302 Fresh Water Cooler Gasket	Gray	70% Chrysotile	30% Non Fibrous Material
0303 Fresh Water Cooler Gasket	Gray	70% Chrysotile	30% Non Fibrous Material
0401 Insulation Debris on Floor	Brown	None Detected	100% Cellulose
0402 Insulation Debris on Floor	Brown	None Detected	100% Cellulose
0403 Insulation Debris on Floor	Brown	None Detected	100% Cellulose
0501 Gasket From Locker – Lower Level	Gray	90% Chrysotile	10% Non Fibrous Material
0502 Gasket From Locker – Lower Level	Gray	90% Chrysotile	10% Non Fibrous Material
0503 Gasket From Locker – Lower Level	Gray	90% Chrysotile	10% Non Fibrous Material
0601 ½" Cable Insulation	Black	None Detected	10% Cellulose 5% Synthetic 85% Vinyl
0602 ½" Cable Insulation	Black	None Detected	10% Cellulose 5% Synthetic 85% Vinyl

Earth Tech Enterprises, Inc.
5409 East 15th Street
Tulsa, OK 74112
918-712-9163

Project: Old Shawnee Water Treatment Plant
800 S. Kickapoo
Shawnee, OK

Sample No.	Color	Asbestos Content	Non Asbestos Content
0603 ½" Cable Insulation	Black	None Detected	10% Cellulose 5% Synthetic 85% Vinyl
0701 Black Filter Sand	Black	None Detected	100% Non Fibrous Material
0702 Black Filter Sand	Black	None Detected	100% Non Fibrous Material
0703 Black Filter Sand	Black	None Detected	100% Non Fibrous Material
0801 Ceiling Block	White	None Detected	5% Cellulose 95% Non Fibrous Material
0802 Ceiling Block	White	None Detected	5% Cellulose 95% Non Fibrous Material
0803 Ceiling Block	White	None Detected	5% Cellulose 95% Non Fibrous Material
0901 Roof Material	Silver/Yellow	None Detected	100% Foam
0902 Roof Material	Silver/Yellow	None Detected	100% Foam

Earth Tech Enterprises, Inc.
5409 East 15th Street
Tulsa, OK 74112
918-712-9163

Project: Old Shawnee Water Treatment Plant
800 S. Kickapoo
Shawnee, OK

Sample No.	Color	Asbestos Content	Non Asbestos Content
0903 Roof Material	Silver/Yellow	None Detected	100% Foam

I certify that the above samples were analyzed by Polarized Light Microscopy using the McCrone method of dispersion staining analysis.

Daryl L. Lewis

Earth Tech Enterprises, Inc.
5409 East 15th Street
Tulsa, OK 74112
918-712-9163



Engine Oil Filter Gasket Location



Fresh Water Cooler Gasket Location



Gasket in Locker Lower Level

08/26/20

Holloway, Updike and Bellen, Inc.
818 East Side Boulevard
Muskogee, OK 74403

Project: Old Chemical Building
Shawnee, OK

Sample No.	Color	Asbestos Content	Non Asbestos Content
0101 Exterior Wall Plaster	Gray	None Detected	3% Cellulose 97% Silicates
0102 Exterior Wall Plaster	Gray	None Detected	3% Cellulose 97% Silicates
0103 Exterior Wall Plaster	Gray	None Detected	3% Cellulose 97% Silicates
0201 Ceiling Block	White	None Detected	100% Non Fibrous Material
0202 Ceiling Block	White	None Detected	100% Non Fibrous Material
0203 Ceiling Block	White	None Detected	100% Non Fibrous Material

Earth Tech Enterprises, Inc.
5409 East 15th Street
Tulsa, OK 74112
918-712-9163

Project: Old Chemical Building
Shawnee, OK

Sample No.	Color	Asbestos Content	Non Asbestos Content
0301 Interior Wall Plaster	Gray	None Detected	4% Cellulose 96% Non Fibrous Material
0302 Interior Wall Plaster	Gray	None Detected	4% Cellulose 96% Non Fibrous Material
0303 Interior Wall Plaster	Gray	None Detected	4% Cellulose 96% Non Fibrous Material

I certify that the above samples were analyzed by Polarized Light Microscopy using the McCrone method of dispersion staining analysis.

Daryl L. Lucas

Earth Tech Enterprises, Inc.
5409 East 15th Street
Tulsa, OK 74112
918-712-9163

Addendum No. 1

Water System Improvements
Water Treatment Plant Expansion
Shawnee Municipal Authority
Shawnee, Oklahoma

April 14, 2021

The plans and specifications on the above referenced project shall be and are hereby amended as follows:

I. PLANS

ITEM NO. 1: Plan Sheet Nos. 25 and 26

PVC collection pipes in the filter floor shall be provided by the contractor (not by the filter equipment supplier).

Provide a DIP wall spool on each 24" line in the wall between the pipe gallery and the filter. Connect the PVC collection pipe to the wall spool with MJ fittings.

ITEM NO. 2: Plan Sheet No. 30

On Section 4/30 change "20" to "24"."

ITEM NO. 3: Plan Sheet No. 19

See attached Sheet No. 19 showing what items are provided by the clarifier supplier.

ITEM NO. 4: Plan Sheet No. 10

Change the line size on the line between MHA and MHB from 30" to 12".

ITEM NO. 5: Plan Sheet No. 11 – Air/Vacuum Valve Details

A detail of the air/vacuum valve on Line A is attached.

ITEM NO. 6: Structural Drawings

The vacuum chamber walls shall be poured monolithically.

Structural fill on Sheet Nos. 57 and 58 shall be sand.

ITEM NO. 7: Electrical Drawings

Refer to Drawing E 3 and E13. Change all references of feeder "F1500" to "F1600".

ITEM NO. 8: Plan Sheet No. 15 – Chemical Lines

PVC conduits for chemical feed lines shall be Schdule 80

ITEM NO. 9: Plan Sheet No. 20 – Canal Gates

Canal gates for 20" interconnect lines shall be Waterman AG-31 aluminum gates.

ITEM NO. 10: Plan Sheet No. 7

Solid slab all disturbed areas per note on Sheet 7.

II. SPECIFICATIONS

ITEM NO. 1: Section 15.6

Provide 8 each of each filter valve in lieu of 4 each.

ITEM NO. 2: Section 15.9

Blowers shall be 40 hp in lieu of 15 hp.

III. BID DOCUMENTS

ITEM NO. 1: Wage Rates

The wage rates in the bid documents shall be replaced with the attached revised wage rates.

ITEM NO. 2: Plans of Existing Facilities

Plans of the existing facilities as available are attached. The Owner is not responsible for the accuracy of these plans.

A copy of this addendum shall be added to and made a part of each bid.

Sincerely,
HOLLOWAY, UPDIKE AND BELLEN, INC.

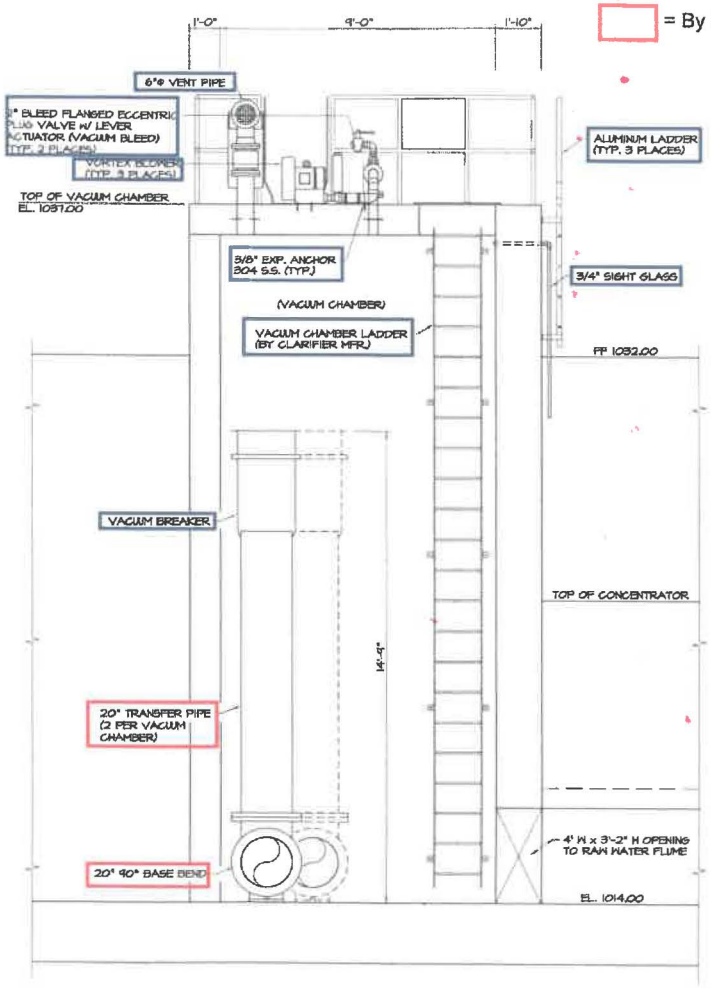
Jay Updike, P.E.
Vice President

JU/mm 19SHAWWTP

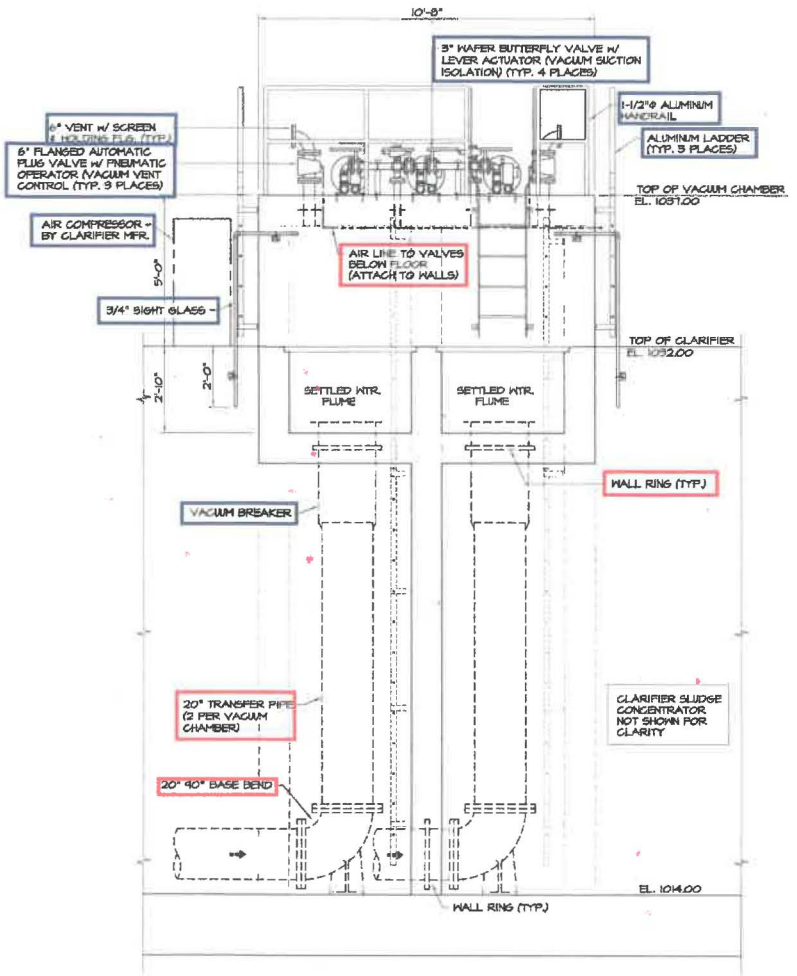


= By SUEZ

= By Others



2 / 19 SECTION
SCALE: 1/2" = 1'-0"



3 / 19 SECTION
SCALE: 1/2" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

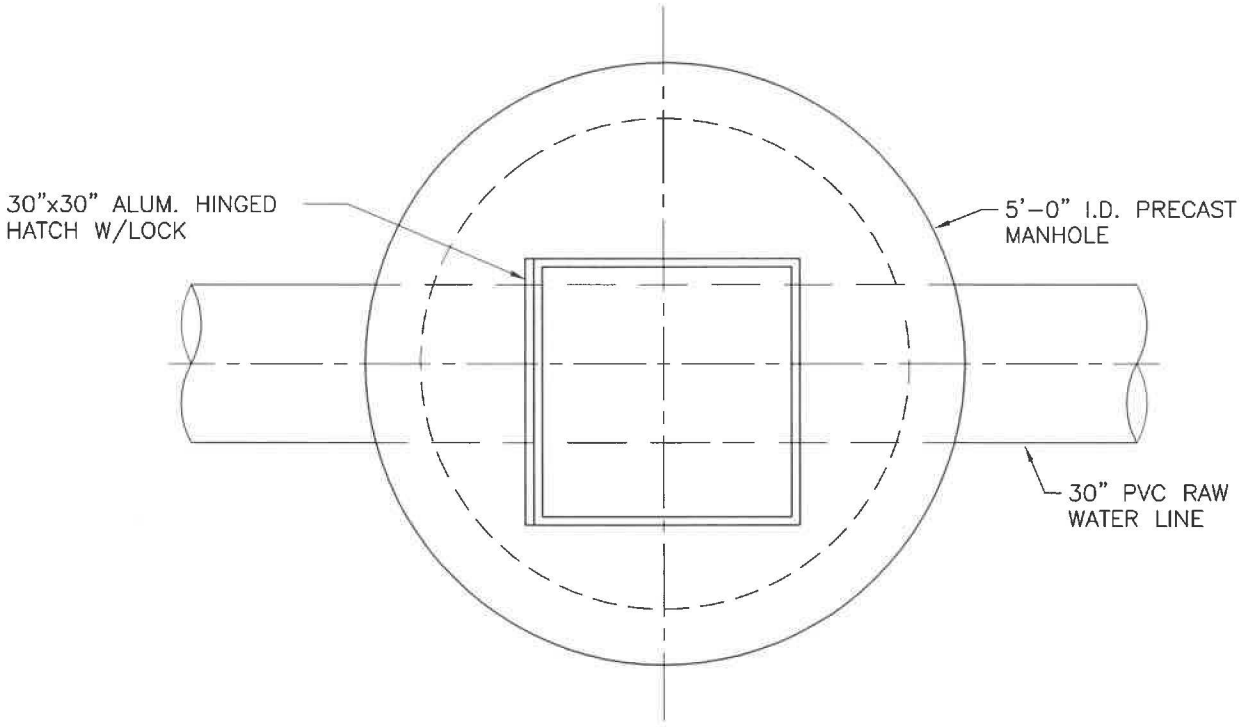
Holloway, Updike and Beilen, Inc.

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

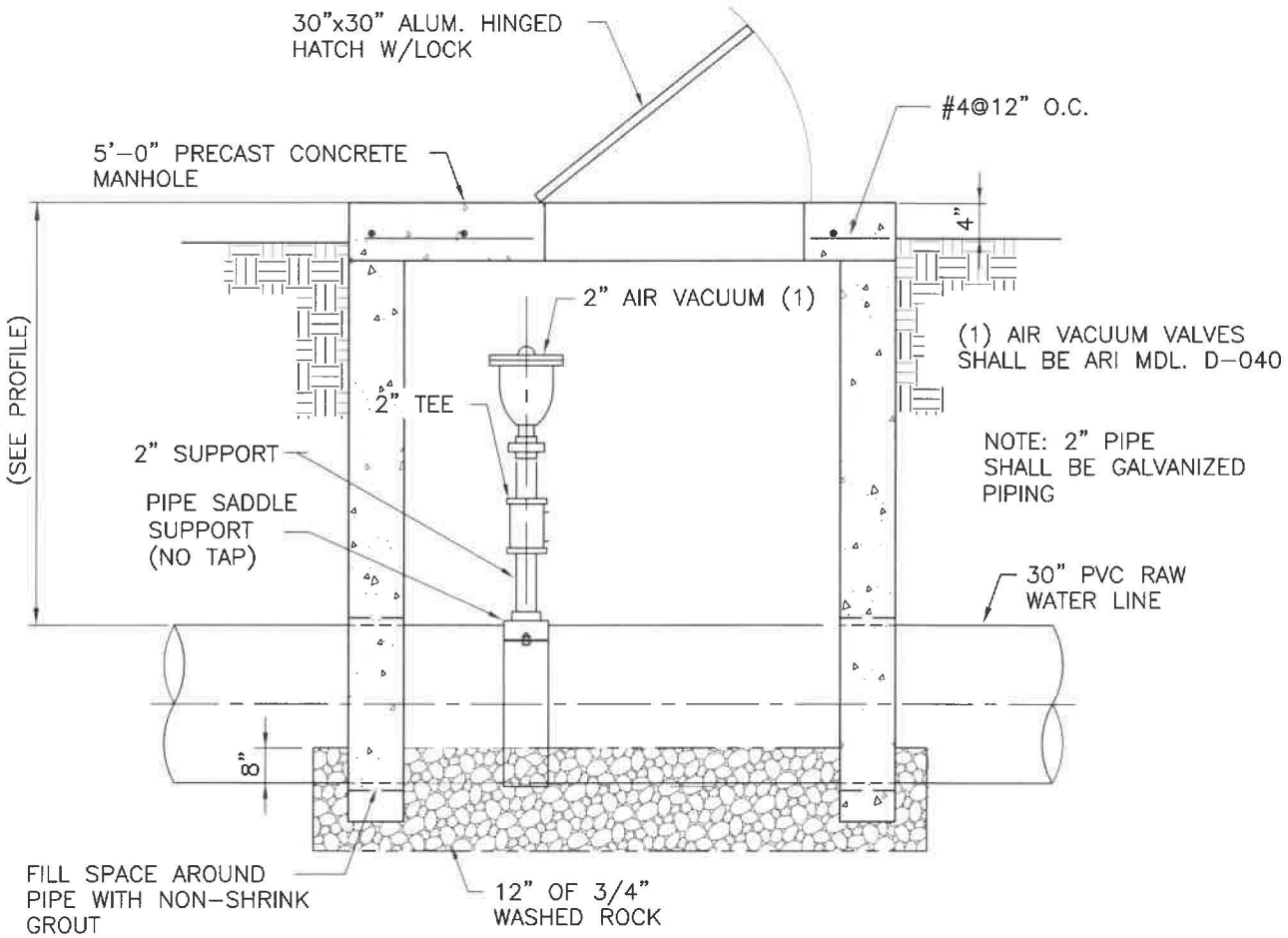
Scale: As Shown | Detail: SPM
Date: 2020 | Check: JRU

TREATMENT PROCESS BUILDING
VACUUM CHAMBER PLAN AND SECTIONS

Proj. No. 19SHAWMTP
Sht. No. 19



PLAN



AIR/VACUUM VALVE DETAILS

SCALE: NONE

"General Decision Number: OK20210035 04/09/2021

Superseded General Decision Number: OK20200035

State: Oklahoma

Construction Type: Heavy

Counties: Atoka, Bryan, Carter, Choctaw, Coal, Garvin, Haskell, Hughes, Johnston, Latimer, Love, Marshall, McCurtain, Murray, Pittsburg, Pontotoc, Pottawatomie, Pushmataha and Seminole Counties in Oklahoma.

HEAVY CONSTRUCTION PROJECTS (including sewer/water line construction; heavy construction projects on treatment plants) (excludes heavy dredging and water well drilling)

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.95 for calendar year 2021 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.95 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2021. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate,if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/01/2021
1	04/09/2021

ELEC1002-005 07/05/2020

	Rates	Fringes
ELECTRICIAN	$ 39.32	29.5%+7.50

ENGI0627-017 06/01/2019

	Rates	Fringes
POWER EQUIPMENT OPERATOR:		
Group 1	$ 31.05	13.75
Group 2	$ 29.35	13.75
Group 3	$ 28.80	13.75
Group 4	$ 28.00	13.75
Group 5	$ 26.90	13.75

Group 6	$ 25.25	13.75
Group 8	$ 23.65	13.75
Group 9	$ 23.15	13.75
Group10	$ 22.20	13.75

POWER EQUIPMENT OPERATOR
GROUP 1: All Crane Type Equipment 200 ton and larger and including 400 ton capacity cranes. All Tower Cranes.

GROUP 2: All Crane Type Equipment 100 ton capacity and larger cranes, and less than 200 ton capacity.

GROUP 3: All Crane Type Equipment 50 ton capacity and larger cranes, and less than 100 ton capacity. Crane Equipment (as rated by mfg.) 3 cu. yd. and over Guy derrick Whirley Power Driven Hole Digger (with 30' and longer mast).

GROUP 4: CRANES with Boom Incl. Jib less than 100 ft and less than 3 cu. Yd.; Overhead Monorail Crane; MECHANIC; BACKHOE; TRACKHOE; GRADER/BLADE; Power Driven Hole Digger with less than 30' mast
GROUP 5: BULLDOZER; BOBCAT/SKID STEER/SKID LOADER
GROUP 6: Rotary Drilling Machine when operated from console
GROUP 8: FORK-LIFT; TRACTOR
GROUP 9: PUMPS
GROUP 10:OILER

IRON0048-008 06/01/2019

CARTER, GARVIN, JOHNSTON, LOVE, MARSHALL, MURRAY, PONTOTOC, POTTAWATOMIE, AND SEMINOLE COUNTIES

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 26.00	15.35

IRON0584-022 06/01/2019

ATOKA, BRYAN, CHOCTAW, COAL, HASKELL, HUGHES, LATIMER, MCCURTAIN, PITTSBURG, AND PUSHMATAHA COUNTIES

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 26.00	15.35

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* TEAM0516-006 07/06/2020

	Rates	Fringes
TRUCK DRIVER		
(3) Flatbed Truck	$ 27.25	13.15

SUOK2012-013 05/18/2012

	Rates	Fringes
CARPENTER (Form Work Only)	$ 14.00	0.00
LABORER: Common or General	$ 13.09	0.00
LABORER: Pipelayer	$ 14.00	0.00

OPERATOR: Scraper.....$ 14.00 0.00

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division

U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

"General Decision Number: OK20210071 04/09/2021

Superseded General Decision Number: OK20200071

State: Oklahoma

Construction Type: Building
Building Construction -does not include residential construction consisting of single family homes and apartments up to and including 4 stories. (Including building projects on treatment plants)

Counties: Coal, Garvin, Haskell, Hughes, Latimer, Marshall, McCurtain, Pittsburg, Pontotoc, Pottawatomie, Pushmataha and Seminole Counties in Oklahoma.

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.95 for calendar year 2021 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.95 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2021. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate,if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/01/2021
1	04/09/2021

BOIL0592-001 01/01/2017

	Rates	Fringes
BOILERMAKER	$ 28.47	21.88

ELEC0301-006 06/01/2017

MCCURTAIN COUNTY ONLY

	Rates	Fringes
ELECTRICIAN	$ 23.80	10.85

ELEC0301-007 06/01/2017

MCCURTAIN COUNTY ONLY

	Rates	Fringes
ELECTRICIAN (Low Voltage Wiring, Alarm Installation, and Sound and Communications Systems Installation Only)	$ 23.80	10.85

ELEC0584-013 05/28/2018

COAL, HASKELL, HUGHES, LATIMER, PITTSBURG AND PUSHMATAHA COUNTIES ONLY

	Rates	Fringes
ELECTRICIAN (Low Voltage Wiring, Alarm Installation, and Sound and Communications Systems Installation Only)	$ 30.43	7%+9.70

ELEC0584-016 05/28/2018

COAL, HASKELL, HUGHES, LATIMER, PITTSBURG AND PUSHMATAHA COUNTIES ONLY

	Rates	Fringes
ELECTRICIAN	$ 30.43	7%+9.70

* ELEC1141-015 12/28/2020

GARVIN, MARSHALL, PONTOTOC, POTTAWATOMIE AND SEMINOLE COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 34.15	17.25%+6.00

ELEC1141-019 06/01/2018

GARVIN, MARSHALL, PONTOTOC, POTTAWATOMIE AND SEMINOLE COUNTIES

	Rates	Fringes
ELECTRICIAN (Low Voltage Wiring, Alarm Installation, and Sound and Communication Systems Installation Only)	$ 19.86	15.5%+5.60

ENGI0627-018 06/01/2019

	Rates	Fringes
POWER EQUIPMENT OPERATOR:		
Group 1	$ 31.05	13.75
Group 2	$ 29.35	13.75
Group 3	$ 28.80	13.75
Group 4	$ 28.00	13.75
Group 5	$ 26.90	13.75
Group10	$ 22.20	13.75

POWER EQUIPMENT OPERATOR
GROUP 1: All Crane Type Equipment 200 ton and larger and

including 400 ton capacity cranes. All Tower Cranes.

GROUP 2: All Crane Type Equipment 100 ton capacity and larger cranes, and less than 200 ton capacity.

GROUP 3: All Crane Type Equipment 50 ton capacity and larger, and less than 100 ton capacity. Crane Equipment (as rated by mfg.) 3 cu. yd. and over Guy derrick Whirley Power Driven Hole Digger (with 30' and longer mast).

GROUP 4: CRANES with Boom Incl. Jib less than 100 ft and less than 3 cu. Yd.; Overhead Monorail Crane.

GROUP 5: BULLDOZER
GROUP 10: OILER

IRON0048-013 06/01/2019

GARVIN, MARSHALL, PONTOTOC, POTTAWATOMIE AND SEMINOLE COUNTIES ONLY

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 26.00	15.35

IRON0584-024 06/01/2019

COAL, HASKELL, HUGHES, LATIMER, MCCURTAIN, PITTSBURG AND PUSHMATAHA COUNTIES ONLY

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 26.00	15.35

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* PLUM0344-015 07/01/2020

COAL, GARVIN, HUGHES, MARSHALL, PONTOTOC, POTTAWATOMIE, PUSHMATAHA AND SEMINOLE COUNTIES

	Rates	Fringes
PIPEFITTER (Including Installation of HVAC Electrical/Temperature Controls and HVAC Pipe Installation)	$ 34.00	14.59

---

* PLUM0344-018 07/01/2020

COAL, GARVIN, HUGHES, MARSHALL, PONTOTOC, POTTAWATOMIE, PUSHMATAHA AND SEMINOLE COUNTIES

	Rates	Fringes
PLUMBER (Excludes HVAC Pipe Installation)	$ 34.00	14.59

PLUM0430-015 10/01/2020

HASKELL, LATIMER, MCCURTAIN AND PITTSBURG COUNTIES

	Rates	Fringes
PIPEFITTER (Including Installation of HVAC Electrical/Temperature Controls and HVAC Pipe Installation)	$ 32.25	13.98

PLUM0430-018 10/01/2020

HASKELL, LATIMER, MCCURTAIN AND PITTSBURG COUNTIES

	Rates	Fringes
PLUMBER (Excludes HVAC Pipe Installation)	$ 32.25	13.98

SHEE0124-013 07/01/2020

COAL, GARVIN, HUGHES, MARSHALL, PONTOTOC, POTTAWATOMIE AND SEMINOLE COUNTIES ONLY

	Rates	Fringes
SHEET METAL WORKER (Including HVAC Duct Installation)	$ 32.98	15.66

SHEE0270-007 06/01/2017

HASKELL, LATIMER, MCCURTAIN, PITTSBURG AND PUSHMATAHA COUNTIES ONLY

	Rates	Fringes
SHEET METAL WORKER (Including HVAC Duct Installation)	$ 31.89	14.31

SUOK2012-051 06/18/2012

	Rates	Fringes
BRICKLAYER	$ 20.00	0.00
CARPENTER (Acoustical Ceiling Installation Only)	$ 16.24	0.00
CARPENTER (Drywall Hanging Only)	$ 14.96	0.00
CARPENTER, Excludes Acoustical Ceiling Installation, Drywall Hanging, and Form Work	$ 16.82	2.82
CEMENT MASON/CONCRETE FINISHER	$ 14.50	0.00
FLOOR LAYER (Hardwood and Carpet)	$ 18.74	1.10
FORM WORKER	$ 16.79	3.12
GLAZIER	$ 15.27	1.46

LABORER: Common or General	$ 11.43	0.00
LABORER: Mason Tender - Brick	$ 12.00	0.00
LABORER: Mason Tender - Cement/Concrete	$ 13.04	0.00
LABORER: Pipelayer	$ 11.65	0.00
OPERATOR: Backhoe/Excavator/Trackhoe	$ 16.83	0.00
OPERATOR: Forklift	$ 18.02	0.00
PAINTER: Brush, Roller and Spray	$ 12.32	0.00
ROOFER	$ 15.00	0.29
SPRINKLER FITTER (Fire Sprinklers)	$ 21.52	6.00

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

==========

END OF GENERAL DECISION"





















SHAWNEE WATER TREATMENT PLANT

1980

MAYOR

JERRY OZERETNY

COMMISSIONERS

GEORGE D. SNIDER

BUREN WILSON

ISSAC E. BRANNON

CECIL JOHNSTON

ARNOLD T. DAVIS,JR.

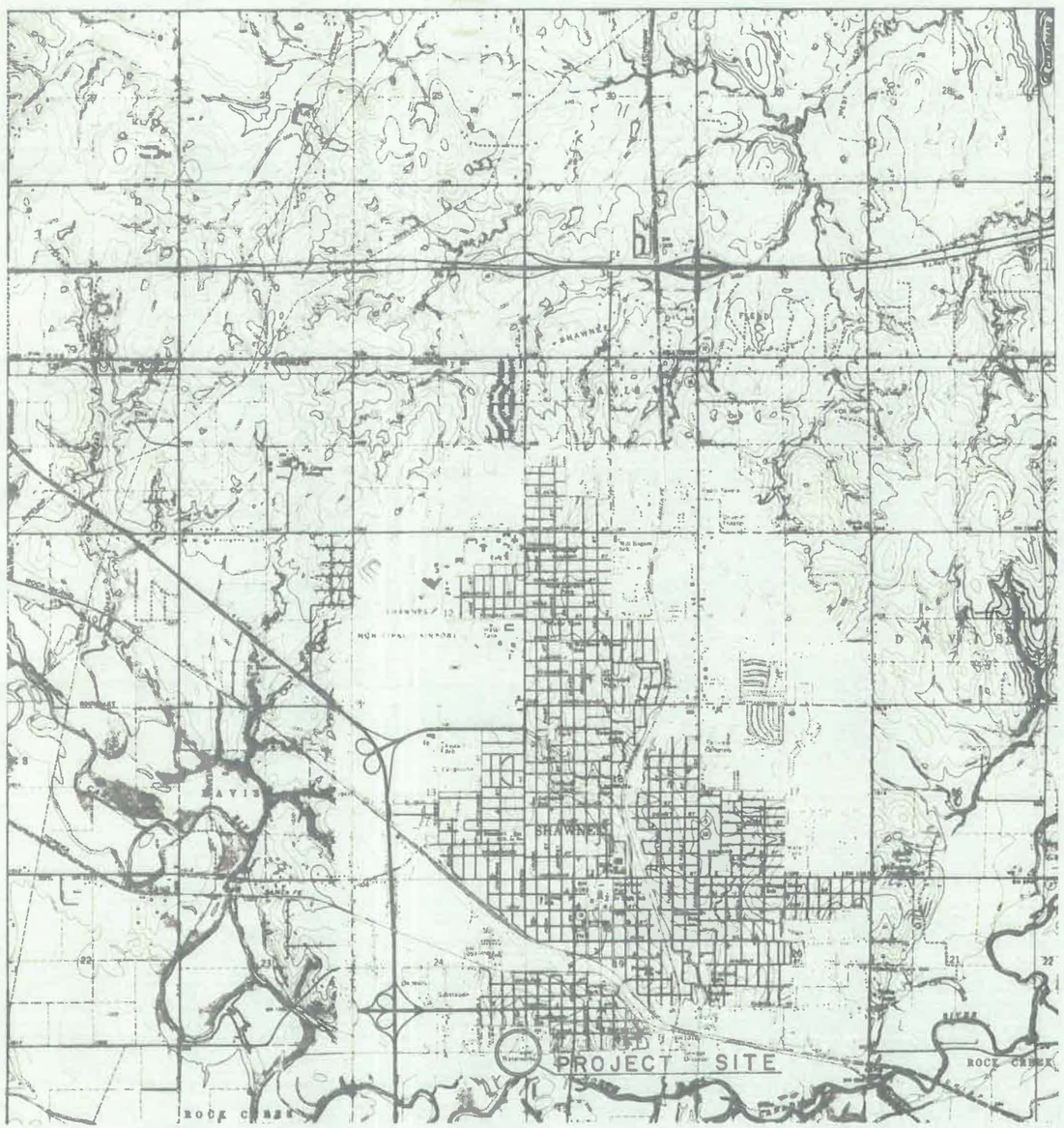
JACK W.KIZZIA

CITY MANAGER

WAYNE J. MARSHALL

BENHAM BLAIR AND AFFILIATES,INC.
ARCHITECTS AND ENGINEERS

DAVE CONSTRUCTION, INC.
GENERAL CONTRACTOR



VICINITY MAP

A POSTING OF ADDENDUM NO. 1 DATED JAN. 9, 1978
B POSTING OF ADDENDUM NO. 2 DATED JAN. 12, 1978
C REVISION DATED FEB. 10, 1978.
D REVISION DATED JUNE 18, 1978
E REVISION DATED JUNE 20, 1978

SITE WORK

SHEET NO.	
A-1	INDEX OF SHEETS & VICINITY MAP
A-2	SITE PLAN
A-3	GRADING & DRAINAGE PLAN
A-4	PIPING PLAN
A-5	SOUTH SITE, GRADING & PIPING PLAN
A-6	ROAD AND STORM SEWER PROFILES
A-7	TYPICAL ROAD SECTIONS
A-8	DRAINAGE CHANNEL
A-9	DRAINAGE CHANNEL DETAILS
A-10	DRAINAGE STRUCTURE DETAILS
A-11	DROP INLET DETAILS
A-12	WATER LINE DETAILS
A-13	MANHOLE DETAILS

STRUCTURAL

SHEET NO.	
B-1	STRUCTURAL GENERAL NOTES AND TYPICAL DETAILS
B-2	CLARIFIER - FLOCCULATOR STRUCTURAL PLAN FOR NO. 1 AND NO. 2 SECTIONS AND DETAILS
B-3	FILTER BUILDING - FOUNDATION PLAN AND SECTIONS
B-4	FILTER BUILDING - UPPER LEVEL FRAMING PLAN AND SECTIONS
B-5	FILTER BUILDING - ROOF FRAMING PLAN AND SECTIONS
B-6	FILTER BUILDING - LONGITUDINAL SECTION A-A
B-7	FILTER BUILDING - LONGITUDINAL SECTION B-B
B-8	FILTER BUILDING - TRANSVERSE SECTIONS C-C AND D-D AND SECTION DETAILS
B-9	FILTER BUILDING - SECTIONS
B-10	FILTER BUILDING - SECTIONS
B-11	FILTER BUILDING - SECTIONS AND DETAILS
B-12	FILTER BUILDING - SECTIONS
B-13	FILTER BUILDING - BEAM SCHEDULE AND COLUMN DETAILS
B-14	FILTER BUILDING - SECTIONS AND CONCRETE STAIR DETAILS
B-15	CLEARWELL - FOUNDATION PLAN AND DETAILS
B-16	CLEARWELL - ROOF FRAMING PLAN AND DETAILS
B-17	PUMP BUILDING - FOUNDATION PLAN AND DETAILS
B-18	PUMP BUILDING - SUMP PLAN AND DETAILS
B-19	PUMP BUILDING - ROOF FRAMING PLAN AND DETAILS
B-20	CHEMICAL BUILDING - FOUNDATION PLAN
B-21	CHEMICAL BUILDING - ROOF FRAMING PLAN
B-22	CHEMICAL BUILDING - SECTIONS AND DETAILS
B-23	CHEMICAL BUILDING - SECTIONS AND DETAILS
B-24	RETAINING WALL DETAILS

ARCHITECTURAL

SHEET NO	
C-1	FILTER BUILDING - FLOOR PLAN
C-2	FILTER BUILDING - BASEMENT PLAN
C-3	FILTER BUILDING - ELEVATIONS
C-4	FILTER BUILDING - SOUTH ELEVATION & SECTIONS
C-5	FILTER BUILDING - SECTIONS & DETAILS
C-6	CASEWORK ELEVATIONS - ROOM FINISH SCHEDULE
C-7	DOOR SCHEDULE & DOOR DETAILS
C-8	CHEMICAL BUILDING - FLOOR PLAN
C-9	CHEMICAL BUILDING - ELEVATIONS EAST & SOUTH
C-10	CHEMICAL BUILDING - ELEVATIONS WEST & NORTH
C-11	CHEMICAL BUILDING - SECTIONS & DETAILS
C-12	CHEMICAL BUILDING - DETAILS
C-13	PUMP BUILDING ELEVATION AND DETAILS

PLUMBING, HEATING, VENTILATING & AIR CONDITIONING

SHEET NO.	
D-1	FILTER BUILDING - LOWER LEVEL HVAC PLAN
D-2	FILTER BUILDING - UPPER LEVEL HVAC PLAN
D-3	FILTER BUILDING - LOWER LEVEL PLUMBING PLAN
D-4	FILTER BUILDING - UPPER LEVEL PLUMBING PLAN
D-5	PUMP BUILDING - HVAC & PLUMBING PLAN
D-6	CHEMICAL BUILDING - HVAC PLAN
D-7	CHEMICAL BUILDING - PLUMBING PLAN
D-8	HEATING, VENTILATING & AIR CONDITIONING DETAILS
D-9	PLUMBING DETAILS

PROCESS EQUIPMENT

SHEET NO.	
E-1	FLOW SCHEMATIC
E-2	HYDRAULIC PROFILE
E-3	INFLUENT VALVE BOX
E-4	RAPID MIX AND FLOW SPLITTER BASIN
E-5	CLARIFIER - FLOCCULATOR PIPING & EQUIPMENT
E-6	SLUDGE CONTROL BOX AND SURGE CONTROL BASIN
E-7	FILTER BUILDING PIPING PLAN
E-8	FILTER BUILDING AND PUMP BUILDING SECTIONS
E-9	FILTER BUILDING DETAILS
E-10	PUMP BUILDING
E-11	CLEARWELL
E-12	GENERAL PLAN, CHEMICAL BUILDING
E-13	CHEMICAL BUILDING ISOMETRIC
E-14	CHLORINATION PIPING ISOMETRIC
E-15	CHLORINATION DETAILS
E-16	PIPING DETAIL
E-17	EXISTING CHEMICAL BUILDING DETAIL
E-18	LAGOON INLET & OUTLET DETAILS
E-19	MISCELLANEOUS DETAILS
E-20	ALTITUDE VALVE BOX
E-21	CLEARWELL CONNECTION
E-22	CARBON STORAGE TANK

INSTRUMENTATION AND CONTROLS

SHEET NO.	
F-1	INSTRUMENTATION LOOP DIAGRAM & DETAILS SHT. 1
F-2	INSTRUMENTATION LOOP DIAGRAM & DETAILS SHT. 2
F-3	INSTRUMENTATION LOOP DIAGRAM & DETAILS SHT. 3
F-4	INSTRUMENTATION LOOP DIAGRAM & DETAILS SHT. 4

ELECTRICAL

SHEET NO.	
G-1	ELECTRICAL SITE PLAN
G-2	ONE LINE DIAGRAM
G-3	ELECTRICAL LEGENDS & SCHEDULES
G-4	CHEMICAL BUILDING LIGHTING & RECEPTACLE PLAN
G-5	CHEMICAL BUILDING POWER PLAN
G-6	PUMP BUILDING LIGHTING & RECEPTACLE PLAN
G-7	PUMP BUILDING POWER PLAN
G-8	FILTER BUILDING UPPER LEVELS POWER & LIGHTING PLAN
G-9	FILTER BUILDING BASEMENT POWER & LIGHTING PLAN
G-10	FILTER BUILDING ELECTRICAL DETAILS
G-11	CLARIFIER - FLOCCULATOR ELECTRICAL PLAN
G-12	MISCELLANEOUS ELECTRICAL DETAILS
G-13	ELECTRICAL CONTROL SCHEMATICS - SHEET 1
G-14	ELECTRICAL CONTROL SCHEMATICS - SHEET 2

PROFESSIONAL ENGINEER

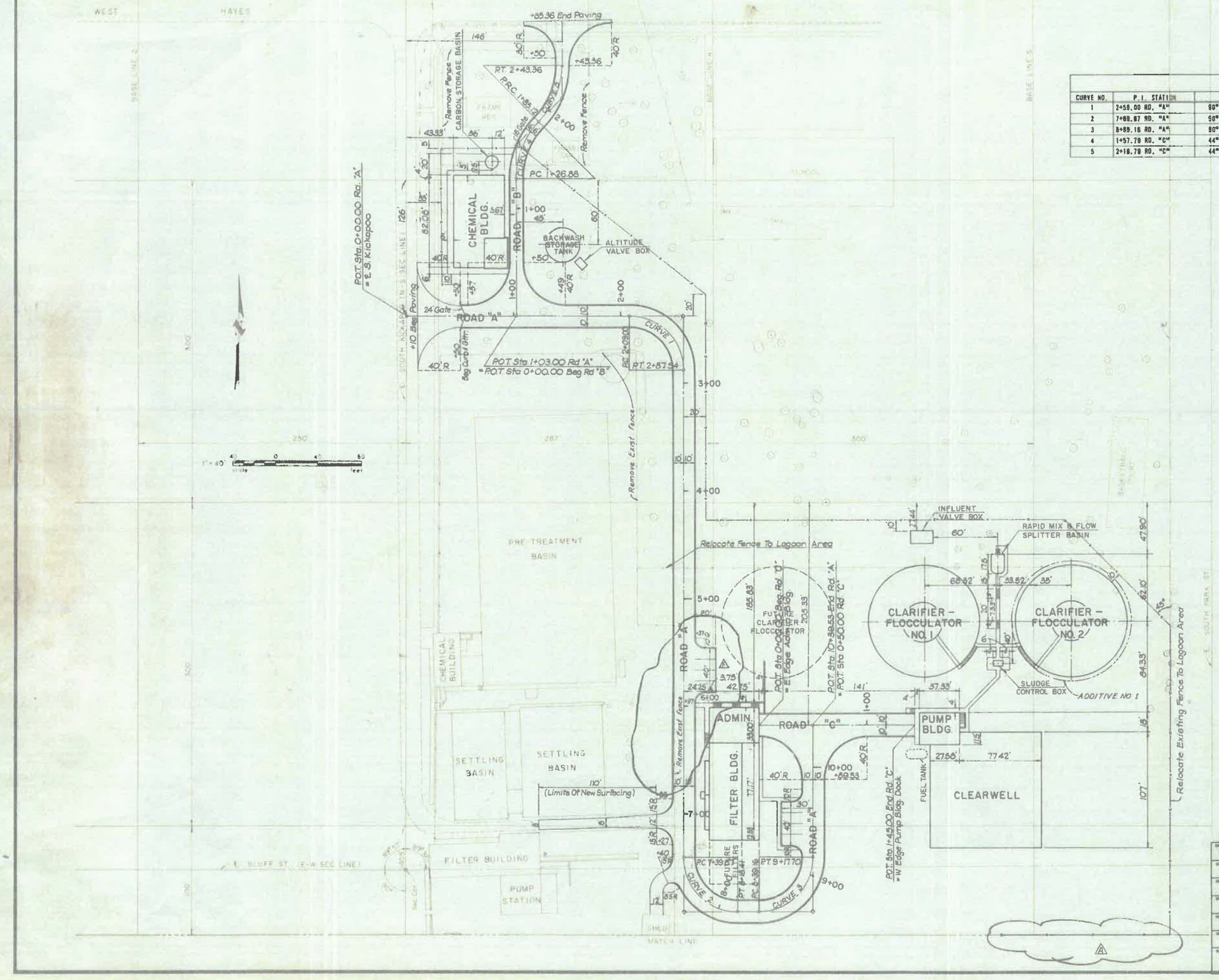
Submitted December 1, 1977
Benham-Blair & Affiliates, Inc.
By John Marion Baker

Approved December 1, 1977
Shawnee Municipal Authority
By Roy H. Ludder
Chairman

Attest: Lottie Ann Young
Secretary

DATE 11-30-77	Shawnee, Oklahoma
JOB NO. NONE	WATER TREATMENT PLANT
DESIGNED BY R.C.C.	INDEX OF SHEETS & VICINITY MAP
DRAWN BY T.S.W.	
CHECKED BY L.W.R	
SUPERVISED BY J.M.B.	
SHEET A-1	Benham - Blair & Affiliates, Inc.

1017 WT IA-Shawnee 12/77



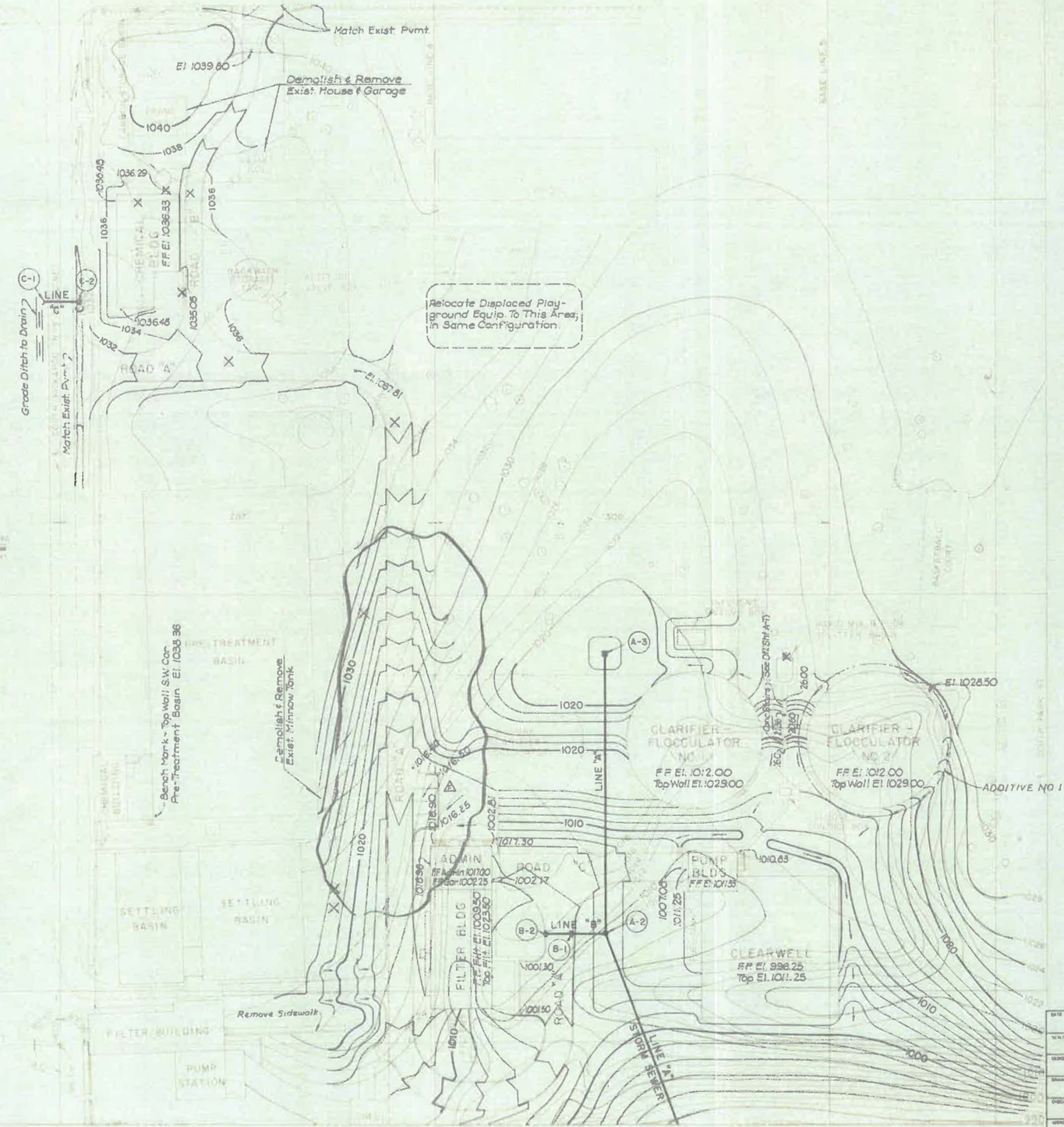
CURVE DATA						
CURVE NO.	P.I. STATION	Δ	D	T	L	R
1	2+59.00 RD. "A"	90°00'00" RT.	114°36'00"	50.00	78.54	50.00
2	7+88.87 RD. "A"	90°00'00" LT.	114°36'00"	50.00	78.54	50.00
3	8+89.16 RD. "A"	90°00'00" LT.	114°36'00"	50.00	78.54	50.00
4	1+57.79 RD. "C"	44°29'24" RT.	76°23'39.74"	30.67	58.24	75.00
5	2+18.79 RD. "C"	44°29'24" LT.	76°23'39.74"	30.67	58.24	75.00

NOTES:

1. ALL SIDEWALKS, NOT SHOWN OTHERWISE, ARE THREE FEET WIDE.
2. ALL DIMENSIONS ARE TO FACE OF CURB AND OUTSIDE OF BUILDING.
3. SEE SPECIFICATIONS FOR FENCE DETAILS.

△ Nov. 9, 1979 Revise Parking
△ Jan. 9, 1978 Revise Fence Location

DATE 11-30-77	Shawnee, Oklahoma
SCALE 1" = 40'	WATER TREATMENT PLANT
DESIGNED BY R.C.C.	NORTH SITE PLAN
DRAWN BY R.C.C.	
CHECKED BY L.W.R.	
APPROVED BY J.M.B.	Benham - Blair & Affiliates, Inc.
SHEET A-2	

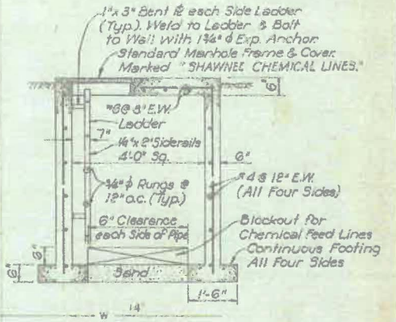

Match Exist. Pvmt.
El 1039.80
Demolish & Remove Exist. House & Garage
1040
1038
1036.45
1036.29
1036
FF El. 1036.33
1035.05
1034.48
1034
1032
1036
1035
Grade Ditch to Drain
C-1
C-2
LINE "C"
Match Exist. Pvmt.
Relocate Displaced Playground Equip. To This Area; In Same Configuration.
El. 1037.81
ROAD A
CHEMICAL BLDG
BACKWASH SETTLING BASIN
Remove Sidewalk
Bench Mark - Top Wall S.W. Cor. Pre-Treatment Basin El. 1038.36
Demolish & Remove Exist. Minnow Tank
PRE-TREATMENT BASIN
SETTLING BASIN
SETTLING BASIN
FILTER BUILDING
PUMP STATION
1030
1020
1020
1020
1010
1010
1000
1010.90
1016.25
1016.50
1002.85
1017.30
1010.63
1007.00
1011.25
1002.17
1001.30
1001.50
ROAD B
ROAD C
ADMIN
FF Admin 1017.00
FF Garr 1002.25
FILTER BLDG
FF Filt El. 1009.50
Top Filt El. 1023.50
PUMP BLDG
FF El. 1011.33
CLEARWELL
FF El. 998.25
Top El. 1011.25
LINE "A"
LINE "B"
STORM SEWER
A-3
A-2
B-2
B-1
CLARIFIER - FLOCCULATOR NO. 1
FF El. 1012.00
Top Wall El. 1029.00
CLARIFIER - FLOCCULATOR NO. 2
FF El. 1012.00
Top Wall El. 1029.00
El. 1028.50
ADDITIVE NO. 1
26.00
26.00
See Detail A-17
See Detail A-17
LEGEND
EXISTING
NEW
BUILDINGS
ROADS & SIDEWALKS
1020 CONTOURS
FENCES
STORM SEWERS
INLET
HEADWALL
NOTES
1. ALL FILL MATERIAL UNDER THE CHEMICAL BUILDING SHALL BE NON-EXPANSIVE. AREAS OF EXCAVATION SHALL BE OVEREXCAVATED SO AS TO PROVIDE A MINIMUM OF ONE FOOT OF UNIFORM FILL UNDER FOOTINGS.
2. REMOVE EXISTING SIDEWALKS A MINIMUM OF FIVE FEET EACH SIDE OF NEW ROADS AND REPLACE TO BACK OF CURB AT A SUITABLE GRADE. ALL EXISTING SIDEWALKS BROKEN DURING CONSTRUCTION SHALL BE REPLACED AT NO EXTRA COST.
3. REMOVE ONLY THOSE TREES MARKED WITH AN "X".
Nov 9, 1979 Revise Parking & Grading
Jan. 9, 1978 Revise Legend
DATE 11-30-77
SCALE 1" = 40'
DESIGNED BY R.C.C.
DRAWN BY R.C.C.
CHECKED BY L.W.R.
APPROVED BY J.M.B.
SHEET A-3
Shawnee, Oklahoma
WATER TREATMENT PLANT
NORTH GRADING & DRAINAGE PLAN
Durham - Blair & Affiliates, Inc.

LEGEND

PY - POLYMER
AL - ALUM
CR - CARBON
CS - CAUSTIC SODA
CLG - CL_2 GAS
CLS - CL_2 SOL'N

SANITARY SEWER SCHEDULE

LINE	STR. NO.	R. IN	R. OUT	BRANCH
A	A-1	1031.67	1031.5	-
A	A-2	1030.7	1030.5	-
A	A (EXIST.)	1030.1	1027.15(EXIST.)	-
C	C-1	999.4	999.0	-
C	C-2	995.55	995.35	-
C	C-3	993.46	993.26	-
C	C-4	991.0	990.7 (EXIST.)	990.7±
D	D-1	1002.37	1002.17	-
D	D-2	1002.87	998.87	997.5
D	D-3	997.80	996.6	997.8
D	D-4	989.1	988.9	-
D	D (EXIST.)	984.	(EXIST.)	-



MANHOLE DETAIL FOR CHEMICAL LINE BLOCK VALVES
(2 LOCATIONS)
SCALE: 1 1/2" = 1'-0"

NOTE: WHERE NOT OTHERWISE INDICATED ON PLANS, THE PIPE SHALL BE LAID AT AN ELEVATION WHICH WILL PROVIDE AFTER COMPLETION A MINIMUM DEPTH OF COVER OVER THE TOP OF PIPE AS FOLLOWS:
IN STREETS - 4 FEET BELOW SURFACE
OFF STREETS - 4 FEET BELOW CURB OR SURFACE GRADE.
DITCH CROSSINGS - 2 FEET 6 INCHES BELOW FLOW LINE
WHERE OBSTRUCTIONS PREVENT THE ABOVE DEPTH OF COVER, A MINIMUM DEPTH OF 2 FEET 6 INCHES MAY BE PERMITTED FOR A LIMITED LENGTH ONLY AFTER SPECIFIC APPROVAL BY THE ENGINEER.



LEGEND

EXISTING	NEW	
RW	———	RAW WATER
W	———	TREATED WATER
OHT	———	OVERHEAD TELEPHONE
P	———	POWER
BW	———	BACKWASH
PW	———	PROCESS WASTE
S	———	SANITARY SEWER
WW	———	WASH WATER

1-80 Chemical Lines Corrected For Record Dwgs.
⚠ Nov. 9, 1979 Revise Parking Area
⚠ Jan. 9, 1978 Revised to Show 24" Butterfly Valve.
⚠ Feb. 10, 1978 Clarification of Piping System.

DATE: 11-30-77	Shawnee, Oklahoma
SCALE: 1" = 40'	WATER TREATMENT PLANT
DESIGNED BY: L.W.R.	
DRAWN BY: L.W.R.	NORTH PIPING PLAN
CHECKED BY: J.W.M.	
APPROVED BY: J.N.B.	
SHEET: A-4	Burham - Stein & Affiliates, Inc.

LEGEND

PY - POLYMER
AL - ALUM
CR - CARBON
CS - CAUSTIC SODA
CLG - CL_2 GAS
CLS - CL_2 SOL'N.

11 Lines: PY, AL, CR, CS, CR, AL, CS, AL, CR, CS, PY — Old Chemical Bldg. / P.T. Basin / New Flash Mixer

6 Lines: PY, AL, CR, CS, CLG, CLS

Connect To Existing 16"x90° Elbow And Valve. Provide 24" Valve, 24"x24"x16" Tee, 16" Tee, 16"x90° Elbow & Plug. Plug North Outlet Of Tee.

MH A

MH A-2

6" Sanitary Sewer Line "A"

To Old Chemical Bldg.
To Exist. Filter Bldg.
To New Filter Bldg.
To Raw Water at Air Valve M.H.

CHEMICAL BLDG

ROAD "B"

M.H A-1

CLG CLG CLG CLG CLS

NOTE: 4" CIP Water Line to be Tapped to 16" Main w/ Wet Connection

4" CIP Water Line & Gate Valve w/ Box

ROAD "A"

CLS

Connect 30" Line w/ Exist. 20" Line & Install 20" Butterfly Valve w/ Box.

4" Air Vacuum Release Valve & Manhole

9 Lines: CR, AL, CS, CLG, CLG, AL, CR, CS, PY — P.T. Basin / Old Filter / New Filter / New Flash Mixer

Pre-Chlorine Diffuser Location

Contractor to Construct 16" Cross-connection & Install 2-16" Butterfly Valves w/ Boxes

24" Feeder Main

Chemical Feed Lines: Carbon, Caustic Soda, Liquid Alum, Polymer, Pre-Chlorination Chlorine To Pre-treatment Basin

2-30x30x20 Plugged Tees & Butterfly Valve & Valve Box

30x30x24 Plugged Tee

30" Raw Water Line

4" Drain Line

PRE-TREATMENT BASIN

Future Control Valve Location

Connect to Existing 30x30x20 Plugged Tee

CS

Contractor to make Dry Connection to Existing Main w/ 14" Tee and Valve

1" Copper Compressed Air

CLARIFIER - FLOCCULATOR NO. 1

CLARIFIER - FLOCCULATOR NO. 2

24"

8" Drain Line

8" Sludge Blowoff Line

2-3/4" Copper Lines from Meter

1" Compressed Air Line

Effluent Flow Meter

6" Backwash Tank Fill Line w/ Gate Valve and Box.

1" Copper Comp Air Line

Lower 14" line to 4" Min below surface

2-3/4" Copper Lines w/ Service Valves & Valve Boxes

30x30x24 Plugged Tee (Vert.)

137'-0"

F.E. Elev. 1005.5

30" Filter Influent Line

24"

M.H. Elev. 1005.5

MH D2

F.C.O.

M.H. D1

ADDITIVE NO. 1 NOT CONSTRUCTED

ADMIN

6" Drain M.H. C-1

Yard Hyd.

Fire Hyd.

4" CIP Water Line & Gate Valve w/ Box

PUMP BLDG

12" RCP Sludge Drain Line Line "D"

FILTER BLDG

6" Filter Bldg. Drain Lines

CLEARWELL

M.H C-2

M.H D-3

1" Copper Sample Line Tapped to 30" Line w/ Corporation Cock

6" San. Sewer Line "C"

30x30x30 Plugged Tee

30" Filter Effluent Line

12" Drain Line w/ Butterfly Valve & Box

30x30x30 Plugged Tees (2 w/ branch Vert., 1 w/ branch horiz.)

24" Clearwell Overflow Line

NOTES: Extend Post Chlorination Line in Filter Building to Existing Chlorinator Location. Locate Chlorine Ejector Assembly on Wall at Site of Existing Chlorinator & Remove Existing Chlorine Feed Equipment. (To Remain The Property of The City of Shawnee.) Tap 1½" Ejector Discharge Line into Existing Post-Chlorination Fittings.

1½" PVC Chlorine Solution Line

3 Chemical Feed Lines: CS

Proposed New Caustic Line C.O. #3 Item No.

1" Copper Airline Connect inside old Plant to Plant Air System w/ Valve. (Cross Connection between Plants) C.O. Item #

Connect New Caustic Line to East End of Settled Water Flume Approx. 18' W. & 10' S. of S.E. Cor. of Basin.

20" Backwash Line

1½" PVC Post Chlorination Line

CLG

Lower M.H. Top 3" to finish

Repair M.H. as required

24" Clearwell Connection

24" Butterfly Valve & Valve Box.

Extend Chlorine Gas Line Through North Wall of Filter Bldg. to Existing Post Chlorination Injection Point in Pipe Gallery (Original Contract)

NOTE: WHERE NOT OTHERWISE INDICATED ON PLANS, THE PIPE SHALL BE LAID AT AN ELEVATION WHICH WILL PROVIDE AFTER COMPLETION A MINIMUM DEPTH OF COVER OVER THE TOP OF PIPE AS FOLLOWS:

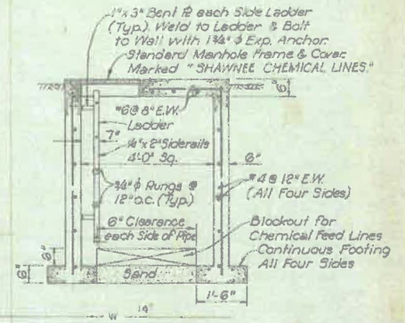
IN STREETS - 4 FEET BELOW SURFACE
OFF STREETS - 4 FEET BELOW CURB OR SURFACE GRADE.
DITCH CROSSINGS - 2 FEET 6 INCHES BELOW FLOW LINE

WHERE OBSTRUCTIONS PREVENT THE ABOVE DEPTH OF COVER, A MINIMUM DEPTH OF 2 FEET 6 INCHES MAY BE PERMITTED FOR A LIMITED LENGTH ONLY AFTER SPECIFIC APPROVAL BY THE ENGINEER.

4 Lines: PY, LS, CR, AL

SANITARY SEWER SCHEDULE

LINE	STR. NO.	R. IN	R. OUT	BRANCH
A	A-1	1031.67	1031.5	-
A	A-2	1030.7	1030.5	-
A	A (EXIST.)	1030.1	1027.15 (EXIST.)	-
C	C-1	999.4	999.0	-
C	C-2	996.55	996.35	-
C	C-3	993.46	993.26	-
C	C-4	991.0	990.7 (EXIST.)	990.7±
D	D-1	1002.37	1002.17	-
D	D-2	1002.07	999.87	997.5
D	D-3	997.83	996.8	997.8
D	D-4	989.1	988.9	-
D	D (EXIST.)	984.	(EXIST.)	-



MANHOLE DETAIL FOR CHEMICAL LINE BLOCK VALVES

(2 LOCATIONS)

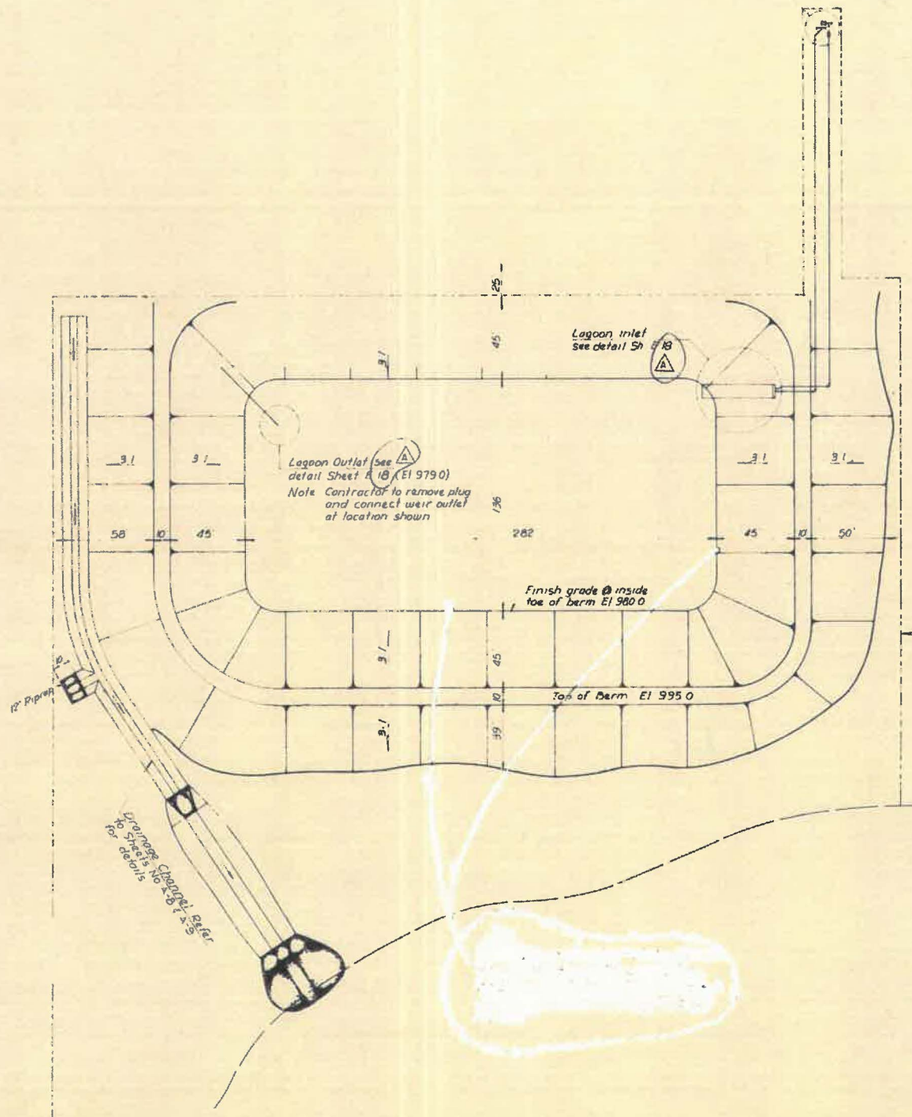
SCALE: 1/2" = 1'-0"

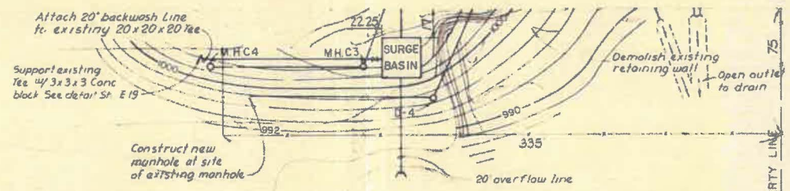
LEGEND

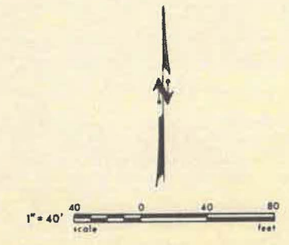
EXISTING	NEW	
RW		RAW WATER
W		TREATED WATER
OHT		OVERHEAD TELEPHONE
P		POWER
BW		BACKWASH
PW		PROCESS WASTE
S		SANITARY SEWER
WW		WASH WATER

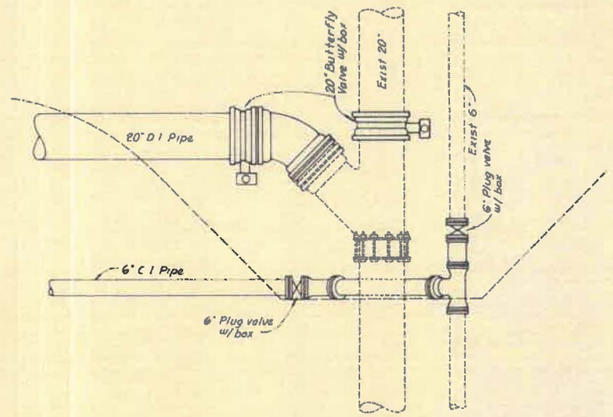
7-80 Chemical Lines Corrected For Record Dwgs.
Nov. 9, 1979 Revise Parking Area
Jan. 9, 1978 Revised to Show 24" Butterfly Valve.
Feb. 10, 1978 Clarification of Piping System.

DATE 11-30-77	Shawnee, Oklahoma
SCALE 1" = 40'	WATER TREATMENT PLANT
DESIGNED BY L.W.R.	NORTH PIPING PLAN
DRAWN BY L.W.R.	
CHECKED BY J.W.M.	
APPROVED BY J.M.B.	Benham - Blair & Affiliates, Inc.
SHEET A-4	









DETAIL "A"

3/8" = 1'-0" 12" 0 1' 2' 3' 4' 5' 6'

A Jan. 9, 1978 Location of Waste Materials and Correction of Sheet Number.

DATE 11-30-77	Shawnee, Oklahoma
SCALE AS SHOWN	WATER TREATMENT PLANT
DESIGNED BY N C	SOUTH SITE, GRADING AND PIPING PLAN
DRAWN BY N C	
CHECKED BY L W R	
APPROVED BY J M B	Benham - Blair & Affiliates, Inc.
SHEET A-5	

CASH FILE CORP Irvine, CA EFH 24

1017 WT A-6 of 13 10/77

ROAD "B"

1130 1140

0+00 +10 ~ 33.74

℄ Road "A" 0+00

+1.40 %

Chord Brg. N 1°E 1136.25

50' V.C.

+75 34.65

P.I. Sta. 1+00 Elev. 1035.00

+00 ~ 35.12

+25 35.86

Exist. Ground

Profile Ground

+3.33%

38.43

+40 ~ 38.80

P.I. Sta. 2+40 Elev. 1039.80

+65 ~ 39.31 (Exist. ℄)

ROAD "C"

1000 1010 1020

FF 1002.25

Admin & Lab

0+00 +00 ~ 02.17

+25 ~ 02.00

P.I. Sta. 0+50 Elev. 1001.75

+50 ~ 02.31

+75 ~ 03.73

50' V.C.

℄ Road "A" 0+50

+1.92%

P.I. Sta. 1+10 Elev. 1006.50

+2.00%

Pump Sta

Exist. Ground

Profile Grade

ROAD "A"

1000 1010 1020 1030 1040

0+00 +10 ~ 30.21 (Exist. E.P.)

33.81

+03 ~ 33.93

+75 36.81

37.31

+25 ~ 37.81

+75 ~ 36.81

+50 ~ 33.05

28.80

+75 21.30

19.10

5+00 +25 ~ 17.50

+75 16.10

16.00

+75 15.70

15.39

+25 ~ 14.65

+75 12.00

10.25

+75 09.00

03.45

P.I. Sta. 9+25 Elev. 1001.50

+25 ~ 02.31

+75 01.25

P.I. Sta. 9+90 Elev. 1001.17

01.40

10+00 +2.30%

10+39.53 Elev. 1002.31

+4.00%

℄ Road "B" 1+03

100' V.C.

P.I. Sta. 2+25 Elev. 1030.81

-4.00%

P.I. Sta. 3+50 Elev. 1033.80

5% Curve

-4.00%

Profile Grade

Exist Ground

P.I. Sta. 5+25 Elev. 1016.30

5% Curve

FF 1017.00

Admin

-0.40%

Top Filter 3 1023.50

P.I. Sta. 7+25 Elev. 1015.50

5% Curve

-4.00%

5% Curve

Curb FF 1002.25

-0.50%

℄ Road "C" 10+39.53

STORM SEWER LINE "A"

990 1000 1010 1020

0+00 ℄ 988.00

Str. No. A-1 Sta. 0+00
Const. Headwall w/45° Wings
O.S.H.D. Std. Des. CP-21
℄ 988.00

164 L.F. - 42" RCP @ 1.33%

℄ Out 991.00
℄ In 992.16

Str. No. A-2 Sta. 1+64
Const. Std. Manhole
℄ Out 991.00, ℄ In 992.16

Class III

212 L.F. - 42" R.C.P. @ 6.94%

Exist. Ground

Fin. Ground

℄ 1011.12

Str. No. A-3 Sta. 3+76
Const. Drop Inlet
O.S.H.D. Std. CDI-1
℄ 1011.12

STORM SEWER LINE "B"

990 1000 1010

0+00 ℄ In 994.16

Str. No. A-2 Sta. 0+00
Const. Std. Manhole
℄ 994.16

28 L.F. 30" R.C.P. @ 0.50%

℄ Out 996.47
℄ In 997.09

Str. No. B-1 Sta. 0+28
Const. Dbl. Gr. Inlet w/2 Add'l. Openings
O.S.H.D. Std. CICI-1 Des. 2(B)
℄ Out 996.47 ℄ In 997.09

℄ Out 997.31

Class III

Fin. Ground

Exist. Ground

Str. No. B-2 Sta. 0+48
Const. Dbl. Gr. Inlet w/2 Add'l. Openings
O.S.H.D. CICI-1 Des. 2(B)
℄ Out 997.31

STORM SEWER LINE "C"

1020 1030

0+00 ℄ 1026.81

Str. No. C-1 Sta. 0+00
Const. Hdwl. w/45° Wings
O.S.H.D. Std. Des. CP-21
℄ 1026.81

℄ 1026.94

Str. No. C-2 Sta. 0+32
Const. Median Drain w/Type I Grate
O.S.H.D. Std. SMD-1-12
℄ Out 1028.94 Top 1029.50

32 L.F. 18" R.C.P. @ 0.40%

Class III

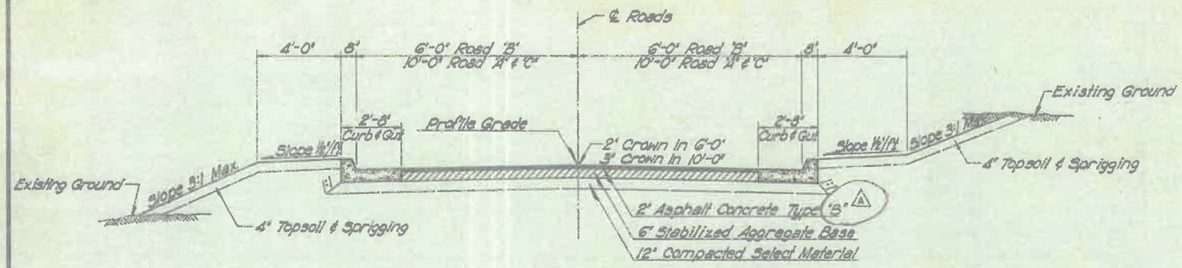
⚠ Feb. 10, 1978 Indicate Class of RCP Pipe.

DATE	11-30-77
SCALE	1" = 50' HOR. 1" = 5' VER.
DESIGNED BY	D.B. & R.C.C.
DRAWN BY	C.B.
CHECKED BY	L.W.R.
APPROVED BY	J.M.B.
SHEET	A-6

Shawnee Oklahoma
WATER TREATMENT PLANT

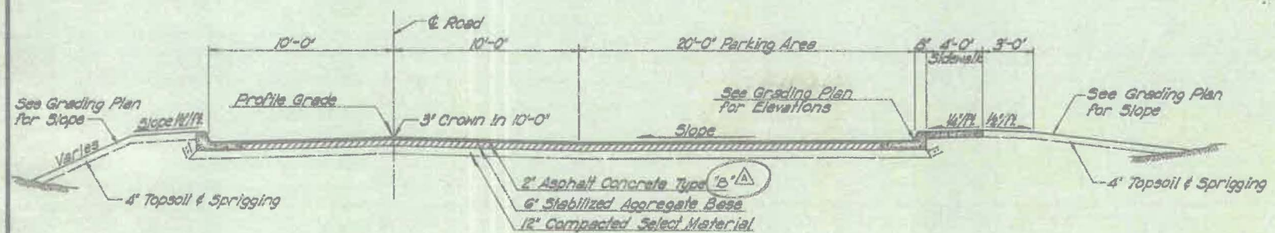
ROAD & STORM SEWER PROFILES

Bowman - Bixler & Associates, Inc.



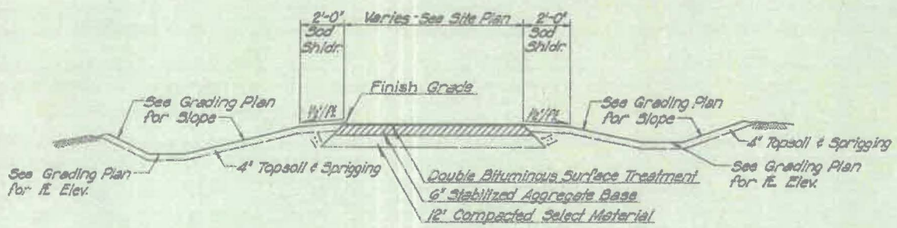
FILL SECTION CUT SECTION

TYPICAL SECTION
ROADS "A", "B" & "C"

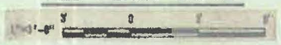


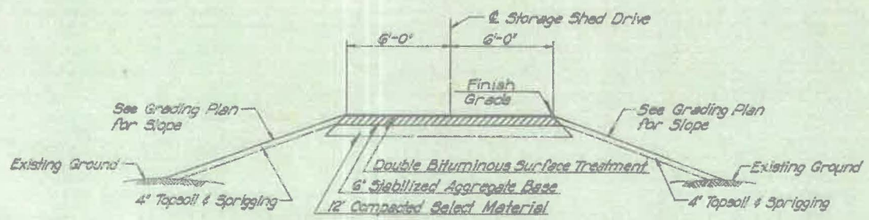
TYPICAL SECTION
THRU PARKING LOTS



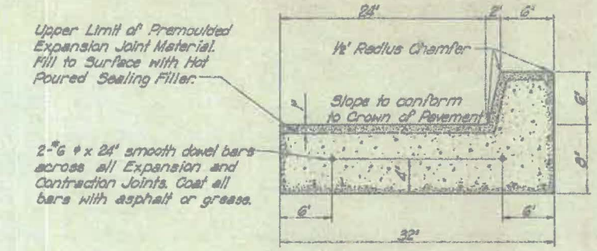


TYPICAL SECTION
OLD PLANT DRIVE



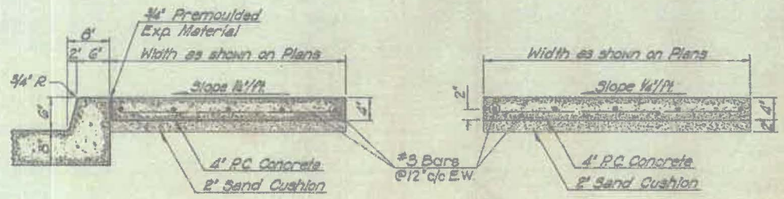


TYPICAL SECTION
STORAGE SHED DRIVE



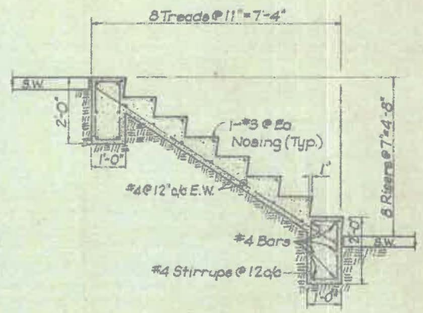
NOTE: Maximum spacing of ¾" Expansion Joints to be 100' c/c with 4 Contraction Joints 18' to 22' apart to match Driveway Returns.

CONCRETE CURB & GUTTER DETAIL



SIDEWALK AT CURB & GUTTER SIDEWALK

SIDEWALK DETAILS



STAIR DETAIL

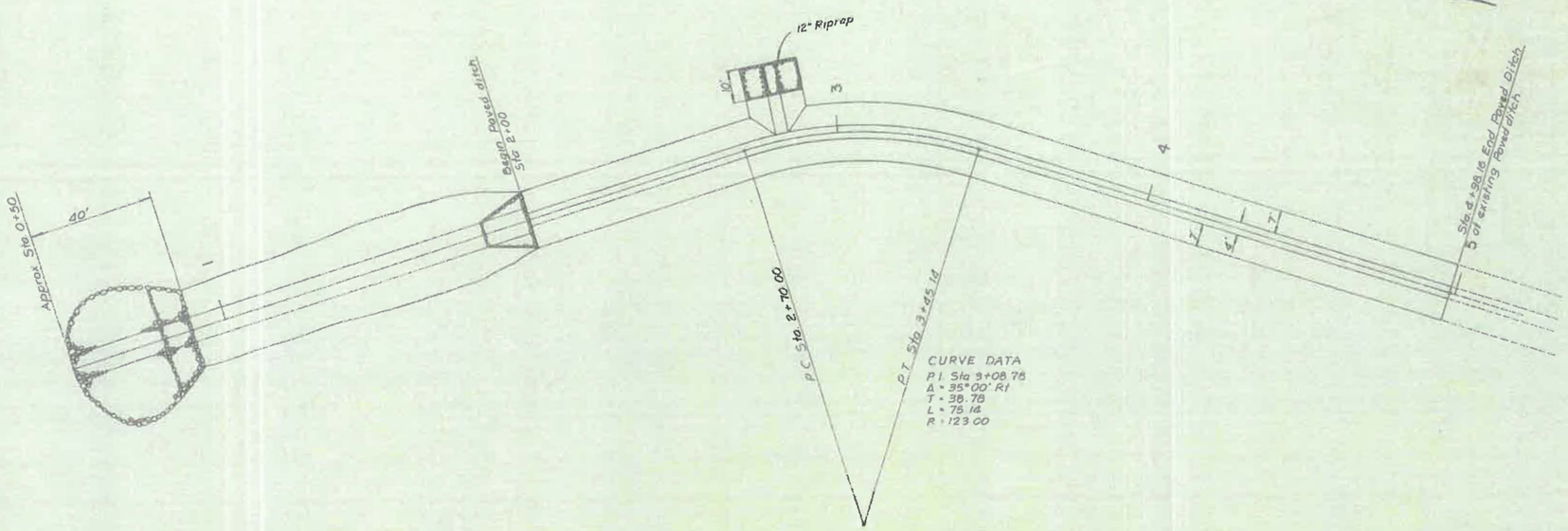


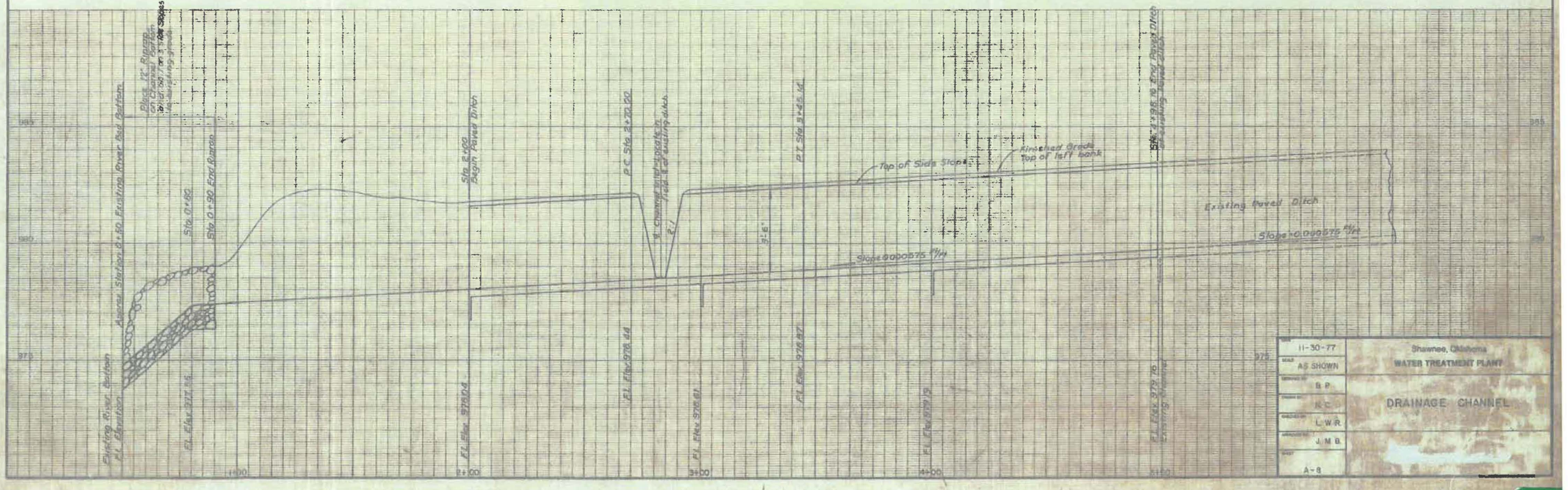
(2 Required ~ South Of Rapid Mix Basin)

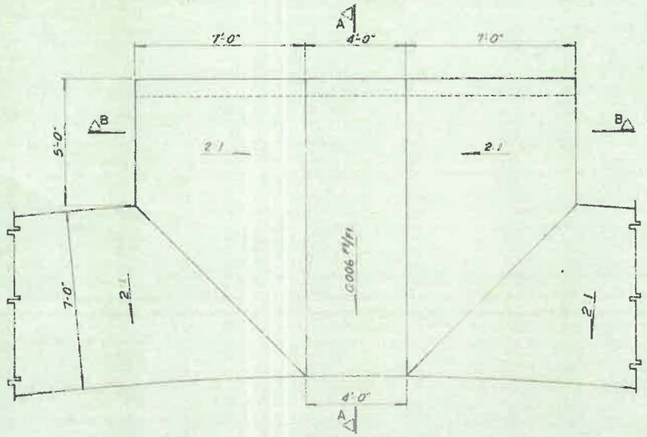
NOTES:
1. ¾"x 4" Premoulded Expansion Material around Posts or other Structures in Walk.
2. Expansion Joints maximum distance = 100'. Use ¾"x 4" Premoulded Expansion Material.
3. Contraction Joints same width as Sidewalk. Saw Cut 2" deep & filled with Hot Poured Sealer.
4. Saw Cut Joints within 24 hours after Pour.

⚠ Jan. 9, 1978 Change Type "A" to Type "B"

DATE: 11-30-77	Delaware, Ohio	
SCALE: AS SHOWN	WATER TREATMENT PLANT	
DRAWN: J.L.H.	TYPICAL ROAD SECTIONS	
CHECKED: C.B.		
APPROVED: L.W.R.		
PROJECT: J.M.B.		
SHEET: A-7		

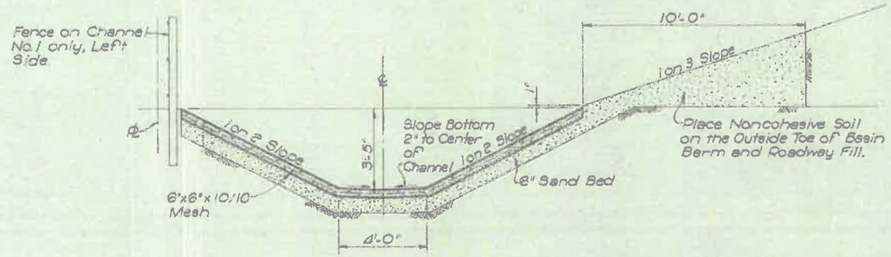

12" Riprap
10'
3
4
Begin Paved ditch
Sta 2+00
Approx Sta 0+50
40'
Sta 4+98.16 End Paved Ditch
5' of existing Paved ditch
P.C. Sta 2+72.00
P.T. Sta 3+45.14
CURVE DATA
P.I. Sta 3+08.78
Δ = 35°00' Rt
T = 38.78
L = 75.14
R = 123.00


Existing Paved Ditch
Approx Station 0+50 Existing Paved Bottom
Sta 0+95
Sta 0+90 End Riprap
Sta 2+00 Begin Paved Ditch
P.C. Sta 2+72.00
P.T. Sta 3+45.14
Top of Side Slope
Finished Grade Top of left bank
Existing Paved Ditch
Slope=0.000375 Ft/Ft
Slope=0.000575 Ft/Ft
El. Elev 978.04
El. Elev 978.44
El. Elev 978.87
El. Elev 979.15
El. Elev 979.76
1+00
2+00
3+00
4+00
5+00
11-30-77
AS SHOWN
B.P.
K.C.
L.W.R.
J.M.B.
A-8
Shawnee, Oklahoma
WATER TREATMENT PLANT
DRAINAGE CHANNEL



PLAN

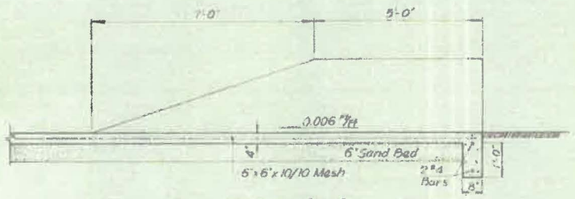
3/8" = 1'-0"



DRAINAGE CHANNEL
TYPICAL SECTION

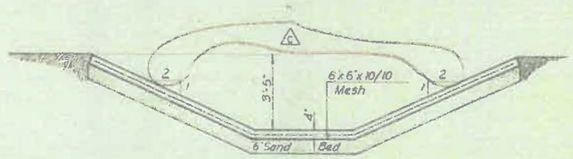
1"=3'-0"

SCALE FEET



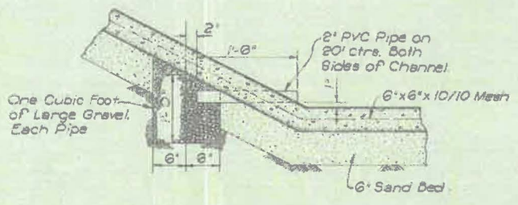
SECTION "A-A"

1/2"=1'-0"



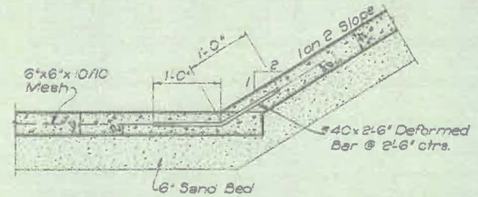
SECTION "B-B"

3/8"=1'-0"



WEEP HOLE DETAIL

1"=1'-0"

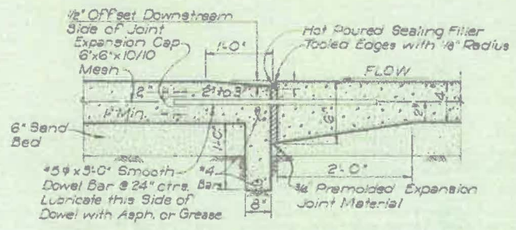


OPTIONAL LONGITUDINAL CONSTRUCTION JOINT

1"=1'-0"

SCALE FEET

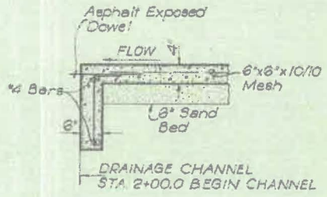
CHANNEL INLET DETAILS



TYPICAL TRANSVERSE EXPANSION JOINT - SPACED AT 100' C/C MAX.

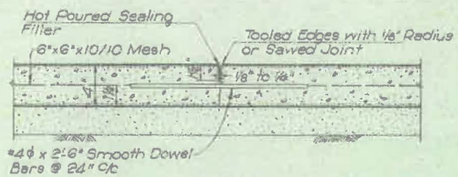
CONCRETE CHANNEL LINER
JOINT DETAILS

NO SCALE



TOE WALL DETAIL

NO SCALE

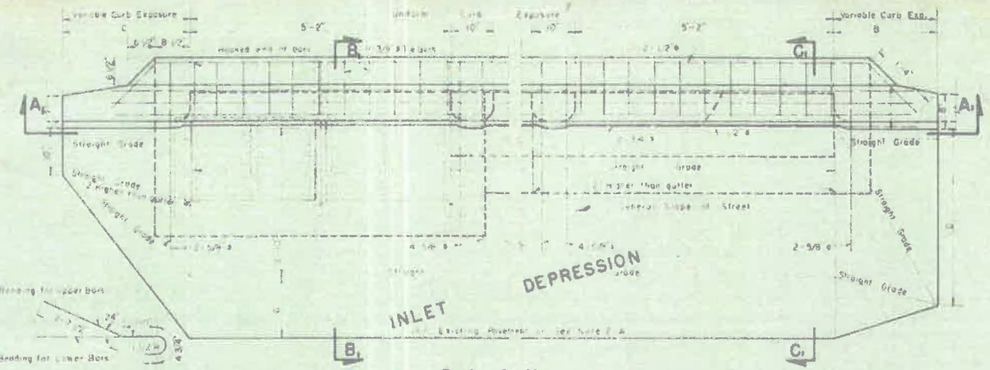


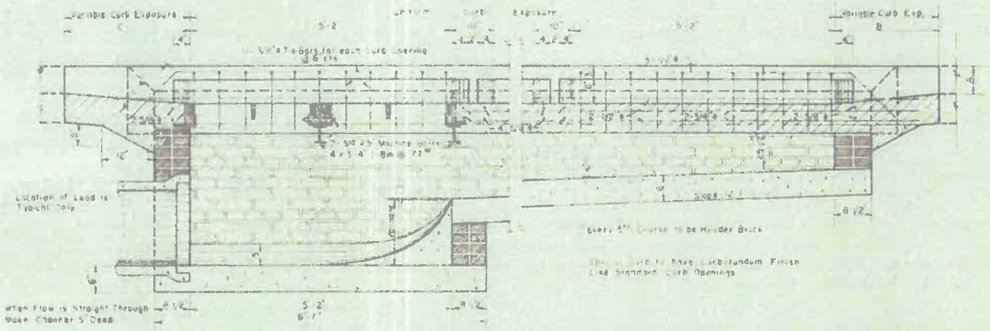
TRANSVERSE DUMMY GROOVE CONTRACTION JOINT
SPACED AT 20 FOOT C/C

NO SCALE

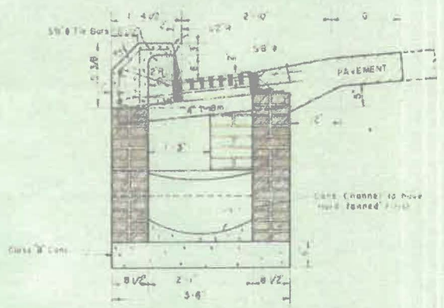
	Feb 10, 1978 Show Slope
11-30-77	Shawnee, Oklahoma
AS SHOWN	WATER TREATMENT PLANT
B P	DRAINAGE CHANNEL DETAILS
N C	
L W R	
J M B	
A-9	

189

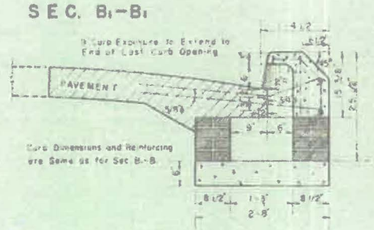




SEC. A,-A.



SEC. B,-B,



SEC. C,-C,

GENERAL NOTES

1. LETTERED DIMENSIONS H TO D INCLUSIVE ARE GOVERNED BY CURB EXPOSURE "A" OF THE EXISTING OR PROPOSED PAVEMENT AND SHALL BE TAKEN FROM THE FOLLOWING SCHEDULE

A	B	C	D
6	6-0	4-0	4-0
8	4-9	3-2	3-6

"S" VARIES FROM 0 TO 3, THE CROSSFALL WITHIN THE LIMITS OF "B" SHALL NOT EXCEED 1/2 PER FOOT AND SHALL NOT BE LESS THAN THE REGULAR CROSS-FALL OF THE EXISTING OR PROPOSED PAVEMENT.

2-A WHEN INLET IS TO BE BUILT IN NEW PAVEMENT, IT SHALL BE MONOLITHIC WITH THE NEW PAVEMENT AND CONFORM TO PLANS AND SPECIFICATIONS THEREFOR.

2-B WHEN INLET IS TO BE BUILT IN EXISTING PAVEMENT THE TYPE OF INLET PAVEMENT SHALL CONFORM TO THAT OF THE ADJACENT SLAB UNLESS OTHER-WISE PROVIDED IN SPECIAL PROVISIONS.

3. CAST IRON STEPS SHALL BE PLACED IN ALL INLETS 3' OR MORE IN DEPTH IN CONFORMITY WITH STANDARD SPECIFICATIONS.

4. GRATINGS TO BE USED IN THIS STRUCTURE WILL BE SHOWN ON THE PLANS OR DESIGNATED IN THE SPECIAL PROVISIONS.

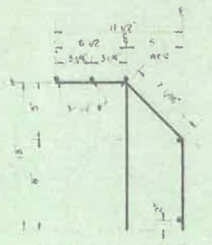
5. THIS STRUCTURE WILL BE DESIGNATED ON THE PLANS AS INLET NO 2-0, 2-1, 2-2, 2-3, ETC (EXTRA GRAB OPENINGS INDICATED BY THE LAST NUMBER) CASE I OR II.

6. BASIS OF PAYMENT FOR INLETS WILL BE AS SHOWN IN SPECIFICATIONS.

CASE I WHEN FLOW IN GUTTER IS FROM ONE DIRECTION ONLY THE INLET DEPRESSION SHALL BE AS SHOWN ABOVE.

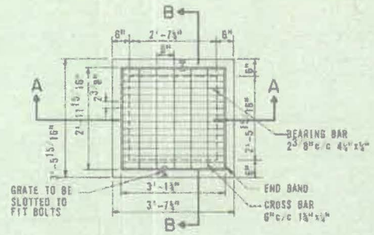
CASE II WHEN FLOW IN GUTTER IS FROM BOTH DIRECTIONS THE DEPRESSION ON BOTH SIDES OF THE INLET SHALL BE THE SAME AS SHOWN ON THE RIGHT SIDE IN THE PLANS ABOVE.

WHEN INLET IS TO BE BUILT ON CURVE SEE TYPE B INLET FRAME FOR DESIGN OF THROAT SECTION.



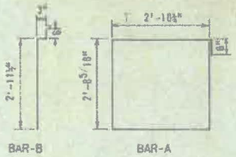
(3/8"ø Stag Fabricated 6" ±)

TIE BARS



PLAN

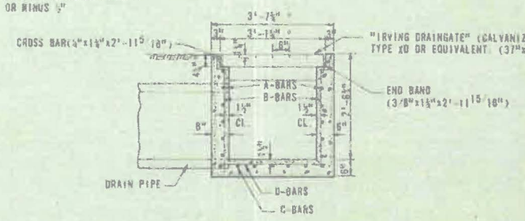
* DIMENSIONS FOR OTHER TYPE GRATES SHALL CONFORM TO DIMENSIONS AS SHOWN PLUS OR MINUS ½"



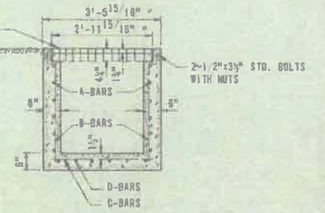
BAR BENDING DIAGRAM

BAR LIST

MARK	SIZE	NO.	FORM	LENGTH	SPACE
A	⅜" ø	6	BENT	11'-8 1/8"	8" C/C
B	⅜" ø	18	BENT	3'-6¾"	8" C/C
C	5/8"ø	7	STR.	3'-15/16"	8"C/C
D	5/8"ø	6	STR.	3'-3¾"	8" C/C



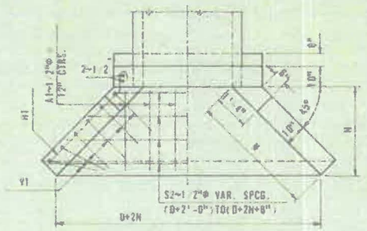
SECTION A-A



SECTION B-B

AREA INLET DETAILS

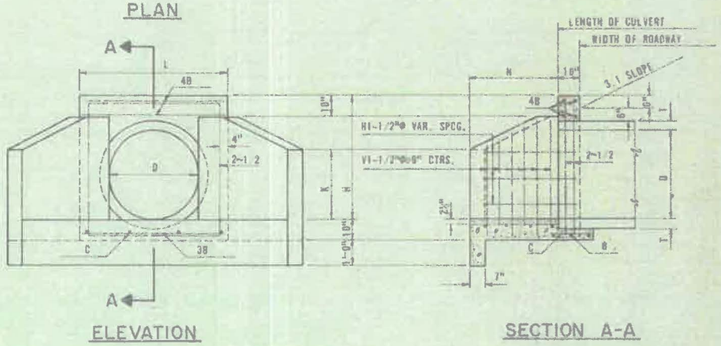
NOT TO SCALE



PLAN

DIMENSIONS

D	AREA SQ. FT.	T	N	R	L	W	H
12"	1.23	3'-4"	2'-5½"	1'-3"	3'-3"	1'-6"	1'-3"
18"	1.77	3'-"	2'-8"	1'-1"	3'-10"	2'-1"	1'-6"
30"	4.81	7'-8"	3'-8½"	2'-2"	4'-10"	3'-8½"	2'-6"
42"	9.87	6'-"	4'-10½"	2'-8"	5'-10"	4'-11½"	3'-6"

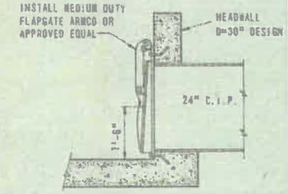


ELEVATION

SECTION A-A

HEADWALL DETAILS

NO TO SCALE



FLAP GATE DETAIL

NOT TO SCALE

(1 Required ~ Clearwell Overflow)

GENERAL NOTES:

ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH T SPECIFICATIONS.

ALL EXPOSED CONCRETE EDGES SHALL HAVE A 3/4" CHAMFER

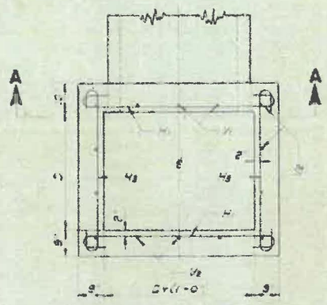
ALL EXPOSED CONCRETE SURFACES SHALL HAVE A CARBORUNDUM FINISH.

MINIMUM DEPTH OF FILL OVER CULVERTS SHALL BE

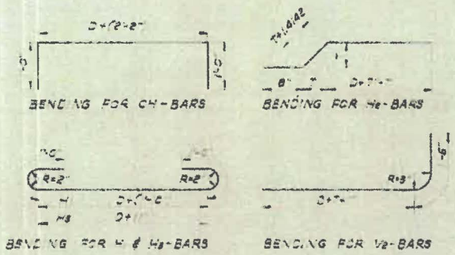
11-30-77	Shawnee Oklahoma
AS SHOWN	WATER TREATMENT PLANT
O.S.H.D.	
B.B.A.	DRAINAGE STRUCTURE DETAI
L.W.R.	
J.M.B.	
A-10	

1012 WT A-10 of 13 10/77

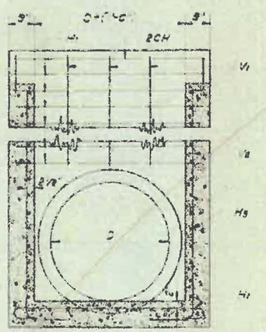
1017 WT



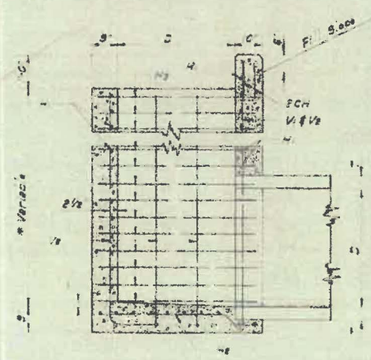
PLAN



BAR BENDING DIAGRAMS



SECTION A-A



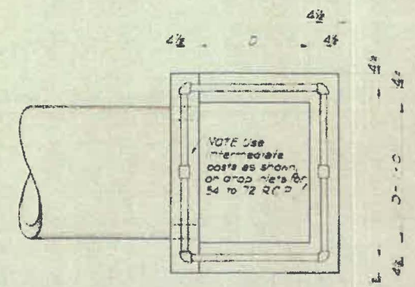
SECTION ON ℄

DROP INLET FOR 15" TO 42" REINF. CONC. PIPE

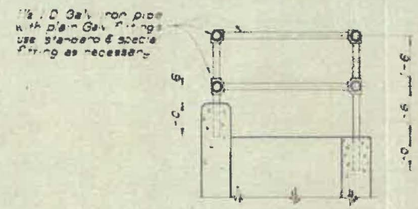
* Dimension for Std. Height Drop Inlet to be 5'-0"

DIMENSIONS				REINFORCING STEEL										CLASS "A" CONCRETE CU YDS.		REINFORCING STEEL LBS.		PIPE HANDRAIL
I.D. Class of Pipe	Area of Pipe Sq. Ft.	Thickness of Pipe	"e"	H-Bars Bent		He-Bars Bent		He-Bars Bent		H-Bars Straight		½-Bars Bent		Total to Top of Pipe Including Curb	Per Foot of Additional Height	Total to Top of Pipe Including Curb	Per Foot of Additional Height	Lin. Ft. of Handrail Including Fittings
				No.	Lgth.	No.	Lgth.	No.	Lgth.	No.	Lgth.	No.	Lgth.					
15	1.23	2¼"	0.50	2	3'-6	10	5'-1"	6	2'-11"	6	4'-8"	1	10	5	3'-10	1.1	2.89	79	28.1	10
18"	1.77	2½"	0.50	2	3'-8	11	5'-4	7	3'-2"	8	4'-3	1	10	7	5'-3	1.33	3.18	1.00	31.4	11
21			0.63*																	
24"	3.14	3"	0.75	2	4'-2	13	5'-10	8	3'-4	10	4'-1	2	10	8	5'-10	2.28	3.75	1.31	35.4	13
27			0.87*																	
30"	4.91	3½"	.00	2	4'-8	15	6'-4"	9	3'-10	12	5'-5	2	10	8	4'-4	2.7	4.32	1.63	38.	13
36"	7.07	4		2	5'-2	17	6'-10	10	4'-4	14	6'-	2	10	8	4'-	2.19	4.89	202	41.5	17
42"	9.62	4½"	1.65	2	7'-8"	19	7'-4"	11	4'-11"	16	6'-5"	3	10"	11	5'-6"	2.74	5.46	251	48.1	19
48																				
54																				
60"																				
66																				
72																				

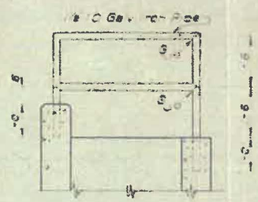
h** Minimum head of water above crown of pipe to give pipe design discharge.



PLAN



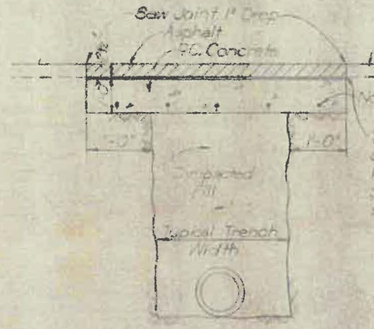
PART SECTION ON ℄



ALTERNATE DETAIL
(Using welded connections on pipe handrail)

DETAILS OF PIPE HANDRAIL

Surface course shall be asphaltic concrete. Hot-mix cold lay conforming to Oklahoma State Highway Commission standard specification for bituminous materials sect 405



ASPHALTIC CONCRETE PAVEMENT REPAIR DETAIL

NOT TO SCALE

GENERAL NOTES
Drainage Structures

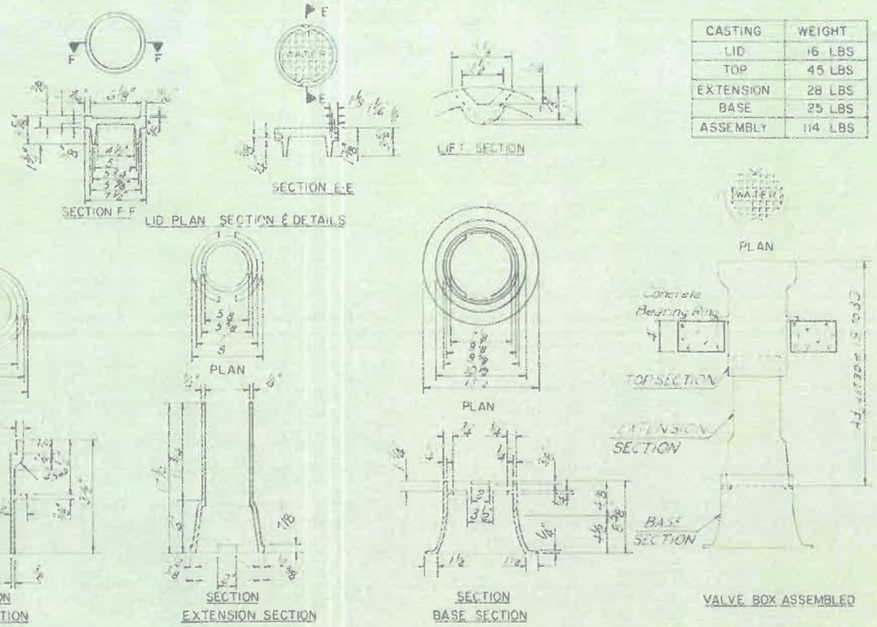
All concrete shall have a compressive strength of not less than 3000 pounds per square inch when tested at 28 days.
All reinforcing steel shall be intermediate grade, of size, ordered type, size and weights in accordance with ASTM designation A-305.
All exposed surfaces to have a corundum finish and all exposed edges shall have a ¾" chamfer.

⚠ Jan 9, 1978 Add "Drainage Structure" to Notes

DATE 11-30-77	Southern Oklahoma WATER TREATMENT PLANT
NONE	
B.B.A.	DROP INLET DETAIL
N.C.	
B.P.	
J.N.B.	
SHEET A-11	

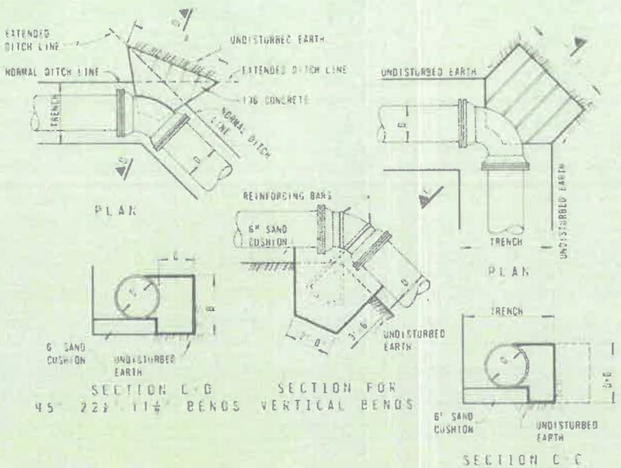
189

CASTING	WEIGHT
LID	16 LBS
TOP	45 LBS
EXTENSION	28 LBS
BASE	25 LBS
ASSEMBLY	114 LBS

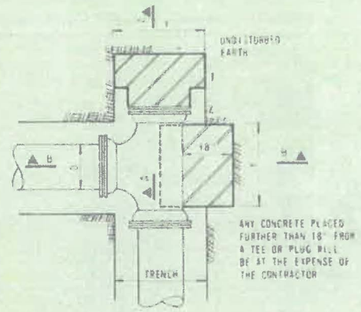


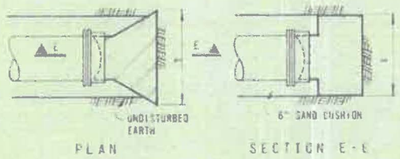
STANDARD CAST IRON VALVE BOX AND LID

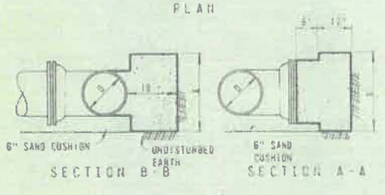
NOT TO SCALE

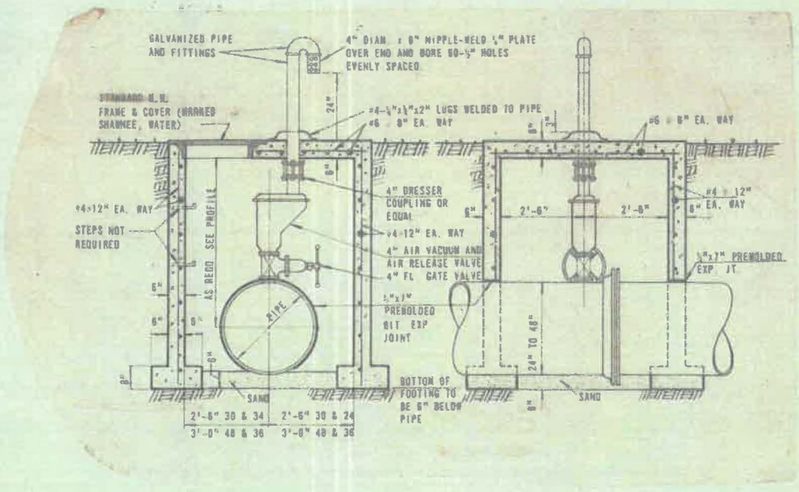


DIMENSIONS FOR CONCRETE ANCHORAGES												
PIPE DIAM.	TRENCH WIDTH	45° BEND			22½° BEND			11¼° BEND			TEE OR PLUG	
		A	B	C	A	B	C	A	B	C	X	Y
6	24	2'-0"	1'-1"	1'-4"	1'-6"	1'-1"	1'-0"	1'-6"	1'-1"	10"	8"	1'-4"	2'-1"
8	26	2'-0"	1'-2"	1'-4"	1'-10"	1'-2"	1'-0"	1'-6"	1'-2"	11"	10"	1'-6"	2'-4"
10	28	2'-0"	1'-4"	1'-4"	2'-0"	1'-4"	1'-0"	1'-10"	1'-4"	11"	1'-0"	1'-9"	2'-8"
12	30	2'-0"	1'-6"	1'-4"	2'-0"	1'-6"	1'-0"	2'-0"	1'-6"	11"	1'-0"	2'-0"	3'-0"
16	35	2'-0"	1'-10"	1'-5"	2'-0"	1'-10"	1'-1"	2'-0"	1'-10"	11"	1'-6"	2'-0"	3'-6"
18	37	2'-3"	2'-0"	1'-6"	2'-3"	2'-0"	1'-1"	2'-3"	2'-0"	11"	2'-3"	2'-0"	3'-9"
20	39	2'-9"	2'-2"	1'-8"	2'-9"	2'-2"	1'-1"	2'-9"	2'-2"	11"	3'-0"	2'-0"	4'-1"
24	44	3'-9"	2'-6"	1'-10"	3'-6"	2'-6"	1'-1"	3'-6"	2'-6"	11"	3'-3"	3'-0"	4'-9"
30	54	5'-6"	2'-6"	2'-0"	4'-6"	2'-6"	1'-0"	4'-6"	2'-6"	1'-0"	3'-6"	3'-0"	5'-8"
36	60	7'-0"	3'-0"	2'-6"	6'-0"	3'-0"	2'-6"	6'-0"	3'-0"	2'-6"	4'-0"	3'-4"	6'-5"





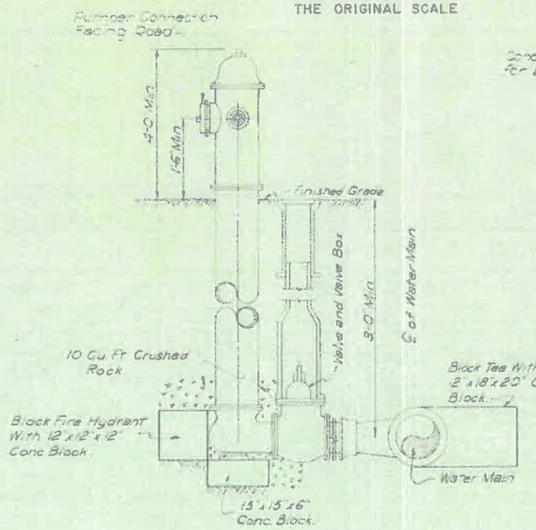




AIR AND VACUUM VALVE MANHOLE

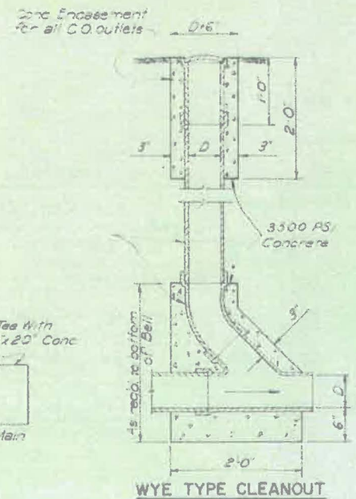
1"=1'-0"

THIS DRAWING HAS BEEN REDUCED TO ONE-HALF THE ORIGINAL SCALE



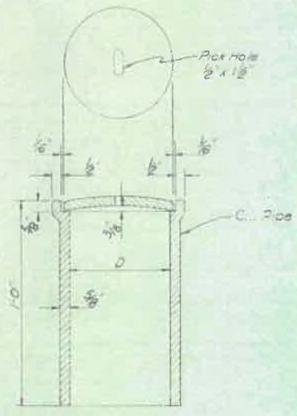
TYPICAL FIRE HYDRANT SETTING

NOT TO SCALE



WYE TYPE CLEANOUT THROUGH FLOW

NO SCALE

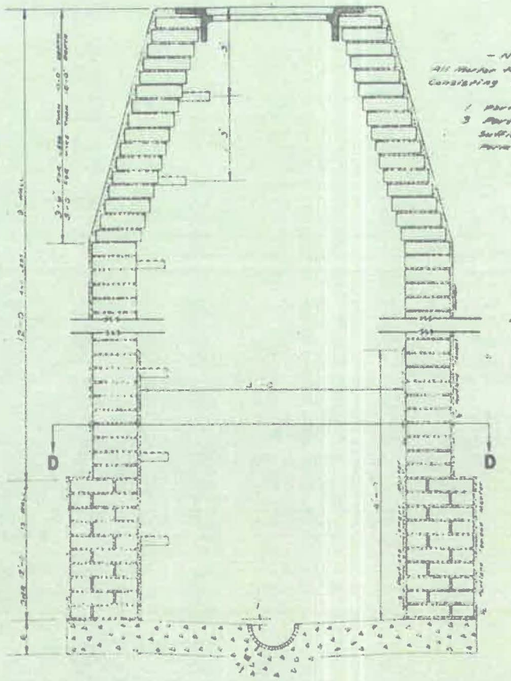


CAST IRON FRAME & COVER FOR GRAVITY LINE CLEANOUT

HORIZONTAL - CONCRETE ANCHORAGES STANDARD NO. 31

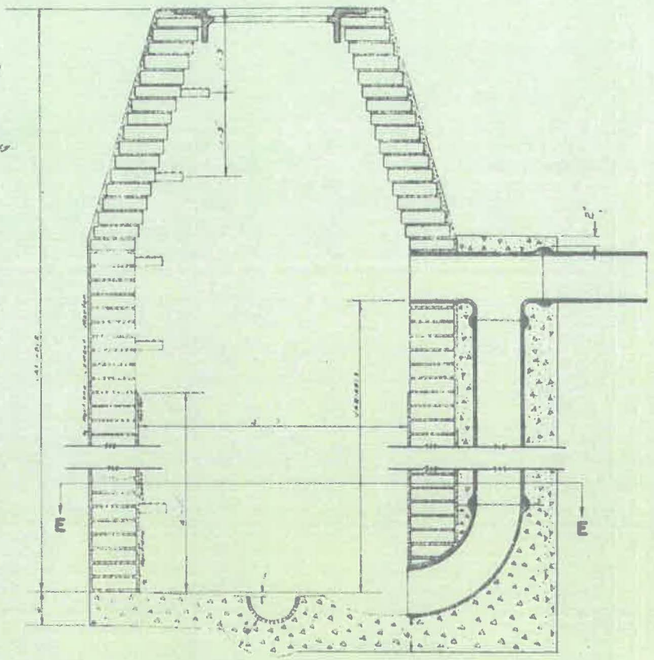
DATE 11-30-77	Shawnee, Oklahoma
SCALE AS SHOWN	WATER TREATMENT PLANT
DESIGNED BY L.W.R.	WATER LINE DETAILS
DRAWN BY B.B.A.	
CHECKED BY E.M.F.	
APPROVED BY J.M.B.	Burgess - Blair & Affiliates, Inc.
SHEET A-12	

1017 WT A-13 of 18

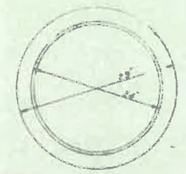


STANDARD MANHOLE

- NOTE -
All Mortar to be Portland Cement Conforming to:
1 Part Portland Cement
3 Parts Mortar Sand
Sufficient Clean Water to Form a Plastic Consistency



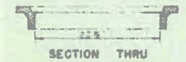
STANDARD DROP MANHOLE



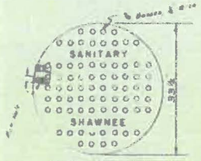
PLAN



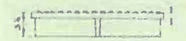
SIDE ELEVATION



SECTION THRU



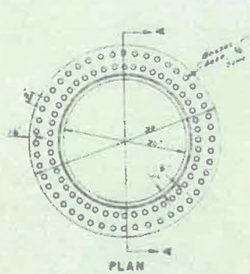
PLAN OF TOP



SIDE ELEVATION



SECTION THRU

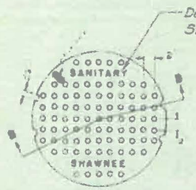


PLAN
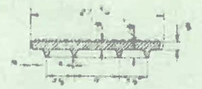


SECTION A-A

Designate kind of Sewer Storm or Sanitary.



PLAN OF TOP



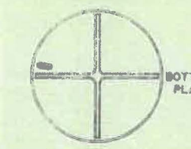
SECTION B-B



BOTTOM PLAN

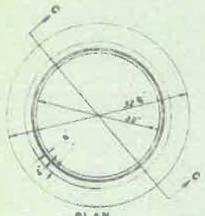
MANHOLE FRAME & COVER TYPE "B"

RING 200#
COVER 130#
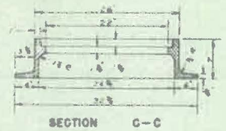


BOTTOM PLAN

MANHOLE FRAME & COVER TYPE "C"



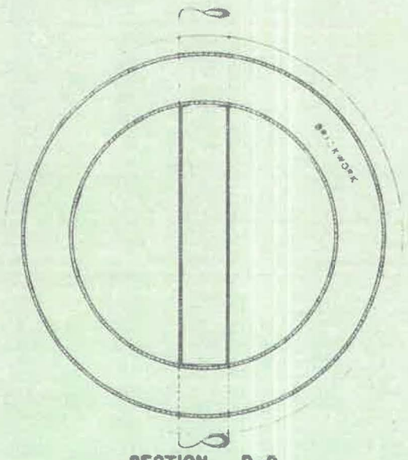
PLAN



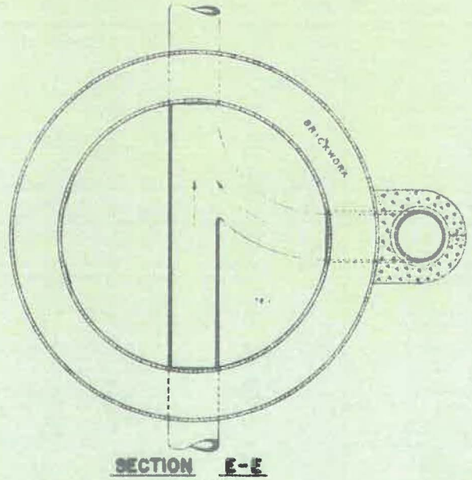
SECTION C-C

MANHOLE FRAME & COVER TYPE "A"

RING 230#
COVER 130#



SECTION D-D



SECTION E-E

DATE 11-30-77	Shawnee, Oklahoma
SCALE NONE	WATER TREATMENT PLANT
DESIGNED BY J.M.B.	MANHOLE DETAILS
DRAWN BY J.C.W.	
CHECKED BY L.W.R.	
APPROVED J.M.B.	
SHEET A-13	Sanders, Rice & Williams, Inc.

A. DESIGN CRITERIA

1. DESIGN CODES
   a. CONCRETE SHALL BE DESIGNED IN ACCORDANCE WITH THE ACI BUILDING CODE (ACI 318-71).
   b. STRUCTURAL STEEL SHALL BE DESIGNED IN ACCORDANCE WITH THE SEVENTH EDITION OF THE AISC SPECIFICATIONS.
2. DESIGN LIVE LOADS
   a. ROOF — 20 PSF
   b. FLOOR 150 PSF

B. CONCRETE

1. THE CONCRETE WEIGHT & MINIMUM 28 DAY COMPRESSIVE STRENGTH SHALL BE AS FOLLOWS
   a. ALL CONCRETE WT. 150 PCF f'_c = 4,000 PSI
2. REINFORCING STEEL AT ALL STRUCTURES SHALL BE DEFORMED BARS CONFORMING TO ASTM SPECS A615 GR. 60 EXCEPT TIES & STIRRUPS SHALL BE GRADE 40.
3. ALL CONCRETE AND REINFORCING UNLESS OTHERWISE NOTED SHALL BE DETAILED AND PLACED ACCORDING TO ACI BLDG. CODE REQUIREMENTS FOR REINFORCED CONCRETE (ACI 318-71 & ACI 315-65)
4. CONSTRUCTION JOINTS IN STRUCTURAL SLABS, BEAMS, GRADE BEAMS AND WALLS SHALL BE AT MIDSPAN UNLESS DETAILED OTHERWISE. MAXIMUM DISTANCE BETWEEN CONSTRUCTION JOINTS SHALL NOT EXCEED 40 FT.
5. SLABS ON GRADE SHALL BE PLACED IN A CHECKERBOARD PATTERN. UNLESS DETAILED OTHERWISE CONSTRUCTION JOINTS FOR SLABS ON GRADE SHALL BE PLACED APPROXIMATELY 25' ON CENTERS EACH WAY, PREFERABLY AT COLUMN LINES, AND SHOULD ENCOMPASS AN AREA OF NOT MORE THAN 625 SQUARE FEET.
6. UNLESS DETAILED OTHERWISE, PROVIDE #4 CORNER BARS OF SAME NUMBER AS HORIZONTAL REINFORCING AT ALL FOOTING INTERSECTIONS AND CORNER BARS OF SAME NUMBER & SIZE AS HORIZ. REINF. AT ALL WALL INTERSECTIONS. SEE DETAILS THIS SHEET.
7. FOR ALL STRUCTURAL SLABS, BEAMS & GRADE BEAMS, WHERE SPLICES ARE NECESSARY IN REINFORCING, TOP BARS SHALL BE SPLICED AT MIDSPAN & BOTTOM BARS SHALL BE SPLICED AT SUPPORT.
8. CONSTRUCTION JOINTS IN CIRCULAR CONCRETE TANK WALLS SHALL BE VERTICAL UNLESS OTHERWISE NOTED. SEE TYPICAL JOINT DETAIL THIS SHEET. ALL CONSTRUCTION JOINTS IN TANK WALLS SHALL BE PROVIDED WITH A 6" WATER STOP UNLESS NOTED OTHERWISE.
9. FOR DETAILS OF REINFORCING AT PIPE OPENINGS THROUGH WALLS SEE TYPICAL DETAIL SHEET.
10. ALL EXPOSED CORNERS OF CONCRETE SHALL HAVE A 3/4" CHAMFER UNLESS OTHERWISE NOTED.
11. ALL REINFORCING STEEL, STRUCTURAL STEEL, ANCHOR BOLTS, DOWELS, ETC. SHALL BE FIRMLY SECURED IN PLACE BEFORE PLACING CONCRETE.
12. REFER TO AND CHECK WITH ALL PLANS, SECTIONS, AND DETAILS OF OTHER TRADES FOR SHOVES, CLIPS, GROUND, SLEEVES, ETC. TO BE CAST INTO CONCRETE.

C. STRUCTURAL STEEL

1. ALL STRUCTURAL STEEL SHALL BE ASTM DESIGNATION A-36 (f_y = 36,000 PSI)
2. STRUCTURAL STEEL SHALL BE DESIGNED, FABRICATED AND ERECTED IN ACCORDANCE WITH THE SEVENTH EDITION OF THE AISC SPECIFICATIONS.
3. ALL BOLTED CONNECTIONS SHALL BE MADE WITH ASTM A-325 HIGH STRENGTH BOLTS.
4. ALL ANCHOR BOLTS SHALL CONFORM TO ASTM A-307 (UNFINISHED BOLTS) WITH SUITABLE NUTS AND WASHERS.
5. ALL WELDS SHALL BE IN ACCORDANCE WITH LATEST SPECIFICATIONS OF AISC AND AWS.
6. ALL ROOF DECK SHALL BE 1½" GALV., 22 GA. (MIN.) METAL DECK SHALL BE CAPABLE OF SUPPORTING A TOTAL DEAD PLUS LIVE LOAD INDICATED ON THE DRAWINGS.
7. STEEL JOISTS SHALL BE DESIGNED, FABRICATED AND ERECTED IN ACCORDANCE WITH LATEST SPECIFICATIONS OF STEEL JOIST INSTITUTE AND AISC.

D. FOUNDATION

1. PLACE 8" CAPILLARY WATER BARRIER UNDER ALL UNSUPPORTED FLOOR SLABS ON FILL EXCEPT AS OTHERWISE NOTED.
2. PLACE 18" MIN. NONEXPANSIVE FILL UNDER THE 8" CAPILLARY WATER BARRIER. NONEXPANSIVE FILL TO BE COMPACTED AS SPECIFIED IN SPECIFICATIONS.
3. BOTTOM OF DRILLED PIERS SHALL BE A MIN. OF 1'-0" INTO ROCK.
4. A SUBSURFACE INVESTIGATION HAS BEEN CONDUCTED AND THE RESULT OF THIS INVESTIGATION IS AVAILABLE AT THE OFFICE OF THE ENGINEER OR THE TESTING LABORATORY. THE OWNER AND THE ENGINEER ASSUME NO RESPONSIBILITY FOR THE SUBSURFACE INVESTIGATION REPORT AND DETERMINE FOR THEMSELVES THE CHARACTER OF THE MATERIALS AND CONDITIONS TO BE ENCOUNTERED.

E. GENERAL

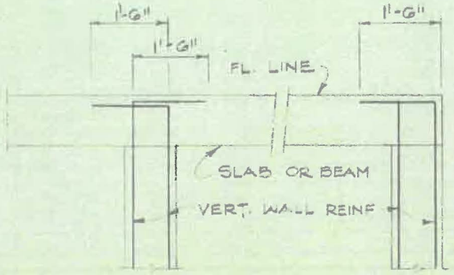
1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS BEFORE STARTING WORK AND THE RESIDENT ENGINEER SHALL BE NOTIFIED IMMEDIATELY AT ANY DISCREPANCIES FOUND.
2. SPECIFIC NOTES SHALL TAKE PRECEDENCE OVER DETAILS & NOTES ON THIS SHEET.
3. WHEN CONSTRUCTION DETAILS ARE NOT SHOWN OR NOTED, WORK SHALL BE THE SAME AS FOR OTHER SIMILAR WORK.

F. BRACING AND SHORING

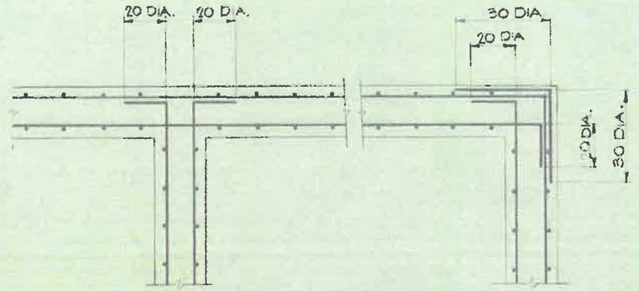
1. CONTRACTOR SHALL PROVIDE AND MAINTAIN ADEQUATE BRACING AND SHORING AT ALL TIMES DURING CONSTRUCTION.

G. OPENINGS

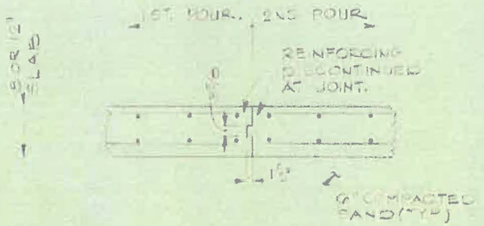
1. SEE ARCHITECTURAL, MECHANICAL AND ELECTRICAL DRAWING FOR APPROXIMATE SIZE AND LOCATION OF ALL WALL, ROOF, AND FLOOR OPENINGS AND CONCRETE PADS UNDER EQUIPMENT. THE CONTRACTOR SHALL VERIFY EXACT SIZE AND LOCATION WITH EQUIPMENT TO BE FURNISHED.



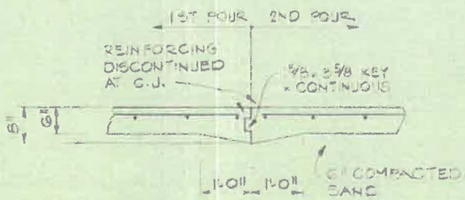
INTERSECTION OF WALL AND SLAB OR BEAM
(UNLESS DETAILED OTHERWISE)



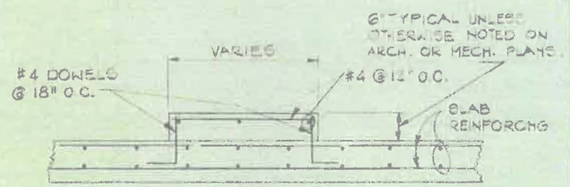
TYPICAL WALL OR CONTINUOUS FOOTING, CORNER OR INTERSECTION REINFORCING DETAIL
(UNLESS DETAILED OTHERWISE)



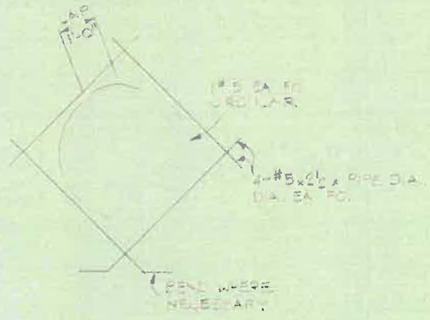
SLAB ON GRADE
CONSTRUCTION JOINT DETAIL
(C.J.)



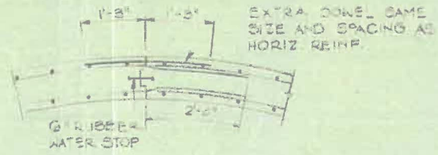
SLAB ON GRADE
CONSTRUCTION JOINT DETAIL
(C.J.)



TYPICAL EQUIPMENT PAD DETAIL
(UNLESS OTHERWISE NOTED)



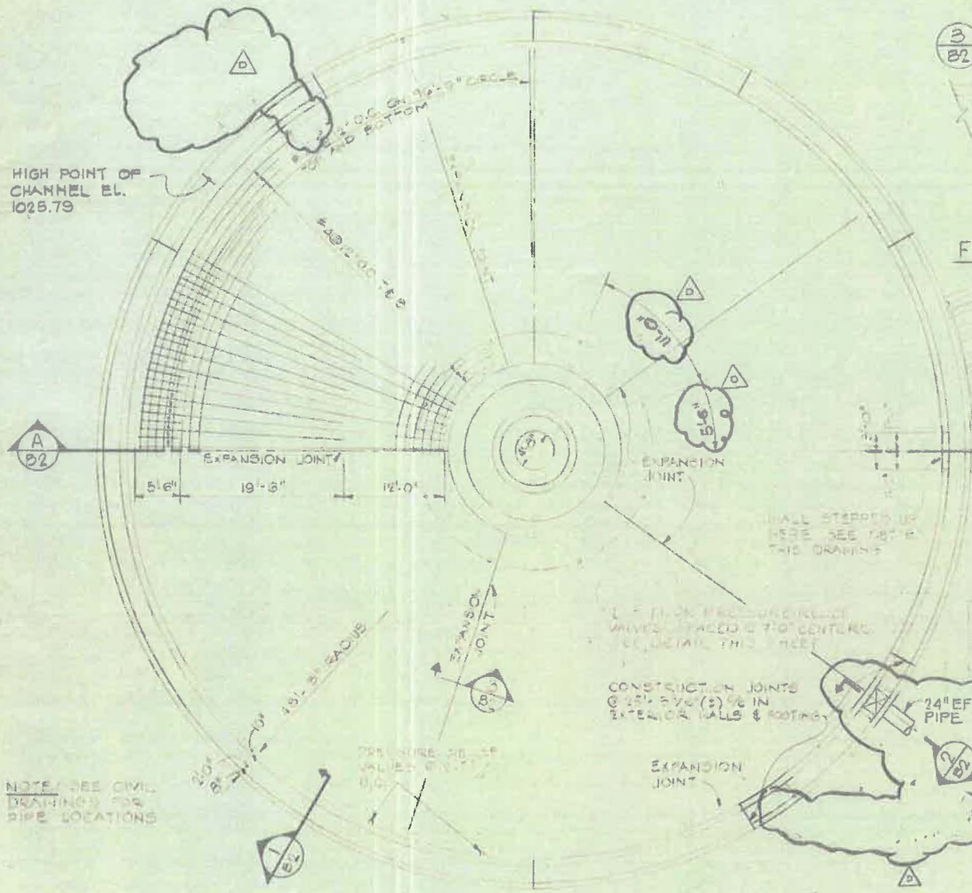
REINFORCING AT PIPE THROUGH WALL OR FLOOR



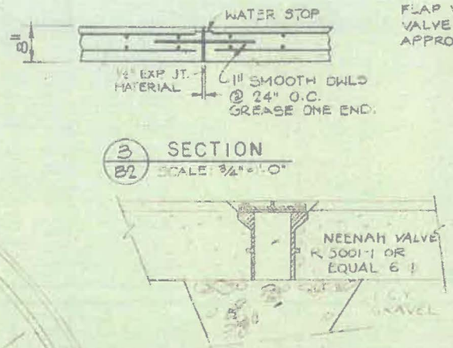
TYPICAL VERTICAL CONSTRUCTION JOINT IN CIRCULAR TANK WALLS

DATE: 11-30-77	Shawnee, Oklahoma
JOB NO: NONE	WATER TREATMENT PLANT
DESIGNED BY: J.T.B.	STRUCTURAL GENERAL NOTES AND TYPICAL DETAILS
DRAWN BY: B.M.	
CHECKED BY: W.E.A.	
APPROVED BY: J.M.B.	Bonham - Blair & Affiliates, Inc.
SHT. NO: 81	

IMPORTANT NOTE: PLAN & DETAILS DRAWN FOR CLARIFIER FLOCCULATOR NO 1 SHOWN. PLAN FOR CLARIFIER FLOCCULATOR NO 2. IDENTICAL EXCEPT FOR ORIENTATION. SEE DRAWING E5 AND A2 FOR ORIENTATION AND LOCATIONS OF SLUDGE BLOWOFF, INFFLUENT AND EFFLUENT LINES., HIGH POINTS CHANNEL, STEP AND BRIDGE LOCATIONS.

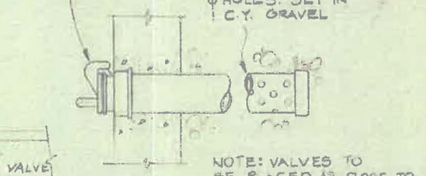


PLAN - CLARIFIER-FLOCCULATOR NO. 1
SCALE 1/8"=1'-0"



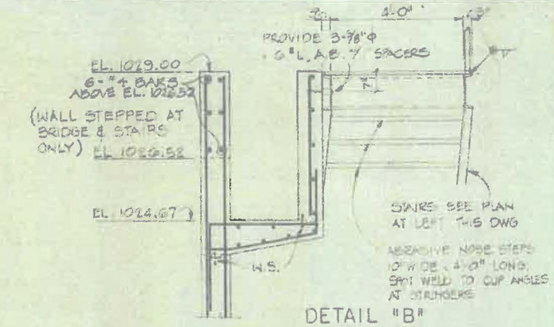
3 / B2 SECTION
SCALE: 3/4"=1'-0"

FLOOR RELIEF VALVE
SCALE 1"=1'-0"

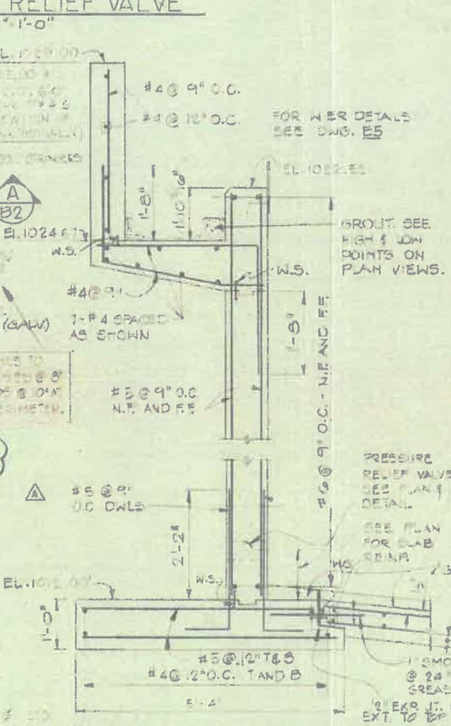


NOTE: VALVES TO BE PLACED AS CLOSE TO BOTT. OF WALL AS EQUIP. WILL ALLOW. MAXIMUM HEIGHT ABOVE FTG. 1'-6"

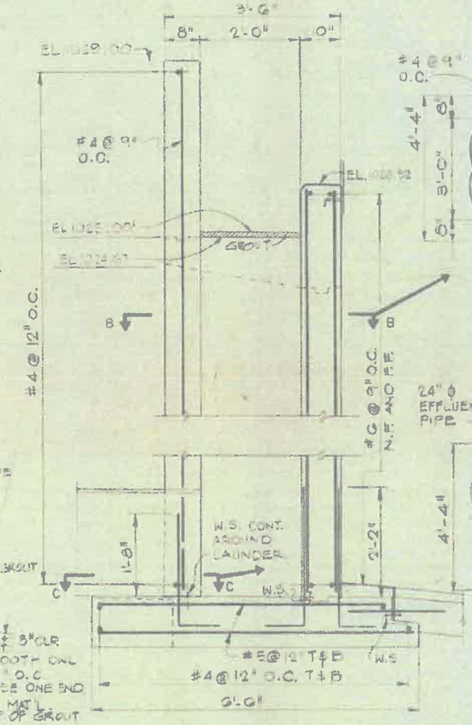
DETAIL PRESSURE RELIEF VALVE
NO SCALE



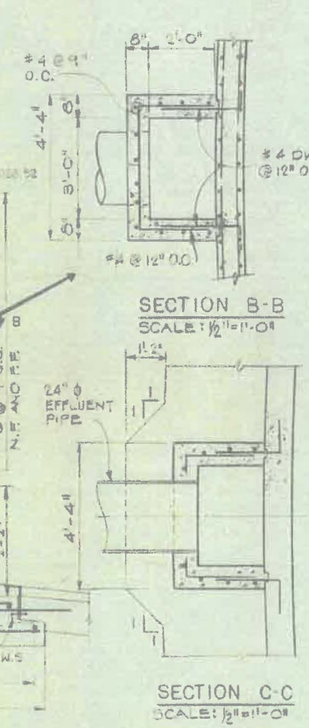
DETAIL "B"
SCALE: 1/2"=1'-0"



TYPICAL SECTION PERIMETER WALL FOR CLARIFIER-NO. 1 AND 2
1 / B2 SCALE: 3/4"=1'-0"

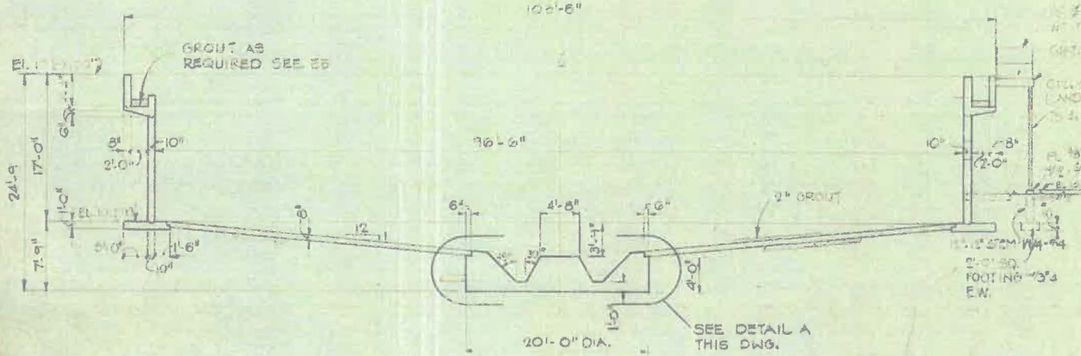


2 / B2 SECTION AT LAUNDER
SCALE 3/4"=1'-0"

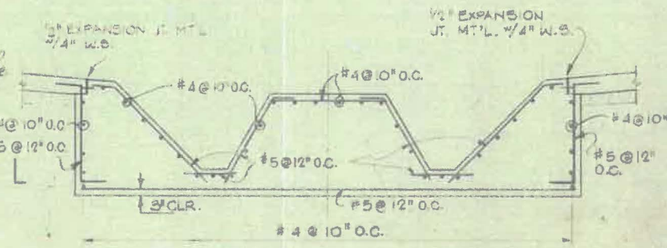


SECTION B-B
SCALE: 1/2"=1'-0"

SECTION C-C
SCALE: 1/2"=1'-0"



SECTION A-A
SCALE 1/8"=1'-0"



DETAIL A
SCALE: 3/8"=1'-0"

GRAPHIC SCALES
3/4"=1'-0"
1/2"=1'-0"
3/8"=1'-0"
1/8"=1'-0"

Jan. 9, 1978 Delete Galv. Stair Note.

△D MAY 11, 1978., CHANGED H.P. & EFFLUENT PIPE LOCATION, ALSO DIMENSIONS.

DATE 11-30-77	Shawnee, Oklahoma
SCALE AS NOTED	WATER TREATMENT PLANT
DESIGNED BY J.T.B.	CLARIFIER-FLOCCULATOR STRUCTURAL PLANS FOR NO. 1 AND NO. 2 SECTIONS AND DETAILS
DRAWN BY B.M.	
CHECKED BY W.E.A.	
APPROVED BY J.M.B.	
SHEET B2	Burns-Blair & Associates, Inc.

1017 WT

123'-0"

11'-0" | 4'-0" | 15'-9" | 4'-0" | 15'-9" | 4'-0" | 15'-9" | 32'-0"

11'-0" (TYP.)

PIPE SUPPORTS LOCATED AS SHOWN. REFER TO DETAILS, DWG B7

#4@12" O.C. T&B

#4@12" O.C. T&B
12" SLAB (EL. 1002.50)

#4@12" T&B

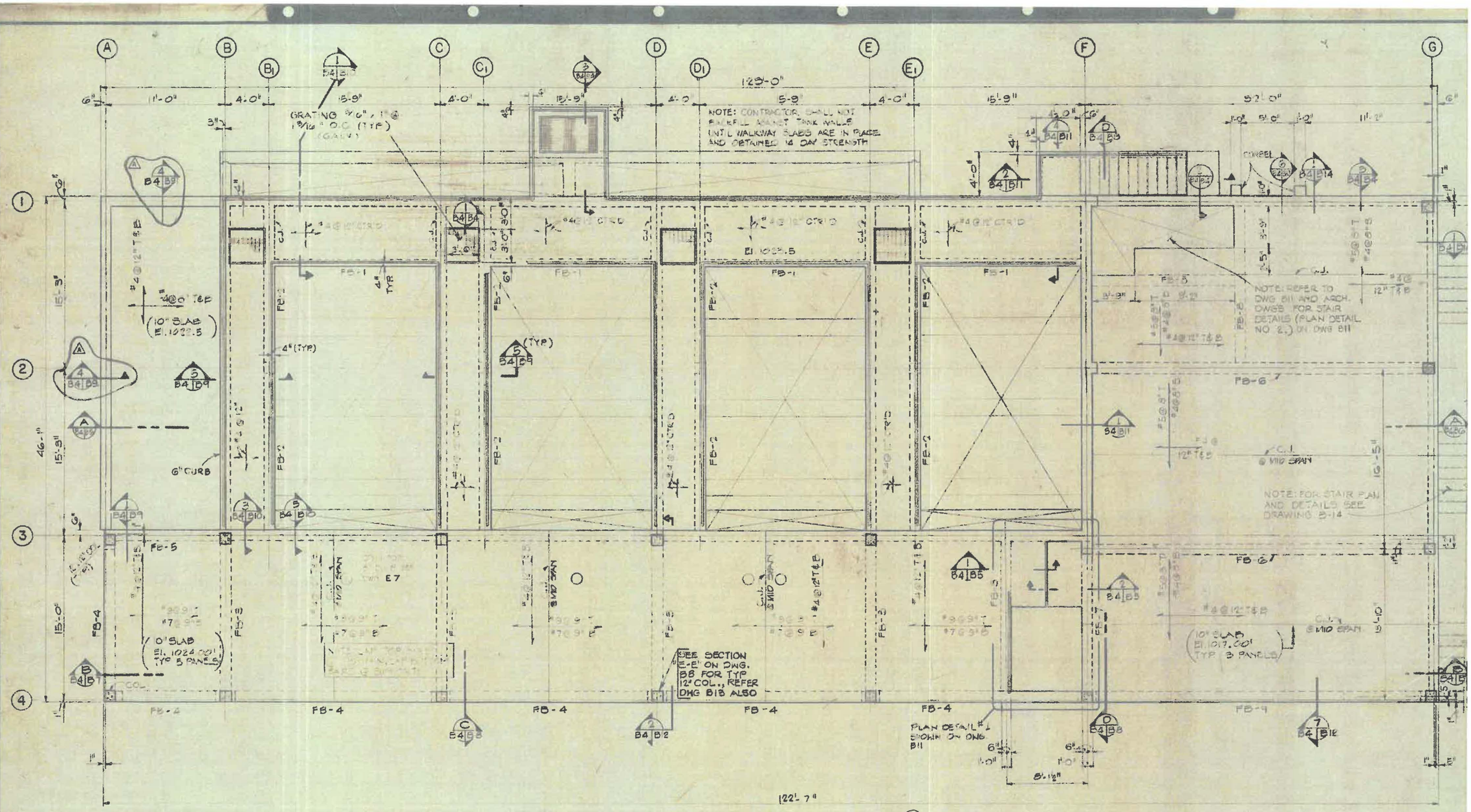
#4@12" T&B
12" SLAB (EL. 1002.25 HIGH POINT AT WALL)

#4@12" O.C. T&B

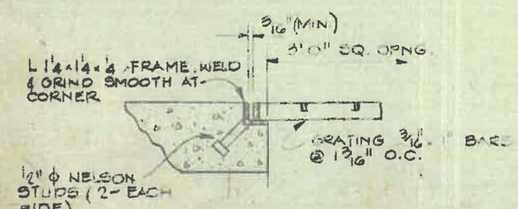
#4@12" T&B

#4@12" T&B

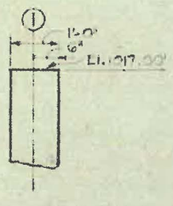
#4@12"



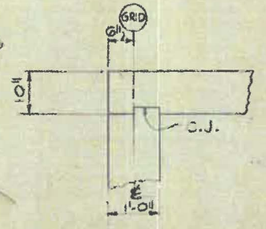
UPPER LEVEL FRAMING PLAN
SCALE: 1/4" = 1'-0"



1 B4|B4 SECTION
SCALE: 3" = 1'-0"

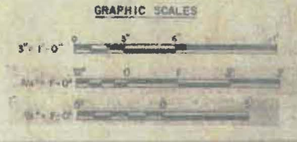


2 B4|B4 SECTION
SCALE: 3/4" = 1'-0"



3 B4|B4 SECTION

GRAPHIC SCALES



⚠ Jan. 9, 1978 Correct Section Designation

DATE 11-30-77	Shawnee, Oklahoma
SCALE AS NOTED	WATER TREATMENT PLANT
DESIGNED BY J.T.B.	FILTER BUILDING
DRAWN BY B.M.	UPPER LEVEL FRAMING PLAN AND SECTIONS
CHECKED BY W.E.A.	
APPROVED BY J.M.B.	
B4	

1012 WT

122'-7"

A B C D E F G

11'-0" | 19'-9" | 19'-9" | 19'-9" | 19'-9" | 32'-0"

1 2 3 4

El. 1023.50

RB-4 RB-4 RB-4 RB-4 RB-4 RB-5 RB-6

15'-3" 15'-3" 15'-2" 15'-0"

46'-1"

90'-0"

122'-2"

32'-0"

8" SLAB El. 1024.25 (TYP 5 PANELS)

8" SLAB

8" SLAB

8" SLAB

8" SLAB El. 1027.67 (TYP 5 PANELS)

24" ϕ OPNG

24" ϕ OPNG

2-#5 T&B @ SLAB ALL AROUND

2-#4 TOP OF SLAB AT EA. CORNER (TYP.)

C.J. @ MID SPAN

C.J. @ MID SPAN

10" ϕ OPENING

2'-7" x 4'-1" OPNG

RB-3 (HIGH) RB-7 (LOW)

RB-8

RB-1

RB-2

RB-3

RB-5

RB-7

RB-8

ROOF FRAME PLAN

SCALE 1/4" = 1'-0"

8'-1½"

El. 1024.00

#9@9"

#4@12" O.C.

#7@9"

10"

FB-3

3'-6½"

#4@12" T&B

#5@8" O.C.

EXTENDED SLAB REINF.

El. 1017.00

#4@8" O.C.

3'-6½"

FB-7

1 SECTION

SCALE: 3/4" = 1'-0"

2 SECTION

SCALE: 3/4" = 1'-0"

GRAPHIC SCALES

DATE	11-30-77
SCALE	AS NOTED
DESIGNED	J.T.B.
DRAWN	B.M.
CHECKED	W.E.A.
APPROVED	J.M.B.
JOB NO.	85

Shawnee, Oklahoma
WATER TREATMENT PLANT

FILTER BUILDING
ROOF FRAMING PLAN
AND SECTIONS

Bedinger - Bice & Associates, Inc.

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A B B1 C C1 D D1 E E1 F G

EL. 1023.50'

EL. 1009.50

EL. 1002.65

EL. 1027.67'

EL. 1017.00'

FB-1 FB-2 FB-5 FB-6 FB-G

WASH TROUGHS (TYP.) SEE CIVIL DWGS.

C.J.'s WITH W.S.

W.S.

C.J.

OPNG.

2'-0" TO F.F.

OPNG IN WALL FOR 20" C.I.P.

NOTE: EXTEND SLAB REINF THRU. CONST JOINTS

BEYOND

BEYOND

SECTION A-A

FROM DWG B3, B4, B5

SCALE: 1/4"=1'-0"

BLOWER AIR INTAKE FILTER

30" ABOVE GRADE

PLANTER

FIN. GRADE SEE CIVIL DWG.

EL. 1017.00

STAIRS DN

NORTH WALL FILTER BLDG

#4 @ 2'-6" E.W.

WELD PL 1/4" SQUARE TO BLOWER INTAKE PIPE

LINK SEAL

12" STEEL PIPE (0.375 WALL) W/ BITUMINUS COATING

RETAINING WALL

SEE DRAWING FOR PIPING PLAN (8" D.I.P.)

1 SECTION

SCALE: 1/4"=1'-0"

GRAPHIC SCALES

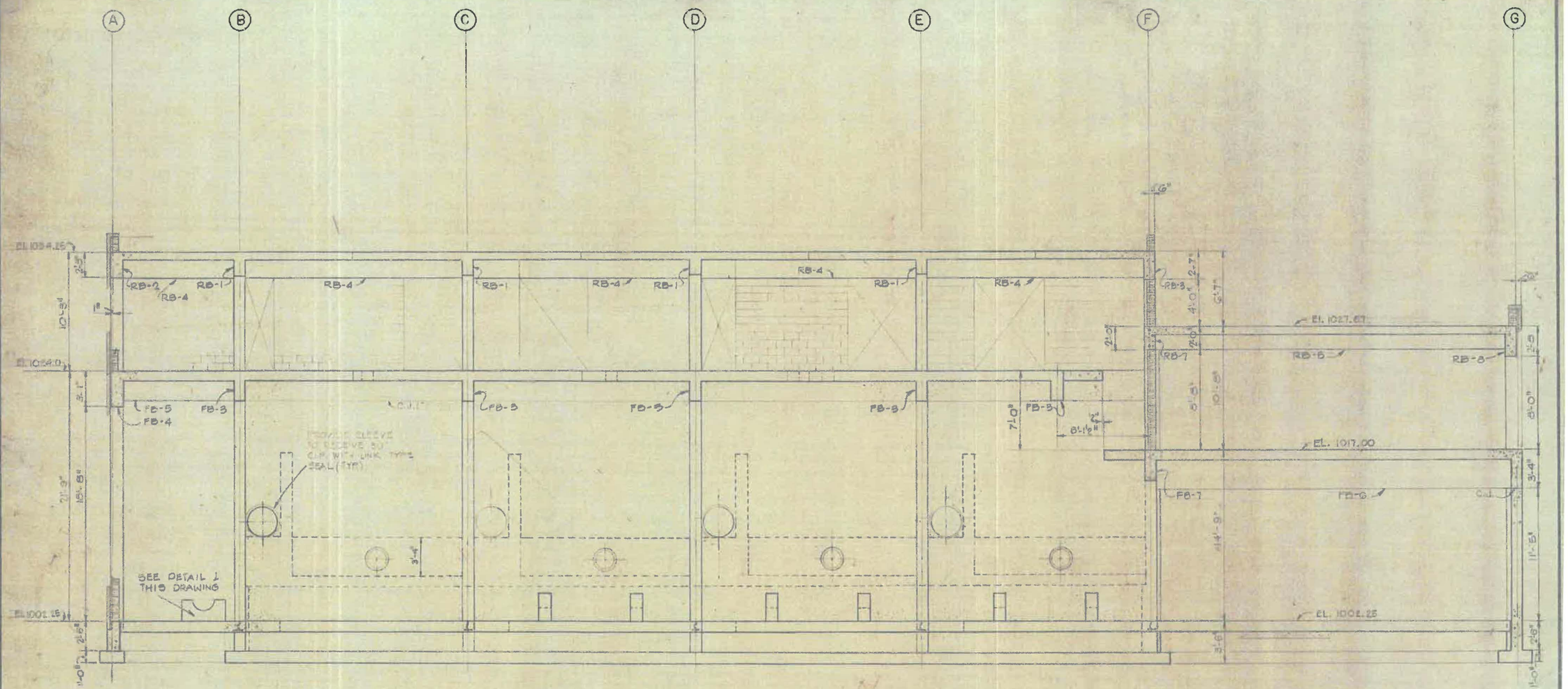
11-30-77	Shawnee, Oklahoma
AS NOTED	WATER TREATMENT PLANT
J.T.B.	FILTER BUILDING
E.M.	LONGITUDINAL SECTION A-A
W.E.S.	
J.M.B.	
85	

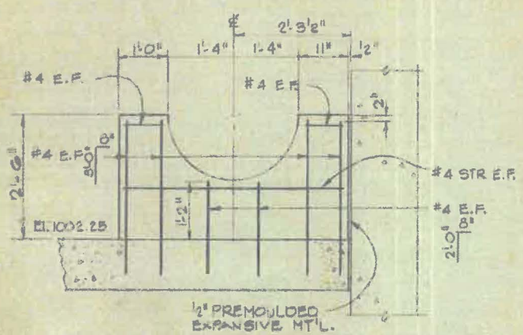
189

SECTION B-B

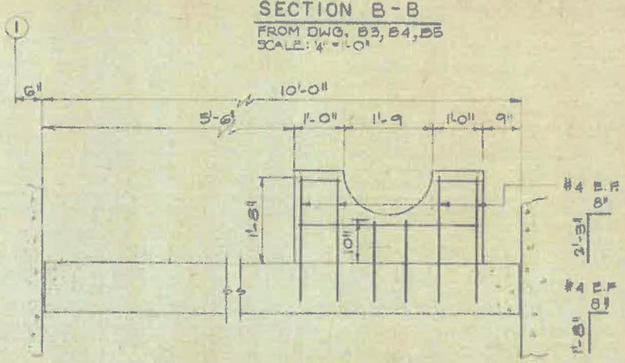
FROM DWG. B3, B4, B5

SCALE: 1/4" = 1'-0"





1 SECTION
B5 B7
SCALE: 3/4" = 1'-0"
(6 - REQUIRED)

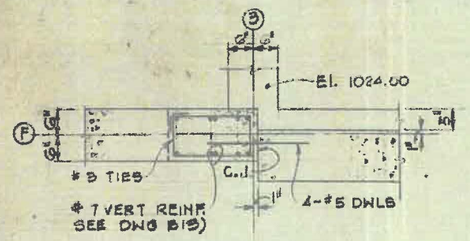


DETAIL 1 (PIPE SUPPORTS)

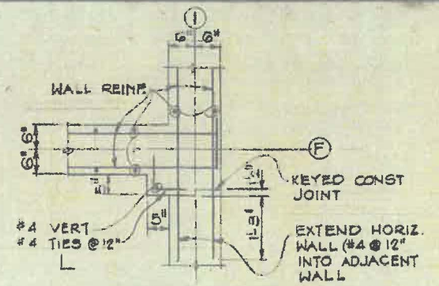
SCALE 3/4" = 1'-0" (2-REQUIRED)

DRAWING SCALES

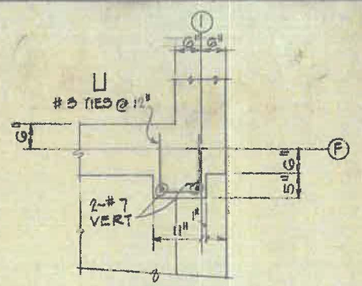
11-30-77	Shawnee, Oklahoma
AS NOTED	WATER TREATMENT PLANT
J.T.B.	FILTER BUILDING
B.M.	LONGITUDINAL SECTION B-B
W.E.A.	
J.M.B.	
B7	



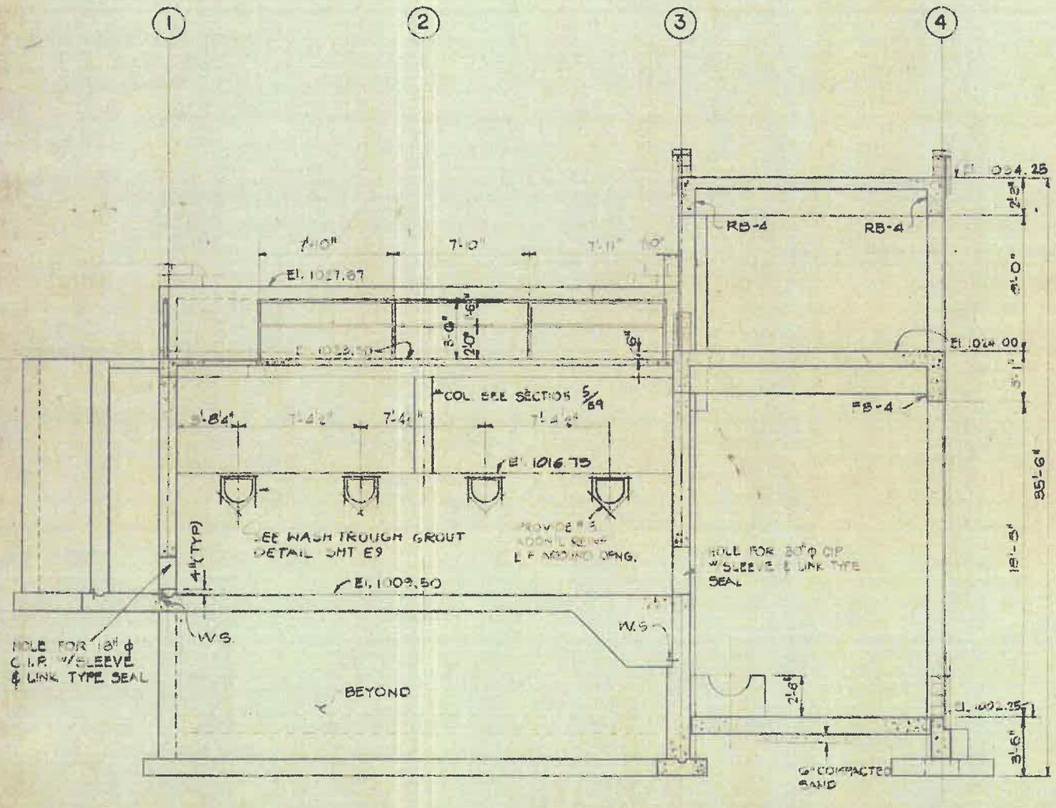
SECTION D-D
SCALE: 3/4"=1'-0"

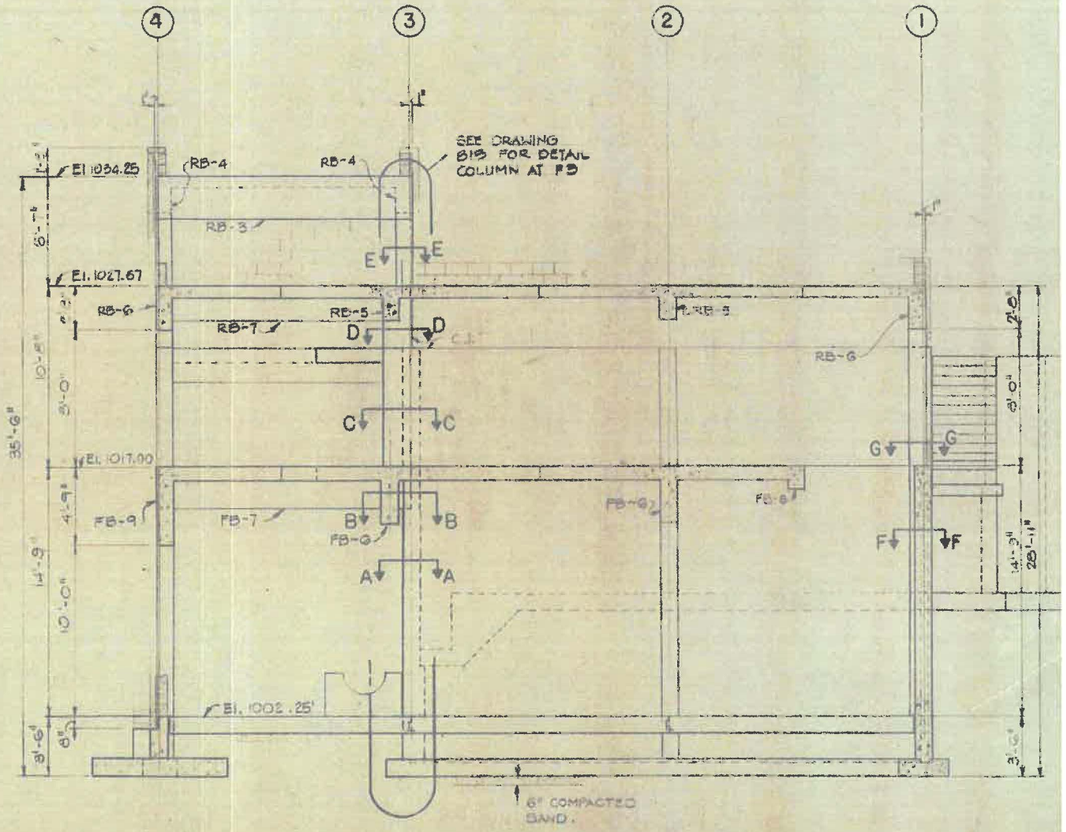


SECTION F-F
SCALE: 3/4"=1'-0"

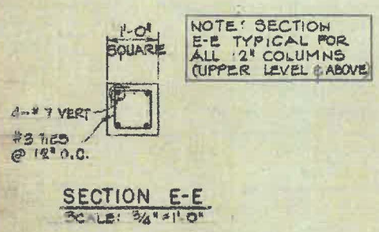


SECTION G-G
SCALE: 3/4"=1'-0"



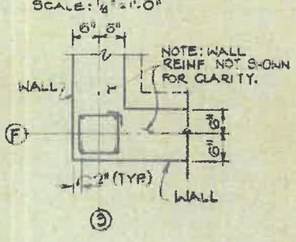


SECTION D-D
FROM DWG B3, B4 & B5
SCALE: 1/4"=1'-0"



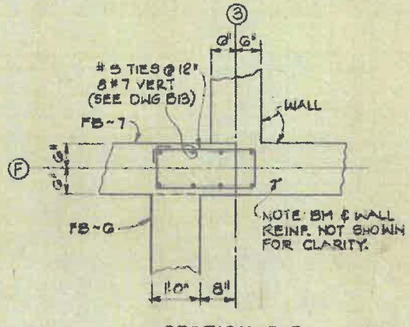
NOTE: SECTION E-E TYPICAL FOR ALL 12" COLUMNS (UPPER LEVEL & ABOVE)

SECTION E-E
SCALE: 3/4"=1'-0"

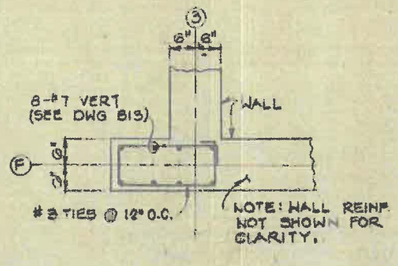


SECTION C-C
FROM DWG B3, B4 & B5
SCALE: 1/4"=1'-0"

SECTION A-A
SCALE: 3/4"=1'-0"



SECTION B-B
SCALE: 3/4"=1'-0"

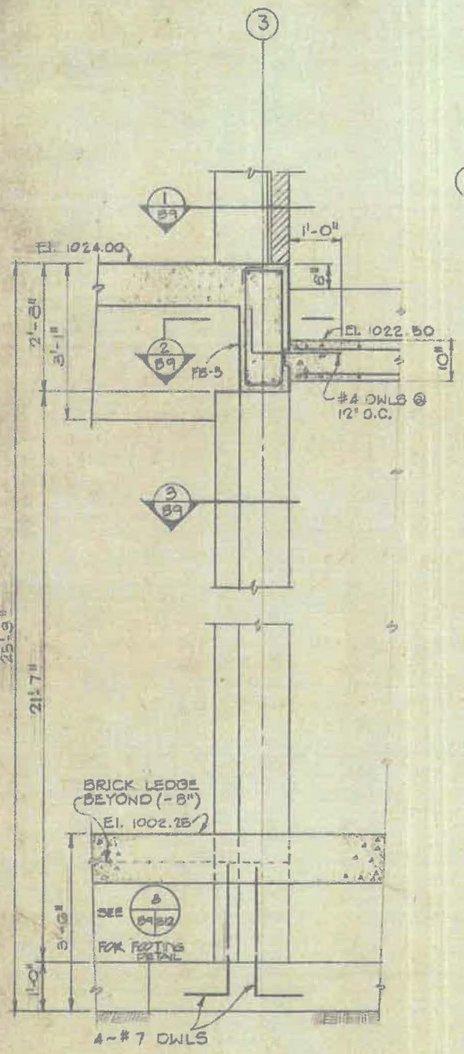


SECTION C-C
SCALE: 3/4"=1'-0"

11-30-77	Shawnee, Oklahoma
AS NOTED	WATER TREATMENT PLANT
J.T.B.	FILTER BUILDING TRANSVERSE SECTIONS C-C AND D-D AND SECTION DETAILS
B.M.	
W.E.A.	
J.M.B.	

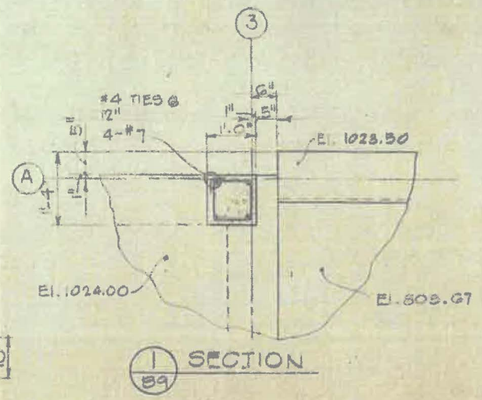
Sheehan - Shirk & Associates, Inc.

DRAWING NO. 1017 WT
SHT. NO. E-2 OF E2
DATE 12/4/77

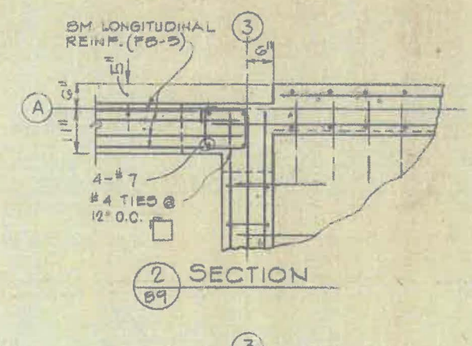


1 SECTION B4 B9 B5

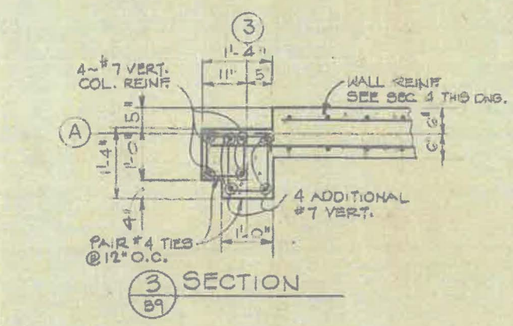
6 SECTION B3 B5



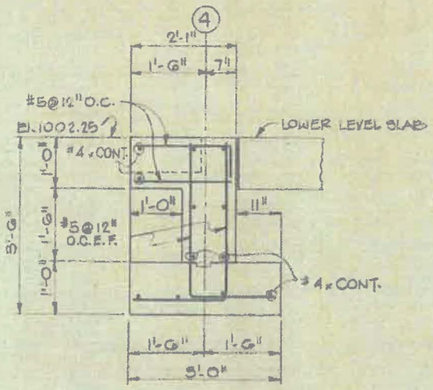
1 SECTION B9



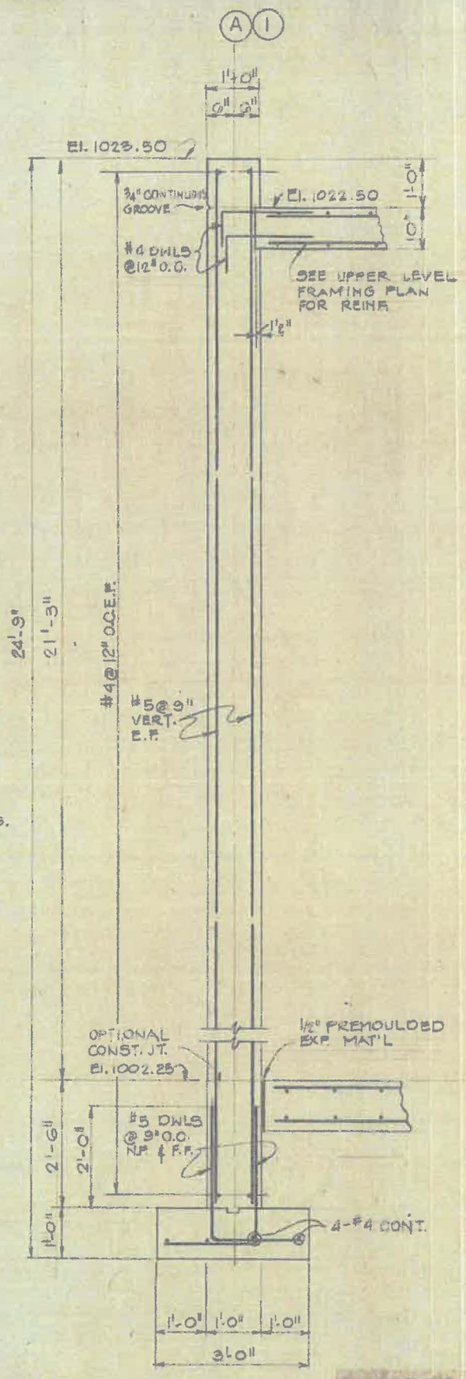
2 SECTION B9



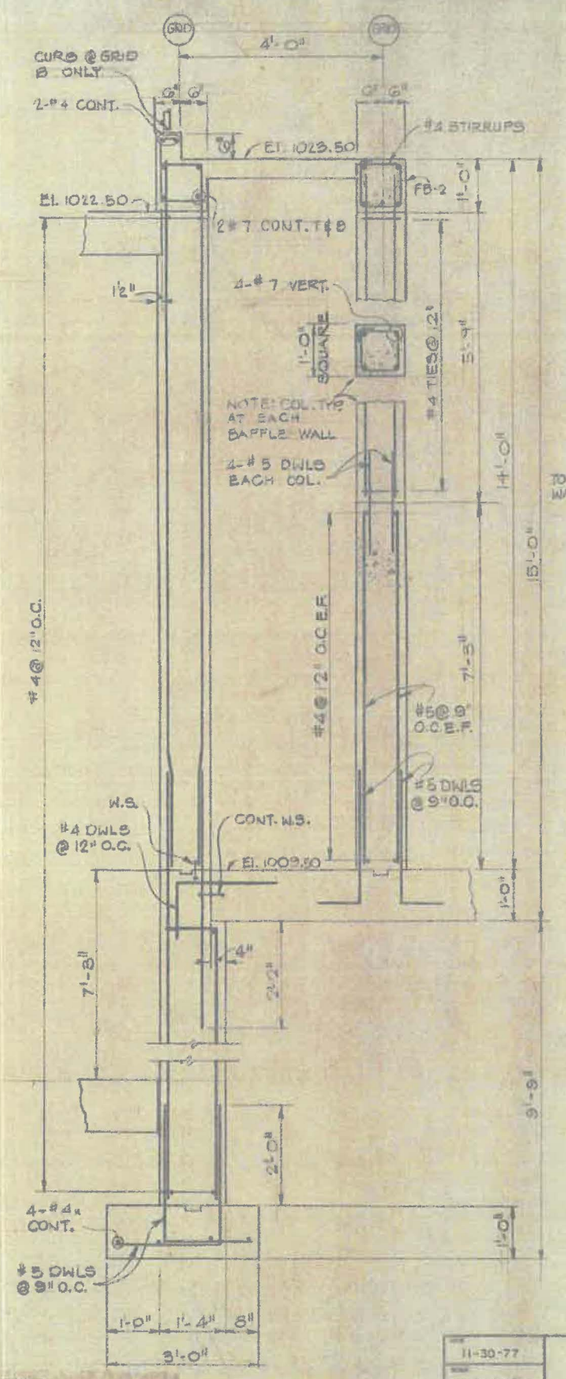
3 SECTION B9



7 SECTION B9 B5



4 SECTION B4 B9 B5

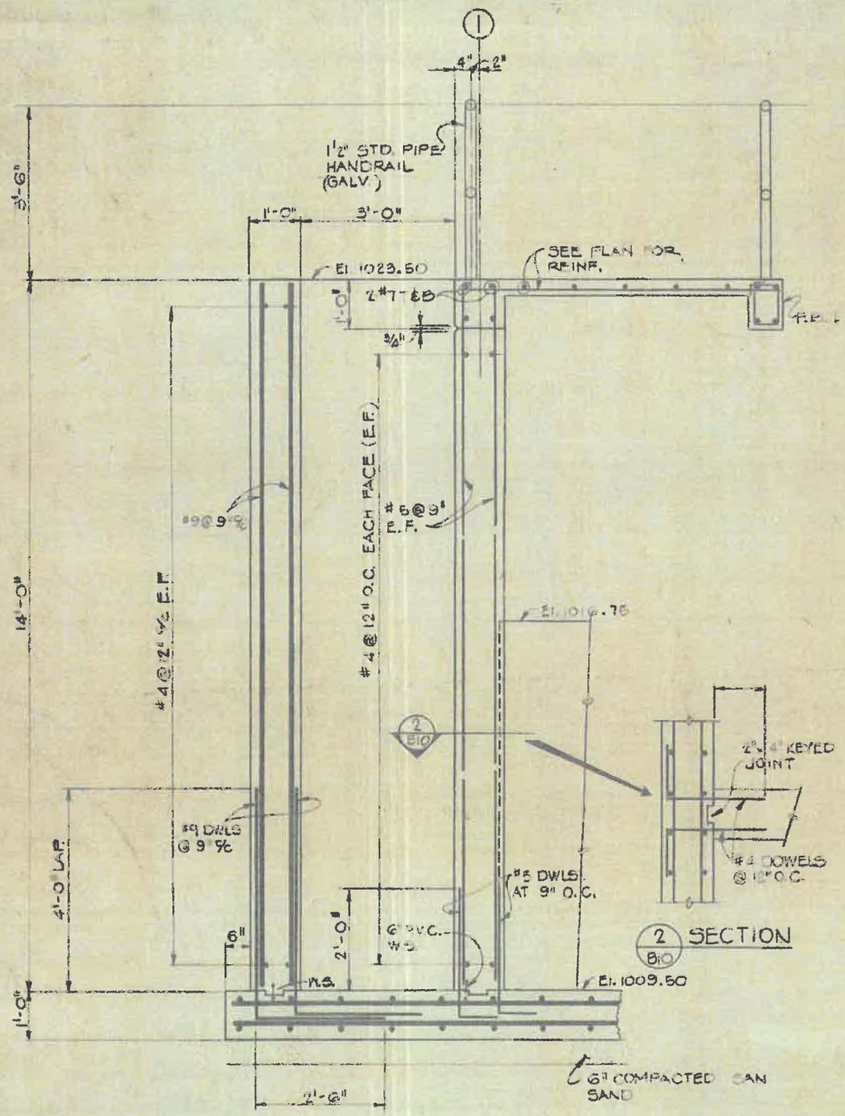


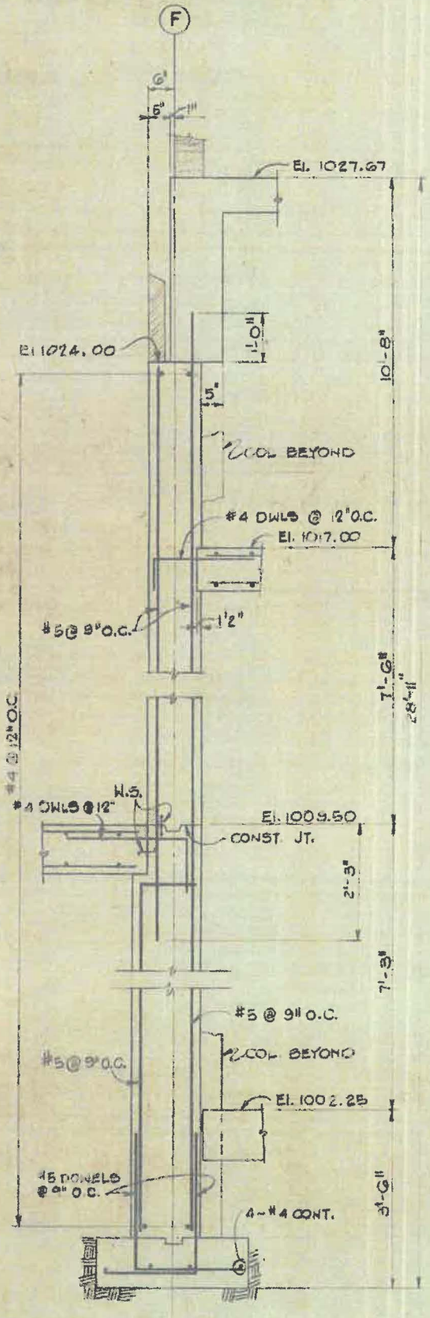
5 SECTION B4 B9 B5

GRAPHIC SCALES

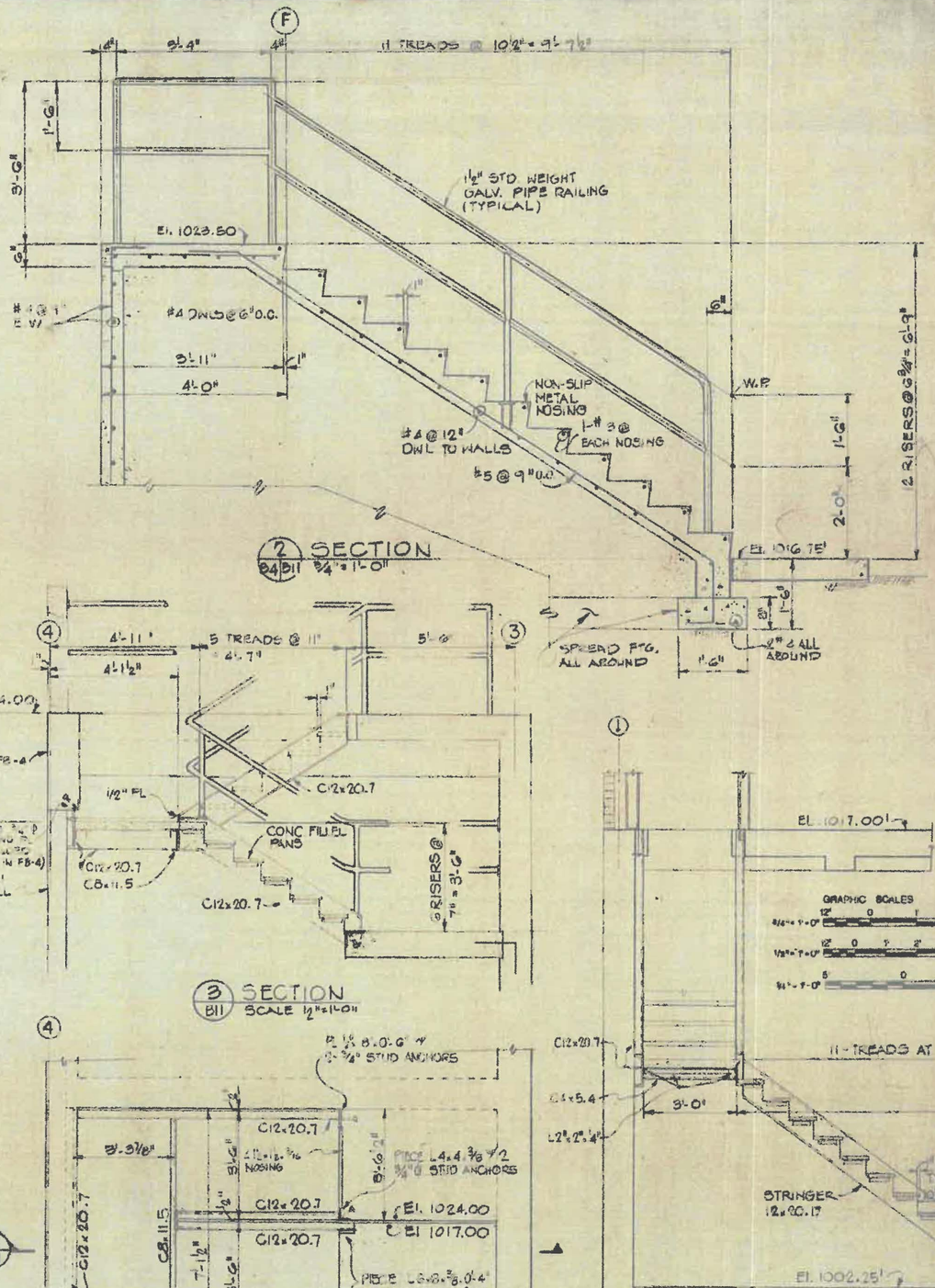
11-30-77	Shawnee, Oklahoma
3/4" = 1'-0"	WATER TREATMENT PLANT
J.T.B.	FILTER BUILDING SECTIONS
B.M.	
W.E.A.	
J.M.B.	
B2	Burns - Allen & Associates, Inc.

1017 NT 10-2 4-24 12/77


1
4"
2"
1½" STD. PIPE HANDRAIL (GALV.)
3'-6"
1'-0"
3'-0"
EL. 1023.50
SEE PLAN FOR REINF.
2-#7 - EB
3/4"
F.F.
#9 @ 9" F.F.
#4 @ 12" O.C. EACH FACE (E.F.)
#5 @ 9" E.F.
14'-0"
#4 @ 12" O.C. E.F.
EL. 1016.75
2
B10
2" x 4" KEYED JOINT
#4 DOWELS @ 12" O.C.
#9 DWLS @ 9" O.C.
#5 DWLS AT 9" O.C.
4'-0" LAP
2'-0"
6"
W.S.
EL. 1009.50
1'-0"
2'-6"
6" COMPACTED SAN SAND
2 SECTION B10
1 SECTION B9 B10 B4
3
6"
1"
COLUMN BEYOND (SEE PLAN)
4 B10
WALKWAY EL. 1023.50
EL. 1024.00'
4-#5 DWLS
C.J.
WALL REINF. #4 @ 12" HORZ. #5 @ 9" VERT.
3 SECTION B4 B10
(GRID)
(GRID)
6"
4'-0"
6"
EL. 1024.00
1'-0"
6"
EL. 1023.50
C.J.
C.J.
WALL
DWL BR INTO WALL (4-#5) TYP. AT 4 WALKWAYS
FOR WALKWAY REINF. SEE PLAN ON DWG. B4
4 SECTION B10
1
6"
2-#4
EL. 1017.00
2-#4
2-#5
#5 WELD TO 2-#5
1'-0"
2-#4 TIES
2-#4
WALL REINF
6 SECTION AT CORBEL B3 B10
GRAPHIC SCALES
3
6"
EL. 1024.00
#5 @ 9" O.C.
EL. 1009.50
#4 @ 12" O.C.
#4 - DOWELS @ 12" O.C.
1'-10"
COMPACTED FILL
2'-4"
#5 @ 9"
#5 @ 9"
EL. 1002.25
#5 DOWELS @ 9" O.C.
1'-0"
6" COMPACTED SAND
2'-0"
7'-3"
4'-7"
7'-3"
21'-9"
25'-3"
31'-4"
1'-0"
1'-6"
1'-0"
3'-0"
5 SECTION B4 B10 B3
10-30-77
3/4" = 1'-0"
J.T.B.
B.M.
W.E.A.
J.M.B.
B10
Shawnee, Oklahoma
WATER TREATMENT PLANT
FILTER BUILDING SECTIONS
Sheffman - Blair & Affiliates, Inc.



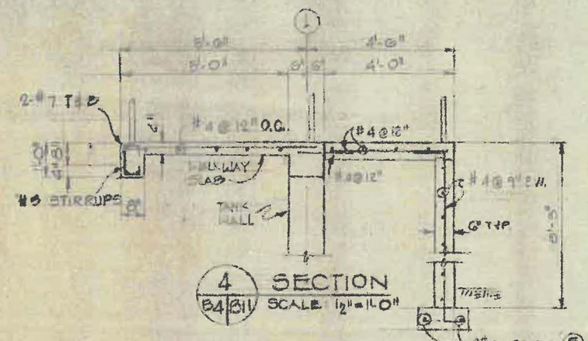
1 SECTION
B4 B11 3/4"=1'-0"



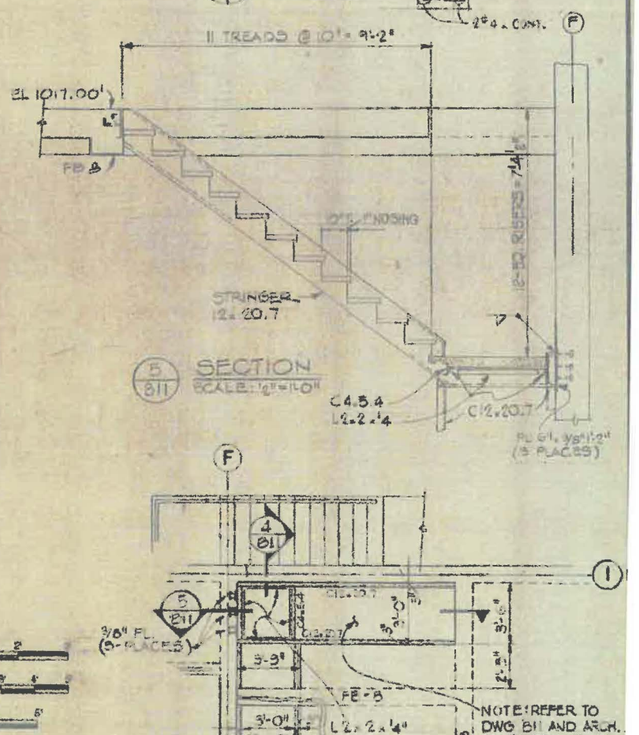
2 SECTION
B4 B11 3/4"=1'-0"

3 SECTION
B11 SCALE ½"=1'-0"

PLAN DETAIL 1
SCALE: ½"=1'-0"

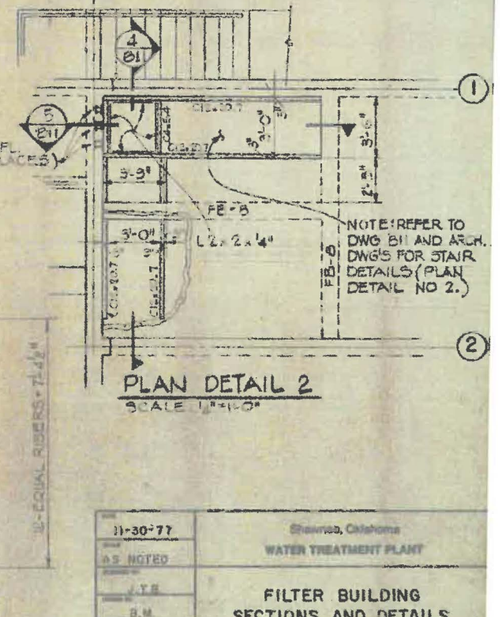


4 SECTION
B4 B11 SCALE ½"=1'-0"



5 SECTION
B11 SCALE: ½"=1'-0"

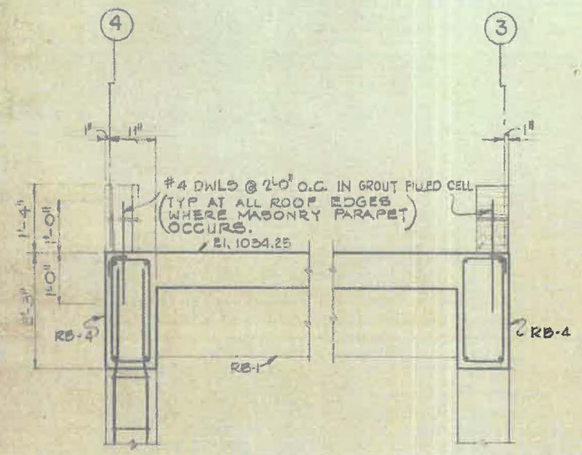
4 SECTION
B11 SCALE ⅜"=1'-0"



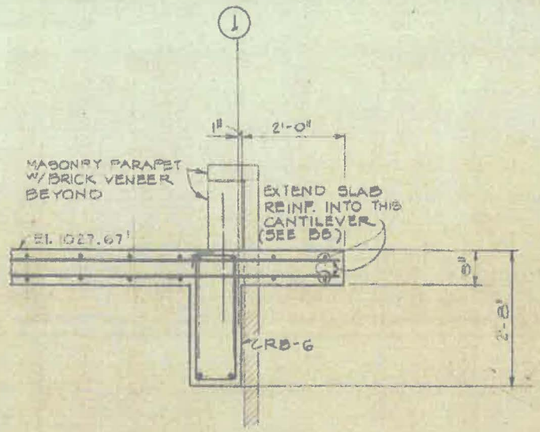
PLAN DETAIL 2
SCALE 1"=1'-0"

11-30-77	Shawnee, Oklahoma	
AS NOTED	WATER TREATMENT PLANT	
J.Y.B.	FILTER BUILDING SECTIONS AND DETAILS	
B.M.		
W.F.A.		
J.M.B.		
B11		

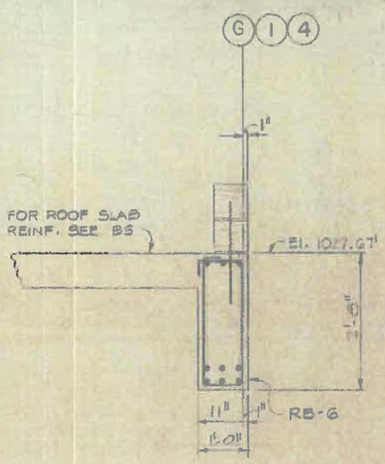
189



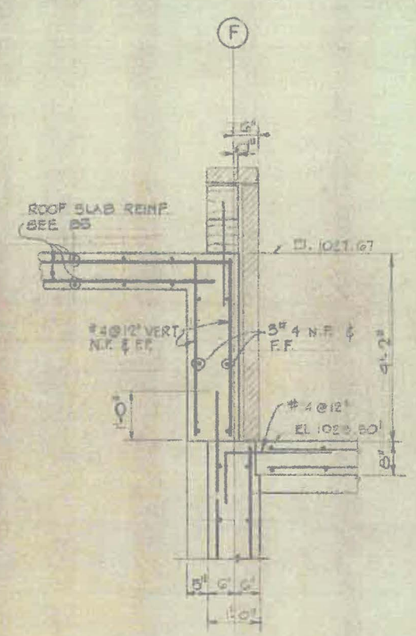
1 SECTION B5 B12 3/4" = 1'-0"



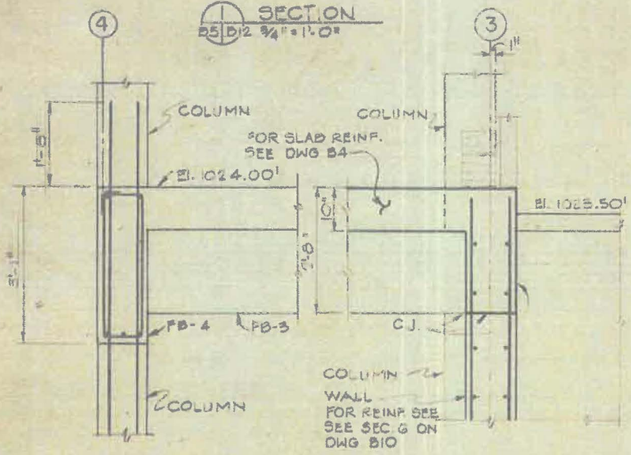
3 SECTION B5 B12



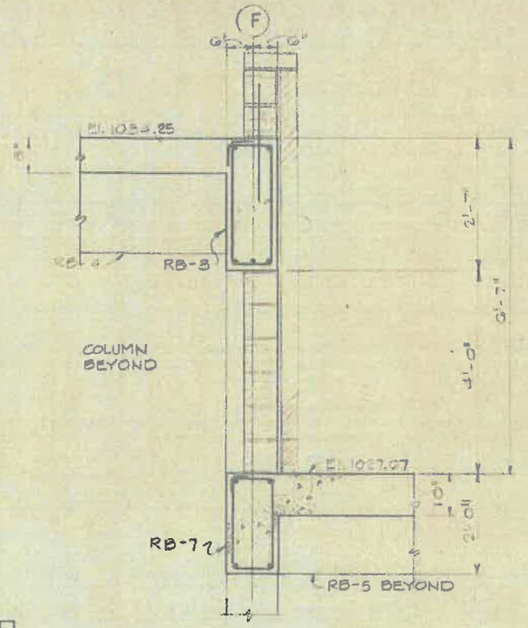
4 SECTION B5 B12



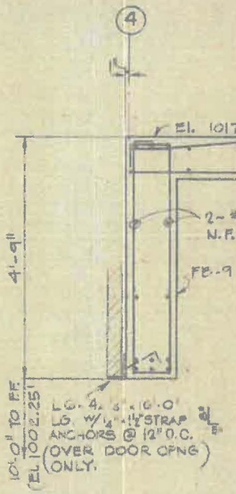
5 SECTION B5 B12 SCALE: 3/4" = 1'-0"



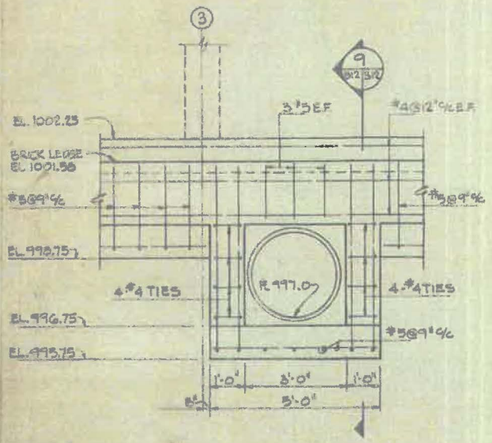
2 SECTION B4 B12 3/4" = 1'-0"



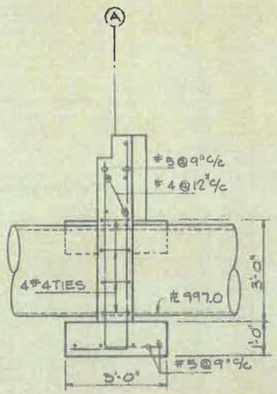
6 SECTION B5 B12



7 SECTION B4 B12



8 SECTION B4 B12 SCALE: 1/2" = 1'-0"



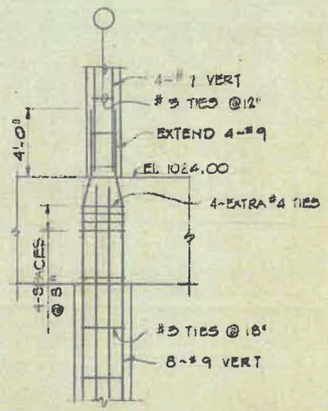
9 SECTION B4 B12 SCALE: 1/2" = 1'-0"

GRAPHIC SCALES

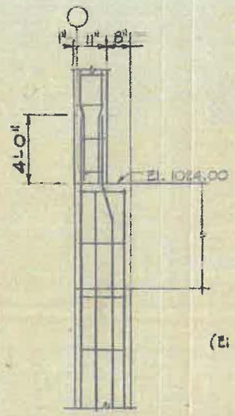
11-30-77	Shawnee, Oklahoma
3/4" = 1'-0"	WATER TREATMENT PLANT
J.T.B.	FILTER BUILDING SECTIONS
B.M.	
W.E.A.	
J.M.B.	

BEAM SCHEDULE

BEAM MARK	SIZE b	SIZE h	REINFORCING LONGITUDINAL TOP	LONGITUDINAL BOTTOM	STIRRUPS SIZE	STIRRUPS	REMARKS
RB-1	12"	24"	3-#7	3-#7	#3	1@3", 6@ 10" BAL. @ 18" E.E.	
RB-2	12"	27"	5-#7	3-#7	#3	1@3", 6@ 10" BAL. @ 18" E.E.	
RB-3	12"	31"	5-#7	5-#7	#3	1@3", 6@ 10" BAL @ 18" E.E.	
RB-4	12"	27"	2-#6	2-#6	#3	1@3", 5@ 10" BAL @ 18" E.E.	
RB-5	12"	24"	5-#9	6-#10	#4	1@3", 16@3" BAL @ 18" E.E.	BOTTOM BARS IN 2-LAYERS
RB-6	12"	32"	5-#9	6-#10	#4	1@3", 16@3" BAL @ 18" E.E.	
RB-7	12"	24"	3-#7	3-#7	#3	1@3", 6@10" BAL @ 18" E.E.	
RB-8	12"	32"	2-#6	2-#6	#3	1@3", 5@10", BAL @ 18" E.E.	
FB-1	8"	12"	2-#7	2-#7	#4	1@3", 7@6" BAL @ 18" E.E.	
FB-2	12"	12"	2-#5	3-#6	#4	1@3", 6@6" BAL @ 18" E.E.	
FB-3	12"	32"	4-#8	4-#8	#4	1@3", 6@12" BAL @ 18" E.E.	
FB-4	12"	27"	2-#6	3-#7	#4	1@3", 9@12" BAL @ 18" E.E.	
FB-5	12"	32"	2-#6	3-#7	#4	1@3", 9@12" BAL @ 18" E.E.	
FB-6	12"	40"	3-#8	6-#10	#4	1@3", 10@6", 10@12" BAL @ 18" E.E.	BOTTOM BARS IN 2-LAYERS
FB-7	12"	32"	3-#8	3-#8	#4	1@3", 6@12" BAL @ 18" E.E.	
FB-8	12"	16"	2-#6	2-#8	#4	1@3", 12@6" BAL @ 12" E.E.	
FB-9	12"	37"	3-#9	6-#9	#4	1@3", 10@15" BAL @ 18 E.E.	BOTTOM BARS IN 2-LAYERS

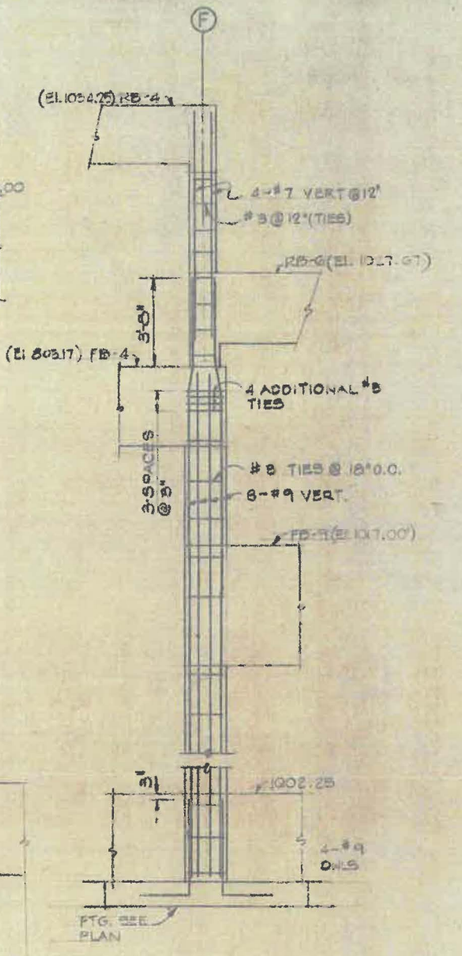


COLUMN TYPICAL B4, C4, D4, E4

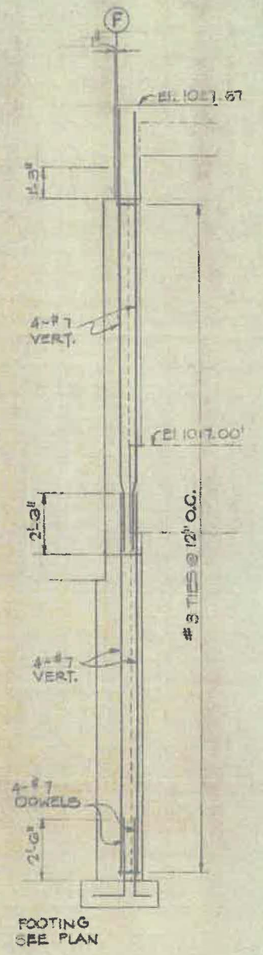


COLUMN AT A4

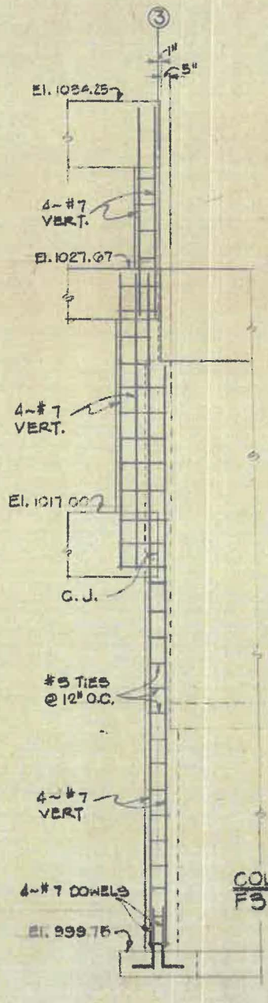
NOTE: COL. AT G4 IS SIMILAR.



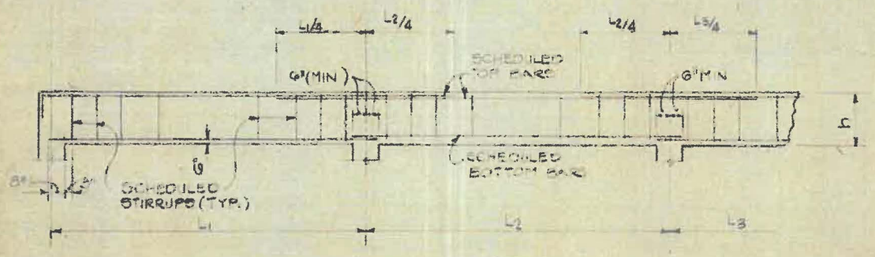
COLUMN AT F4



COLUMN AT F2

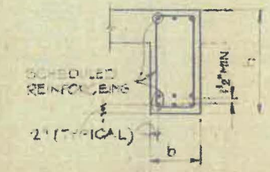


COLUMN AT F5



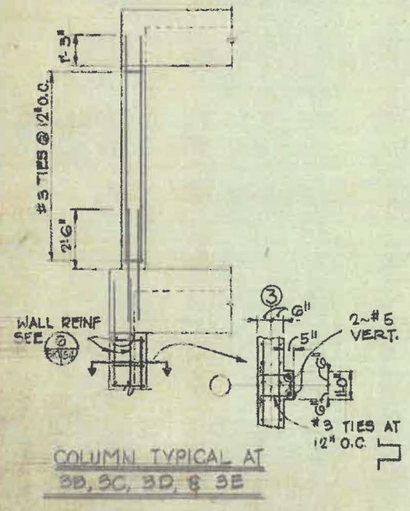
TYPICAL BEAM REINFORCEMENT

NO SCALE

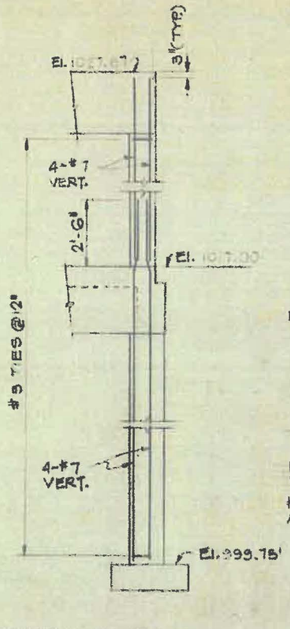


TYPICAL BEAM SECTION

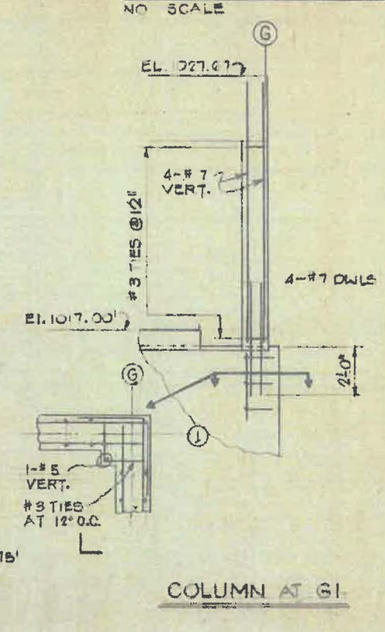
NO SCALE



COLUMN TYPICAL AT 3B, 3C, 3D, & 3E



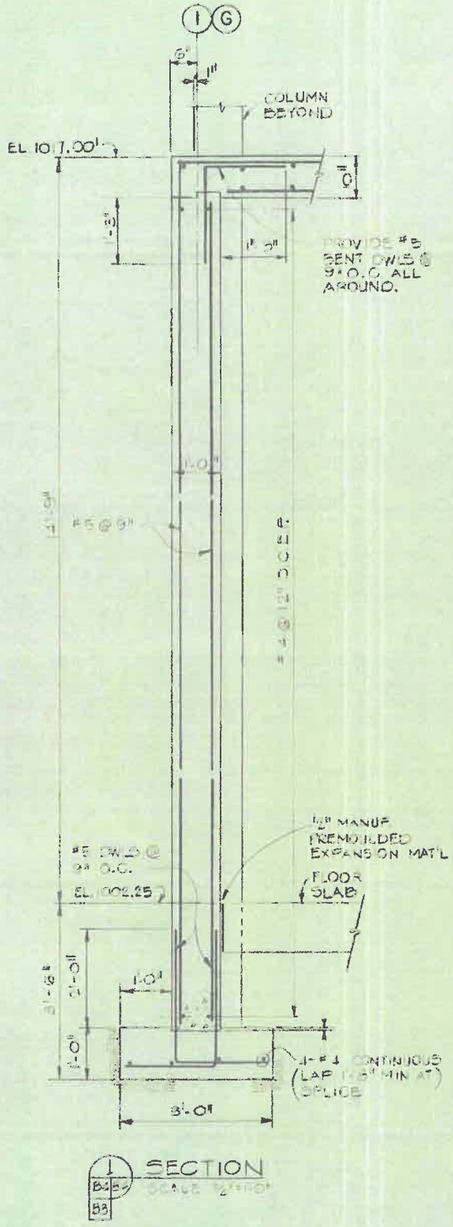
COLUMN AT G2, G3



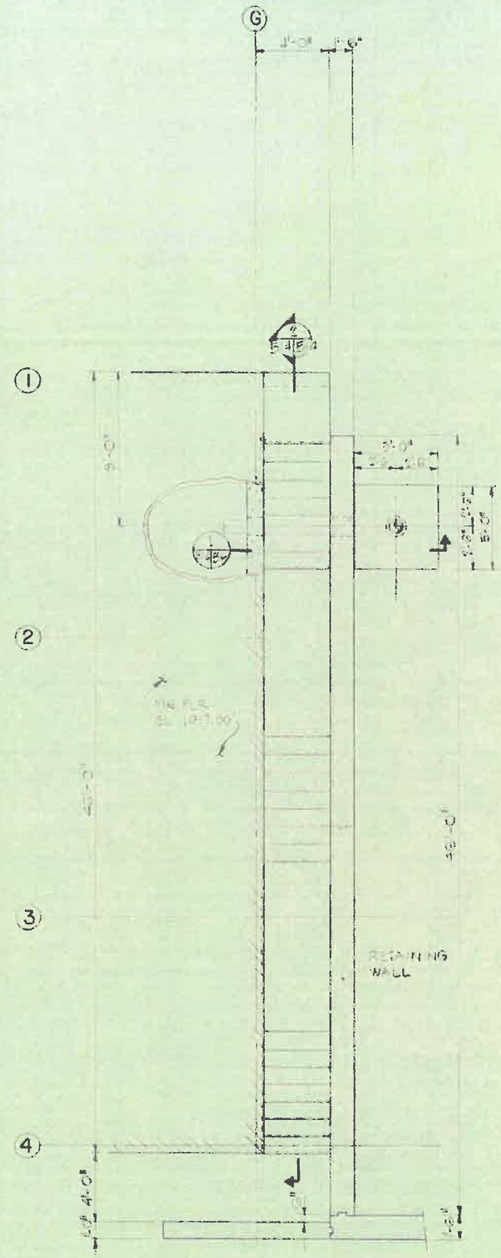
COLUMN AT G1

11-30-77	Shawnee, Oklahoma
NO SCALE	WATER TREATMENT PLANT
J.T.S.	FILTER BUILDING BEAM SCHEDULE AND COLUMN DETAILS
S.M.	
W.E.A.	
J.M.B.	
D.L.S.	

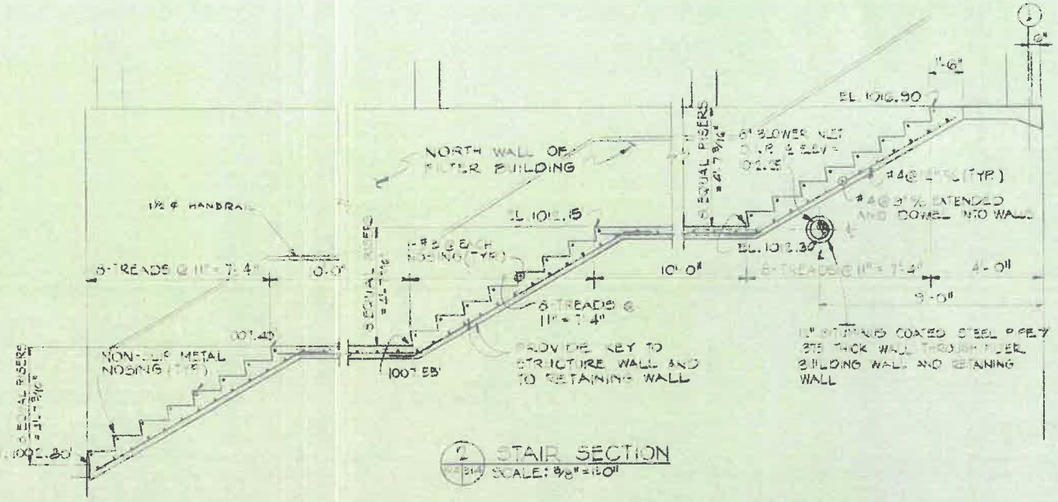
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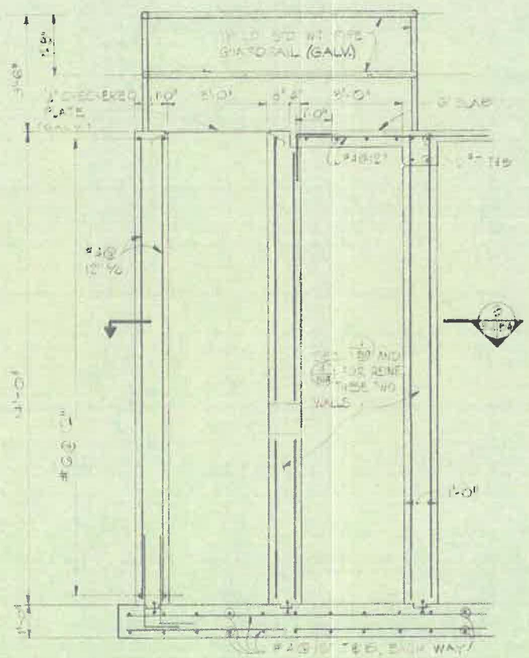
1 SECTION
B4 E7 B3

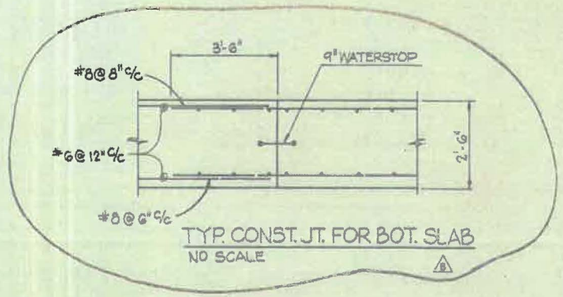


DETAIL FOR NORTH END FILTER BUILDING
SCALE: 1/4"=1'-0"

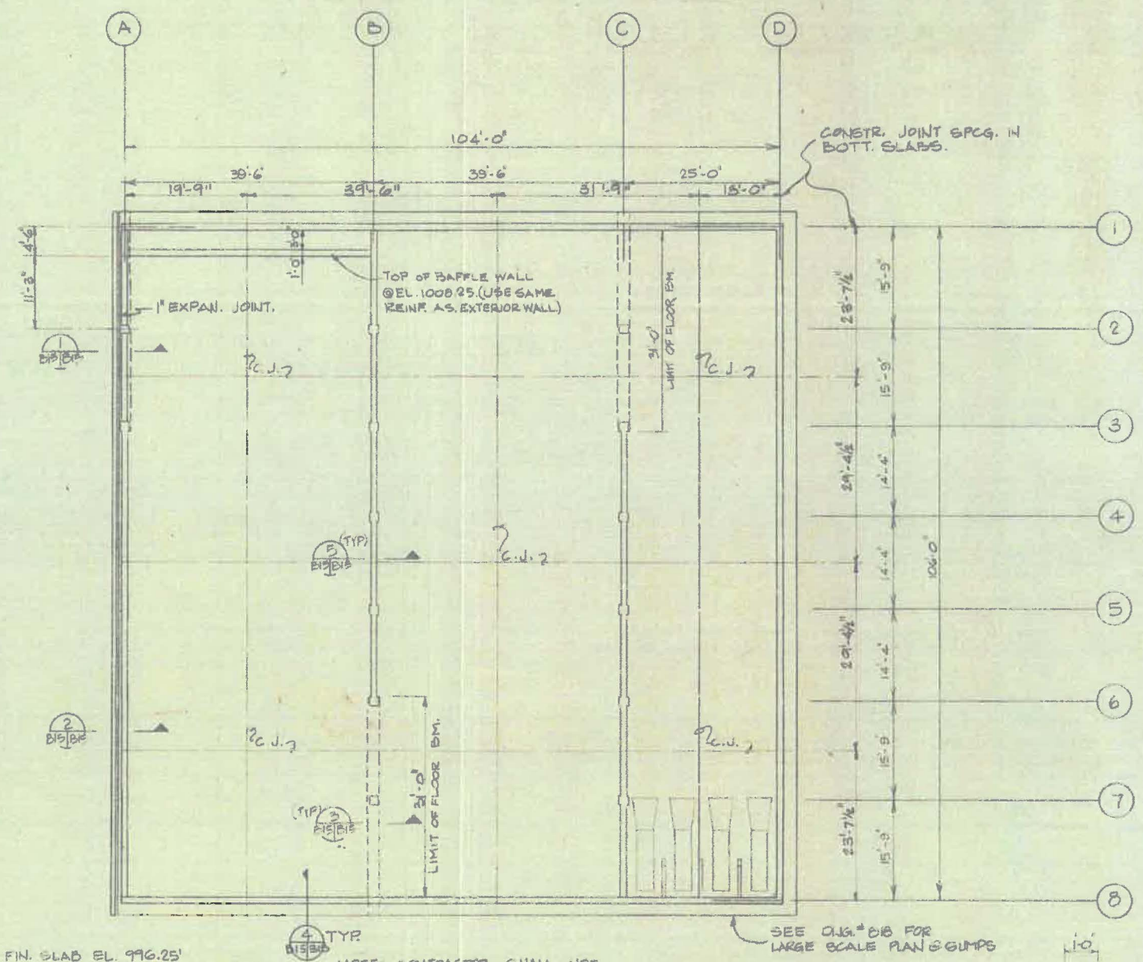


2 STAIR SECTION
SCALE: 3/8"=1'0"


#3@12"
#5@12" E.W.
#4@12" E.W.
#5@12" E.W.
#4@12" E.W.
#5@12" E.W.
#4@12" E.W.



TYP. CONST. JT. FOR BOT. SLAB
NO SCALE

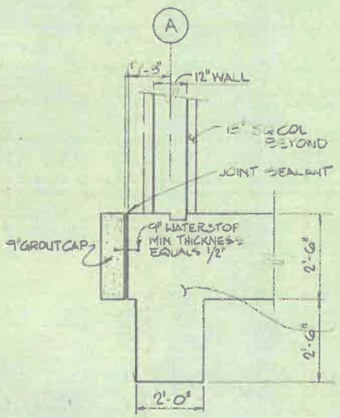


FIN. SLAB EL. 996.25'

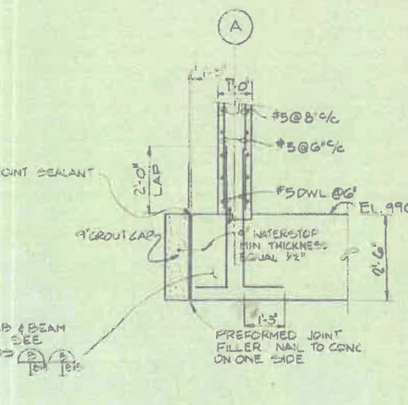
FOUNDATION PLAN
SCALE: 3/32" = 1'-0"

NOTE: CONTRACTOR SHALL NOT BACKFILL AGAINST TANK WALLS UNTIL ROOF SLABS ARE IN PLACE & OBTAINED 14 DAY STRENGTH.

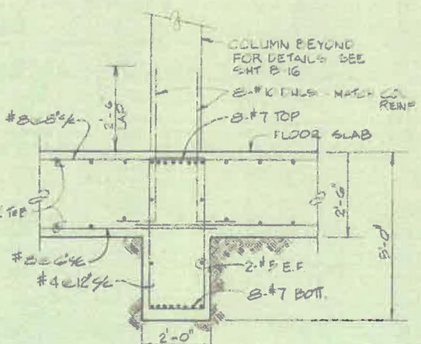
THIS DRAWING HAS BEEN REDUCED TO ONE-HALF THE ORIGINAL SCALE



SECTION 1
½" = 1'-0"

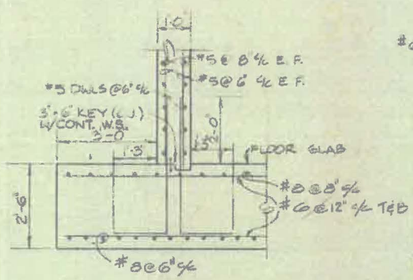


SECTION 2
½" = 1'-0"

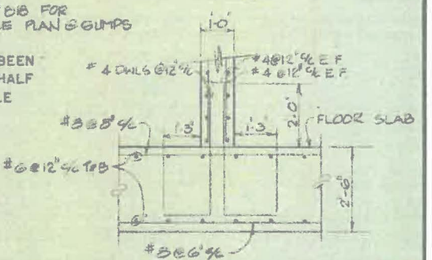


SECTION 3
½" = 1'-0"

GRAPHIC SCALES
1/2"=1'-0" 12" 0 1' 2' 3' 4' 5'
3/32"=1'-0" 10 0 10 20
SCALE FEET



SECTION 4
½" = 1'-0"

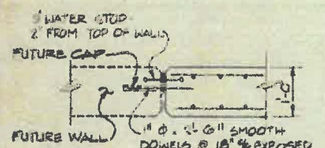


SECTION 5
½" = 1'-0"
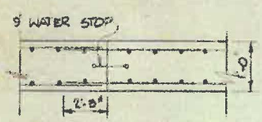
Jan. 16, 1978 Add. Const. Jt. Detail

DATE 11-30-77	Shawnee, Oklahoma
SCALE AS NOTED	WATER TREATMENT PLANT
DESIGNED BY H.L.A.	CLEARWELL
DRAWN BY L.D.M.	FOUNDATION PLAN & DETAILS
CHECKED BY W.E.A.	
APPROVED BY O.W.B.	Burgess - Black & Affiliates, Inc.
JOB NO. 815	

189



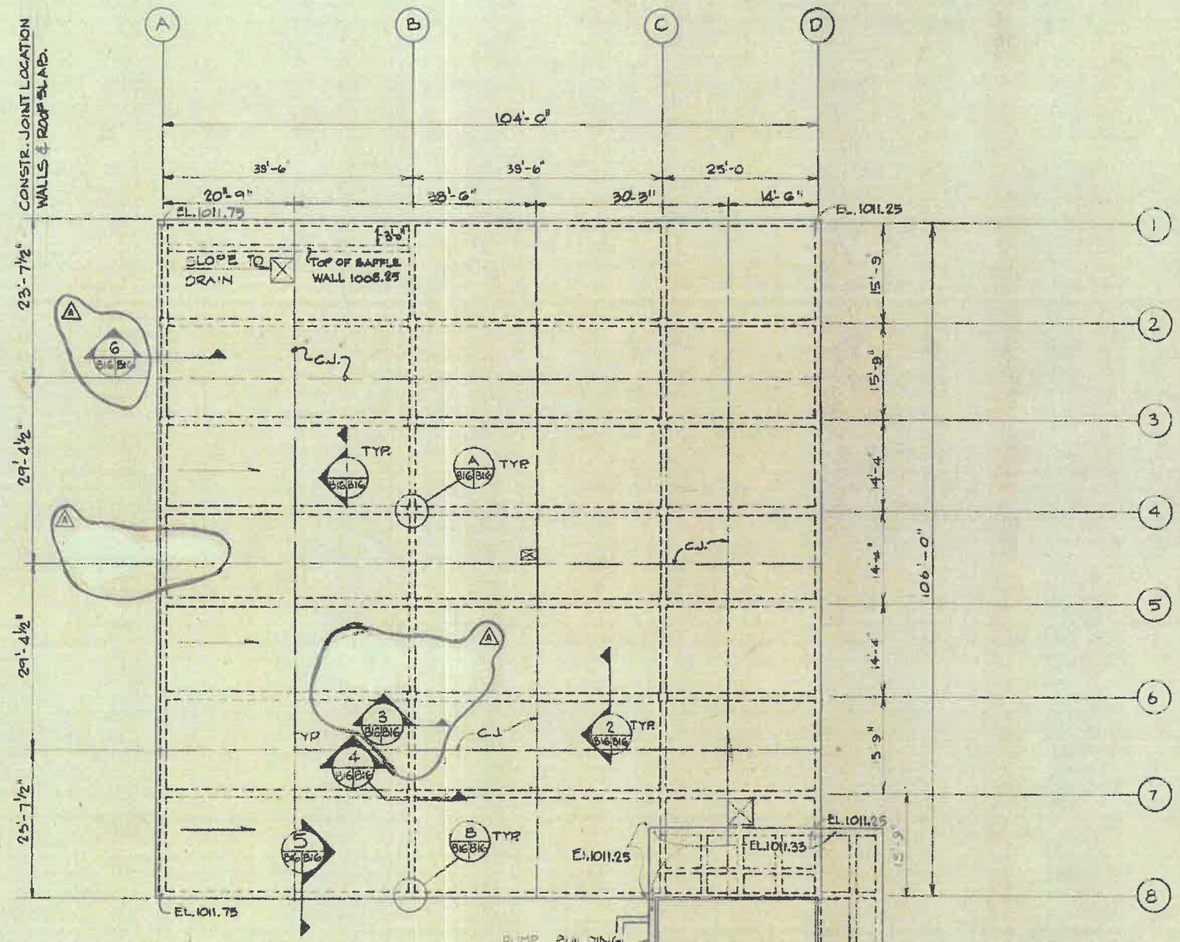
TYP. WALL EXPANSION JT.
SCALE 3/4" = 1'-0"



TYP. EXT. WALL & ROOF CONST. JT. DETAIL
SCALE 3/4" = 1'-0"



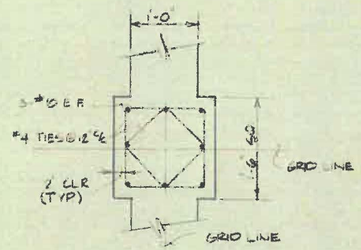
TYP. INTERIOR WALL CONST. JT. DETAIL
SCALE 3/4" = 1'-0"



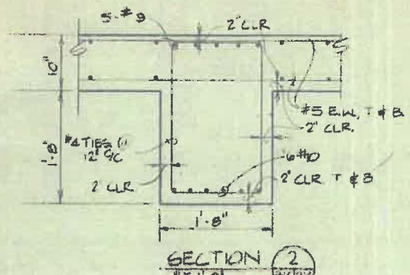
ROOF FRAMING PLAN
SCALE 3/32" = 1'-0"



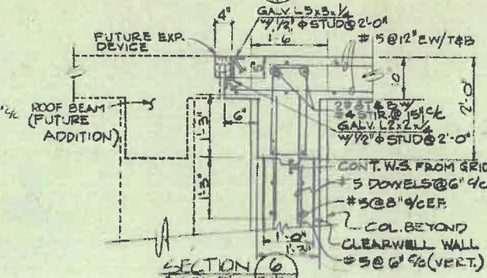
TYP. ROOF SECTION
SECTION 1
1" = 1'-0"



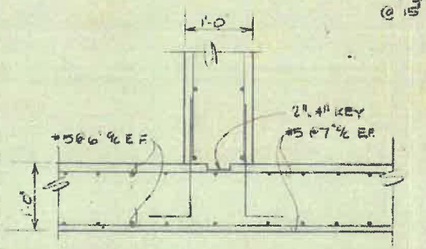
DETAIL A
1" = 1'-0"



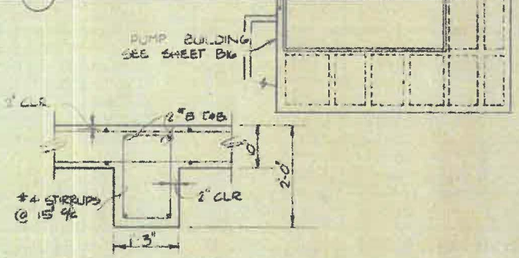
SECTION 2
1" = 1'-0"



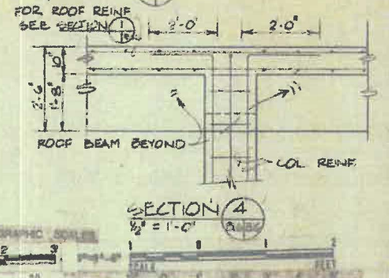
SECTION 6
1" = 1'-0"



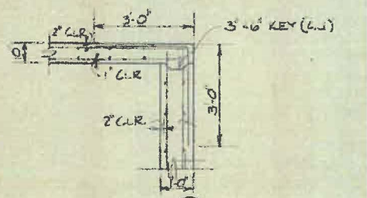
DETAIL B
1" = 1'-0"



SECTION 3
3/4" = 1'-0"



SECTION 4
3/4" = 1'-0"



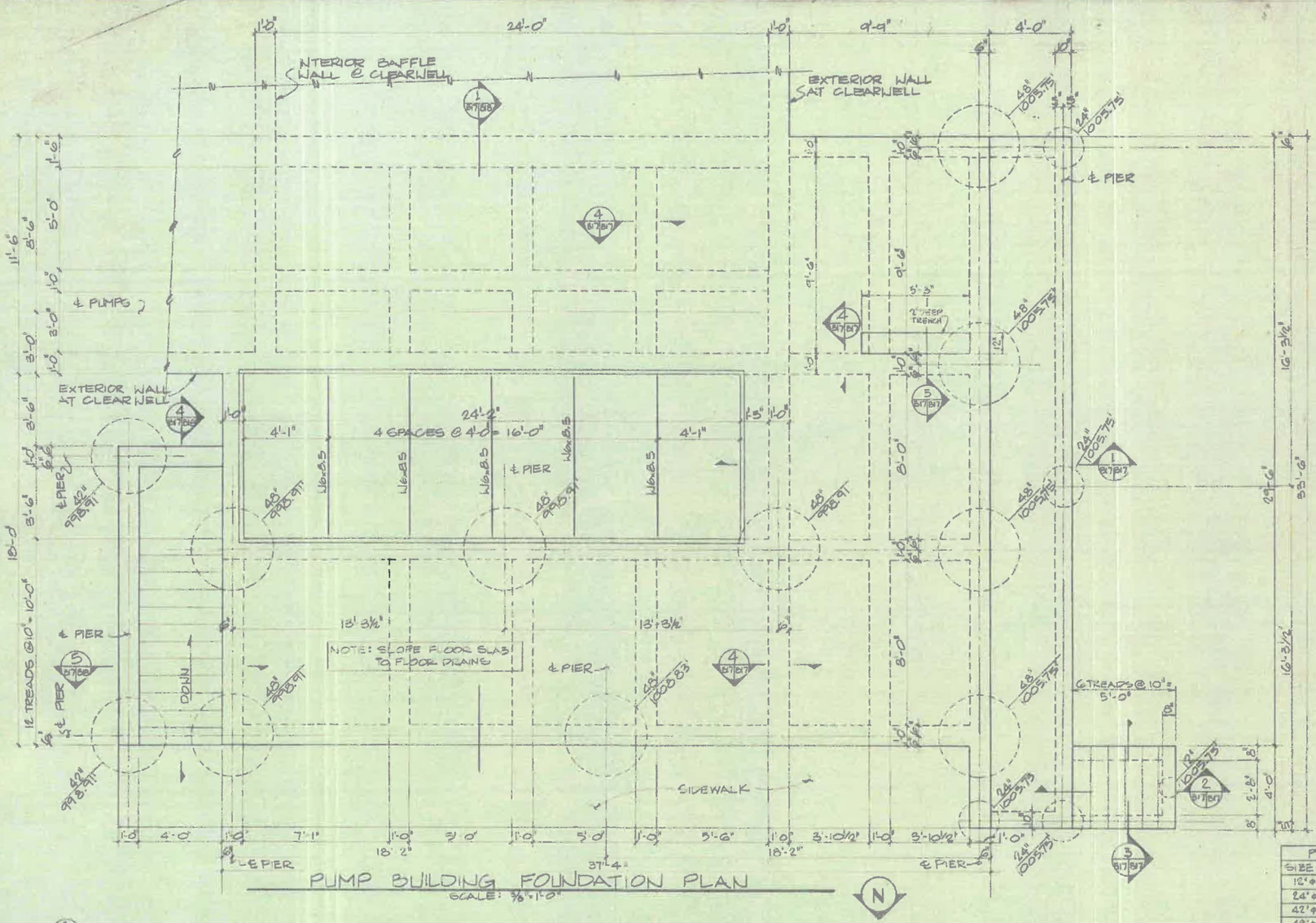
SECTION 5
1½" = 1'-0"

⚠ Jan 9, 1978 Correct Section Designation

DATE 11-30-77	Shawnee, Oklahoma
SCALE AS NOTED	WATER TREATMENT PLANT
DESIGNED BY H.I.A.	CLEARWELL
DRAWN BY L.D.M.	ROOF FRAMING PLAN & DETA
CHECKED BY W.E.A.	
APPROVED BY	
JOB NO. 816	Shelton - Blair & Associates, Inc.

GRAPHIC SCALES
3/4"=1'-0" 0 1 2
3/32"=1'-0" 10 0 10 20

1017 WT 11-14-77

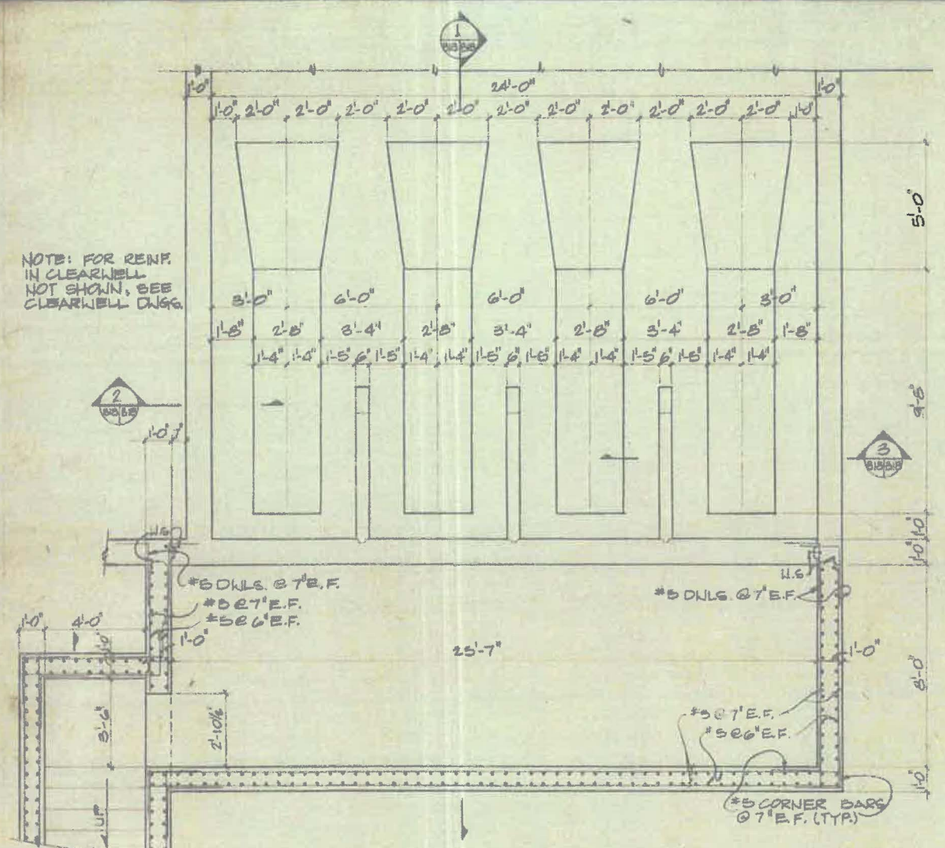


PIER SCHEDULE		
SIZE	REINFORCING	TIES
12"ø	4-#5	#3@12"c/c
24"ø	6-#8	#3@12"c/c
42"ø	14-#9	#3@12"c/c
48"ø	16-#10	#3@12"c/c

12-2-77	Shawnee, Oklahoma WATER TREATMENT PLANT
AS NOTED	
H.I.A.	PUMP BUILDING FOUNDATION PLAN AND DETAILS
J.R.S.	
W.F.A.	
J.M.B.	
B.I.Z.	Burgess - Blair & Associates, Inc.

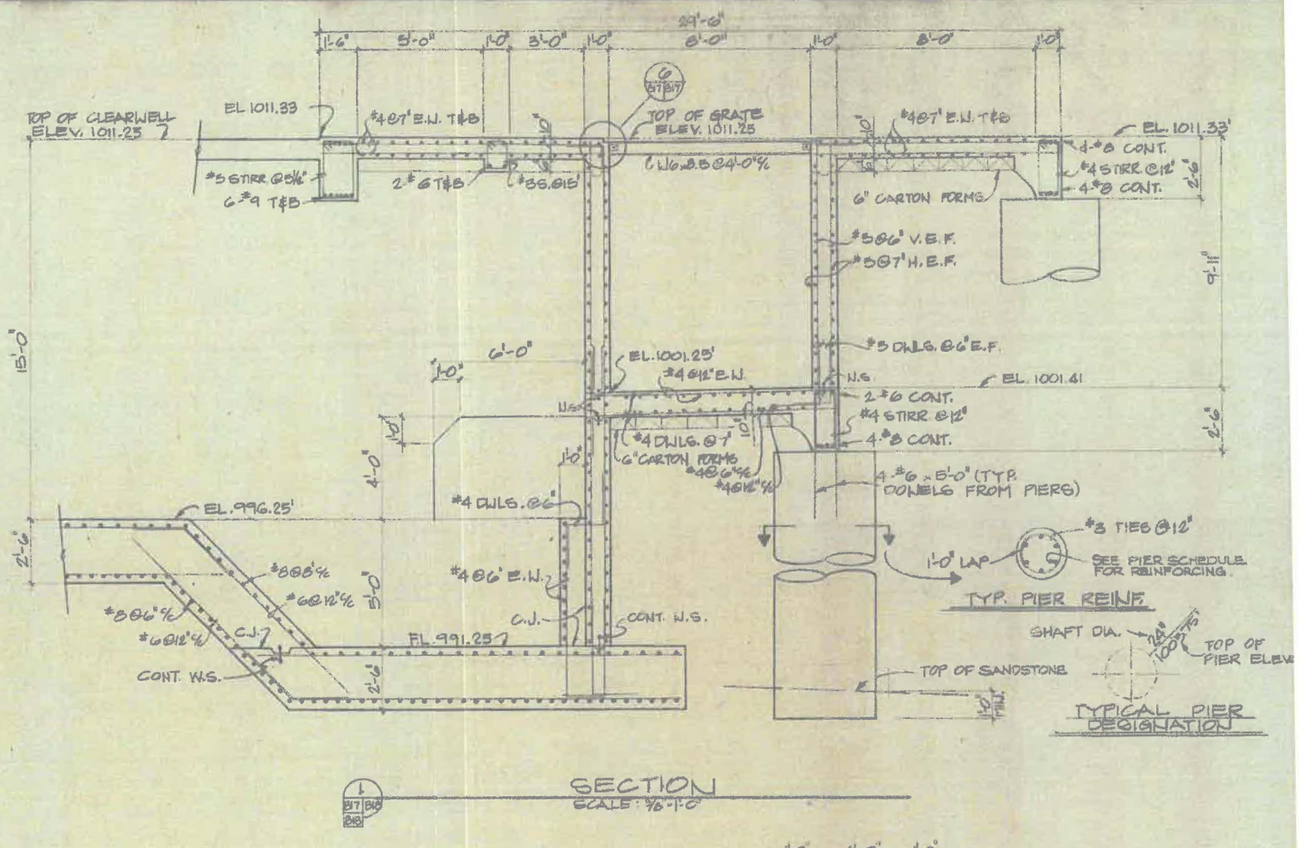
GRAPHIC SCALES

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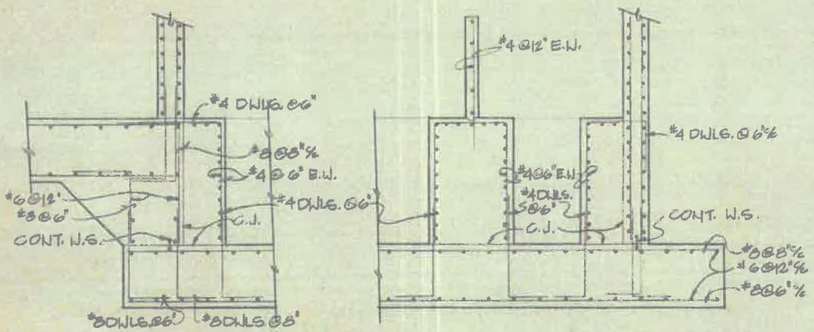


NOTE: SEE SHEET B16 FOR DRILLED PIERS.

PLAN AT LOWER LEVEL & SUMP
SCALE: 3/16"=1'-0"

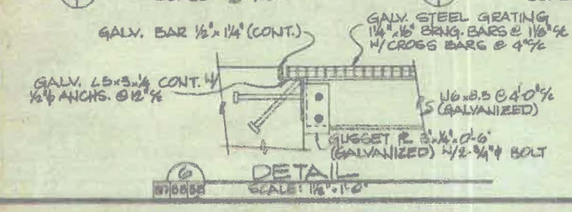


SECTION
SCALE: 3/16"=1'-0"

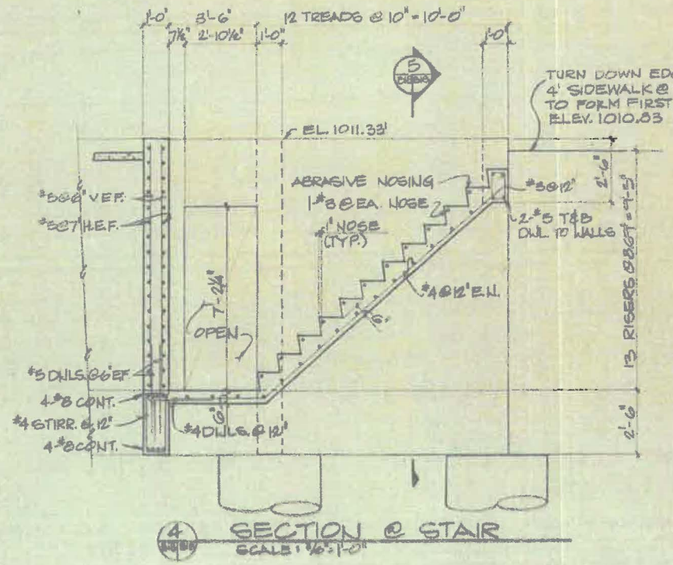


SECTION
SCALE: 3/16"=1'-0"

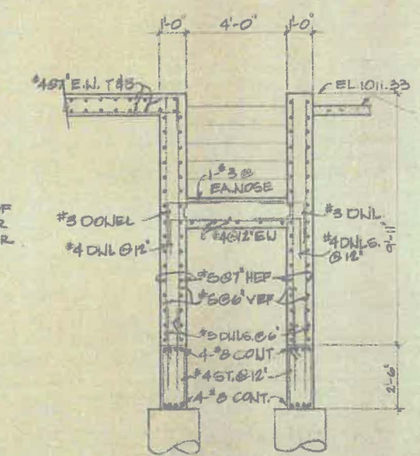
SECTION
SCALE: 3/16"=1'-0"



DETAIL
SCALE: 1 1/2"=1'-0"



SECTION @ STAIR
SCALE: 3/16"=1'-0"

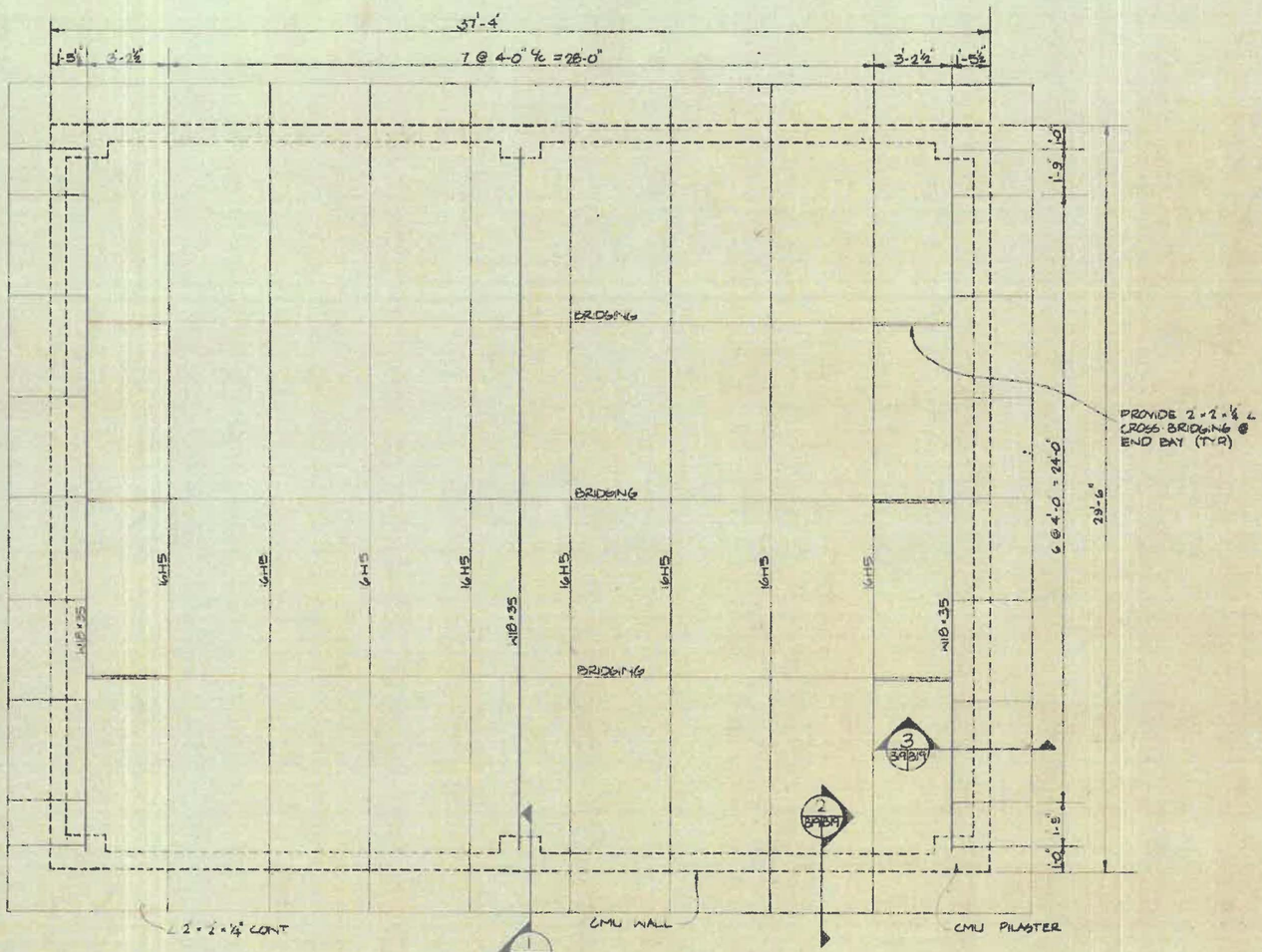


SECTION
SCALE: 3/16"=1'-0"

12-2-77	Shawnee, Oklahoma
AS NOTED	WATER TREATMENT PLANT
H.I.A.	PUMP BUILDING SUMP PLAN AND DETAILS
J.R.S.	
W.E.A.	
J.W.S.	
BIB	

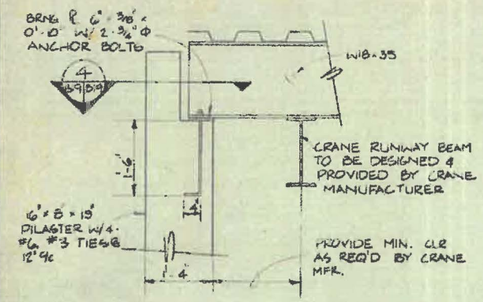
189

1017 W 21st 4-19-77

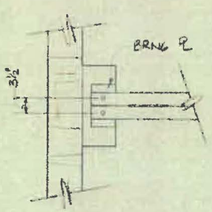


ROOF FRAMING PLAN
SCALE 3/16" = 1'-0"

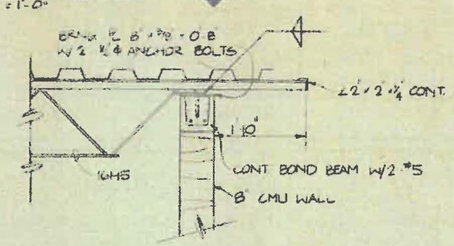
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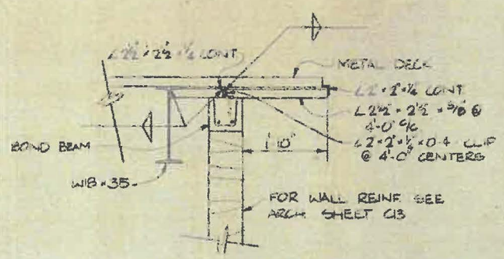
SECTION 1 3/A2/S1
¾" = 1'-0"



SECTION 4 3/A2/S1
¾" = 1'-0"



SECTION 2 3/A2/S1
¾" = 1'-0"



SECTION 3 3/A2/S1
½" = 1'-0"

GRAPHIC SCALES

DATE	12-2-77
SCALE	AS NOTED
DESIGNED	H.I.A.
DRAWN	L.O.M.
CHECKED	W.E.A.
APPROVED	J.M.B.
JOB NO.	819

Shawnee, Oklahoma
WATER TREATMENT PLANT
PUMP BUILDING
ROOF FRAMING PLAN & DETAILS
Burhham - Stair & Affiliates, Inc.

DETAIL 'A'
SCALE: 3/8"=1'-0"

E FOOTINGS @ GRIDS A-A THRU 'A-B'

8" SLAB ~ FOR FIN FLOOR ELEV. SEE CIVIL DWGS (E12)
NOTE: SLOPE FLOOR SLAB TO DRAIN TRENCHES OR FLOOR DRAINS.

SEE DTL 'A' THIS SHEET

6" SLAB ~ FOR FIN FLOOR ELEV. SEE CIVIL DWGS (E12)
NOTE: SLOPE FLOOR SLAB TO DRAIN TRENCHES OR FLOOR DRAINS.

GLAD SLOPE DOWN

CONCRETE SIDEWALK

10½" c½" EXP JT.
4 #4 BARS
GRADE BM
#3 @ 12"

1 SECTION
SCALE: 3/4"=1'-0"

CONC. PAD

6" SLAB ~ FOR FIN FLOOR ELEV. SEE CIVIL DWGS (E12)

½ FTGS @ GRIDS 'A-B' THRU 'D-B'

CONCRETE SIDEWALK

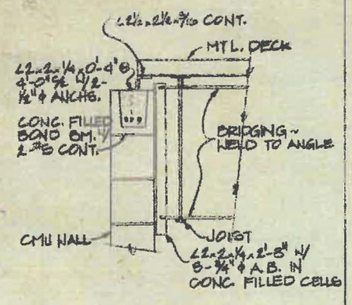
12 #6 = 1'-6" EA CORNER OF COL AS SHOWN

FOUNDATION PLAN
SCALE: 1/4" = 1'-0"

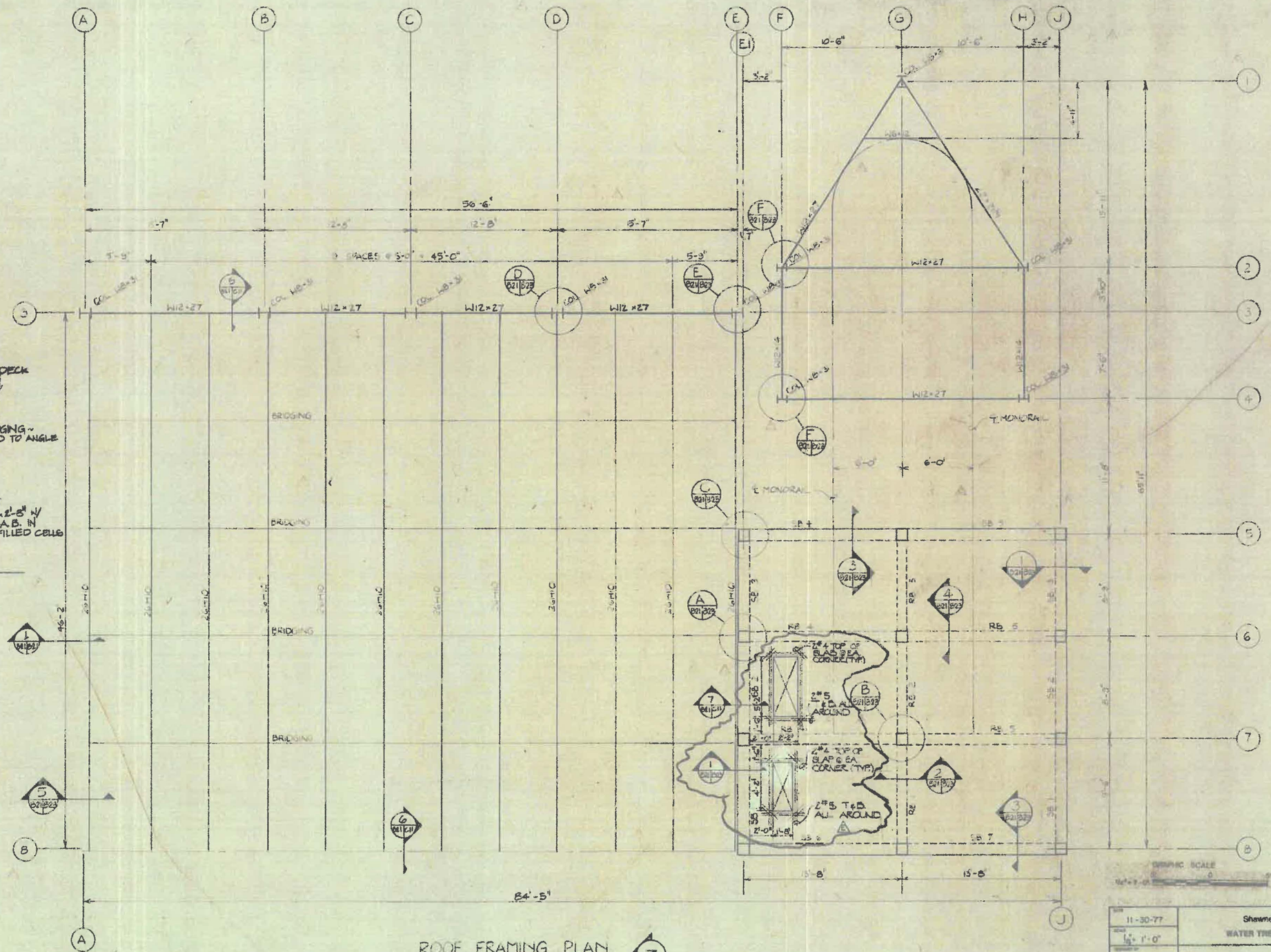
△ Feb. 10, 1978 Change Foundation Issued New Sheet

11-30-77	Shawnee, Oklahoma
1"=1'-0"	WATER TREATMENT PLANT
J.T.B.	CHEMICAL BUILDING FOUNDATION PLAN
L.M.	
W.E.A.	
J.M.B.	
820	

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1 SECTION
SCALE: 1"=1'-0"



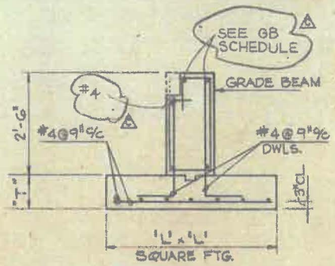
ROOF FRAMING PLAN
SCALE: 1/4" = 1'0"

11-30-77	Shawnee, Oklahoma
1/4" = 1'-0"	WATER TREATMENT PLANT
J T B	CHEMICAL BUILDING
L M	ROOF FRAMING PLAN
W F A	
J M B	Burnham - Blair & Affiliates, Inc.
S21	

⚠ 08-20-78 Openings Added To Roof

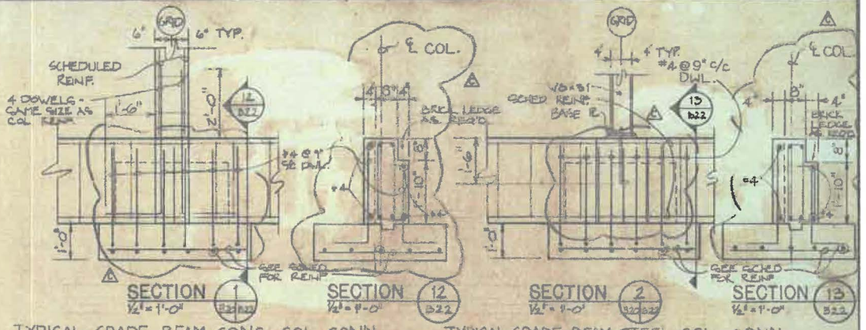
GRADE BEAM SCHEDULE

MARK	b, IN.	h, IN	TOP BARS	BOTT BARS	#3 STIRRUPS	REMARKS
GB1	8/12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	BRICK LEDGE NO REQ'D.
GB2	8/12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	" "
GB3	8/12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	" "
GB4	8/12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	
GB5	8/12	30	2-#5	3-#6	2@6" E.E. BAL @ 12"	
GB6	8/12	30	2-#5	2-#6	2@6" E.E. BAL @ 12"	
GB7	8/12	30	2-#5	2-#6	2@6" E.E. BAL @ 12"	
GB8	8/12	30	2-#5	2-#6	2@6" E.E. BAL @ 12"	
GB9	8/12	30	2-#5	2-#6	2@6" E.E. BAL @ 12"	
GB10	8/12	30	2-#5	2-#6	2@6" E.E. BAL @ 12"	
GB11	8/12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	
GB12	8/12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	
GB13	8/12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	
GB14	12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	SLOPE GB
GB15	12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	SLOPE GB
GB16	8/12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	
GB17	8/12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	
GB18	8/12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	
GB19	8/12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	
GB20	8/12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	
GB21	12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	
GB22	12	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	
GB23	10	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	
GB24	10	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	
GB15-24	18	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	
GB17	18	30	2-#5	2-#5	2@6" E.E. BAL @ 12"	



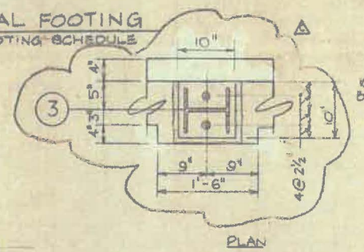
FOOTING SCHEDULE

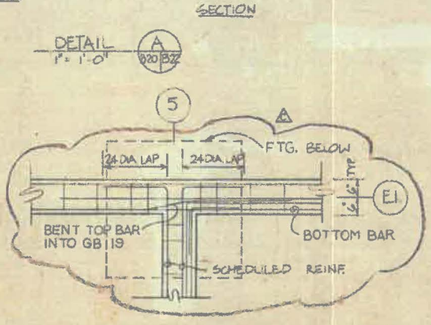
MARK	'L' SQ.	'T'	REINFORCING
F1	2'-0"	1'-0"	#4@9"c/c E.W.
F2	3'-0"	1'-0"	#4@9"c/c E.W.
F3	3'-6"	1'-0"	#4@9"c/c E.W.
F4	4'-0"	1'-0"	#4@9"c/c E.W.
F5	4'-6"	1'-0"	#4@9"c/c E.W.
F6	5'-0"	1'-0"	#4@9"c/c E.W.

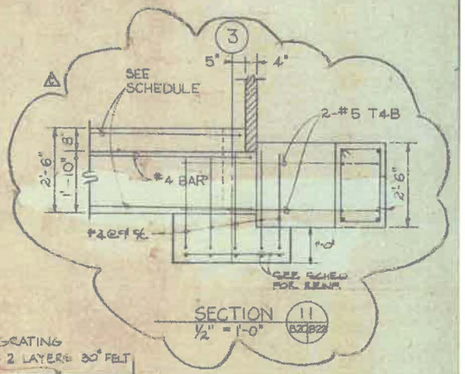


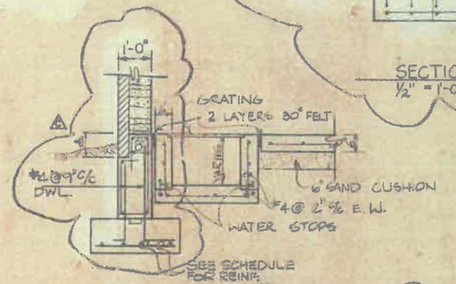
TYPICAL GRADE BEAM-CONC. COL. CONN.

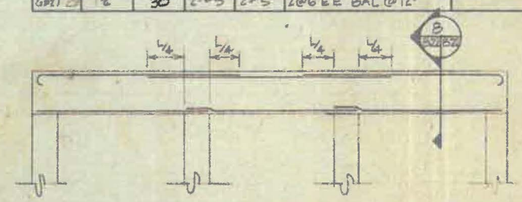
TYPICAL GRADE BEAM-STEEL COL. CONN.





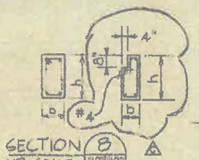


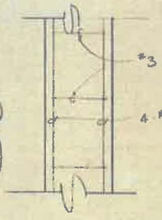




TYPICAL GRADE BEAM REINF. DETAIL

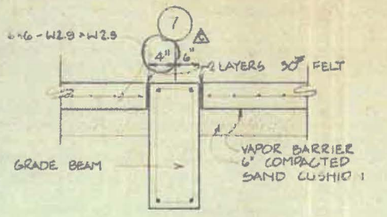
NO SCALE

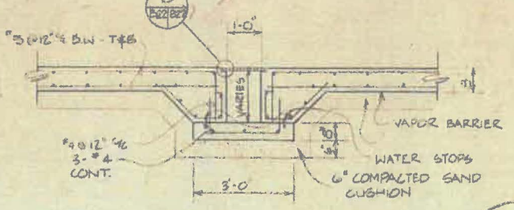


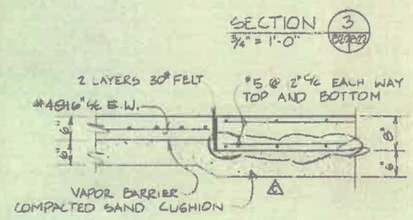


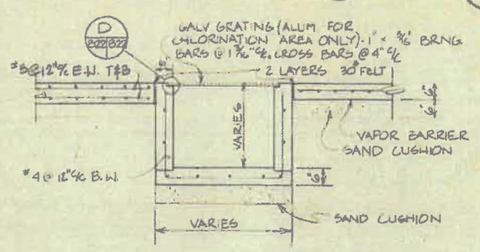
TYPICAL COL. REINF

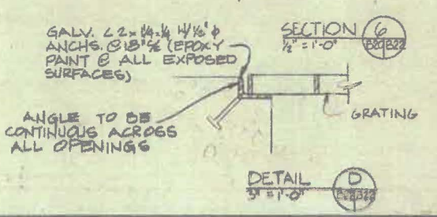
SCALE 1"=1'-0"

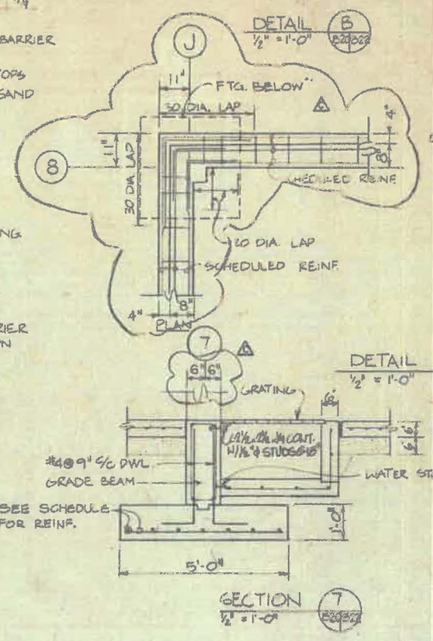


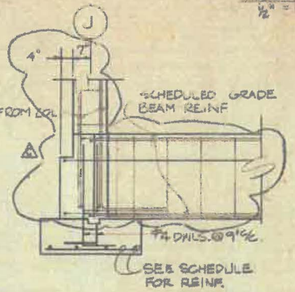


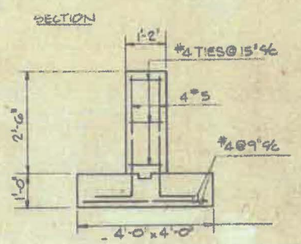




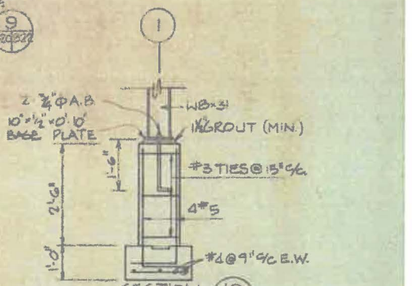








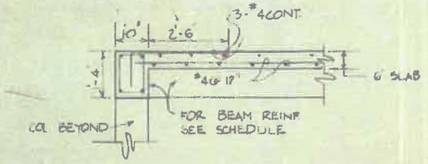
FOOTING AT G6



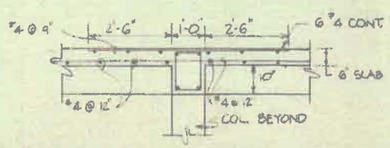
GRAPHIC SCALES

△ Feb. 10, 1978 Change Foundation Details

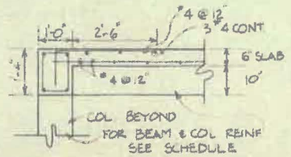
11-30-77	Shawnee, Oklahoma WATER TREATMENT PLANT
AS NOTED	
J.T.S.	CHEMICAL BUILDING SECTIONS & DETAILS
L.M.	
W.E.A.	
J.M.B.	Benham-Blair & Affiliates, Inc.
B22	



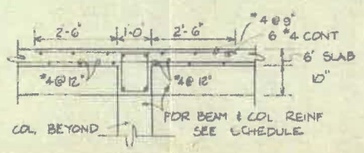
SECTION
SCALE: ½" = 1'-0" (1 B21/B23)



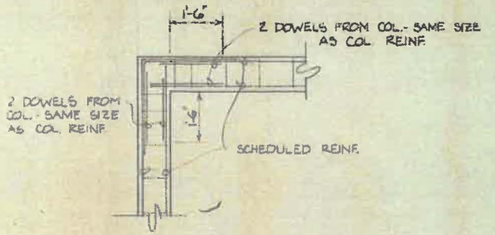
SECTION
SCALE: ½" = 1'-0" (2 B21/B23)



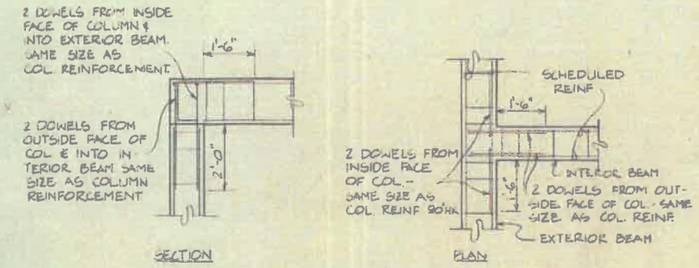
SECTION
SCALE: ½" = 1'-0" (3 B21/B23)



SECTION
SCALE: ½" = 1'-0" (4 B21/B23)

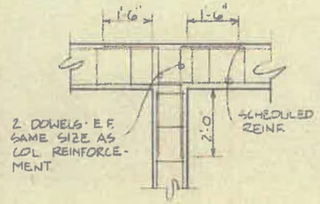


PLAN VIEW - TYPICAL CORNER BEAM TO COLUMN CONNECTION



TYPICAL REINF AT EXTERIOR BEAM TO COL. CONNECTIONS

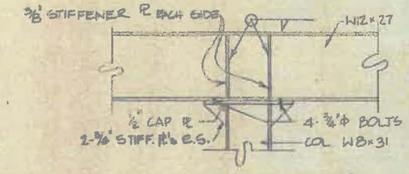
DETAIL
SCALE ½" = 1'-0" (A B21/B23)



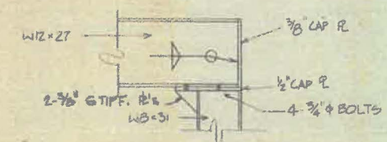
TYPICAL REINF AT INTERIOR BEAM TO COLUMN CONNECTIONS

DETAIL
SCALE ½" = 1'-0" (B B21/B23)

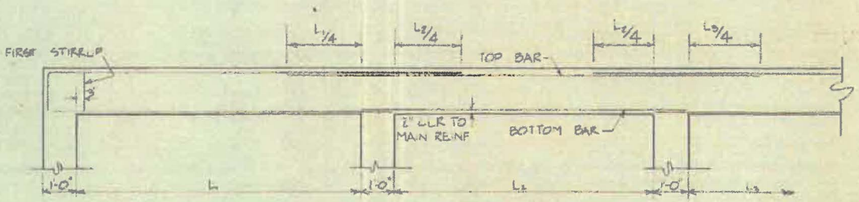
DETAIL
SCALE 1" = 1'-0" (C B21/B23)



DETAIL
SCALE 1" = 1'-0" (D B21/B23)



DETAIL
SCALE 1" = 1'-0" (E B21/B23)

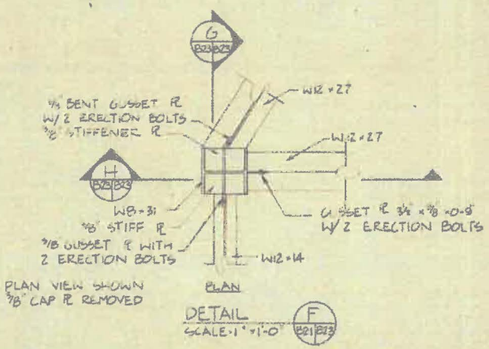


TYPICAL ROOF BEAM REINFORCING DIAGRAM

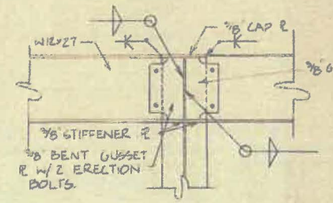
ROOF BEAM SCHEDULE						
MARK	DIMENSIONS b, IN	DIMENSIONS h, IN.	TOP BARS	BOTT. BARS	#3 STIRRUPS	REMARKS
RB1	12	16	2-#5	2-#5	2 @6" E.E. BAL. @ 12"	
RB2	12	16	2-#5	2-#5	2 @6" E.E. BAL @ 12"	
RB3	12	16	2-#5	2-#5	2 @6" E.E. BAL @ 12"	
RB4	12	16	2-#5	2-#6	2 @6" E.E. BAL @ 12"	
RB5	12	16	2-#5	2-#6	2 @6" E.E. BAL @ 12"	
SB1	12	16	2-#5	2-#5	2 @6" E.E. BAL @ 12"	
SB2	12	16	2-#5	2-#5	2 @6" E.E. BAL @ 12"	
SB3	12	16	2-#5	2-#5	2 @6" E.E. BAL @ 12"	
SB4	12	16	2-#5	2-#6	2 @6" E.E. BAL @ 12"	
SB5	12	16	2-#5	2-#6	2 @6" E.E. BAL @ 12"	
SB6	12	16	2-#5	2-#5	2 @6" E.E. BAL @ 12"	
SB7	12	16	2-#5	2-#5	2 @6" E.E. BAL @ 12"	



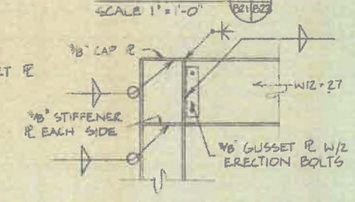
TYPICAL SECTION AT ROOF BEAM
NO SCALE



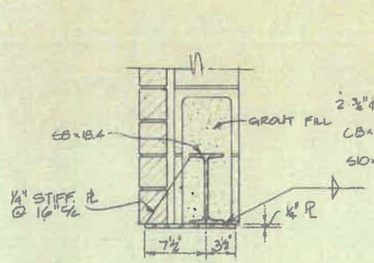
DETAIL
SCALE 1" = 1'-0" (F B21/B23)



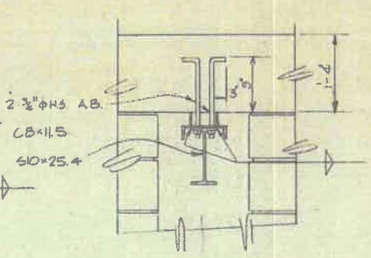
SECTION
SCALE 1" = 1'-0" (G B23/B25)



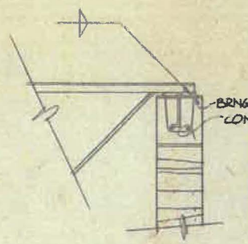
SECTION
SCALE 1" = 1'-0" (H B23/B25)



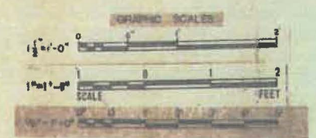
LINTEL TO SUPPORT WALL OVER VENT. OPNG.
SECTION
1½" = 1'-0" (S B21/B23)



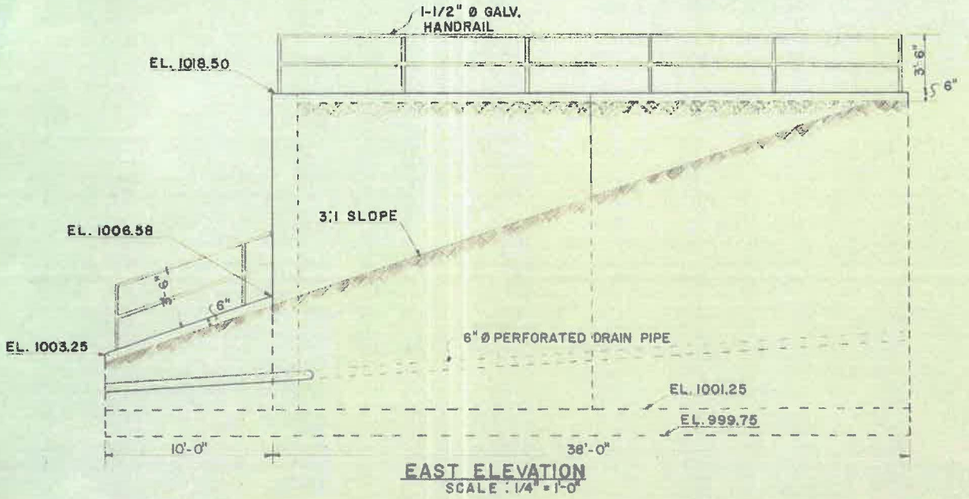
TYP. MONORAIL @ GRID (7)
SCALE 1" = 1'-0"



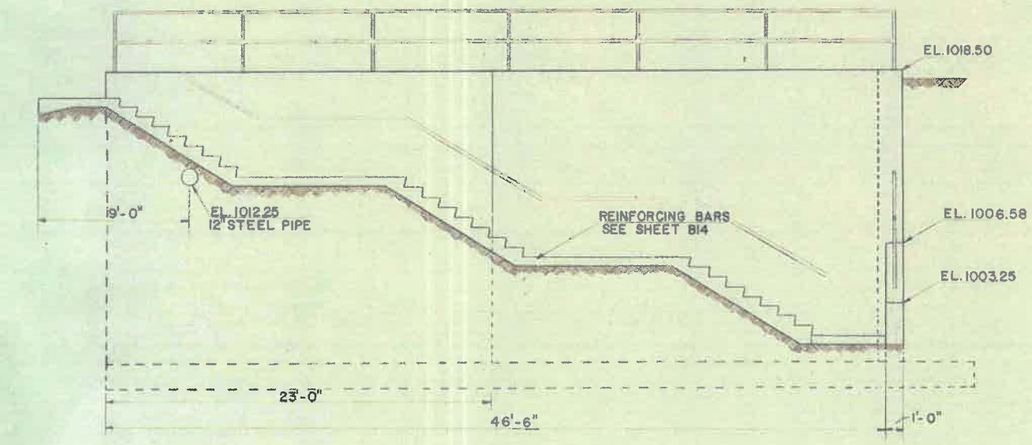
TYP. JOIST BEARING DETAIL
SCALE 1" = 1'-0"



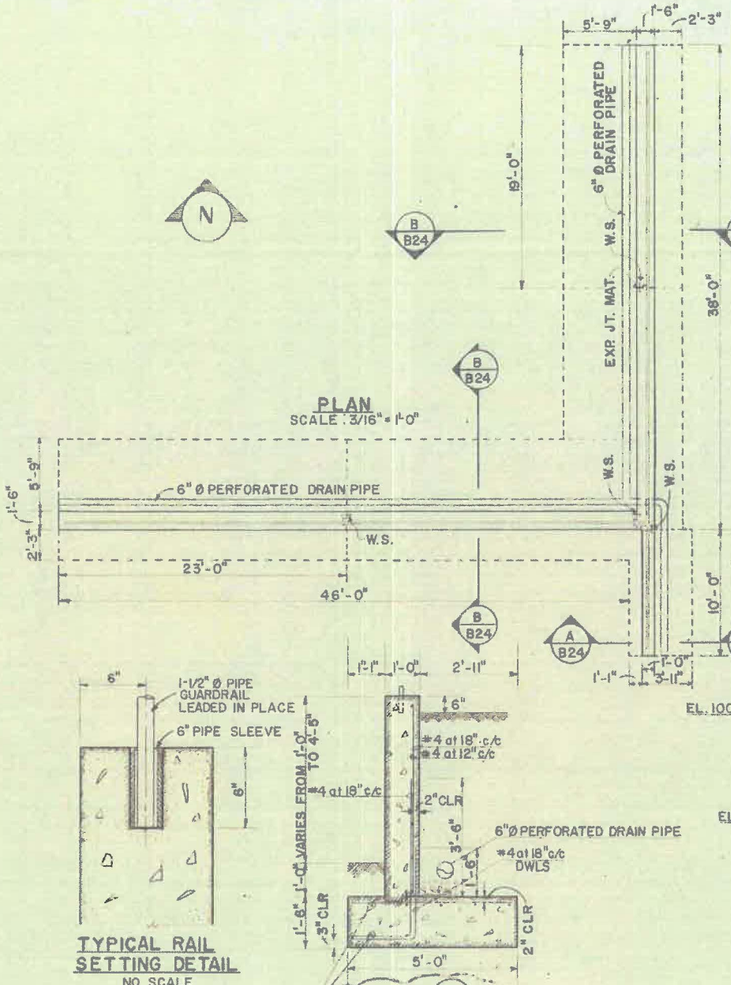
11-30-77	Shawnee, Oklahoma
AS NOTED	WATER TREATMENT PLANT
J.T.B.	CHEMICAL BUILDING SECTIONS & DETAILS
L.M.	
W.E.A.	
J.M.B.	Burns · Blair & Affiliates, Inc.
B23	



EAST ELEVATION
SCALE : 1/4" = 1'-0"



SOUTH ELEVATION
SCALE : 1/4" = 1'-0"



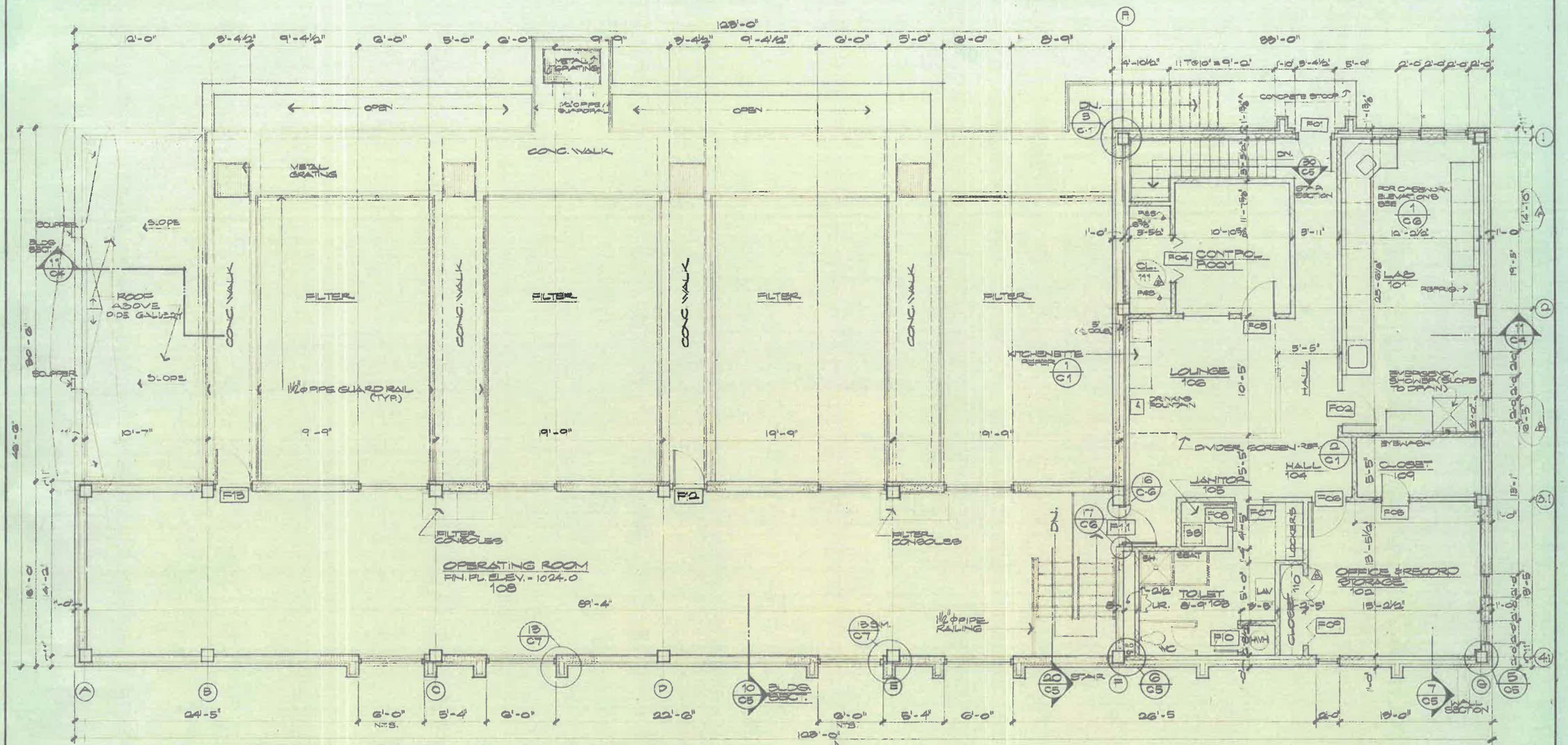
GRAPHIC SCALES
12" 0 1' 2' 3' 4'
1/2" = 1'-0"
GRAPHIC SCALES
5' 0
1/4" = 1'-0"

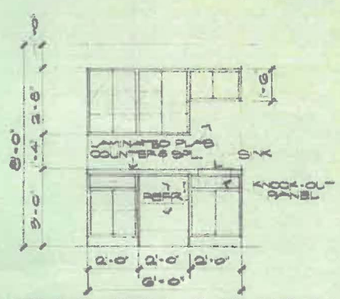
Jan. 12, 1978 Change Section Number

DATE 11-30-77	Shawnee, Oklahoma
SCALE AS NOTED	WATER TREATMENT PLANT
DESIGNED BY JTB	RETAINING WALL DETAILS
DRAWN BY GSR	
CHECKED BY WEA	
APPROVED BY JMB	Benham - Blair & Affiliates, Inc.
SHEET B24	

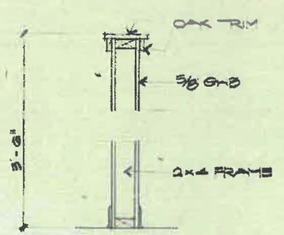
UPPER LEVELS FLOOR PLAN

SCALE: 1/4"=1'-0"

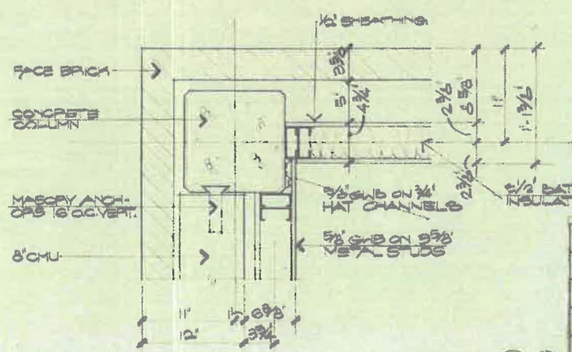




1/C1 KITCHENETTE ELEVATION
SCALE: 3/8"=1'-0"



2/C1 DIVIDER SCREEN DET'L.
SCALE: 1"=1'-0"



5/C1 DETAIL @ CONCRETE COLUMN GRID (1) (F)
SCALE: 1½"=1'-0"

△ ALIG. 05-75/ DIM. CORRECTED

Graphic Scales

1/4" = 1'-0"
3/8" = 1'-0"
1" = 1'-0"
1-1/2" = 1'-0"

DATE 11-30-77	Shawnee, Oklahoma
SCALE AS NOTED	WATER TREATMENT PLANT
DESIGNED BY J.A.B.	FILTER BUILDING UPPER LEVELS FLOOR PLAN
DRAWN BY S.K.B.	
CHECKED BY J.M.B.	
APPROVED BY E.M.F.	
SHEET C1	Burnham - Blair & Affiliates, Inc.

1017 WT 6-21-78

EXHAUST FAN SEE MECH.

PIPE GALLERY B10

MAINTENANCE & STORAGE AREA B09

STORAGE

1 LAYER 5/8" GYP BOARD EACH SIDE OF 3 5/8" MTL STUDS (FULL HT.)

3/8 GYP BOARD (ONE SIDE) ON 3 5/8" MTL STUDS (FULL HT.)

GYP BOARD ON 3 5/8" VERT. STUDS

GYP BOARD ON 3 5/8" SPRING CLIP SYSTEM TO TOP OF STRINGER

STRINGER

CONCRETE STRUCTURE

F14 F15 F16 F17

BLDG. SECTION

LOUVERS

1 BASEMENT PL.
SCALE: 1/4"=1'-0"

2 JAMB DETAIL (HEAD SIM.)
SCALE: 3"=1'-0"

BRICK

8" CMU

LOUVERS

SCREEN

ROOF PLAN-1

ROOF ABOVE PIPE GALLERY

ROOF ABOVE OPERATING FLR.

ROOF ABOVE OPERATING FLR.

OVERFLOW SCUPPER

CONC. PARAPET

PRECAST CONC. PARAPET COPING

OPEN

OPENING

OVERFLOW SCUPPER

OVERFLOW SCUPPER

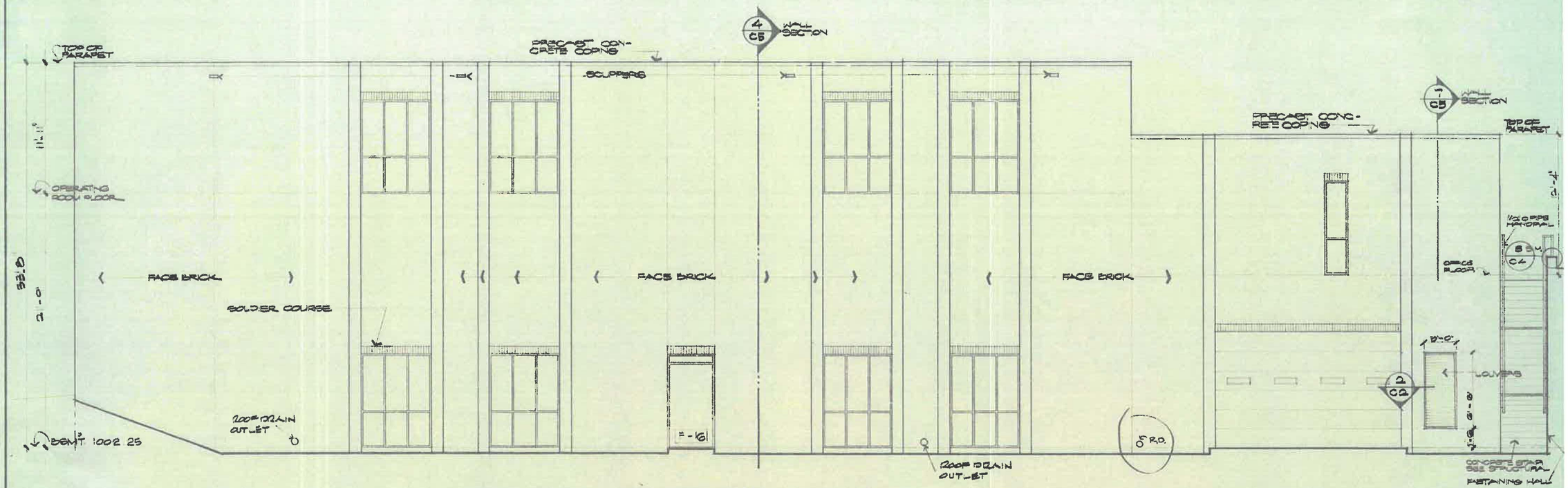
PRECAST CONC. (PARAPET COPING)

Jan 10, 1978 Show Door Reference Number
Aug.-08-78 DOOR NO. ROOF PL. NOTES

Graphic Scale
1/4" = 1'-0"
1" = 1'-0"

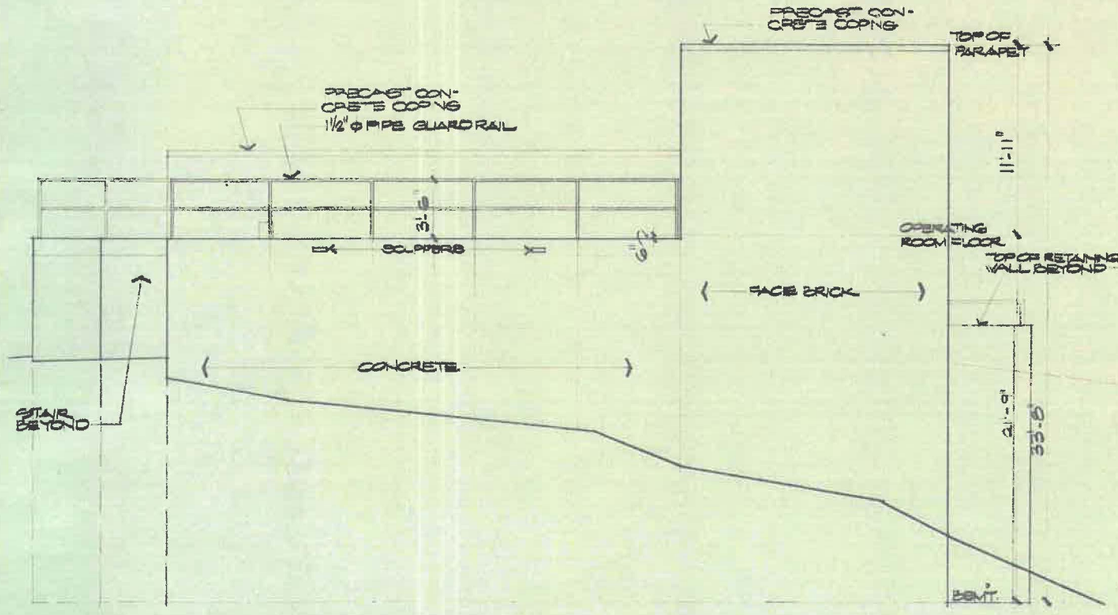
11 30-77	Shawnee Oklahoma
1/4"=1'-0"	WATER TREATMENT PLANT
J.A.B.	FILTER BUILDING BASEMENT PLAN
S.K.B.	
J.M.B.	
E.M.F.	Benham - Blair & Affiliates, Inc.
C2	

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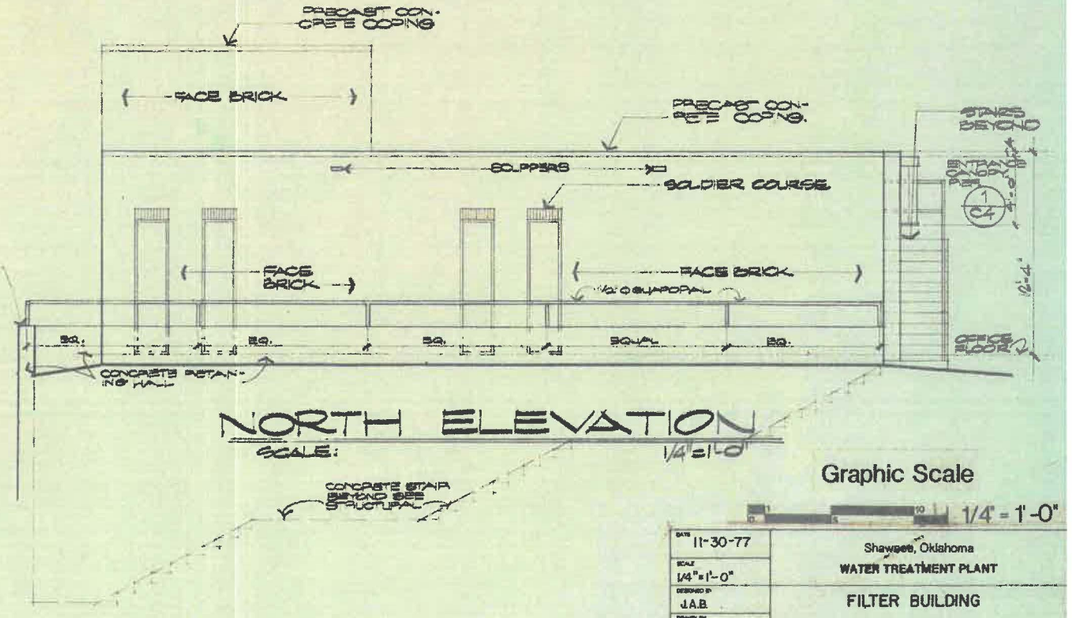
EAST ELEVATION

SCALE: 1/4"=1'-0"



SOUTH ELEVATION

SCALE: 1/4"=1'-0"



NORTH ELEVATION

SCALE: 1/4"=1'-0"

Graphic Scale

1/4" = 1'-0"

DATE 11-30-77	Shawnee, Oklahoma
SCALE 1/4"=1'-0"	WATER TREATMENT PLANT
DESIGNED BY J.A.B.	FILTER BUILDING ELEVATIONS
DRAWN BY J.A.B.-S.K.B.	
CHECKED BY J.M.B.	
APPROVED BY E.M.F.	
SHEET C3	Benham - Blair & Affiliates, Inc.

SHAWNEE WATER TREATMENT PLANT.

WEST ELEVATION

SCALE: 1/4"=1'-0"

CONCRETE COPING

2" METAL STRIP - SEE SPECS FOR STYLE AND ATTACHMENT

TOP OF PARAPET

SOLDER COURSE

FACE BRICK

1½" ø PIPE GUARD RAIL

OPERATING ROOM FLOOR

TOP OF PARAPET

CONCRETE COPING

SOLDER COURSE

FACE BRICK

CONCRETE

SPLASH BLOCK

5'-0"

EXPLOSION

11 C4 SECTON

SCALE: 1/4"=1'-0"

CAP FLASHING

ANODIZED ALUMINUM FASCIA W/STAND. SEAM @ 4" O.C.

SLOPE TO ROOF DRAIN

30# FELT (1 LAYER)

¾" EXTERIOR GRADE PLYWD.

2x4 WOOD FRAME

3/8"x1½" ANGLE FRAME

BRICK PILASTER (BEYOND)

4 C4 CANOPY SECTION

SCALE: 1/2"=1'-0"

½" EXT. GRADE PLYWOOD

SLOPE TO R.D.

ANODIZED ALUMINUM FASCIA W/STAND SM.

¾" PLYWOOD

3/8"x1½" ANGLE FRAME

4 C4 SECTION THRU ENTRY CANOPY

SCALE: 1/2"=1'-0"

ALUM. MULLIONS (COL.)

½" EXT. GRADE PLYWOOD SOFFIT

4 C4 PARAPET-SCUPPER DETAIL

SCALE: 1"=1'-0"

TOP OF PARAPET (BEYOND)

TOP OF CANOPY

CONTINUOUS SUPERIOR TYPE B-CUSHION REGLET.

¾" CHAMFER

SCUPPER (BEYOND) SEE ELEVATIONS FOR LOCATIONS

BUILT-UP ROOF

CONCRETE STRUCTURE

1½ RIGID INSULATION

SLOPE

3 C4 HANDRAIL @ CONCRETE DETAIL

SCALE: 1"=1'-0"

½" Ø PIPE GUARD RAIL WELDED TO PLATE.

6"x6"x⅜" STEEL PLATE W/ ½" ø ANCHORS

CONCRETE COL. BEYOND

SLOPE TO R.D.

5/8 GYP. BD. ON 5/8" FURRING

ACST. C.4.

EL. 1007.0

EL. 1002.25

EL. 1000.50

EL. 1025.50

MAINTENANCE FLOOR

△ XLG-08-78 / CANOPY DET'L COMPLETIONS & SECTION

Graphic Scales

1/4" = 1'-0"

1" = 1'-0"

1-1/2" = 1'-0"

DATE: 11-30-77	Shawnee Oklahoma
SCALE: 1/4"=1'-0"	WATER TREATMENT PLANT
DESIGNED BY: J.A.B.	FILTER BUILDING
DRAWN BY: S.K.B.	SOUTH ELEVATION & SECTIONS
CHECKED BY: J.M.B.	
APPROVED BY: E.M.F.	Benham · Blair & Affiliates, Inc.
SHEET: C4	

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1017 WT Issued 12/77

CONCRETE COPING
FACE BACK (BEYOND)
SLOPES TO ROOF DRAIN
SCUPPER
EL. 1024.0
EL. 017.0
EL. 009.50
EL. 002.25
99'-8"
11'-11"
7'-0"
7'-8"
1'-3"
(10) C5 BUILDING SECTION SCALE: 1/4" = 1'-0"

3 EQUAL TREADS @ 1'-6" = 4'-6"
8" CONCRETE FILLED PAN (TYPICAL)
C 12 STRINGER
2x2x1/4 ST. TUBING
(1) C5
(2) C5
(2) C5 METAL STAIR SECTION SCALE: 1/2" = 1'-0"

11 TREADS @ 10" = 9'-2"
8" CONCRETE FILLED PAN
C 12 STRINGER
12 EQUAL RISERS @ 7-4 1/2"
OFFICE FLR.
LANDING FLR.
(40) C5
(2) C5
(30) C1 STAIR SECTION (OFFICE-LANDING) SCALE: 1/2" = 1'-0"

CONCRETE SLAB ON DECK W/ ST. FRAMING
2x2x1/4
SEE STR.
2x2x1/4 ST. FRAMING
C 12 STRINGER (BEYOND)
(1) C5 METAL STAIR DETAIL SCALE: 1/2" = 1'-0"

3/4" O PIPE GUARD RAIL WELDED TO STRINGER (TYP.)
CONCRETE ON DECK W/ 2x2x1/4 ST. FRAMING
3/4" O SELF ANCHORED @ 4'-0"
C 12 STRINGER BEYOND
L4 2x2x1/4
(2) C5 STAIR LANDING DETAIL SCALE: 1/2" = 1'-0"

"X" TOP OF PARAPET
FACE BRICK & NOM. CMU
CONCRETE STRUCTURE
(3) C5 BRICK TERMINATION SCALE: 1" = 1'-0"

PRECAST CONCRETE COPING
CONCRETE DECK (BEYOND)
FACE BRICK
5/8" GWB ON 3/5" METAL STUDS @ 16" O.C.
3/4" BATT INSUL.
CONCRETE STRUCTURAL SLAB
CONCRETE COLUMN (BEYOND)
1/2" EXPANSION JOINT
(7) C3 WALL SECTION SCALE: 1" = 1'-0"

BUILT-UP ROOF ON 1/2" RIGID INSULATION
PRECAST CONCRETE COPING
FIBERGLASS
SCUPPER (BEYOND) SEE ELEVATION FOR LOCATION
FACE BRICK
8" CMU W/ BOND BEAMS 4'-0" OC VERTICALLY (MAX)
8" CONCRETE STRUCTURAL SLAB
CONCRETE COLUMN (BEYOND)
1/2" EXPANSION JOINT
(4) C3 MASONRY WALL SECTION SCALE: 1" = 1'-0"

11 TREADS @ 10" = 9'-2"
LANDING FLR.
8" CONCRETE FILLED PAN
C 12 STRINGER
12 RISERS @ 7-4 1/2"
MAINT. FLR.
(40) C5 STAIR SECTION (LAND.-MAINTENANCE) SCALE: 1/2" = 1'-0"

11"
5/8" GWB ON 3/5" METAL STUDS
3/4" BATT INSUL.
5/8" GWB ON 7/8" FURRING CHAN.
12" (TYP.)
1/2" SHEATHING
FACE BRICK
(5) C5 COLUMN @ GWB WALL PLAN DTL SCALES: 1/2" = 1'-0"

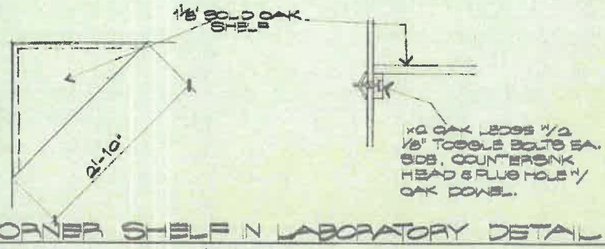
8" CMU
HORIZ. MASONRY REINFORCEMENT 16" OC.
5/8" GWB ON 3/5" METAL STUDS
3/4" BATT INSUL.
12"
FACE BRICK
1/2" SHEATHING
(6) C5 CMU @ GWB PLAN DETAIL SCALES: 1/2" = 1'-0"

Graphic Scales
1/4" = 1'-0"
1/2" = 1'-0"
1" = 1'-0"
1-1/2" = 1'-0"

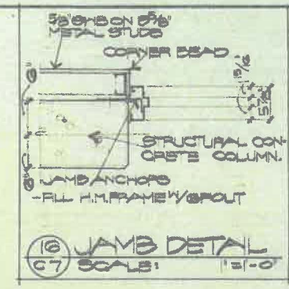
A ALG-06-78/PARAPET HT. CORRECTED

DATE 11-30-77	Shawnee, Oklahoma
SCALE AS NOTED	WATER TREATMENT PLANT
DESIGNED BY S.K.B.	FILTER-BUILDING
DRAWN BY S.K.B.	SECTIONS & DETAILS
CHECKED BY J.M.B.	
APPROVED BY E.M.F	Bonham-Blair & Affiliates, Inc.
SHEET C5	

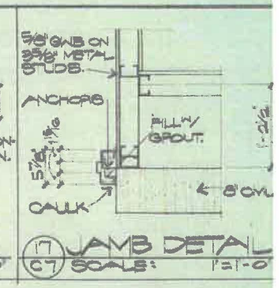
18



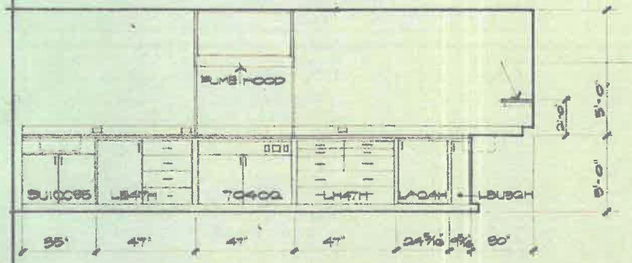
(2/C8) CORNER SHELF LABORATORY DETAIL
SCALE: 1" = 1'-0"



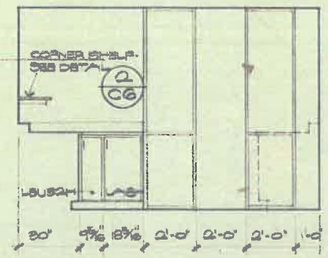
(6/C7) JAMB DETAIL
SCALE: 1"=1'-0"



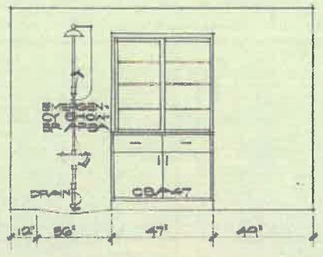
(7/C7) JAMB DETAIL
SCALE: 1"=1'-0"



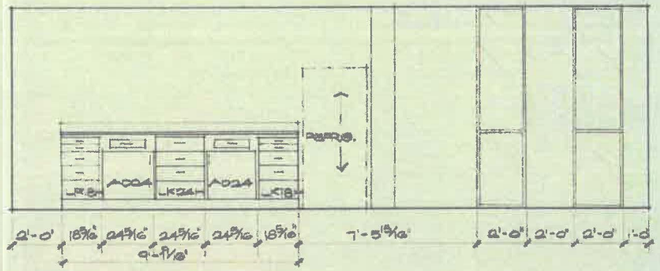
EAST ELEVATION



SOUTH ELEVATION



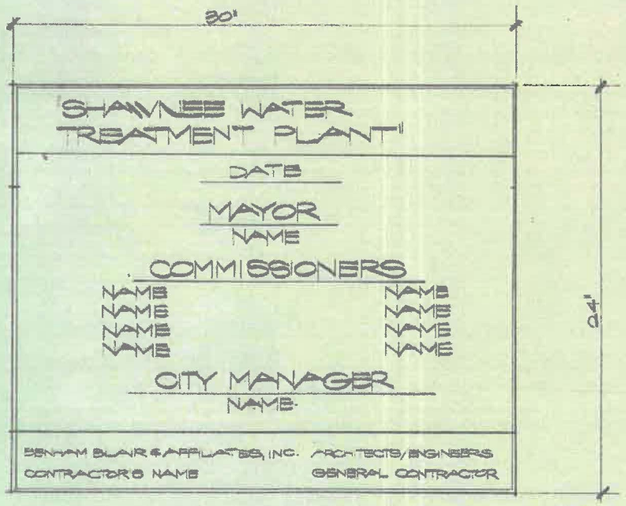
NORTH ELEVATION



WEST ELEVATION

(1/C8) LABORATORY EQUIPMENT ELEVATIONS
SCALE: 3/8"=1'-0"

NOTE: ALL CASEWORK NUMBERS REFER TO PRODUCTS OF LISTED EQUIP. MFR'S A DIVISION OF UNITED INDUST. MFR'S WICHITA, KANSAS FOR ITS AND STANDARD OF QUALITY.



(P/C8) PLAQUE ELEVATION
SCALE: 3"=1'-0"

ROOM FINISH SCHEDULE

BLDG. NAME	ROOM NO.	ROOM NAME	FLOOR	BASE	WALLS NORTH	WALLS EAST	WALLS SOUTH	WALLS WEST	CLG.	CLG. HT.	REMARKS
FILTER	101	LABORATORY	VAT	RBS.	GWB	GWB	GWB	GWB	ACST	8'-0"	
	102	OFFICE	CRPT.	RBS.	GWB	GWB	GWB	GWB	ACST	8'-0"	
	103	TOILET	C.T.	C.T.	GWB	GWB	GWB	GWB	GWB	8'-0"	1,2 Δ
	104	HALL	VAT	RBS	GWB	GWB	SCRN.	GWB	ACST	7'-2"	FUR
	05	JANITOR CLOS.	C.T.	C.T.	GWB	GWB	GWB	GWB	GWB	7'-2"	1,2
	106	LOUNGE	CRPT.	RBS	SCRN	GWB	GWB	SCRN	ACST	8'-0"	
	107	CONTROL RM	CRPT.	RBS.	GWB	GWB	GWB	GWB	ACST	8'-0"	
	108	OPERAT. RM	CONC.	-	CMU	CMU	CMU	CMU	EXP	-	
	B09	MAINTEN/STOR	CONC.	-	CMU	CONC.	GWB	CONC	EXP	-	
	B10	PIPE GALLERY	CONC.	-	CMU	CONC	CONC.	-	EXP	-	
	109	CLOSET	CRPT.	RBS.	GWB	GWB	GWB	GWB	ACST.	7'-2"	
Δ	110 +/111	CLOSET	CRPT	RBS	GWB	GWB	GWB	GWB	ACST	7'2"	
CHEMICAL	201	TANK STOR.	CONC	-	CMU	CMU	CMU	CMU	EXP	-	
	202	STORAGE	CONC	-	CMU	CMU	CMU	CMU	EXP	-	
	203	OPERATIONS	CONC	-	CMU	CMU	CMU	CMU	EXP	-	
	204	TOILET	CER TILE		CMU	CMU	CMU	CMU	GWB	8'-0"	
PUMP	301	PUMP ROOM	CONC	-	CMU	CMU	CMU	CMU	EXP	-	
	302	LOWER LEV.	CONC	-	CONC	CONC.	CONC	CONC.	METAL GRATE	-	

ROOM FINISH NOTE:
1. 4'-0" HIGH CERAMIC TILE (CT) WAINSCOT w/ WATER-PROOF GYPSUM BOARD ABOVE.
2. WATER PROOF GYPSUM BOARD ON CEILING.

Δ AUG 5-08-78 COMPLETING OF RM. FINISH SCHED.

Graphic Scales
3/8" = 1'-0"
1" = 1'-0"
3" = 1'-0"

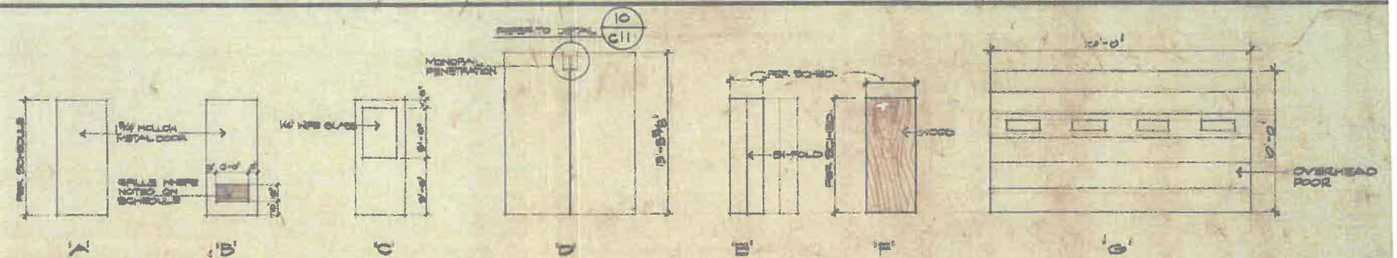
DATE 11-30-77	Shawnee, Oklahoma
SCALE AS NOTED	WATER TREATMENT PLANT
DESIGNED BY S.K.B.	CASEWORK ELEVATIONS & ROOM FINISH SCHEDULE
DRAWN BY S.K.B.	
CHECKED BY J.M.B.	
APPROVED BY E.M.F	Benham - Blair & Affiliates, Inc.
SHEET C6	

444 ENTERED

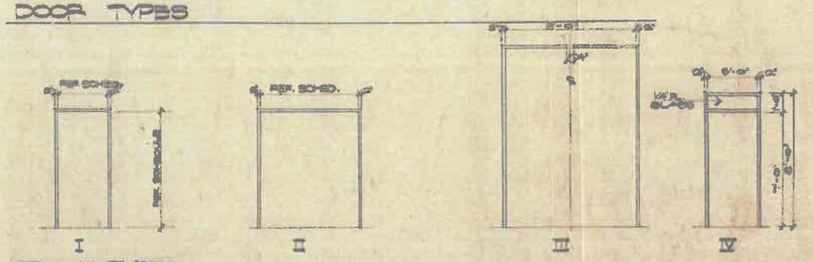
189

DOOR SCHEDULE

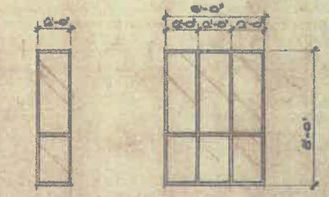
NUMBER	SIZE	FRM.	SALLS	TYPE	HARDWARE	HEAD	JAMB	SILL	REMARKS
CHEMICAL BUILDING									
C01	3'-0"x7'-0"	I	-	C	2	1	2	3	
C02	3'-0"x7'-0"	I	-	C	2	1	2	3	
C03	PR. 4'-0"x13'-5½"	III	-	D	1	4	2	3	
C04	PR. 4'-0"x13'-5½"	III	-	D	1	4	2	3	
C05	3'-0"x7'-0"	I	-	C	2	1	2	3	
C06	PR. 3'-0"x7'-0"	II	-	C	3	1	2	3	
C07	3'-0"x7'-0"	I	-	A	4	6	5	-	
C08	3'-0"x7'-0"	I	-	C	2	1	2	3	
FILTER BUILDING									
F01	3'-0"x7'-0"	IV	-	C	2	8	7SIM.	3	
F02	3'-0"x7'-0"	I	22-24	B	6	10	9	-	
F03	3'-0"x7'-0"	I	18x12	B	6	10	9	-	
F04	PR. 2'-0"x7'-0"	II	-	E	7	10SIM	9SIM	-	
F05	3'-0"x7'-0"	I	-	E	4	10	9	-	
F06	3'-0"x7'-0"	I	18x12	B	6	10SIM	9SIM	-	
F07	2'-8"x7'-0"	I	-	E	4	10	9	-	UNDERCUT 1"
F08	2'-8"x7'-0"	I	-	E	6	10	9SIM.	-	UNDERCUT 1"
F09	PR 3'-0"x7'-0"	II	-	E	7	10SIM	9SIM	-	
F10	2'-8"x7'-0"	I	-	E	6	10	9SIM.	-	
F11	3'-0"x7'-0"	I	-	C	5	8SIM	5/17/87 7SIM.	3	
F12	3'-0"x7'-0"	IV	-	C	2	8	7SIM.	3	
F13	3'-0"x7'-0"	III	-	C	2	8	15.2	3	
F14	PR 2'-8"x7'-0"	II	-	A	3	10	9	-	
F15	2'-8"x7'-0"	I	-	A	5	10	9	3SIM.	
F16	3'-0"x7'-0"	IV	-	A	2	8SIM	2	3	
F17	12'-0"x10'-0"	-	-	G	9	12	11	-	
F18	PR 2'-8"x7'-0"	II	-	A	3	10	9	-	
PUMP BUILDING									
P01	2'-8"x7'-0"	I	-	A	2	8SIM	5SIM	3	
P02	3'-0"x7'-0"	I	-	A	2	↓	↓	3	
P03	PR-3'-0"x7'-0"	II	-	A	3	↓	↓	3	



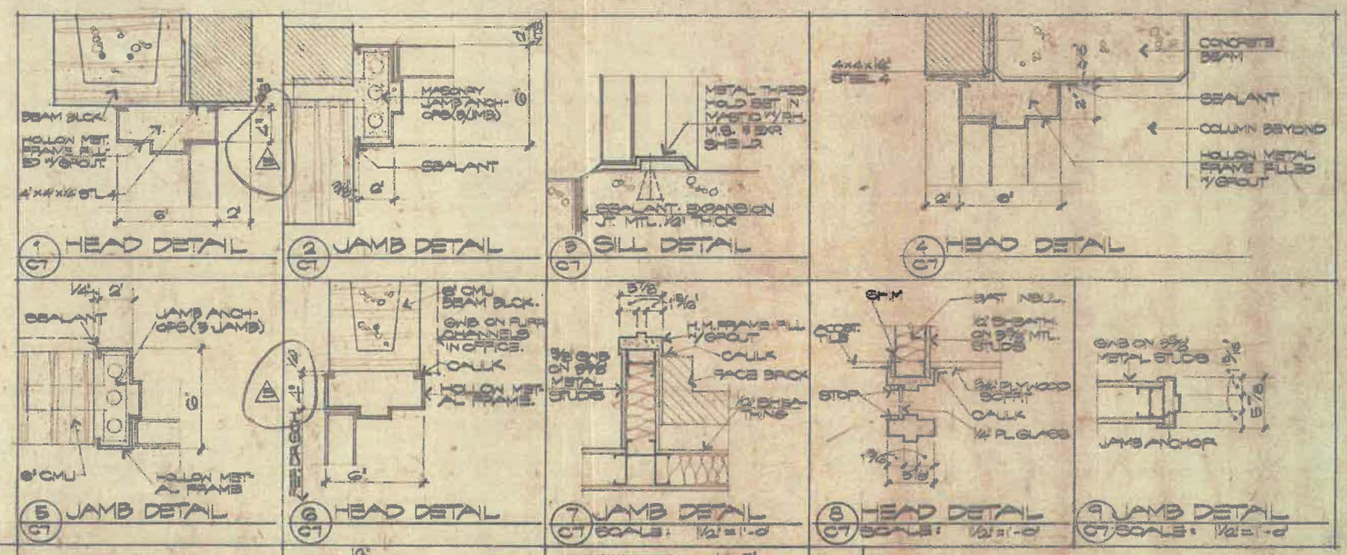
DOOR TYPES

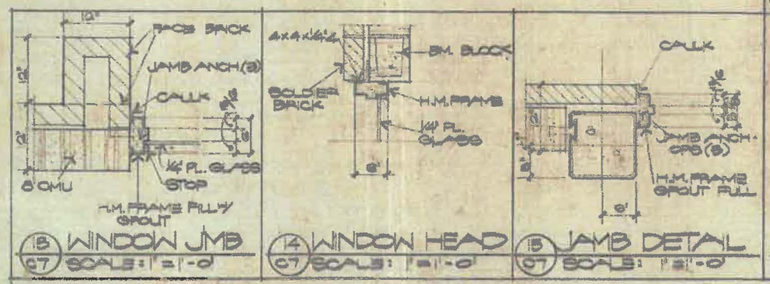


FRAME TYPES



WINDOW ELEVATIONS





NOTE: FOR DOORS OVER 7'-0" IN HEIGHT, PROVIDE 3 ANCHORS @ EACH JAMB AS SPECIFIED.

Graphic Scale

1" = 1'-0"
1-1/2" = 1'-0"
3" = 1'-0"

DATE 11-30-77	Shawnee, Oklahoma
SCALE AS NOTED	WATER TREATMENT PLANT
DRAWN J.K.B.	DOOR SCHEDULE & DETAILS
TRACED J.K.B.	
CHECKED J.M.B.	
APPROVED R.M.E.	
JOB NO. 67	Brewer, Bass & Associates, Inc.

⚠ Jan 9, 1978 Show Filter Building Door
⚠ JUNE 20-78 CHANGE DOOR & FRAME DIMENSIONS
⚠ AUG / 08 / 79 - DOOR SCHED

BLOCK OUT 1'x2' OPENING IN SIDEWALK BELOW ℄ OF CHEMICAL FEED LINES. PROVIDE ½ C.Y. OF PEA GRAVEL OR WASHED RIVER ROCK PER OPENING. TOP OF ROCK SHALL BE FLUSH WITH TOP OF SIDEWALK.

58'-0"

9'-2" 5'-7" 12'-8" 12'-8" 15'-7"

3'-4" 9'-4" 3'-4" 9'-4" 3'-4" 9'-4" 3'-4" 9'-4" 3'-4"

7½" 3'-2" 10'-8" 10'-8" 3'-2"

MONORAIL BEAM

CRADLE BLOCKS

4 SPACES @ 2'-4" = 11'-4"

CONCRETE SIDEWALK

HOOKUP KNOCK OUT PANELS

DRAINAGE TRENCHES

℄ TANK

℄ SADDLE

SLOPE TO DRAIN

NEUTRALIZATION TANK

ALUM. TANK

ALUM. TANK

CAUSTIC SODA TANK

TANK STOR. RM. 001

STORAGE 002

OPERATIONS 003

004 005 006 007 008

RAISED PAD FOR MIXER

RAISED PAD FOR PUMPS

EMERGENCY SHOWER

EYE WASH

TOP LAB TABLE ELEVATION PER

LOUVERS

CONCRETE SIDEWALK

CHLORINATORS

EVAPORATOR 150 LB/HR

METAL GRATING

SUMP PUMP

SEE SHEET D-8

Graphic Scale 1/4" - 1'-0"

CHEMICAL BUILDING FLOOR PLAN

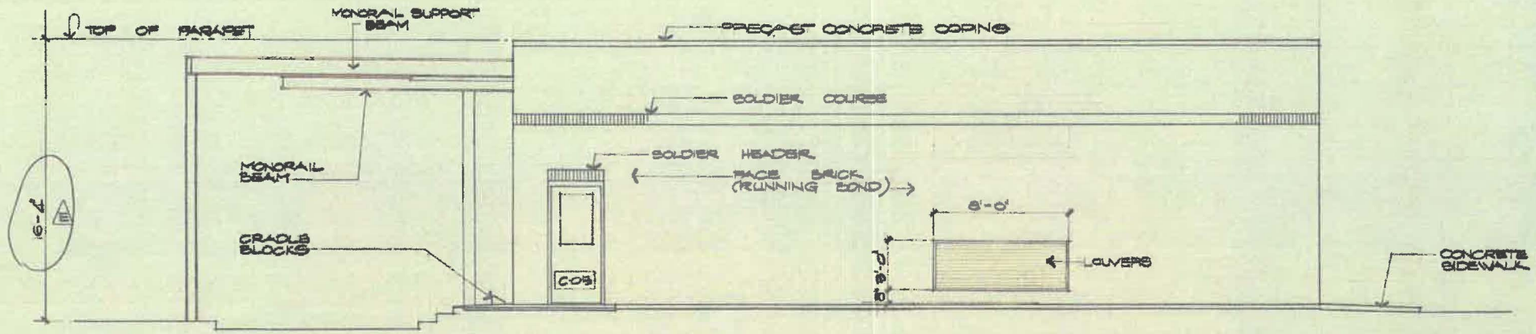
Jan 3, 1978 Correct Dimensions
Feb 16, 1978 Correct Dimensions
JUNE 18 -78 / GRID LINES & DIM.
APRIL 3, 1980 PROVIDE DRIP SUMP

DATE	11-30-77
SCALE	1/4"-1'-0"
DESIGNED BY	RHK
DRAWN BY	SKB
CHECKED BY	JMB
APPROVED BY	EMF
JOB NO.	C8

Shawnee, Oklahoma
WATER TREATMENT PLANT
CHEMICAL BUILDING
FLOOR PLAN

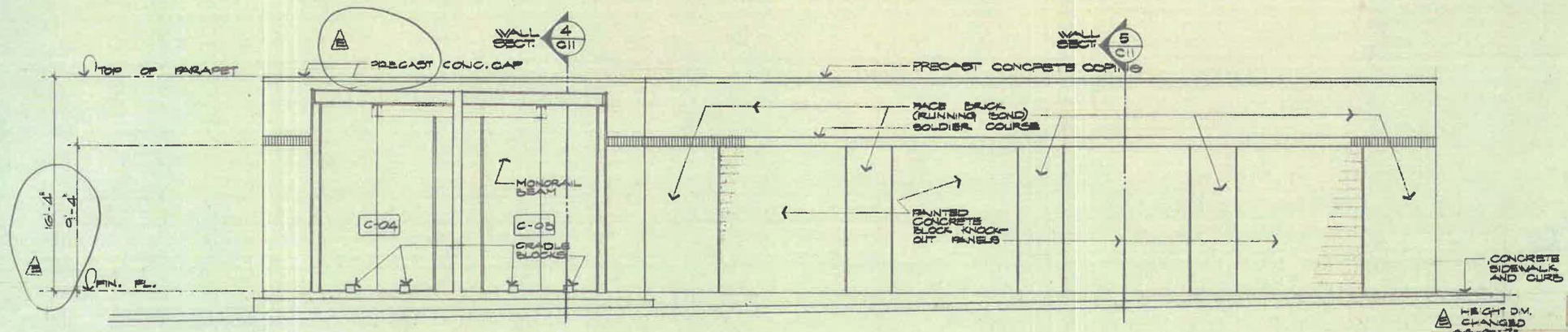
Burns - Stein & Associates, Inc.

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NORTH ELEVATION

SCALE: 1/4"=1'-0"



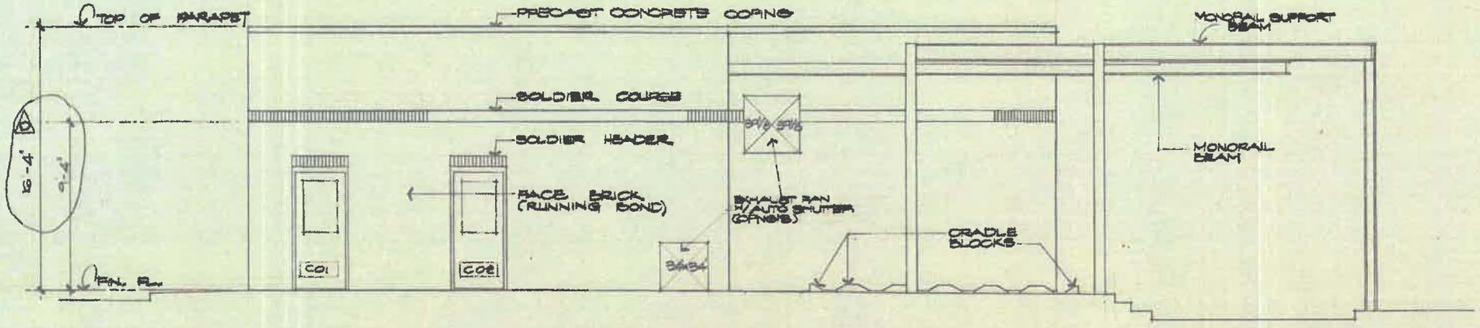
EAST ELEVATION

SCALE: 1/4"=1'-0"

Graphic Scale 1/4" - 1'-0"

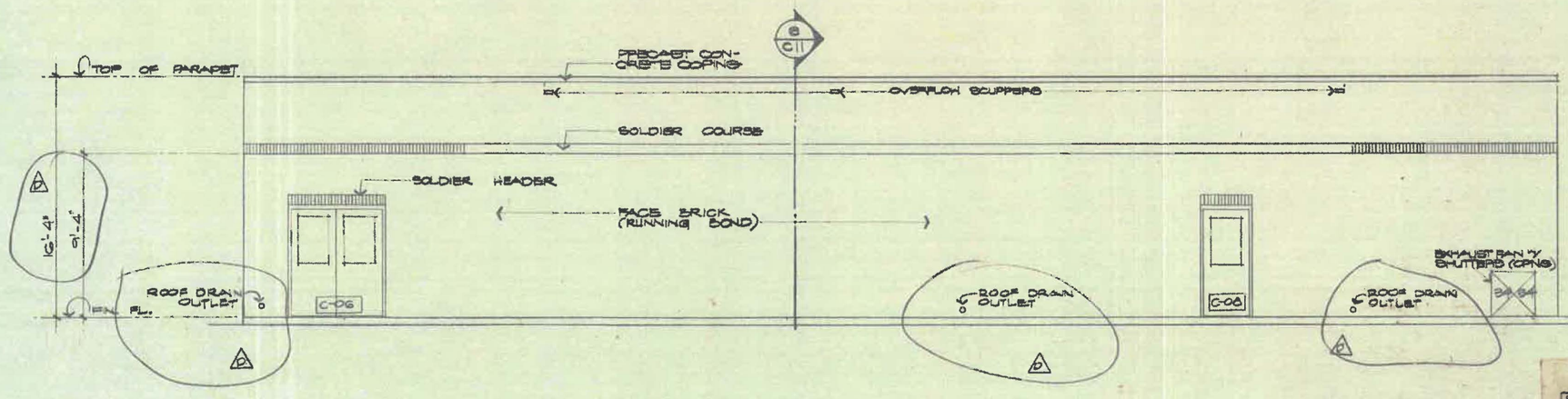
11-30-77	Shawnee, Oklahoma
1/4"=1'-0"	WATER TREATMENT PLANT
R.H.K.	CHEMICAL BUILDING ELEVATIONS
R.H.K.	EAST AND NORTH
J.M.B.	
E.M.F.	Bamham - Black & Affiliates, Inc.
C9	

1017 WT C-9 dtl 1/4"



SOUTH ELEVATION

SCALE: 1/4"=1'-0"



WEST ELEVATION

SCALE: 1/4"=1'-0"

△6 06-18-78
HEIGHT DIM. CHANGES
ROOF DRAIN & WALL PENETRATION & SPLASH BLOCKS SHOWN

Graphic Scale 1/4" - 1'-0"

DATE: 11-30-77	Shawnee, Oklahoma
SCALE: 1/4"=1'-0"	WATER TREATMENT PLANT
DESIGNED BY: R.H.K.	CHEMICAL BUILDING ELEVATIONS
DRAWN BY: R.H.K.	WEST AND SOUTH
CHECKED BY: J.M.B.	
APPROVED: E.M.E.	Barkham, Rizk & Associates, Inc.
JOB NO: CID	

BAR JOISTS @ 8'-0" O.C.

STRUCTURAL STEEL BEAM AND FRAME

8" CMU KNOCK-OUT PANELS W/ BOND BEAM COURSES @ 48" O.C. VERTICALLY

STEEL GRATE

DRAINAGE PIT

EXPN. JT.

16'-4" TO TOP OF PARAPET

5/C11

7/C11

10/C11

1/C8 SECTION
SCALE: 1/4" = 1'-0"

16'-4" T.O.P (BEYOND)

SLOPE

BAR JOISTS

EXHAUST FAN

8" CONCRETE MASONRY UNITS (CMU) BEYOND

BOND BEAMS EVERY FIFTH COURSE

TOILET BEYOND

8" CMU

8" RAISED PAD FOR METER PUMPS SEE FLOOR PLAN

EXP. JT. COVER (BEYOND)

ROOF DRAIN

5/C11

7/C11

1/C12

9/C11

2/C8 SECTION
SCALE: 1/4" = 1'-0"

FLASHING

CANT STRIP

BUILT-UP ROOF SLOPE

1½" INSULATION

SOLDER COURSE 4"x4"x⅜" L

SEALANT

GROUT FULL

DOOR FRAME

MONORAIL BEAM (BEYOND)

METAL DOOR

COLUMN BEYOND

SLOPES ¼"/FT.

EXPAN. JT. MATERIAL

T.O.P. ABOVE F.F.

16'-4"

18'-5⅝"

1'-0"

1'-4"

PRECAST CONCRETE COPING

2x2x⅜"@ 4'-0" O.C.

¼" BRNG. PL. W/ ANCHORS

BEND BEAM W/ 2#5 BARS TYP. EVERY FIFTH COURSE OF BLOCK. FILL W/ 4000 PSI CONC.

⅝" STUDS @ 32" O.C.

⅝" STEEL PL.

¼" STIFFENER PL. @ 6'-0" O.C.

SOLDER COURSE

KNOCK OUT CONCRETE BLOCK WALL W/ BOND BM.

BAR JOIST

15" BRNG.

2'-4"

4'-8"

9'-4"

SLOPES

1'-5"

TAPERED FOAM INSULATION SLOPES ½" PER FOOT TO DRAIN

SLOPES TO DRAIN

EXP. JT.

SLOPES

SEE STRUCTURAL DRAWINGS FOR FOUNDATION DETAILS.

4/C11 WALL SECTION @ DOOR
SCALE: 1 1/2" = 1'-0"

5/C11 WALL SECTION @ CMU KNOCK-OUT
SCALE: 1½" = 1'-0"

6/C10 C11 WALL SECTION
SCALE: 1½" = 1'-0"

SEALANT

2"x5"x¼" STEEL TUBE SPACER

CONCRETE BEAM (12" x 18" @ 13'-0" ABOVE F.F.S. (SECTION OF BEAM)

¼" STEEL FILLER PL.

WEATHERSTRIP

DOOR FRAME

MONORAIL BEAM

METAL DOORS

10/C11 MONORAIL DETAIL
SCALE: 3" = 1'-0"

MONORAIL BM.

MONORAIL FRAMING MEMBERS.

PRECAST CONCRETE COPING CAP FLASHING

BUILT-UP ROOF OVER RIGID INSUL.

½" VP'L DECK

T.O.J. VARIES @ 14'-2" @ GRID

1/2 1/2 BAR @ 4'-0" O.C. (HELD TWO SIDES)

⅜" BRNG. PL. W/ ANCHORS

BEND BEAM CONT. W/ 2#5 BARS

BAR JOIST

JOINT FILLED W/ INSULATION

T.O.J. VARIES @ 15'-0" ABOVE F.F.S. GRID (5)

CONCRETE STRUCTURE

COLUMN BEYOND

10" CMU

12" CMU

SLOPES CONCRETE ¼"/FT.

7/C12 INTERIOR WALL SECTION
SCALE: 1½" = 1'-0"

T.O.P.

ROOF DRAIN

8" CMU (BEYOND)

2" STRUCT. CONCRETE COLUMN

EXHAUST FAN

C01

C02

8/C8 SECTION
SCALE: 1/4" = 1'-0"

MIRROR

8/C8 TOILET ELEVATION
NO SCALE

8" CMU

¾" PLYWOOD

2"x8"@16" O.C.

8" CMU BOND BEAM

JOIST HANGERS

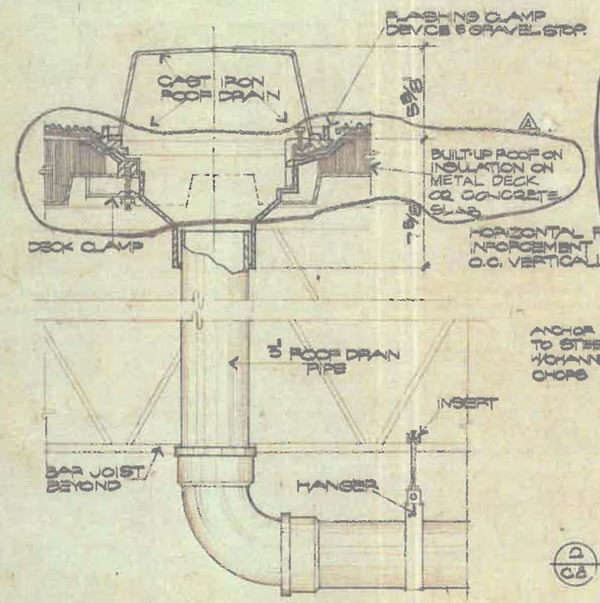
9/C11 TOILET CEILING DETAIL
SCALE: 1½" = 1'-0"

Graphic Scale
1/4" = 1'-0"
1-1/2" = 1'-0"
3" = 1'-0"

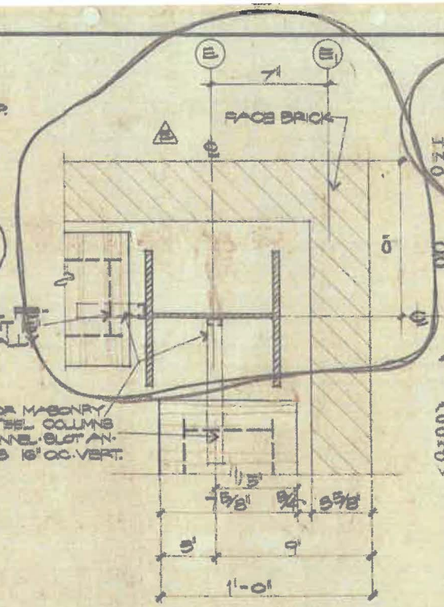
DATE	11-30-77
SCALE	AS NOTED
DRAWN BY	SKB
CHECKED BY	B.K.B.
APPROVED BY	J.M.B.
JOB NO.	E.M.F.
DWG. NO.	C11

Shawnee, Oklahoma
WATER TREATMENT PLANT
CHEMICAL BLDG.
SECTIONS & DETAILS

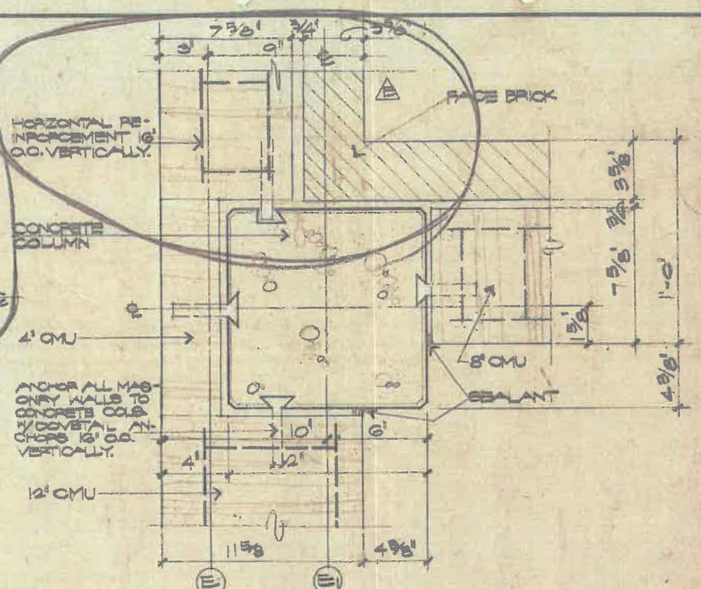
189



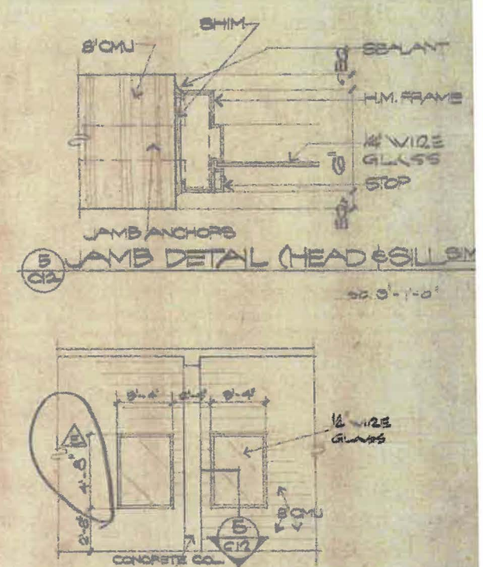
1 C11 ROOF DRAIN DETAIL (3"ϕ R.D.)



2 C8 TYPICAL STEEL COLUMN DET'L
sc. 3"=1'-0"

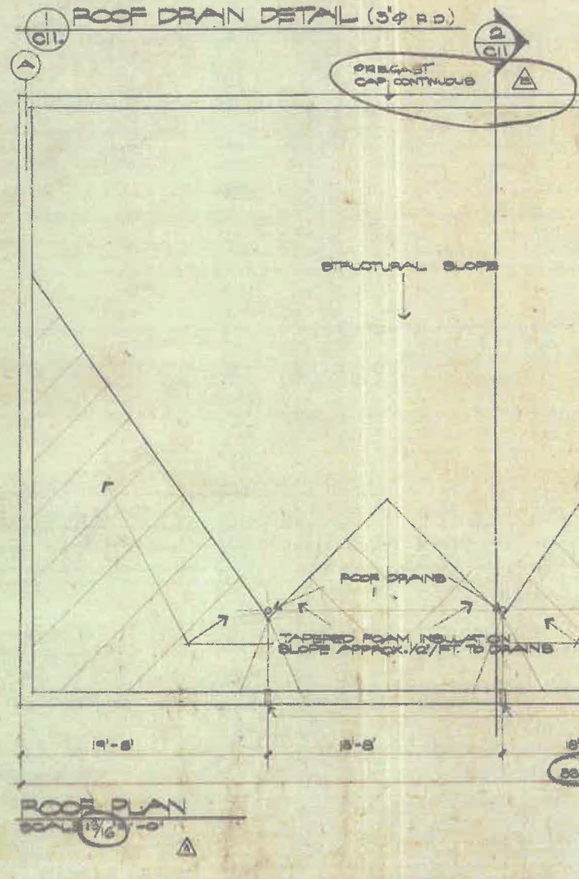


3 C8 TYPICAL CONCRETE COLUMN DETAIL
sc. 3"=1'-0"

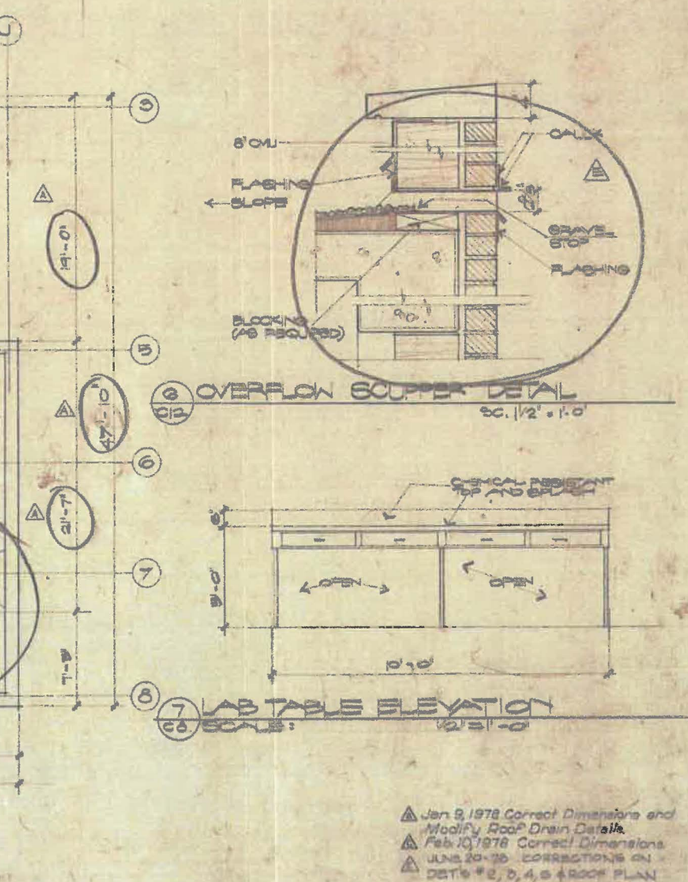


5 C12 JAMB DETAIL (HEAD & SILL SIM.)
sc. 3"=1'-0"

4 C8 BORROWED LIGHTS ELEVATION
sc. 1/4"=1'-0"



ROOF PLAN
SCALE: 1/16"=1'-0"



6 C12 OVERFLOW SCUPPER DETAIL
sc. 1 1/2"=1'-0"

7 C8 LAB TABLE ELEVATION
SCALE: 1/2"=1'-0"

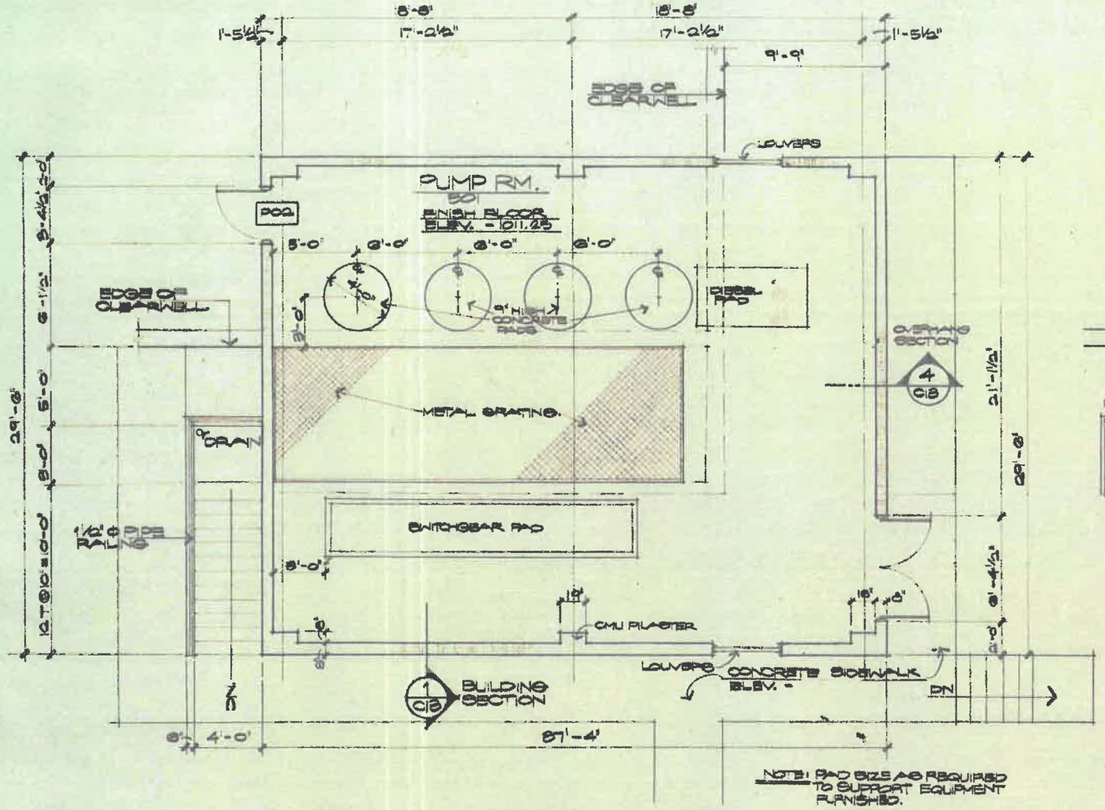
Graphic Scales
3/16"=1'-0"
1/4"=1'-0"
1/2"=1'-0"
1-1/2"=1'-0"
3"=1'-0"

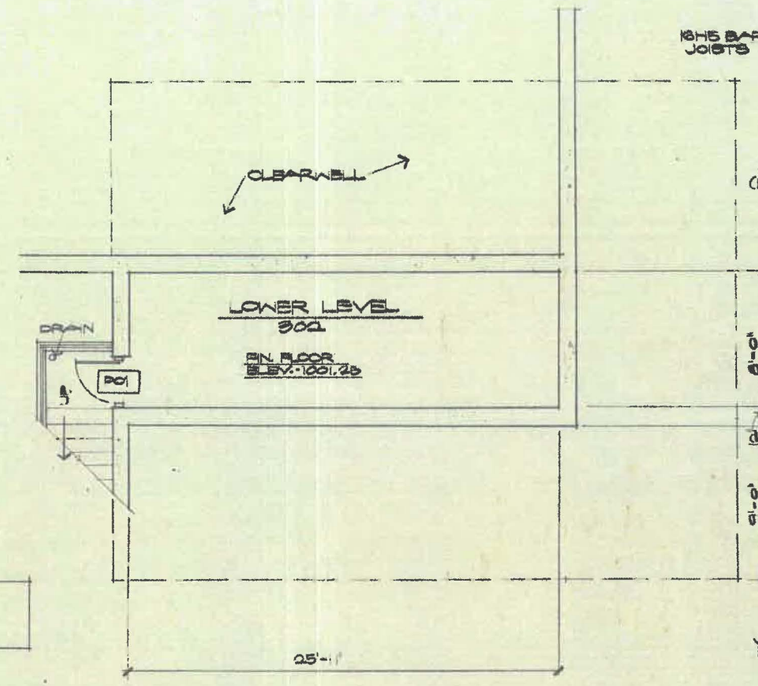
DATE	11-30-77
SCALE	AS NOTED
DRAWN	S.K.B.
CHECKED	S.K.B.
APPROVED	J.M.S.
PROJECT	E.M.F.
SHEET	C12

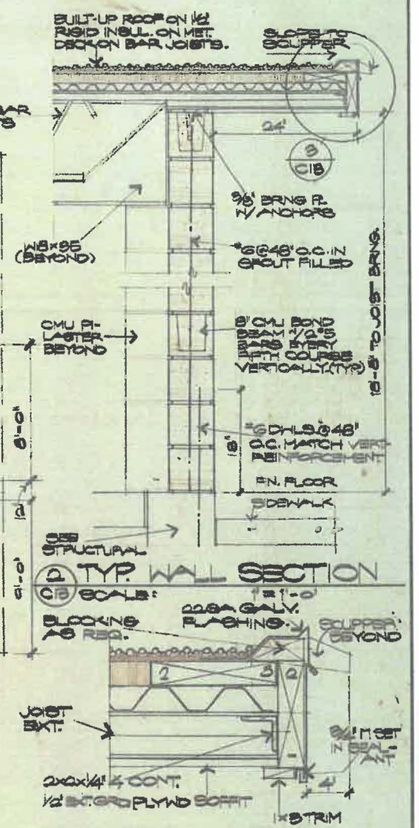
Shawnee, Oklahoma
WATER TREATMENT PLANT
CHEMICAL BUILDING DETAILS

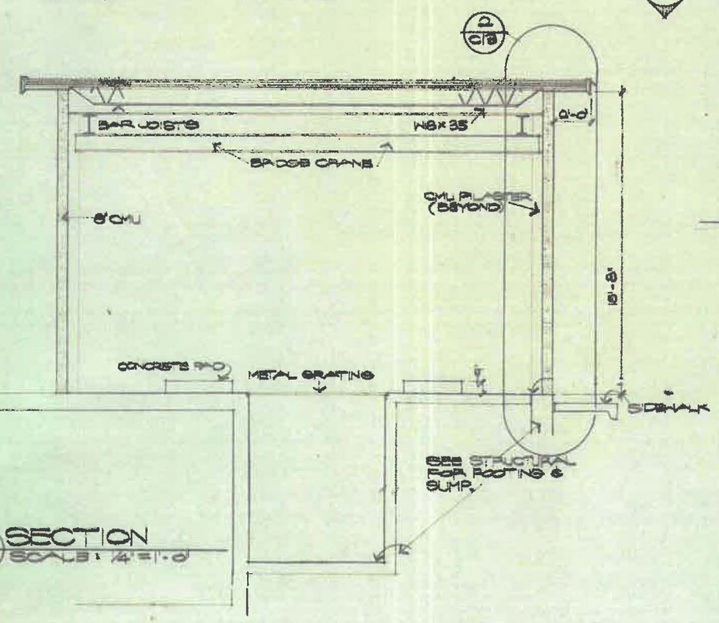
Bowman - Stull & Associates, Inc.

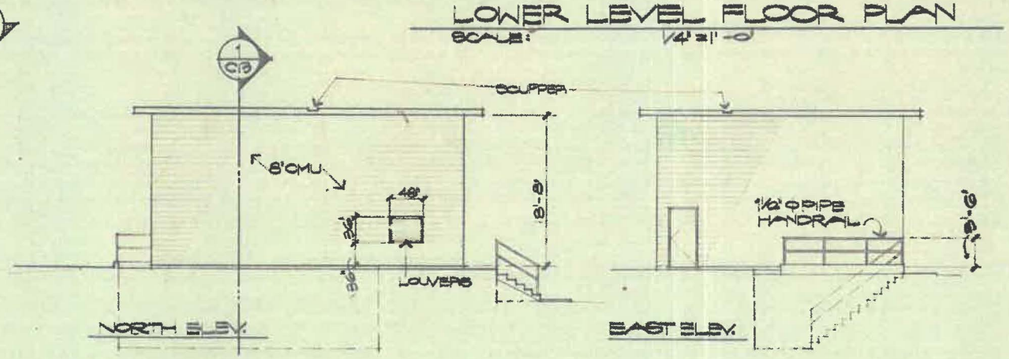
Jan 9, 1978 Correct Dimensions and Modify Roof Drain Details.
Feb 10, 1978 Correct Dimensions
JUNE 20-28 CORRECTIONS ON DETS #2, 5, 4, 6 & ROOF PLAN

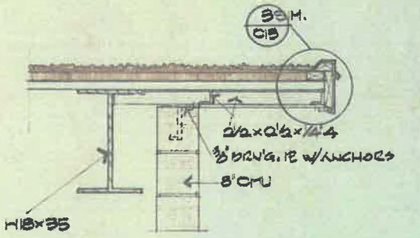












Graphic Scales

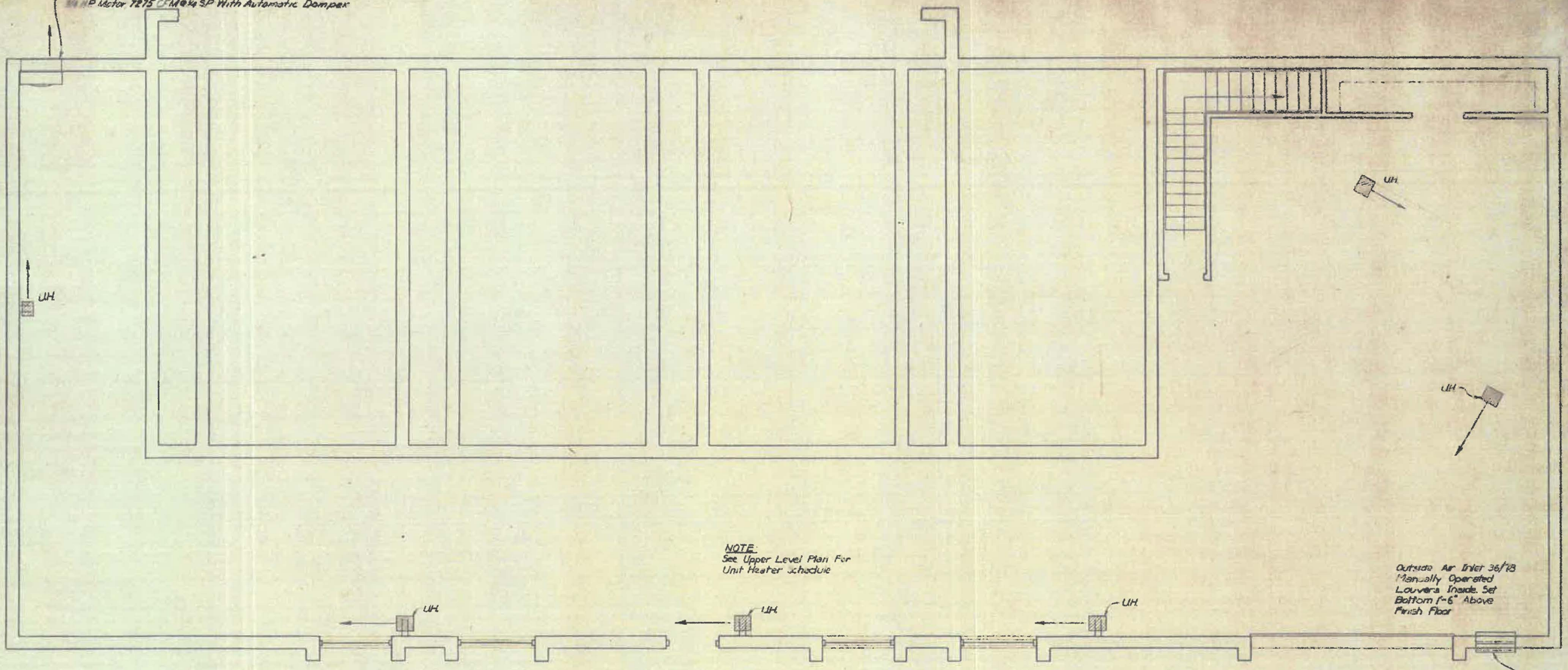
1/8" = 1'-0"
1/4" = 1'-0"
1" = 1'-0"
3" = 1'-0"

11-30-77	Shawnee, Oklahoma
AS NOTED	WATER TREATMENT PLANT
DESIGNED BY S.K.B.	PUMP BUILDING ELEVATIONS & DETAILS
DRAWN BY S.K.B.	
CHECKED BY J.M.B.	
APPROVED BY E.M.F.	Burhoop - Blair & Associates, Inc.
JOB NO. C/B	

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1017 WT D-1 of 9 1977

Ventilation Exhaust Fan 40" x 40" Q.D. Mounted 12'0" Above Finish Floor to Bottom of Fan. Jenn-Air Model No 5303 E.W. 3/4 HP Motor 7275 CFM @ 1/4 S.P. With Automatic Damper

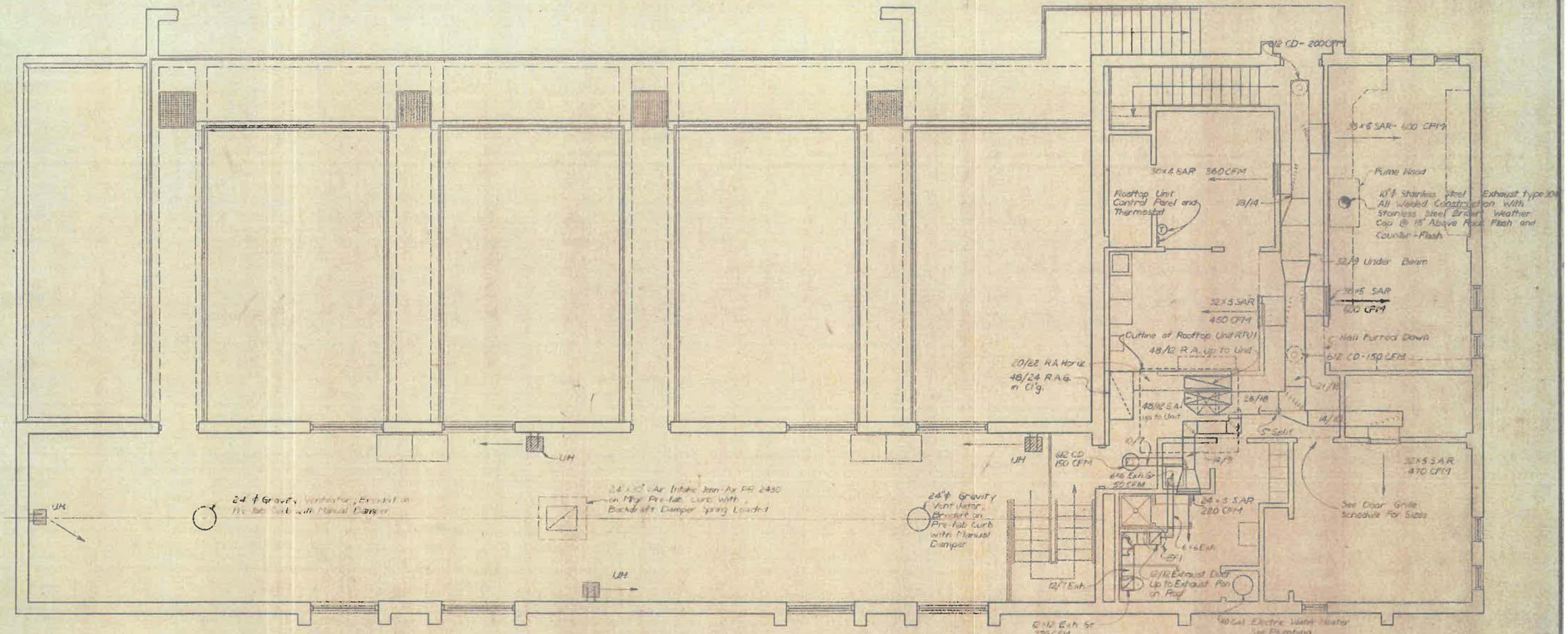


FILTER BUILDING LOWER LEVEL
HVAC PLAN

SCALE: 1/4" = 1'-0"

11-30-77	Simpson Gumpertz & Heger WATER TREATMENT PLANT
1/4"=1'-0"	FILTER BUILDING LOWER LEVEL HVAC PLAN
JRS	
TAB	
EJS	

18



FILTER BUILDING UPPER LEVEL
HVAC PLAN
SCALE: 1/4" = 1'-0"

DOOR GRILLE SCHEDULE		
SIZE	SERVES	MFGR. & TYPE
18×12	Control Room	Barber Colman-R Core
18×12	Office and Records	" " "
26×24	Laboratory	" " "
Undercut	Janitor's Closet and Toilet	

UNIT HEATER SCHEDULE							
MARK	BTUH	KW	CFM	MTG	ELECT DATA VOLTS	Φ	HZ
U.H.	34130	10	750	9' Max.	480	3	60
Chromalox Cat. No. LUH-10-15 Design Basis							

ROOFTOP UNIT SCHEDULE				
MARK	TOTAL SENSIBLE BTU	GRAND TOTAL BTU	CFM @ O.T. S.P. EXT.	ELECT HTG DATA @ 35° TEMP RISE
RTU-1	87000	113000	3200	45 KW-2 Stage

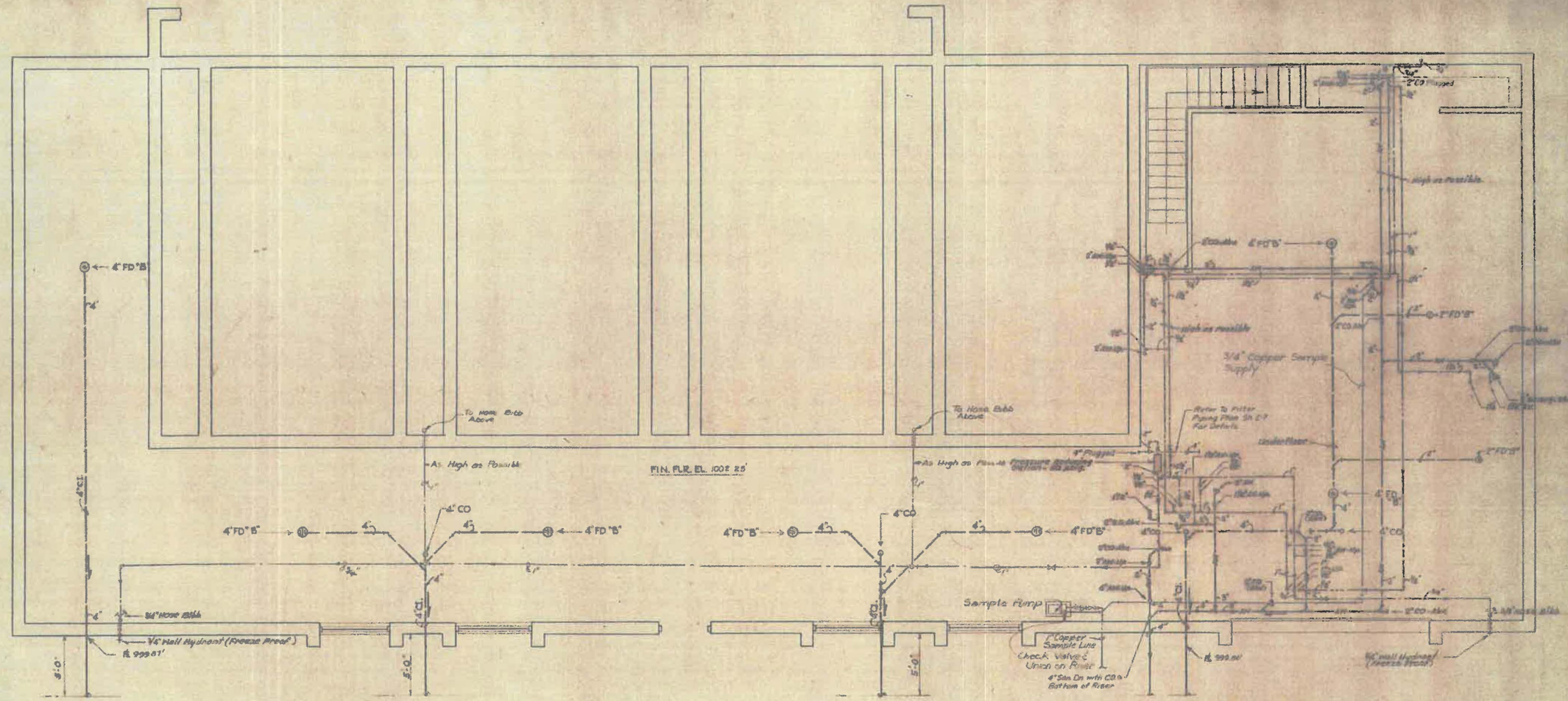
DESIGN DATA:
80°F DB E.A.T. @ Evaporator
67°F WB
105°F DB E.A.T. Condenser
Manufacturer Name & Model No.; Trane-TSCA 100
Pre-fab Curb Supplied by Manufacturer
Elect Service 480 V-3Φ-60 HZ

EXHAUST FAN SCHEDULE				
MARK	CFM @ 1/8" S.P.	MOTOR H.P.	VOLTAGE	MFGR & MODEL
EF1	320	1/12	120V-1Φ	JENN-AIR 108CR
Provide: Backdraft Damper & Pre-fab Curb				

MECHANICAL LEGEND:
- SAR ——— Supply Air Register
- RAG ——— Return Air Grille
- CD ——— Ceiling Diffuser
- CFM ——— Supply Air Quantity (Cubic Feet/Minute)
- (T) ——— Thermostat (Mounted @ 5'-6" ℄ Above Fin Flr.)

GENERAL NOTES:
1. Refer to Architectural Drawings For Laboratory Layout
2. Hall Ceiling Height 7'-2"
3. Line All Ducts With an Acoustical Liner
4. Contractor to Coordinate Roof Opening Size and Location With Rooftop Equipment Manufacturer

8-30-77	Stillwater, Oklahoma
1/4"=1'-0"	WATER TREATMENT PLANT
J.E.E.	FILTER BUILDING UPPER LEVEL HVAC PLAN
T.D.B.	
F.A.	
J.M.R.	
D.R.	

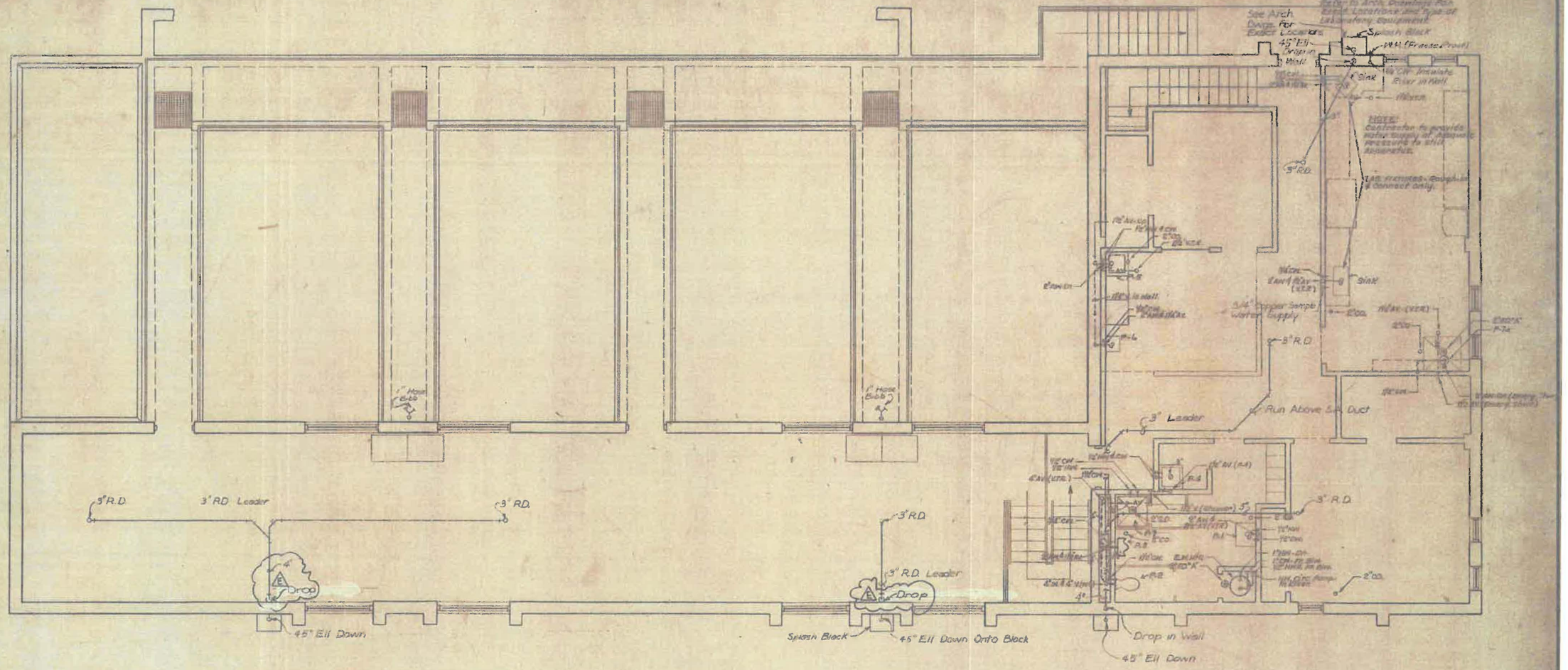


FILTER BUILDING LOWER LEVEL PLUMBING PLAN

SCALE: 1/4"=1'-0"

11-30-77	
1/4"=1'-0"	
JEK	FILTER BUILDING LOWER LEVEL PLUMBING PLAN
RF	
TG	
LWH	
DS	

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GENERAL NOTES:
All Horizontal Piping And Riser to Roof Drain Trunk Shall be Insulated With 1/2" Thickness Fiberglass Insulation

FILTER BUILDING UPPER LEVEL PLUMBING PLAN

SCALE: 1/4" = 1'-0"

21 June 78	San Leader Exposed
8-30-77	Shawnee Oklahoma WATER TREATMENT PLANT
1/4"=1'-0"	
	FILTER BUILDING UPPER LEVEL PLUMBING PLAN

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PUMP BUILDING
HVAC & PLUMBING PLAN
SCALE: 3/8"=1'-0"

N

4" Fill pipe @ Opposite End Of Tank- Provide Locking Cap See Detail This Sheet

2" Vent

FOS

FOR

See Specifications for Tank & Piping Fittings

Fuel Oil Storage Tank- Fiberglass Model 6000 D-3B15940 Gal Cap 19'-5" Long x 7'-11" Dia. Overall

48"x12" Bottom M.O. Damper Actuated by Engine #8 #36" Top M.O. Damper and Bottom Damper Both Actuated by Exhaust Fan #2

Run and Turn Horizontal #18" Belowy Overhang. Cut Pipe at 60° on Bottom. Use Long Sweep Elbows - 90° at Each Turn

Simplex Model SFT-100A Package Day Tank System with Pump

Wall Sleeve 6" Vent with OBW 23

OBW 23 Vent Extend 10' Above Fin. Grade and Install Weather Cap With Insect Screen

UH

4"FOS

4"FOR

2"FO-"B" In Bot. of Trench

Laid On Floor Against Wall. Pipe Trench With Grating. Refer Struct

2"

4"FO-"B"

Discharge Free Heat Exch to Room Air Gap

Filters- See Note

Semi-Critical Muffler Support From Floor

DIESEL ENGINE

8'-0" Above Fin. Flr. (Approx.)

Water Source See Sht E-1

Wall Sleeve Packed With Asbestos

Exhaust Fan #1

UH

4"FO-"D"

Exhaust Fan #2

4"FO-"D"

4"FO-"D"

4"F.O.-"D"

NOTE

3 Throwaway Air Filters in Sheet Metal Rack. Provide Ready Access to Filter Rack. Filters for Both Openings.

4"FOS

4"FOR

Vent Fan- Jenn Air Model No. 5742 AW Installed In 1/4" x 1/4" x 1" L Frame and Anchored to Underside of Conc. Slab as shown with Two Stiff Legs to Int. Wall

Typical Mounting Height 8'-0" Above Finish Floor

UH

48"x16" M.O. Damper Actuated By Exhaust Fan #1

Duct Primary Underground

Electric Trench

From Water Source. See Plan- Piping Sized By Manufacturer of Heat Exchanger

Heat Exchanger

To Waste - See Plan

DIESEL ENGINE

Engine Water Piping Size Same as Engine Outlet & Inlet

Flexible Coupling

Heat Sensing Element

HEAT EXCHANGE PIPING FOR DIESEL ENGINE
NO SCALE

UNIT HEATER SCHEDULE							
MARK	BTUH	KW	CFM	MBH†	ELECTRICAL		
					VOLTS	Ø	HZ
UH	23536	7.5	670	8	480	3	60

Chromalox Cat. No. LUH-07-09 Design Basis

EXHAUST FAN SCHEDULE				
MARK	CFM @ WG	MOTOR HP	VOLTAGE	MFGR. & MODEL
Sheet Fan	2410	1/4	460V 3Ø	ERNFAIR 244 STD

Provide: Fire Pab Curb & Backdraft Damper

NOTE:- Provide Thermostatic Control for each Exhaust Fan.

Simplex Model SFT 100A Day Tank

Pump

Strainer

Y Valve

Y Drain

Fuel Engine

Fuel Oil Tank

DIAGRAMATIC PIPING FUEL OIL SYSTEM
NO SCALE

Fuel Oil Tank

2

4" Fill Pipe

18" Square Conc. Block

Cast I.D. Pit Box Size 4'-0" With Drain Cap which Can be Locked

Top of Tank

Drill & Tap 4" Submerged Pipe Tube (Also Can Be Used as Dipstick to Check Fuel Oil Level Manually)

45°

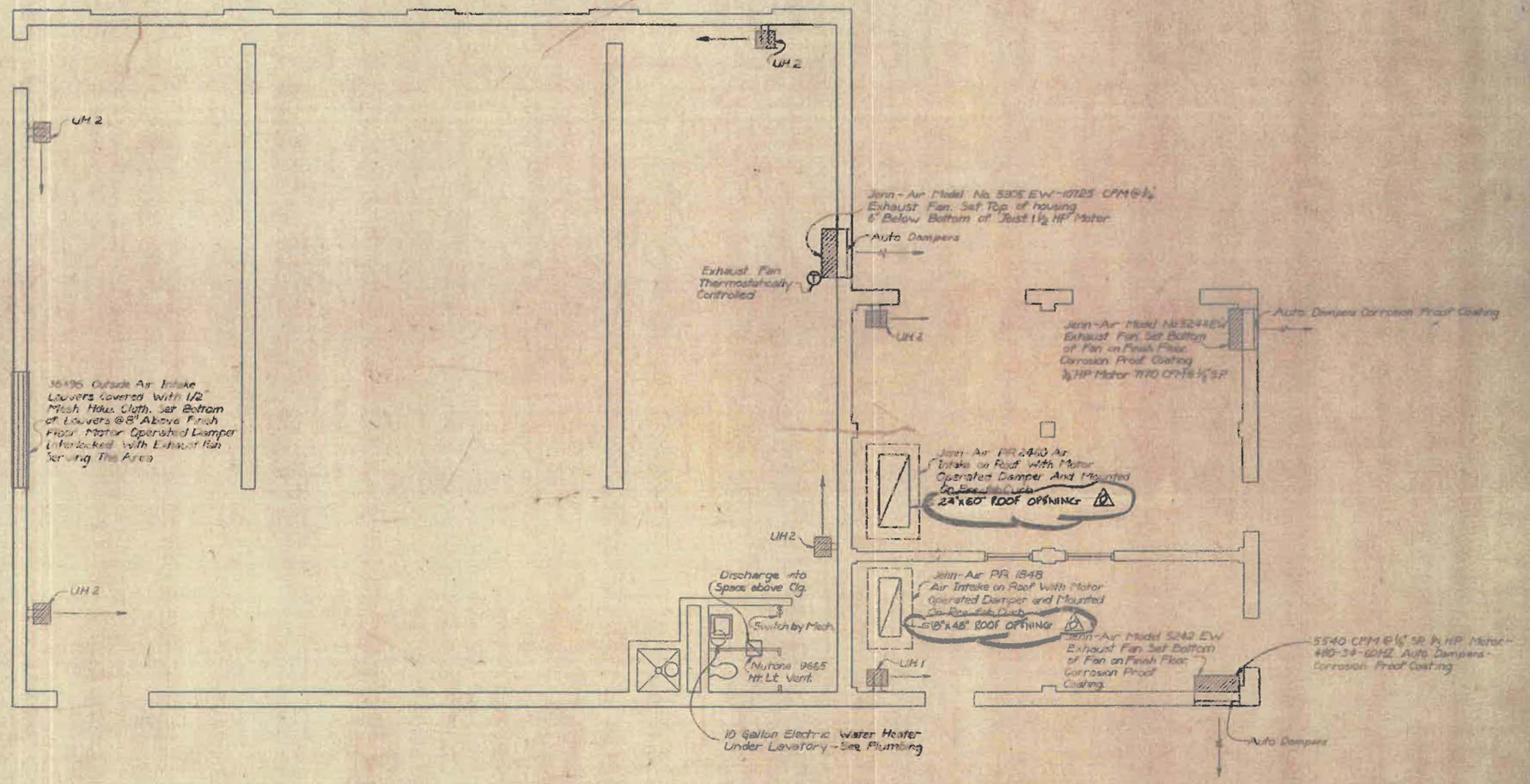
Inside Bottom of Tank

DETAIL TANK FILL
NO SCALE

⚠ AUG 13, 1979 - RELOCATE FUEL OIL DAY TANK

11-30-77	Shawnee, Oklahoma WATER TREATMENT PLANT
3/8"=1'-0"	
J.E.E.	PUMP BUILDING HVAC & PLUMBING PLAN
T.D.A.	
J.M.B.	

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UNIT HEATER SCHEDULE							
MARK	BTUH	KW	CFM	MTHT	ELECT DATA		
					VOLTS	Ø	HZ
UH 1	25598	7.5	670	8	480	3	60
UH 2	34190	10	750	9 Max.	480	3	60
Chromalox Cat No. LUH-07-09 Design Basis (UH 1)							
Chromalox Cat No. LUH-10-15 Design Basis (UH 2)							

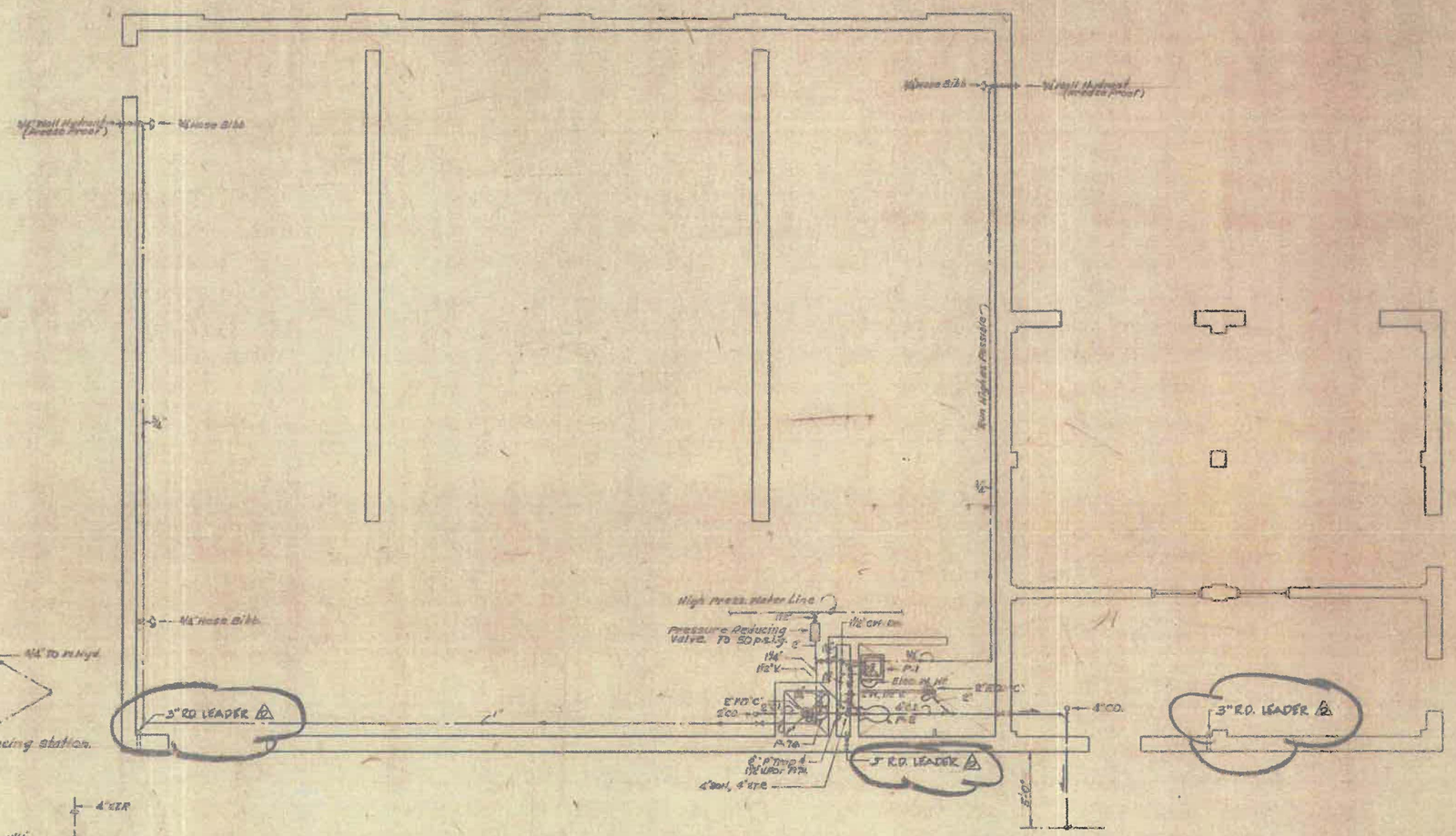
CHEMICAL BUILDING HVAC PLAN

SCALE: 1/4" = 1'-0"

GENERAL NOTES

1. All Exhaust Fans & Air Intakes Shall be Interlocked
2. All Exhaust Fans are 480V-3Ø-60 HZ

6-30-77	1	ADDED ROOF OPENING NOTES
11-6-78	2	WATER HEATER PLAN
12-7-78	3	CHEMICAL BUILDING HVAC PLAN

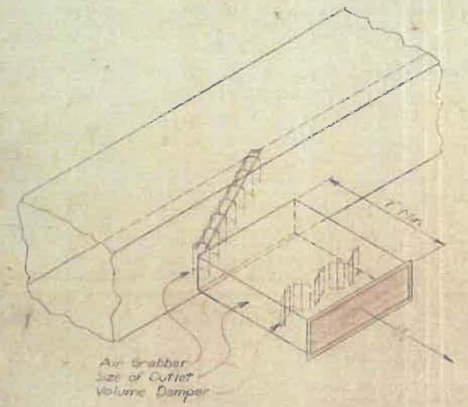


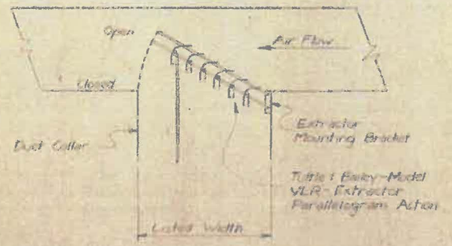
CHEMICAL BUILDING PLUMBING PLAN

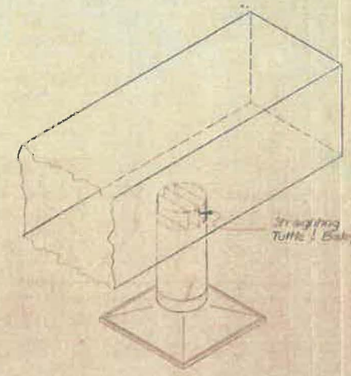
SCALE: 1/4" = 1'-0"

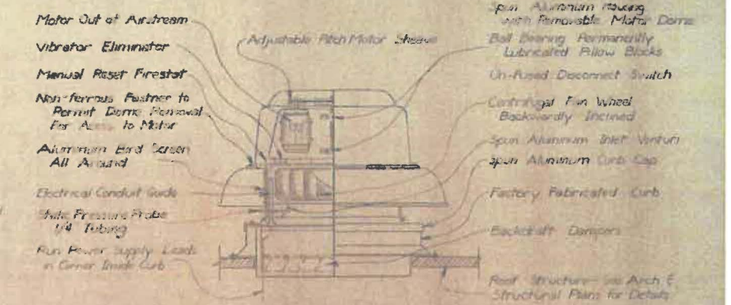
6	6 JUNE '78	ADDED R.D. LEADER
11-10-77		
AS NOTED		

CHEMICAL BUILDING PLUMBING PLAN

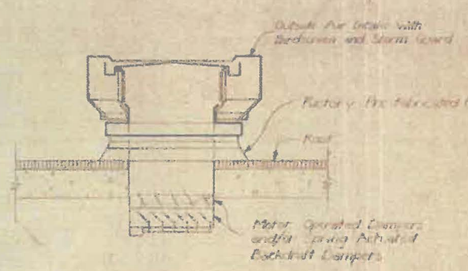




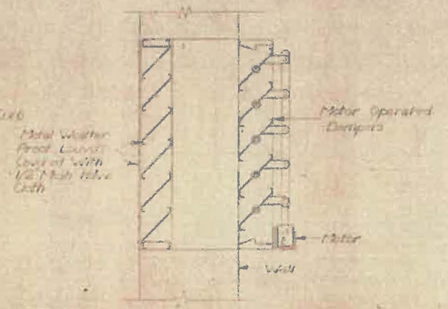




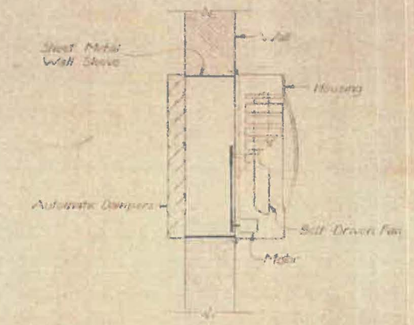
TYPICAL SUPPLY REGISTER INSTALLATION
NO SCALE



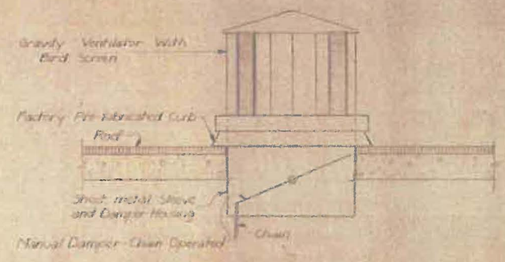
AIR GRABBER DETAIL
NO SCALE



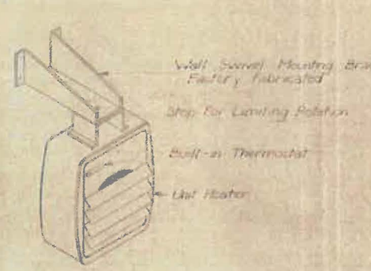
MAIN DUCT CEILING OUTLET DETAIL
NO SCALE



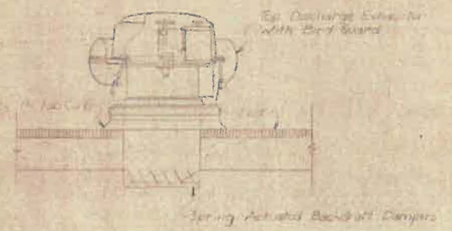
TYPICAL ROOF MOUNTED EXHAUST FAN
NO SCALE



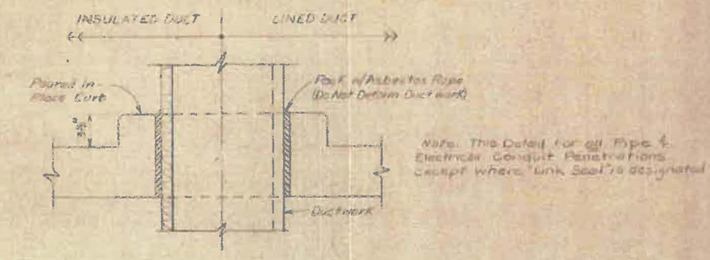
OUTSIDE AIR INTAKE DETAIL
NO SCALE



OUTSIDE AIR INTAKE DETAIL
NO SCALE



PROPELLER EXHAUST FAN-WALL MOUNTED DETAIL
NO SCALE



GRAVITY VENTILATOR DETAIL
NO SCALE

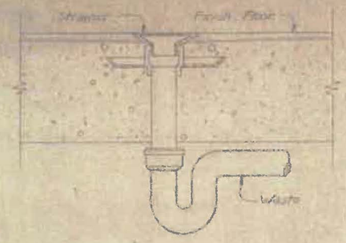
UNIT HEATER MOUNTING DETAIL
NO SCALE

TYPICAL EXHAUST FAN DETAIL
NO SCALE

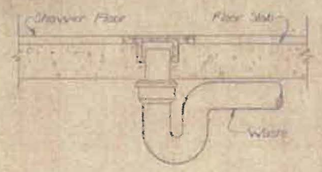
DUCT OPENING THRU FLOOR
NO SCALE

DATE 11-30-77	Shawnee, Oklahoma
SCALE AS NOTED	WATER TREATMENT PLANT
DESIGNED J.E.S.	HEATING, VENTILATING, AND AI
DRAWN TDR	CONDITIONING—DETAILS
CHECKED T.D.	
APPROVED J.N.S.	Burnham - Blair & Affiliates, Inc.
JOB NO. D.B.	

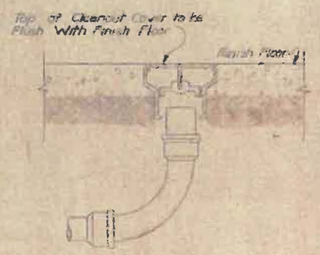
189



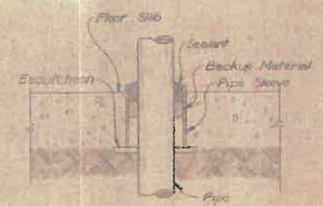
TYPICAL FLOOR DRAIN DETAIL, TYPE "A" & "C"
NO SCALE



SHOWER DRAIN DETAIL
NO SCALE



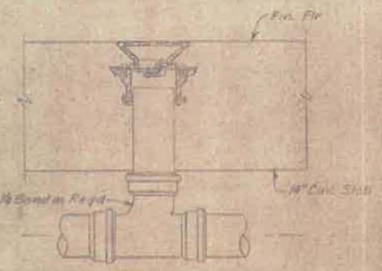
TYPICAL CLEANOUT DETAIL
NO SCALE



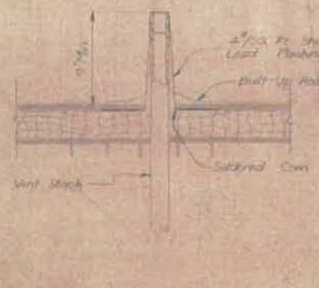
PIPE SLEEVE THRU FLOOR
NO SCALE

PLUMBING SYMBOLS

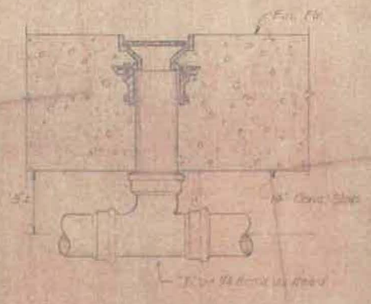
	GATE VALVE		PLUMBING VENT
	CHECK VALVE	VTR	VENT THRU ROOF
	DOM. COLD WATER	WH	WALL HYDRANT
	DOM. HOT WATER	F.O.	FUEL OIL
	DOM. HOT WATER RETURN		WASTE LINE
AW	ACID WASTE	CO	CLEANOUT
AV	ACID VENT	R	PRESSURE REG VALVE
AW	ACID WASTE UNDER FLOOR		



TYPICAL FLOOR DRAIN DETAIL - TYPE "D"
NO SCALE



DETAIL OF TYPICAL VENT THRU ROOF
NO SCALE



TYPICAL FLOOR DRAIN DETAIL-TYPE "B"
NO SCALE

PLUMBING FIXTURE SCHEDULE

MARK / FIXTURE	SIZE / TYPE	MANUFACTURER / MODEL	COLOR	CARRIER / TRAP	PIPING CONNECTIONS: SOIL	VENT	CW	HW	REMARKS
P-1 Laundry	20"x18" Wall Hung	Kohler Std. Orlen Old	W	Integral	3	1½	½	½	Lav. #30 Combination Faucet With Pedestal Grid Basin Supplies.
P-2 Lavatory	Wall Mounted	Kohler Std. 2000 Old	W	Integral	2	1½	½	½	Sloan Royal No. 115 Bedpan White Ref. Cm-39
P-3 Urinal	Wall Mounted	Kohler Std. 4988	W	Integral	2	½	1	—	Sloan Royal 186
P-4 Mop Service Basin	24"x24" Floor	Fiat Model 58		N/A 3" Soil Pipe	3	2	½	½	With 1259 SB Bumper Guard 8124A Stainless Steel Wall Guard 1" Pail Hanger 8804 Mop Holder Wall Bracket
P-5 Sink	25"x22" Counter	Elkay LR 2522	SU	Self Rim 1402 SS	2	1½	½	½	LK 400 Single Lever Faucet LK 35 Strn. LK 30 Escutcheon Hose, Stops & Supplies.
P-6 Eye Wash	Wall	Elkay E.W. 8	SU	N/A 4100 CP	2	—	½	½	Angle, With Grip.
P-7 Drinking Fountain	Wall Recessed	Symmons 0-DW-Bub	—	N/A N/A	2	1½	½	½	Vandal Proof Self Closing Valve, Stops & Supplies
P-8 Emergency Eye Wash	Floor Mount	Haws 8308	SS	N/A 7 AW Sw	3	—	1½	—	10" Dia. Metal Bowl Self Contained Fully Piped Emergency Eye Wash With Push Valve Push Cowling

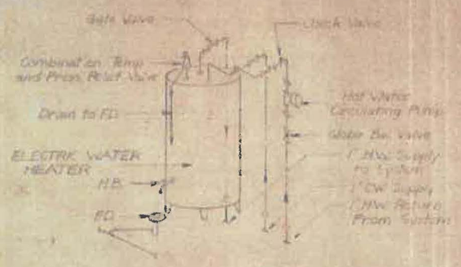
FLOOR DRAIN SCHEDULE

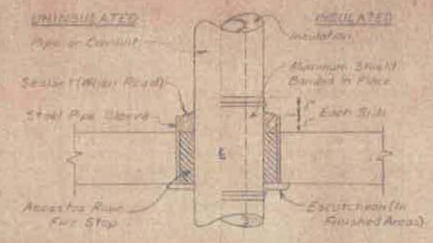
TYPE	SERIES	REMARKS
"A"	Zurn Z-415-A	Cast Iron Body with Top Flate Deck with Drain Flange Bottom Outlet.
"B"	Josam 30000-E1	CI with Top Flate Body with Drain Flange Bottom Outlet and Satin Nickel Plated Extended Rim Strainer.
"C"	Josam - 30000A	CI with Top Flate Body, Round Strainer, Integral Bottom Outlet, Polished Satin Nickel Plated Strainer.
"D"	Josam 32048AJ	CI With Two Piece Body with Double Drainage Flange Bottom Outlet and Satin Nickel Round Super-Flo Strainer with Internal Primer & Integral Valve.

ELECTRIC WATER HEATER SCHEDULE

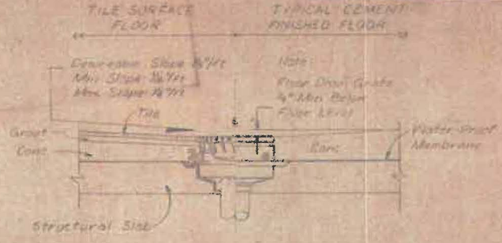
LOCATION	MANUFACTURE / MODEL	STORAGE	RECOVERY RATE	ELEMENT WATTAGE	VOLTAGE
Filter Bldg. - Chemical Area	Natural NRG-40-75	40 Gallon	19 GPH @ 100° Rise	4500 (Upper) 4500 (Lower)	208 V-1 Ø
Chemical Bldg.	Instantel NEG-10	10 Gallon	5 GPH @ 100° Rise	1250	120V-1 Ø

ELECTRIC WATER HEATER DIAGRAM
NO SCALE





PIPE PENETRATIONS WITH **SLEEVE** CAST IN PLACE
NO SCALE
(Alternate to Detail on Sheet D 8)



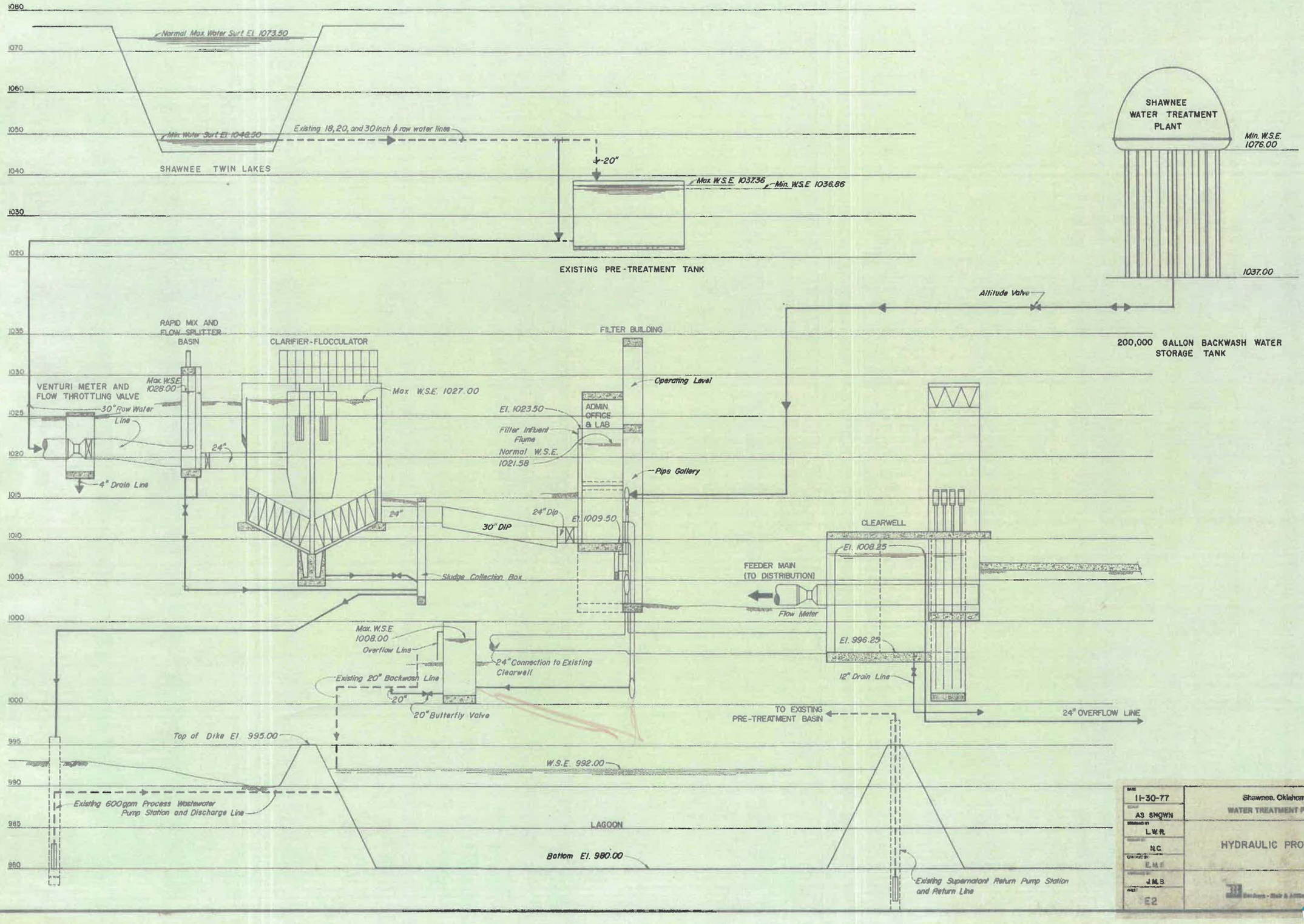
TYPICAL FLOOR DRAIN INSTALLATION DETAIL
NO SCALE

11-30-77	Shawnee, Oklahoma
AS NOTED	WATER TREATMENT PLANT
A.E.R.	
T.D.R.	PLUMBING DETAILS
T.G.	
J.M.S.	Bedford - Black & Veatch, Inc.
D 9	

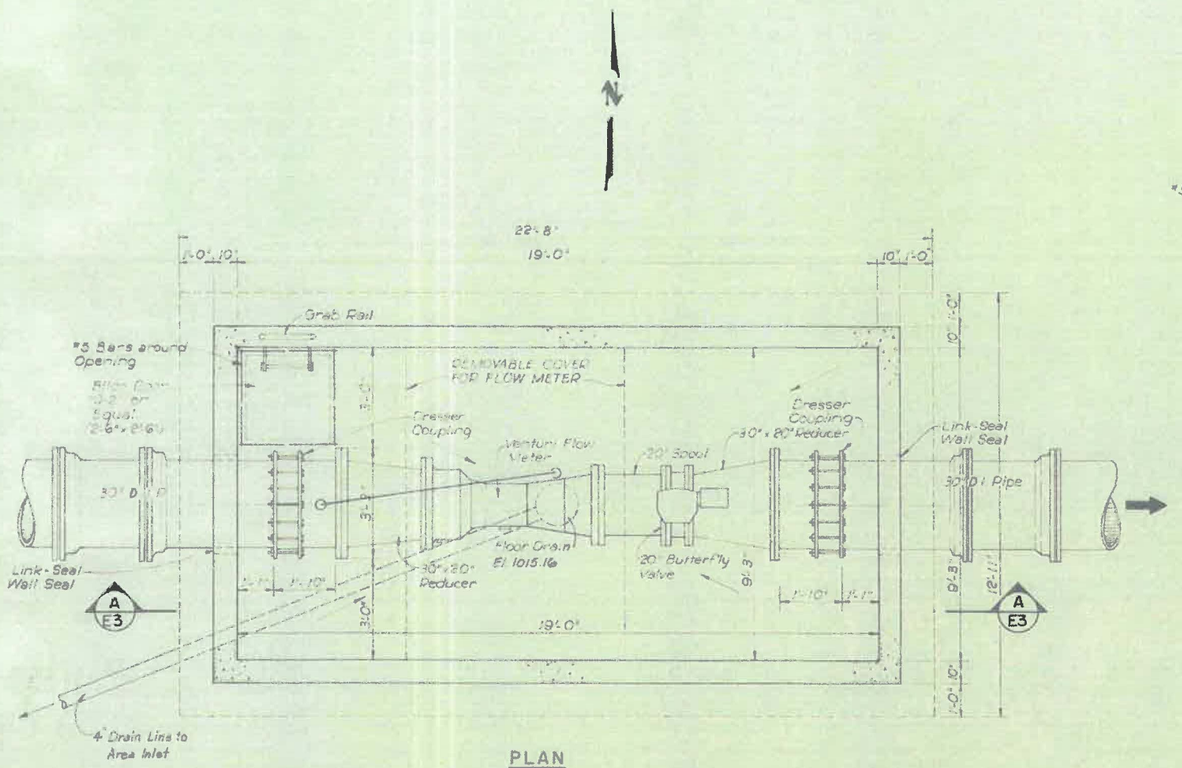
CHEMICAL BUILDING
Caustic Soda Tank
Liquid Alum Tank
Liquid Alum Tank
Future Alum Tank
Ton Chlorine Cylinders
Chlorine evaporator
Chlorinators
For Future Service
Pre-Chlorination Line
CARBON STORAGE TANK
Caustic Soda
Carbon
Alum
Chlorine
To Existing Chemical Building
To Pretreatment Basin
Polymer feed Lines to accomodate future polymer feed equipment
30" Raw Water Line
16" Connection to Existing Backwash Line
4" Chemical Building water supply Line
Altitude Valve Box
30x30x24 Tee for connection to future expansion
To Elevated Tank
To Distribution
Carbon
Chlorine
Alum
Caustic Soda
Polymer (future use)
Influent Meter
Throttling Valve
Effluent Flow Meter
CLARIFIER - FLOCCULATOR
Rapid Mix Basin
30" 30x24 Plugged Tee for connection of future Clarifier (Branch in vert position)
30" Filter Influent Line
Sludge Control Box
8" Drain Line
12" Sludge Blowoff Line
8" Sludge Blowoff Line
24"
Post-Chlorination Line
20" Backwash Water Supply Line
ADMIN. & LAB
4" Potable Water Line
24" Feeder Main
FILTER BUILDING
Connection to existing Clearwell
30x24 Reducer
PUMP STATION
1,000,000 gallon CLEARWELL
30" Backwash Waste Line
Plug
30x30x30 Plugged Tee (W Branch in vert position)
20" To Lagoon
20" Overflow Line
BACKWASH SURGE BASIN
To existing Process Wastewater Pump Station
24" Overflow Line
12" Clearwell Drain Line
CLARIFIER - FLOCCULATOR

11-30-77	Shattuck, Oklahoma
NO SCALE	WATER TREATMENT PLANT
	FLOW SCHEMATIC

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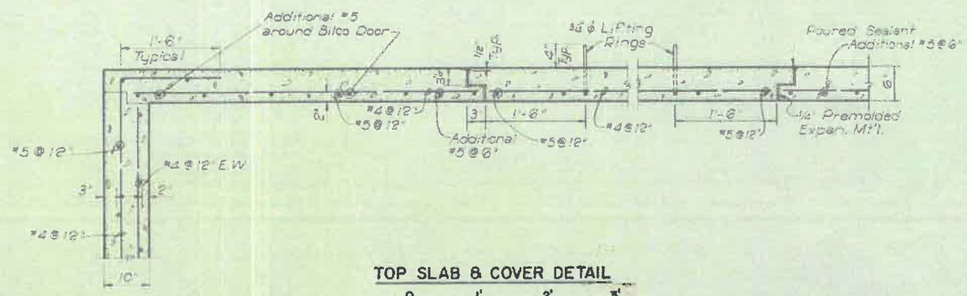


DATE 11-30-77	Shawnee, Oklahoma
SCALE AS SHOWN	WATER TREATMENT PLANT
DESIGNED BY L.W.R.	HYDRAULIC PROFILE
DRAWN BY N.C.	
CHECKED BY E.M.F.	
APPROVED J.M.B.	Burns - Blair & Affiliates, Inc.
SHEET E2	



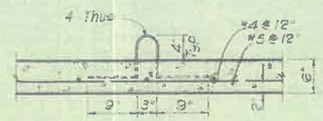
PLAN

1/2" = 1'-0"



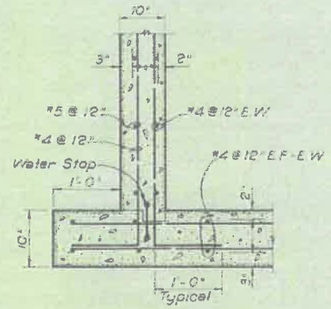
TOP SLAB & COVER DETAIL

1"=1' Scale 0 1' 2' 3' feet



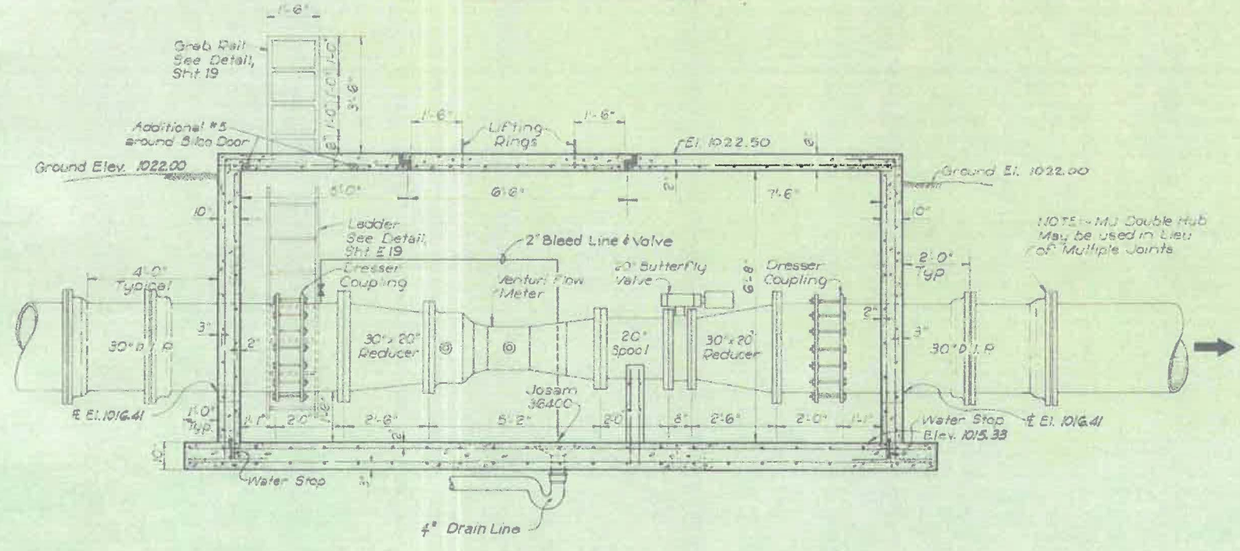
DETAIL OF LIFTING RINGS

1"=1' Scale 0 1' 2' 3' feet



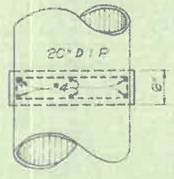
WALL & FOOTING DETAIL

1"=1' Scale 0 1' 2' 3' feet

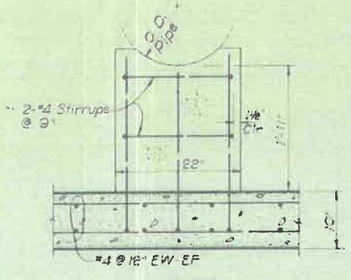


SECTION A-A

1/2" = 1'-0"



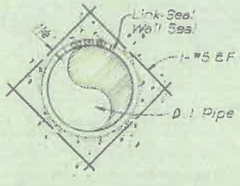
PLAN



ELEVATION

DETAIL PIPE SUPPORT

1"=1' Scale 0 1' 2' 3' feet

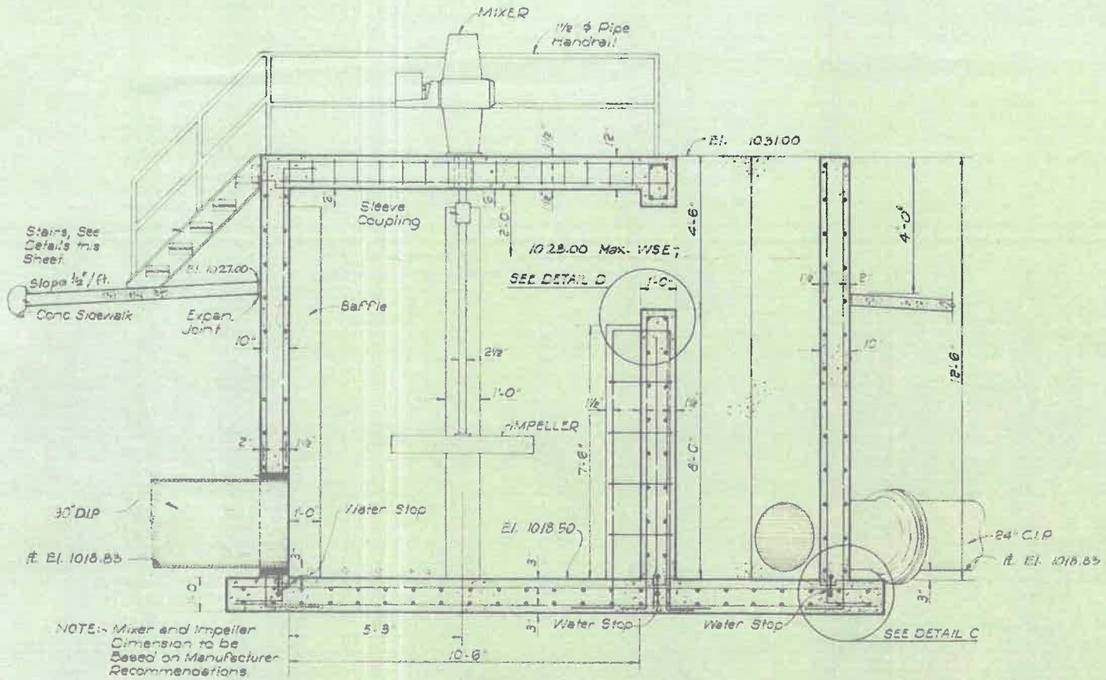


REINFORCING DETAIL AROUND WALL OPENING

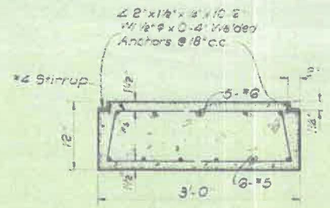
1/2" = 1'-0"

DATE 11-30-77	Shawnee, Oklahoma
SCALE AS SHOWN	WATER TREATMENT PLANT
DESIGNED BY L.W.R.	INFLUENT VALVE BOX
DRAWN BY H.L.H.	
CHECKED BY E.M.F.	
APPROVED BY J.M.B.	Burns - Blair & Associates, Inc.
SHEET E3	

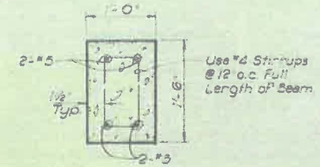
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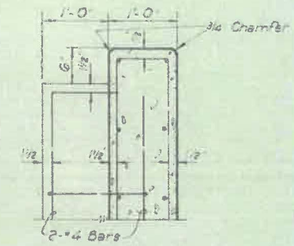
SECTION A-A



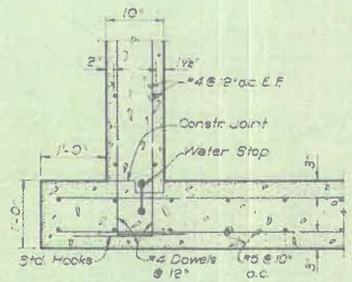
MIXER SUPPORT BEAM



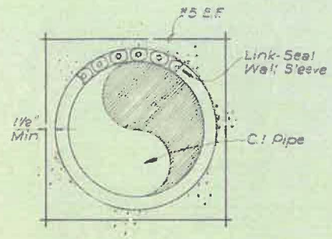
SECTION B-B



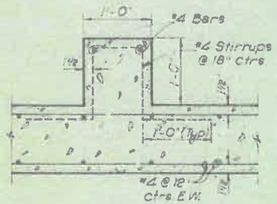
DETAIL D



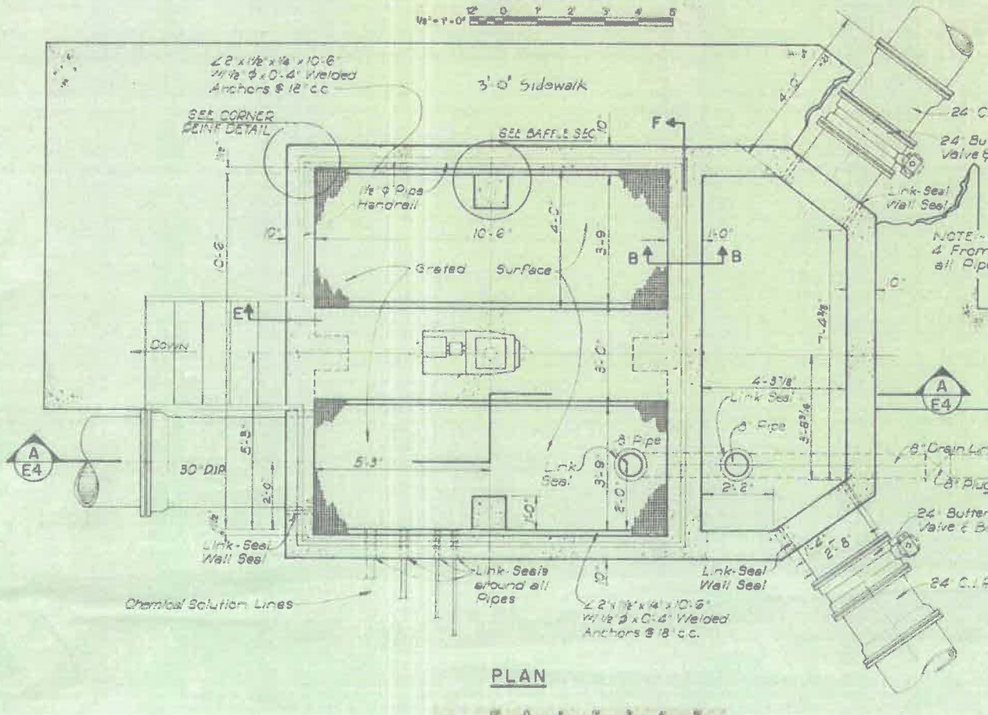
DETAIL C



TYPICAL OPENING

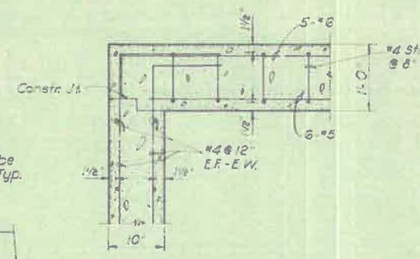


TYPICAL BAFFLE SECTION

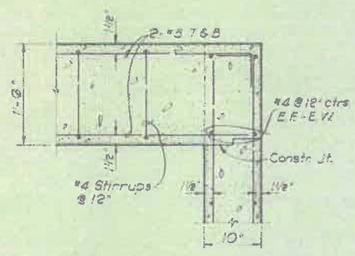


PLAN

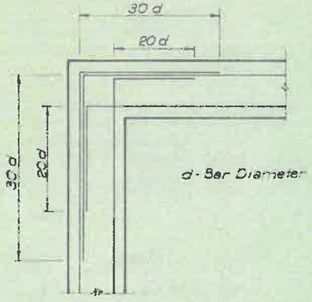
NOTE:-For Number and Size of Reinforcing Bars, See Details this Sheet.



END OF BEAM E

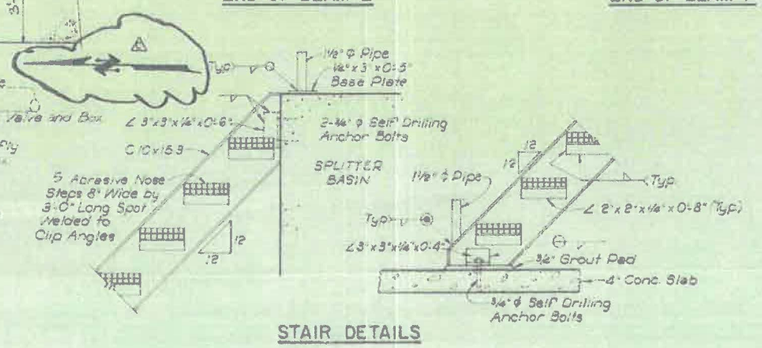


END OF BEAM F



TYPICAL CORNER REINFORCING DETAILS

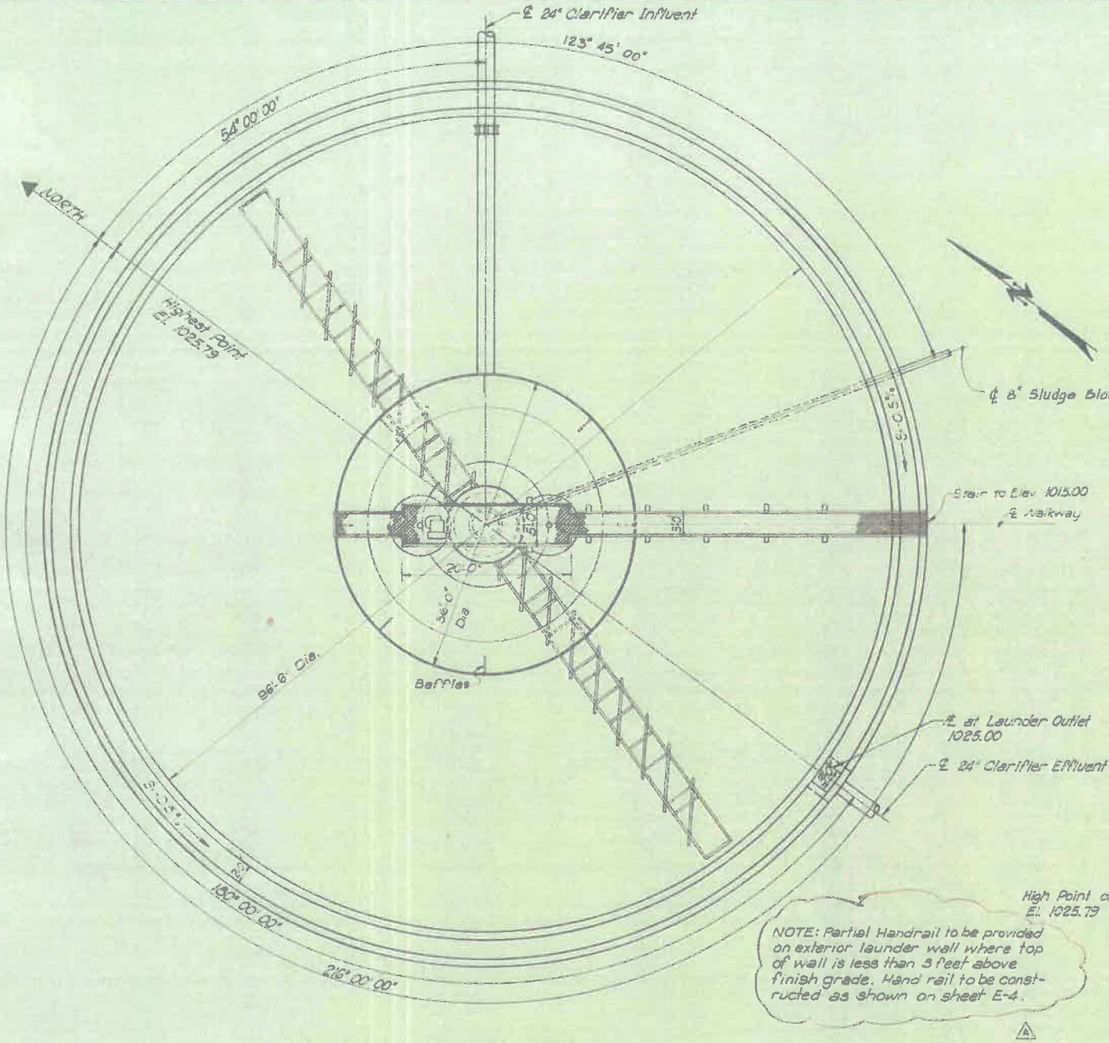
NOT TO SCALE



STAIR DETAILS

Feb. 10, 1978 Reorient North Arrow

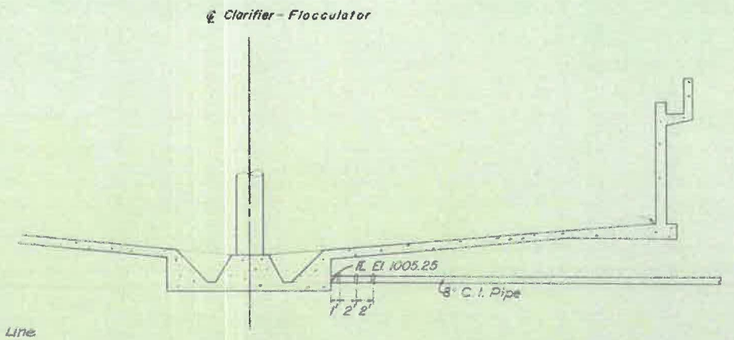
DATE 11-30-77	Shawnee, Oklahoma
SCALE AS SHOWN	WATER TREATMENT PLANT
DESIGNED BY L.W.B.	
DRAWN BY H.L.H.	RAPID MIX & FLOW SPLITTER BA
CHECKED BY E.M.F.	
APPROVED BY J.M.B.	Burgess - Blair & Associates, Inc.
SHEET E4	



NOTE: Partial Handrail to be provided on exterior launder wall where top of wall is less than 3 feet above finish grade. Hand rail to be constructed as shown on sheet E-4.

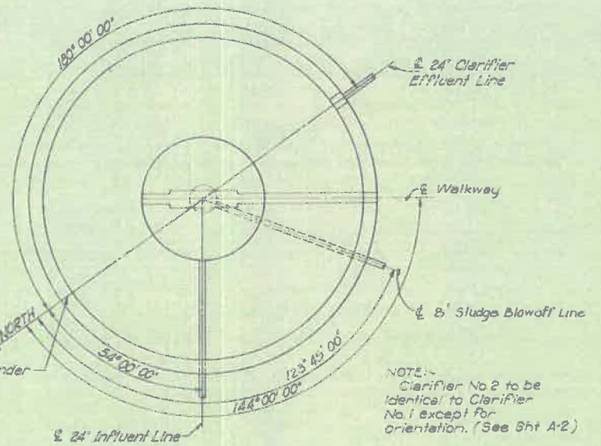
PLAN-CLARIFIER-FLOCCULATOR NO. 1

1/8" = 1'-0" 5' 0 5' 10' 15'



TYPICAL SLUDGE DRAIN CONNECTION

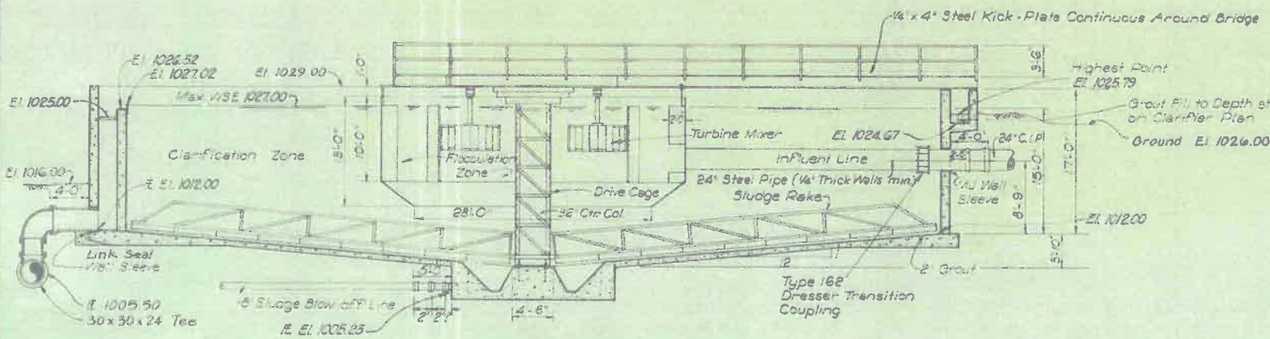
1/8" = 1'-0" 5' 0 5' 10' 15'



NOTE:- Clarifier No 2 to be identical to Clarifier No. 1 except for orientation. (See Sht A-2)

PLAN-CLARIFIER-FLOCCULATOR NO.2

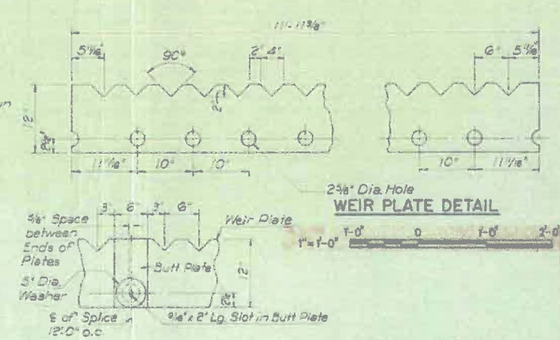
NOT TO SCALE



Note: Contractor to provide adequate support for 24" Steel Influent Line

LONGITUDINAL SECTION

1/8" = 1'-0" 5' 0 5' 10' 15'



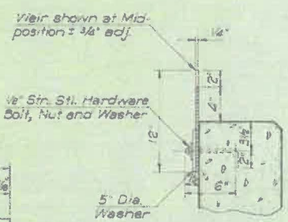
WEIR PLATE DETAIL

1"=1'-0" 1'-0" 0 1'-0" 2'-0"

WEIR SPLICE DETAIL

1"=1'-0" 1'-0" 0 1'-0" 2'-0"

⚠ Jan. 9, 1978 Add' Handrail Note.

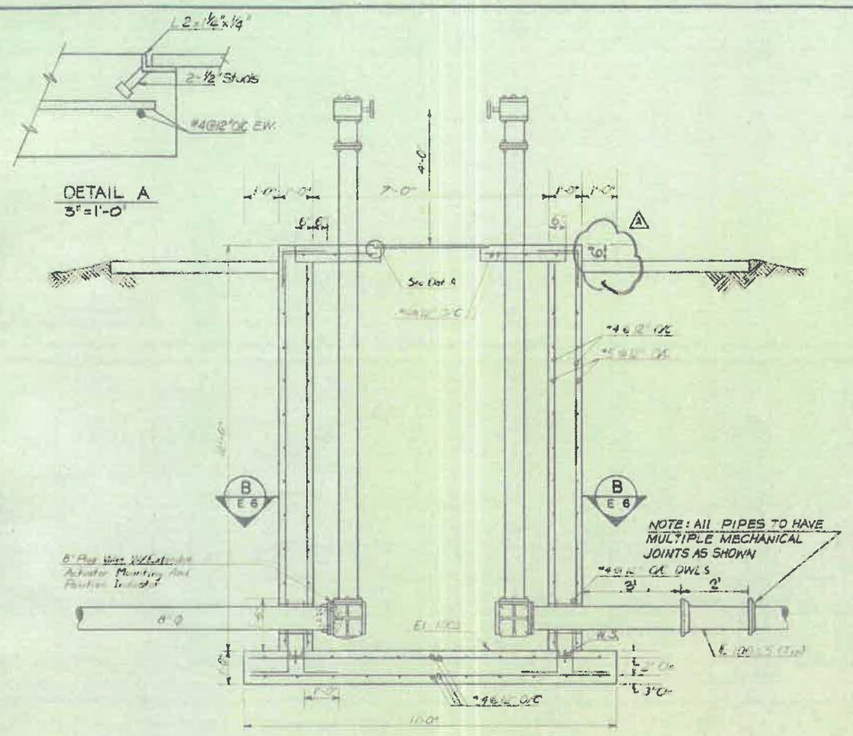


SECTION OF CLARIFIER WEIR

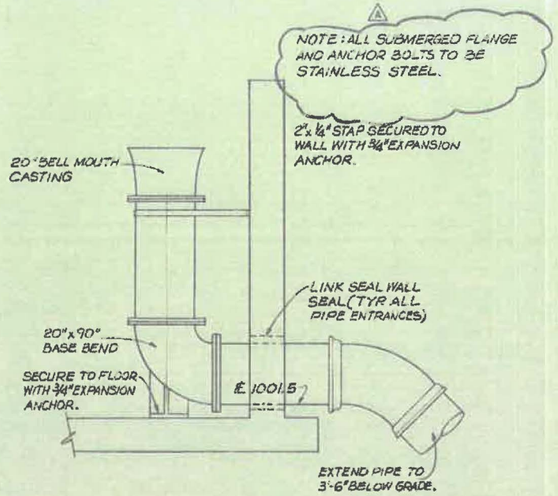
NOT TO SCALE

NOTE:- Weir Plates, Butt Plates and 5" Dia. Washers shall be Constructed of Steel. One Short Weir Section approx. 4'-6" Long will be required.

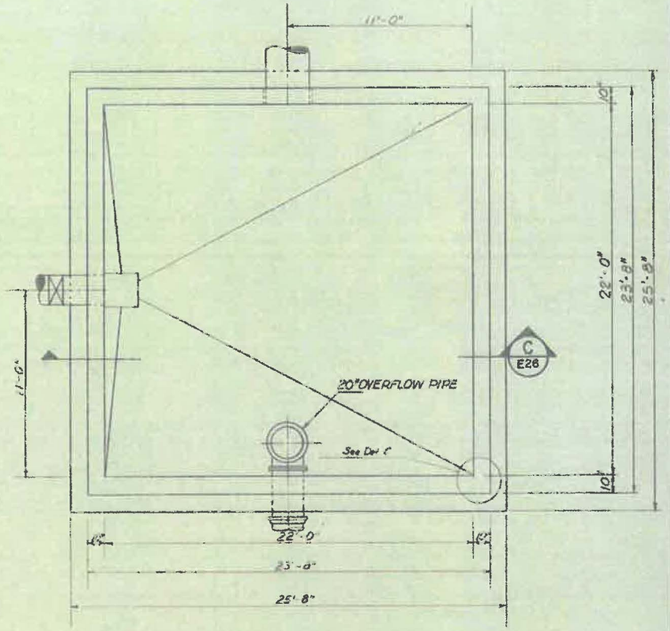
DATE 11-30-77	Shawnee, Oklahoma
SCALE AS SHOWN	WATER TREATMENT PLANT
DESIGNED BY L.W.R.	CLARIFIER - FLOCCULATOR PIPING AND EQUIPMENT
DRAWN BY K.L.H.	
CHECKED BY E.M.F.	
APPROVED BY J.M.B.	Burgess - Blair & Affiliates, Inc.
SHEET E5	



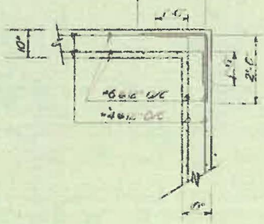
SECTION A E 6
1/2" = 1'-0"



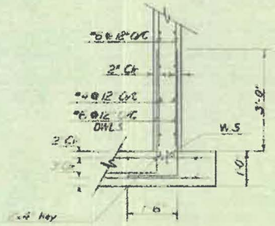
OVERFLOW PIPE DETAIL
SCALE: ½" = 1'-0"



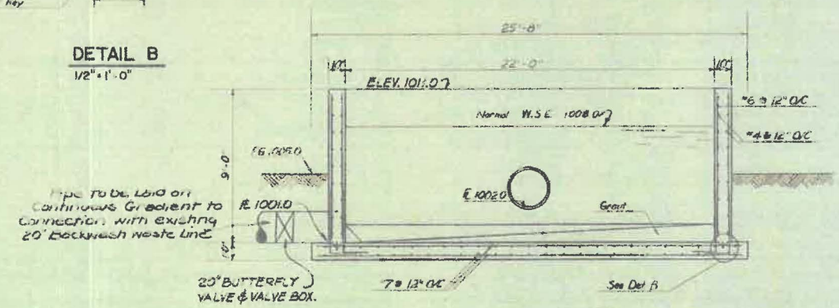
PLAN
1/4" = 1'-0"
BACKWASH SURGE BASIN



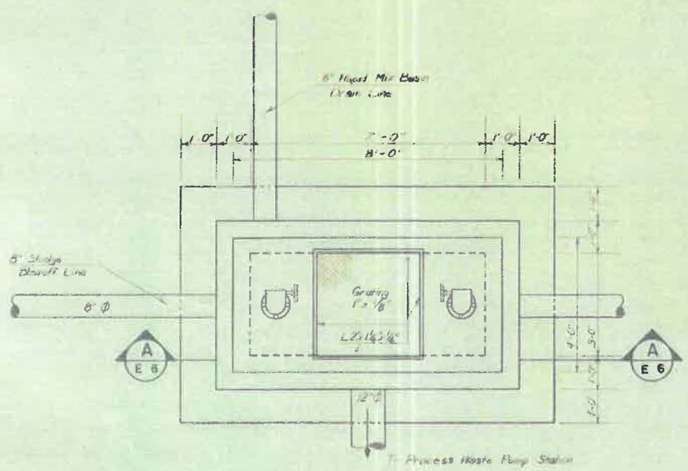
DETAIL C
1/2" = 1'-0"



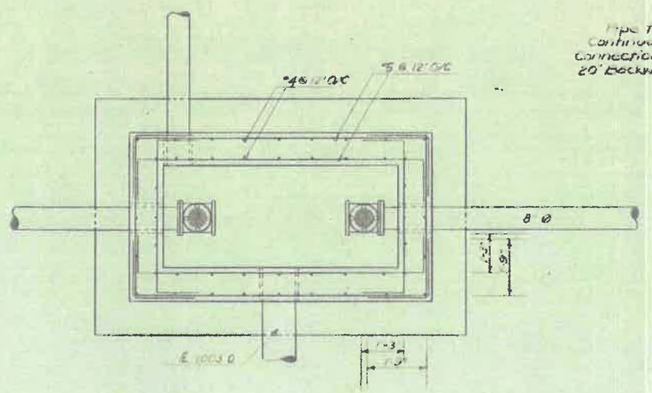
DETAIL B
1/2" = 1'-0"



SECTION C E 6
1/4" = 1'-0"



PLAN
1/2" = 1'-0"
SLUDGE CONTROL BOX



SECTION B E 6
1/2" = 1'-0"

⚠ Jan. 9, 1978 Add Dimensions and SS Bolt Note.

GRAPHIC SCALE
8"=1'-0"

DATE	11-30-77
SCALE	AS SHOWN
DESIGNED	LWR & JTB
DRAWN	ODB
CHECKED	EMF
APPROVED	JMB
JOB NO.	E 8

Shawnee, Oklahoma
WATER TREATMENT PLANT
SLUDGE CONTROL BOX
BACKWASH SURGE BASIN
Bennett · Black & Associates, Inc.

FIRST FLOOR PLAN

NOTE: All submerged, flanged Valves and Fittings to have Stainless Steel bolts.

NOTE:- Extend Compressed Air Line to Filter Influent Valve Operators. Provide Air Pressure Requiator (Outlet Pressure 80 psi) at all Application Points throughout the Plant.

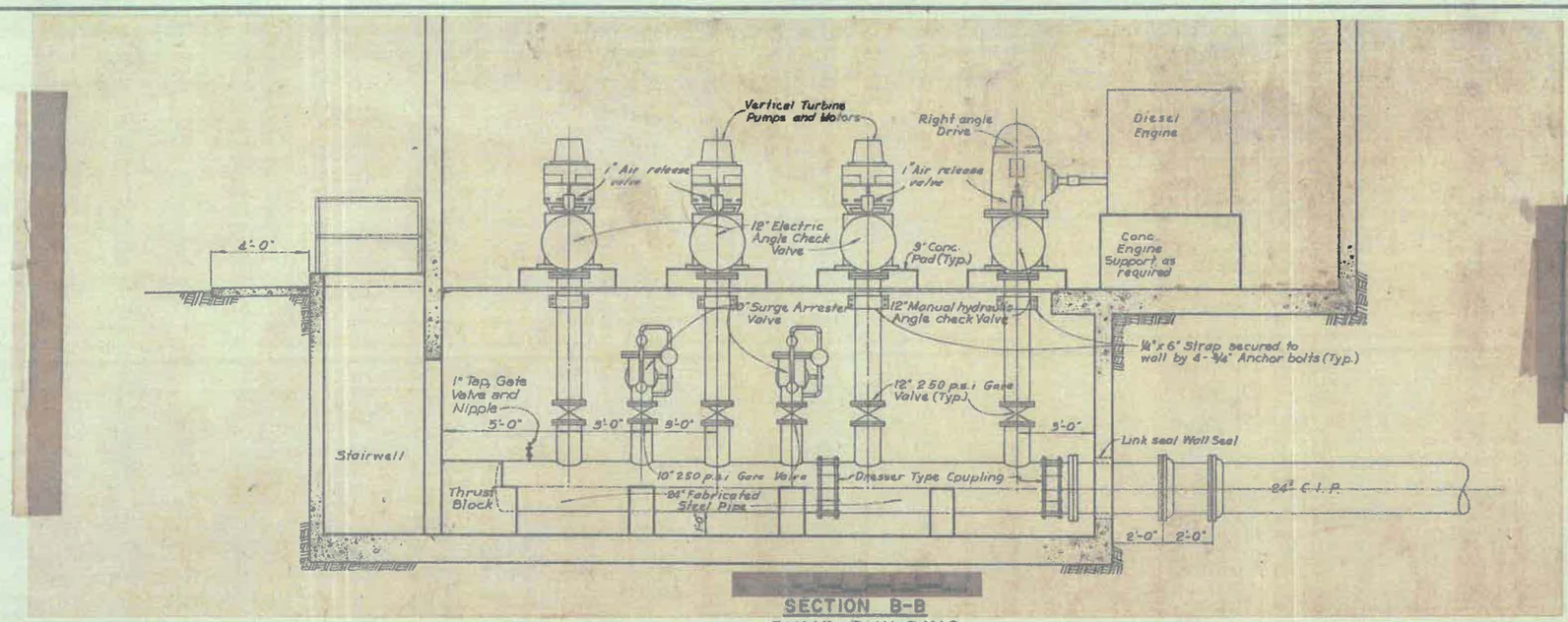
NOTE: Contractor to Provide Calgon Feed System as Manufactured by Calgon Corp. (Chemonitor NP-2 Feed System), Wallace & Tiernan (44-147 Standard System), or Equal. System is to include 55 gal. Solution Tank w/95 Dissolver Basket, 10-125 gpd cap. Metering Pump w/SCR Drive, Strainer and Pressure Relief Valve, and ¼ HP Mechanical Mixer

23'-3½"
39'-6"
30" Plug
5'-0"
10'-0"
3'-0"
30 x 30 x 24 Tea
30" ϕ Clarified Water Line
24" Butterfly Valve
Provide ¼" Checkered Plate Cover
6" Gate Valves @ El. 1010.00
Link Seal Wall-Seal (TYP.)
24" Butterfly Valve
20" Backwash Water Line
Link Seal Wall Seal
24" Butterfly Valve w/Extended Waterproof Bonnet
24 Flanged Wall Pipe @ El. 1013.00
Filter Influent Flume
2'-0" Typ
Elev 1002.25
Dresser Coupling
20"x 18" Reducer
Backwash rate control with 14" Ball Valve
14"x 20" Increaser
Concrete Pipe Support
Air and Vacuum Valve
20"-90° Base Bend
10'-0"
Link Seal Wall Seal (Typ.)
Gullet
Wash Troughs (Typical)
Filter Underdrain Flume
* NOTE: Exact Dimensions and Location of Underdrain Flume to be based on Underdrain Manufactures Recommendations
El. 1010.00 (TYP.)
18" Filter Influent Butterfly Valve. See Detail Sh. E9
1'-6" 2'-11⅝"
5'-10⅛"
1'-6"
5'-10⅛"
29'-6"
1'-6"
5'-10⅛"
1'-6"
2'-11⅝"
9'-0"
Air Wash Blower
See Drawing 36 for Continuation
6" Filter Inlet D.I.P.
4" Concrete Base
6" D.I.P.
1" Compressed Air Line
Fluoride Feeder (see detail Sht. E9)
2'-0"
1½" Water Line
1½" Gate Valve
Clayton 95 E6 01CS Pressure reducing and Solenoid Valve
Ejector Pump (Peristaltic Type LM ¼" Or Equal)
2" Water Line (Above)
Strainer 0-150 psi
Pressure Gage
Frame or Wall Mounted Rotameters Air Compressor
2" Calgon Discharge Line
Calgon Feeder (connect overflow line to floor drain)
¾" Water Line
1½" Fluoride Ejector Discharge
4" Water Line (Above)
Compressed Air Dryer
Compressed Air Filters
6" Air Wash D.I.P.
½" Instrument Air Line (Above)
90° Base Bend mounted on 1'x1'x2' Conc. Base
4" backflow Preventer
1" Compressed Air Line
Elev 1002.25
16'-0" Overhead Door
From Distribution Main
20" Blind Flange
7'-6"
A E6
1½" Fluoride Line tapped to 24" Filtered Water Line
Drosser Coupling (Typical)
90° Butterfly Valve (Typical)
Pipe Hanger (Typ.) See Det. Sh. E19
Calgon Application Point Tap w/1½ Corporation Cock
1½" P.V.C Ejector Discharge Line
2" Gate Valve
Strainer
0-150 psi Pressure Gage
2" Ejector
2" Clayton 93 E6 01CS Pressure reducing & Solenoid Shut off valve
Elev 1002.25
1¼" Chlorine Ejector Suction Line (Post Chlorination)
Filter Effluent Rate Controller
30" Backwash Drain Line
Link-Seal Wall Seal (TYP.)
3'-0"
14'-9"
20" Backwash Line
2" Water Line (Above)
30" Filtered Water Line
Sample Pump Piped to Laboratory See Sh.
Conc. Pad
1" Copper Sample Line Tap to filter effluent line 3' from clearwell Min. Cover 3'-0"
Note: Slope Floors in all Buildings to Floor drains

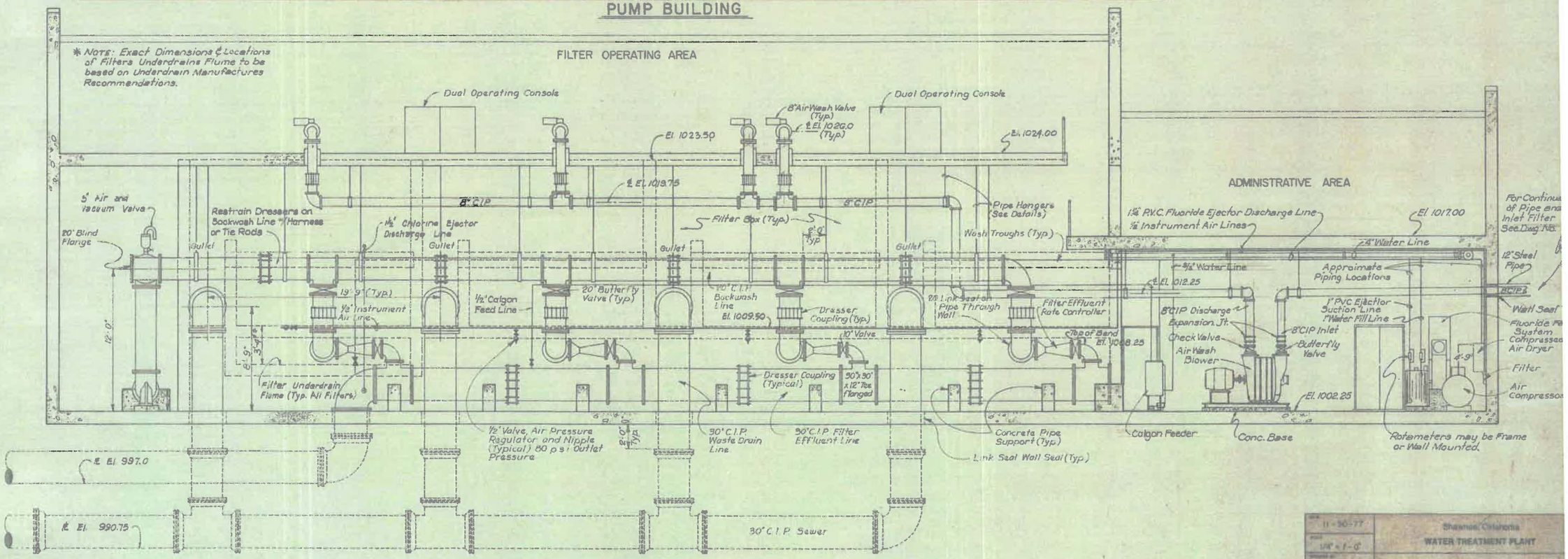
11-30-17	Shidler, Oklahoma
1/4" = 1'-0"	WATER TREATMENT PLANT
L.W.N.	FILTER BUILDING PIPING PLAN
W.G.S.	
E.M.F.	
J.M.S.	
E7	

18

1017 WT
F-2 of 23
4/17

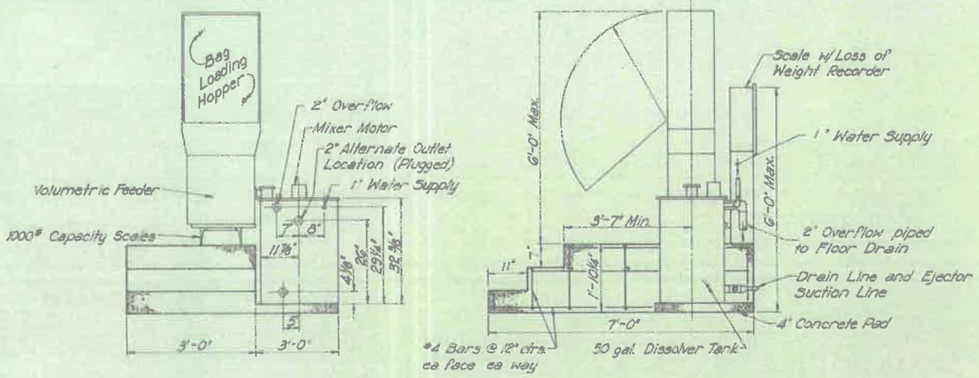


SECTION B-B
PUMP BUILDING



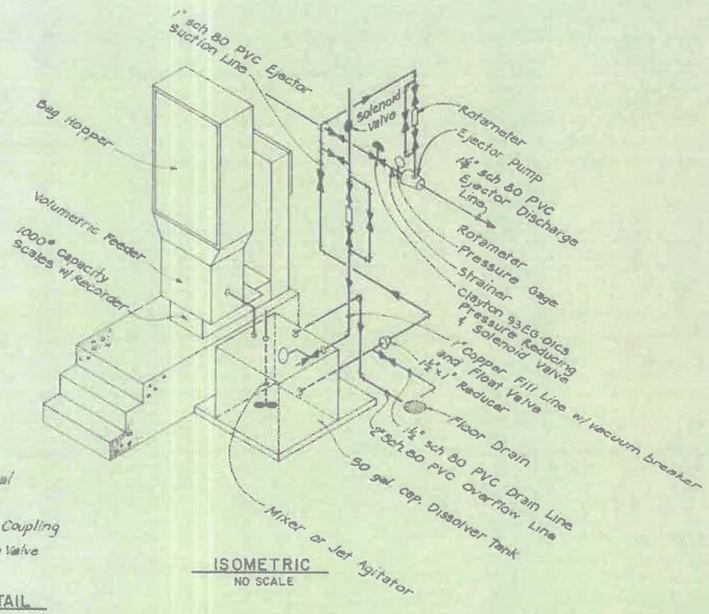
SECTION A-A
FILTER BUILDING

11-30-77	Shawnee, Oklahoma
1/4" = 1'-0"	WATER TREATMENT PLANT
L.W.R.	FILTER BUILDING AND PUMP BUILDING SECTIONS
E.S.H.	
E.M.E.	
J.M.S.	
E.B.	



FLUORIDE FEEDER DETAIL

NO SCALE

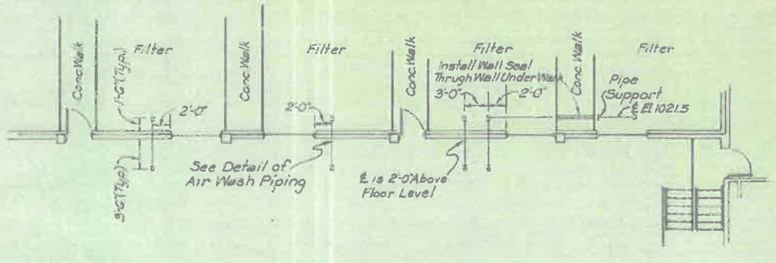


ISOMETRIC

NO SCALE

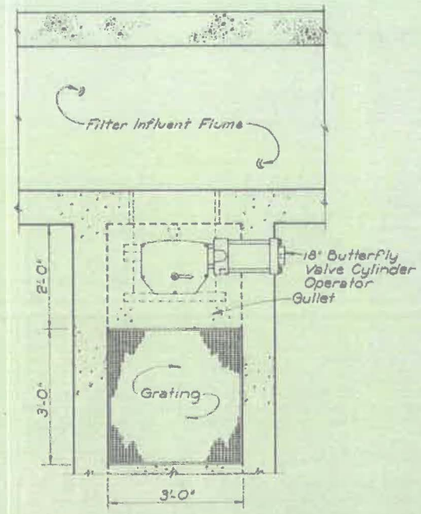
AIR WASH PIPING DETAIL

1/4" = 1'-0"

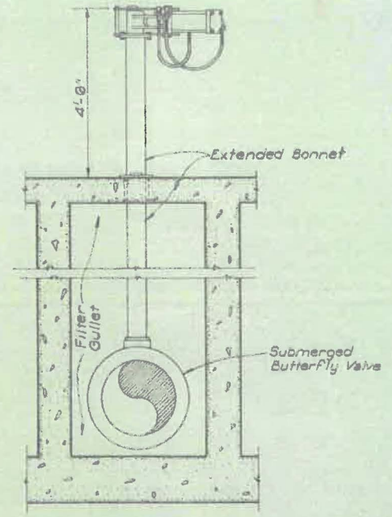


OPERATING LEVEL AIR WASH PIPING LOCATION

1/8" = 1'-0"



PLAN

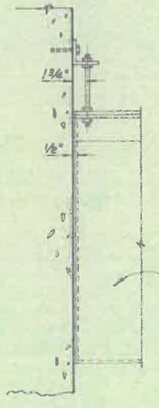


ELEVATION

FILTER INFLUENT VALVE DETAIL

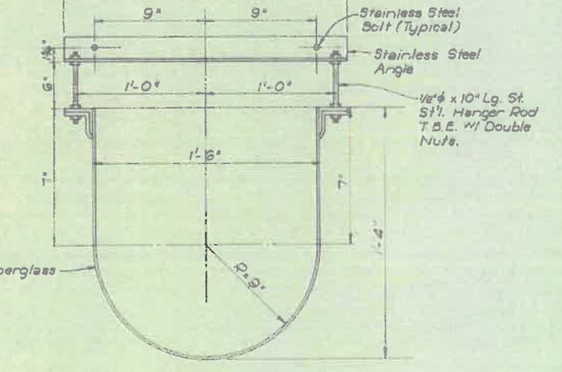
NO SCALE

Note: Trough Bottom to be set not more than 12" above unexpanded media



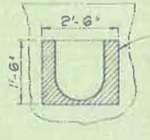
SIDE VIEW

NO SCALE



SECTION THRU WASH TROUGH

NO SCALE

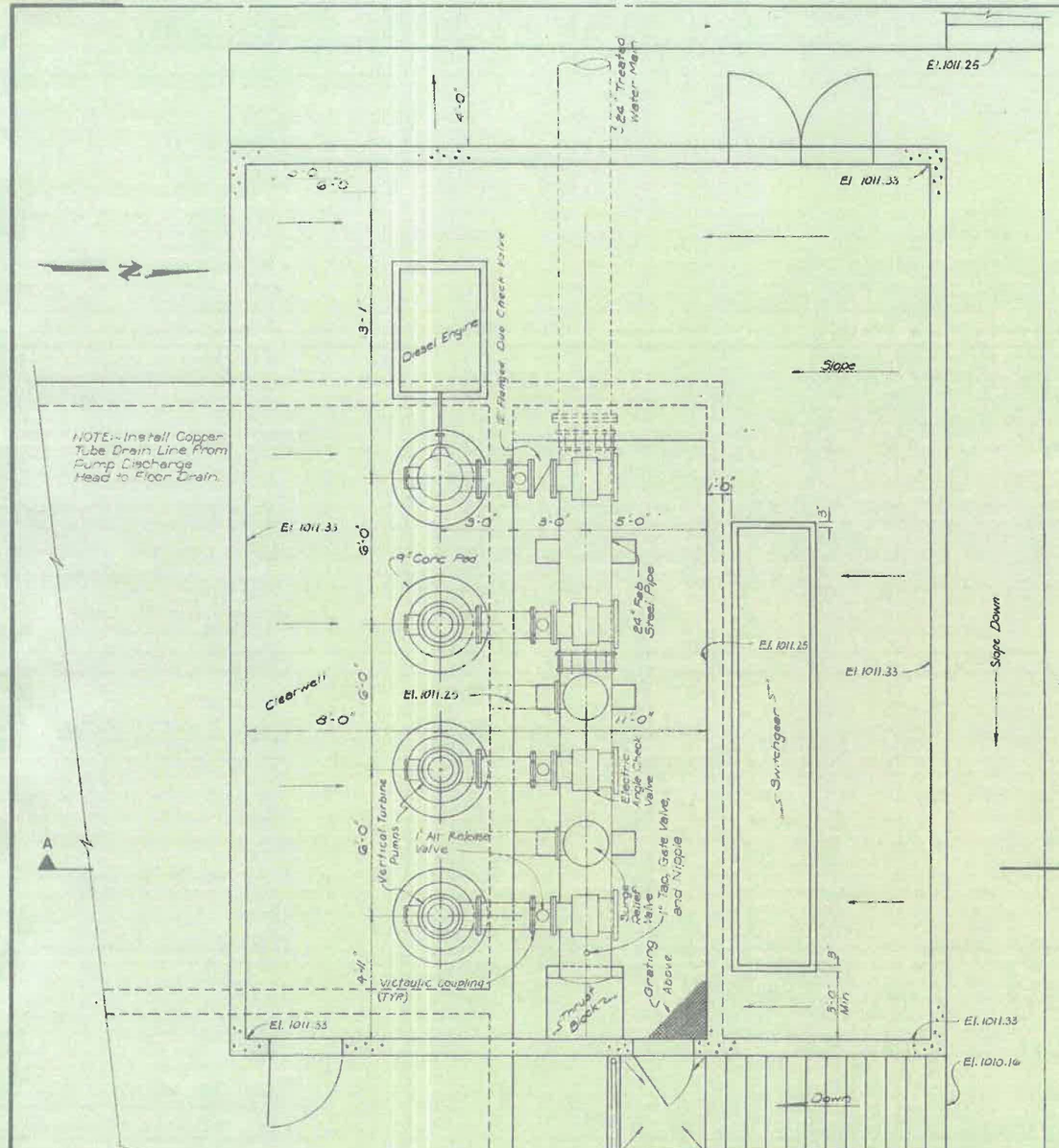


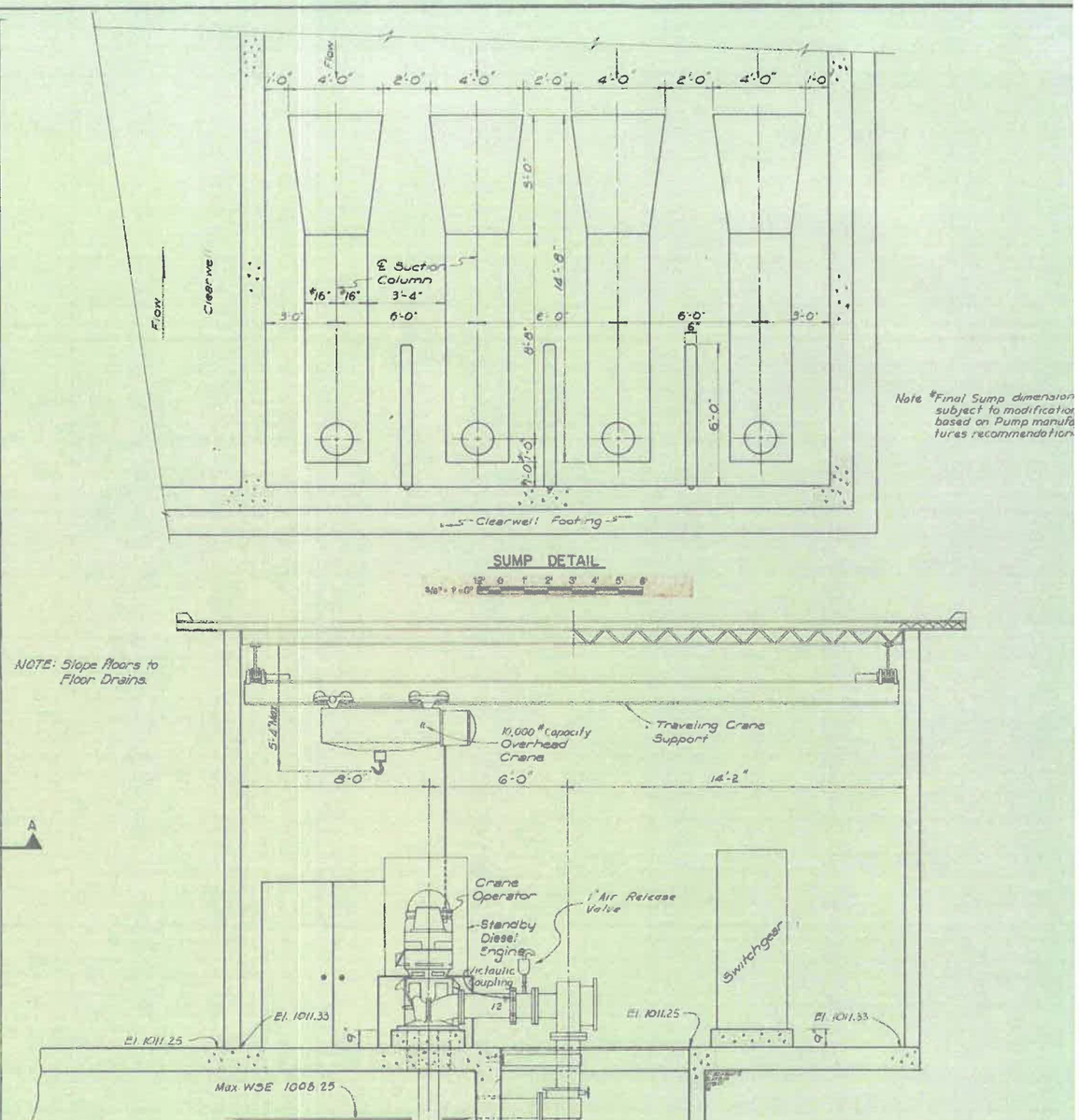
GROUT DETAIL

NO SCALE

DATE 11-30-77	Shawnee, Oklahoma
SCALE NO SCALE	WATER TREATMENT PLANT
DESIGNED BY L.W.R.	FILTER BUILDING DETAILS
DRAWN BY H.L.H.	
CHECKED BY E.M.P.	
APPROVED BY J.M.B.	
SHEET E9	Benham - Blair & Affiliates, Inc.

1017 WT FM 823 1X7



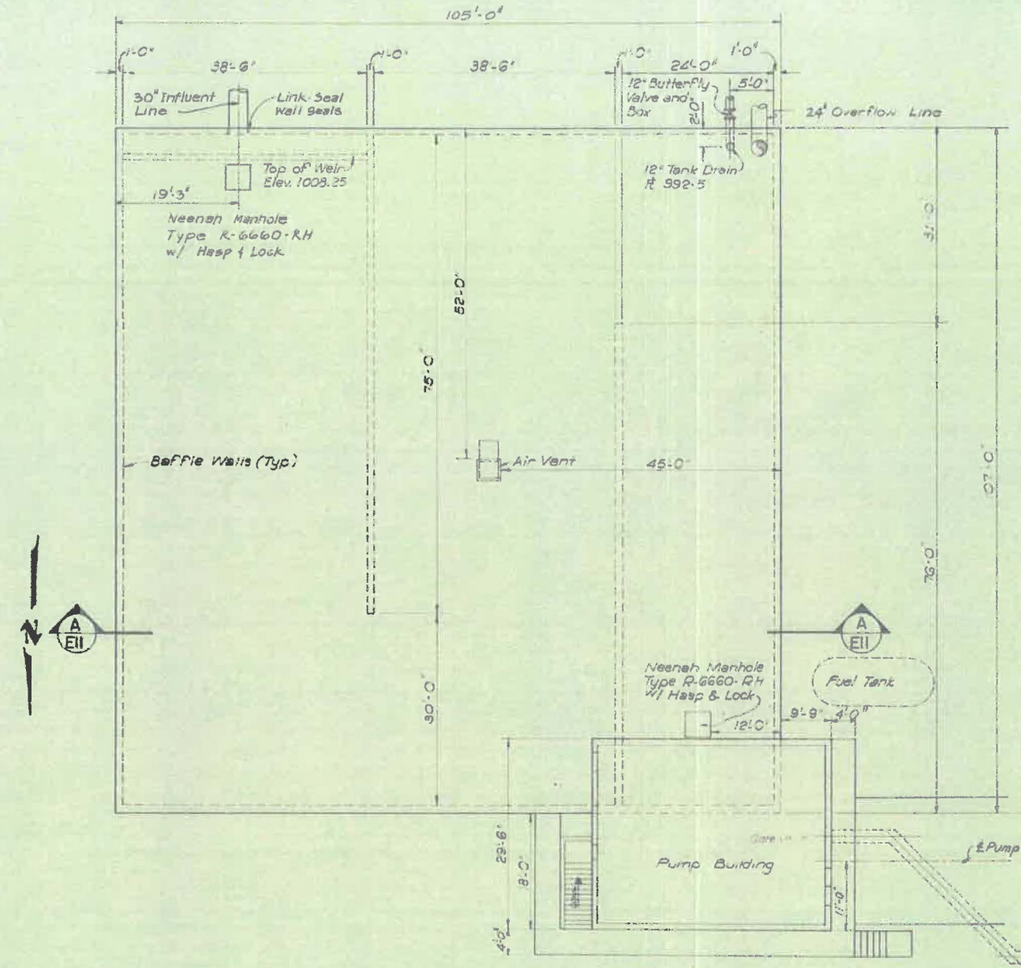


DATE	11-30-77
SCALE	AS SHOWN
DESIGNED BY	V.K.
DRAWN BY	R.K.T.
CHECKED BY	L.W.R.
APPROVED BY	J.M.B.
SHEET	E10

Shawnee, Oklahoma
WATER TREATMENT PLANT

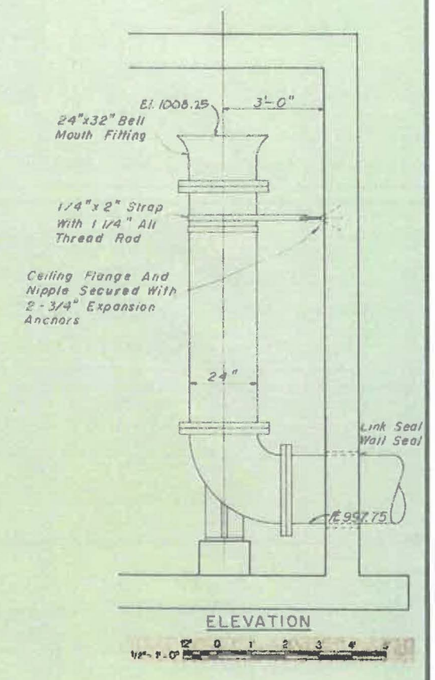
PUMP BUILDING

Burgess - Blair & Williams, Inc.



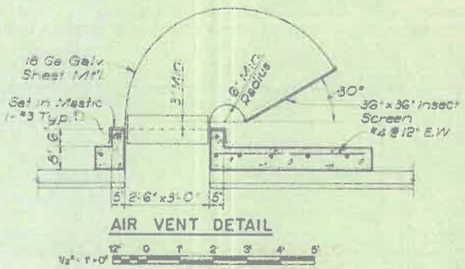
PLAN

3/32"=1'-0"



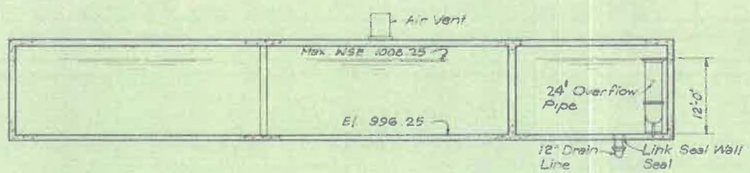
ELEVATION

1/2"= 1'-0"



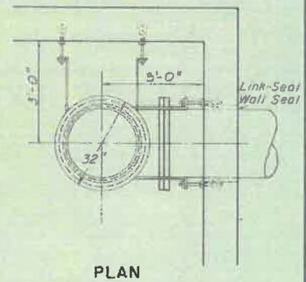
AIR VENT DETAIL

1/2"= 1'-0"



SECTION A-A

3/32"=1'-0"



PLAN

OVERFLOW PIPE DETAIL

1/2"= 1'-0"

DATE 11-30-77	Shawnee, Oklahoma
SCALE AS SHOWN	WATER TREATMENT PLANT
DESIGNED BY L.W.R.	CLEARWELL
DRAWN BY H.L.H.	
CHECKED BY E.M.F.	
APPROVED BY J.M.B.	Bowman - Black & Associates, Inc.
SHEET E11	

18

NOTE:- Pressure Relief Line Discharge to be visible to Operator

1" Air Line

Pressure Gauge

Rotameter

Blind Flange

1/2" Carbon Suction Line

4'-6" Max.

FUTURE ALUM TANK

ALUM TANK

ALUM TANK

Transparent Splash Guard

CAUSTIC SODA TANK

Link Seal Wall Seal

5'-8 1/2"

2'-0"

2'-7 1/2"

4'-0"

Valve & Strainer

4" Conc. Pad

Grate

SECTION A-A

1/4"=1'-0"

Dilution Water Rotameters

0-150 psi Pressure Gauges

3/4" Lines to Caustic Soda Metering Pumps

3/4" Gate Valves

Valves

3/4" Pressure Regulators

Solenoid Valves

3/4" Gate Valves

3/4" Pipe

1/2" Pipe

Conc. Floor

5'-0"

4'-3"

ROTAMETER DETAILS

3/4" Copper Air Line

El. 1036.29

1" Copper Air Line

Bot El 1034.94

El. 1036.25

6" Min (Typ.)

NOTE:- Contractor to provide adequate Unions and Compressed Air Connectors to facilitate Chemical Transfer to Storage Tanks.

El. 1036.25

El. 1036.21

Drainage Trenches

4'-0"

4'-0"

7'-7"

NOTE:- Piping on this Sheet indicates General Relationship between Piping and Equipment. See also Detailed Chlorination Piping Isometric, Dwg. No. E-14 and Chemical Piping Isometric, Dwg. No. E-13.

CARBON SLURRY STORAGE TANK

1" Automatic Flow Proportioning Meter and Valve.

El. 1036.35

FUTURE ALUM. TANK

ALUM. TANK

ALUM. TANK

CAUSTIC SODA TANK

Manways (Typ.) 28" O.D.

Slope - 0.88 %

Top of Grate El. 1036.17

Slope - 0.88 %

Top of Grate El. 1036.12

9 Saddles

10'-5"

El. 1036.33

1" Carbon Tank Fill Line

Vent & Overflow Pipe. Connect to Drain Trench through Grate.

Bot. El 1034.67

Josam Floor Drain #31706

Bot. El. 1034.67

Flat

2'-0"

6" Drain Line

Josam Floor Drain #38694

4" Drain Line

El. 1036.42

Top of Grate El. 1036.42

1/16"

Slope - 0.88%

NOTE: All Drains to have Integral Traps. Slope Floors to Drains.

Meter Pumps

Bot. El. 1034.17

3" C.I.P. (Above)

1/4" Carbon Suction Lines

Link-Seal Wall Seals (Typ.)

A E19

Ejector Pumps

Trench Bottom El. 1034.69

Air Compressor

El. 1036.52

Gas Mask Storage

El. 1036.48

Checker Plate

Emergency Shower & Eye Wash

El. 1036.42

El. 1036.33

Provide 4-3" Dia. Plugged Holes in Wall for Future Lines

Chemical Feed Lines Extend 1 1/2" P.V.C. Polymer Feed Lines Thru Wall and Plug Inside Building

80'-0"

FLOOR PLAN

1/4"=1'-0"

El. 1036.48

El. 1036.52

Reserve Chlorine Cylinders

Monorail

Josam Floor Drain #31704

El. 1036.33

Scales

Rotameters See Detail this Sheet

Chlorine Detector

Cle Gas Header, See Detail Sht. E 15

13'-6"

6'-8"

7'-0"

2'-6"

11'-4"

5'-4"

7'-8"

12'-0"

7'-4"

3'-6"

El. 1036.52

Trench Bottom El. 1034.86

3" Backflow Preventer

4"x 3" Reducer

Ejector

El. 1036.52 Link-Seal Wall Seals (Typ.)

4" Treated Water Line

2" Ejector Discharge Line

Trench Bottom El. 1035.0

Top of Grate El. 1036.36

Chlorinators

1/4" Chlorine, Ejector Supply Lines Provide Plugged 3" Dia. Holes in Trench Wall For 2 Future Lines

A E19

El. 1036.48

Evaporator

Josam Floor Drain #38694

El. 1036.52

Chlorine Detector

Chlorine Vent Lines

4" Drain Pipe

Finished Floor

5" Grated Pit

3"

Conc. Base

11"

2'-0"

1"

11"

NOTE:- Exact Dimension of Motor Support Plate to be determined by Pump Manufacturer.

PLAN

Meter Pump

1/4 HP Motor

1/4" Steel Plate (Exact Size to be Determined by Pump Manufacturer)

SCR Control Center

3'-0"

1/4"x 3"x 3" Steel Tube

1/2"ϕ Expan Anchor 4 Thus

1/2" Steel Plate

6"

1'-10"

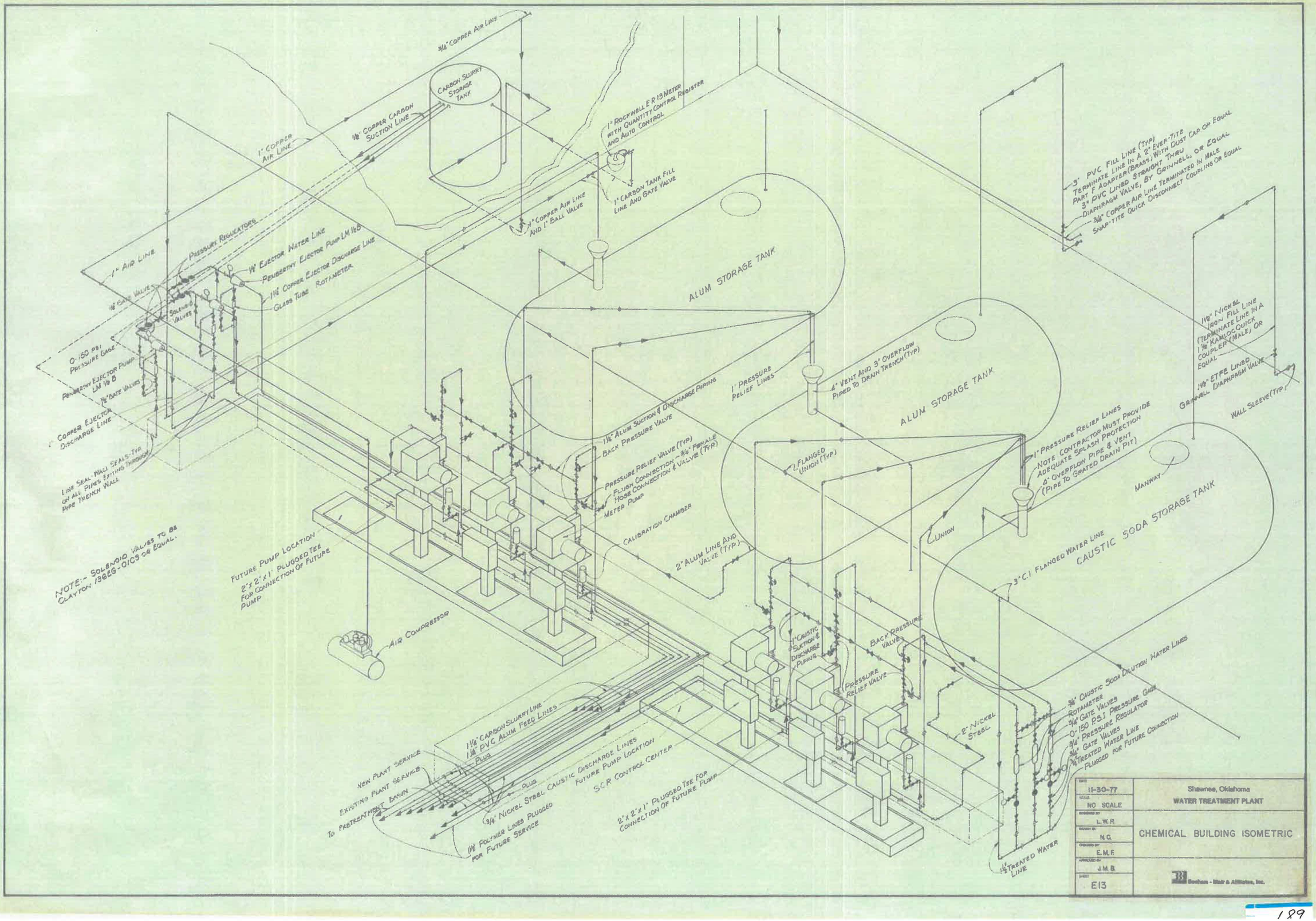
ELEVATION

METER PUMP STAND DETAIL

DATE 11-30-77	Shawnee, Oklahoma
SCALE AS SHOWN	WATER TREATMENT PLANT
DESIGNED BY L.W.R.	GENERAL PLAN
DRAWN BY H.L.H.	CHEMICAL BUILDING
CHECKED BY E.M.F.	
APPROVED BY J.M.B.	Burns & McDonnell Engineering Co., Inc.
SHEET E12	

1017 WT

18



DATE 11-30-77	Shawnee, Oklahoma WATER TREATMENT PLANT
SCALE NO SCALE	
DESIGNED BY L.W.R.	CHEMICAL BUILDING ISOMETRIC
DRAWN BY N.G.	
CHECKED BY E.M.E.	
APPROVED BY J.M.B.	Burns - Blair & Affiliates, Inc.
SHEET E13	

1" Sch. 80 PVC Pipe Vent to Exterior

Diaphram Protected Pressure Gauge High & Low Pressure Alarm

Electric Shut-off & Pressure Reducing Valve

Filter

Pressure Gauge

Drip Leg

Chlorine Evaporator

1" Sch. 80 Seamless Steel Pipe

Continuous Gradient

Expansion Chamber

1" Sch. 80 Seamless Steel Pipe

1" Drain and Overflow Pipe

¾" Water Supply line

Continuous Gradient

1" Schedule 80 Seamless Steel Pipe.

¾" Schedule 80 Seamless Steel Pipe

¾" Strainer (Typ.)

1" Schedule 80 Seamless Steel Pipe

¾" Sch. 80 PVC Vent Pipe

1" Sch. 80 PVC Vent Pipe

Install 1000 lb/Day Rotameter

Install 500 lb/Day Rotameter

Exterior Vent and Screen

Chlorinators

1/4" PVC Hose Shank Coupler and Cap or Equal (Typ.)

NOTE:- Contractor to Provide Suitable, Flexible Teflon Tube and Connectors to Facilitate Inter-Connection between Chlorinators and Ejector Suction Lines.

3" Backflow Preventer

1¼" Over Flow line

Ejector Assembly See Detail Sht E16

Grated Pit

Pressure Gauge

2" Strainer

2" Clayton 3326 OICS Pressure Reducing & Solenoid Shutoff Valve

1¼" Sch. 80 PVC Ejector Suction Line

4" x 3" reducer

EJECTOR SUCTION LINES
Existing Plant (Pre-Chlorination)
To New Plant (Post-Chlorination)
To Pretreatment Basin (Pre-chlorination)

2" Sch. 80 PVC Ejector Solution Line to New Plant (Pre-Chlorination)

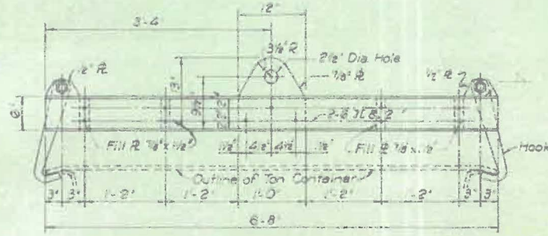
2" Sch. 80 PVC Ejector Water Supply Line

4" Treated Water Line

Header

Ton Chlorine Cylinders

11-30-77	Shawnee, Oklahoma
NO SCALE	WATER TREATMENT PLANT
L.W.R.	CHLORINATION PIPING ISOMETRIC
H.L.H.	
E.M.F.	
J.M.B.	Benham - Blair & Affiliates, Inc.
E14	

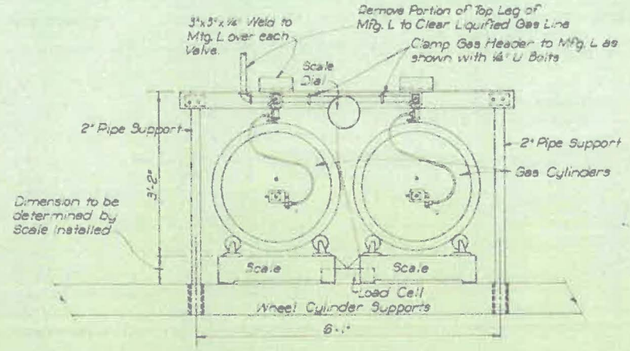


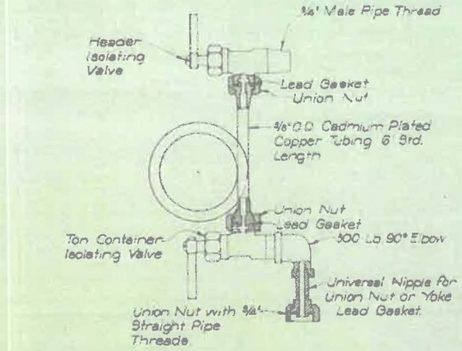
SLING BEAM & HOOK FOR TON CONTAINERS

No Scale

(Shall be equal to Man-Saver Industries Style 1118)

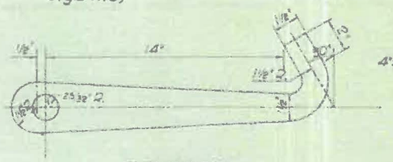
NOTE - All Bolts Not Otherwise Designated are 3/4" ϕ





FLEXIBLE TON CONTAINER CONNECTOR

No Scale



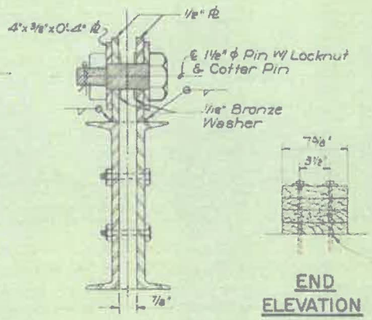
ELEVATION



PLAN

HOOK DETAIL

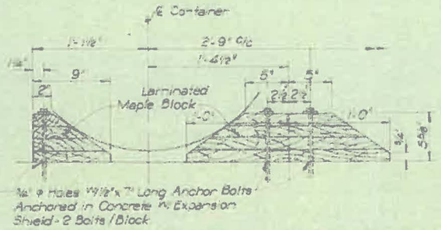
No Scale



END

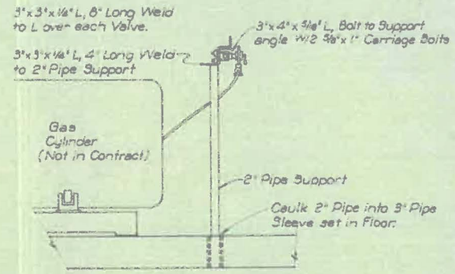
No Scale

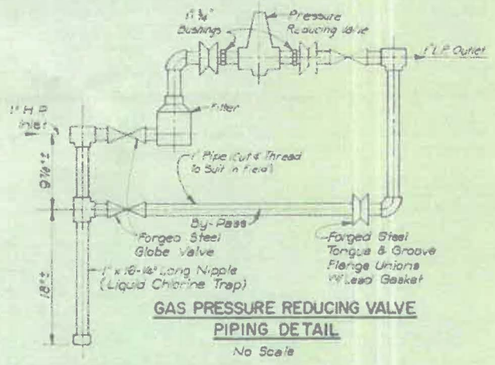
END ELEVATION END BLOCK



CRADLE BLOCK DETAIL

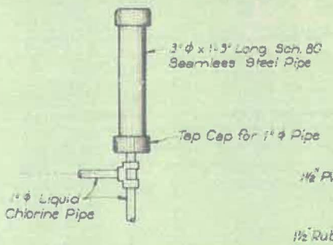
No Scale





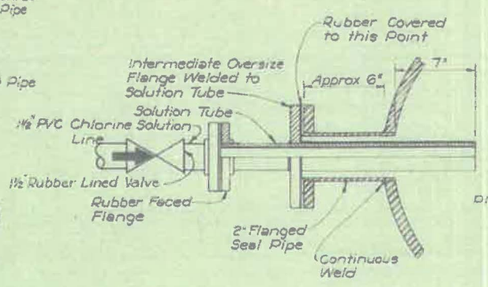
GAS PRESSURE REDUCING VALVE PIPING DETAIL

No Scale



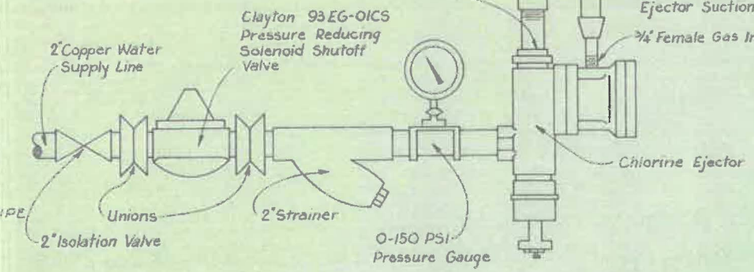
DETAIL - EXPANSION CHAMBER

No Scale



CHLORINE SOLUTION DIFFUSER

No Scale



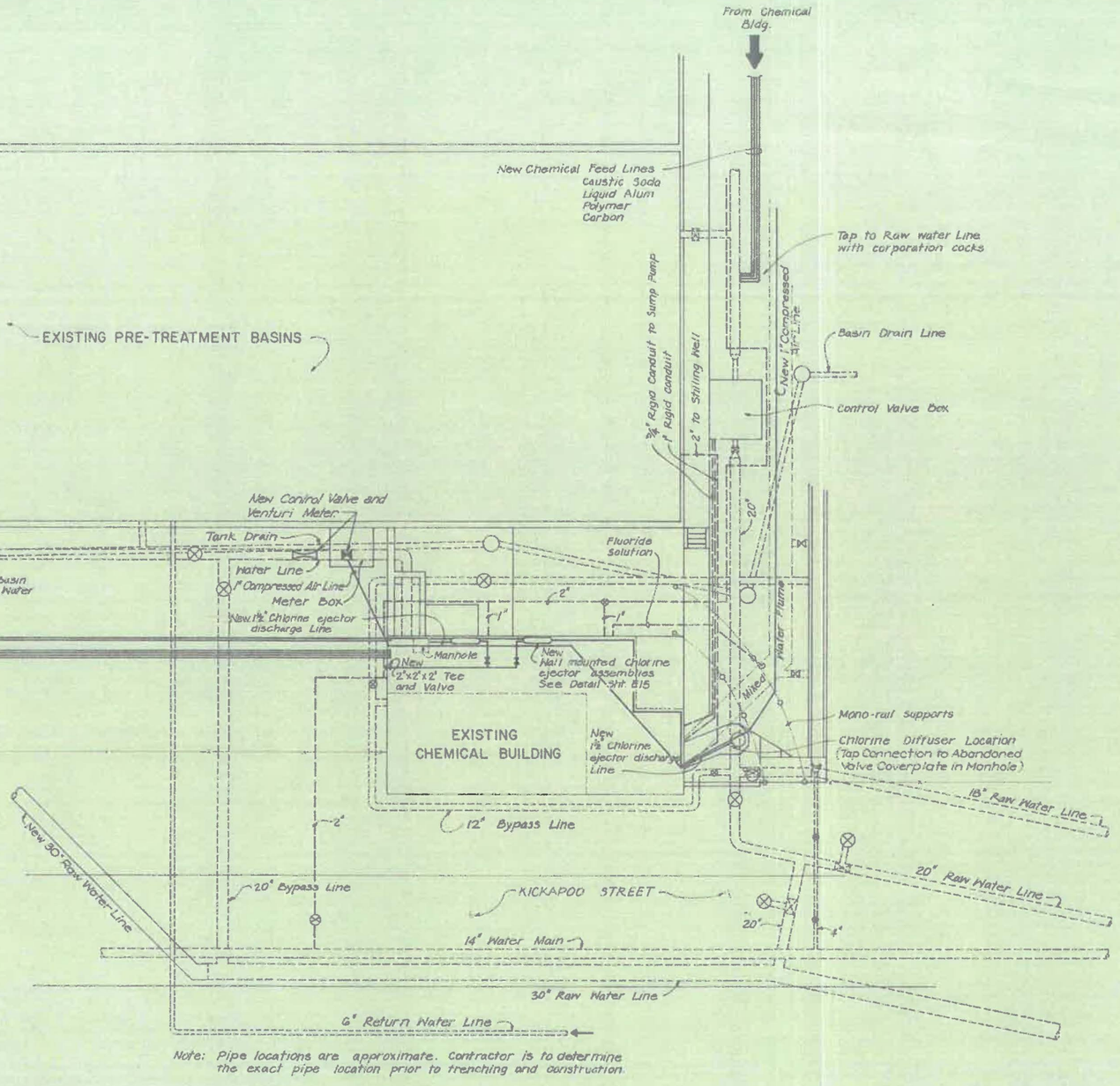
CHLORINE EJECTOR ASSEMBLY

No Scale

[redacted]

DATE 11-30-77	Shawnee, Oklahoma
SCALE NO SCALE	WATER TREATMENT PLANT
DESIGNED BY L.W.R	CHLORINATION DETAILS
DRAWN BY H.L.H.	
CHECKED BY E.M.E	
APPROVED BY J.M.B.	
SHEET E15	

1017 WT Fill 1977



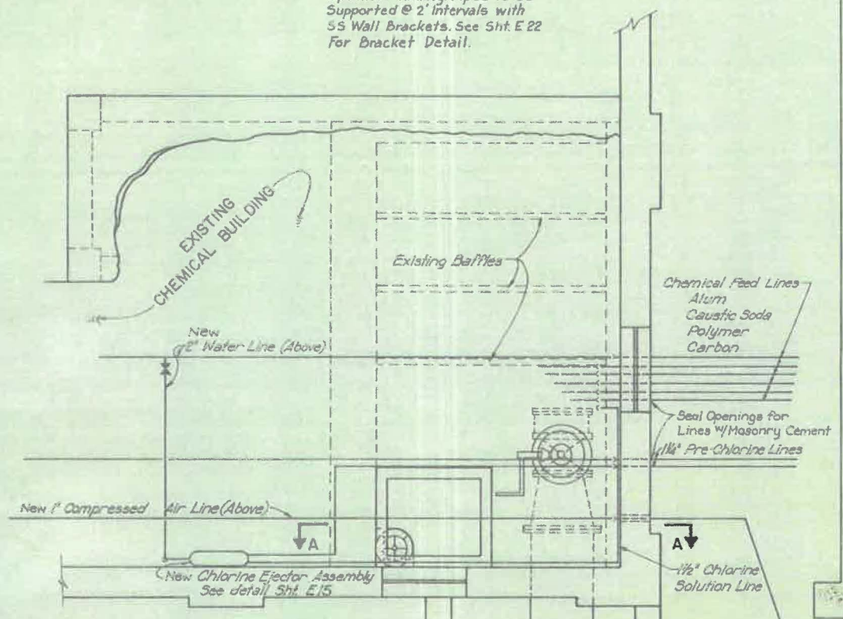
Note: Pipe locations are approximate. Contractor is to determine the exact pipe location prior to trenching and construction.

DETAIL PIPING PLAN

1" = 10'

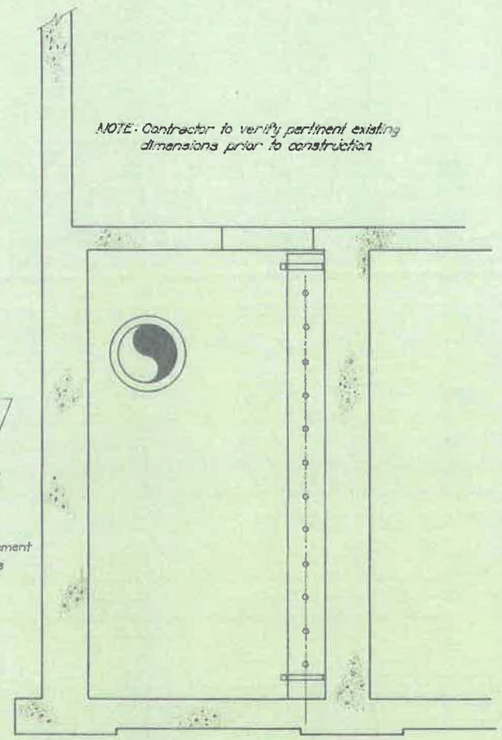
11-30-77	Shawnee, Oklahoma
AS SHOWN	WATER TREATMENT PLANT
L.W.R.	
B. F.	PIPING DETAIL
E.M.F.	
J.M.B.	Burham - Blair & Affiliates, Inc.
E16	

Note: Contractor to Locate Chemical Lines in Mixing Basin to Achieve Optimum Mixing. Pipes to be Supported @ 2' intervals with SS Wall Brackets. See Sht. E 22 For Bracket Detail.

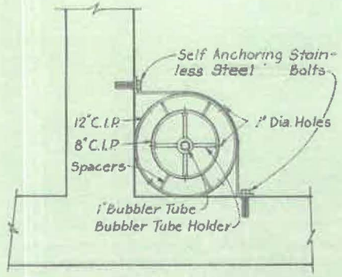


PLAN
EXISTING CHEMICAL BUILDING

NOTE: Contractor to verify pertinent existing dimensions prior to construction



SECTION A-A

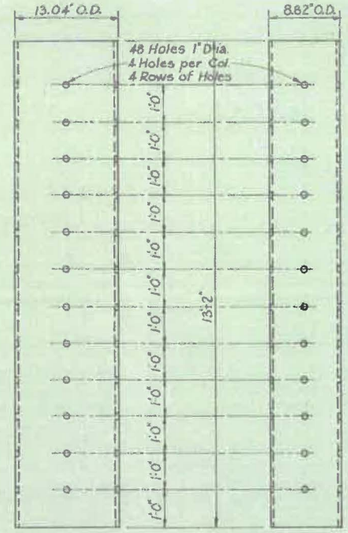


MOUNTING DETAIL

No Scale

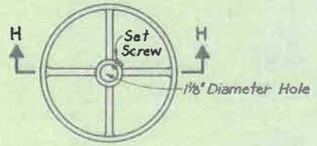


SECTION H-H

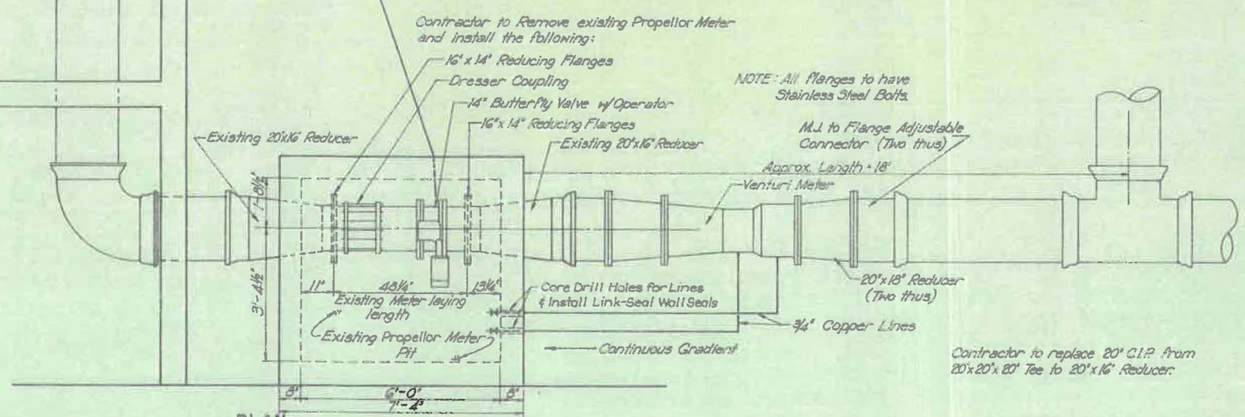


STILLING WELL

No Scale



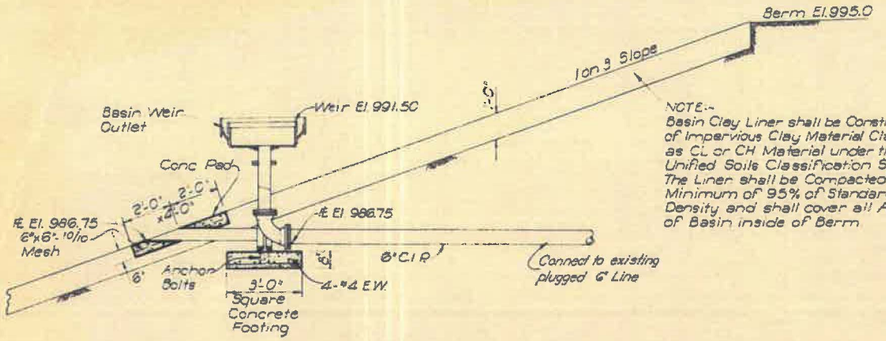
PLAN
BUBBLER TUBE HOLDER



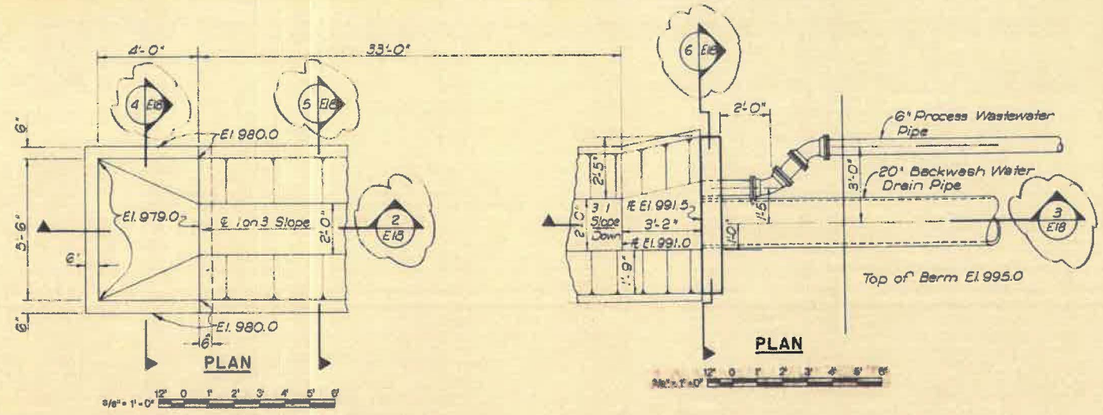
PLAN
EXISTING CHEMICAL BUILDING

Contractor to replace 20" C.I.P. from 20"x20"x20" Tee to 20"x16" Reducer.

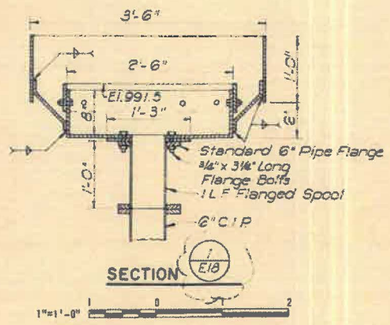
DATE 11-30-77	Shawnee, Oklahoma
SCALE AS SHOWN	WATER TREATMENT PLANT
DESIGNED BY L.W.R.	EXISTING CHEMICAL BUILDING DETAIL
DRAWN BY B.F.	
TRACED BY E.M.F.	
APPROVED BY J.M.B.	Burgess - Black & Affiliates, Inc.
SHEET E17	

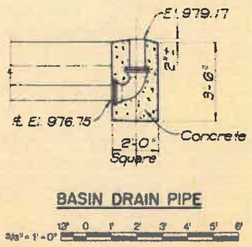


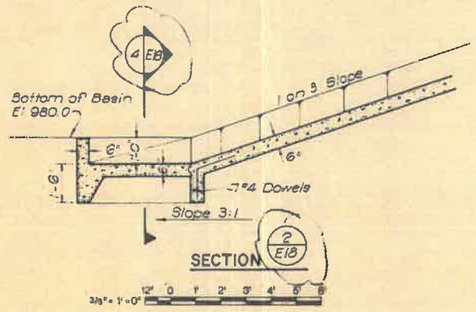
LAGOON OUTLET DETAIL

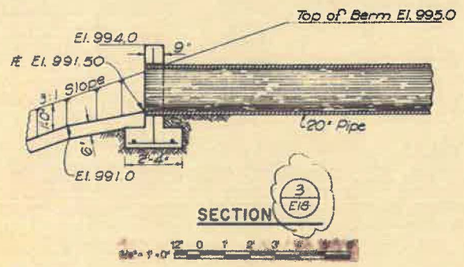


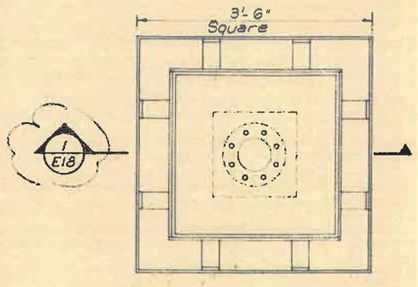
LAGOON INLET DETAIL

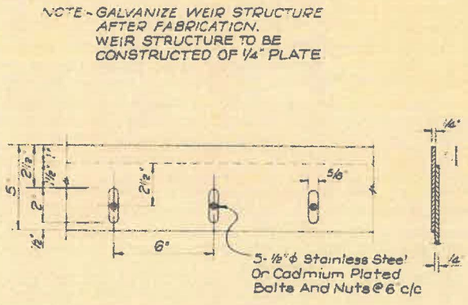




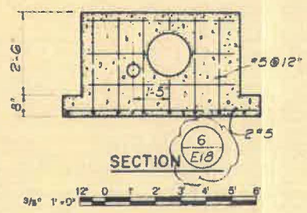


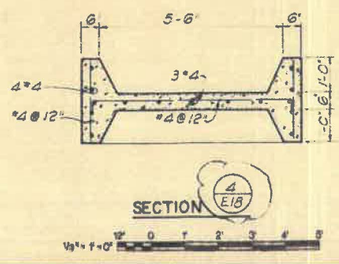


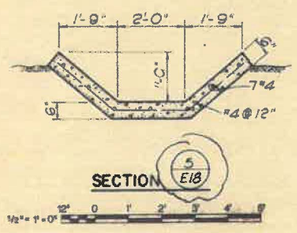




WEIR STRUCTURE

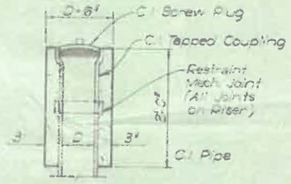




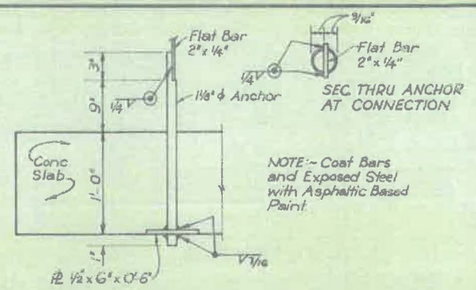


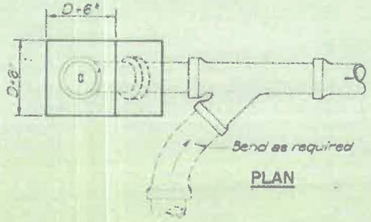
△ Feb. 9, 1978 Change Page Number at Section Designation.

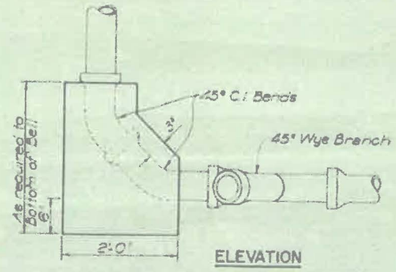
11-30-77	Shawnee, Oklahoma
AS SHOWN	WATER TREATMENT PLANT
B.P.	LAGOON INLET & OUTLET DETAILS
H.L.H.	
L.W.R.	
J.M.B.	
E18	



CAST IRON COUPLING & SCREWED PLUG ENTRANCE FOR PRESSURE LINE CLEANOUT

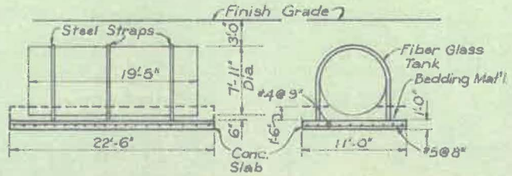






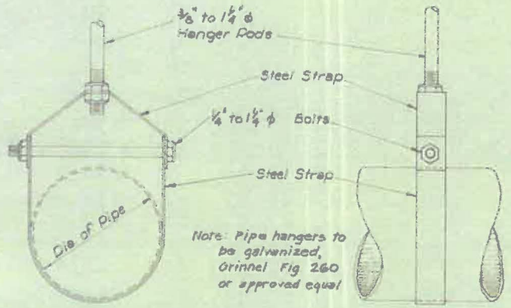
WYE TYPE CLEANOUT OFFSET FLOW

NOT TO SCALE



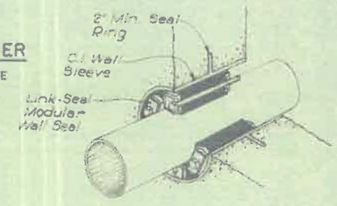
SKETCH 3

FUEL TANK ANCHOR



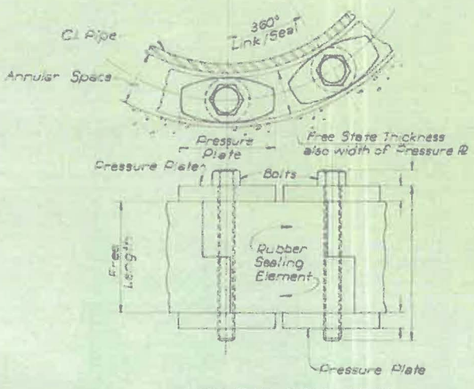
PIPE HANGER

NOT TO SCALE



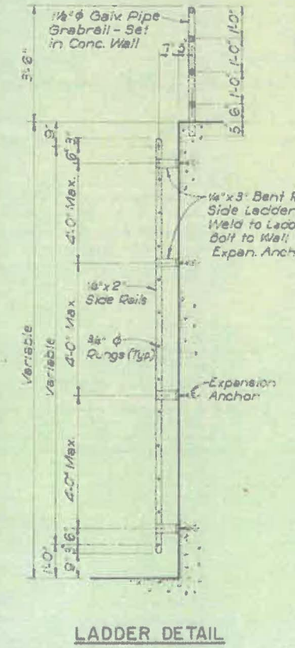
ISOMETRIC

NOT TO SCALE

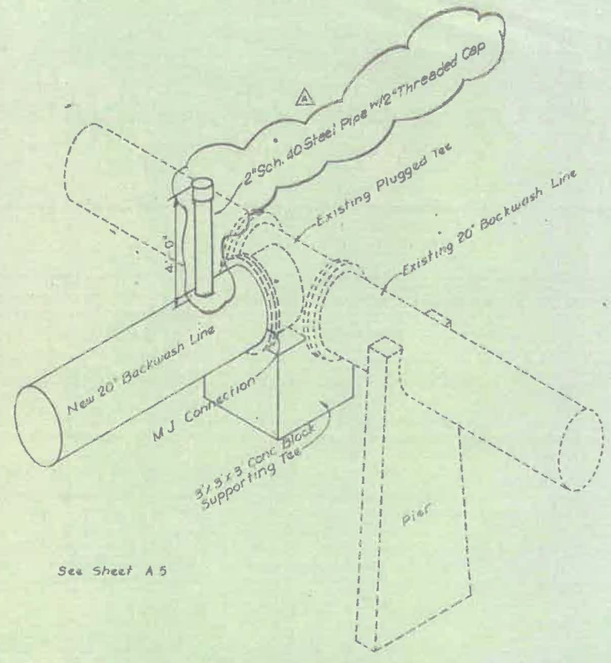


LINK-SEAL WALL SEAL DETAIL

NOT TO SCALE



LADDER DETAIL



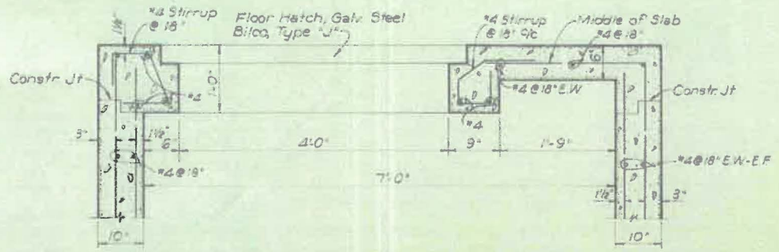
See Sheet A 5

BACKWASH LINE CONNECTION

NOT TO SCALE

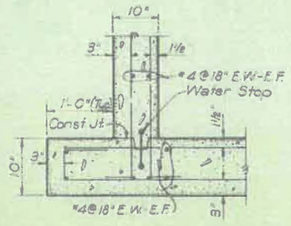
A Feb. 9, 1976 Change Size of Pipe and Delete Valve.

DATE 11-30-77	Shawnee, Oklahoma WATER TREATMENT PLANT
SCALE AS SHOWN	
DESIGNED BY L.W.R.	MISCELLANEOUS DETAILS
DRAWN BY H.L.H.	
CHECKED BY E.M.E.	
APPROVED BY J.M.B.	Benham - Blair & Affiliates, Inc.
SHEET E19	



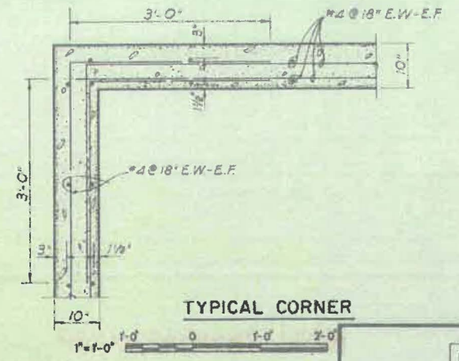
LONGITUDINAL SECTION

1"=1'-0" 1'-0" 0 1'-0" 2'-0"



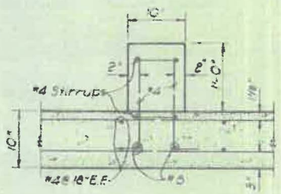
FOOTING DETAIL

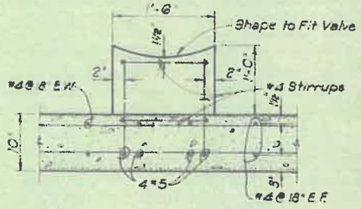
1"=1'-0" 1'-0" 0 1'-0" 2'-0"



TYPICAL CORNER

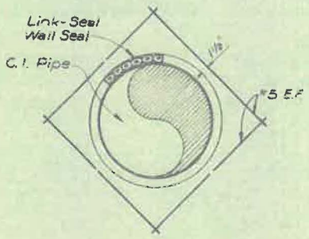
1"=1'-0" 1'-0" 0 1'-0" 2'-0"





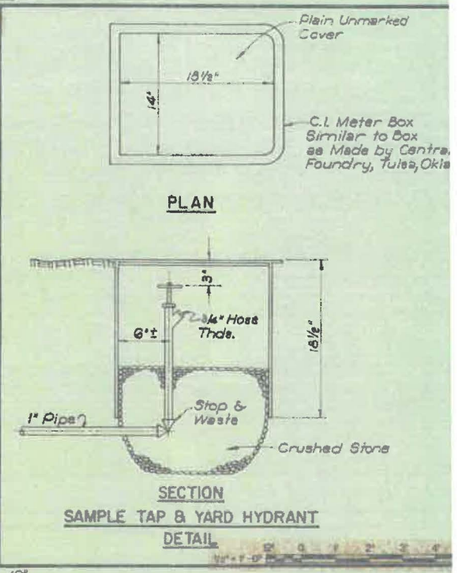
VALVE SUPPORT

1"=1'-0" 1'-0" 0 1'-0" 2'-0"



REINFORCING DETAIL AROUND WALL OPENING

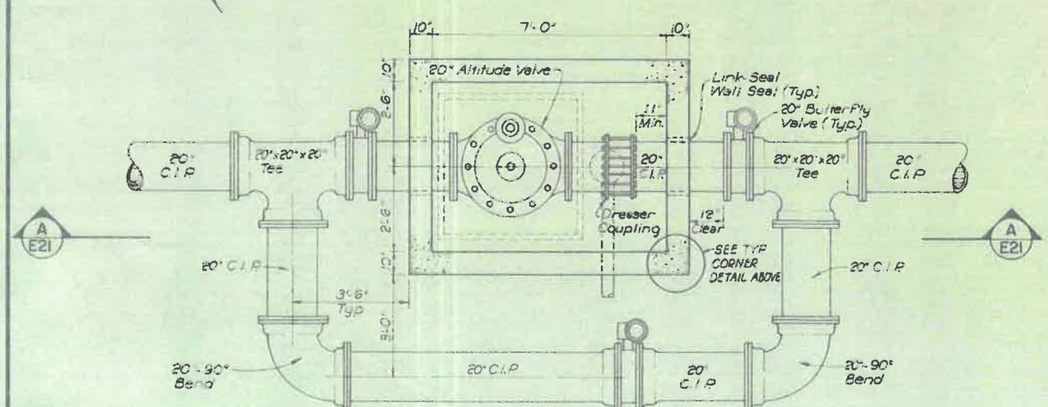
1"=1'-0" 1'-0" 0 1'-0" 2'-0"



PLAN

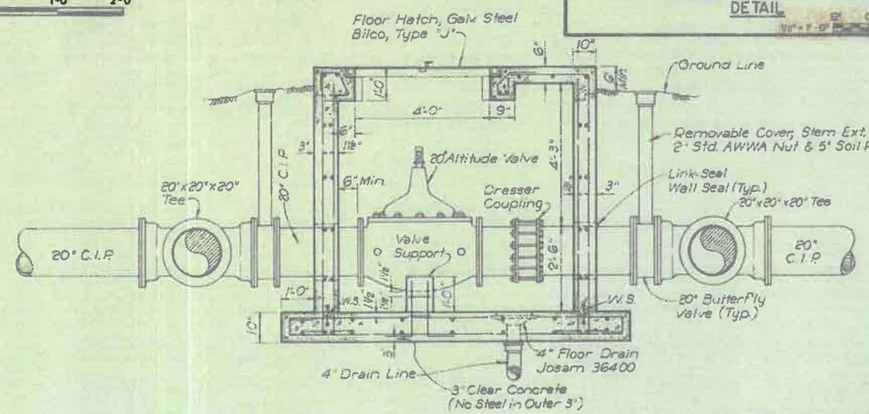
SECTION
SAMPLE TAP & YARD HYDRANT DETAIL

1"=1'-0" 12" 0 1' 2' 3' 4' 5'



PLAN

1/8"=1'-0" 12" 0 1' 2' 3' 4' 5'



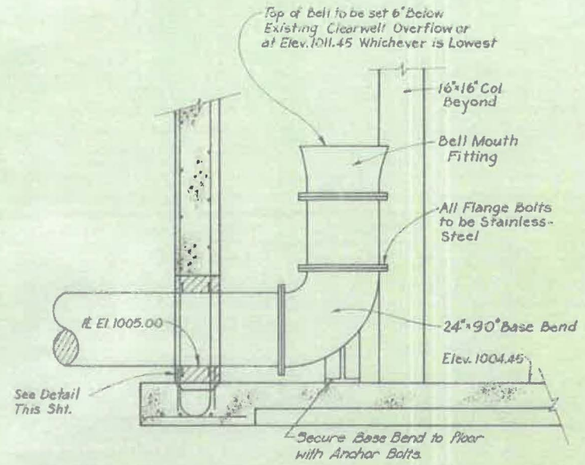
SECTION A-A

1/2"=1'-0" 12" 0 1' 2' 3' 4' 5'

NOTE:- For Reinforcing Steel in Altitude Valve Box, See Details Above.

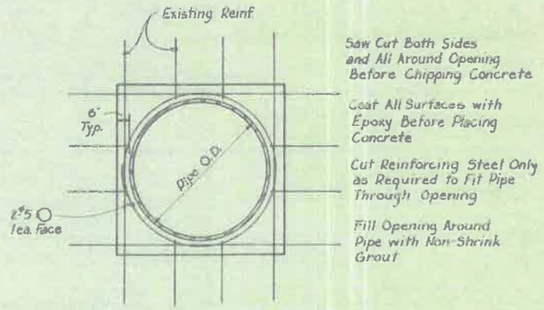
DATE 11-30-77	Shawnee, Oklahoma
SCALE AS SHOWN	WATER TREATMENT PLANT
DESIGNED L.W.R.	ALTITUDE VALVE BOX
DRAWN H.L.H.	
CHECKED E.M.E.	
APPROVED J.M.B.	Benham - Blair & Affiliates, Inc.
SHEET E20	

1017 WT F-20429 1977



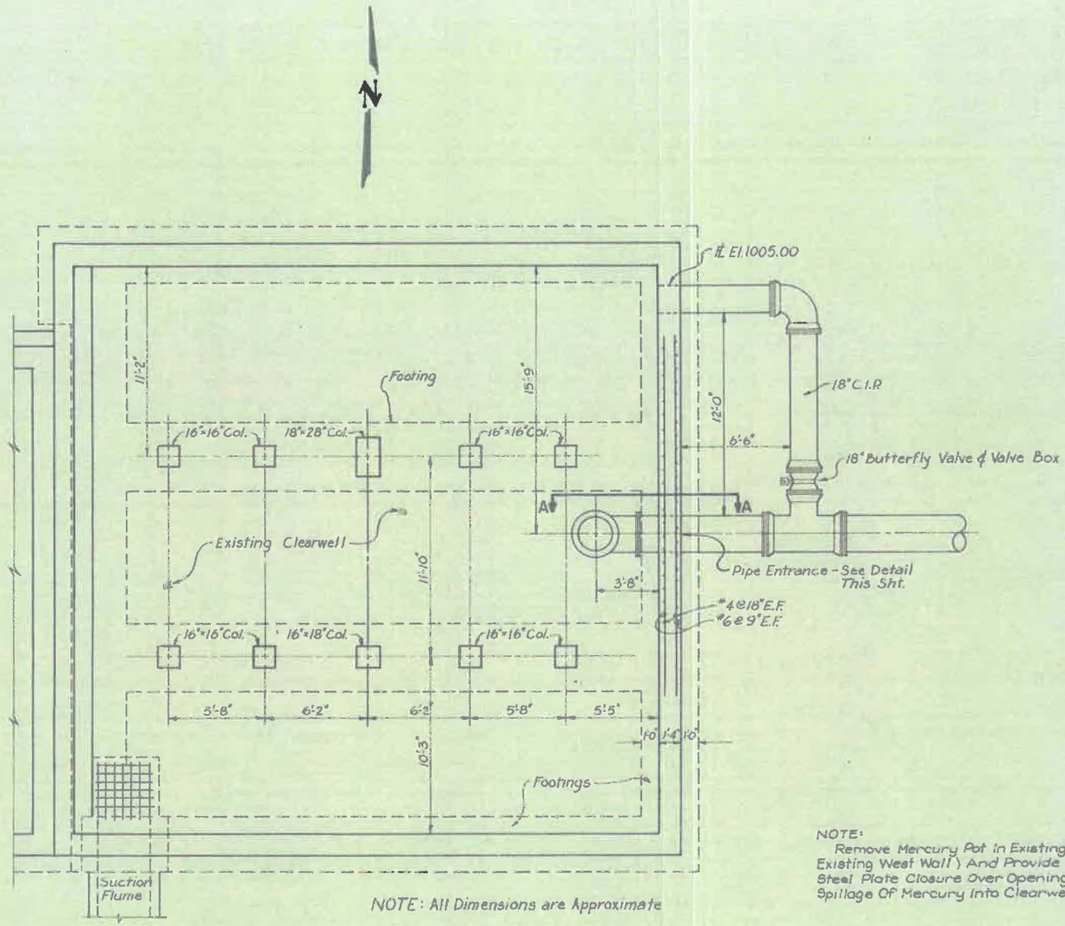
SECTION A-A





TYPICAL PIPE ENTRANCE DETAIL

NO SCALE



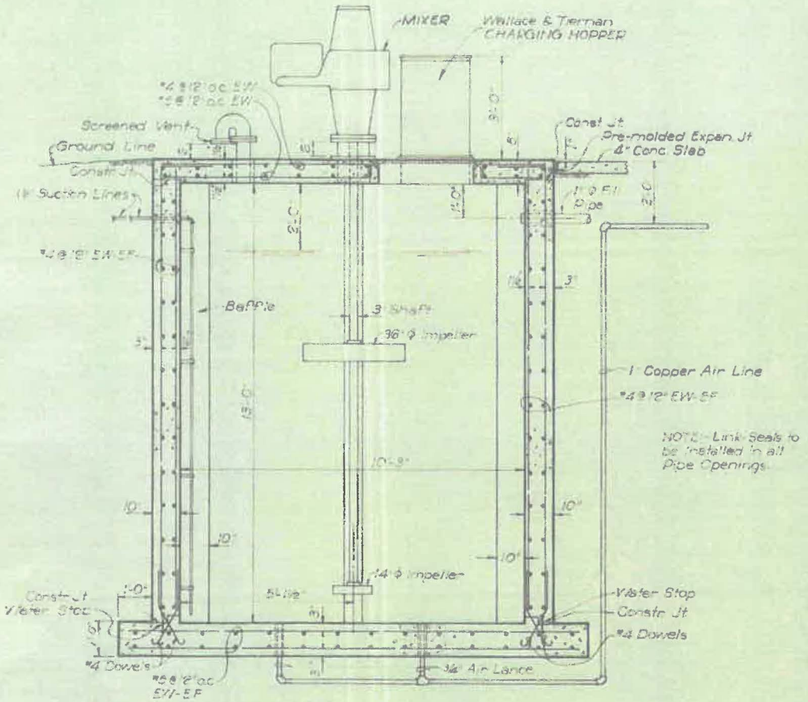
NOTE: All Dimensions are Approximate

CLEARWELL CONNECTION



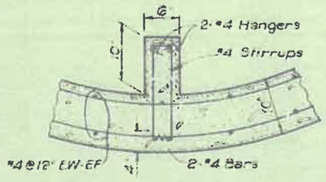
NOTE:
Remove Mercury Pot in Existing Clearwell On Filter No. 1 (By Existing West Wall) And Provide Gasketed And Sealed ¼" Steel Plate Closure Over Opening. Care Shall Be Taken To Avoid Spillage Of Mercury Into Clearwell.

11-30-77	Shawnee, Oklahoma
AS SHOWN	WATER TREATMENT PLANT
L.W.R.	CLEARWELL CONNECTION
B.F.	
E.M.F.	
J.M.B.	Burns - Blair & Affiliates, Inc.
E 21	

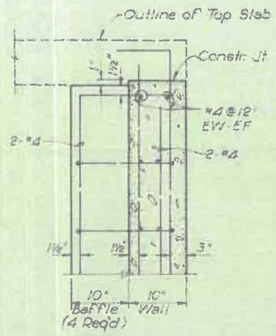


SECTION A-A

1/2" = 1'-0"



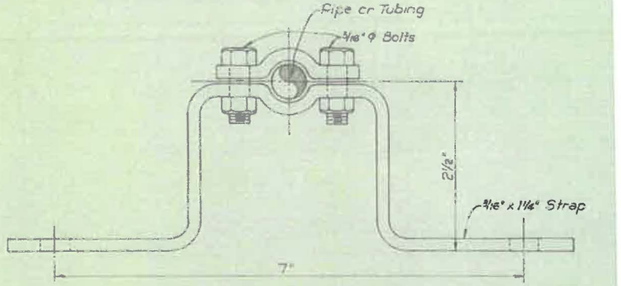
TOP



DETAIL B

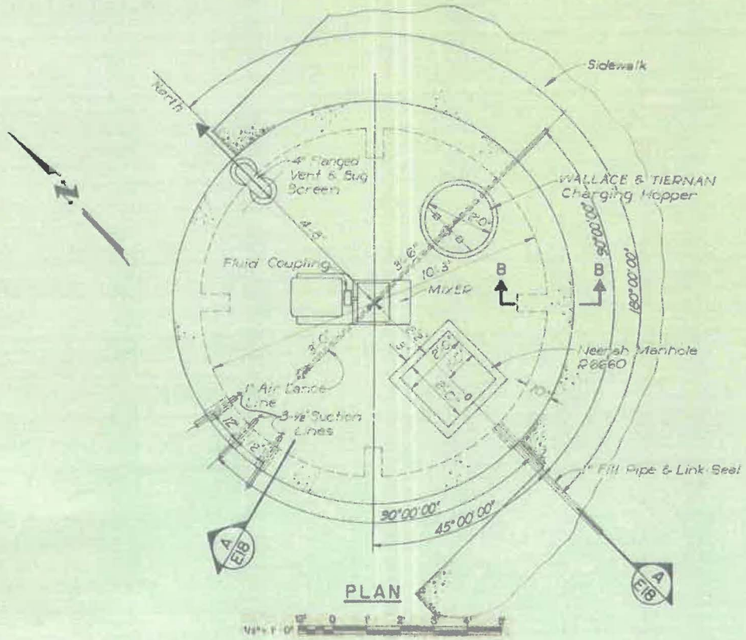
BAFFLE DETAILS

1" = 1'-0"



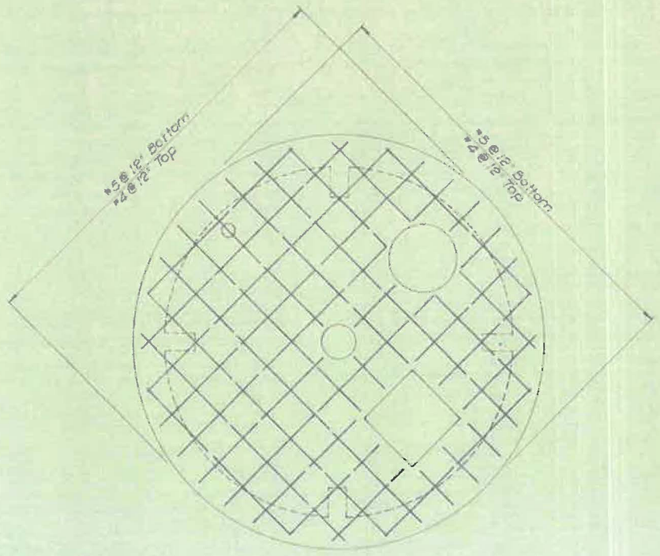
OFFSET PIPE CLAMP DETAIL

FULL SIZE



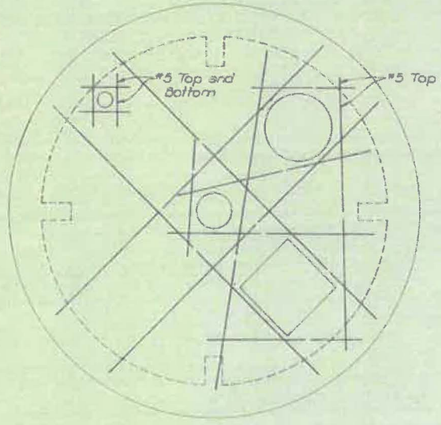
PLAN

1/8" = 1'-0"



TOP SLAB REINFORCING

1/8" = 1'-0"

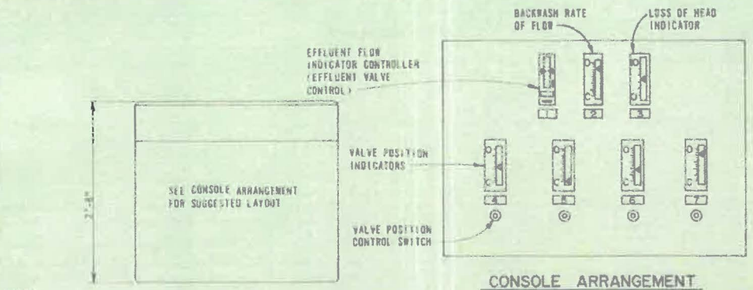


NOTE:- All Reinforcing bars must be a Minimum of 1½" From Edge of Concrete.

REINFORCING AROUND OPENINGS

1/8" = 1'-0"

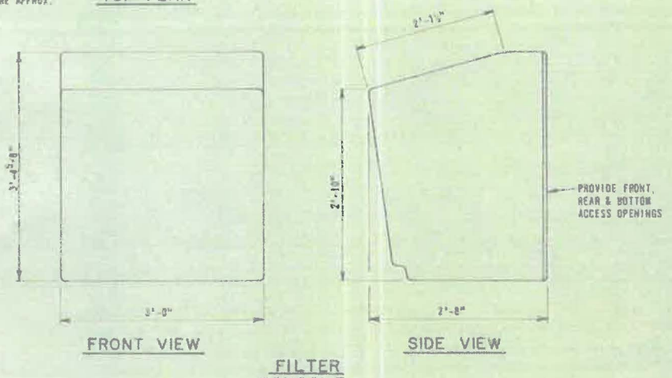
11-30-77	Shawnee, Oklahoma
AS SHOWN	WATER TREATMENT PLANT
L.W.R.	
H.L.H.	CARBON STORAGE TANK
E.M.F.	
J.M.B.	
E 22	Burham - Blair & Affiliates, Inc.



CONSOLE ARRANGEMENT
1 1/2" = 1'-0"

TOP PLAN

NOTE
DIMENSIONS ARE APPROX. AND MAXIMUM



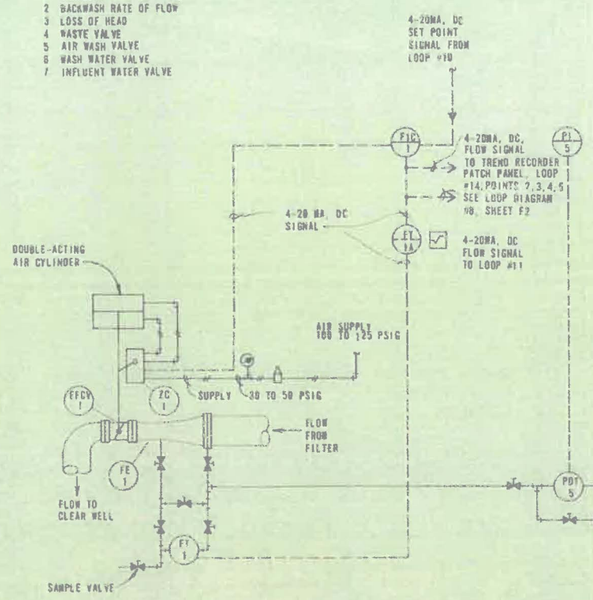
FRONT VIEW

SIDE VIEW

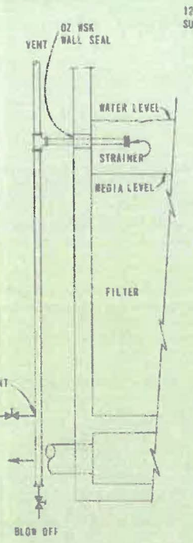
FILTER CONSOLE
1" = 1'-0"

NAME PLATES
INSTRUMENT FACE

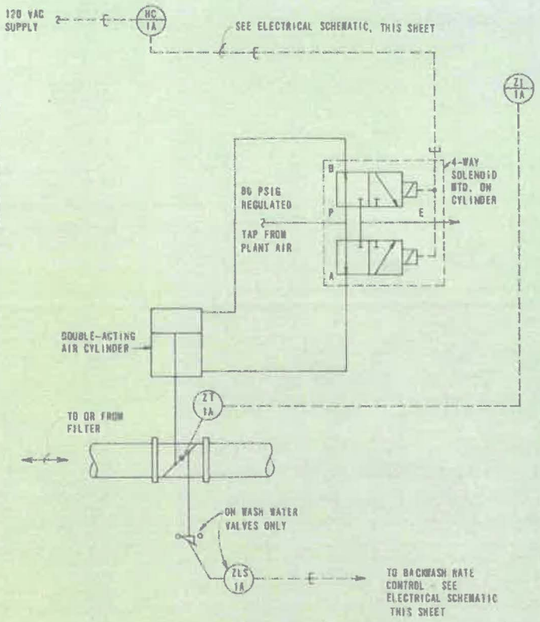
1. EFFLUENT FLOW CONTROLLER
2. BACKWASH RATE OF FLOW
3. LOSS OF HEAD
4. WASTE VALVE
5. AIR WASH VALVE
6. WASH WATER VALVE
7. INFLUENT WATER VALVE



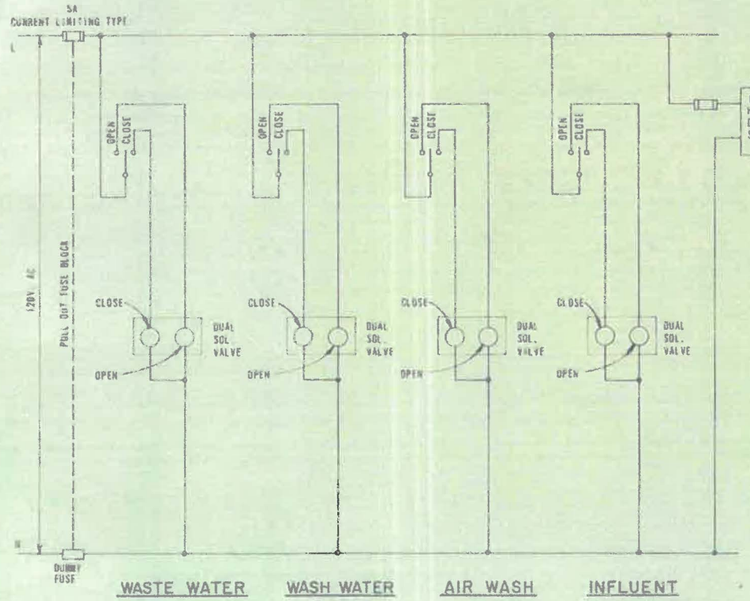
LOOP DIAGRAM #1
EFFLUENT FLOW CONTROL
LOOPS #1, #2, #3, & #4



LOOP DIAGRAM #2
LOSS OF HEAD INDICATION
LOOPS #5, #6, #7, & #8



LOOP DIAGRAM #1A
FILTER TWO POSITION VALVE CONTROLS,
LOOPS #1A, #1B, #1C, #1D,
#2A, #2B, #2C, #2D, #3A, #3B, #3C, #3D,
#4A, #4B, #4C, & #4D

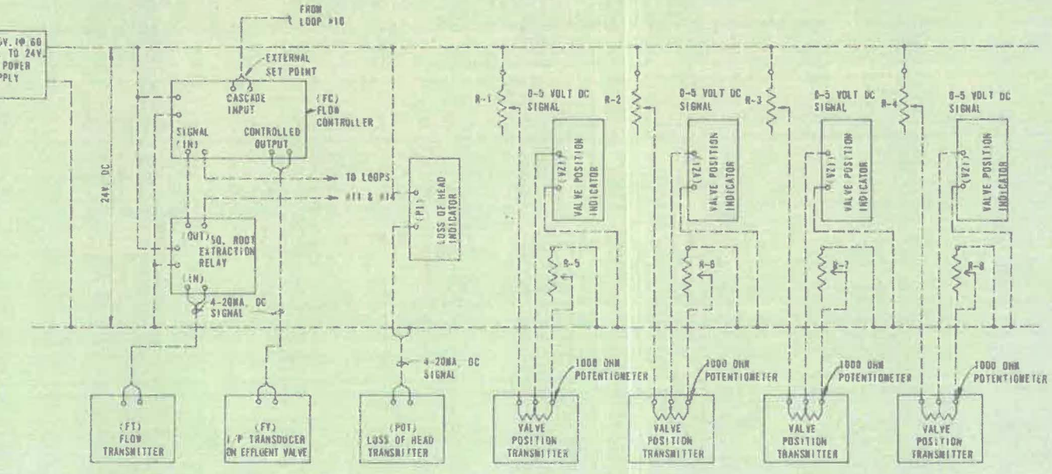


WASTE WATER VALVE

WASH WATER VALVE

AIR WASH VALVE

INFLUENT WATER VALVE



EFFLUENT VALVE CONTROL

LOSS OF HEAD INDICATOR

WASTE WATER VALVE

WASH WATER VALVE

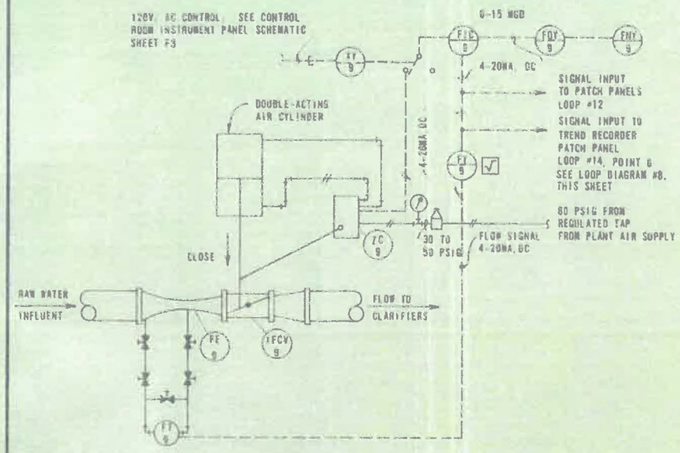
AIR WASH VALVE

INFLUENT WATER VALVE

REFERENCES:
SIGNAL CABLE SCHEDULE ..... SHEET G14
LOOP DIAGRAM LEGEND ..... SHEET G1

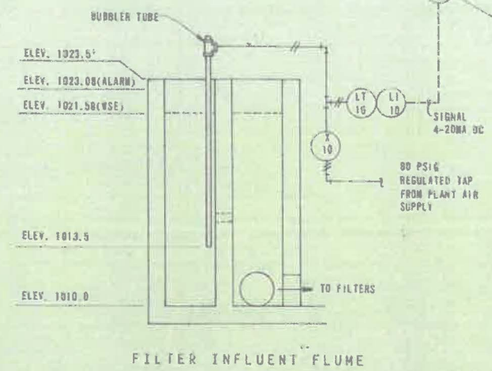
ELECTRICAL SCHEMATIC
FILTER CONSOLES

DATE 12-2-77	Shawnee, Oklahoma
SCALE NO SCALE	WATER TREATMENT PLANT
DESIGNED BY JWP	INSTRUMENTATION
DRAWN BY LCB	LOOP DIAGRAMS & DETAILS
CHECKED BY JER	SHEET 1
APPROVED BY JMB	
SHEET F1 OF 4	Burns - Blair & Affiliates, Inc.



LOOP DIAGRAM #3

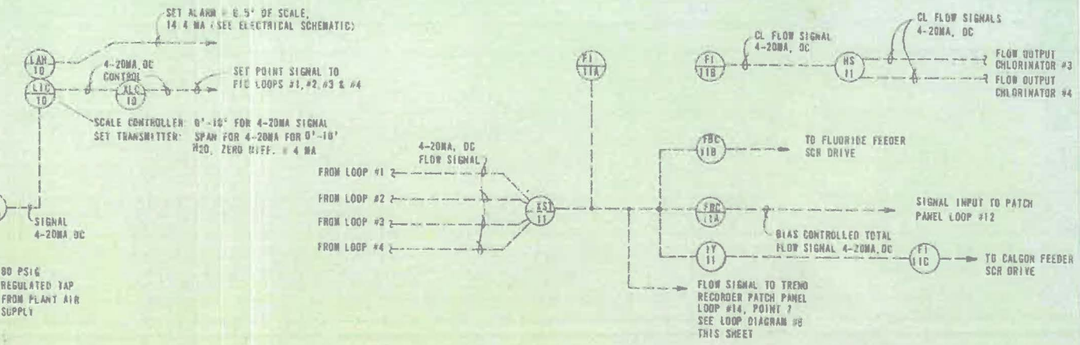
RAW WATER INFLUENT CONTROL, LOOP #9



FILTER INFLUENT FLUME

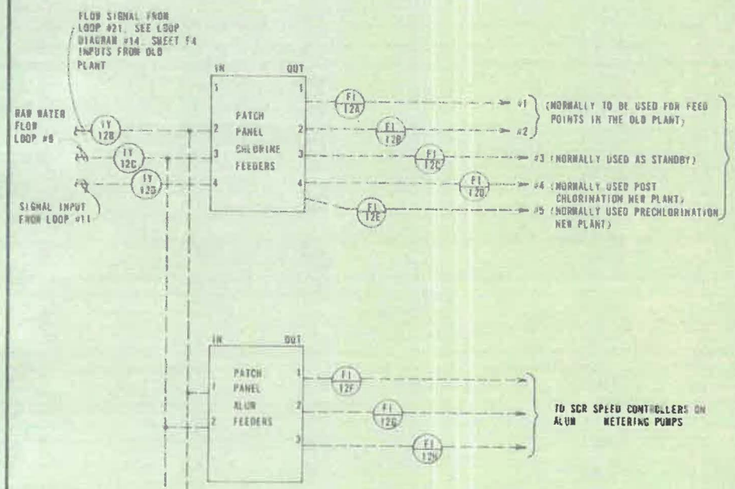
LOOP DIAGRAM #4

FILTER MASTER FLOW CONTROL LOOP #10



LOOP DIAGRAM #5

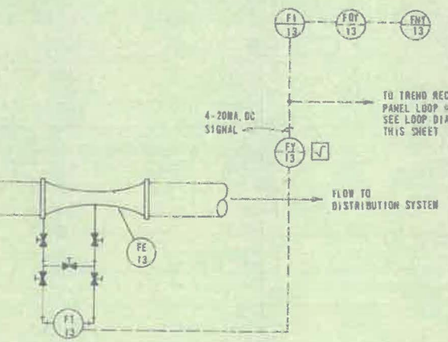
FILTER TOTAL FLOW LOOP #11 & POSTCHLORINATION CONTROL



REFERENCES
SIGNAL CABLE SCHEDULE.....SHEET G14
LOOP DIAGRAM LEGEND.....SHEET G1

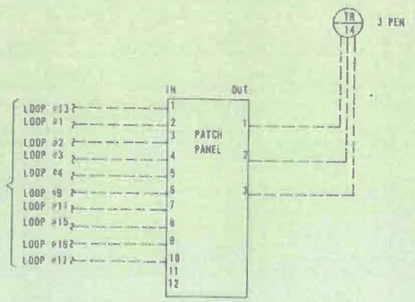
LOOP DIAGRAM #6

CHEMICAL FEEDER FLOW PACING, LOOP #12



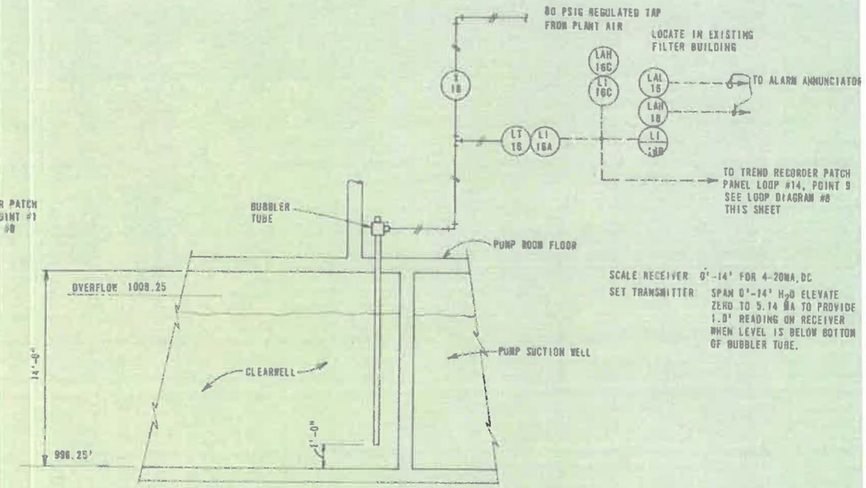
LOOP DIAGRAM #7

FLOW TO DISTRIBUTION SYSTEM, LOOP #13



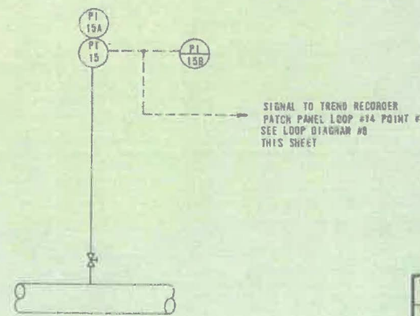
LOOP DIAGRAM #8

TREND RECORDER, LOOP #14



LOOP DIAGRAM #10

CLEARWELL LEVEL INDICATION, LOOP #16

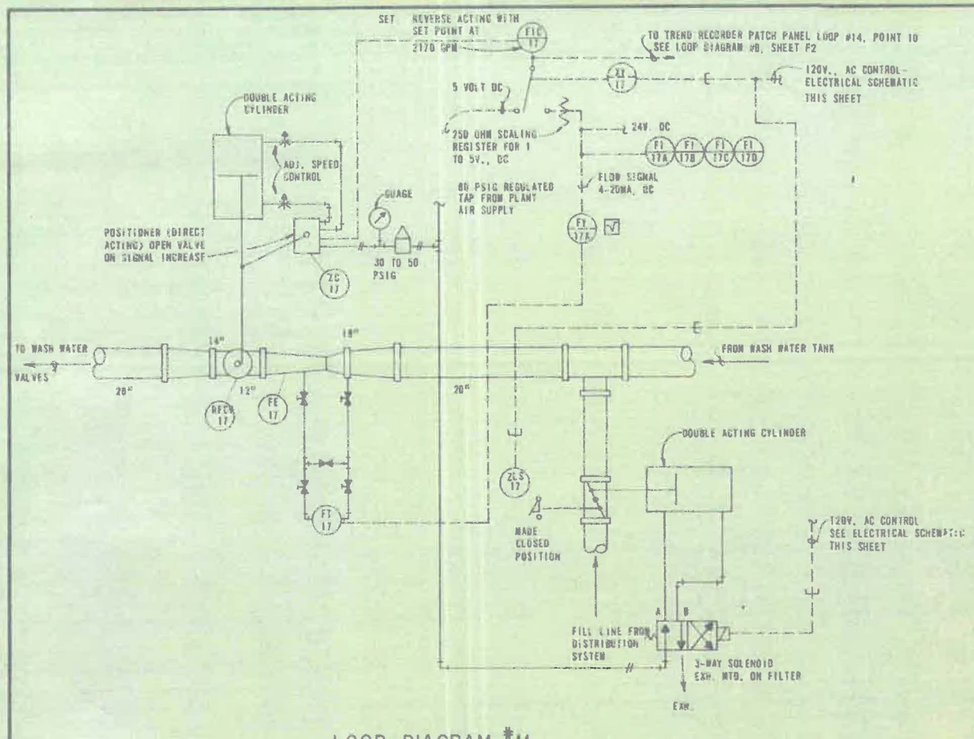


PUMP STATION DISTRIBUTION HEADER

LOOP DIAGRAM #9

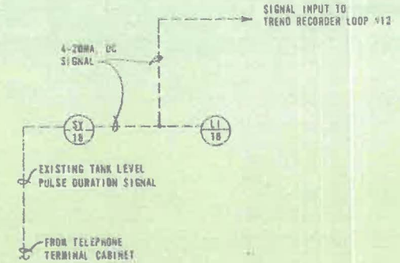
DISTRIBUTION SYSTEM SUPPLY PRESSURE, LOOP #15

DATE 12-2-77	Shawnee, Oklahoma
SCALE NO SCALE	WATER TREATMENT PLANT
DESIGNED BY JWP	INSTRUMENTATION LOOP DIAGRAMS & DETAILS SHEET 2
DRAWN BY LCB	
CHECKED BY JER	
APPROVED BY JMB	Burhorn - Blair & Affiliates, Inc.
SHEET F2 OF 4	



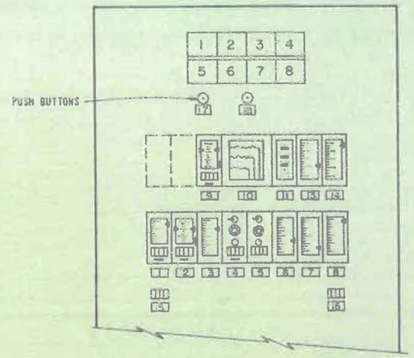
LOOP DIAGRAM #11

WASH WATER RATE CONTROL, LOOP #17



LOOP DIAGRAM #12

ELEVATED TANK LEVELS, LOOP #18



PARTIAL ELEVATION CONTROL ROOM INSTRUMENT PANEL

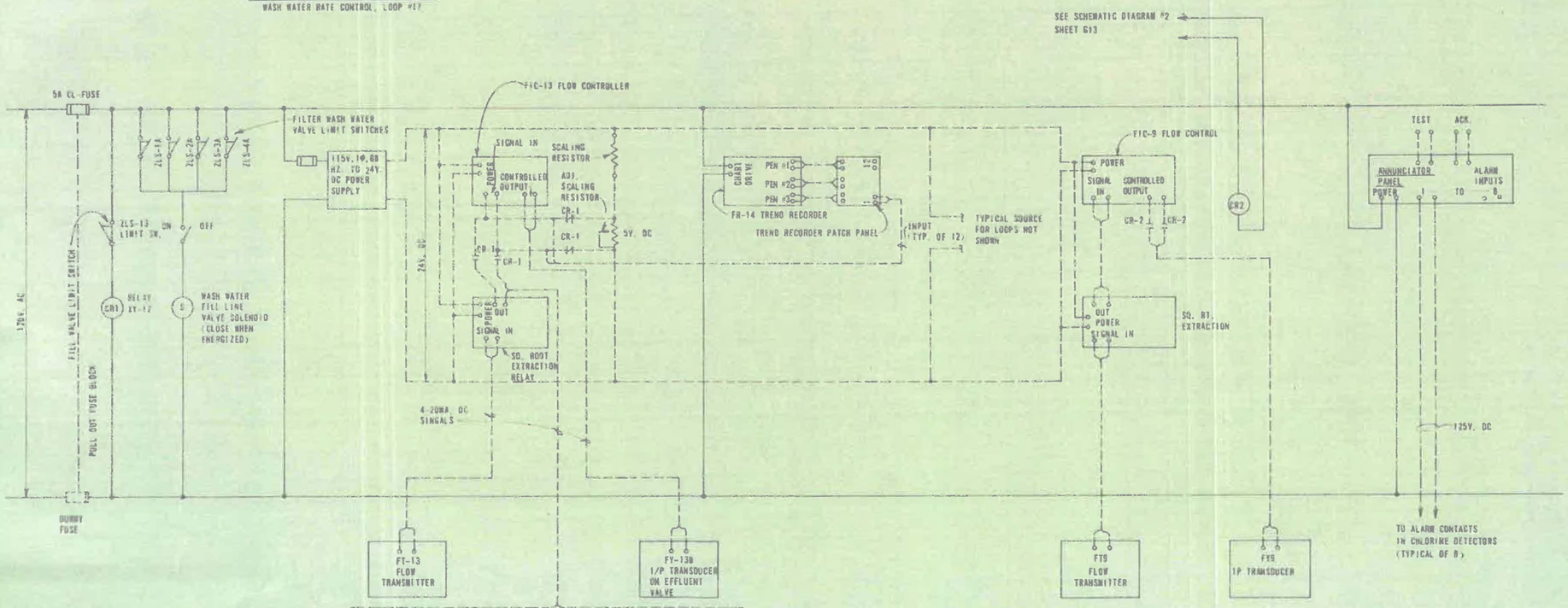
1 1/2" = 1'-0"

ANNUNICATOR ALARMS

1 - CHLORINE LEAK ALARM
2 - LIQUID CHLORINE PRESSURE
3 - HIGH FILTER LEVEL
4 - CLEARWELL LEVEL
5 - ENGINE DAYTANK FUEL LEVEL
6 - ENGINE BATTERY CHARGER
7 - SPARE
8 - SPARE ALARM

NAME PLATES

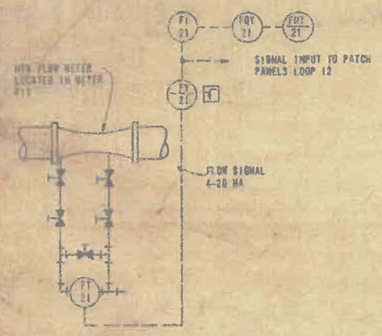
1 - RAW WATER (FI-9) INFLUENT FLOW
2 - FILTER MASTER (LIC-16) FLOW CONTROL
3 - FILTER TOTAL (FI-11A) FLOW
4 - POST CHLORINATION (FBC) FLOW CONTROL
5 - FLUORIDE FEEDER FLOW CONTROL
6 - POST CHLORINATION (FI-11B) FLOW
7 - CLEARWELL (LI-16) LEVEL
8 - DISTRIBUTION (PI-15) PRESSURE
9 - WASH WATER RATE (FIC-17) FLOW
10 - TREND RECORDER (TR-14)
11 - TREND RECORDER PATCH PANEL
13 - ELEVATED TANK LEVEL (LI-18) 1/2 MILLION
14 - DISTRIBUTION (FI-13) FLOW
15 - RAW WATER (FNY-9) TOTAL FLOW
16 - DISTRIBUTION (FI-13) TOTAL FLOW
17 - ACKNOWLEDGE
18 - TEST



ELECTRICAL SCHEMATIC CONTROL ROOM INSTRUMENT PANEL

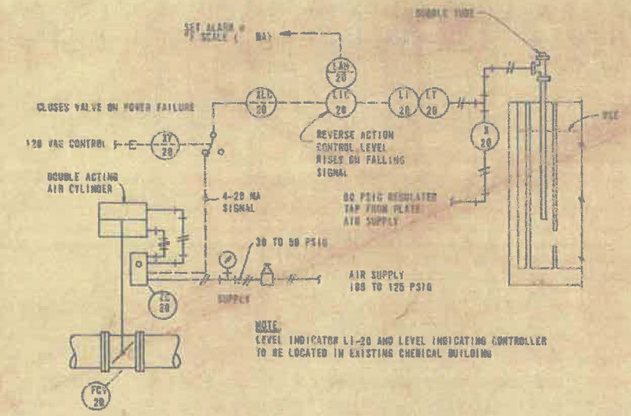
REFERENCES:
SIGNAL CABLE SCHEDULE.....SHEET G14
LOOP DIAGRAM LEGEND.....SHEET G1

DATE 12-2-77	Shawnee, Oklahoma
SCALE NO SCALE	WATER TREATMENT PLANT
DESIGNED BY JWP	INSTRUMENTATION LOOP DIAGRAMS & DETAILS SHEET 3
DRAWN BY LCB	
CHECKED BY JER	
SUPERVISED BY JMB	Benham - Blair & Affiliates, Inc.
SHEET F3 OF 4	



LOOP DIAGRAM #14

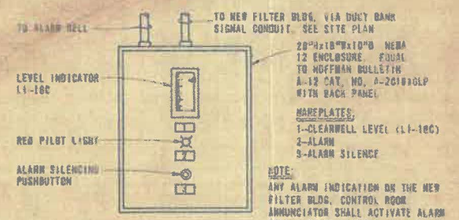
FLOW METER LOOP #21



NOTE:
LEVEL INDICATOR LI-28 AND LEVEL INDICATING CONTROLLER TO BE LOCATED IN EXISTING CHEMICAL BUILDING

LOOP DIAGRAM # 13

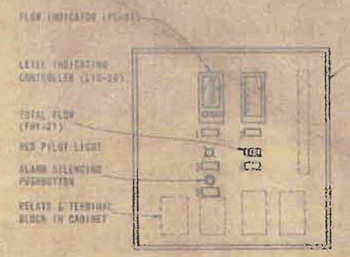
EXISTING INFLUENT WATER LOOP #28



NOTE:
ANY ALARM INDICATION ON THE NEW FILTER BLDG. CONTROL ROOM ANNUNCIATOR SHALL ACTIVATE ALARM BELL & PILOT LIGHT ON THIS PANEL (PARALLEL ANNUNCIATOR AUXILIARY CONTACTS)

DETAIL A

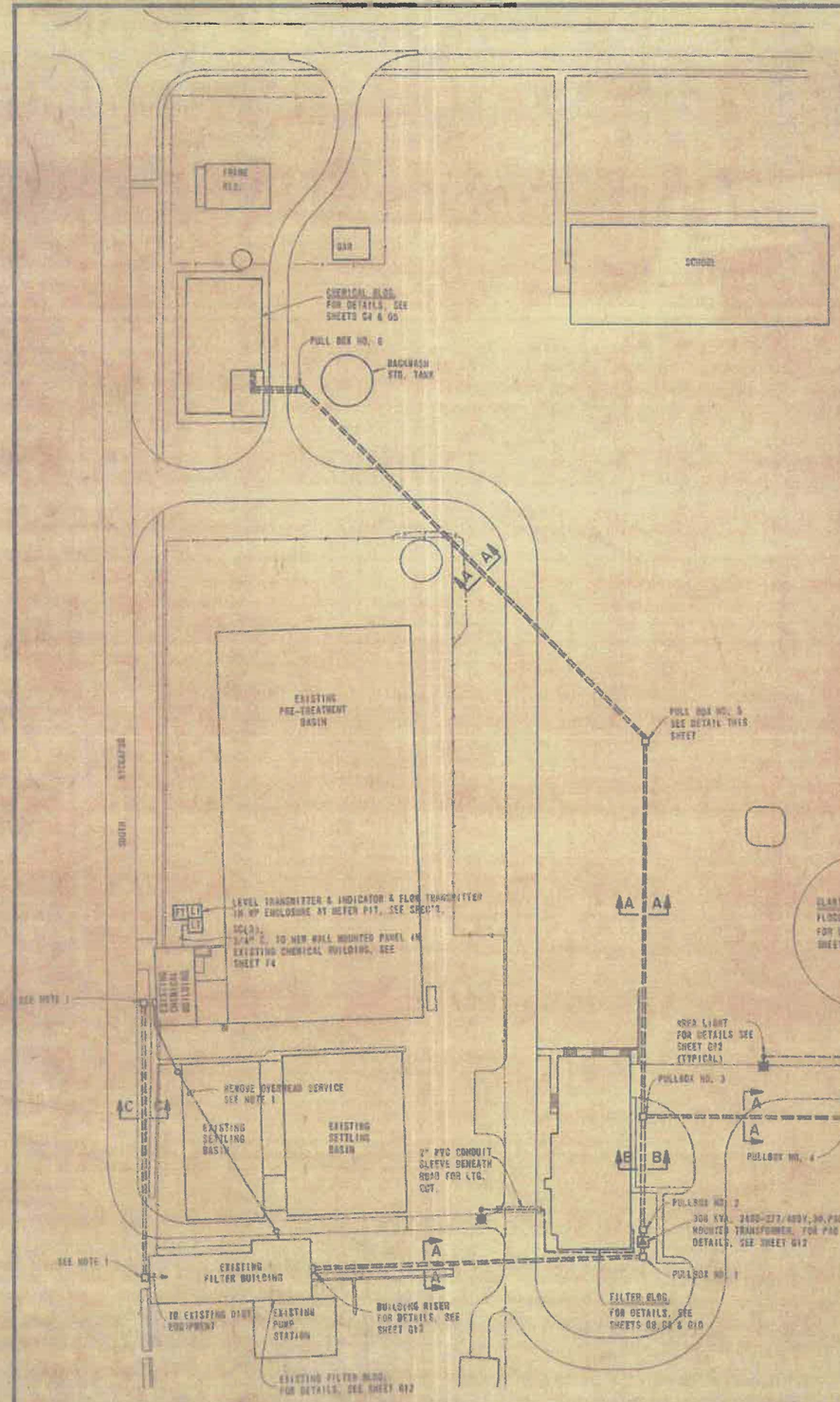
NEW CONTROL PANEL IN EXISTING BUILDING

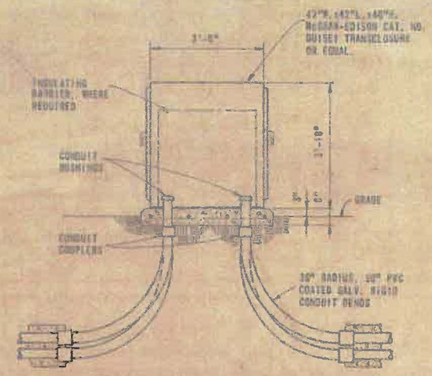


DETAIL B

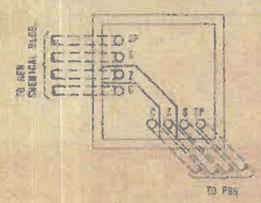
NEW CONTROL PANEL IN EXISTING CHEMICAL BLDG.
SCALE: 1" = 1'-0"

12-2-77	Stearns Conrad
NO SCALE	WATER TREATMENT PLANT
JWF	INSTRUMENTATION LOOP DIAGRAMS & DETAILS SHEET 4
LCB	
JER	
JMB	
94 OF 4	Stearns - Wolf & Jeffcoat, Inc.

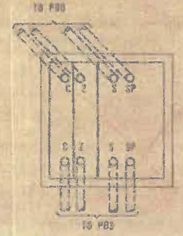




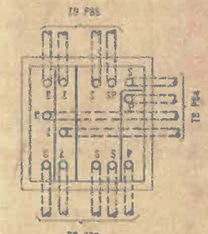
TYPICAL SECTION
PULLBOX
SCALE: 1" = 1'-0"



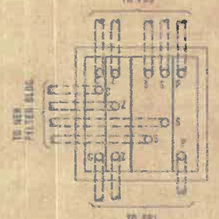
PULLBOX NO. 6
NO SCALE



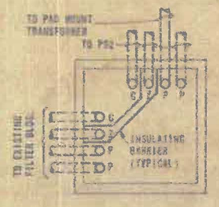
PULLBOX NO. 5
NO SCALE



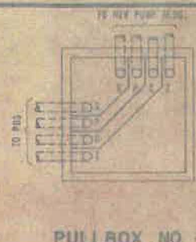
PULLBOX NO. 3
NO SCALE



PULLBOX NO. 2
NO SCALE



PULLBOX NO. 1
NO SCALE



PULLBOX NO. 4
NO SCALE



SECTION A-A
NO SCALE



SECTION B-B
NO SCALE



SECTION C-C
NO SCALE

LEGEND
P=PRIMARY (2400V)
S=SECONDARY (480V)
C=CONTROL (120V)
I=INTERLOCK
SP=SPARE

NOTES:
1. INSTALL NEW DUCT BANK BETWEEN EXISTING FILTER AND CHEMICAL BUILDINGS AND REPLACE THE EXISTING OVERHEAD SERVICE WITH A NEW UNDERGROUND FEEDER CONSISTING OF 4 NO. 3, 600V. CABLES AND 1 NO. 1/0 BARE GROUND CONDUCTOR. BUILDING RISERS SHALL BE INSTALLED IN ACCORDANCE WITH DETAIL SHOWN ON SHEET G13. RELOCATE SERVICE ENTRANCE TO WEST SIDE OF EXISTING FILTER BLDG.
2. ALL CONDUITS IN DUCT BANK SHALL BE AS FOLLOWS:
   PRIMARY CONDUITS..... 3"
   SECONDARY CONDUITS..... 3"
   SIGNAL CONDUITS..... 2"
   CONTROL CONDUITS..... 2"
3. TRENCHING FOR DUCT BANK AND CONDUITS SHALL BE DONE WITH UTMOST CAUTION TO AVOID DAMAGE TO ANY EXISTING UNDERGROUND FACILITIES.
4. REFER TO ONE LINE DIAGRAM, SHEET E2 FOR CONDUCTOR SIZES.
5. AREA LIGHTING CIRCUITS SHALL BE 2 NO. 12 DIRECT BURIED CABLE.
6. ELECTRICAL CONDUIT IN DUCT BANKS CAN BE PVC.

⚠ AUG 13, 1979 - REROUTE CONDUITS

⚠ Feb 3, 1978 Allow PVC Electrical Conduit

12-1-77	Riverside, California
AS NOTED	WATER TREATMENT PLANT
AWA	
J.C.N.	ELECTRICAL SITE PLA
LER	
JMB	

1917 WT 16 of 19 1977

2400 VOLT, 3Φ, 3 WIRE
UTILITY CO. SERVICE

3 NO. 8, 5 KV, 1 NO. 1/0 GRD.
1¼" CONDUIT

3 NO. 6, 5 KV, 1 NO. 1/0 GRD.
1½" CONDUIT

3-25 KVA, 2400-120/240 VOLT
1Φ, TRANSFORMERS (EXISTING)

4 NO. 3/0, 600V.
2½" CONDUIT

3 NO. 6, 5KV.
1½" CONDUIT

120/240V, 3Φ, 4W
STANDBY SERVICE
TO UTILITY CO.

4 NO. 2, 600V.
1¼" CONDUIT

225A

240V, 3Φ, 4W
PANELBOARD
(EXISTING)

MOTOR STARTER
(EXISTING)

15 HP WASH
PUMP MOTOR
(EXISTING)

6 NO. 3/0, 5 KV (2 PER Φ)
2-2" CONDUITS

2300V. SWITCHGEAR (EXISTING)

¼"x2" CU. GRD. BUS

3Φ6

3KV

5KV, 600 A. SEL SW.

5 KV, 600A. LD. BRK. SW.

600/5A

20E

3#2/0

UNIT 1

UNIT 2

UNIT 3

2.4 KV FUSE MOUNTINGS
WITH 125E AMP CURRENT
LIMITING FUSES

3 NO. 4, 5 KV

3 NO. 3/0, 5KV,
1 NO. 1/0 GRD.
2" CONDUIT

3 NO. 4, 5 KV, 1 NO. 1/0 GRD.

300 KVA, 2400-277/480 VOLT
3Φ PAD MOUNT TRANSFORMER
(NEW)

3 KV
LA'S

GROUND LUG

4 NO. 500MCM, 600V.
1 NO. 1/0 GRD.

3 NO. 4/0, 5KV, 1 NO. 1/0 GRD.

LOCATED IN
CHEMICAL BLDG.

PANEL
PP
(NEW)

4 NO. 250 MCM, 600V.
1 NO. 1/0 GRD.

LOCATED IN FILTER BLDG.

PPANEL
PP
(NEW)

PANEL
HP
(NEW)

4 NO. 2, 1 NO. 8 GRD.
1½" CONDUIT

4 NO. 4/0, 600V., 1 NO. 2 GRD.
2½" CONDUIT

100A

225A

400 VOLT, 400 AMP, 3Φ, 4W
DISTRIBUTION PANEL "DP"
(LOCATED IN FILTER BLDG.)
(NEW)

NO. 1/0 GROUND TO
WATER PIPE

GROUND BUS

NO. 1/0

NEUTRAL
BUS

4 NO. 2, 600V.
1 NO. 1/0 GRD.

PANEL
PP
(NEW)

LOCATED IN
PUMP BLDG.

MOTOR CONTROL CENTER (EXISTING)

¼"x2" CU. BUS BARS

CPT

S1

S2

50/5

INCOMING
SECTION

STARTER 4

STARTER 3

STARTER 2

STARTER 1

3#4, 5 KV
1¼" C.

3#8, 5 KV
1¼" C.

200 HP
PUMP MOTOR

150 HP
PUMP MOTOR

125 HP
PUMP MOTOR

100 HP
PUMP MOTOR

EXISTING

250 KW GEN
CONTROL
PANEL
(METERING &
CONTROLS)

133 KW GEN
CONTROL
PANEL
(METERING &
CONTROLS)

GEN
250 KW

GEN
133 KW

EXISTING

MOTOR STARTER CENTER (NEW)

2300V. 600 AMP BUS

FUTURE

20:1

VS

3 KV
L.A.'S

CU. GRD. BUS

100/5

3 NO. 4, 5KV
1 NO. 8 GRD.
1¼" CONDUIT

3 NO. 4, 5KV
1 NO. 6 GRD.
1¼" CONDUIT

3 NO. 4, 5KV
1 NO. 6 GRD.
1¼" CONDUIT

250 HP
PUMP MOTOR

250 HP
PUMP MOTOR

250 HP
PUMP MOTOR

12-2-77	Shawnee, Oklahoma
NO SCALE	WATER TREATMENT PLANT
JWP	
AGS	ONE LINE DIAGRAM
JER	
JMB	
88 OF 14	

1017 WT E-2 dN 12/77

LOOP DIAGRAM LEGEND

SYMBOL	DESCRIPTION
	AIR FILTER REGULATOR
——E——	ELECTRICAL POWER
- - - - -	ELECTRICAL SIGNAL
—L—L—	HYDRAULIC SIGNAL
————	PNEUMATIC SIGNAL
	SERVICE OR SHUTOFF VALVE
	SQUARE ROOT EXTRACTION
	RESISTOR (ADJUSTABLE 50-500 OHMS WIRE WOUND, 1 WATT MIN.)
	VALVE POSITION SELECTOR SWITCH

ABBREVIATIONS

EFCV	EFFLUENT FLOW CONTROL VALVE
FE	FLOW ELEMENT (DIFFERENTIAL PRESSURE FLOW TUBE)
FI	FLOW INDICATOR
FIC	FLOW INDICATING CONTROLLER
FNY	TOTALIZING COUNTER
FQY	INTEGRATING RELAY
FT	FLOW TRANSMITTER
FY	FLOW RELAY
HS	SELECTOR SWITCH
IFCV	INFLUENT CONTROL VALVE
IY	SIGNAL RELAYS (ISOLATION)
LAH	LEVEL ALARM HIGH
LIC	LEVEL INDICATING CONTROL
LT	LEVEL TRANSMITTER
PDT	PRESSURE DIFFERENTIAL TRANSMITTER
PI	PRESSURE INDICATOR (LOSS OF HEAD)
RFCV	RATE FLOW CONTROL VALVE
SY	SIGNAL RELAY
X	PURGE METER
XLC	SIGNAL CONDITIONING RELAY
XST	SIGNAL TOTALIZING RELAY
XY	CONTROL RELAY
ZC	POSITION CONTROL (4-WAY POSITIONER)
ZI	VALVE POSITION INDICATOR 0-5 VDC VOLTMETER (CAL. 0-10 OR 0-100)
ZLS	VALVE POSITION LIMIT SWITCH
ZT	VALVE POSITION TRANSMITTER

ELECTRICAL LEGEND

A C	FLUORESCENT LIGHTING FIXTURE. REFER TO FIXTURE SCHEDULE.
G	INCANDESCENT LIGHTING FIXTURE. REFER TO FIXTURE SCHEDULE.
B	MERCURY VAPOR LIGHTING FIXTURE. REFER TO FIXTURE SCHEDULE
	DUPLEX RECEPTACLE (WP INDICATES WEATHERPROOF DEVICE)
J	JUNCTION BOX
	MOTOR OUTLET
S	TOGGLE SWITCH
S_3	3 WAY SWITCH
	DISCONNECT SWITCH
	MAGNETIC MOTOR STARTER
	COMBINATION MOTOR STARTER
S_M	MANUAL MOTOR STARTER
	PUSHBUTTON STATION
T	THERMOSTAT
C	CLOCK OUTLET
L	LIMIT SWITCH
P	PRESSURE SWITCH
F	FLOW SWITCH
S	SOLENOID
MH	MANHOLE
HH	HANDHOLE
PB	PULLBOX
	TELEPHONE OUTLET
	PANELBOARD. REFER TO PANEL SCHEDULES.
	POWER PANEL, REFER TO PANEL SCHEDULES.
	TERMINAL CABINET FOR SIGNAL OR CONTROL CIRCUITS
	CONDUIT RUN. SLASHES INDICATE NO. OF WIRES, INCLUDING GREEN GROUND WIRE. RUNS SHOWN WITHOUT SLASHES INDICATE 2 NO. 12 AWG IN 3/4" CONDUIT UNLESS NOTED OTHERWISE.
	HOMERUN TO PANELBOARD OR DEVICE. ARROWHEADS INDICATE NO. OF CIRCUITS.

SCHEMATIC SYMBOLS

	TRANSFORMER
	POTENTIAL TRANSFORMER
	CURRENT TRANSFORMER
AS	AMMETER SWITCH
VS	VOLTMETER SWITCH
A	METER. (A-AMMETER, V-VOLTMETER, ETC)
	FUSE
	CIRCUIT BREAKER
	OVERLOAD DEVICE
	LIGHTNING ARRESTER
	INTERRUPTER SWITCH
	GROUND
	NORMALLY OPEN CONTACT
	NORMALLY CLOSED CONTACT
	CONTACTOR OR RELAY COIL
	PUSHBUTTON OPERATOR
	SELECTOR SWITCH
	LIMIT SWITCH
	FLOW SWITCH
	LEVEL SWITCH
	PRESSURE SWITCH
	TEMPERATURE SWITCH
	KNIFE SWITCH
	DRAWOUT DEVICE
R	PILOT LIGHT. (R-RED, G-GREEN, W-WHITE, A-AMBER, B-BLUE)

LIGHTING FIXTURE SCHEDULE

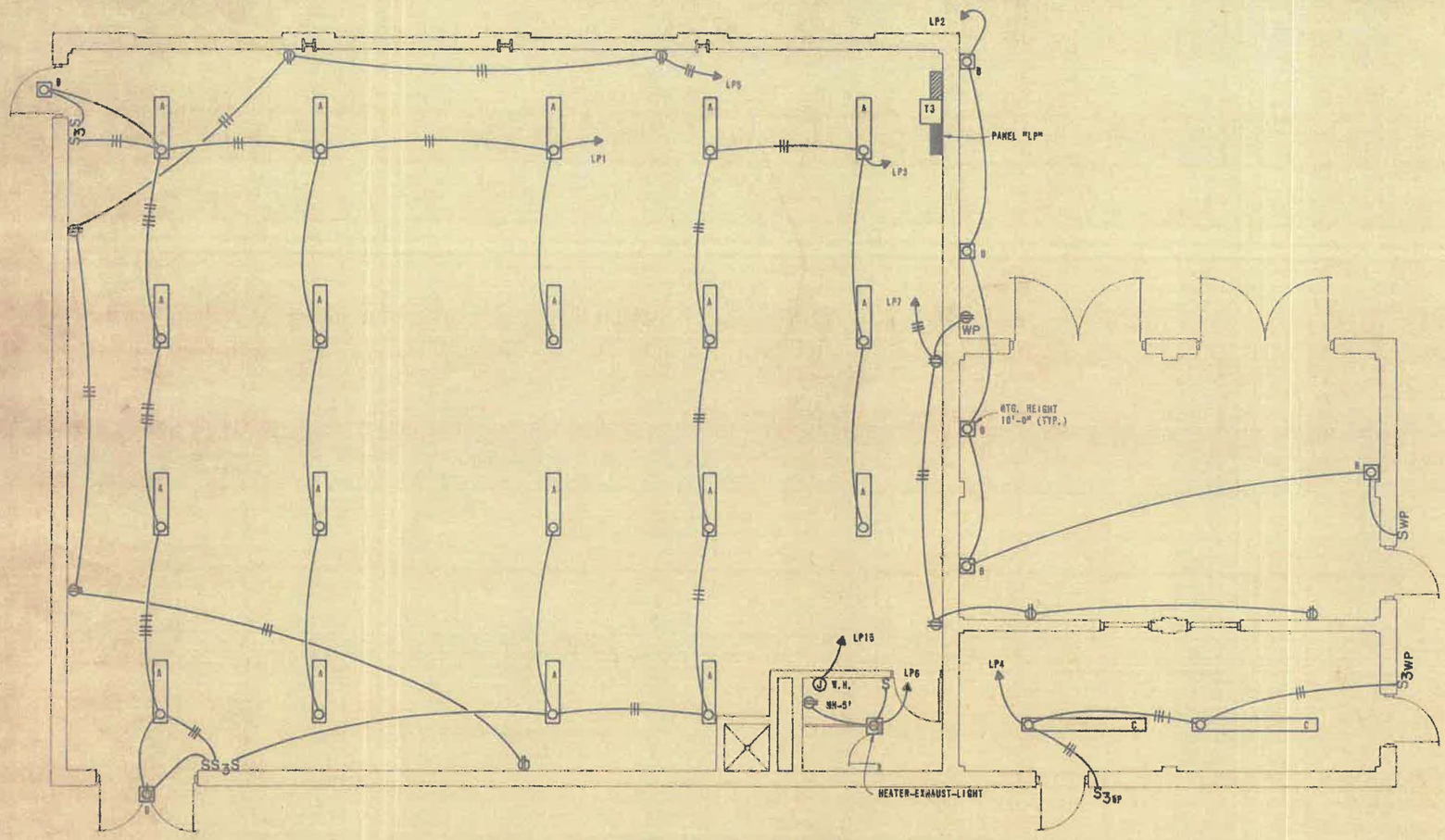
FIXTURE	MANUFACTURER	CATALOG NO.	VOLTS	AMPS NO.	AMPS WATTS	AMPS TYPE	MOUNTING	REMARKS
A	DAY-BRITE	4021I-4	120	2	40	F40CW	PENDANT	CPI-10 RAPID START
B	HOLOPHANE	412-120	120	1	100	MERCURY	WALL MTD.	WALL PACKETTE
C	DAY-BRITE	R-81441	120	4	40	F40CW	PENDANT	VAPORLUME
D	DAY-BRITE	80211-8	120	2	110	FB6T12HO	PENDANT	10' MOUNTING HT. CPI-10 HIGH OUTPUT
E	DAY-BRITE	45242-4	120	2	40	F40CW	WALL	EQUALITE
F	DAY-BRITE	4642-883-4	120	4	40	F40CW	RECESSED	MOBILEX-OCTEX
G	HOLOPHANE	488-240	240	1	250	MH	WALL MTD.	WALL PACKETTE
H	LIGHTOLIER	8772	120	2	75	INC	CEILING OR WALL	

NOTES:

1. ALL CONDUIT PENETRATIONS THRU WALLS SHALL BE MADE USING OZ TYPE "WSK" WALL SEALS OR EQUAL.
2. TERMINAL BLOCKS FOR SIGNAL AND CONTROL CABINETS SHALL BE:
   SIGNAL CONDUCTORS - BUCHANAN TYPE "SS" OR EQUAL.
   CONTROL CONDUCTORS - G.E. TYPE "EB-5" OR EQUAL.
3. ALL CONDUIT PENETRATIONS THROUGH FLOORS SHOULD BE SEALED USING DETAIL ON SHEET E8.

DATE 12-2-77	Shawnee, Oklahoma
SCALE NO SCALE	WATER TREATMENT PLANT
DESIGNED JWP	ELECTRICAL LEGENDS & SCHEDULES
DRAWN LCB	
CHECKED JER	
APPROVED JMS	
SHEET E3 OF 14	Bridges - Bice & Affiliates, Inc.

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CHEMICAL BUILDING LIGHTING AND RECEPTACLE PLAN

	AC		BC	
LIGHTING (TANK STOR. RM.)	1	20	2	20	LIGHTING (SCALE RM.)
LIGHTING (TANK STOR. RM.)	3	20	4		LIGHTING (CHLORINATOR RM)
RECEPTACLES	5	20	6	20	TOILET (LT., VENT., E.F.)
RECEPTACLES	7	20	8	20	CHLORINE PATCH PANEL
CHLORINE DETECTOR	9	20	10	15	HOIST
CHLORINATOR CONTROL	11	20	12	20	
CHLORINATOR CONTROL	13	20	14	15	PANEL LVP (SEE SHT. 65)
WATER HEATER	15	20	16		
SPARE	17	20	18		SPACE ONLY
SPARE	19	20	20		SPACE ONLY

PANEL "LP" SCHEDULE

120/240 VOLT, 1Φ, 3W, 100 AMP MAIN LUGS ONLY SURFACE MOUNTING

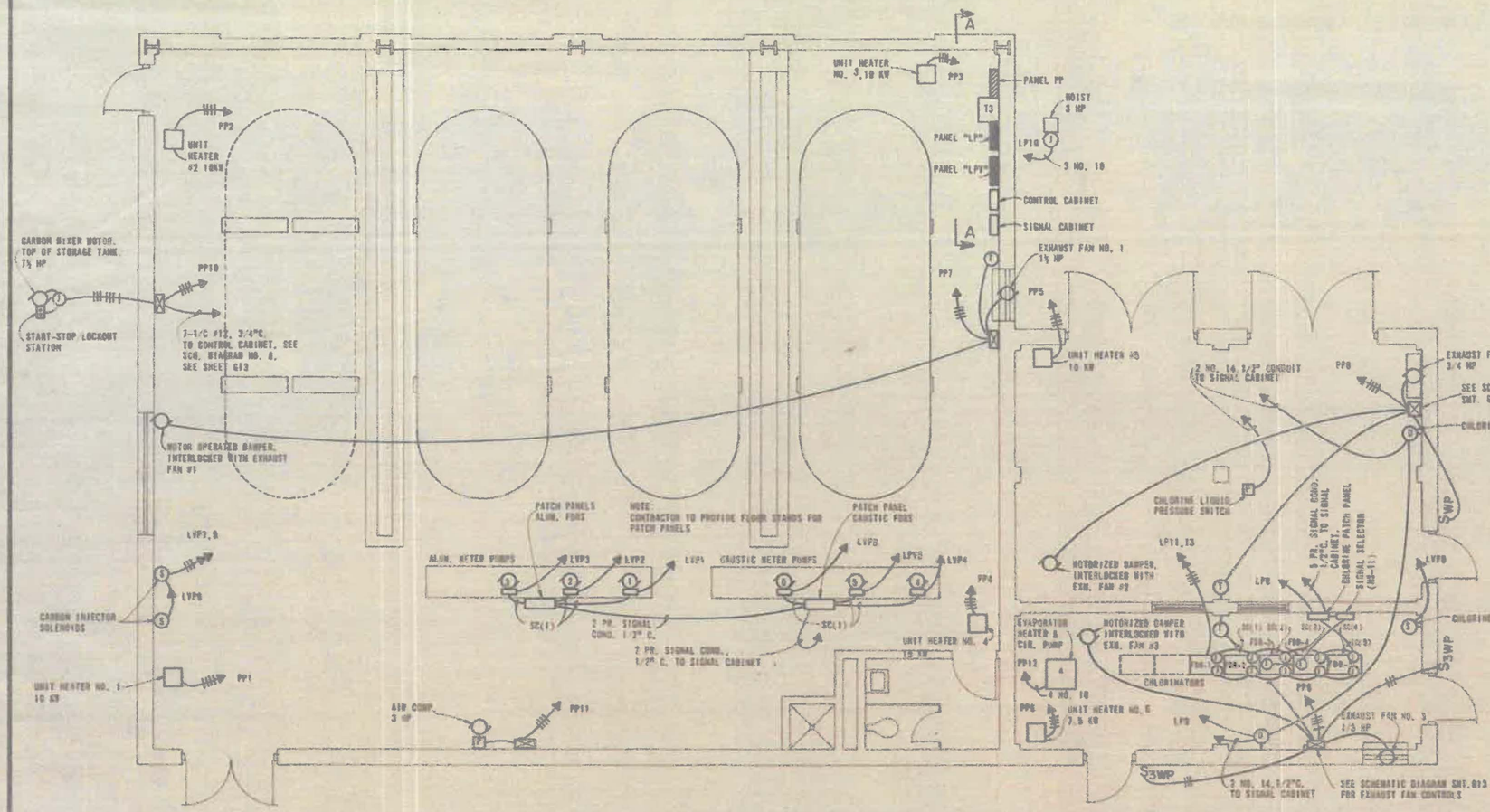
NOTE:
ALL CONDUITS BETWEEN ROOMS SHALL HAVE CONDUIT SEALS AND ALL WALL OPENINGS SHALL BE SEALED.

REFERENCES
ELECTRICAL SITE PLAN.....SHEET 61
ONE LINE DIAGRAM.....SHEET 62
CHEMICAL BLDG. POWER PLAN.....SHEET 65

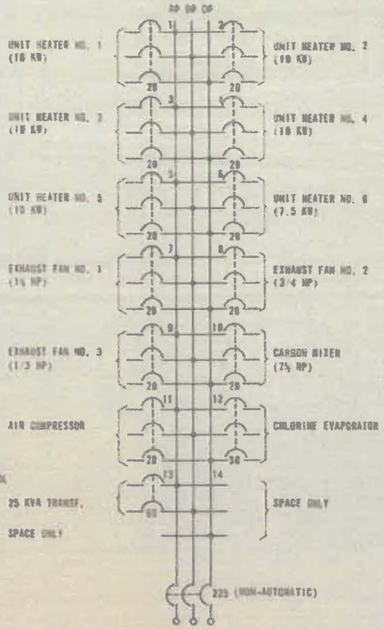
1 0 1 2 3 4 5 6 7
SCALE IN FEET
1/4" = 1'-0"
GRAPHIC SCALE

12-2-77	Shawnee, Oklahoma
1/4"=1'-0"	WATER TREATMENT PLANT
JWP	CHEMICAL BUILDING LIGHTING AND RECEPTACLE PLAN
LCR	
JER	
JMB	
64 OF 14	Benham - Blair & Affiliates, Inc.

1017 WT E-4&17

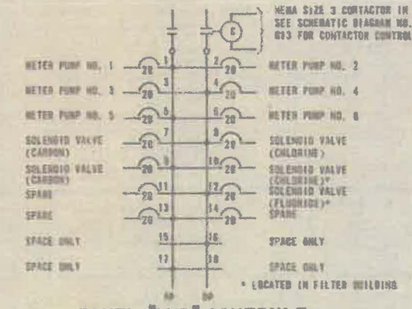


CHEMICAL BUILDING POWER PLAN



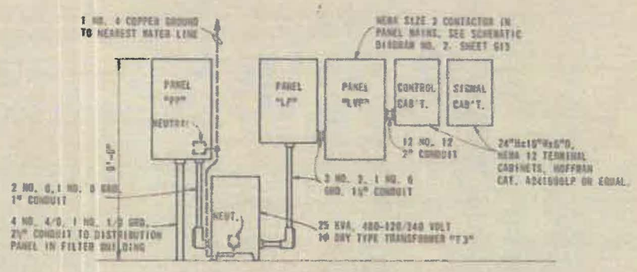
PANEL "PP" SCHEDULE

277/480 VOLT, 3Ø, 4W, 225 AMP MAIN CIRCUIT BREAKER SURFACE MOUNTING



PANEL "LVP" SCHEDULE

120/240 VOLT, 1Ø, 3W, 100 AMP MAIN LUGS ONLY, SURFACE MOUNTING



ELEVATION A-A

NO SCALE

REFERENCES:

ELECTRICAL SITE PLAN	SHEET G1
ONE LINE DIAGRAM	SHEET G2
CHEMICAL BLDG. LTG. & REC. PLAN	SHEET G4
ELECTRICAL CONTROL SCHEMATICS	SHEET G13
INSTRUMENTATION LOOP DIAGRAMS	SHEET F1, F2, F3, F4

SCALE IN FEET
1/4" = 1'-0"

DATE	12-2-77
SCALE	1/4"=1'-0"
DESIGNED BY	JWP
DRAWN BY	LCB
CHECKED BY	JER
APPROVED BY	JMB
SHEET	G5 OF 14

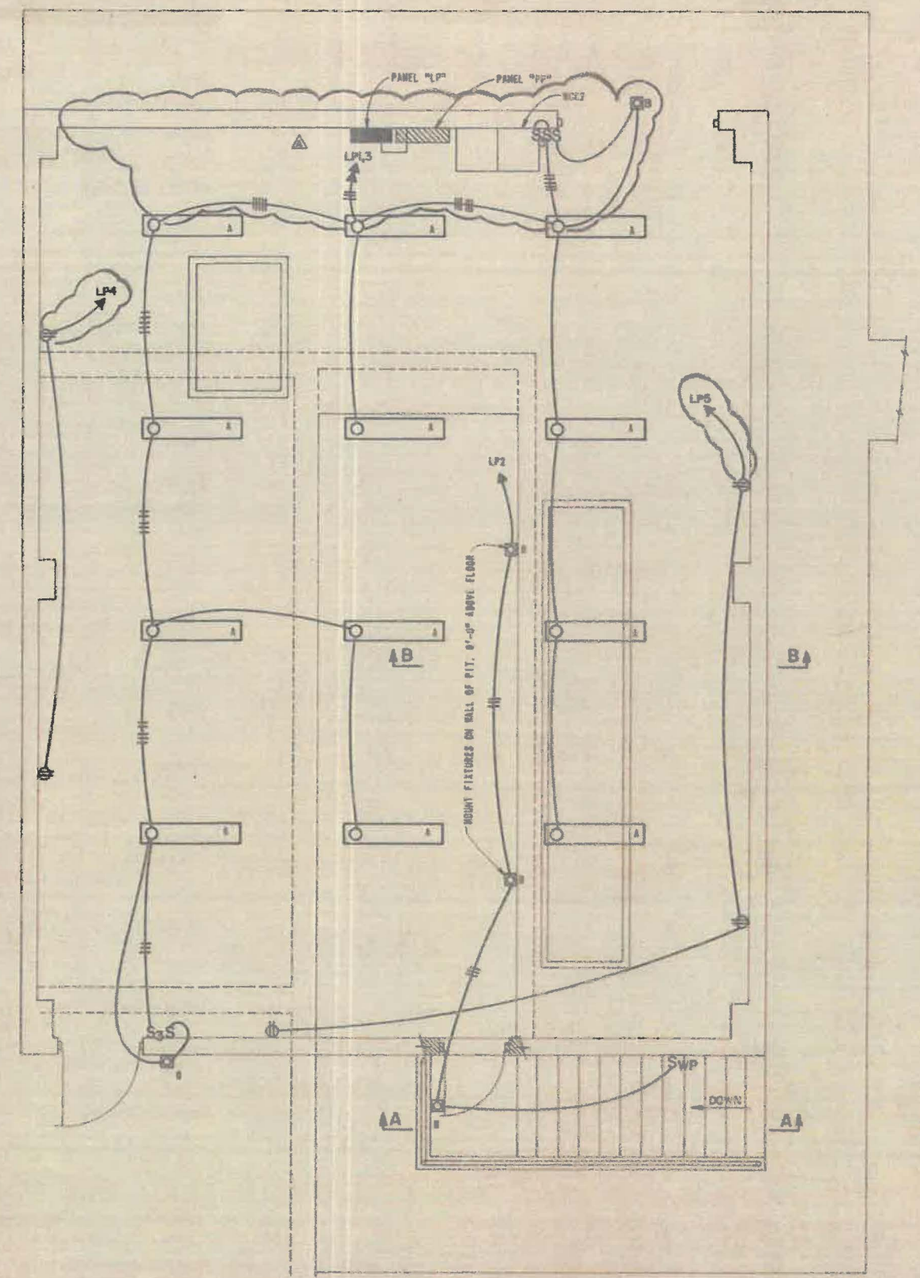
Shawnee, Oklahoma
WATER TREATMENT PLANT

CHEMICAL BUILDING POWER PLAN

Burns & McDonnell Engineering Co., Inc.

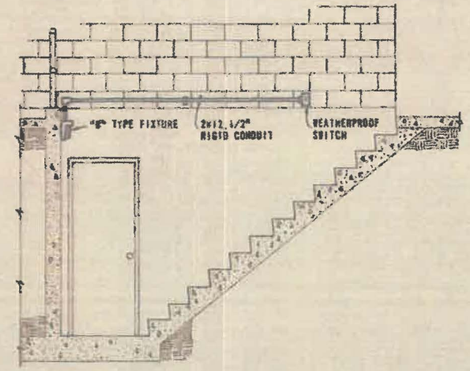
1017 WT 6-28-77

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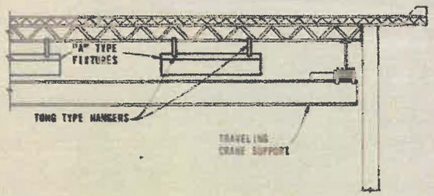


REFERENCES:
ELECTRICAL SITE PLAN.....SHEET G1
ONE LINE DIAGRAM.....SHEET E2
PUMP BLDG. POWER PLAN.....SHEET E7

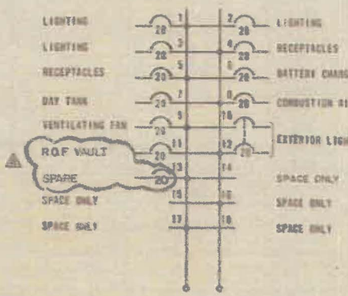
PUMP BUILDING LIGHTING AND RECEPTACLE PLAN



SECTION A-A



SECTION B-B



PANEL "LP" SCHEDULE

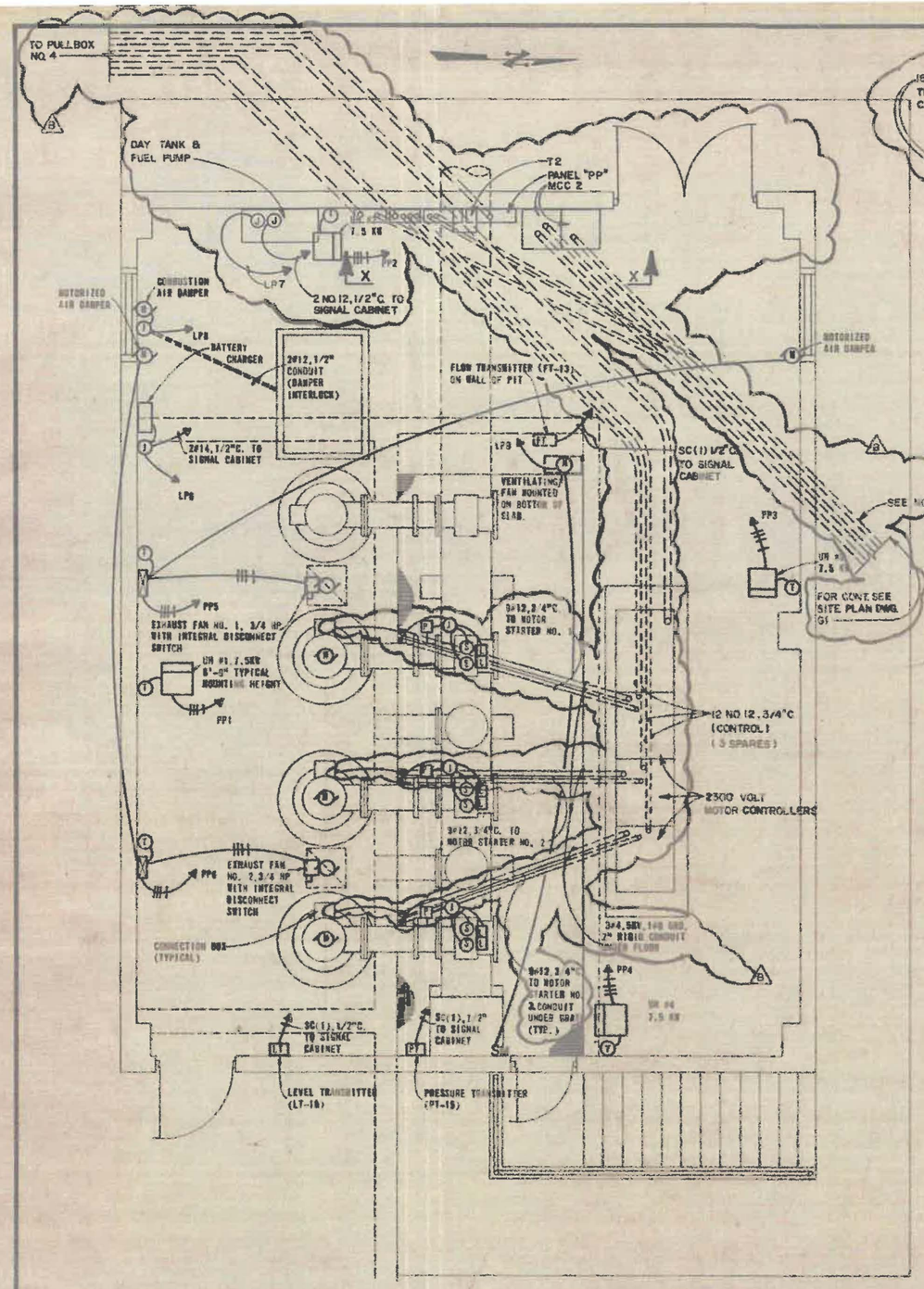
120/240 VOLT, 1Ø, 3W, 100 AMP MAIN LUGS ONLY SURFACE MOUNTING

SCALE IN FEET
3/64" = 1'-0"

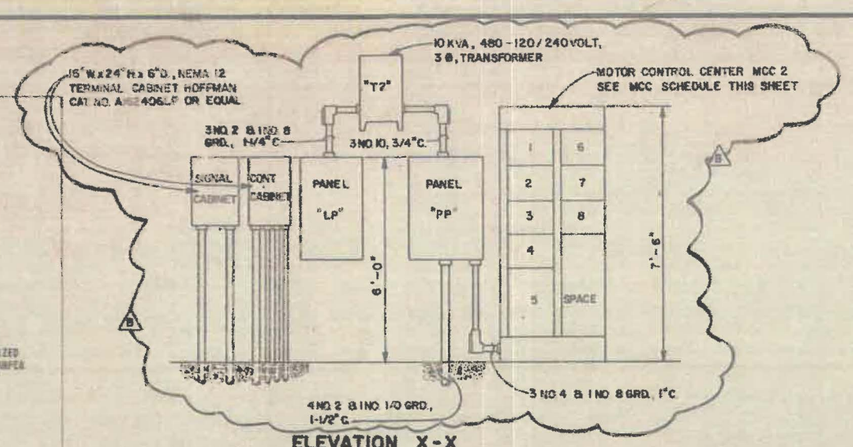
⚠ AUG 13, 1979 - RELOCATE ELECTRICAL EQUIPMENT AND REROUTE CONDUITS

DATE 12-2-77	Shawnee, Oklahoma
SCALE 3/8"=1'-0"	WATER TREATMENT PLANT
DESIGNED BY JWP	PUMP BUILDING LIGHTING AND RECEPTACLE PLAN
DRAWN BY LCG	
CHECKED BY JER	
APPROVED BY JMB	Burns - Hutt & Affiliates, Inc.
SHEET 66 OF 74	

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PUMP BUILDING POWER PLAN

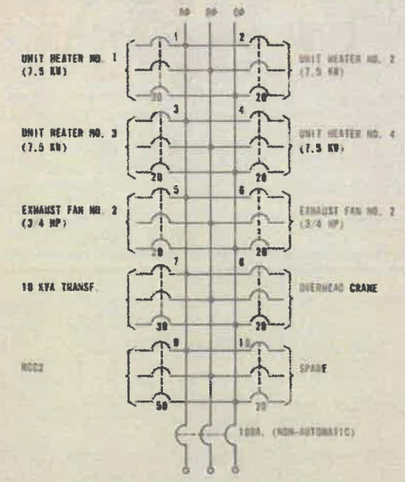


ELEVATION X-X

NO SCALE

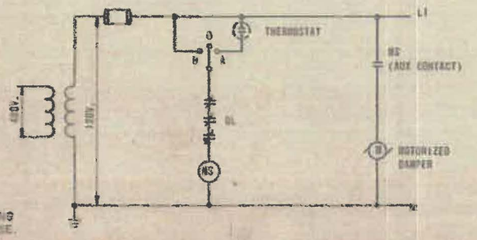
MOTOR CONTROL CENTER MCC2 SCHEDULE

CIRCUIT NUMBER	CONDUCTOR PHASE	CONDUCTOR GND	COND. SIZE	NAMEPLATE	DESIGN HP	DESIGN AMPS	CCT. BKR. AMPS	STARTER SIZE	CONTROL SCHEMATIC	REMARKS
MCC2-1	#2	#8		CLARIFIER NO. 1	1½	2.8	3	1	4	
MCC2-2	#2	#2		FLOCCULATOR 1A	3	4.8	7	1	5	
MCC2-3	#2	#2		FLOCCULATOR 1B	3	4.8	7	1	5	
MCC2-4	#2	#2		RAPID MIXER	3	4.8	7	1	5	
MCC2-5	4	8		INCOMING LINE	-	-	-	-	-	
MCC2-6	#2	#2		CLARIFIER NO. 2	1½	2.8	3	1	4	
MCC2-7	#2	#2		FLOCCULATOR 2A	3	4.8	7	1	5	
MCC2-8	#2	#2		FLOCCULATOR 2B	3	4.8	7	1	5	



PANEL "PP" SCHEDULE

277/480 VOLT, 3Ø 4W, 100 AMP MAIN CIRCUIT BREAKER, SURFACE MOUNTING



EXHAUST FAN CONTROL SCHEMATIC

TYPICAL FOR EXHAUST FANS 1 & 2

NOTES.

1 CONDUIT FOR CLARIFIER NO 2 AND FLOCCULATORS 2A & 2B TO BE STUBBED 10'-0" OUTSIDE OF BUILDING WALL AND CAPPED FOR FUTURE USE.

REFERENCES

ELECTRICAL SITE PLAN.....SHEET G1
ONE LINE DIAGRAM.....SHEET G2
PUMP BLDG. LTG. & REC. PLAN.....SHEET G8
ELEC. CONTROL SCHEMATICS.....SHEET G13
INSTRUMENTATION LOOP DIAGRAMS.....SHEETS F1, F2, F3 & F4

SCALE IN FEET 1 0 1 2 3 4 5 6 7
3/8" = 1'-0"

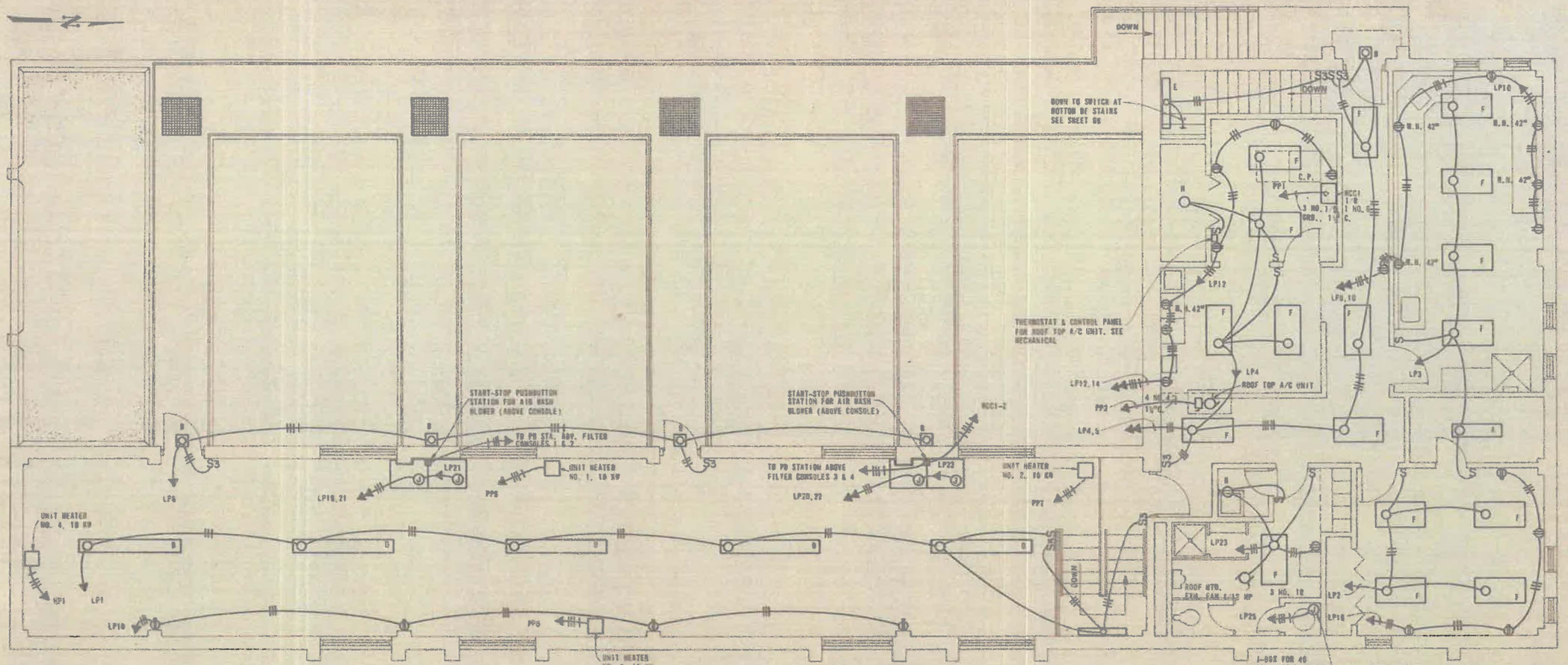
⚠B AUG 13, 1979 RELOCATE ELECTRICAL EQUIPMENT AND REROUTE CONDUITS

⚠A Jan. 9, 1978 Show Electrical Conduit above Floor.

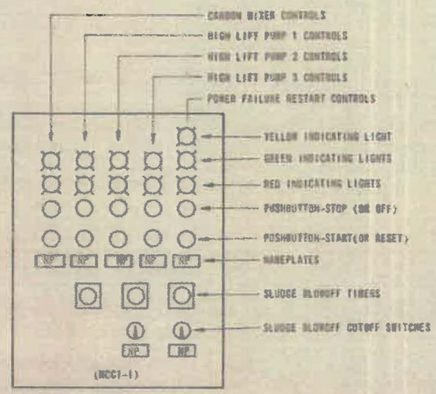
DATE 12-2-77	Shawnee, Oklahoma
SCALE 3/8"=1'-0"	WATER TREATMENT PLANT
DESIGNED JWP	PUMP BUILDING POWER PLAN
DRAWN LCB	
CHECKED JER	
APPROVED JMB	
SHEET 97 OF 114	

1017 WT 4/4/79

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FILTER BUILDING UPPER LEVELS POWER & LIGHTING PLAN



DETAIL "A"



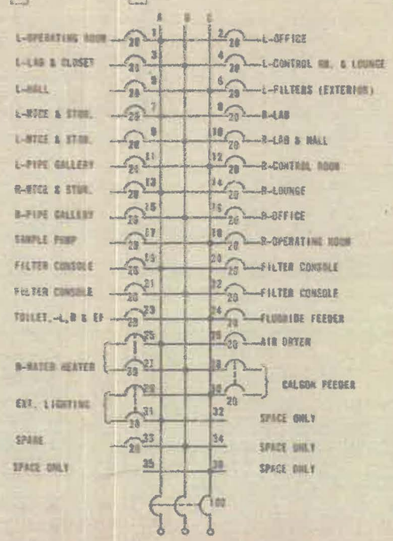
NOTE: NCC1 LOCATED IN CONTROL ROOM. SEE NCC SCHEDULE THIS SHEET.

ELEVATION MOTOR CONTROL CENTER MCC1

NO SCALE

MOTOR CONTROL CENTER MCC1 SCHEDULE

CIRCUIT NUMBER	CONDUCTOR PHASE	CONDUCTOR GRD.	COND. SIZE	NAMEPLATE	DESIGN HP	DESIGN AMPS	CKT. BKR. AMPS	STARTER SIZE	CONTROL SCHEMATIC	REMARKS
MCC1-1	-	-	-	RELAY & CONTROL	-	-	-	-	1,2,7	SEE DET. "A" THIS SHT.
MCC1-2	3 NO. 1	1 NO. 6	1½"	AIR WASH BLOWER	75	96	125	4	9	
MCC1-3	3 NO. 1/0	1 NO. 6	1½"	INCOMING LINE	-	-	-	-	-	



PANEL "LP" SCHEDULE

120/208 VOLT, 3Ø, 4 WIRE 100 AMP MAIN CIRCUIT BREAKER SURFACE MOUNT

REFERENCES:

ELECTRICAL SITE PLAN	SHEET E1
ONE LINE DIAGRAM	SHEET E2
FILTER BLDG. BASEMENT POWER & LTG. PLAN	SHEET E8
FILTER BLDG. ELECTRICAL DETAILS	SHEET E10
ELECTRICAL CONTROL SCHEMATICS	SHEET E13

1 0 1 2 3 4 5 6 7

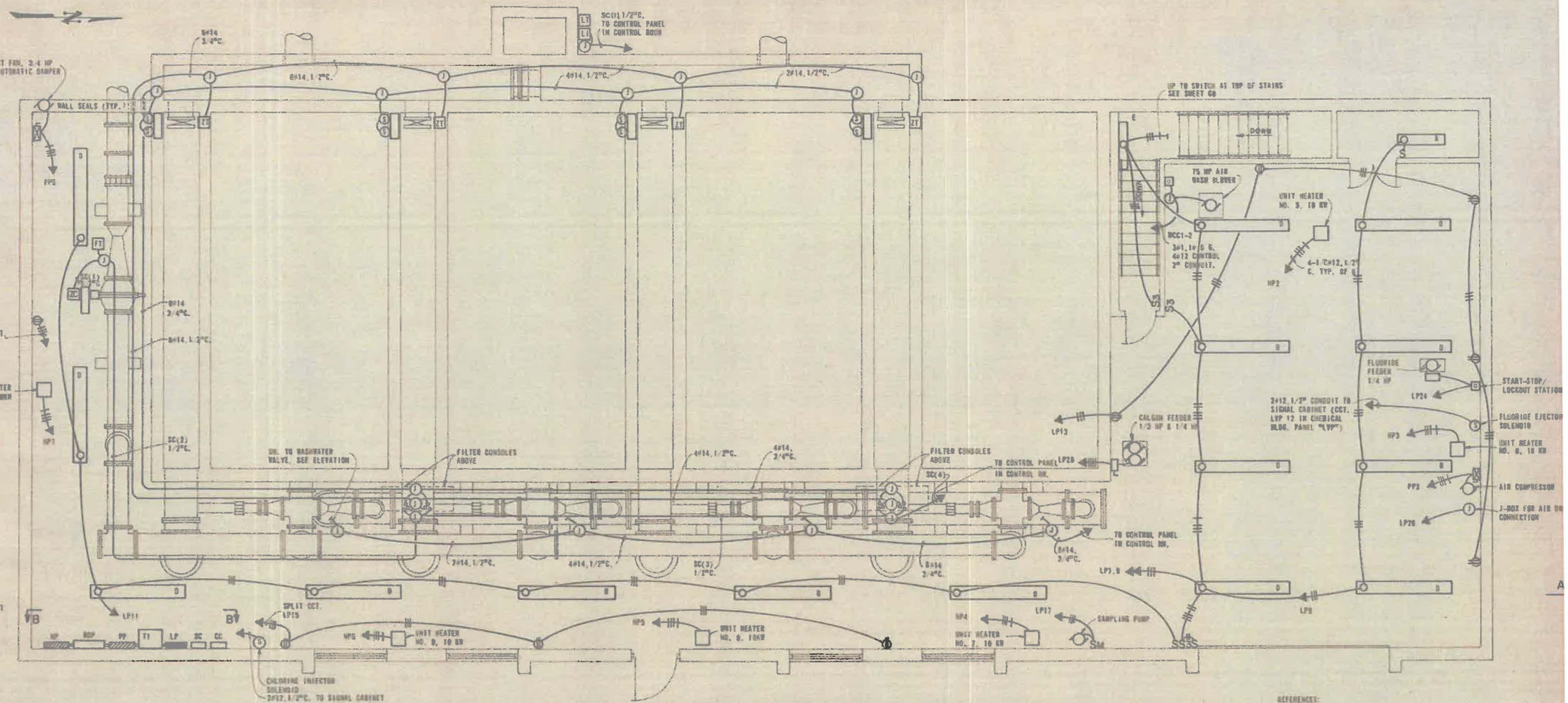
SCALE IN FEET
1/4" = 1'-0"

DATE	12-2-77
SCALE	1/4" = 1'-0"
DESIGNED	JWP
DRAWN	LCB
CHECKED	JER
APPROVED	JMB
SHEET	68 OF 14

Shawnee, Oklahoma
WATER TREATMENT PLANT

FILTER BUILDING UPPER LEVELS POWER & LIGHTING PLAN

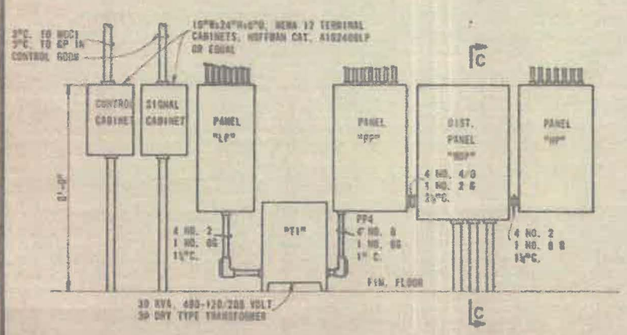
Benham-Blair & Affiliates, Inc.



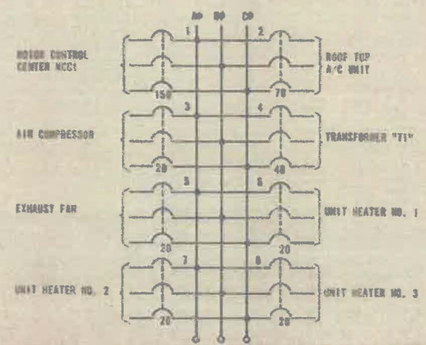
FILTER BUILDING-BASEMENT POWER & LIGHTING PLAN

REFERENCES:

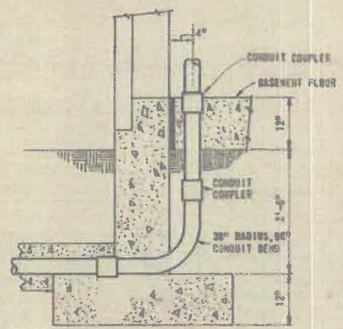
ELECTRICAL SITE PLAN	SHEET G1
ONE LINE DIAGRAM	SHEET G2
FILTER BLDG. UPPER LEVEL LTG. & POWER	SHEET G8
FILTER BLDG. ELECTRICAL DETAILS	SHEET G10
ELECTRICAL CONTROL SCHEMATICS	SHEET G13
INSTRUMENTATION LOOP DIAGRAMS	SHEETS F1,F2,F3,F4



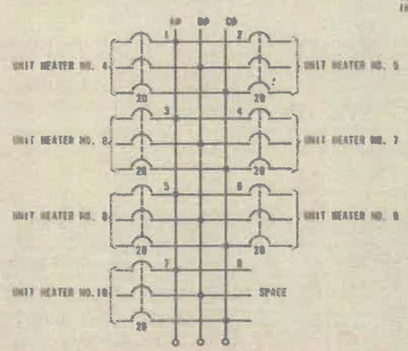
ELEVATION "B-B"
NO SCALE



POWER PANEL "PP"
480Y...3Ø,4W...225 AMP, MAIN LUGS ONLY SURFACE MOUNTING



SECTION "C-C" TYPICAL CONDUIT ENTRANCE
NO SCALE



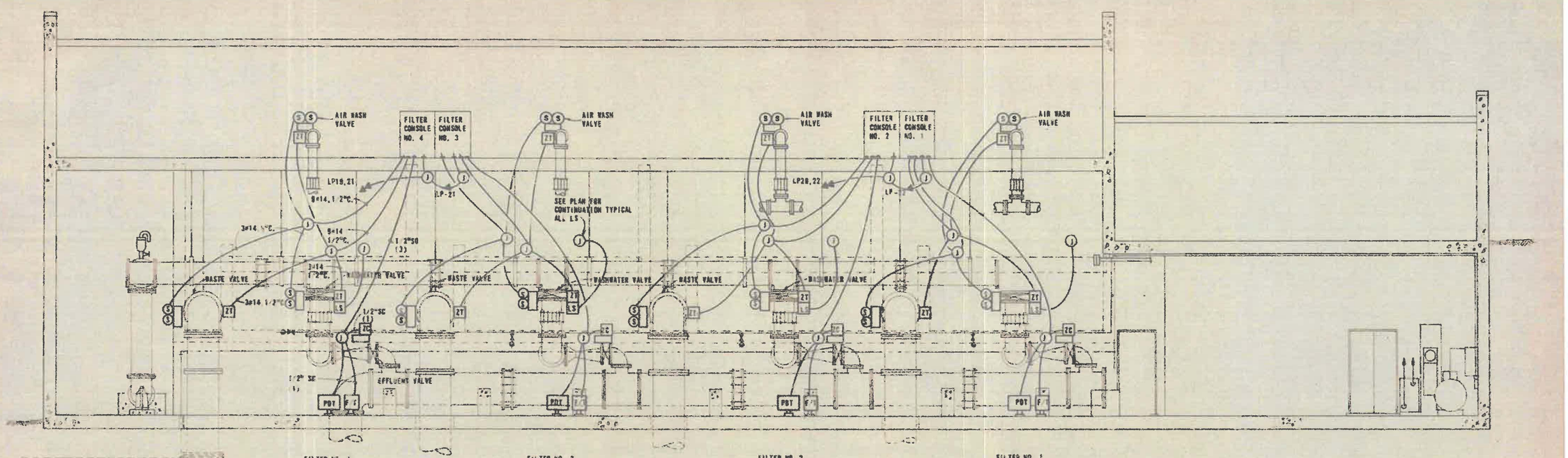
HEATER PANEL "HP"
480Y, 3Ø, 4W, 100 AMP MAIN LUGS ONLY, SURFACE MOUNT

SCALE IN FEET
1/4" = 1'-0"

DATE	12-2-77
SCALE	1/4" = 1'-0"
DESIGNED	JWP
DRAWN	LCG
CHECKED	JER
APPROVED	JMB
SHEET	59 OF 14

Shawnee, Oklahoma
WATER TREATMENT PLANT
FILTER BUILDING BASEMENT POWER & LIGHTING PLAN
Burns · Glue & Associates, Inc.

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NOTE: CONDUCTOR & CONDUIT DATA SHOWN FOR FILTER NO. 4 CONTROLS IS TYPICAL FOR ALL FILTERS

ELEVATION "A-A"

LEGEND

- (S)(S) DUAL SOLENOID VALVE
- 2T POSITION TRANSMITTER
- F/T FLOW TRANSMITTER
- PDT LOSS OF HEAD TRANSMITTER
- 2C VALVE POSITIONER
- (J) JUNCTION OR OUTLET BOX
- SC (6) SIGNAL CONDUIT WITH NO. OF SIGNAL PAIRS IN PARENTHESIS

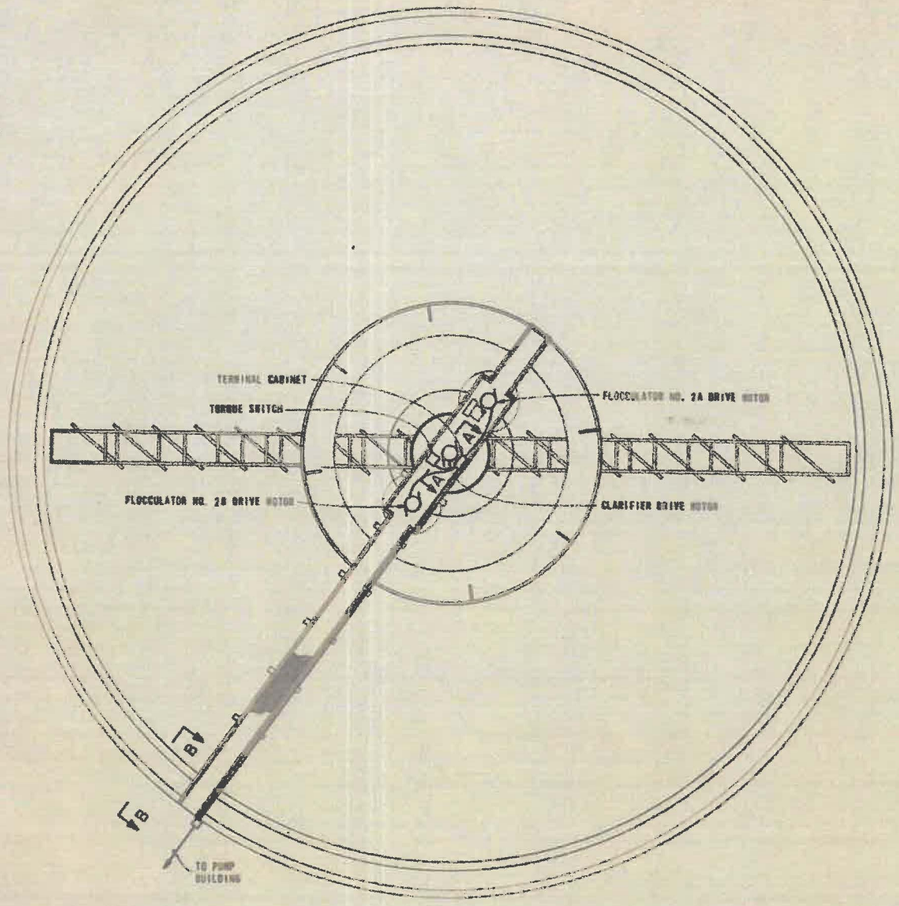
REFERENCES:

ELECTRICAL SITE PLAN	SHEET G1
ONE LINE DIAGRAM	SHEET G2
FILTER BLDG. UPPER LEVEL POWER & LTG. PLAN	SHEET G8
FILTER BLDG. BASEMENT POWER & LTG. PLAN	SHEET G9
INSTRUMENTATION LOOP DIAGRAMS, SHEETS 1,2 & 3	SHEET F-1,2,3 & 4

1 0 1 2 3 4 5 6 7
SCALE IN FEET
1/4" = 1'-0"

12-2-77	Shawnee, Oklahoma
1/4" = 1'-0"	WATER TREATMENT PLANT
JWP	FILTER BUILDING ELECTRICAL DETAILS
LCB	
JER	
JMB	
G10 of 14	Burns & McDonnell Engineering Co., Inc.

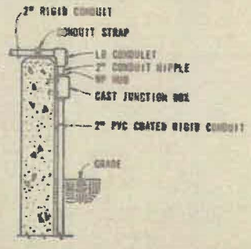
189



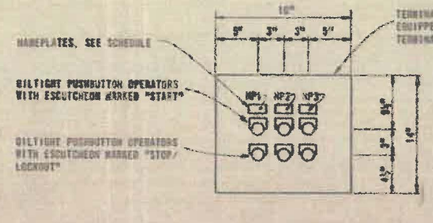
CLARIFIER - FLOCCULATOR NO. 2
CLARIFIER - FLOCCULATOR NO. 1 SIMILAR

NAMEPLATE SCHEDULE

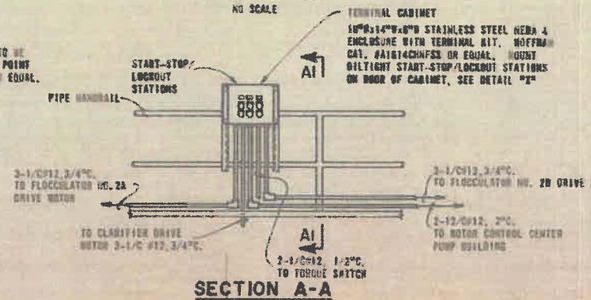
NO.	SIZE	MARKING
NP1	1"x2"	FLOCCULATOR DRIVE NO. 2A
NP2	1"x2"	CLARIFIER DRIVE
NP3	1"x2"	FLOCCULATOR DRIVE NO. 2B



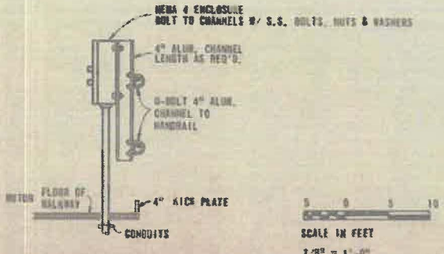
SECTION B-B
NO SCALE



DETAIL "X"
NO SCALE



SECTION A-A
NO SCALE



SECTION A1-A1
NO SCALE

SCALE IN FEET
3/8" = 1'-0"

REFERENCES
ELECTRICAL SITE PLAN.....SHEET G1
ONE LINE DIAGRAM.....SHEET G2
ELEC. CONTROL SCHEMATICS.....SHEET G13

DATE	12-2-77
SCALE	1/8" = 1'-0"
DESIGNED BY	JWP
DRAWN BY	LCB
CHECKED BY	JER
APPROVED BY	JMB
SHEET	G11 OF 14

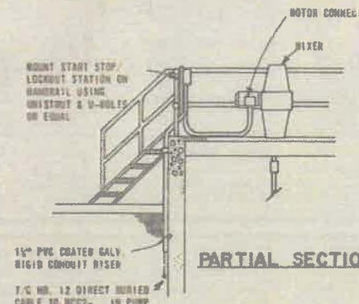
Shawnee, Oklahoma
WATER TREATMENT PLANT

CLARIFIER - FLOCCULATOR ELECTRICAL PLAN

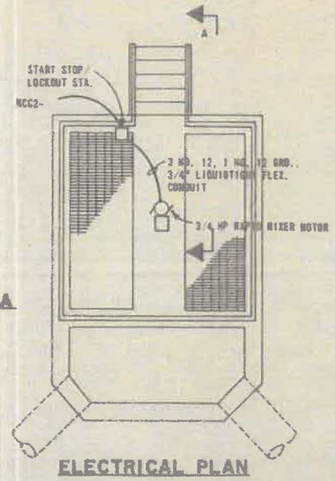
Bovay Engineers - Black & Veatch Associates, Inc.

1017 WT

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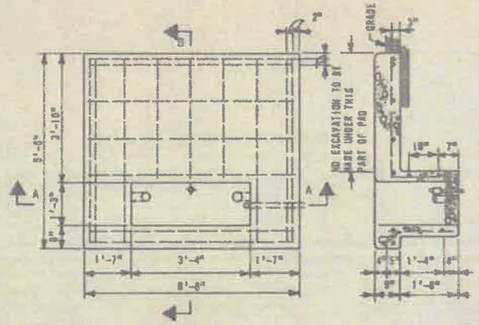
PARTIAL SECTION A-A



ELECTRICAL PLAN

RAPID MIX BASIN

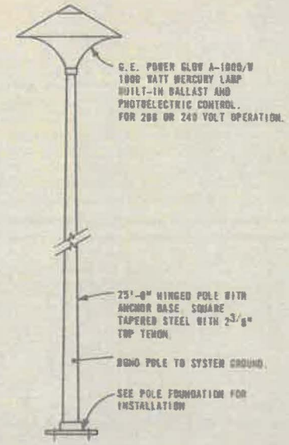
NOTES:
1. CONCRETE SHALL BE 3000 SPI @ 28 DAYS.
2. ALL REBARS TO BE #4.



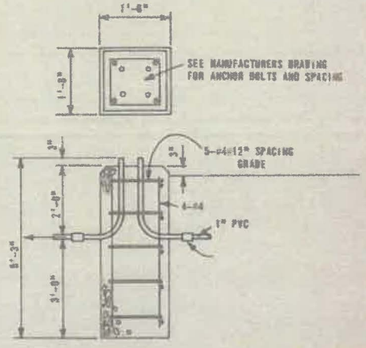
PLAN

SECTION A-A

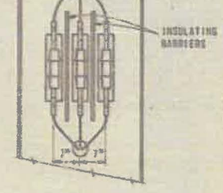
DISTRIBUTION TRANSFORMER PAD



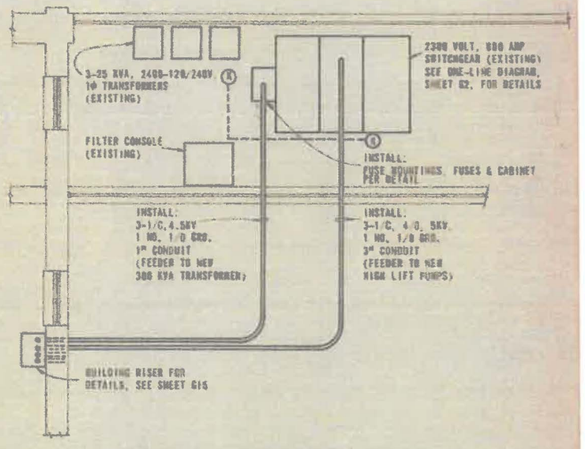
AREA LIGHTING STANDARD



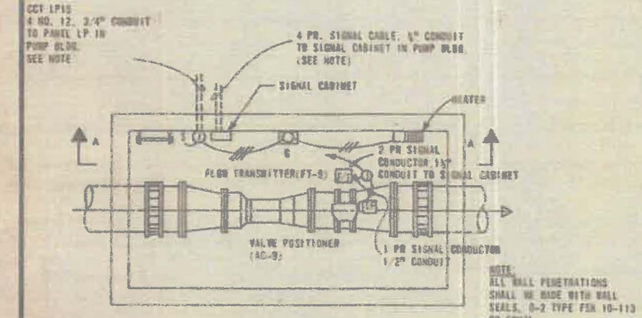
LIGHT POLE FOUNDATION



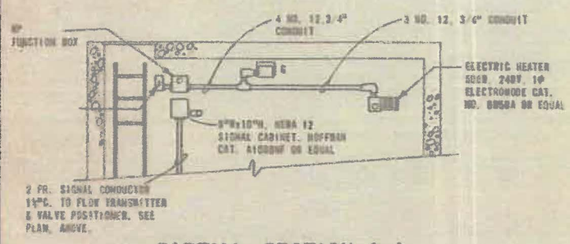
PARTIAL SECTION A-A



EXISTING FILTER BUILDING
PARTIAL PLAN

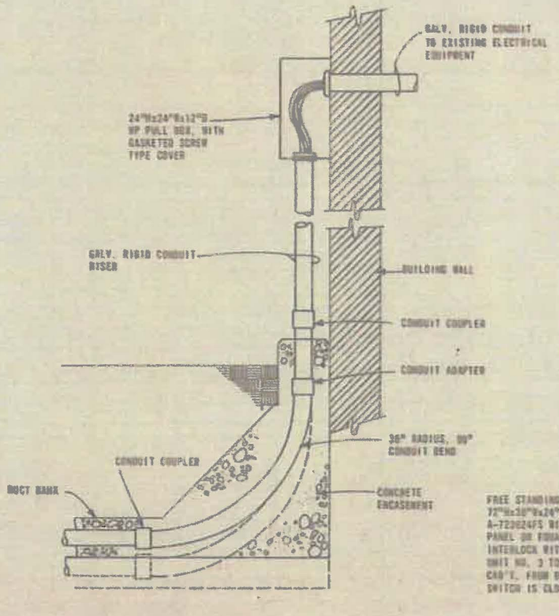


PLAN

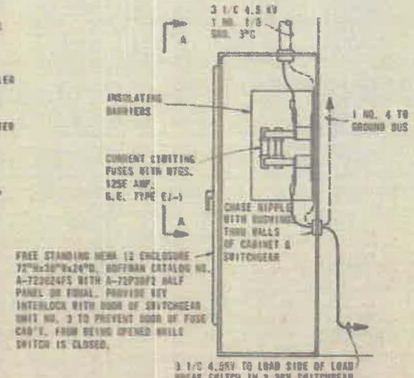


PARTIAL SECTION A-A

INFLUENT VALVE BOX



TYPICAL BUILDING RISER

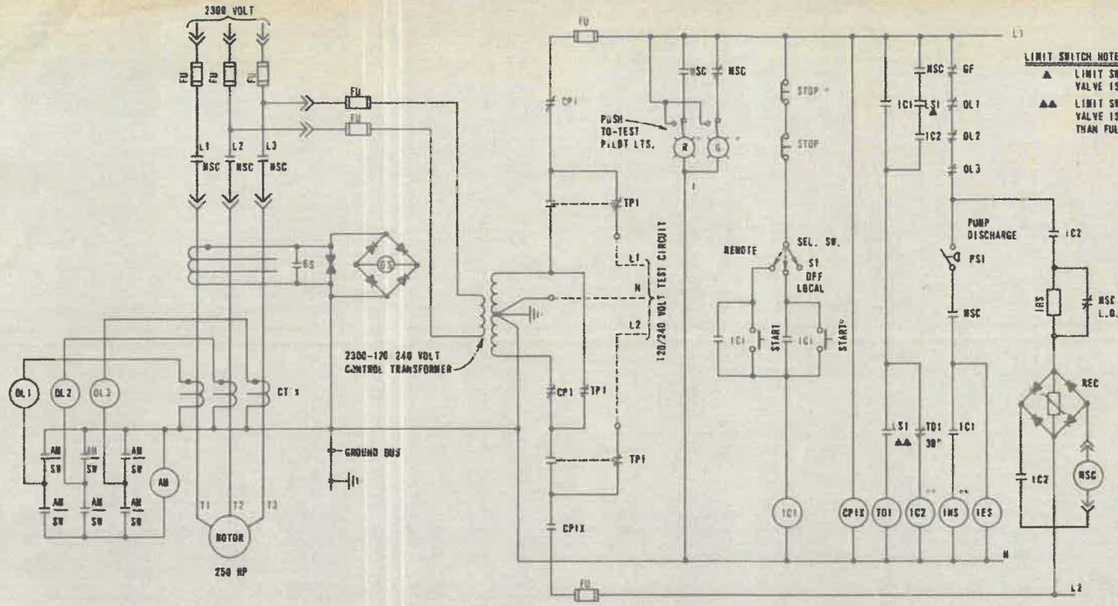


DETAIL FUSE CABINET

SCALE: 3/4" = 1'-0"

DATE: 12-2-77	Shawnee, Oklahoma
SCALE: AS SHOWN	WATER TREATMENT PLANT
DESIGNED BY: JWP	MISCELLANEOUS ELECTRICAL DETAILS
DRAWN BY: AGS	
CHECKED BY: JER	
APPROVED BY: JMB	
SHEET: G12 OF 14	Bennett · Black & Associates, Inc.

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SCHEMATIC DIAGRAM #1.

HIGH LIFT PUMPS - TYPICAL OF 3 UNITS

CONTACTS HANDLE END		POSITIONS 1	INT	2	OFF	
1	1	X	X			REMOTE
	2		X	X		LOCAL

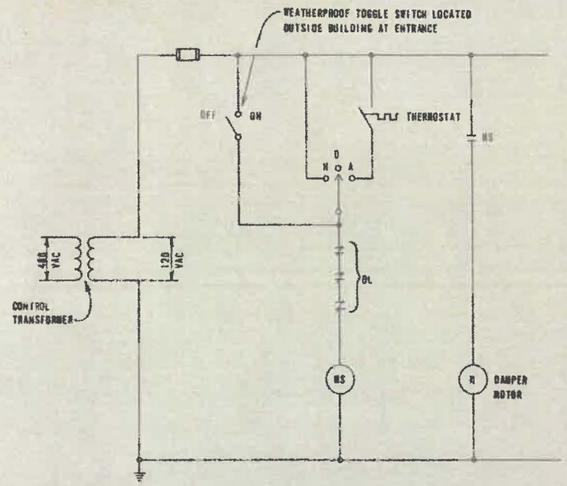
SELECTOR SWITCH "S1"

(GE TYPE [illegible] PISTOL GRIP HANDLE)

CONTACT DEVELOPMENT DIAGRAM

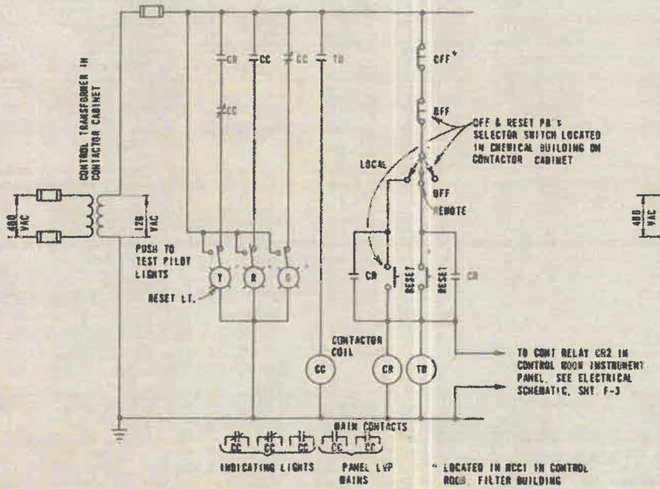


ESCUTCHEON (FY)



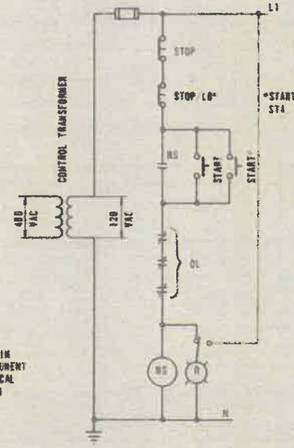
SCHEMATIC DIAGRAM #6

CHEMICAL BUILDING EXHAUST FANS (TYPICAL)



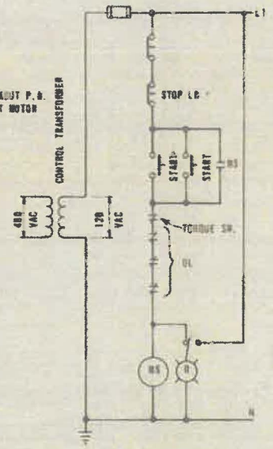
SCHEMATIC DIAGRAM #2

CONTACTOR CONTROL



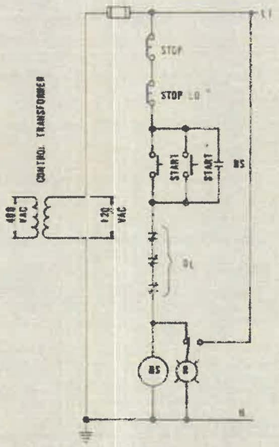
SCHEMATIC DIAGRAM #3

RAPID MIXER.



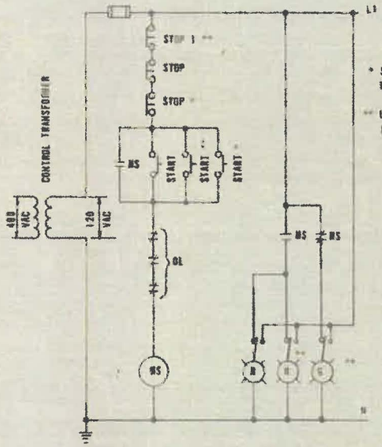
SCHEMATIC DIAGRAM #4

CLARIFIERS



SCHEMATIC DIAGRAM #5

FLOCCULATORS



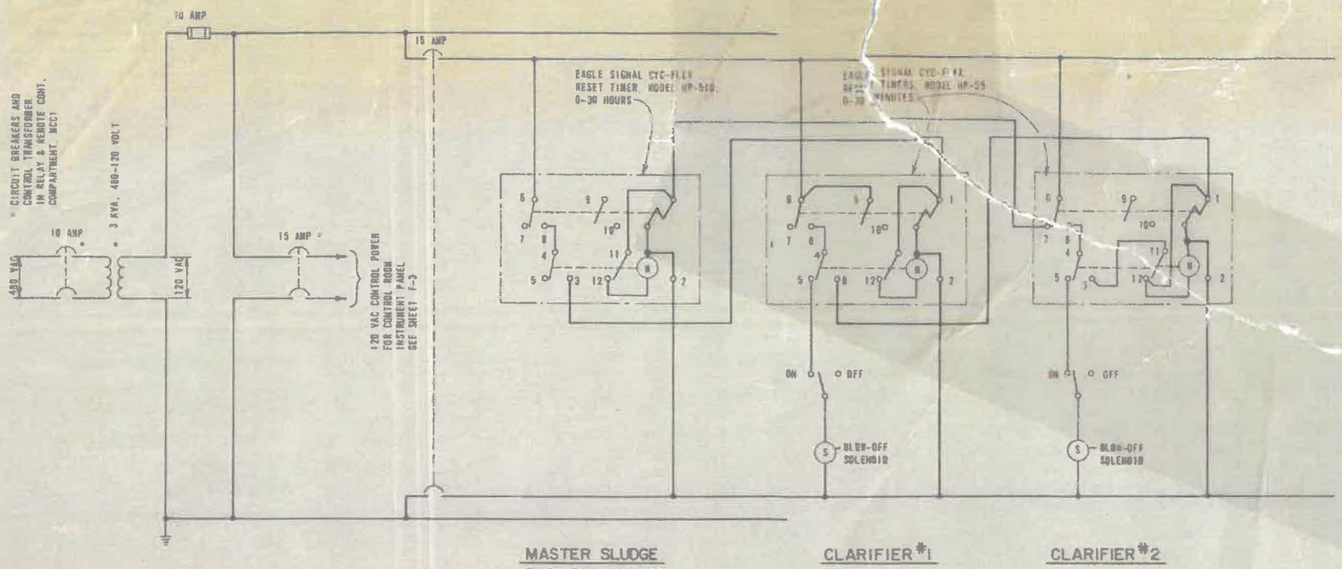
SCHEMATIC DIAGRAM #8

CARBON MIXER

REFERENCES:
CONTROL CABLE SCHEDULE.....SHEET G14

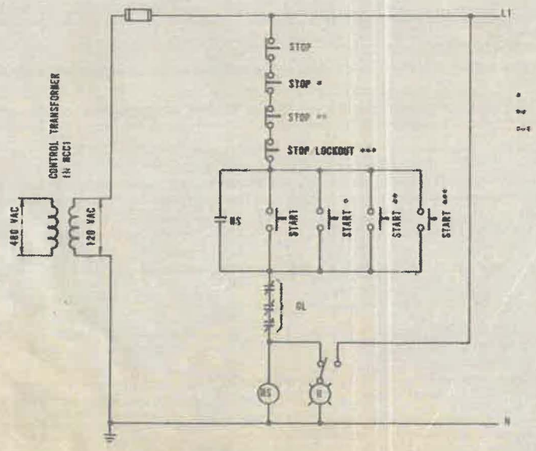
12-2-77	Shawnee, Oklahoma
NO SCALE	WATER TREATMENT PLANT
JWP	ELECTRICAL
LCB	CONTROL SCHEMATICS
JER	SHEET 1
JMB	
G13 OF 14	Burns & McDonnell Engineering Co., Inc.

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SCHEMATIC DIAGRAM #7

SLUDGE BLOW-OFF CONTROLS



* LOCATED ABOVE FILTER CONSOLES 1 & 2
** LOCATED ABOVE FILTER CONSOLES 3 & 4
*** LOCATED AT MOTOR

SCHEMATIC DIAGRAM #9

AIR WASH BLOWER

SIGNAL CABLE SCHEDULE (SEE LOOP DIAGRAMS SHEETS F1, F2 & F3)

FILTER BLDG. SIGNAL CABINET TO CHEMICAL BLDG. SIGNAL CABINET

6-PAIR SIGNAL CABLE

1 PAIR - OUTPUT FY-8 TO CHLORINE PATCH PANEL } LOOP #12
1 PAIR - OUTPUT FRC-11 TO CHLORINE PATCH PANEL }
1 PAIR - OUTPUT HS-11 TO FI-11B IN CONTROL ROOM INSTRUMENT PANEL
1 PAIR - CHLORINE DETECTOR ALARM TO ANNUNCIATOR IN CONTROL ROOM INSTRUMENT PANEL
1 PAIR - CHLORINE LIQUID PRESSURE ALARM TO ANNUNCIATOR
1 PAIR - SPARE

INFLUENT VALVE PIT SIGNAL CABINET TO FILTER BLDG. SIGNAL CABINET VIA PUMP BLDG. SIGNAL CABINET

4-PAIR SIGNAL CABLE

1 PAIR - OUTPUT FI-8 TO FY-6 IN CONTROL ROOM INSTRUMENT PANEL
1 PAIR - OUTPUT ZY-8 TO ZC-8 IN INFLUENT VALVE PIT
2 PAIR - SPARES

PUMP BLDG. SIGNAL CABINET TO FILTER BLDG. SIGNAL CABINET

8-PAIR SIGNAL CABLE

1 PAIR - OUTPUT LT-16 TO LI-16B IN CONTROL ROOM INSTRUMENT CABINET

1 PAIR - OUTPUT PT-15 TO PI-15B IN CONTROL ROOM INSTRUMENT CABINET
1 PAIR - BATTERY CHARGER ALARMS TO ANNUNCIATOR IN CONTROL ROOM INSTRUMENT PANEL
1 PAIR - DAY TANK FUEL LEVEL ALARM TO CONTROL ROOM INSTRUMENT PANEL
1 PAIR - SPARE
4 PAIR - INFLUENT VALVE SIGNALS

INFLUENT VALVE BOX SIGNAL CABINET TO CHEMICAL BLDG. SIGNAL CABINET

4-PAIR SIGNAL CABLE

1 PAIR - OUTPUT FT-8 TO FY-8 IN CONTROL ROOM INSTRUMENT PANEL
1 PAIR - OUTPUT FIC-9 TO ZC-8 ON INFLUENT VALVE
2 PAIR - SPARES

CONTROL CABLE SCHEDULE (SEE SCHEMATICS SHEET E-13)

CHEMICAL BLDG. CONTROL CABINET TO FILTER BLDG. CONTROL CABINET

2-12/C #12

B/C - PANEL LVP CONTACTOR IN CHEMICAL BLDG.
2/C - CHLORINE INJECTOR SOLENOID IN FILTER BLDG.
2/C - FLUORIDE INJECTOR SOLENOID IN FILTER BLDG.
7/C - CARBON MIXER REMOTE CONTROL
5/C - SPARES

PUMP BLDG. CONTROL CABINET TO FILTER BLDG. CONTROL CABINET

2-12/C #12

7/C - HIGH LIFT PUMP #1
7/C - HIGH LIFT PUMP #2
7/C - HIGH LIFT PUMP #3
3/C - SPARES

FLOCCULATOR - CLARIFIER #1 TO MCC2 IN PUMP BLDG.

2-12/C #12

3/C - FLOCCULATOR DRIVE MOTOR 1A
3/C - FLOCCULATOR DRIVE MOTOR 1B
3/C - CLARIFIER DRIVE MOTOR 1
3/C - FLOCCULATOR 1A CONTROL STATION
3/C - FLOCCULATOR 1B CONTROL STATION
4/C - CLARIFIER 1 CONTROL STATION & TORQUE SW.
4/C - SPARE
1/C - GROUND

INFLUENT VALVE BOX TO PANEL IN PUMP BLDG.

1-4/C #12

3/C - POWER FOR HEATER & LIGHT
1/C - GROUND

FLOCCULATOR - CLARIFIER 2 TO MCC2 IN PUMP BLDG.

2-12/C #12

3/C - FLOCCULATOR DRIVE MOTOR 2A
3/C - FLOCCULATOR DRIVE MOTOR 2B
3/C - CLARIFIER DRIVE MOTOR #2
3/C - FLOCCULATOR 2B CONTROL STATION
3/C - FLOCCULATOR 2B CONTROL STATION
4/C - CLARIFIER 2 CONTROL STATION & TORQUE SW.
1/C - GROUND
4/C - SPARES

RAPID MIXER TO MCC2 IN PUMP BLDG.

1-10/C#12

3/C - MIXER MOTOR
3/C - MIXER CONTROL STATION
1/C - GROUND
3/C - SPARE

12-2-77	Stevens, California
NO SCALE	WATER TREATMENT PLANT
JWP	ELECTRICAL
LGB	CONTROL SCHEMATICS
JER	SHEET 2
JMB	
E-14 OF 14	Bowman, Wolf & Williams, Inc.

CITY OF SHAWNEE, OKLAHOMA

1/2 SIZE PLANS

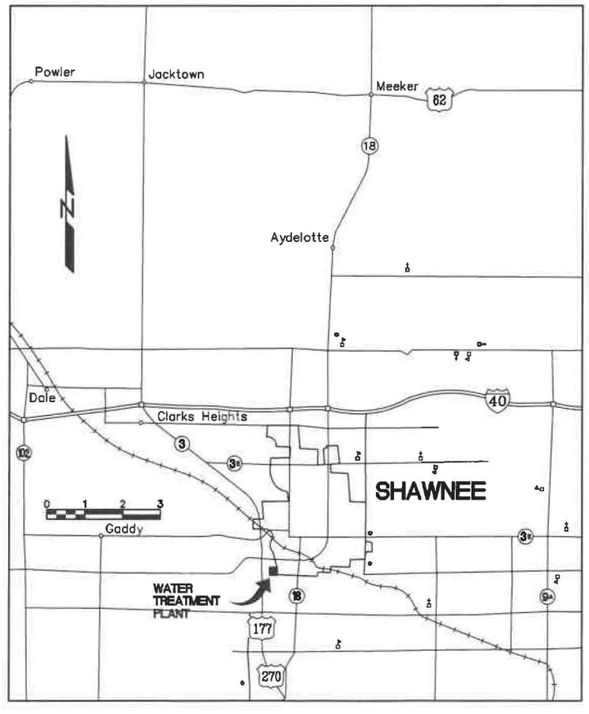
PHASE I WATER PLANT IMPROVEMENTS

INCREASED CAPACITY FOR PLANT NO. 2

OCTOBER 27, 2000

CITY OF SHAWNEE

CHRIS HARDEN	Mayor
TOM A. CLAYBROOK	Commissioner Ward 1
ROBERT M. PETTYJOHN	Commissioner Ward 2
JAMES HARROD	Commissioner Ward 3
STEVEN BLAIR	Commissioner Ward 4
BRAD ROACH, DVM	Commissioner Ward 5
R.J. "BOB" DOWNING	Commissioner Ward 6
TERRY POWELL	City Manager
DIANA HALLOCK	City Clerk
JOHN KRYWICKI	City Engineer
JAMES COLE	Public Works Director
JOHN CANAVAN	City Attorney



VICINITY MAP

RECORD DRAWINGS

THESE PLANS RECORD THE ACTUAL CONSTRUCTION CONDITIONS OF THE PROJECT INCLUDING VARIATIONS FROM THE ORIGINAL CONTRACT DOCUMENTS IN ACCORDANCE WITH INFORMATION AVAILABLE TO THE ENGINEER

DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.

REGISTERED PROFESSIONAL ENGINEER
BRUCE H BELLEN 11505
OKLAHOMA

HOLLOWAY UPDIKE & BELLEN, INC.

C.A. 219

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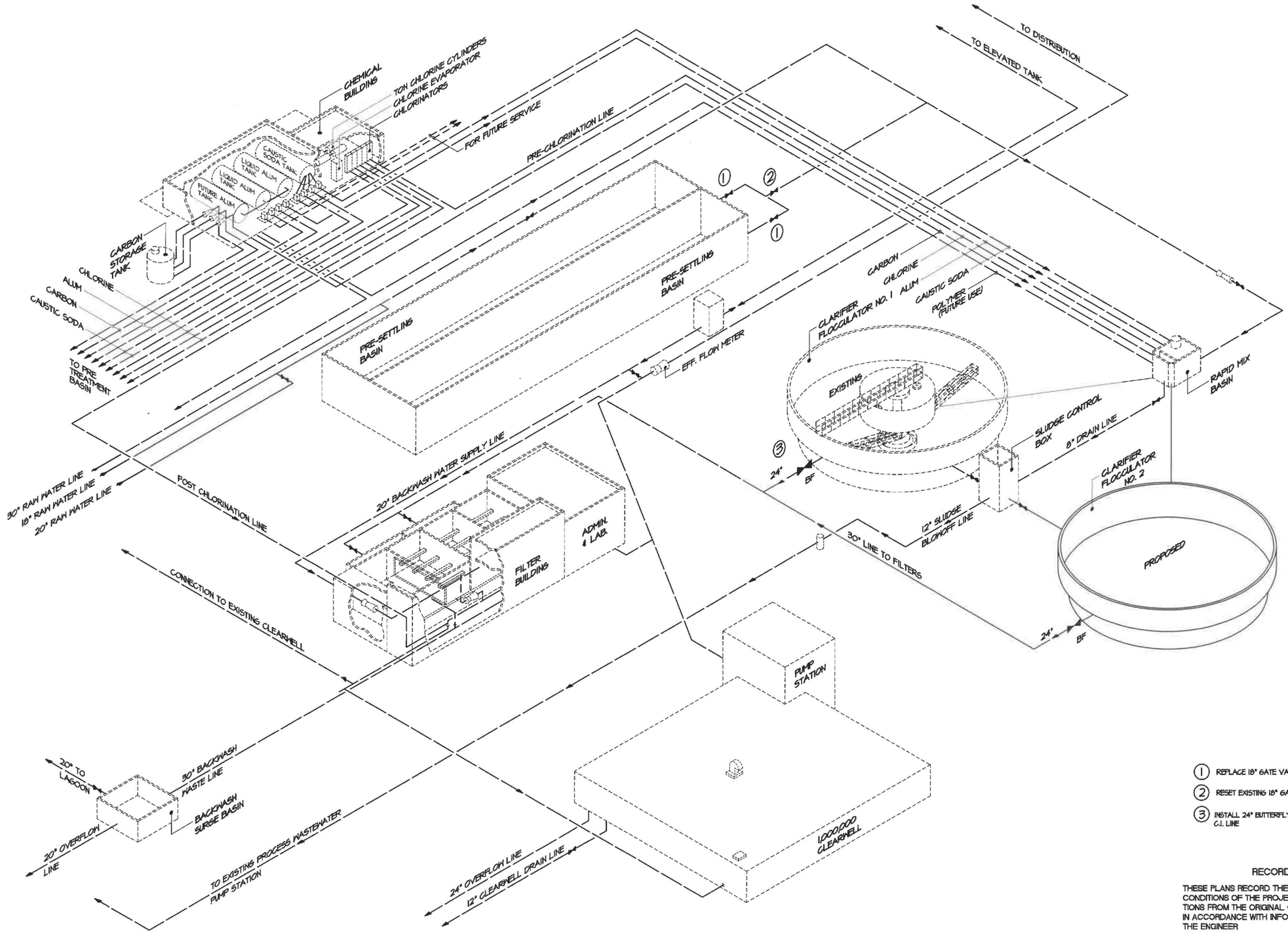
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(1) REPLACE 18" GATE VALVE

(2) RESET EXISTING 18" GATE VALVE

(3) INSTALL 24" BUTTERFLY VALVE IN EXISTING C.I. LINE

RECORD DRAWINGS

THESE PLANS RECORD THE ACTUAL CONSTRUCTION CONDITIONS OF THE PROJECT INCLUDING VARIATIONS FROM THE ORIGINAL CONTRACT DOCUMENTS IN ACCORDANCE WITH INFORMATION AVAILABLE TO THE ENGINEER

DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.

Holloway, Updike and Bellen, Inc.	CITY OF SHAWNEE, OKLAHOMA	SCALE:	NTS	PICTORIAL SCHEMATIC	Detail: GPM	Date: MAY 2000
	WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No. 965033	Check: BHB	Sheet No. 2

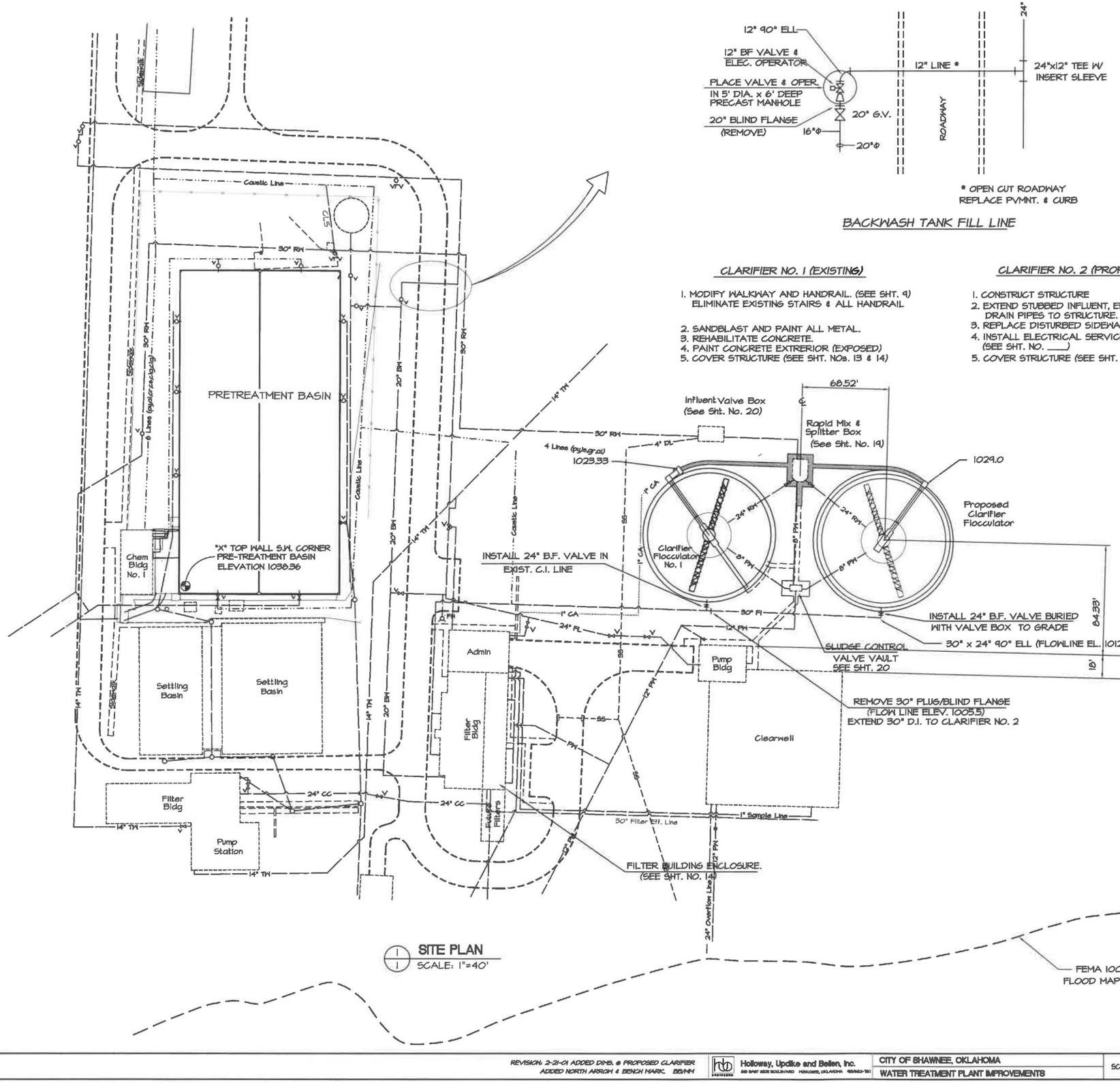
H:\Active Projects\1998\965033 Shawnee WTP\arc-pub\mxd\GB_DETAILSHEET.mxd, 2/6/2020 1:43:25 PM

1080
1070
1060
1050
1040
1030
1020
1035
1030
1025
1020
1015
1010
1005
1000
1000
995
990
985
980

NORMAL MAX. WATER SURF. EL. 1073.50
MIN. WATER SURF. EL. 1048.50
SHAWNEE
TWIN LAKES
EXISTING 18", 20" AND 30" RAW WATER LINES
PRESETTLING
BASIN
SHAWNEE
WATER TREATMENT
PLANT
MIN. W.S.E. 1076.00
EL. 1037.00
ALTITUDE VALVE
200,000 GALLON BACKWASH
WATER STORAGE TANK
RAPID MIX &
FLOW SPLITTER
BASIN
MAX. W.S.E.
1028.00
VENTURI METER &
FLOW THROTTLING
VALVE
30" RAW
WATER LINE
4" DRAIN
LINE
PROPOSED ELEC. OPERATOR
ON EXIST. BUTTERFLY VALVE
PROPOSED
CLARIFIER - FLOCCULATOR NO. 2
EXISTING
CLARIFIER - FLOCCULATOR NO. 1
PROPOSED FRP/ALUM. COVER
ON BOTH CLARIFIERS
PROPOSED FRP/ALUM.
ENCLOSURE OVER EXISTING FILTERS
FILTER BUILDING
ADMIN.
OFFICE
& LAB
EL. 1023.50
FILTER INFLUENT
FLUME
OPERATING LEVEL
NORMAL W.S.E. 1021.58
PIPE GALLERY
24"
24"
24"
BF
ADD 24" BF VALVE
24" DIP
30" DIP
TO 30"
D.I.P.
SLUDGE COLLECTION BOX
CLEARWELL
EL. 1008.25
FEEDER MAIN
(TO DIST.)
FLOW METER
EL. 996.25
12" DRAIN LINE
PROPOSED 8" ELEC. OPER.
BUTTERFLY VALVES
MAX. W.S.E. 1008.00
OVERFLOW LINE
24" CONNECTION TO
EXISTING CLEARWELL
EXISTING 20"
BACKWASH LINE
20" BUTTERFLY VALVE
TOP OF DIKE EL. 995.00
TO EXISTING PRE
TREATMENT BASIN
24" OVERFLOW LINE
W.S.E 992.00
EXISTING 600 GPM
PROCESS WASTEWATER
PUMP STATION AND
DISCHARGE LINE
LAGOON
BOTTOM EL. 980.00
EXISTING SUPERNATANT RETURN
PUMP STATION AND LINE

1/2 HYDRAULIC PROFILE
SCALE: 1"=6' VERT

Holloway, Updike and Bellen, Inc.	CITY OF SHAWNEE, OKLAHOMA	SCALE:	As Shown	HYDRAULIC PROFILE	Detail:	SPM	Date: APRIL 1998
	WATER TREATMENT PLANT IMPROVEMENTS			Project No. 965033	Check:	BHB	Sheet No. 3



REVISION: 2-21-01 ADDED DIMS. & PROPOSED CLARIFIER
ADDED NORTH ARROW & BENCH MARK. BMM

Holloway, Updike and Beilen, Inc.
320 SHAT 33RD BOULEVARD MUSKOGEE, OKLAHOMA 918/683-1301

CITY OF SHAWNEE, OKLAHOMA	SCALE:	1" = 40'	SITE PLAN	Detail:	M²	Date:	July 2000
WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No. 965033	Check:	BHB	Sheet No.	4

Pre-Treatment Basin

Influent Valve Box

ADD 5/16"x36" ALUM. CHECKERED PLATE WALKWAY WITH STEPS PER OPPOSITE END

SEE SHT. 6 FOR DITCH & SIDEWALK SECTIONS

Rapid Mix & Splitter Box

PROPOSED CLARIFIER FLOCCULATOR

USE ALUM. WALKWAY & HANDRAIL W/STL. OR STAINLESS STEEL MECHANISM & SUPPORT

ADD ALUM. HANDRAIL

REMOVE STL. HANDRAIL

Existing Clarifier Flocculator

REMOVE STL. STAIRWAY & SIDEWALK

36 L.F. OF PAVED DITCH TO 12'x8' CGMP W/END SECT. FL 1009.75 - 1009.50

REPLACE SIDEWALK

SCALE 1" = 20'

Admin

Filter Bldg

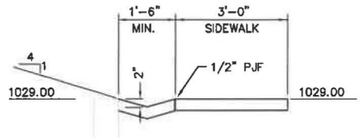
Future Filters

Pump Bldg

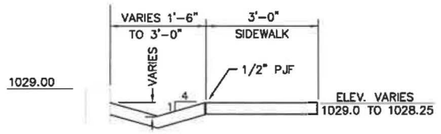
Clearwell

1030 1028 1026 1024 1022 1020 1018 1016 1012 1008 1004 1002 1000 998 996 994 992 990 1006 1010

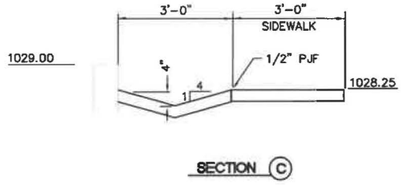
Holloway, Updike and Bellen, Inc.	CITY OF SHAWNEE, OKLAHOMA	SCALE:	1" = 20'	GRADING PLAN	Detail:	M²	Date: July 2000
	WATER TREATMENT PLANT IMPROVEMENTS			Project No.	Check:	BHB	Sheet No. 5



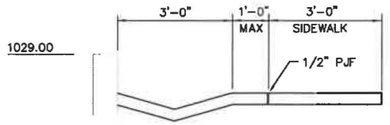
SECTION (A)



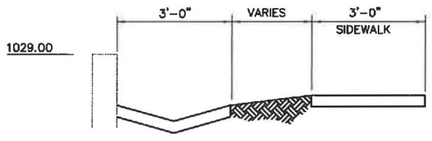
SECTION (B)



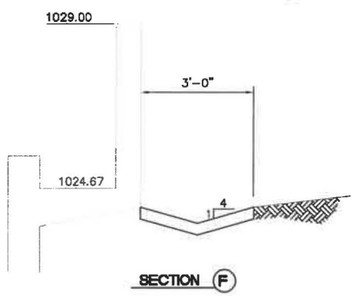
SECTION (C)



SECTION (D)

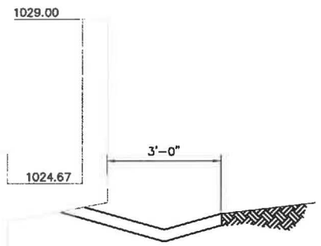


SECTION (E)

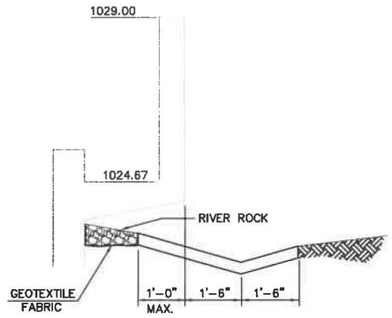


SECTION (F)

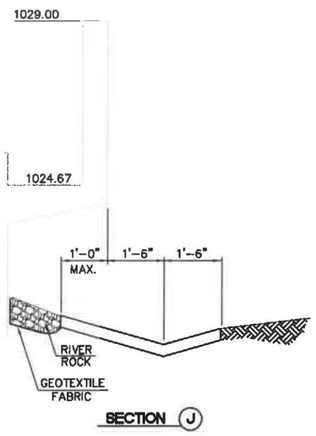
PJF = PREFORMED JOINT FILLER



SECTION (G)

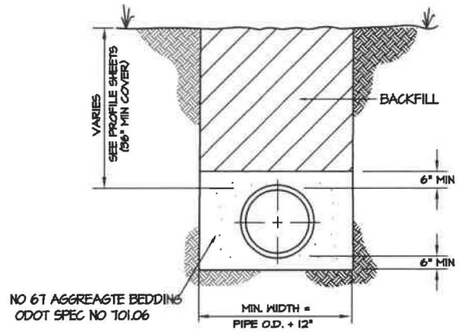


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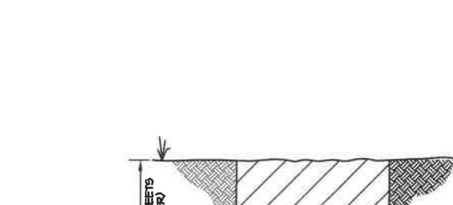


SECTION (J)

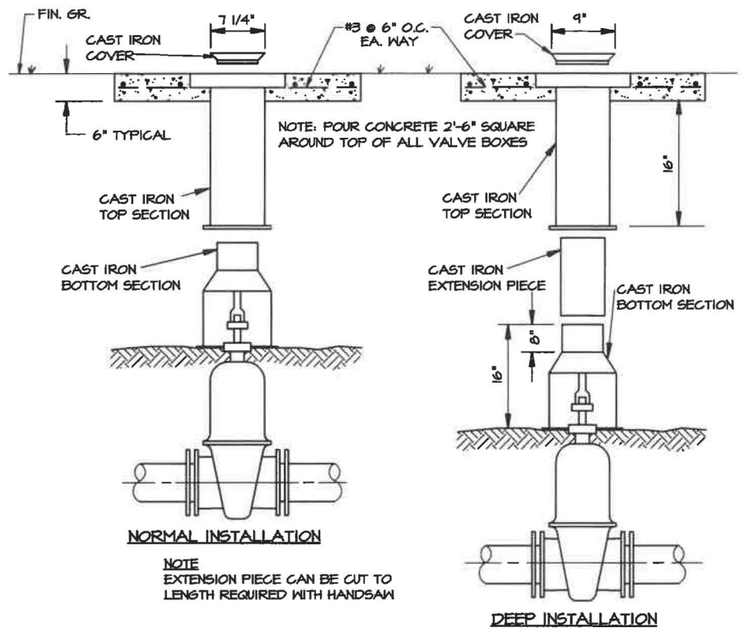
SEE SHT. NO. 5 FOR PLAN



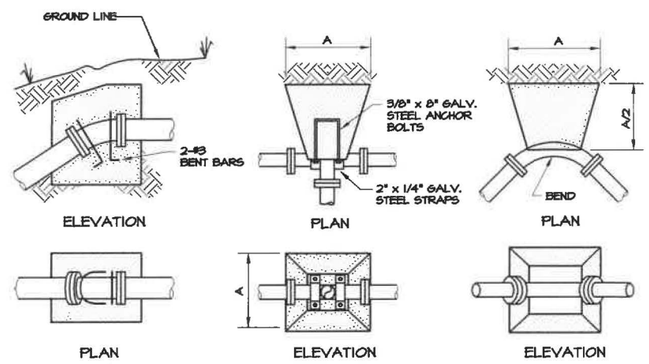
BEDDING DETAIL
(ALL LINES)
NO SCALE



TYPICAL SIDEWALK and DITCH SECTIONS A - G
NTS



1 VALVE BOX INSTALLATION
NO SCALE

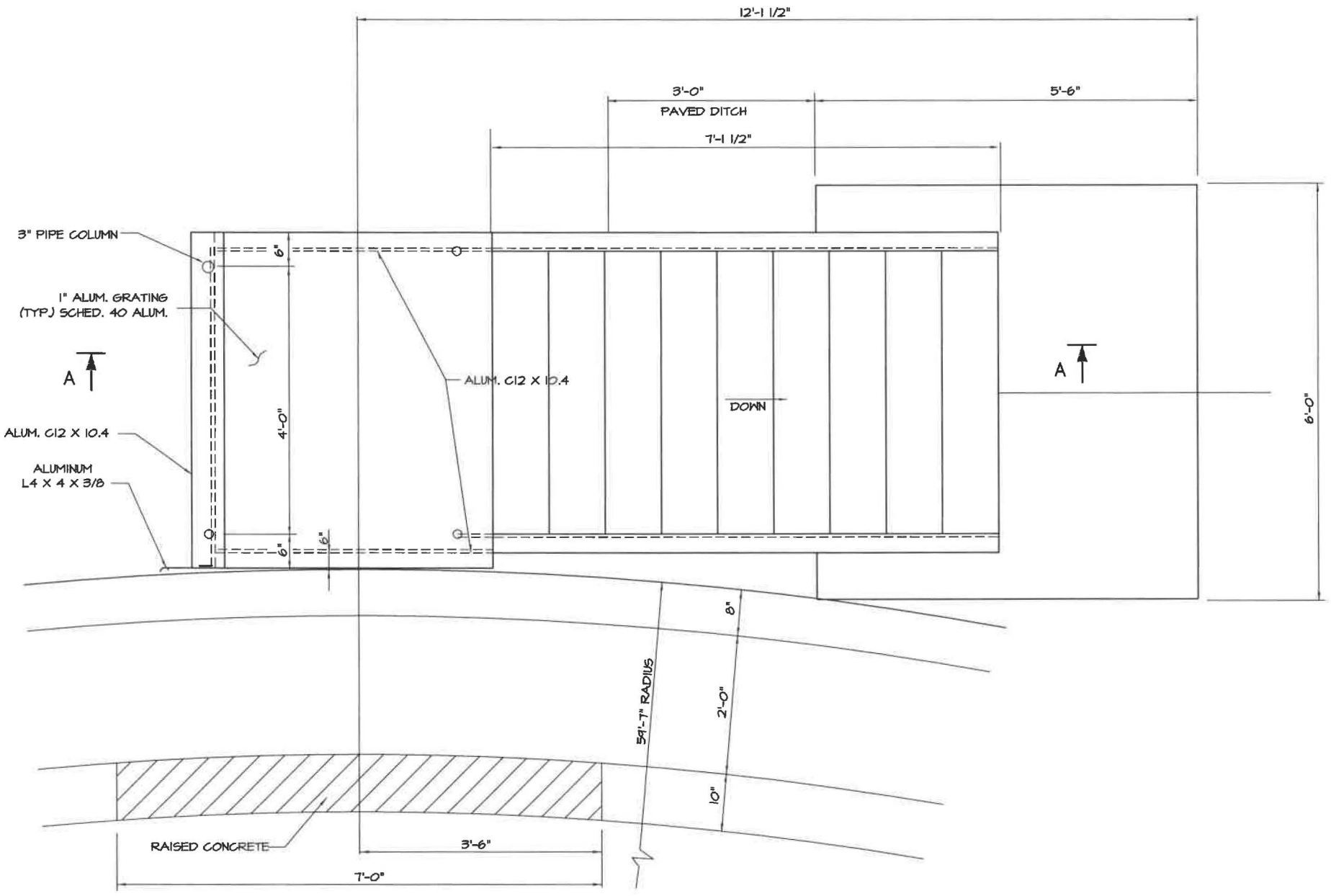


VERTICAL BENDS

"A" DIMENSION (FEET)								
FITTINGS	4"-6"	6"-10"	12"-14"	16"-18"	20"-24"	30"-36"	42"-48"	54"-60"
90° or TEE	1.78	2.89	4.04	5.20	6.48	10.39	15.85	17.52
45°	1.26	2.12	2.97	3.82	5.10	7.64	10.19	12.74
22 1/2°	0.91	1.56	2.12	2.73	3.64	5.46	7.28	9.10
11 1/4°	0.65	1.10	1.50	1.93	2.58	3.87	5.16	6.45

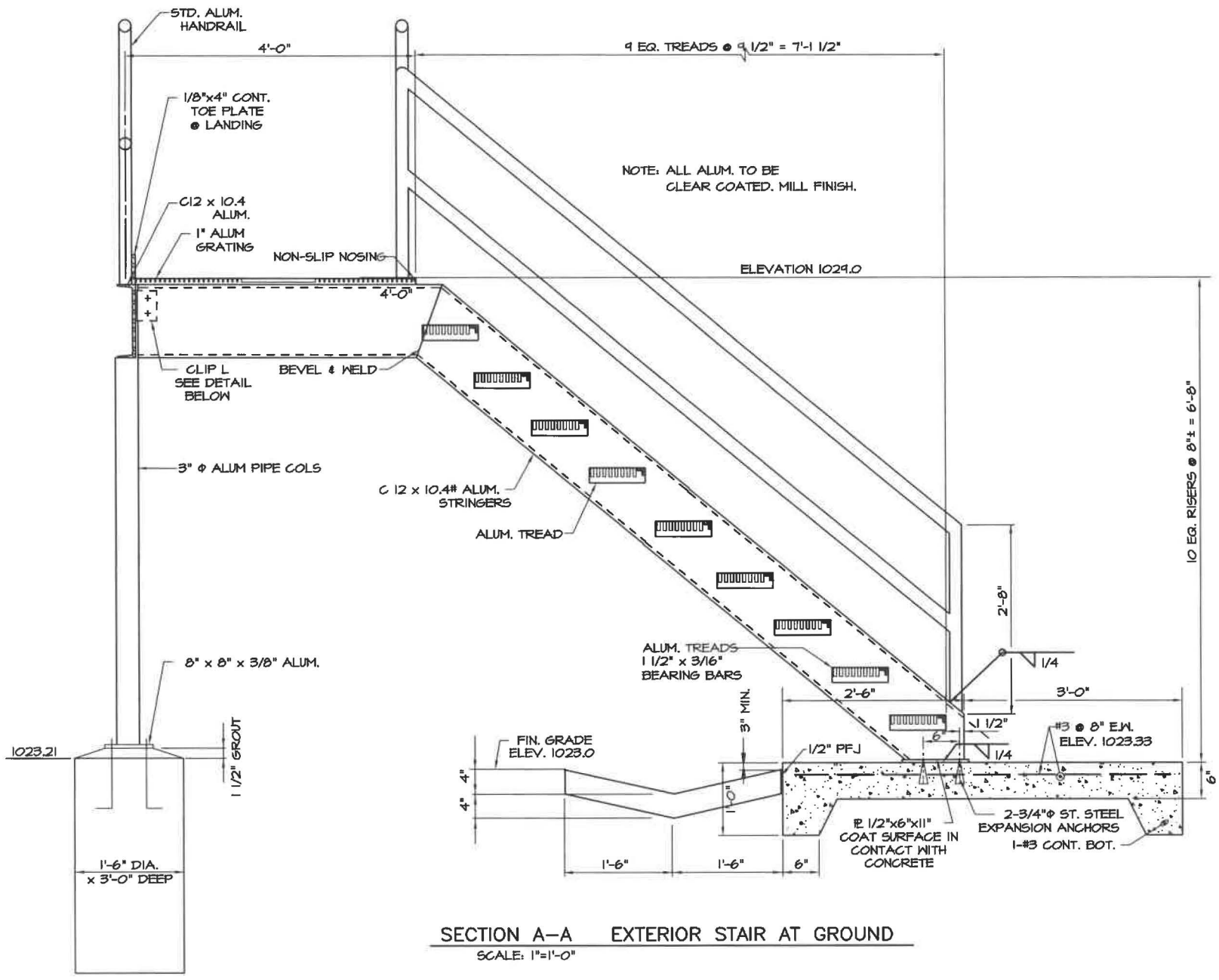
THRUST BLOCKING DETAILS FOR FORCE MAINS
NO SCALE

Holloway, Updike and Bellen, Inc.	CITY OF SHAWNEE, OKLAHOMA	SCALE:	1/2"=1'-0"	DITCH, SIDEWALK and PIPING DETAILS	Detail:	M²	Date: July 2000
	WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No. 465033	Check:	BHB	Sheet No. 6



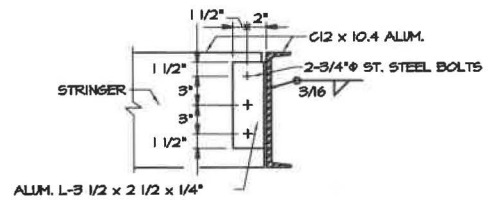
PLAN AT PLATFORM

SCALE: 1" = 1'-0"



SECTION A–A EXTERIOR STAIR AT GROUND

SCALE: 1"=1'-0"



CLIP ANGLE DETAIL SCALE: 1 1/2"=1'-0"

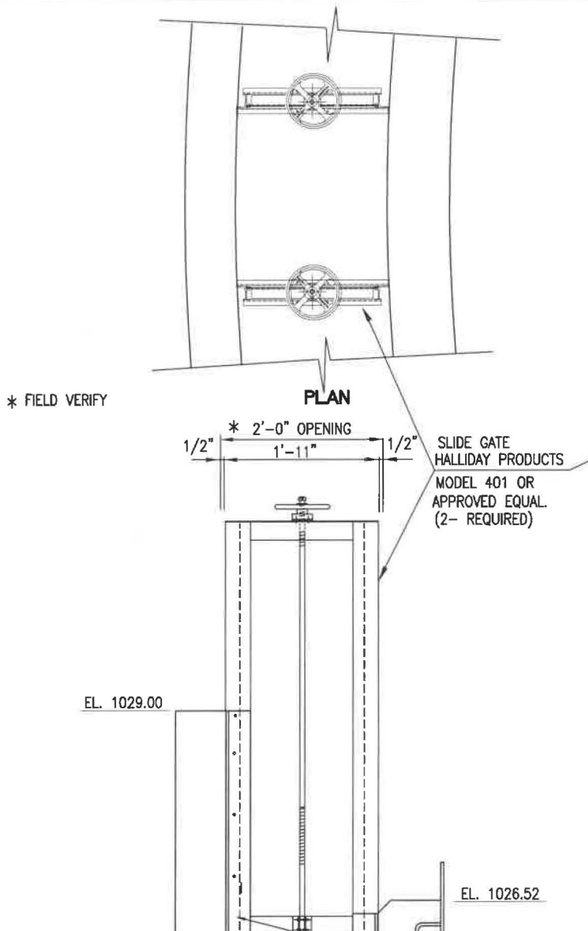
TYP. CONNECTION – STRINGERS TO LANDING BEAM

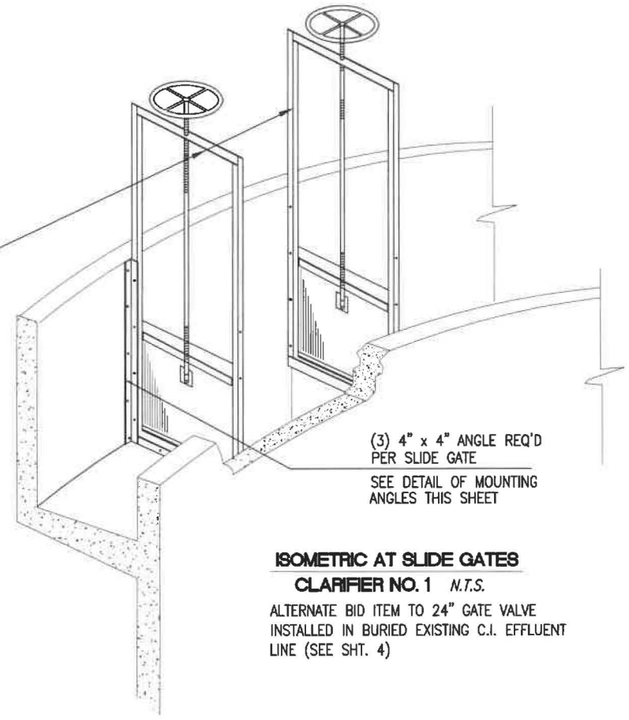
Holloway, Updike and Beiker, Inc.
ENGINEERS
819 EAST SEC. BOULEVARD - SEMINOLE, OKLAHOMA 819/382-7811

CITY OF SHAWNEE, OKLAHOMA
WATER TREATMENT PLANT IMPROVEMENTS

STAIR AND LANDING DETAIL

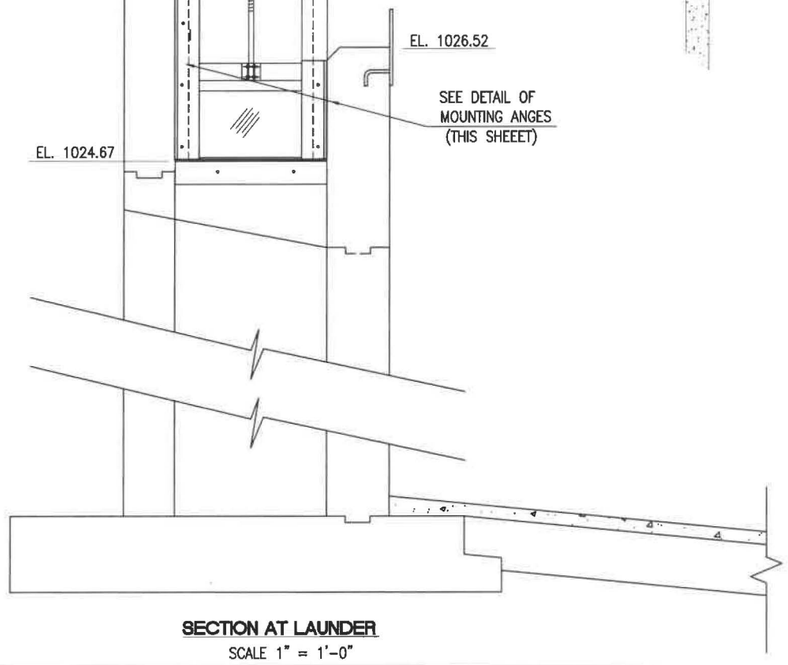
Project No. 965033
Detail: W²
Check: BB
Date: JUNE 2000
Sheet No. 8
SCALE: 1"=1'-0
Ver N/A



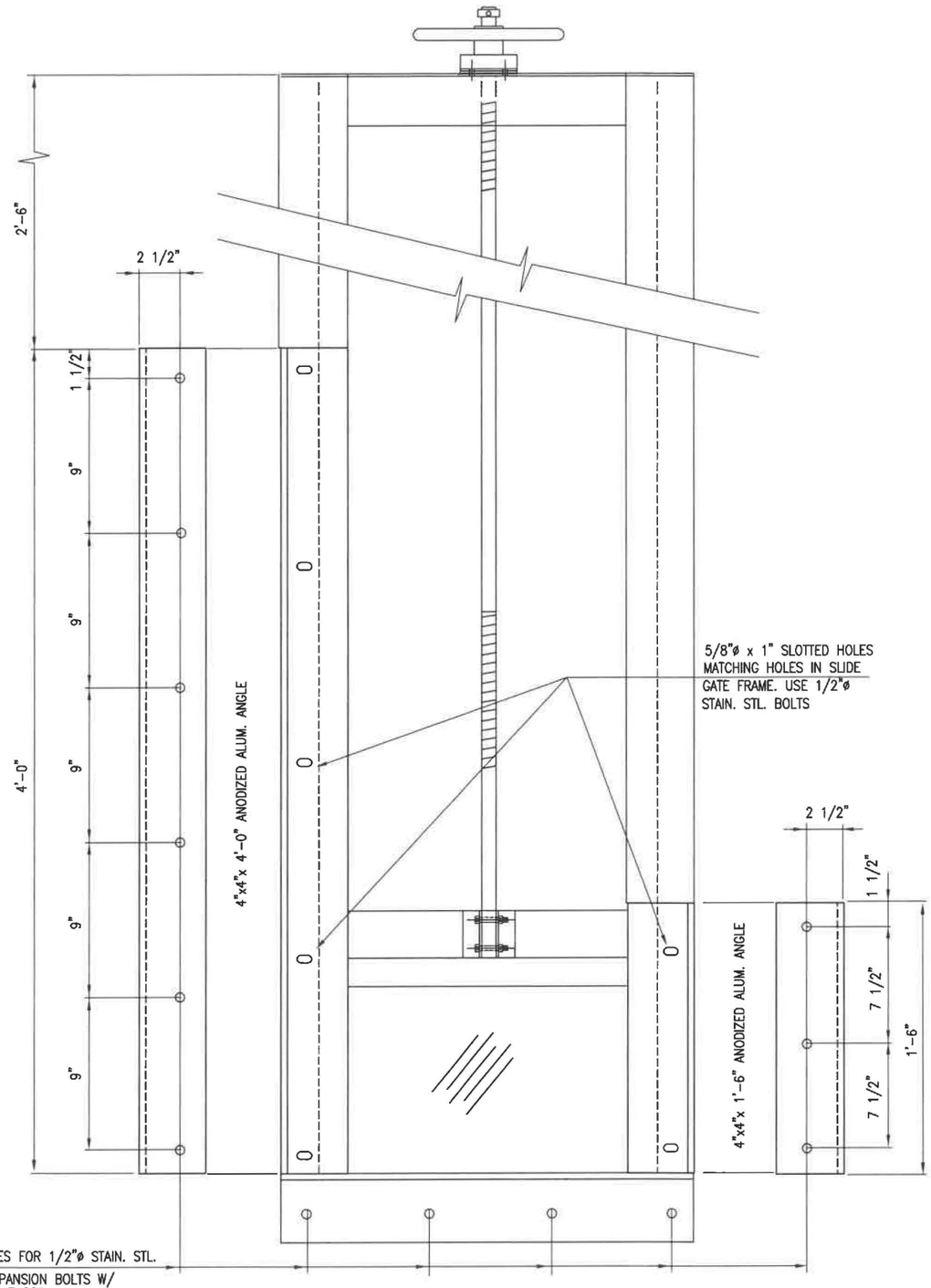


ISOMETRIC AT SLIDE GATES
CLARIFIER NO. 1 *N.T.S.*

ALTERNATE BID ITEM TO 24" GATE VALVE INSTALLED IN BURIED EXISTING C.I. EFFLUENT LINE (SEE SHT. 4)

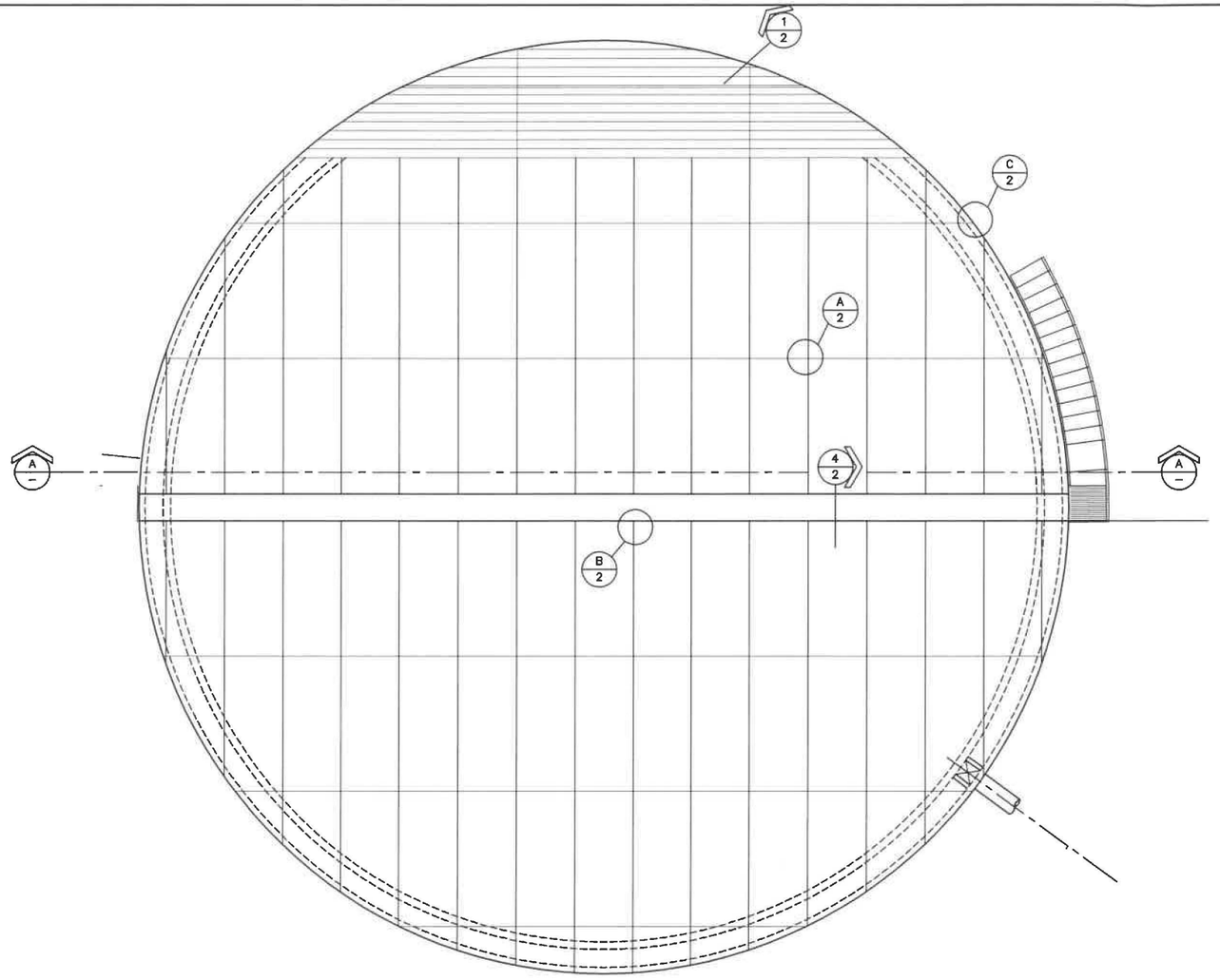


SECTION AT LAUNDER
SCALE 1" = 1'-0"



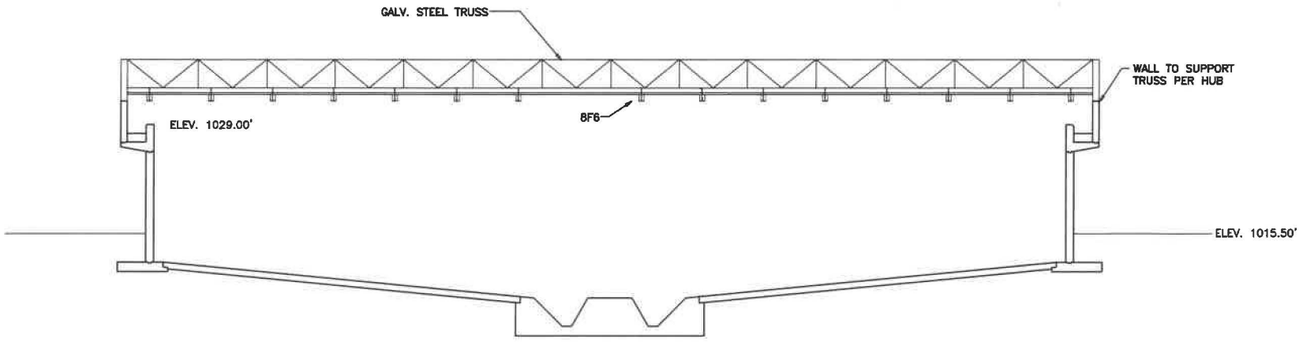
DETAIL OF MOUNTING ANGLES
SCALE 3" = 1'-0"

Holloway, Updike and Bellen, Inc. 918 EAST SEE BOULEVARD - MUSKOGEE, OKLAHOMA 918/682-7811	CITY OF SHAWNEE, OKLAHOMA	SCALE:	AS NOTED	CLARIFIER NO. 2 DETAILS (SLIDE GATES)	Detail: M²	Date: MAY 2000
	WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No.	Check: BB	Sheet No. 8



PLAN - CLARIFIER - FLOCCULATOR NO.1 (SHOWN)

PLAN - CLARIFIER - FLOCCULATOR NO.2 (IDENTICAL EXCEPT ORIENTATION)



SECTION A-A

N.T.S.

GENERAL NOTES:

GENERAL/MATERIAL NOTES:

1. FRP FRAMING MEMBERS ARE VINYL ESTER.
2. ALL RESIN SYSTEMS ARE PREMIUM GRADE.
3. FRP FRAMING MEMBERS ARE FIRE RETARDANT.
4. FRP FRAMING MEMBERS ARE STANDARD BEIGE.
5. FLOOR DECKING TO BE SUREGRIP W/SURFACE GRIT STANDARD GRAY.
6. DECK PANEL IS POLYESTER.
7. ALL BOLT & ROD FASTENERS ARE 316 S.S.
8. ALL BEAM SEATS ARE 316 S.S. AND ALL CLIP ANGLES TO BE FRP.
9. CAREFULLY REVIEW INSTALLATION INSTRUCTIONS AND DRAWINGS BEFORE PROCEEDING WITH ERECTION. NOTE: THE INSTALLATION INSTRUCTIONS ARE A GENERAL GUIDE AND ARE SUPERSEDED BY ANY OTHER INSTRUCTIONS, LAYOUTS, DETAILS, OR NOTES SHOWN ON THESE CONTRACT (SHOP) DRAWINGS.
10. THESE DRAWINGS ARE FOR THE ERECTION OF *TUFF SPAN* MATERIALS ONLY.
11. ERECTION OF FRP MATERIALS SHALL PROCEED ONLY AFTER RECEIPT OF DRAWINGS MARKED AND ISSUED "FOR CONSTRUCTION".
12. CAREFULLY REVIEW HARDWARE CONNECTIONS AND INSTRUCTIONS AS SEEN IN THE GENERAL DETAILS DO NOT OVERTIGHTEN FRP CONNECTIONS.
13. TANK COOVER DEWCKING IS ACCESSIBLE TO FOOT TRAFFIC AND SHALL BE CAPABLE OF SUPPORTING A 300lb. LOAD OVER AN EFFECTIVE AREA OF 30" SQUARE

FLASHING NOTES:

1. ALL FLASHING IS PFR.
2. FLASHING COLOR: STANDARD GRAY.
3. PERIMETER CURVED FLASHING IS STANDARD GRAY.
4. SAVE FLASHING DROP AND USE AS REQUIRED AT OTHER LOCATIONS.

DESIGN LOADS:

THE FOLLOWING CRITERIA WERE USED IN THE DESIGN OF THE BEAMS:

LOAD	DEFLECTION LIMIT	FACTOR OF SAFETY
DEAD = 5 PSF	L/360	5
DEAD + LIVE OR SNOW= 35 PSF	L/180	2.1

THE FOLLOWING CRITERIA WERE USED IN THE DESIGN OF THE COVER:

LOAD	DEFLECTION LIMIT	FACTOR OF SAFETY
COVER (PERSONNEL) = 30 PSF	L/180	2.1

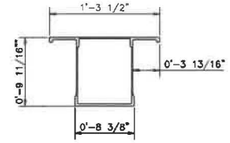


DESIGN PROPERTIES

WEIGHT = 1.25 lb / ft
AREA = 1.6 sq in
IX = 7.7 in^4
IY = .3 in^4
E = 3,660,000 psi

STRUCTURAL PROFILE: 6C1

RESIN: VINYL-ESTER
COLOR: BEIGE



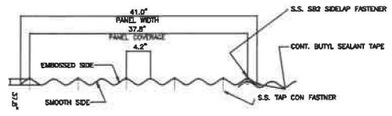
DESIGN PROPERTIES

WEIGHT = 6.1 lb / ft
AREA = 8.0 sq in
IX = 93 in^4
IY = 98 in^4
E = 3,841,000 psi
M = 456,000 lb-in

STRUCTURAL PROFILE: 8F6

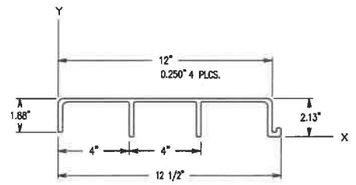
RESIN: VINYL-ESTER
COLOR: BEIGE

DESIGN OF FLASHING FOR COVER



PANEL PROFILE: TUFF SPAN 4.2 X 106

SERIES: 200
COLOR: GREY
RESIN: POLY



DESIGN PROPERTIES

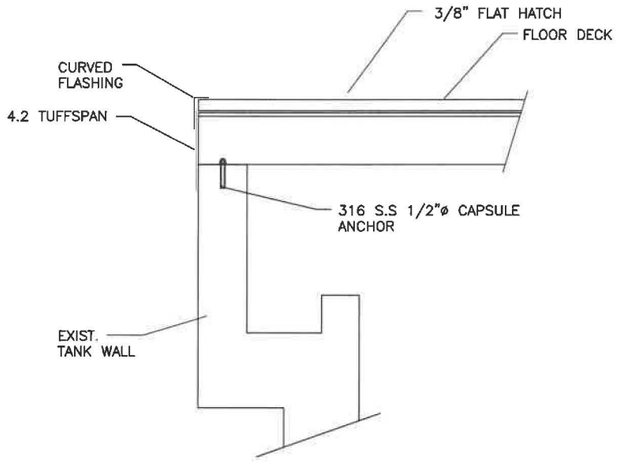
WEIGHT = 4.0 lb / ft
AREA = 4.22 sq in
IX = 1.95 in^4
IY = 67.22 in^4
E = 3,000,000 psi

STRUCTURAL PROFILE: FLOOR DECK

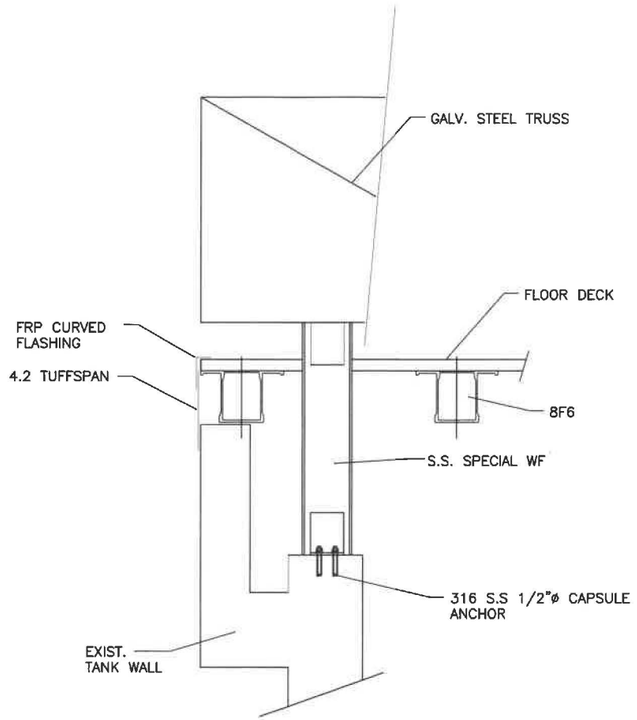
RESIN: RESIN
COLOR: COLOR

ENDURO COMPOSITE SYSTEMS
AN ESI DIVISION
7100 OLD KATY ROAD
HOUSTON, TEXAS 77024
(713) 868-4804
(800) 231-7271
1005 BLUE MOUND ROAD
FORT WORTH, TEXAS 76131
(817) 232-1127

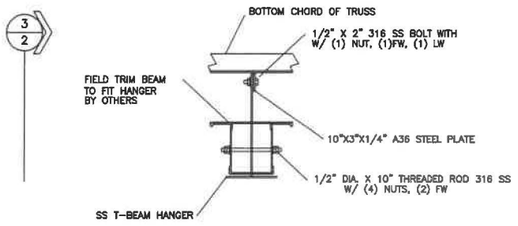
Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA 918/682-7811	SHAWNEE MUNICIPAL AUTHORITY	SCALE:		CLARIFIER COVER PLAN	Detail: M²	Date: MAY 2000
	WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No. 965033	Check: BB	Sheet No. 10



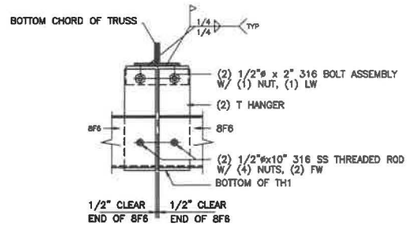
1/2 SECTION THRU TANK WALL
SCALE: NONE



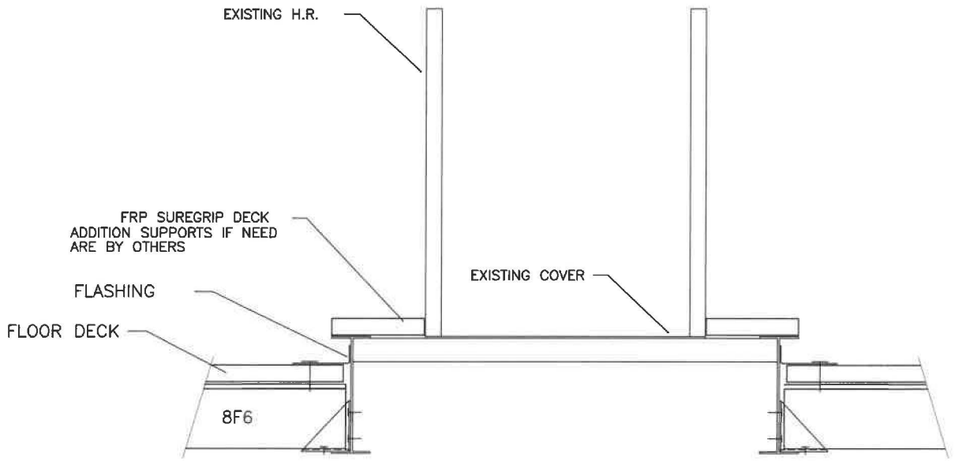
C/2 DETAIL 8F6 AT BRIDGE
SCALE: NONE



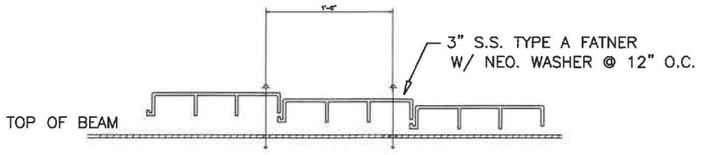
A/2 SECTION - 8F6 TO TRUSS CONNECTION
SCALE: NONE

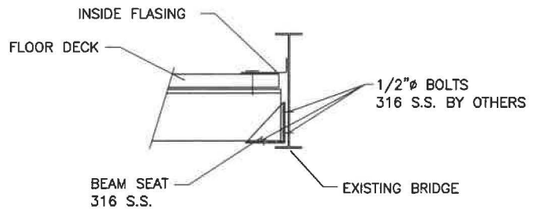


3/2 SECTION - 8F6 TO TRUSS CONNECTION
SCALE: NONE



1/2 SECTION THRU WALK WAY
SCALE: NONE





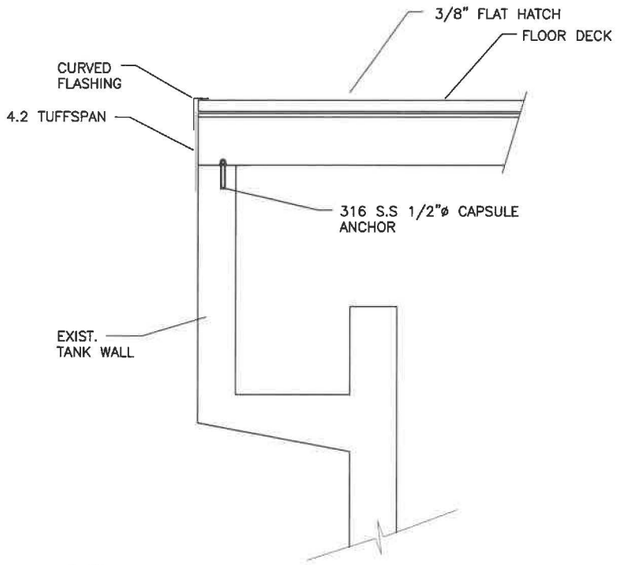
B/2 DETAIL 8F6 AT BRIDGE
SCALE: NONE

EXPLODED DECK CONNECTION DETAIL NON-REMOVABLE

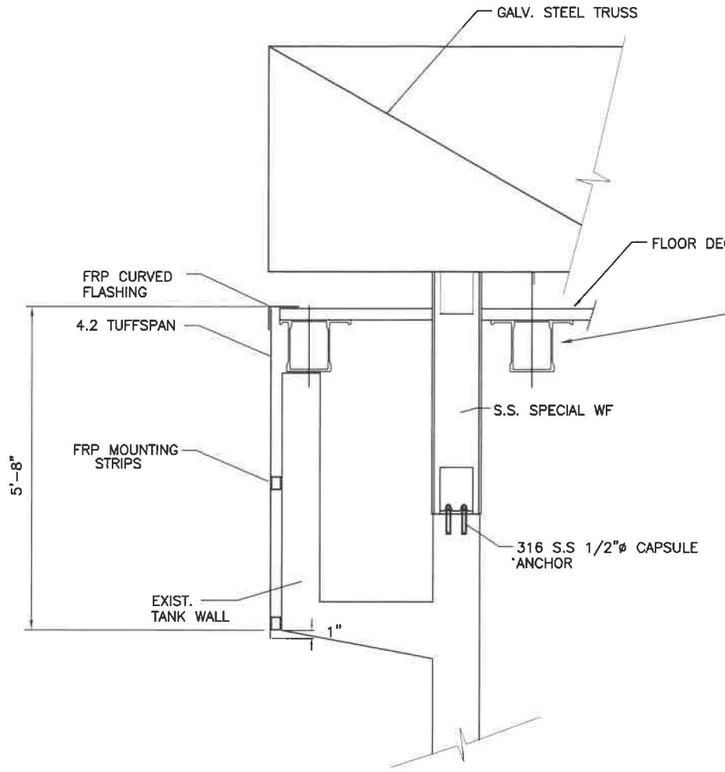
SCALE: N.T.S.

ENDURO COMPOSITE SYSTEMS
AN ESI DIVISION
7100 OLD KATY ROAD HOUSTON, TEXAS 77024 (713) 869-4904 (800) 231-7271
1005 BLUE MOUND ROAD FORT WORTH, TEXAS 76131 (817) 232-1127

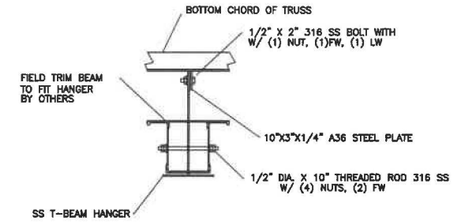
Holloway, Updike and Bellen, Inc. ENGINEERS 818 EAST SIDE BOULEVARD - MUSKOGEE, OKLAHOMA 918/682-7811	SHAWNEE MUNICIPAL AUTHORITY	SCALE:	NTS	CLARIFIER COVER PLAN DETAILS	Detail:	M²	Date: MAY 2000
	WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No. 965033	Check:	BB	Sheet No. 11



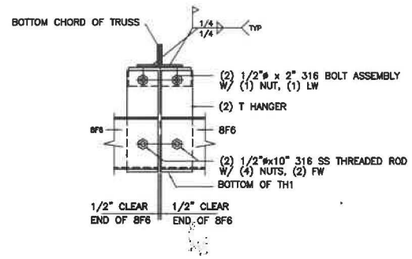
1/2 SECTION THRU TANK WALL
SCALE: NONE



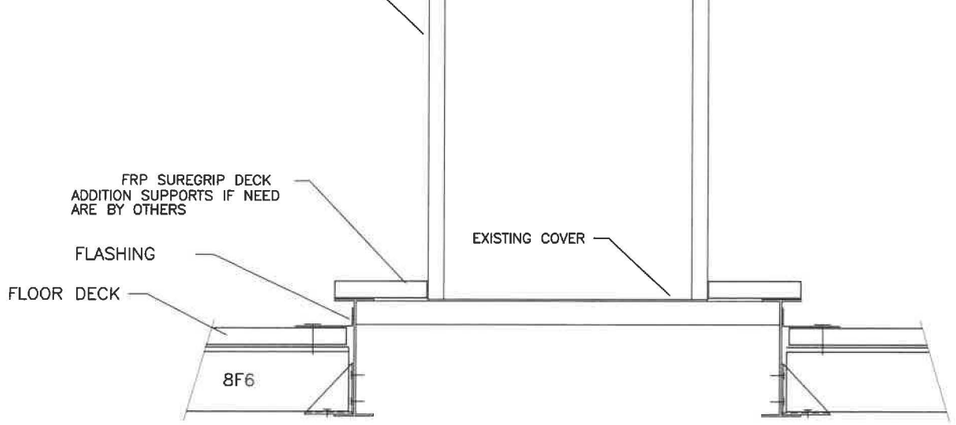
C/2 DETAIL 8F6 AT BRIDGE
SCALE: NONE



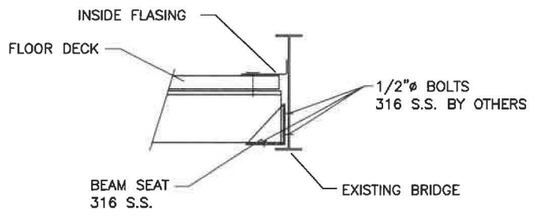
A/2 SECTION - 8F6 TO TRUSS CONNECTION
SCALE: NONE



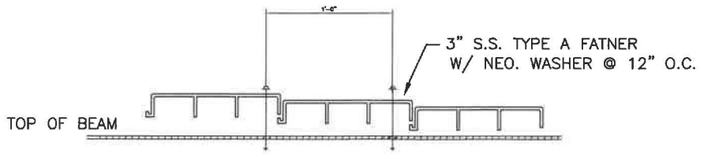
3/2 SECTION - 8F6 TO TRUSS CONNECTION
SCALE: NONE



1/2 SECTION THRU WALK WAY
SCALE: NONE



B/2 DETAIL 8F6 AT BRIDGE
SCALE: NONE

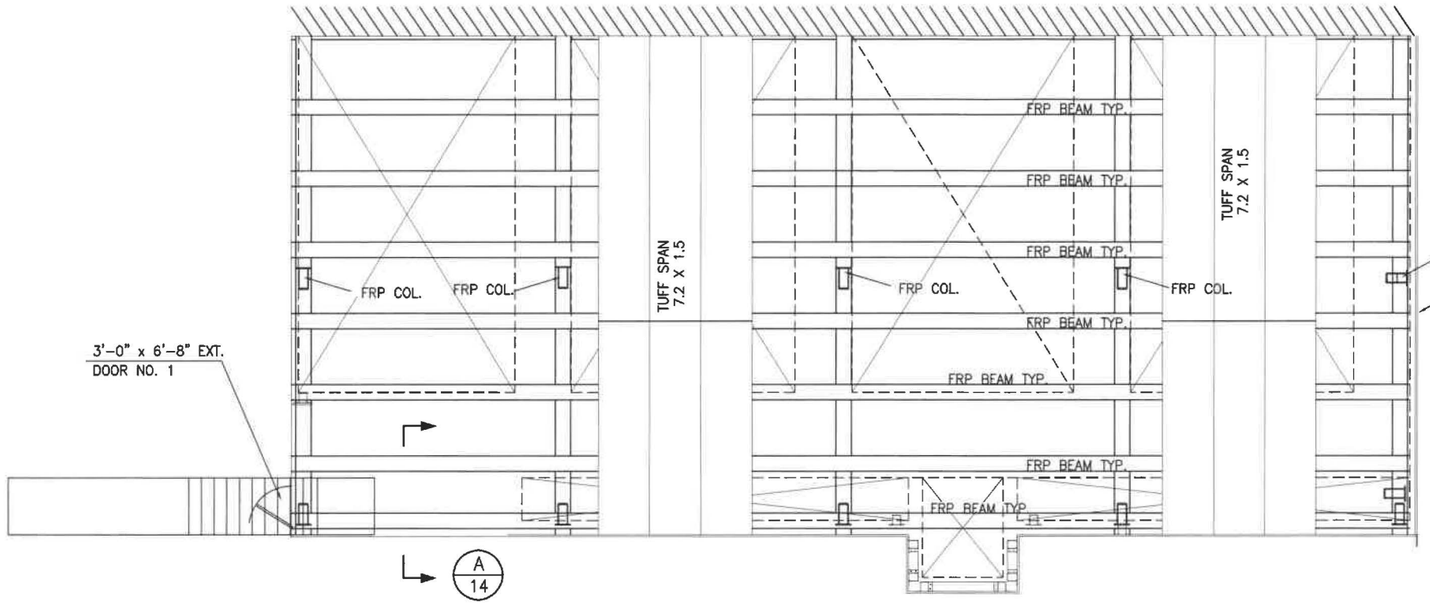


EXPLODED DECK CONNECTION DETAIL NON-REMOVABLE

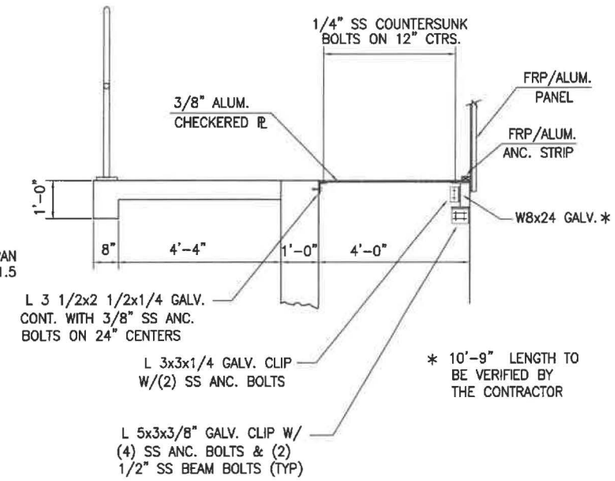
SCALE: N.T.S.

ENDURO COMPOSITE SYSTEMS
AN ESI DIVISION
7100 OLD KATY ROAD HOUSTON, TEXAS 77024 (713) 850-4004 (800) 231-7271
1005 BLUE MOUND ROAD FORT WORTH, TEXAS 76131 (817) 232-1127

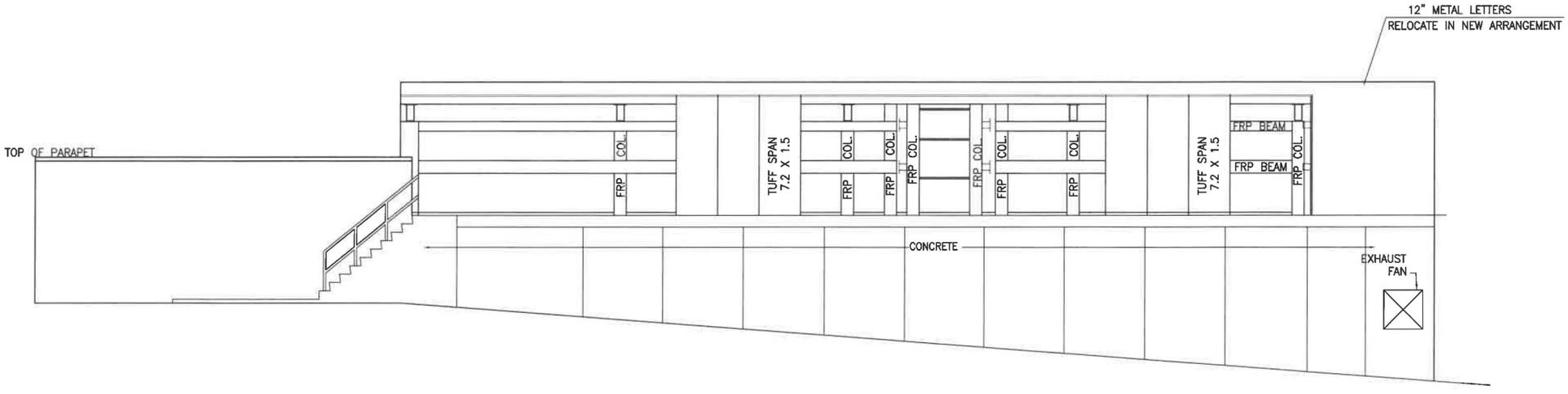
Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD - MUSKOGEE, OKLAHOMA 918/682-7811	CITY OF SHAWNEE, OKLAOMA	SCALE:	NTS	CLARIFIER COVER PLAN DETAILS	Detail: M²	Date: MAY 2000
	WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No. 965033	Check: BB	Sheet No. 12



PLAN VIEW

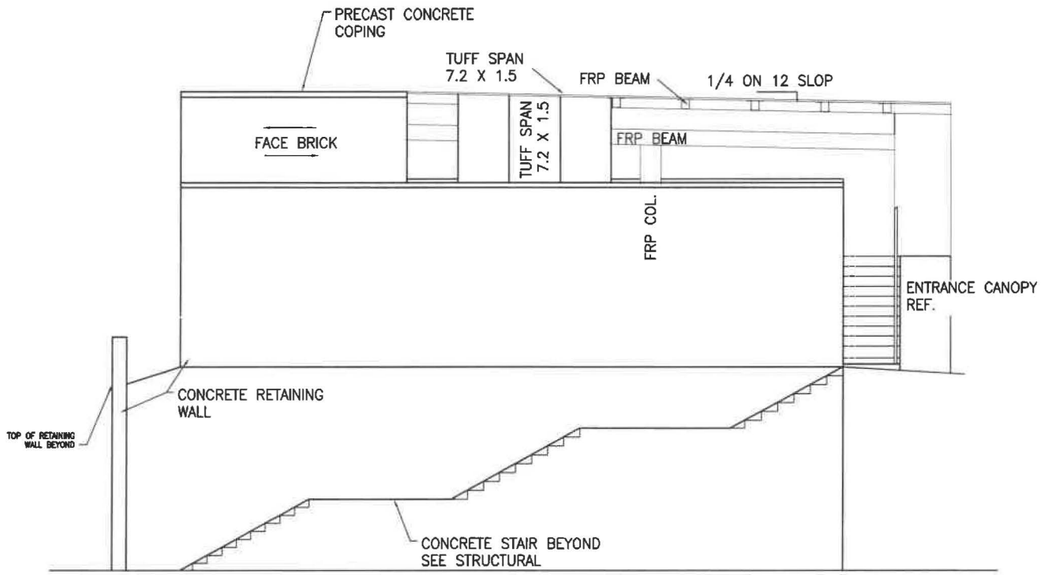


SECTION A 14

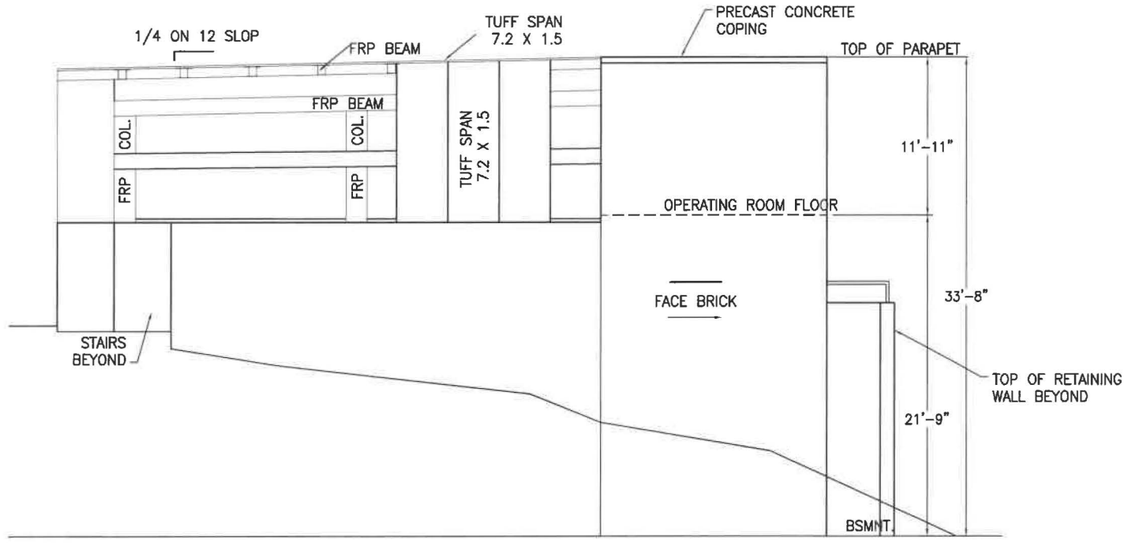


WEST ELEVATION

Holloway, Updike and Bellen, Inc. 518 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA 918/682-7811	CITY OF SHAWNEE, OKLAHOMA	SCALE:	3/16" = 1'-0"	FILTER COVER PLAN AND ELEVATION	Detail: M²	Date: MAY 2000
	WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No.	Check: BB	Sheet No. 13

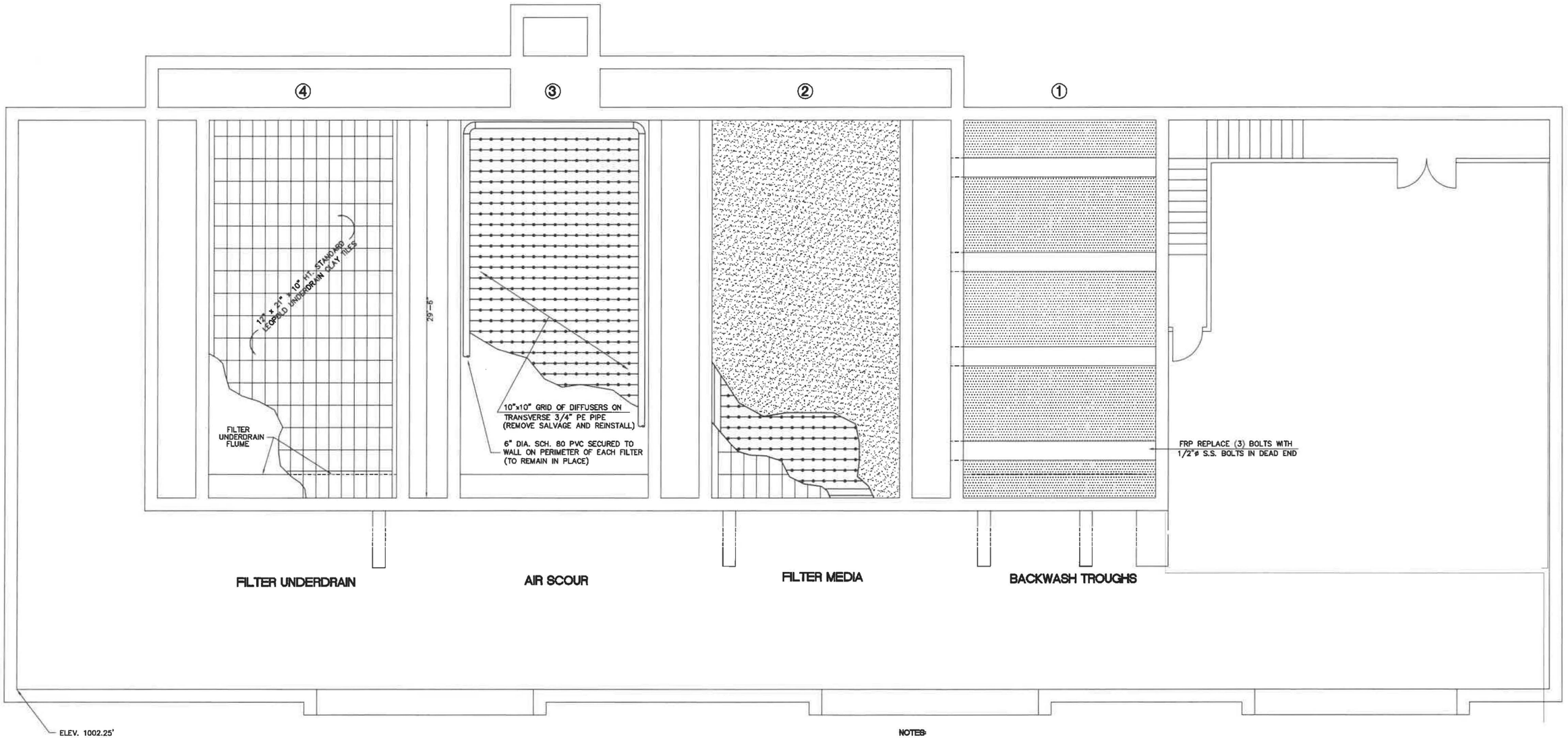


NORTH ELEVATION



SOUTH ELEVATION

Holloway, Updike and Bellen, Inc. 515 EAST SIDE BOULEVARD -MUSKOGEE, OKLAHOMA 918/682-7811	CITY OF SHAWNEE, OKLAHOMA	SCALE:	3/16" = 1'-0"	FILTER COVER ELEVATIONS	Detail:	M²	Date: MAY 2000
	WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No.	Check:	BB	Sheet No. 14



FILTER PLAN

SCALE 1/4"=1'-0"

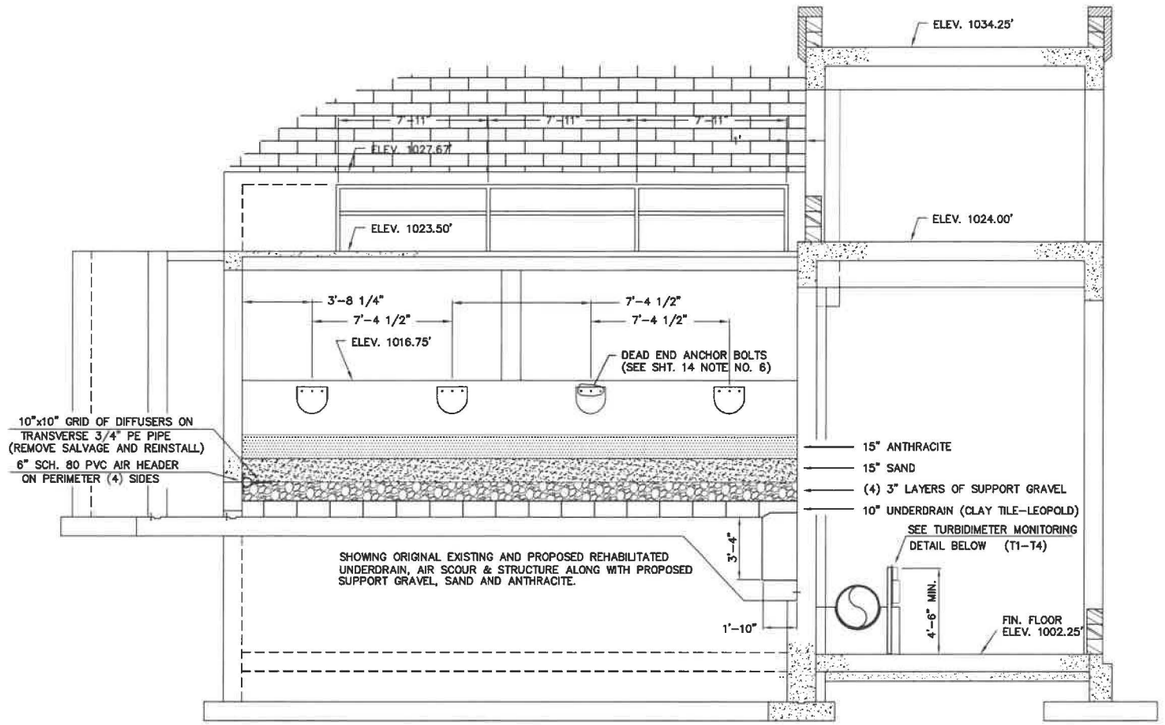
NOTES:

1. THE CONTRACTOR SHALL BEGIN THE FILTER REHABILITATION WITH FILTER NO. 2.
2. ANY EXPOSED STRUCTURAL CRACKS OR DEFICIENCIES IN THE EXISTING CONCRETE SHALL BE CLEANED AND REPAIRED USING THE PRICE BID IF ACCEPTED AS AUTHORIZED BY THE ENGINEER.
3. THE BASE BID SHALL INCLUDE 200 S.F. OF LEOPOLD FILTER BLOCK REPLACEMENT FROM OWNER FURNISHED STOCK. THE OWNER HAS 120–150 BLOCKS, SOME OF WHICH HAVE BEEN CUT TO LESS THAN STANDARD 21" LENGTH. A UNIT PRICE IS MANDATORY FOR ADDITION OR DEDUCTION FROM THE BASE BID QUANTITIY.
4. FOR SALVAGE AND REINSTALLATION AND REPLACEMENT AND/OR REPAIR OF THE AIR SCOUR SYSTEM, INCLUDING DIFFUSERS WILL BE PAID AS TIME AND MATERIALS WITH SPECIFIED MULTIPLIERS FROM THE ALLOWANCE. THE AIR SCOUR SYSTEM IS TO BE IN GOOD CONDITION. (SEE DETAIL SHT. 16)
5. ALL EXISTING SUPPORT GRAVEL, SAND AND ANTHRACITE ARE TO BE REMOVED AND DISPOSED OF OFF SITE BY THE CONTRACTOR.
6. THE FRP BACKWASH TROUGHS ARE TO REMAIN IN PLACE. THE DEAD END ANCHOR BOLTS ARE TO BE REPLACED WITH STAINLESS STEEL BOLTS, WASHERS AND NUTS. THE ANCHOR INSERTS MAY BE REUSED.

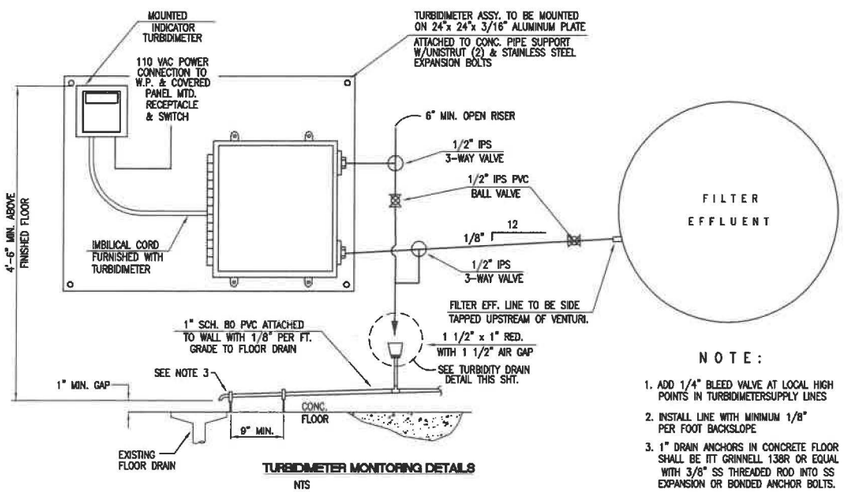
FILTER UNDERDRAIN REPLACEMENT

ADD ALTERNATE

IN LIEU OF THE REPAIR AND/OR PARTIAL REPLACEMENT, THE CONTRACTOR SHALL TOTALLY REMOVE MEDIA, UNDERDRAIN, AND AIR SCOUR SYSTEM AND REPLACE WITH AN FRP INTEGRAL AIR AIR SCOUR UNDERDRAIN. THE AIR HEADER SYSTEM SHALL BE ALTERED TO BE AT ONE END WITH DROP PIPE 1 1/2" DIA. INTO EACH LINE OF UNDERDRAIN.



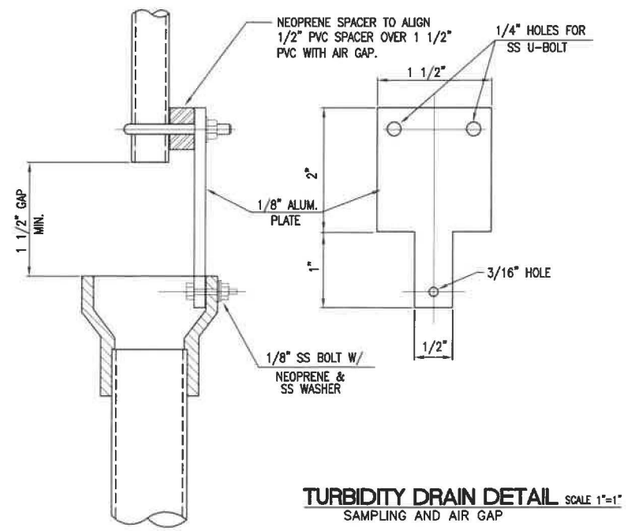
SECTION A-A
SCALE 1/4"=1'-0"



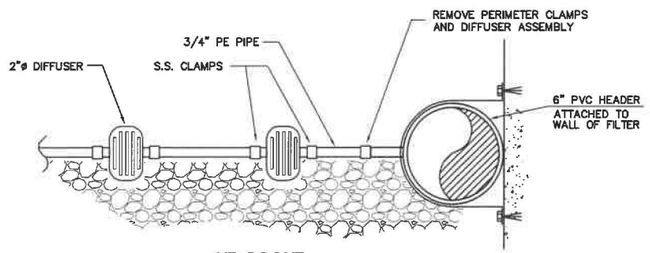
TURBIDIMETER MONITORING DETAILS
NTS

NOTE:

1. ADD 1/4" BLEED VALVE AT LOCAL HIGH POINTS IN TURBIDIMETERSUPPLY LINES
2. INSTALL LINE WITH MINIMUM 1/8" PER FOOT BACKSLOPE
3. 1" DRAIN ANCHORS IN CONCRETE FLOOR SHALL BE ITT GRINNELL 138R OR EQUAL WITH 3/8" SS THREADED ROD INTO SS EXPANSION OR BONDED ANCHOR BOLTS.
4. WHERE EXIST. PIPE EXTENDS TO FLOOR DRAIN THE TURBIDITY DRAIN MAY BE CONNECTED TO IT IN A NEAT MANNER.

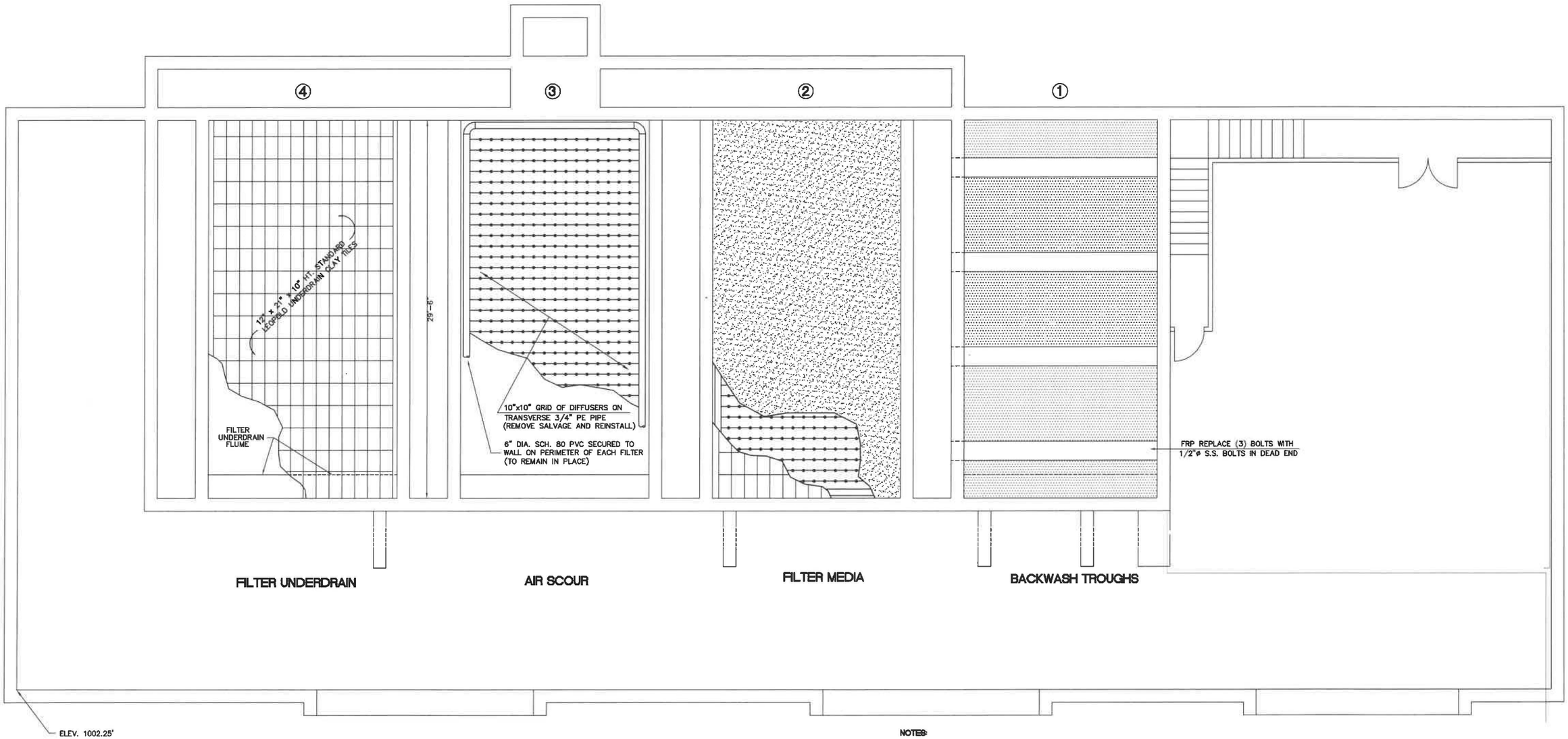


TURBIDITY DRAIN DETAIL SCALE 1"=1"
SAMPLING AND AIR GAP



AIR SCOUR NTS
BEST AVAILABE RENDITION OF EXIST.
AND REUSED AIR SCOUT SYSTEM

Holloway, Updike and Bellen, Inc. 819 EAST SIDE BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811	CITY OF SHAWNEE, OKLAHOMA	SCALE:	AS NOTED	FILTER SECTION AND DETAILS	Detail: M²		Date: JULY 2000
	WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No. 965033	Check: BB		Sheet No. 16



FILTER PLAN

SCALE 1/4"=1'-0"

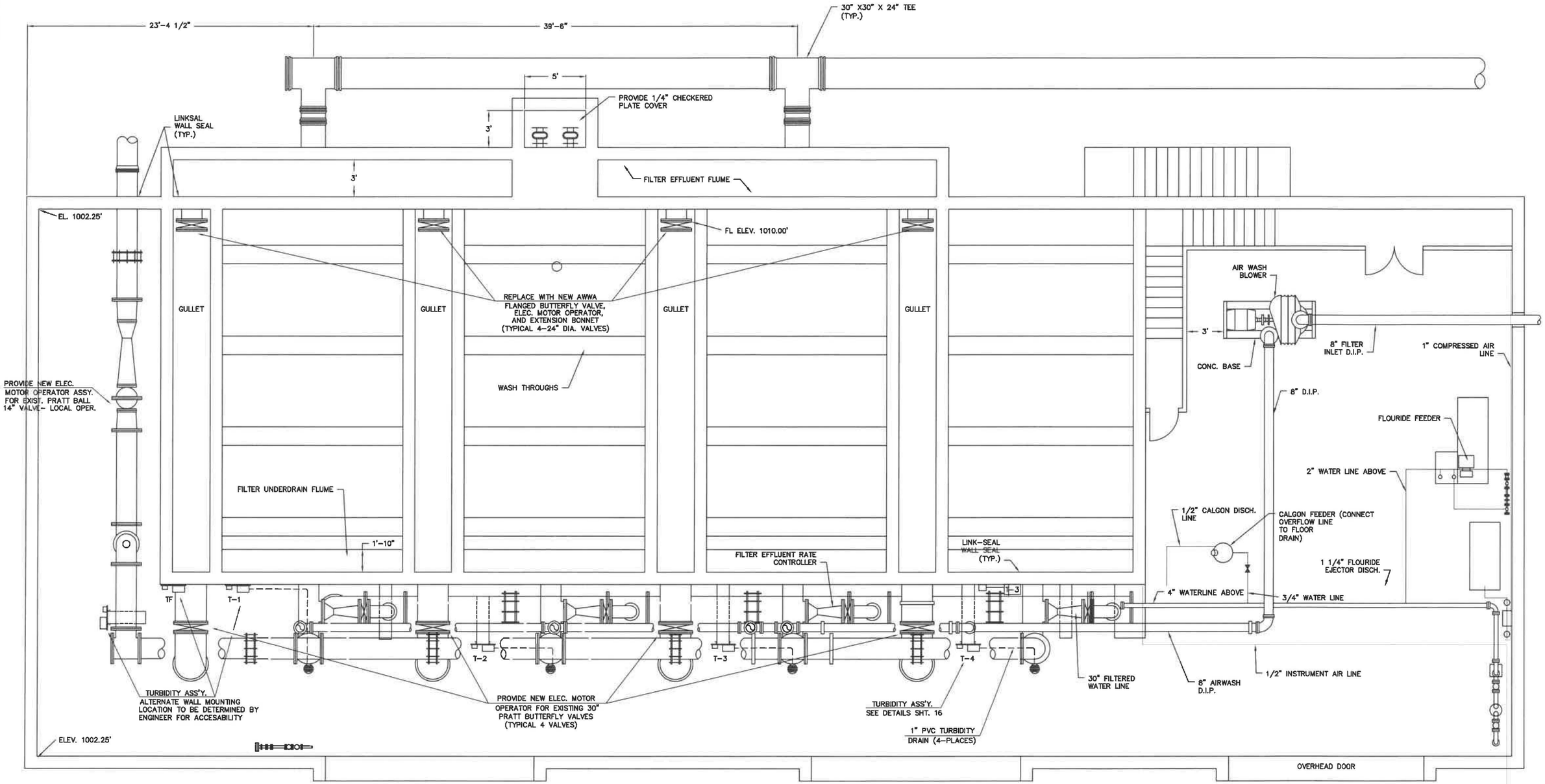
NOTES:

1. THE CONTRACTOR SHALL BEGIN THE FILTER REHABILITATION WITH FILTER NO. 2.
2. ANY EXPOSED STRUCTURAL CRACKS OR DEFICIENCIES IN THE EXISTING CONCRETE SHALL BE CLEANED AND REPAIRED USING THE PRICE BID IF ACCEPTED AS AUTHORIZED BY THE ENGINEER.
3. THE BASE BID SHALL INCLUDE 200 S.F. OF LEOPOLD FILTER BLOCK REPLACEMENT FROM OWNER FURNISHED STOCK. THE OWNER HAS 120–150 BLOCKS, SOME OF WHICH HAVE BEEN CUT TO LESS THAN STANDARD 21" LENGTH. A UNIT PRICE IS MANDATORY FOR ADDITION OR DEDUCTION FROM THE BASE BID QUANTITY.
4. FOR SALVAGE AND REINSTALLATION AND REPLACEMENT AND/OR REPAIR OF THE AIR SCOUR SYSTEM, INCLUDING DIFFUSERS WILL BE PAID AS TIME AND MATERIALS WITH SPECIFIED MULTIPLIERS FROM THE ALLOWANCE. THE AIR SCOUR SYSTEM IS TO BE IN GOOD CONDITION. (SEE DETAIL SHT. 17)
5. ALL EXISTING SUPPORT GRAVEL, SAND AND ANTHRACITE ARE TO BE REMOVED AND DISPOSED OF OFF SITE BY THE CONTRACTOR.
6. THE FRP BACKWASH TROUGHS ARE TO REMAIN IN PLACE. THE DEAD END ANCHOR BOLTS ARE TO BE REPLACED WITH STAINLESS STEEL BOLTS, WASHERS AND NUTS. THE ANCHOR INSERTS MAY BE REUSED.

FILTER UNDERDRAIN REPLACEMENT

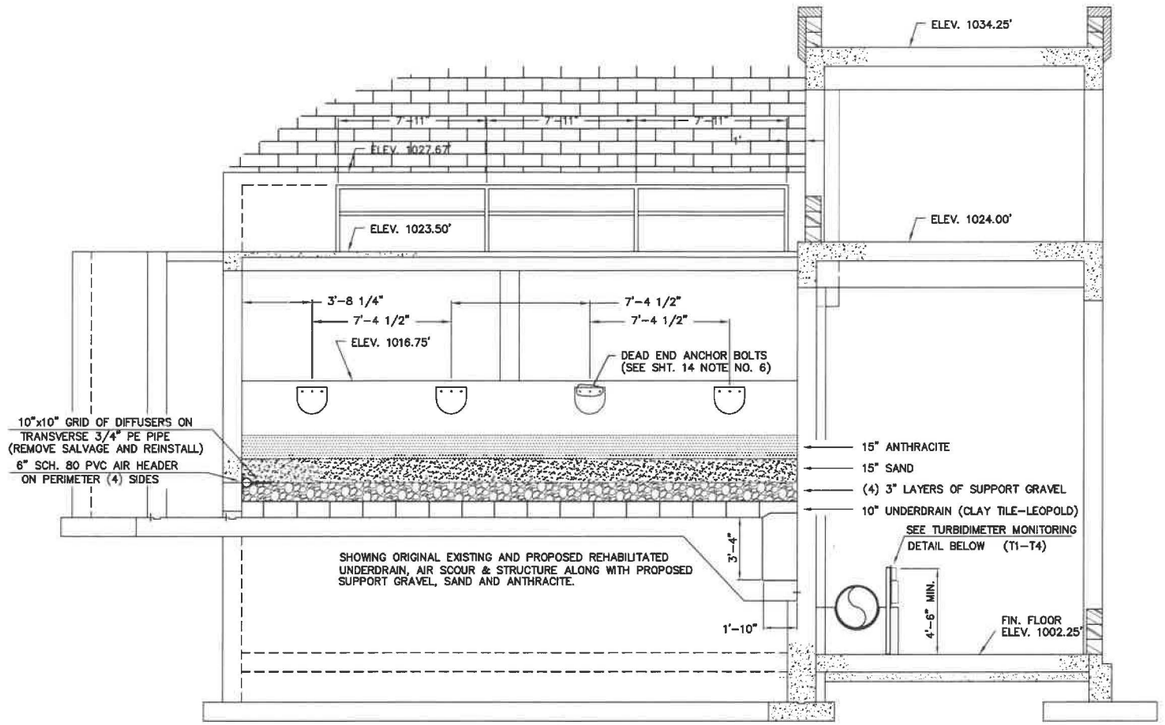
ADD ALTERNATE

IN LIEU OF THE REPAIR AND/OR PARTIAL REPLACEMENT, THE CONTRACTOR SHALL TOTALLY REMOVE MEDIA, UNDERDRAIN, AND AIR SCOUR SYSTEM AND REPLACE WITH AN FRP INTEGRAL AIR AIR SCOUR UNDERDRAIN. THE AIR HEADER SYSTEM SHALL BE ALTERED TO BE AT ONE END WITH DROP PIPE 1 1/2" DIA. INTO EACH LINE OF UNDERDRAIN.

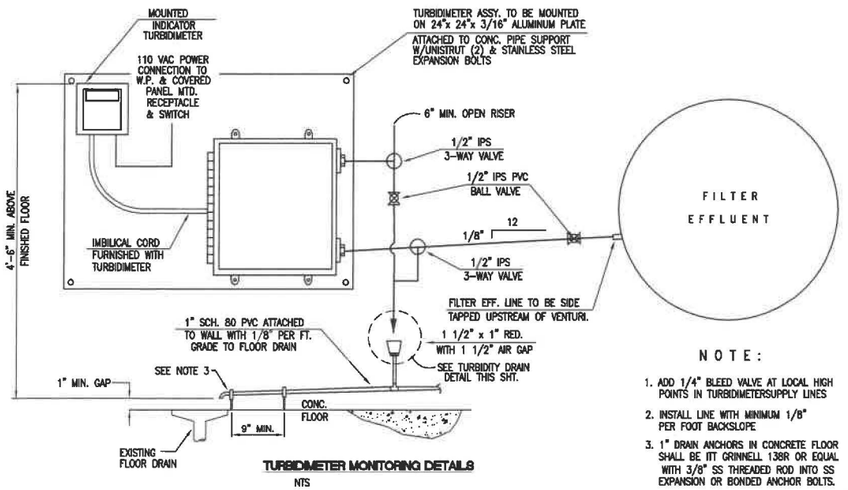


FIRST FLOOR PLAN
SCALE: 1/4"=1'-0"

Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD - MUSKOGEE, OKLAHOMA 918/682-7811	CITY OF SHAWNEE, OKLAHOMA	SCALE:	1/4" = 1'-0"	FILTER VALVE REPLACEMENT PLAN	Detail: M²	Date: MAY 2000
	WATER TREATMENT PLANT IMPROVEMENTS			Project No. 965033	Check: BB	Sheet No. 17



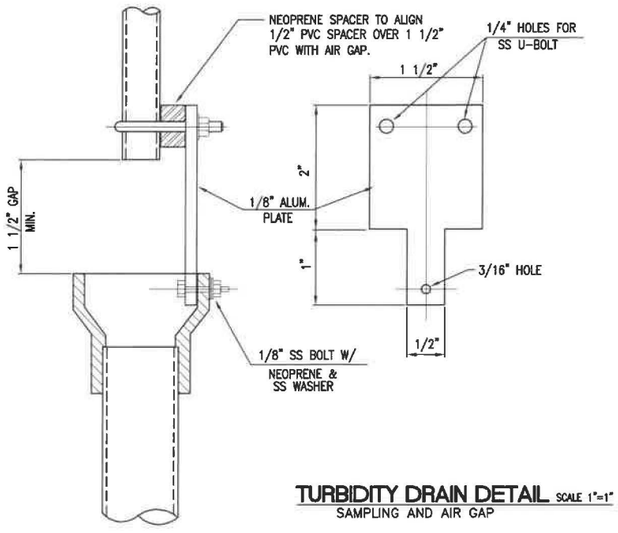
SECTION A-A
SCALE 1/4"-1'-0"



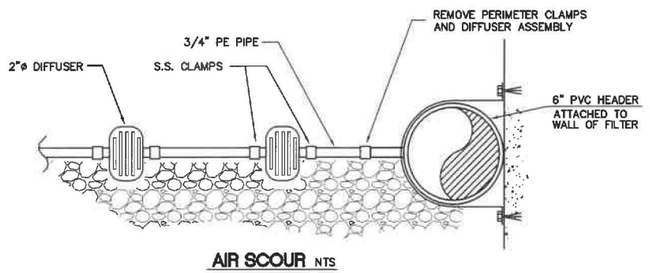
TURBIDIMETER MONITORING DETAILS
NTS

NOTE:

1. ADD 1/4" BLEED VALVE AT LOCAL HIGH POINTS IN TURBIDIMETERSUPPLY LINES
2. INSTALL LINE WITH MINIMUM 1/8" PER FOOT BACKSLOPE
3. 1" DRAIN ANCHORS IN CONCRETE FLOOR SHALL BE ITT GRINNELL 138R OR EQUAL WITH 3/8" SS THREADED ROD INTO SS EXPANSION OR BONDED ANCHOR BOLTS.
4. WHERE EXIST. PIPE EXTENDS TO FLOOR DRAIN THE TURBIDITY DRAIN MAY BE CONNECTED TO IT IN A NEAT MANNER.

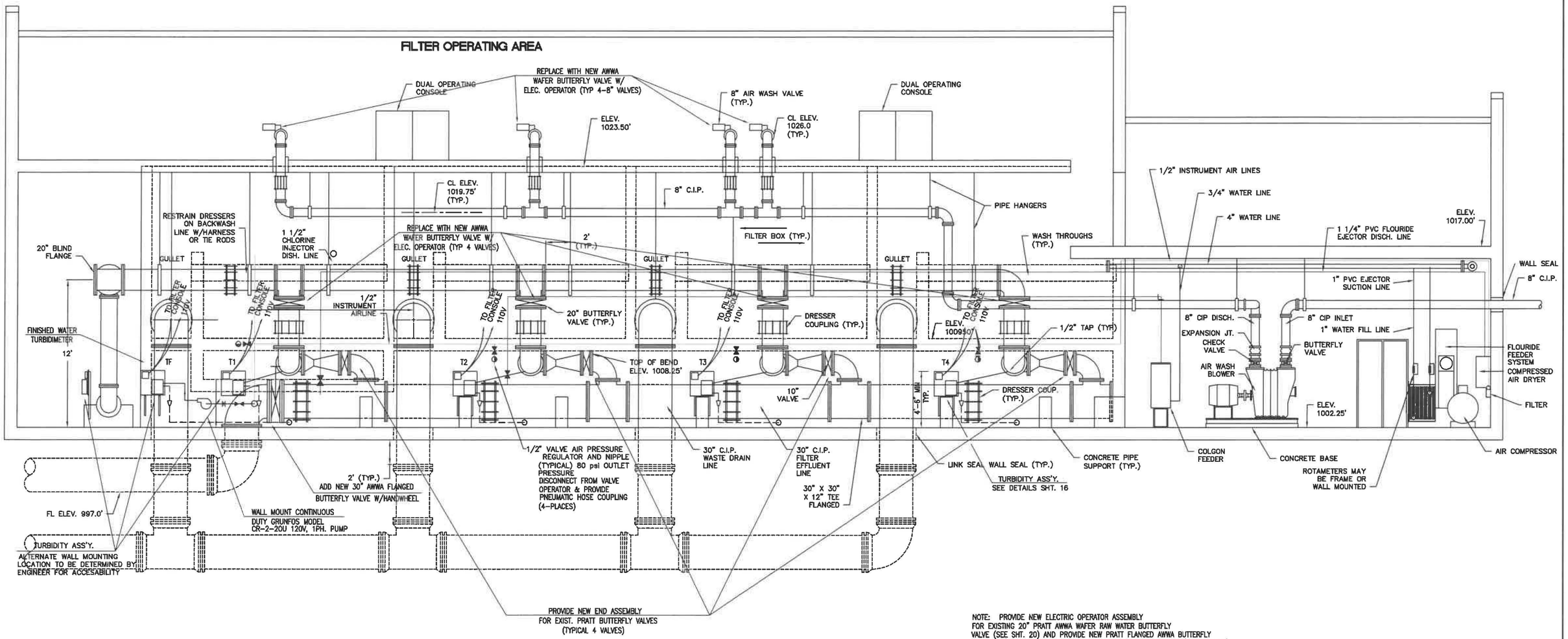


TURBIDITY DRAIN DETAIL SCALE 1"=1"
SAMPLING AND AIR GAP



AIR SCOUR NTS
BEST AVAILABE RENDITION OF EXIST.
AND REUSED AIR SCOUT SYSTEM

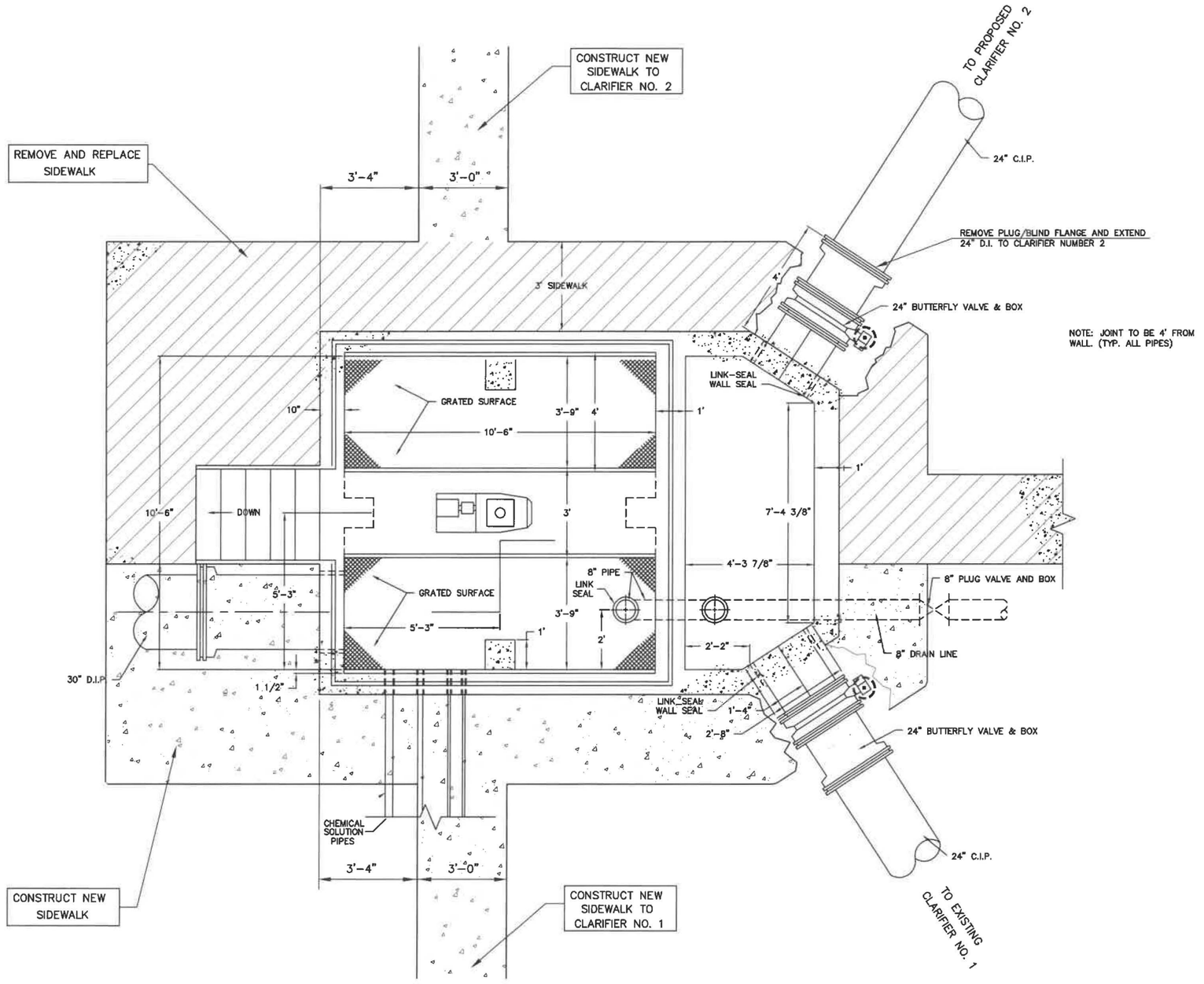
	Holloway, Updike and Bellen, Inc. 815 EAST SIDE BOULEVARD · MUSKOGEE, OKLAHOMA 918/682-7811	CITY OF SHAWNEE, OKLAHOMA	SCALE:	AS NOTED	FILTER SECTION AND DETAILS	Detail: M²	Date: JULY 2000
		WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No. 965033	Check: BB	Sheet No. 17



NOTE: PROVIDE NEW ELECTRIC OPERATOR ASSEMBLY FOR EXISTING 20" PRATT AWWA WAFER RAW WATER BUTTERFLY VALVE (SEE SHT. 20) AND PROVIDE NEW PRATT FLANGED AWWA BUTTERFLY VALVES W/ELECTRIC OPERATORS, BONNETS FOR CLARIFIER DRAIN. (SEE SHT. 20)

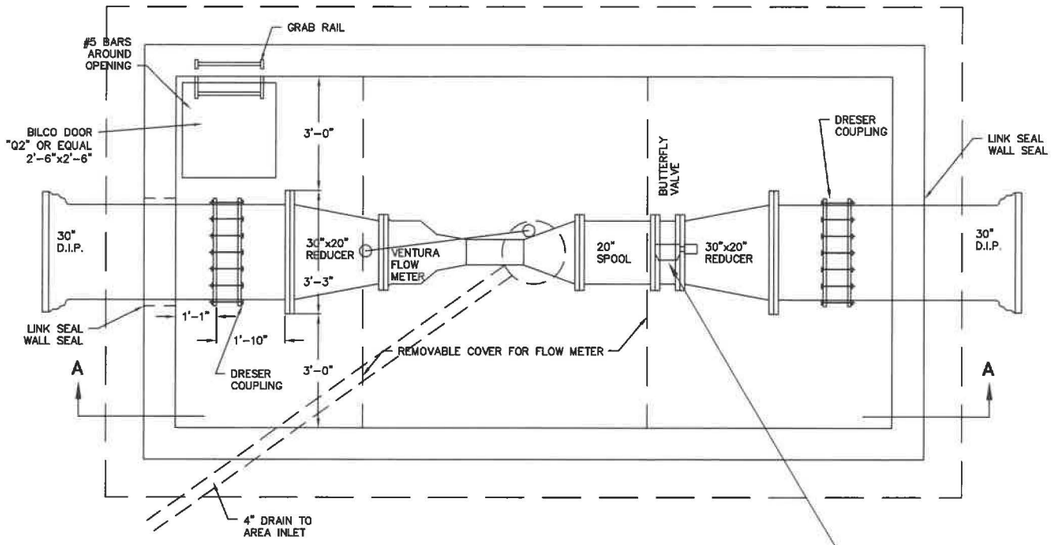
PROVIDE 1/2" DIA. TAP IN FILTER EFFLUENT LINE FOR SUPPLY TO (5) FIVE TURBIDITY UNITS AS SHOWN.

FILTER BUILDING
SCALE: 1/4"=1'-0"

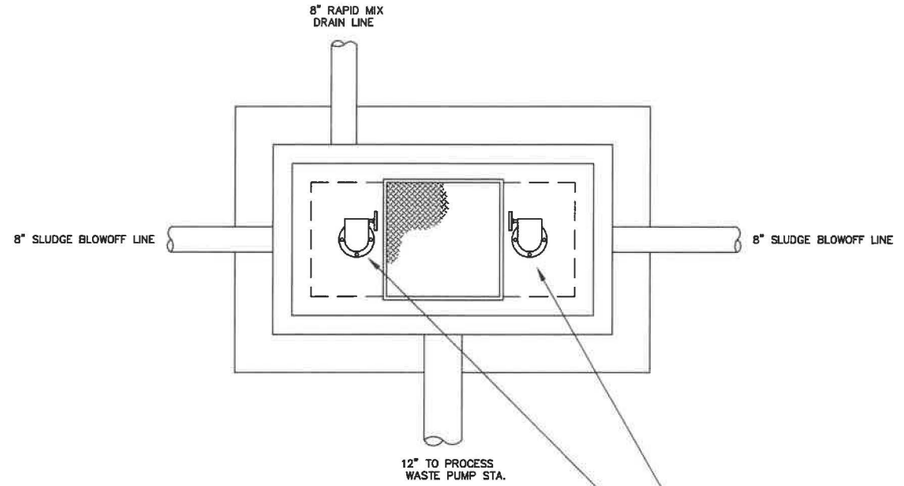


PLAN AT SPLITTER BOX
SCALE: 1/2"=1'0"

Holloway, Updike and Bellen, Inc. 816 EAST SIDE BOULEVARD - MUSKOGEE, OKLAHOMA 918/682-7811	CITY OF SHAWNEE, OKLAHOMA	SCALE:	1/2" = 1'-0"	PLAN AT SPLITTER BOX	Detail: M²	Date: JULY 2000
	WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No. 965033	Check: BB	Sheet No. 19



INFLUENT VALVE BOX PLAN
SCALE: 1/2"=1'-0"

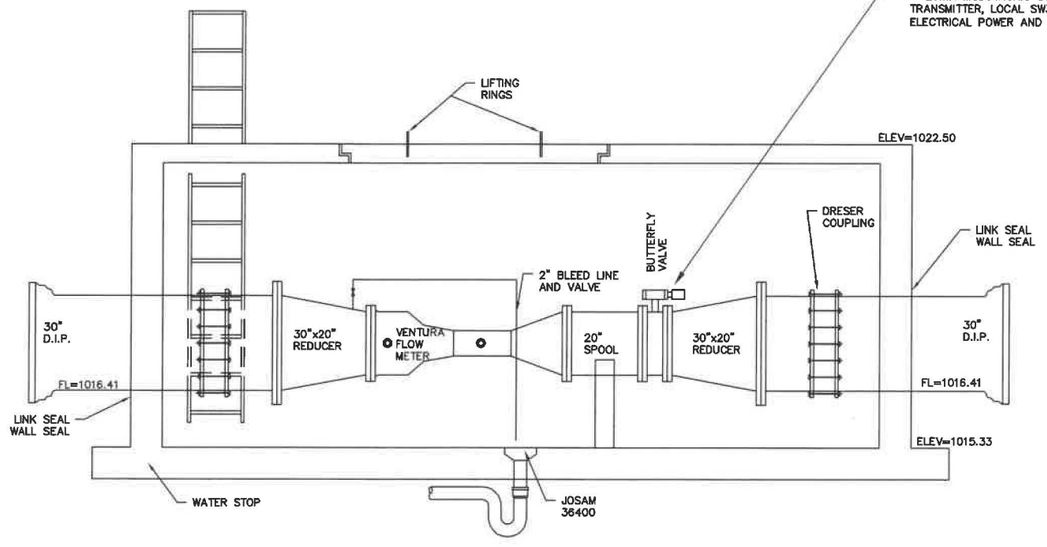


SLUDGE CONTROL BOX PLAN
SCALE: 1/2"=1'-0"

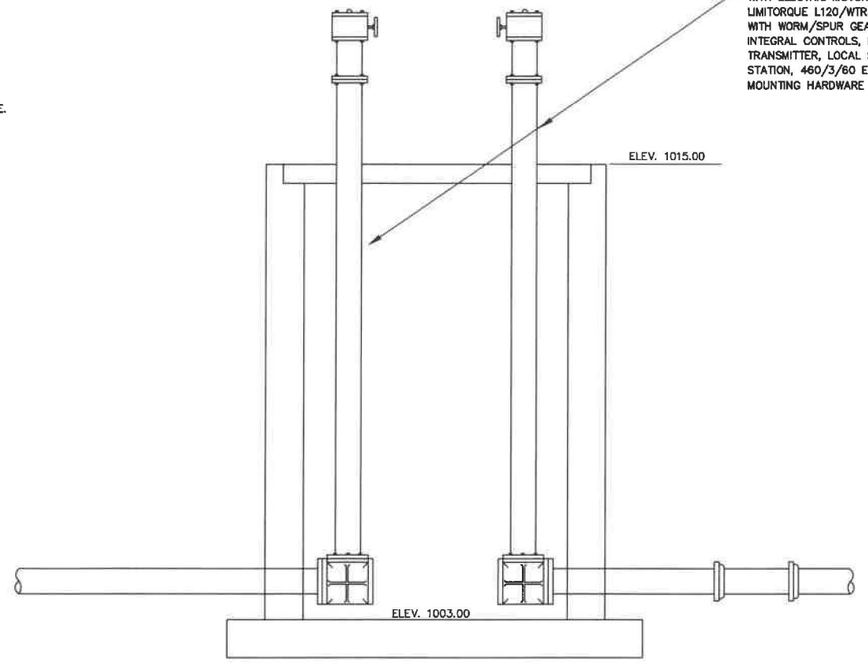
EXISTING 20" WAFER STYLE PRATT BF VALVE TO BE EQUIPPED WITH AN ELECTRIC MOTOR OPERATOR

ROTORK OR LIMITORQUE L120/WTRA EMA ASSEMBLY WITH WORM/SPUR GEARS, BIC/MOD20 BASIC INTEGRAL CONTROLS 4-20mA MODUTRONIC CONTROLS, R/I VALVE POSITION TRANSMITTER, LOCAL SW323 PUSHBUTTON STATION, 460/3/60 ELECTRICAL POWER AND MOUNTING HARDWARE FOR EXIST. VALVE.

REMOVE 8" EXISTING PLUG VALVES AND REPLACE WITH AWWA FLANGED BF VALVES WITH ELECTRIC MOTOR OPERATORS, LIMITORQUE L120/WTRA EMA ASSEMBLY WITH WORM/SPUR GEARS, BIC BASIC INTEGRAL CONTROLS, R/I VALVE POSITION TRANSMITTER, LOCAL SW323 PUSHBUTTON STATION, 460/3/60 ELECTRICAL POWER AND MOUNTING HARDWARE FOR NEW VALVE.

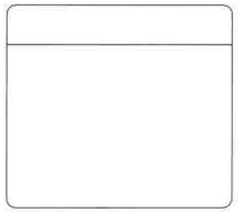


INFLUENT VALVE BOX SECTION
SCALE: 1/2"=1'-0"

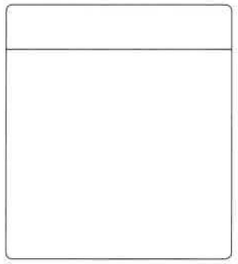


SLUDGE CONTROL BOX SECTION
SCALE: 1/2"=1'-0"

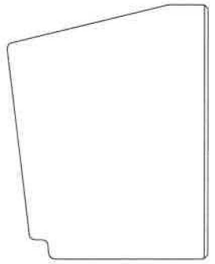
Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD - MUSKOGEE, OKLAHOMA 918/682-7811	CITY OF SHAWNEE, OKLAHOMA	SCALE:	1/2" = 1'-0"	INFLUENT and SLUDGE CONTROL VALVE BOX	Detail: M²	Date: JULY 2000
	WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No.	Check: BB	Sheet No. 20



TOP PLAN

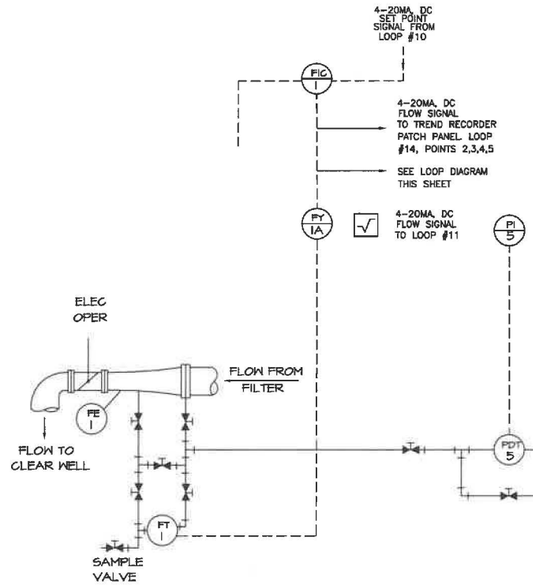


FRONT VIEW



SIDE VIEW

EXISTING FILTER CONSOLE

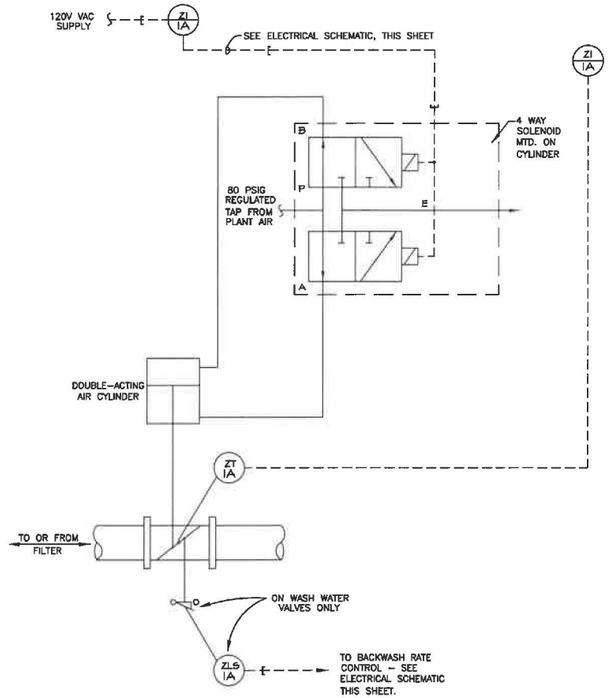


LOOP DIAGRAM NO. 1

EXISTING - NO WORK THIS CONTRACT

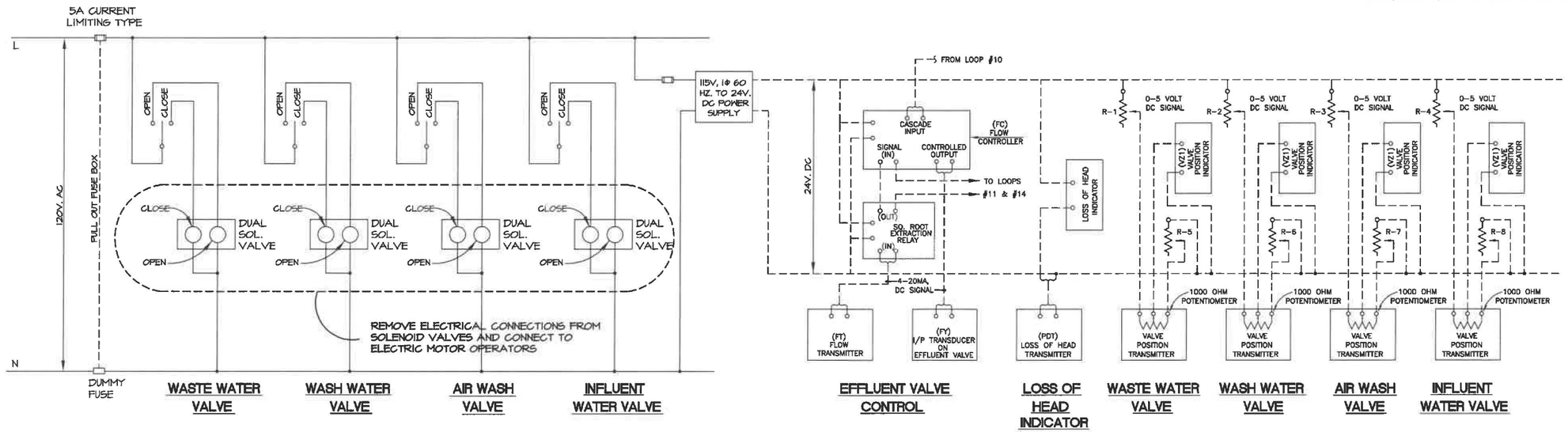
LOOP DIAGRAM NO. 2

EXISTING - NO WORK THIS CONTRACT



LOOP DIAGRAM NO. 1A

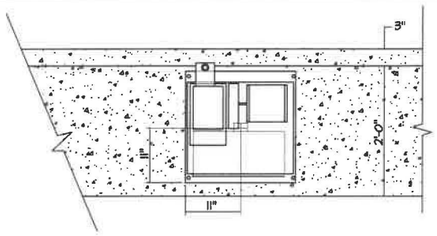
EXISTING TO BE REPLACED BY MODULATING ELECTRIC MOTOR OPERATOR

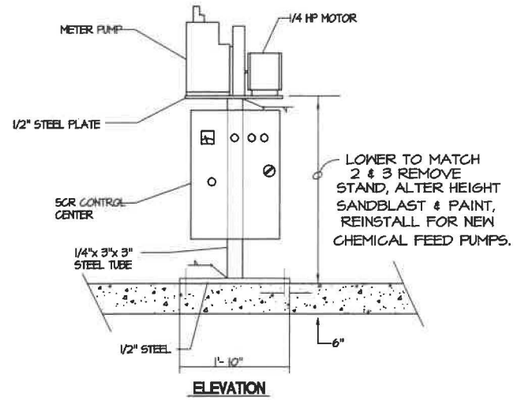


Holloway, Updike and Bellen, Inc. 618 EAST SIDE BOULEVARD - MUSKOGEE, OKLAHOMA 918/682-7811	CITY OF SHAWNEE, OKLAHOMA	SCALE:	NTS	FILTER OPERATOR CONSOLE and CONTROLS	Detail: M²	Date: JULY 2000
	WATER TREATMENT PLANT IMPROVEMENTS			Project No. 965033	Check: BB	Sheet No. 20

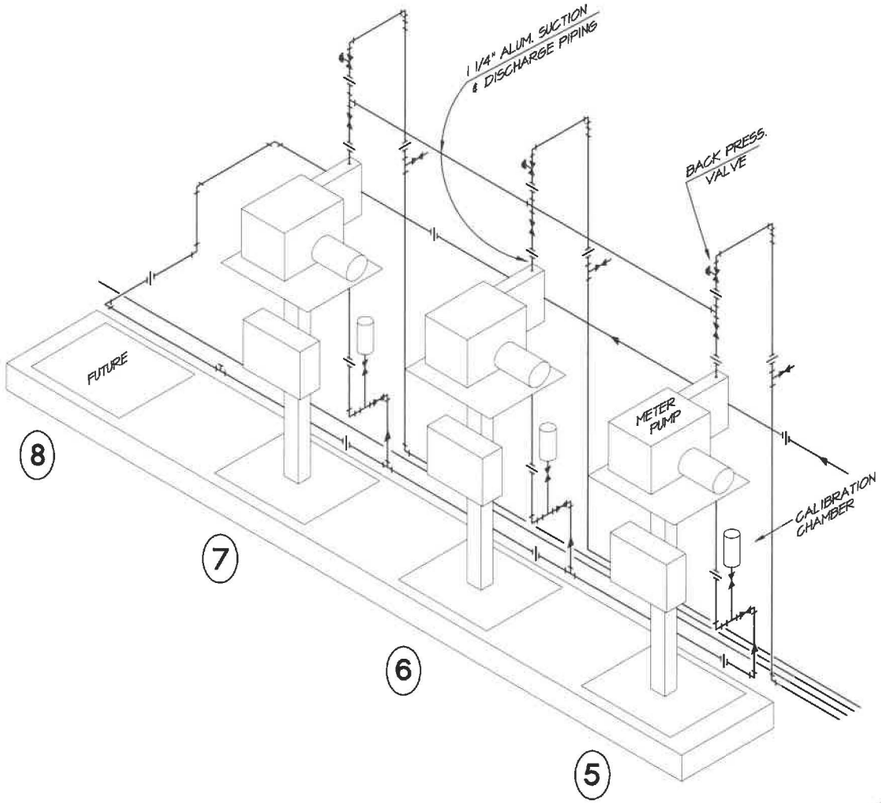
NOTES:

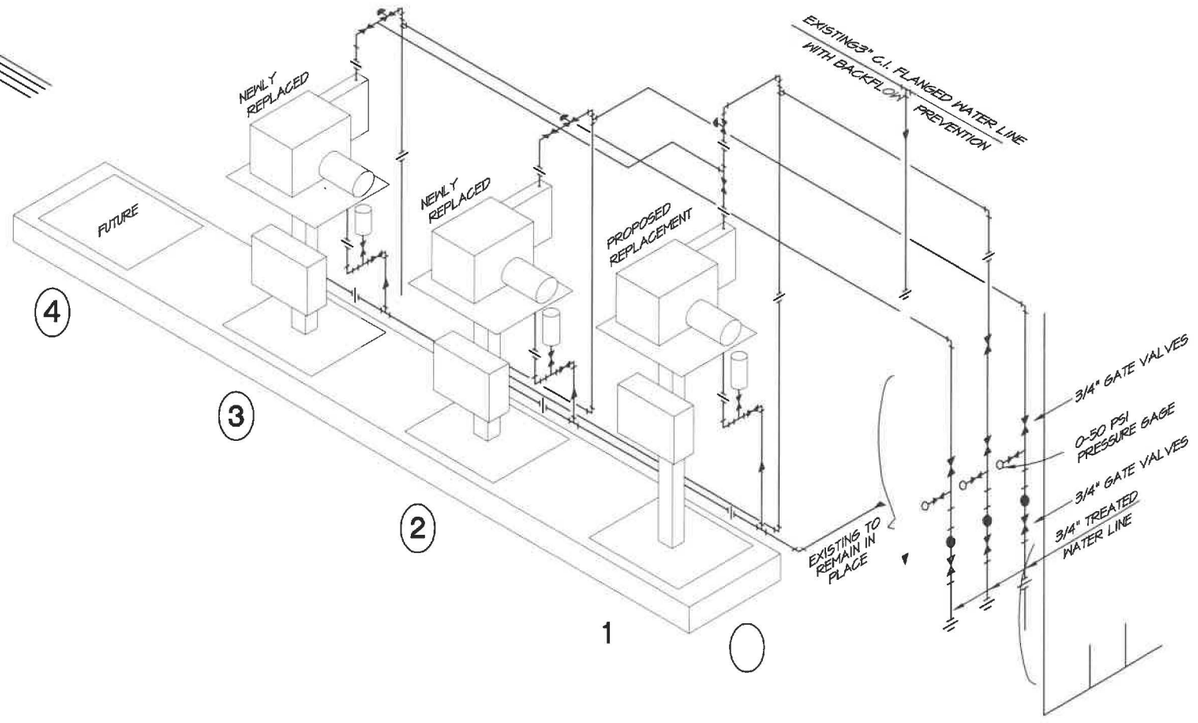
1. REPLACE 1 WITH NEW CHEMICAL FEED PUMP. (SEE SPEC. 15) LOWER PEDESTAL TO MATCH 2 & 3 AND REDO PLUMBING TO MATCH 2 & 3 ELIMINATING OVERHEAD PIPING.
2. CHEMICAL FEED PUMPS 2 & 3 HAVE BEEN RECENTLY REPLACED BY THE OWNER AND SHALL REMAIN IN PLACE.
3. REMOVE AND REPLACE CHEMICAL FEED PUMPS 5 6 & 7 (SEE SPEC. 15) LOWER PEDESTAL TO MATCH 2 & 3 AND OVERHEAD PIPING TO ALIGN WITH 2 & 3 REPLACING ALL PIPE, FITTINGS, VALVES AND APPURTENANCES BELOW GRATE PIPING.



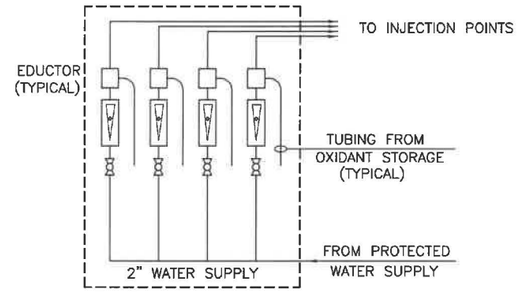


METER PUMP STAND DETAIL

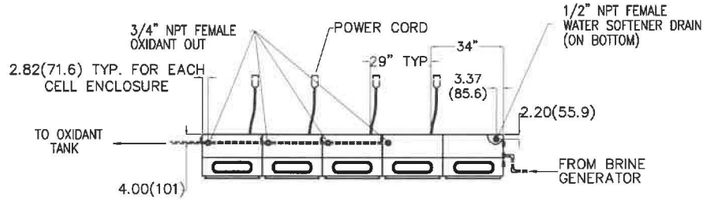




Holloway, Updike and Bellen, Inc. 310 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811	CITY OF SHAWNEE, OKLAHOMA	SCALE:	NTS	CHEMICAL BUILDING ISOMETRIC	Detail: M²	Date: AUG. 2000
	WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No. 965033	Check: BB	Sheet No. 22

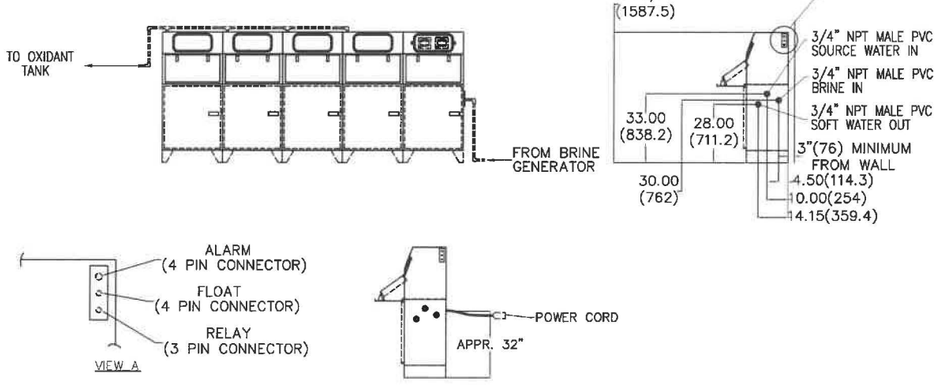


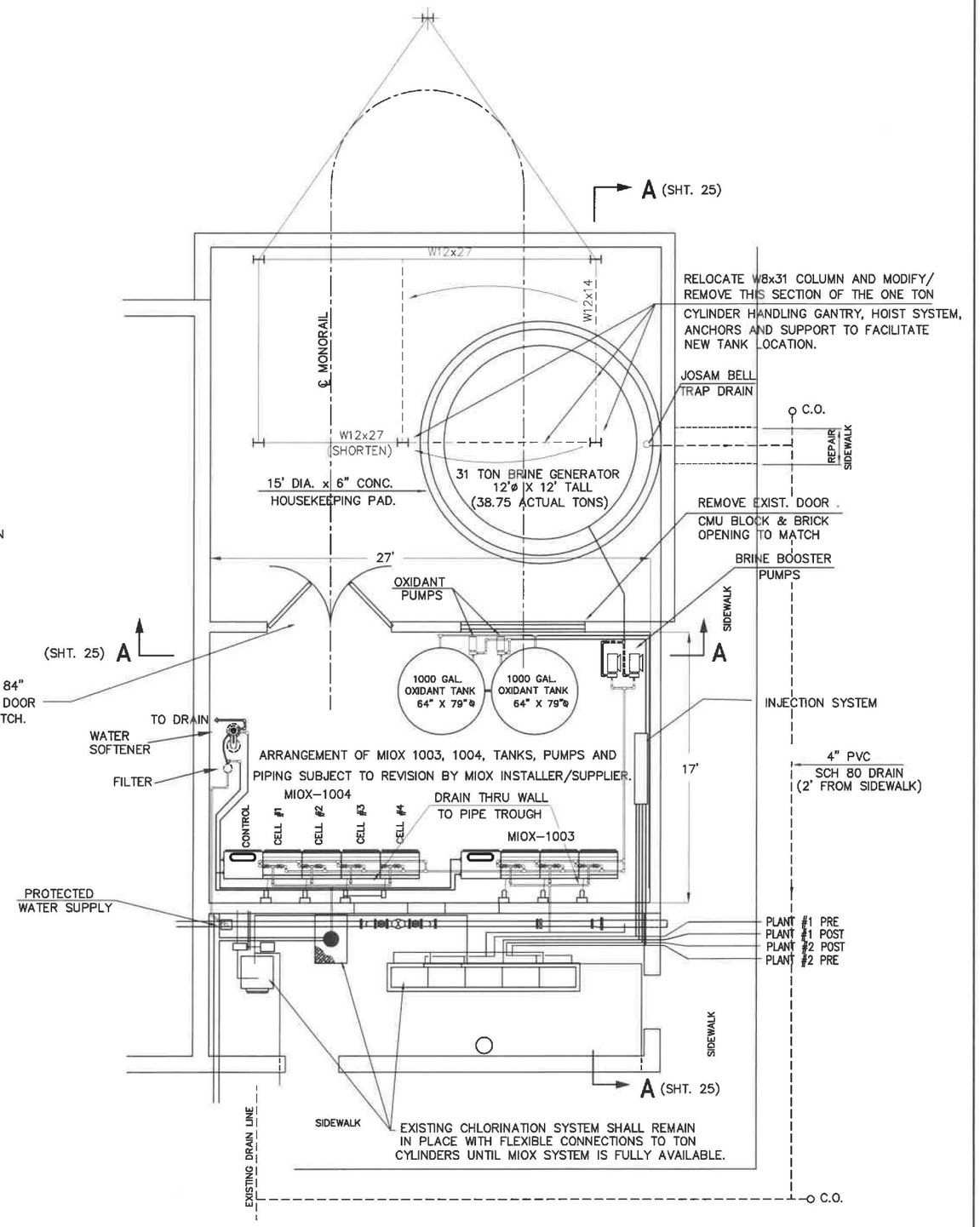
INJECTOR SYSTEM



NOTES:

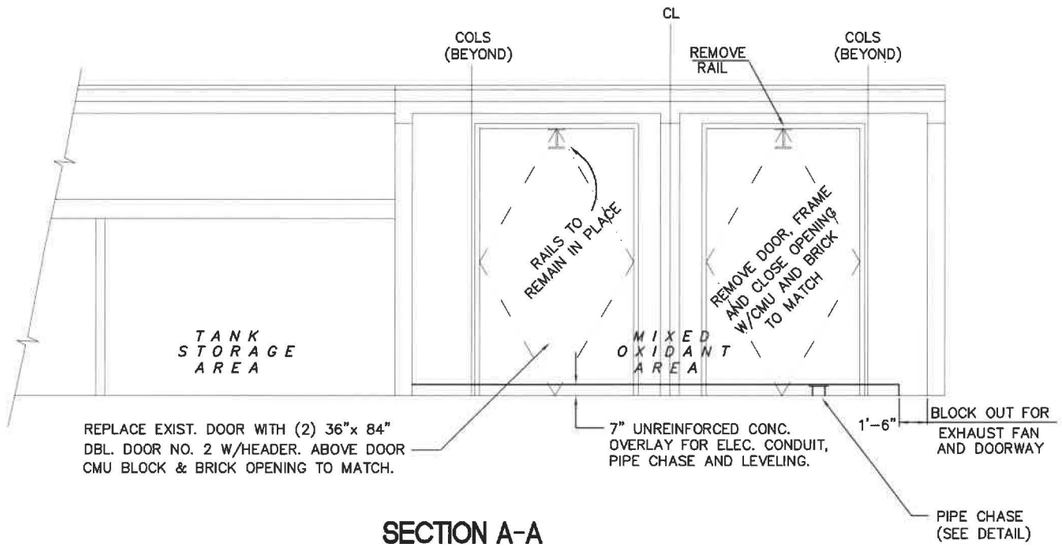
1. WATER REQUIREMENTS: 560 GAL./HOUR @ 60 PSI. MINIMUM (2120 L/HR @ 4.1 BAR)
2. POWER REQUIREMENTS: 480V, 50 AMP, THREE PHASE WYE (PER CELL UNIT)
   GROUND CONNECTION MANDATORY
3. SHIPPED WITH TURNLOK #C58165 MALE PLUG ON 10' CORD.
4. BRINE AND OXIDANT TANK SIZES VARY WITH INSTALLATIONS. CONTACT MIOX CORPORATION FOR DETAILS.
5. DIMENSIONS IN PARENTHESIS ARE METRIC EQUIVALENTS.
6. ALL PIPING SHALL BE SCH. 80 – 3/4" PVC UNLESS OTHERWISE SHOWN.
7. ALL PIPING, VALVES, FITTINGS FOR THE MIOX SYSTEM FROM THE WATER SUPPLY CONNECTION TO THE (4) FOUR INJECTION POINTS SHALL BE FURNISHED AND INSTALLED BY THE MIOX SUPPLIER.



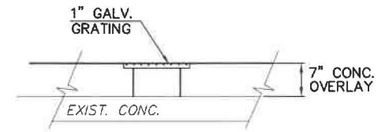


FLOOR PLAN

Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD - MUSKOGEE, OKLAHOMA 918/682-7811	CITY OF SHAWNEE, OKLAHOMA	SCALE:	1/4" = 1'-0"	MIXED OXIDENT SYSTEM	Detail: M²	Date: JULY 2000
	WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No. 965033	Check: BB	Sheet No. 24

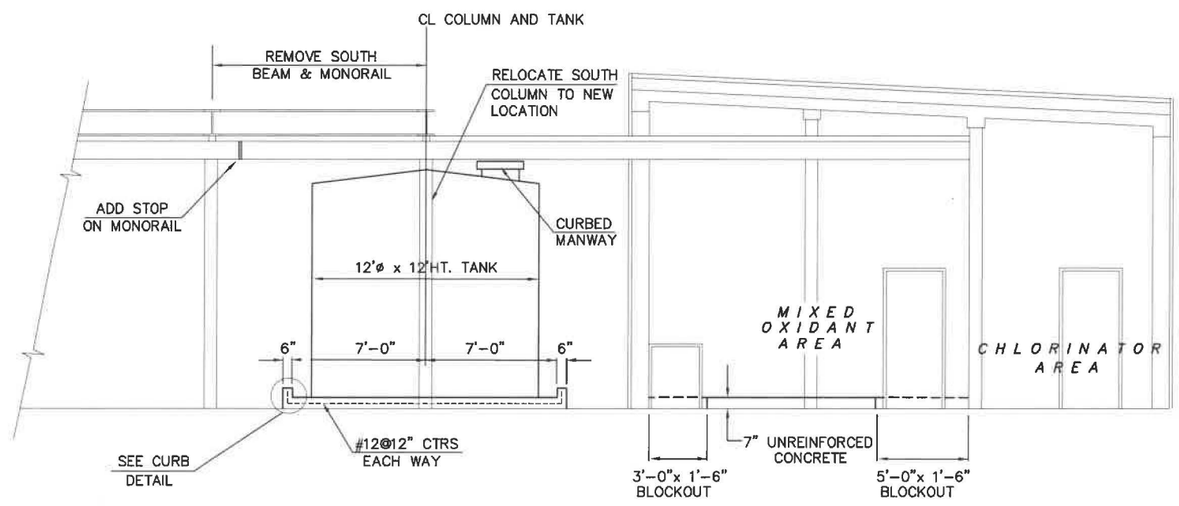


SECTION A-A

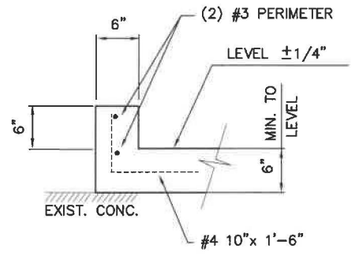


PIPE CHASE

NTS



SECTION B-B



CURB DETAIL

NTS

Holloway, Updike and Bellen, Inc. 816 EAST SIXTH BOULEVARD · MUSKOGEE, OKLAHOMA · 918/682-7811	CITY OF SHAWNEE, OKLAHOMA	SCALE:	1/4" = 1'-0"	MIXED OXIDENT SYSTEM	Detail: M²	Date: JULY 2000
	WATER TREATMENT PLANT IMPROVEMENTS		Ver N/A	Project No. 965033	Check: BB	Sheet No. 25

POWER, LIGHTING & SYSTEM LEGEND

- UNDER CABINET LIGHT FIXTURE
- 1x4 FLUORESCENT LIGHT
- 2x4 FLUORESCENT LIGHT
- EL — FLUORESCENT LIGHT WITH EMERGENCY LIGHT (EL) BATTERY
- 2x2 FLUORESCENT LIGHT
- RECESSED LIGHT, UNLESS OTHERWISE SHOWN
- WALL MOUNTED LIGHT–MOUNTING HEIGHT AS INDICATED
- EXIT LIGHT CEILING MOUNTED, DARKENED AREA INDICATES FACE, ARROWS INDICATE DIRECTION OF EGRESS
- 4 FT. STRIP FLUORESCENT LIGHT
- BATTERY PACK EMERGENCY LIGHTING FIXTURE, 2 LAMP HEADS LIGHT FIXTURE TYPE X2
- S — LIGHT SWITCH, MTD. 4'–0" A.F.F.
- S_2 — LIGHT SWITCH, 2 POLE, MTD 4'–0" A.F.F.
- S_3 — LIGHT SWITCH, 3–WAY, MTD. 4'–0" A.F.F.
- S_4 — LIGHT SWITCH, 4–WAY, MTD. 4'–0" A.F.F.
- S_P — LIGHT SWITCH WITH PILOT LIGHT, MTD. 4'–0" A.F.F.
- 20 AMP DUPLEX RECEPTACLE MTD. HORIZ. 6" ABOVE COUNTER TOP UNLESS OTHERWISE SHOWN
- 20 AMP DUPLEX RECEPTACLE MTD. 18" A.F.F., WITH #12 GROUND WIRE, GFCI INDICATES GROUND FAULT CIRCUIT INTERRUPTER, WP INDICATES WEATHERPROOF ENCLOSURE AND COVER
- SINGLE RECEPTACLE, RATINGS AS NOTED
- S_M — HP RATED TOGGLE SWITCH, 1 OR 2 POLES AS REQUIRED W/OVERLOADS
- OR — NON–FUSED DISCONNECT SWITCH, SIZE AS NOTED
- OR — COMBINATION DISCONNECT AND MOTOR STARTER, SIZE AS NOTED. FUSED TYPE SHOWN.
- F OR — FUSED DISCONNECT SWITCH, SIZE AS NOTED
- PUSHBUTTON STATION, NEMA 4X
- HAND–OFF–REMOTE SELECTOR SWITCH
- ELECTRICAL PANEL, SURFACE MOUNTED, 5'–6" TO TOP OF ENCLOSURE
- ELECTRICAL PANEL, RECESSED MOUNTED, 5'–6" TO TOP OT ENCLOSURE
- EQUIPMENT CABINET SIZE AS NOTED, RECESSED MOUNTED, 5'–6" TO TOP OF ENCLOSURE
- EQUIPMENT CABINET SIZE AS NOTED, SURFACE MOUNTED, 5'–6" TO TOP OF ENCLOSURE
- L–1 — HOME RUN TO PANEL, RECEPTACLES AND EQUIPMENT SHALL HAVE GREEN GROUND WIRE. NUMBER OF ARROWS INDICATES NUMBER OF PHASE CONDUCTORS, LETTER(S) INDICATE NAME OF PANEL, NUMBER(S) INDICATE CIRCUIT NUMBERS
- BRANCH CIRCUIT WITH PHASE, NEUTRAL, SWITCHED PHASE AND EQUIPMENT GROUNDING CONDUCTORS

- ∇_W — TELEPHONE OUTLET, SINGLE GANG BOX MTD. 18" A.F.F. WITH 3/4"C STUB TO ABOVE LAY–IN CEILING. "W" INDICATES 4'–6" MTD. HEIGHT FOR WALL PHONE.
- GROUND
- 3/4" PLYWOOD TELEPHONE BACKBOARD, SIZE AS NOTED, MTD. 5'–6" TO TOP
- JUNCTION BOX 42 CUBIC INCH MINIMUM CAPACITY
- F_S — FIRE ALARM SYSTEM, SMOKE DETECTOR, COMBINATION TYPE – PHOTOELECTRIC, HEAT
- F — FIRE ALARM SYSTEM, MANUAL PULL STATION
- F_D — FIRE ALARM SYSTEM, DUCT MOUNTED SMOKE DETECTOR WITH AUXILIARY CONTACTS TO SHUT OFF SUPPLY FAN
- $F_{135°}$ — FIRE ALARM SYSTEM, HEAT DETECTOR 135°F
- FIRE ALARM SYSTEM, HORN AND STROBE LIGHT COMBINATION DEVICE
- FIRE ALARM SYSTEM, STROBE LIGHT DEVICE
- FS — SPRINKLER FLOW SWITCH
- FLOOR TELEPHONE OUTLET, CAST JUNCTION–BOX
- S — DOOR SWITCH MOUNTED IN DOOR JAMB
- DOOR BUTTON WEATHER PROOF, 50" A.F.F.
- B — DOOR BUZZER MTD 7'–0" A.F.F.
- H, H1 — HANDHOLE, IDENTIFIER SHOWN, REFER TO HANDHOLE SCHEDULE FOR SIZE
- CIRCUIT BREAKER, TRIP RATING SHOWN, 3–POLE UNLESS NOTED
- FUSE, CURRENT LIMITING, RATING AS SHOWN
- TRANSFORMER, RATINGS AS SHOWN
- M, 10 HP — ELECTRIC MOTOR, HORSEPOWER SHOWN
- MOTOR STARTER, SIZE AS SHOWN OR REQUIRED. FVNR UNLESS NOTED
- VARIABLE FREQUENCY DRIVE
- 4–4" — DUCT BANK, IDENTIFIER SHOWN. REFER TO DUCT BANK SCHEDULE FOR SIZE AND CONFIGURATION.
- 3/4" x 10' COPPER CLAD GROUND ROD
- SA SA — SURGE ARRESTER
- G, * kW — GENERATOR
- ATS/BP/IS 3P400 — ATS
- WEATHERHEAD
- CABLE CONNECTION

2(3#8 + 1#8 + 1#10EG) 3/4" GRS

- CONDUIT TYPE (SEE ABBREVIATIONS) REFER TO SPECIFICATIONS IF NOT SHOWN
- CONDUIT SIZE
- GROUNDING (GROUND) CONDUCTOR, NUMBER AND SIZE
- GROUNDED (NEUTRAL) CONDUCTOR, NUMBER AND SIZE
- PHASE (HOT) CONDUCTOR, NUMBER AND SIZE
- NUMBER OF SETS

ABBREVIATIONS

A	AMP
ABC	ABOVE COUNTER
ACU	AIR CONDITIONING UNIT
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AIC	AMPS INTERRUPTING CAPACITY
AM	AMP–METER
ANN	ANNUNCIATOR
AP	AERIAL PRIMARY
AS	AERIAL SECONDARY
ATS	AUTOMATIC TRANSFER SWITCH
AUX	AUXILIARY
BFI	BLOWN FUSE INDICATOR
BKR	BREAKER
C	CONDUIT
CGRS	PVC COATED GALVANIZED RIGID STEEL
CKT	CIRCUIT
CL	CENTERLINE
COM	COMMON
CONT	CONTINUOUS
CP	CONTROL PANEL
CPT	CONTROL POWER TRANSFORMER
CR	CONTROL RELAY
CS	CORD SET
CU	COEFFICIENT OF UTILIZATION
DEB	DIRECT EARTH BURIED
EC	EMPTY OR EMBEDDED CONDUIT
EF	EXHAUST FAN
EG	EQUIPMENT GROUND
EL	ELEVATION
EMT	ELECTRICAL METALLIC TUBING
ETM	ELASPED TIME METER
FA	FIRE ALARM
FAP	FIRE ALARM PANEL
FC	FAN COIL
FLR	FLOOR
FOC	FIBER OPTIC CABLE
FS	FLOAT SWITCH
FT	FEET
FVNR	FULL VOLTAGE NON–REVERSING
FVR	STARTER
GFCI	FULL VOLTAGE REVERSING STARTER
GND	GROUND FAULT CIRCUIT INTERRUPTER GROUND
GRS	GALVANIZED RIGID STEEL
HOA	HAND–OFF–AUTO
HOR	HAND–OFF–REMOTE
HP	HORSEPOWER OR HEAT PUMP
HR	HOUR
ISP	INDIVIDUALLY SHIELDED PAIR
JB	JUNCTION BOX
kVA	KILOVOLT–AMPERE
kVAR	KILOVOLT–AMPERE, REACTIVE
kW	KILOWATT
LA	LIGHTNING ARRESTOR
LSIG	LONG SHORT INSTANTANEOUS GROUND
L.O.	LUGS ONLY
LV	LOW VOLTAGE
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MFR	MANUFACTURER
MIN	MINIMUM
MLO	MAIN LUGS ONLY
MS	MOTOR STARTER
MTD	MOUNTED
NFDS	NON–FUSED DISCONNECT SWITCH
NTS	NOT TO SCALE
OC	ON CENTER
OH	OVERHEAD
OHP	OVERHEAD PRIMARY
OHS	OVERHEAD SECONDARY
OL	OVERLOAD
PB	PUSH BUTTON
PEC	PHOTO ELECTRIC CELL
PF	POWER FACTOR
PL	PILOT LIGHT
PMR	PHASE MONITOR RELAY
PNL	PANEL
PP	POWER POLE
PTT	PUSH–TO–TEST
PVC	SCHEDULE 40 POLYVINYL CONDUIT
RECPT	RECEPTACLE
RM	ROOM
RVAT	REDUCED VOLTAGE AUTO–TRANSFORMER STARTER
S	SECOND
SA	SURGE ARRESTER
SDBC	SOFT DRAWN BARE COPPER
SE	SERVICE ENTRANCE
SHT	SHEET
SN	SOLID NEUTRAL
SS	STAINLESS STEEL
STA	STATION
STT/STP	START/STOP
SW	SWITCH
TEL	TELEPHONE
TD	TIME DELAY
TDD	TIME DELAY ON DE–ENERGIZATION
TDE	TIME DELAY ON ENERGIZATION
THD	TOTAL HARMONIC DISTORTION
TYP	TYPICAL
TC	TIME CLOCK
UGE	UNDER GROUND ELECTRIC
UH	UNIT HEATER
UP	UNDERGROUND PRIMARY
US	UNDERGROUND SECONDARY
UTP	UNSHIELDED TWISTED PAIR
V	VOLT
VA	VOLT–AMP
VFD	VARIABLE FREQUENCY DRIVE
VM	VOLT–METER
W	WATT OR WIRE
WH	WEATHER HEAD
WM	WATT METER
WP	WEATHERPROOF
W/	WITH
XMFR	TRANSFORMER

GENERAL NOTES:

1. SOME SYMBOLS OR ABBREVIATIONS MAY APPEAR ON THIS SHEET AND NOT BE UTILIZED ON THE PROJECT.

CONTROL SCHEMATIC LEGEND

- WIRING WITHIN PANEL
- WIRING TO FIELD DEVICE
- PUSHBUTTON SWITCH, NORMALLY OPEN
- PUSHBUTTON SWITCH, NORMALLY CLOSED
- SELECTOR SWITCH, NUMBER OF POSITIONS AND CONTACTS AS SHOWN
- RELAY CONTACT, NORMALLY OPEN
- RELAY CONTACT, NORMALLY CLOSED
- TIME DELAY CONTACT, CLOSE ON ENERGIZATION
- TIME DELAY CONTACT, OPEN ON ENERGIZATION
- TIME DELAY CONTACT, OPEN ON DE–ENERGIZATION
- TIME DELAY CONTACT, CLOSE ON DE–ENERGIZATION
- LEVEL SWITCH
- PRESSURE SWITCH
- LIMIT SWITCH CONTACT, NORMALLY OPEN
- LIMIT SWITCH CONTACT, NORMALLY CLOSED
- LIMIT SWITCH CONTACT, HELD OPEN
- LIMIT SWITCH CONTACT, HELD CLOSED
- RELAY COIL, "TR" INDICATES "TIMING RELAY"
- PILOT LIGHT; "A" INDICATES "AMBER LENS" "G" INDICATES "GREEN LENS" "R" INDICATES "RED LENS"
- SOLENOID
- ETM — ELAPSED TIME METER
- TERMINAL BLOCK
- ELECTRICAL CONNECTION
- FUSE, AMPERE RATING AS SHOWN OR REQUIRED "BFI" INDICATES "BLOWN FUSE INDICATOR" TYPE
- GROUND CONNECTION TO ENCLOSURE GROUND BAR

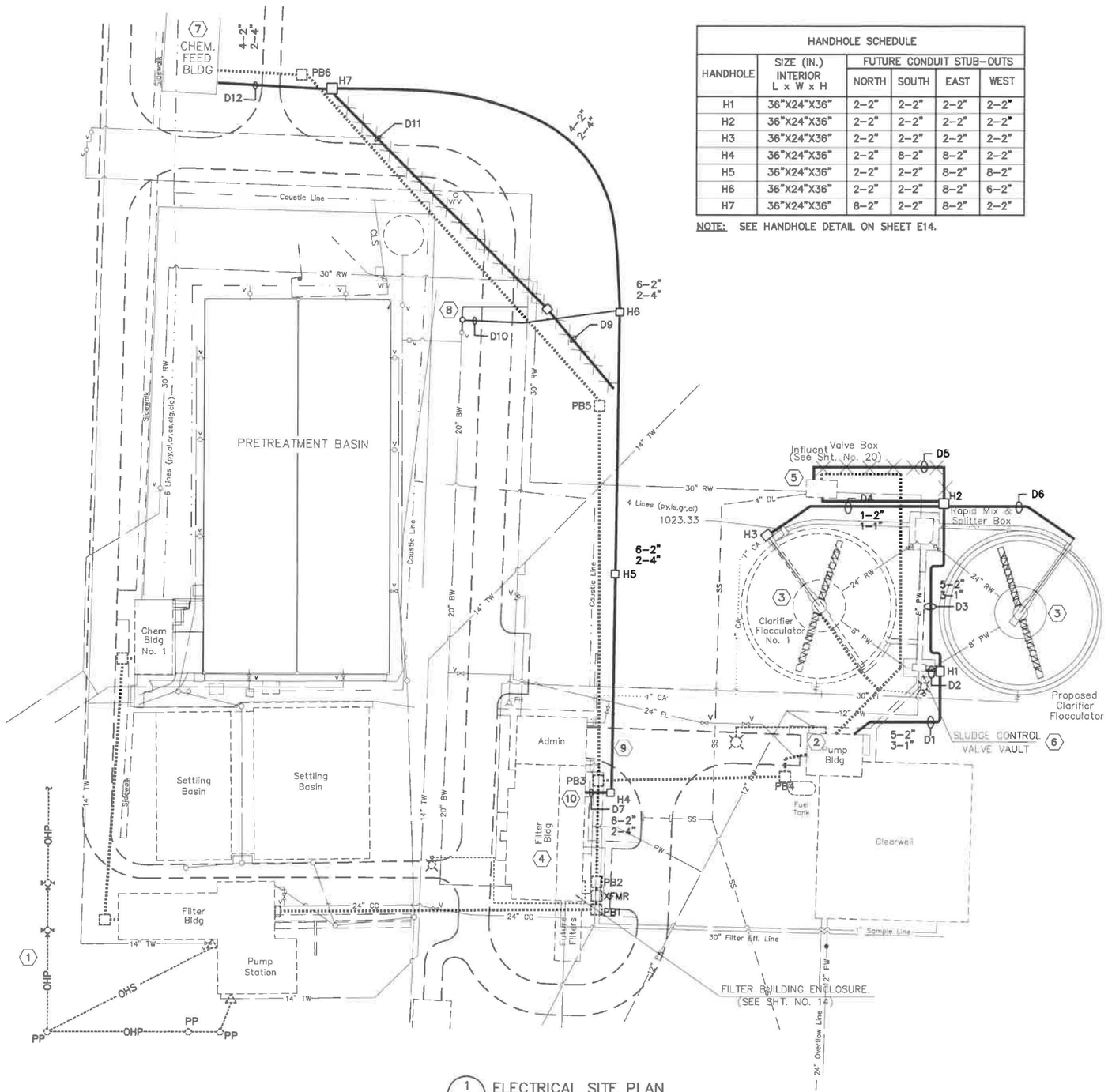
- FURNISH AND INSTALL
- EXISTING
- EXISTING TO BE REMOVED

RECORD DRAWINGS

THESE PLANS RECORD THE ACTUAL CONSTRUCTION CONDITIONS OF THE PROJECT INCLUDING VARIATIONS FROM THE ORIGINAL CONTRACT DOCUMENTS IN ACCORDANCE WITH INFORMATION AVAILABLE TO THE ENGINEER

DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.



1/E2 ELECTRICAL SITE PLAN
SCALE: 1" = 40'

HANDHOLE SCHEDULE					
HANDHOLE	SIZE (IN.) INTERIOR L x W x H	FUTURE CONDUIT STUB-OUTS			
		NORTH	SOUTH	EAST	WEST
H1	36"X24"X36"	2-2"	2-2"	2-2"	2-2"
H2	36"X24"X36"	2-2"	2-2"	2-2"	2-2"
H3	36"X24"X36"	2-2"	2-2"	2-2"	2-2"
H4	36"X24"X36"	2-2"	8-2"	8-2"	2-2"
H5	36"X24"X36"	2-2"	2-2"	8-2"	8-2"
H6	36"X24"X36"	2-2"	2-2"	8-2"	6-2"
H7	36"X24"X36"	8-2"	2-2"	8-2"	2-2"

NOTE: SEE HANDHOLE DETAIL ON SHEET E14.

KEYED NOTES:

1. EXISTING (3)-167kVA POLE MOUNTED TRANSFORMER BANK.
2. INSTALL NEW ELECTRICAL EQUIPMENT, SEE DETAILS ON SHEET E5.
3. INSTALL NEW ELECTRICAL EQUIPMENT, SEE DETAILS ON SHEET E3.
4. INSTALL NEW ELECTRICAL EQUIPMENT, SEE DETAILS ON SHEETS E6, E7, AND E8.
5. INSTALL NEW ELECTRICAL EQUIPMENT, SEE DETAILS ON SHEET E9.
6. INSTALL NEW ELECTRICAL EQUIPMENT, SEE DETAILS ON SHEET E10.
7. INSTALL NEW ELECTRICAL EQUIPMENT, SEE DETAILS ON SHEET E11.
8. INSTALL NEW ELECTRICAL EQUIPMENT FOR BACKWASH TANK FILL VALVE OPERATOR. INSTALL NEMA 4X STAINLESS STEEL NONFUSED DISCONNECT SWITCH, 30A/3P WITH CGRS TO EQUIPMENT, MOUNT SWITCH WITHIN BACKWASH STRUCTURE. INSTALL NEMA 4X JUNCTION BOXES FOR CONTROL AND SPARE CONDUITS. SEE DETAILS 3 AND 4 ON SHEET E14 (TYPICAL).
9. SAWCUT AND REPAIR EXISTING ROADWAY, REPAIR TO MATCH EXISTING.
10. INSTALL CONDUIT ENTRY TO FILTER BUILDING, SEE DETAIL 3 ON SHEET E4, COORDINATE INSTALLATION OF INTERIOR JUNCTION BOXES AND CONDUITS FOR POWER, CONTROLS AND SIGNAL LOCATIONS.

CAUTION:

UNDERGROUND UTILITIES EXIST WITHIN AND ADJACENT TO THE LIMITS OF CONSTRUCTION. AN ATTEMPT HAS BEEN MADE TO LOCATE THESE UTILITIES ON THE PLANS, HOWEVER, ALL EXISTING UTILITIES MAY NOT BE SHOWN AND THE ACTUAL LOCATIONS OF THE UTILITIES MAY VARY FROM THE LOCATIONS SHOWN. PRIOR TO BEGINNING ANY TYPE OF EXCAVATION, THE CONTRACTOR SHALL CONTACT THE UTILITIES INVOLVED AND MAKE ARRANGEMENTS FOR THE LOCATION OF THE UTILITIES ON THE GROUND. THE CONTRACTOR SHALL MAINTAIN THE UTILITY LOCATION MARKINGS UNTIL THEY ARE NO LONGER NECESSARY.

GENERAL NOTE:

SEE SHEET E17 FOR DUCT BANK SCHEDULE.

SCALE: 1" = 40'

40 20 0 40 80 120

RECORD DRAWINGS

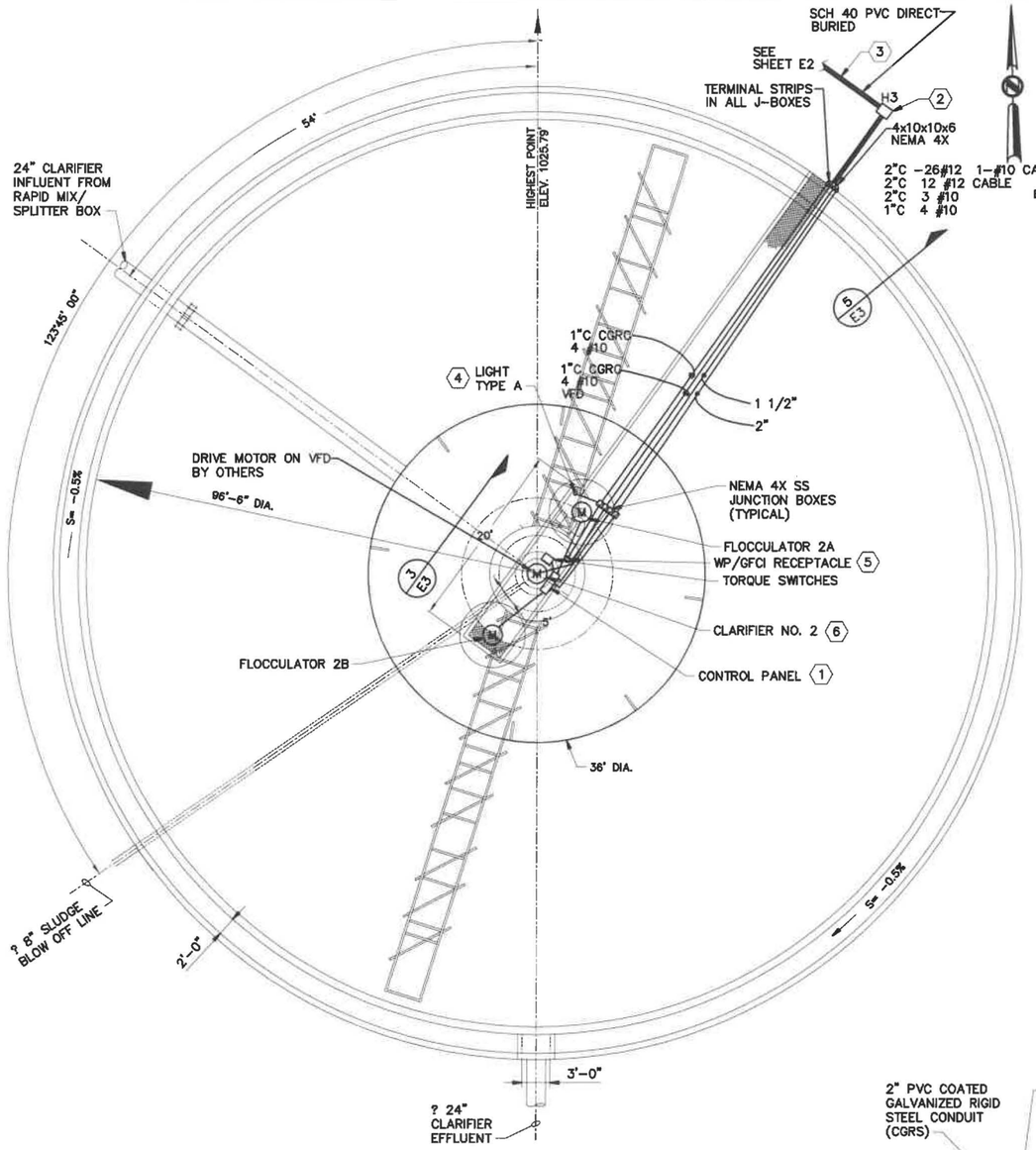
THESE PLANS RECORD THE ACTUAL CONSTRUCTION CONDITIONS OF THE PROJECT INCLUDING VARIATIONS FROM THE ORIGINAL CONTRACT DOCUMENTS IN ACCORDANCE WITH INFORMATION AVAILABLE TO THE ENGINEER

DATE MARCH 2002

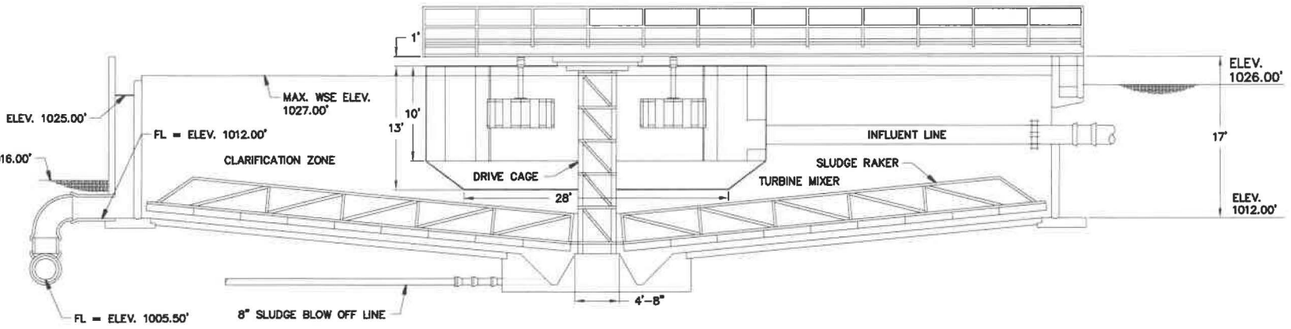
HOLLOWAY, UPDIKE + BELLEN,INC.

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Xrefs: [P:\standards\projdev\stamps\ ECF_OK] [ref\ SWT_TBX]

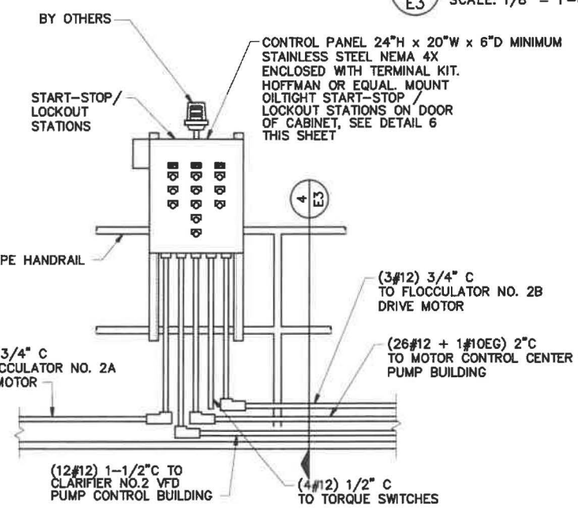
Holloway, Updike and Bellen, Inc. 918 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-1611	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS SHAWNEE, OKLAHOMA	SCALE:	AS SHOWN Ver N/A	ELECTRICAL SITE PLAN Project No. 965033	Detail: CAC Check: ECF	Date: OCT. 2000 Sheet No. E2



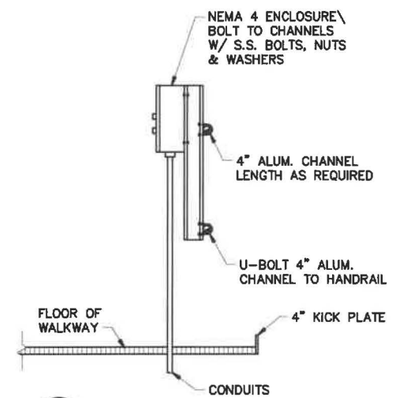
1 E3 ELECTRICAL PLAN OF CLARIFIER – FLOCCULATOR NO. 2
SCALE: 1/8" = 1'-0"



2 E3 ELECTRICAL LONGITUDINAL SECTION
SCALE: 1/8" = 1'-0"



3 E3 CONTROL PANEL INSTALLATION FRONT VIEW
SCALE: 3/4" = 1'-0"

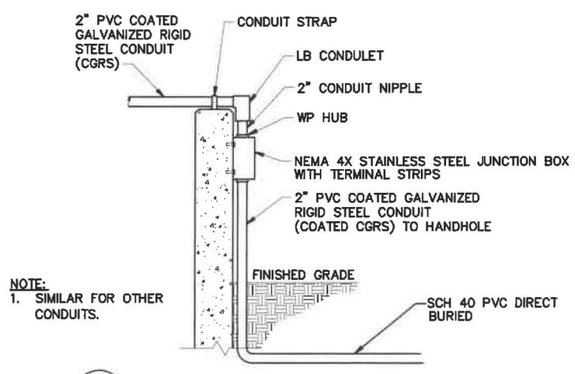


4 E3 CONTROL PANEL SECTION
SCALE: 3/4" = 1'-0"

SCALE: 1/8" = 1'-0"
96" 48" 0 4' 8' 12' 16' 20' 24'

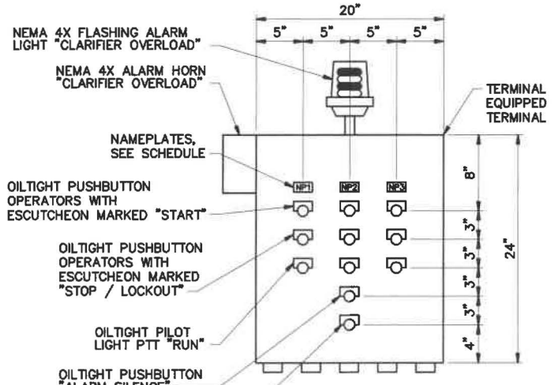
SCALE: 1/2" = 1'-0"
24" 12" 0 1' 2' 3' 4' 5' 6'

SCALE: 3/4" = 1'-0"
18" 12" 6" 0 1' 2' 3' 4'



NOTE:
1. SIMILAR FOR OTHER CONDUITS.

5 E3 CONDUIT INSTALLATION DETAIL SECTION
SCALE: 3/4" = 1'-0"



6 E3 CONTROL PANEL LAYOUT
SCALE: 1 1/2" = 1'-0"
(BY OTHERS)

NAMEPLATE SCHEDULE

NO.	MARKING
NP1	FLOCCULATOR 2A
NP2	CLARIFIER NO. 2
NP3	FLOCCULATOR 2B

NOTE:
1. SIMILAR FOR CLARIFIER NO. 1 CONTROL PANEL PANEL REPLACEMENT.

RECORD DRAWINGS

THESE PLANS RECORD THE ACTUAL CONSTRUCTION CONDITIONS OF THE PROJECT INCLUDING VARIATIONS FROM THE ORIGINAL CONTRACT DOCUMENTS IN ACCORDANCE WITH INFORMATION AVAILABLE TO THE ENGINEER

DATE MARCH 2002
HOLLOWAY, UPDIKE + BELLEN,INC.

KEYED NOTES:

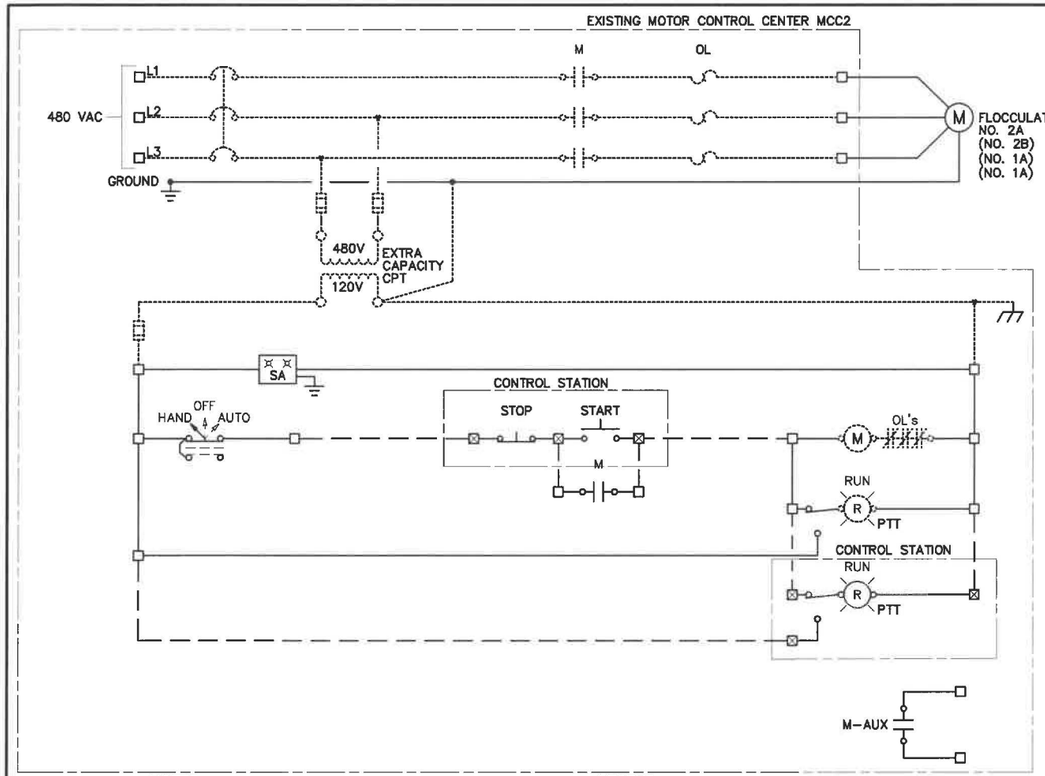
1. INSTALL CLARIFIER NO. 2 CONTROL PANEL, SEE DETAILS THIS SHEET. REPLACE CLARIFIER NO. 1 CONTROL PANEL SEE DETAIL THIS SHEET.
2. INSTALL HANDHOLE "H3", SEE DETAIL ON SHEET E4.
3. INSTALL ELECTRICAL DUCT "D6" TO PUMP BUILDING.
4. INSTALL LIGHT FIXTURE TYPE A, SEE DETAIL ON SHEET E4, CIRCUIT "LP-14".
5. INSTALL WP/GFCI RECEPTACLE MOUNTED NEXT TO CONTROL PANEL, CIRCUIT "LP-14".
6. INSTALL DEDICATED 1"C WITH VFD CONDUCTORS TO CLARIFIER.

GENERAL NOTE:

SIMILAR FOR CLARIFIER NO. 1.

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Holloway, Updike and Bellen, Inc. 810 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7511	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS	SCALE:	AS SHOWN	ELECTRICAL CLARIFIER NO. 2 PLAN	Detail: CAG	Date: OCT. 2000
	SHAWNEE, OKLAHOMA		Ver N/A	Project No. 965033	Check: ECF	Sheet No. E3



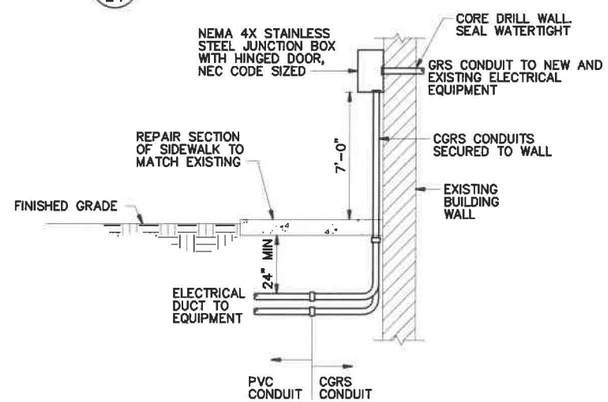
NOTES:

1. SIMILAR CONTROLS FOR FLOCCULATOR 2B.
2. REPLACE MCC "START" PUSHBUTTON WITH NEW H-O-A SELECTOR SWITCH AND MAKE ALL FINAL CONNECTIONS.
3. RECONNECT CONTROLS AS SHOWN.
4. REMOVE "STOP" PUSHBUTTON AND INSTALL BLANK COVER.
5. MODIFY EXISTING CONTROLS FOR FOCULATOR 1A AND 1B AS SHOWN ABOVE.

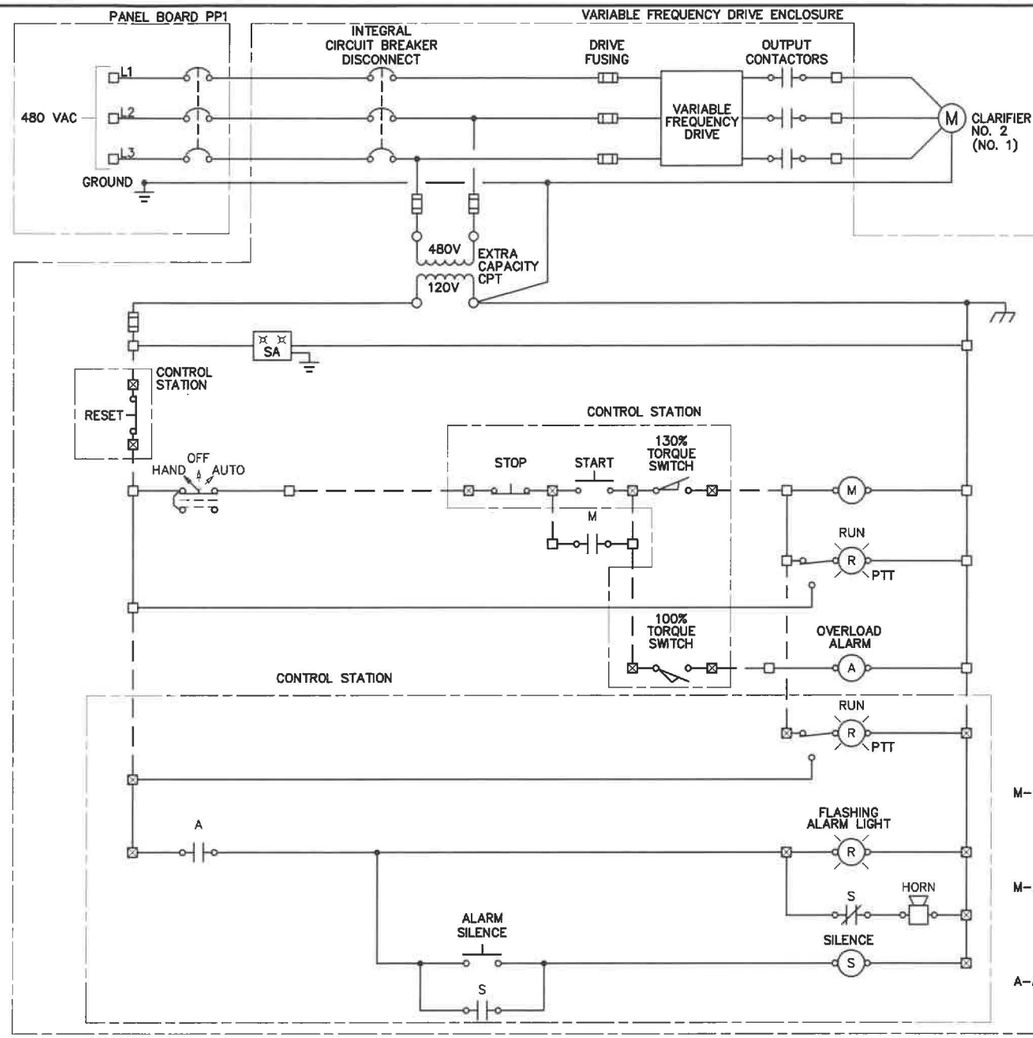
LEGEND

----------	EXISTING
————	FURNISH AND INSTALL
— — —	FIELD WIRING
— · — · —	EQUIPMENT BOUNDARY
⊠	CONTROL STATION TERMINAL
□	MCC TERMINAL

1/E4 FLOCULATOR SCHEMATIC DIAGRAM
SCALE: NONE



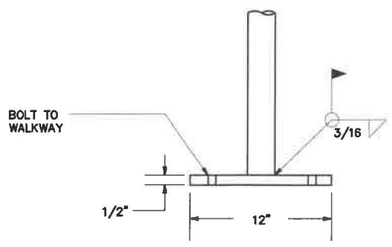
3/E4 CONDUIT ENTRY BUILDING RISER
SCALE: NONE



NOTES:

1. SIMILAR CONTROLS FOR CLARIFIER NO. 1.
2. REPLACE MCC "START" PUSHBUTTON WITH NEW H-O-A SELECTOR SWITCH AND MAKE ALL FINAL CONNECTIONS.
3. RECONNECT CONTROLS AS SHOWN.

2/E4 CLARIFIER SCHEMATIC DIAGRAM
SCALE: NONE



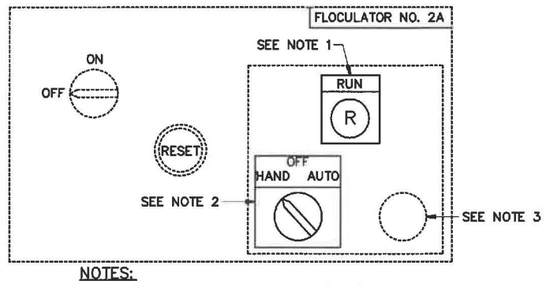
4/E4 LIGHT AT CLARIFIER POST DETAIL
SCALE: NONE

RECORD DRAWINGS

THESE PLANS RECORD THE ACTUAL CONSTRUCTION CONDITIONS OF THE PROJECT INCLUDING VARIATIONS FROM THE ORIGINAL CONTRACT DOCUMENTS IN ACCORDANCE WITH INFORMATION AVAILABLE TO THE ENGINEER

DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.



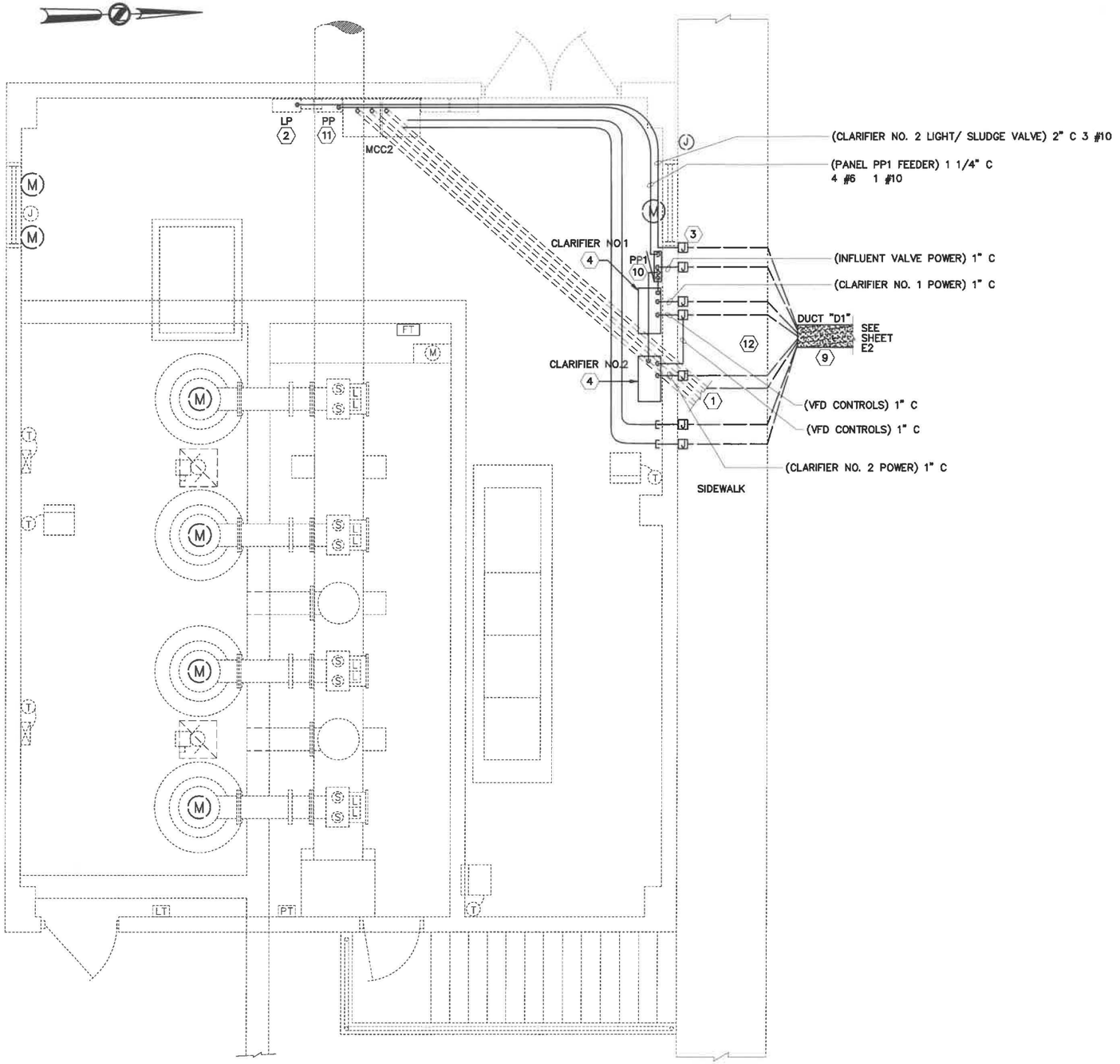
NOTES:

1. INSTALL NEW PILOT LIGHT LAMP AND "RUN" NAMEPLATE.
2. REPLACE MCC "START" PUSHBUTTON WITH NEW H-O-A SELECTOR SWITCH AND MAKE ALL FINAL CONNECTIONS.
3. REMOVE "STOP" PUSHBUTTON AND INSTALL BLANK COVER

5/E4 FLOCULATOR MCC2 PANEL MODIFICATIONS
SCALE: NONE

CAGcrr SWT_E04.dwg L:\1996\965033\DRAWINGS\ 34x22 1=1 10/27/2000 1:30 pm
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Xrefs: P:\standards\prodev\stamps\ ECF_OK [ref', SWT_TBX

Holloway, Updike and Bellen, Inc. 248 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS	SCALE:	AS SHOWN	ELECTRICAL CLARIFIER DETAILS	Detail: CAG	Date: OCT. 2000
	SHAWNEE, OKLAHOMA		Ver N/A	Project No. 965033	Check: ECF	Sheet No. E4



1 / E5 ELECTRICAL PUMP BUILDING PLAN
SCALE: 3/8"=1'-0"

SCALE: 3/8" = 1'-0"
36" 24" 12" 0 2' 4' 6' 8'

KEYED NOTES:

1. FIELD LOCATE AND EXTEND EXISTING 2" CONDUIT STUBOUT FROM "MCC2" IN PUMP BUILDING TO CLARIFIER NO.2 CONTROL PANEL WITH POWER / CONTROL CONDUCTORS.
2. INSTALL 20A/1P CIRCUIT BREAKER, LABEL AS "CLARIFIER NO. 2 RECEPT/LIGHT".
3. INSTALL NEMA 4X STAINLESS STEEL JUNCTION BOXES MOUNTED ON EXTERIOR PUMP BUILDING WALL, TYPICAL, SEE DETAIL 3 ON SHEET E4.
4. INSTALL CLARIFIER VARIABLE FREQUENCY DRIVE, HAND-OFF-REMOTE, SPEED CONTROL, NEMA 12 ENCLOSURE, FAN VENTILATED, NEMA 12 FILTERS. SEE SPECS FOR DETAILS.
5. NOT USED
6. NOT USED
7. NOT USED
8. NOT USED
9. INSTALL ELECTRICAL DUCT D1 TO HANDHOLE H1.
10. INSTALL NEW POWER PANEL PP1.
11. INSTALL 60A/3P CIRCUIT BREAKER, WITHIN EXISTING PANEL "PP", LABEL AS "PANEL PP1"
12. SAW CUT AND REPAIR EXISTING SIDEWALK AS REQUIRED, REPAIR TO MATCH EXISTING.

RECORD DRAWINGS

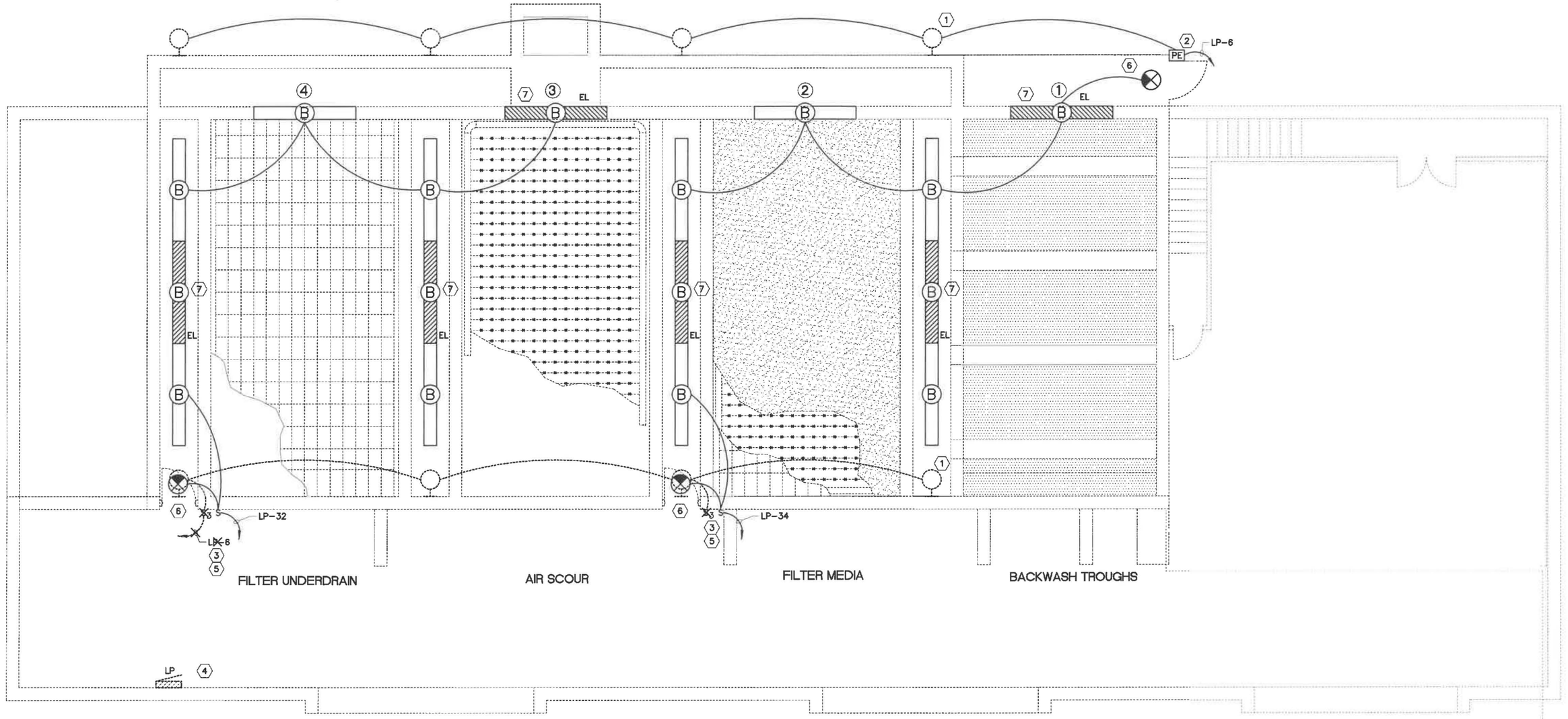
THESE PLANS RECORD THE ACTUAL CONSTRUCTION CONDITIONS OF THE PROJECT INCLUDING VARIATIONS FROM THE ORIGINAL CONTRACT DOCUMENTS IN ACCORDANCE WITH INFORMATION AVAILABLE TO THE ENGINEER

DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.

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Images: [none]
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Holloway, Updike and Bellen, Inc. 515 EAST SIDE BOULEVARD · HENRYETTE, OKLAHOMA · 918/652-7811	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS	SCALE:	AS SHOWN	ELECTRICAL PUMP BUILDING	Detail: DEH	Date: OCT. 2000
	SHAWNEE, OKLAHOMA		Ver N/A	Project No. 965033	Check: ECF	Sheet No. E5



GENERAL NOTES:

1. JUNCTION BOXES WITHIN THE ENCLOSED FILTER AREA SHALL BE NEMA 4X ENCLOSURES.
2. CONDUITS ONLY WITHIN THE ENCLOSED FILTER AREA SHALL BE ALUMINUM RIGID CONDUIT.

1/E6 ELECTRICAL FILTER LIGHTING PLAN – UPPER FLOOR

SCALE: 1/4" = 1'-0"

SCALE: 1/4" = 1'-0"

48" 24" 0 2' 4' 6' 8' 10' 12'

RECORD DRAWINGS

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DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.

KEYED NOTES:

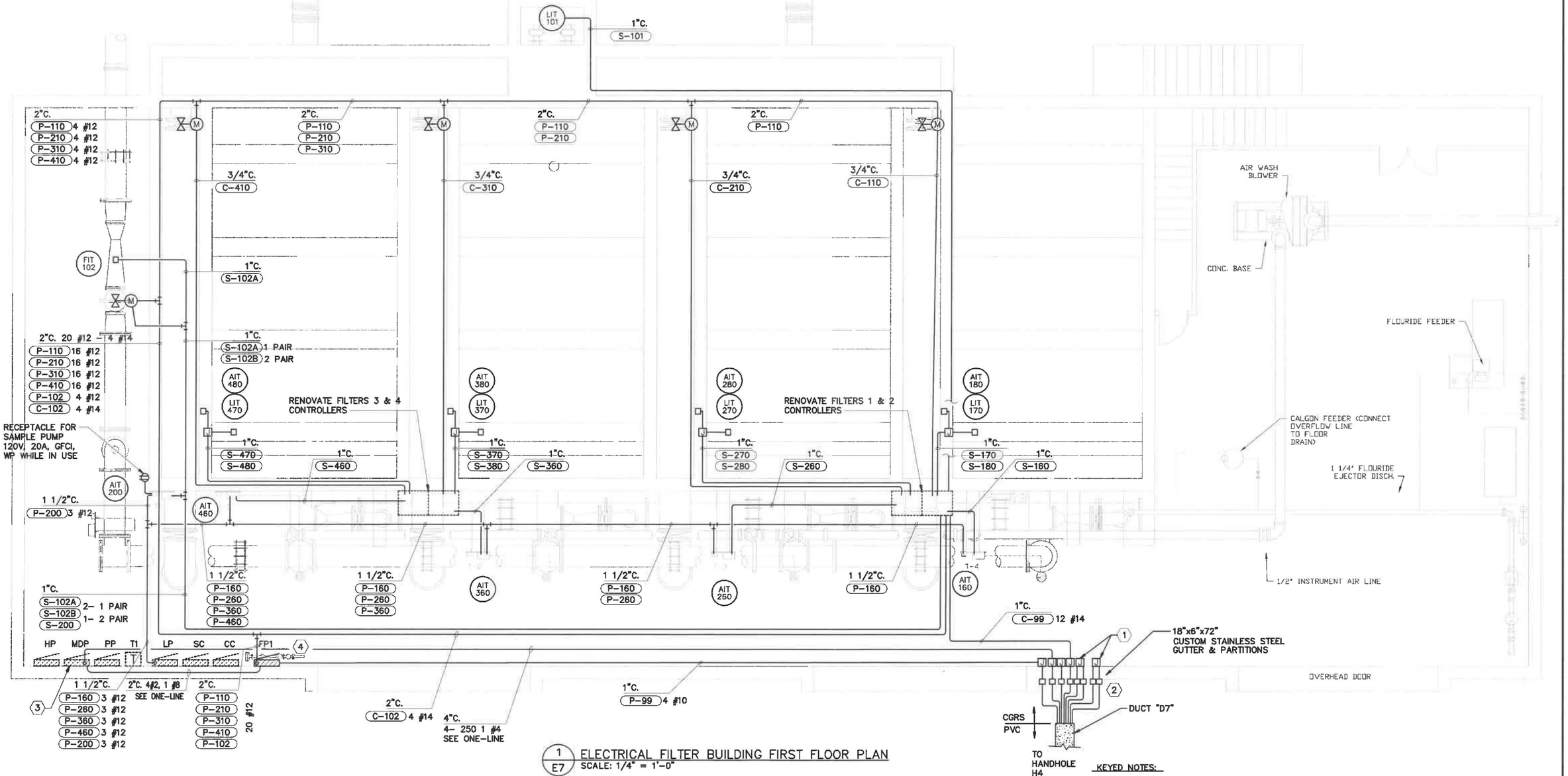
1. REMOVE, STORE, AND RELOCATE 100W MERCURY LAMP, WALL PACK FIXTURES. CLEAN LENS. INSTALL NEW LAMPS. MATCH PREVIOUS MOUNTING HEIGHT. RECONNECT AND REINSTALL. (TYPICAL)
2. INSTALL PHOTO ELECTRIC CELL 120V/15A CONTACTS: ON SET 35 FT-CD, OFF AT 58 FT-CD. PROVIDE CROUSE-HINDS PEC-4 OR EQUAL. ORIENT NORTH ABOVE ROOFLINE.
3. REMOVE EXISTING 3-WAY SWITCH. INSTALL NEW SINGLE POLE LIGHT SWITCH AND COVER. INSTALL NEW CONDUIT AND WIRING TO NEW LIGHT FIXTURES.
4. APPROXIMATE LOCATION ON BASEMENT FLOOR OF EXISTING PANEL "LP", GE NLAB TYPE. INSTALL TWO NEW 20A/1P CIRCUIT BREAKERS FOR CIRCUITS "LP-32" AND "LP-34". INSTALL CIRCUITS USING (3#10) 3/4"C FOR EACH BRANCH CIRCUIT.
5. CORE DRILL FLOOR AND WALLS FOR NEW LIGHTING CIRCUITS USING (3#10) 3/4"C. COORDINATE ALL LOCATIONS WITH OWNER PRIOR TO WORK. SEAL ALL WALL AND FLOOR PENETRATIONS WATERTIGHT.
7. INSTALL FIXTURE WITH EMERGENCY BATTERY (NI-CD) PACKS WITH SELF DIAGONISTIC FUNCTIONS.

Holloway, Updike and Bellen, Inc. 810 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7881	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS	SCALE:	AS SHOWN	ELECTRICAL FILTER LIGHTINGPLAN	Detail: CAG	Date: OCT. 2000
	SHAWNEE, OKLAHOMA		Ver N/A	Project No. 965033	Check: ECF	Sheet No. E6

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Images: [none]
Xrefs: P:_standards\projdev\stamps\ ECF_OK [ref\ SWT_TBX]

GENERAL NOTES

1. REPLACE ALL LOSS OF HEAD TRANSMITTERS AND FILTER EFFLUENT FLOW INDICATING TRANSMITTERS AND BACKWASH FLOW INDICATING TRANSMITTER.
2. JUNCTION BOXES WITHIN THE FILTER BUILDING SHALL BE NEMA 3R ENCLOSURES.
3. CONDUITS WITHIN THE FILTER BUILDING SHALL BE GRSC.



1 / E7 ELECTRICAL FILTER BUILDING FIRST FLOOR PLAN
SCALE: 1/4" = 1'-0"

SCALE: 1/4" = 1'-0"
48" 24" 0 2' 4' 6' 8' 10' 12'

CABLE NOTE:
REFER TO CABLE SCHEDULE ON SHEET E8.

RECORD DRAWINGS

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DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.

KEYED NOTES:

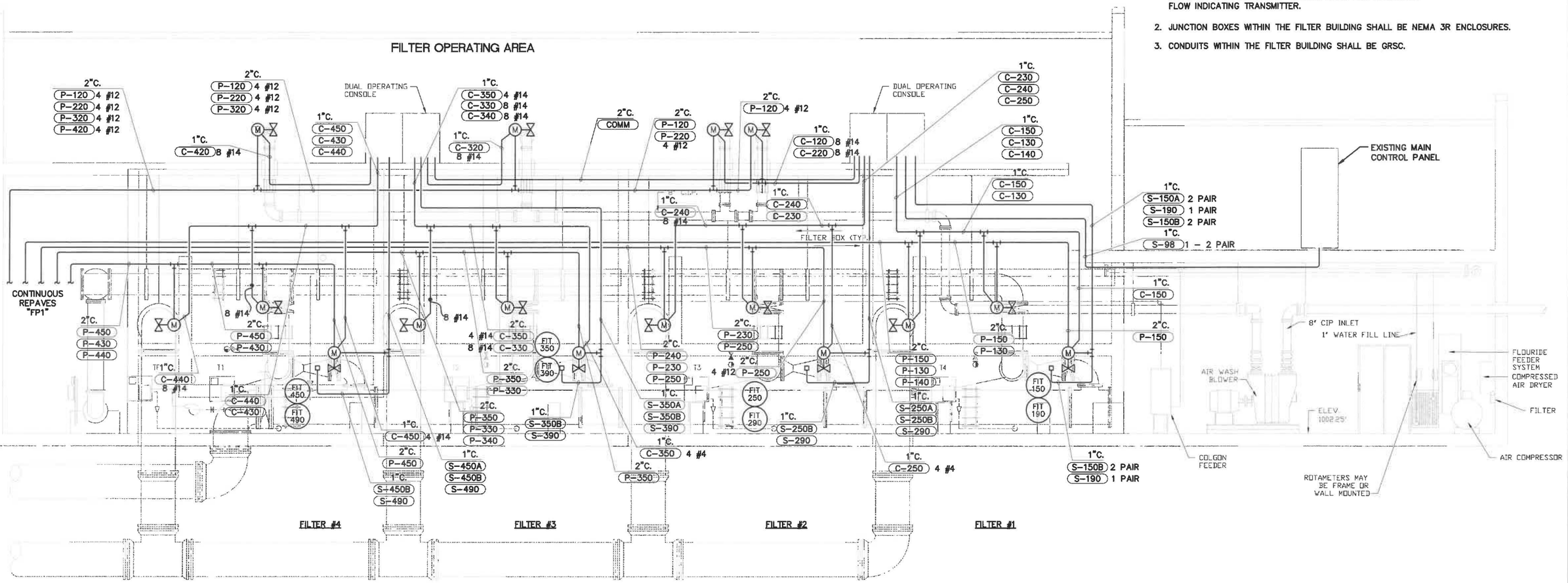
1. CONTROL AND SIGNAL JUNCTION BOXES, NEMA 3R, HINGED DOOR ENCLOSURES, 12"X12"X6", 5'6" A.F.F.
2. CORE DRILL AND PENERATE WALL 12" A.F.G. SEAL WATERTIGHT. SIMILAR REQUIREMENTS TO DETAIL 3 ON SHEET E4.
3. REFER TO ONE-LINE DIAGRAM FOR DETAILS.
4. INSTALL NEW POWER PANEL "FP1".

Holloway, Updike and Bellen, Inc. 616 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS	SCALE:	AS SHOWN	ELECTRICAL FILTER BUILDING FIRST FLOOR PLAN	Detail: CAG	Date: OCT. 2000
	SHAWNEE, OKLAHOMA		Ver N/A	Project No. 965033	Check: ECF	Sheet No. E7

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Images: [none]
Xrefs: P:\standards\rnodev\stamps\ ECF_OK [ref] SWT_TBX

GENERAL NOTES

1. REPLACE ALL LOSS OF HEAD TRANSMITTERS AND FILTER EFFLUENT FLOW INDICATING TRANSMITTERS AND BACKWASH FLOW INDICATING TRANSMITTER.
2. JUNCTION BOXES WITHIN THE FILTER BUILDING SHALL BE NEMA 3R ENCLOSURES.
3. CONDUITS WITHIN THE FILTER BUILDING SHALL BE GRSC.



1 / E8 ELECTRICAL FILTER BUILDING SECTION
SCALE: 1/4" = 1'-0"

SCALE: 1/4" = 1'-0"
48" 24" 0 2' 4' 6' 8' 10' 12'

CABLE SCHEDULE

TAG	CONTENT	TAG	CONTENT	TAG	CONTENT
S-101	(1ISP16)	C-110	(8#14)	P-110	(3#12 + 1#12EG)
S-170	(1ISP16)	C-210	(8#14)	P-210	(3#12 + 1#12EG)
S-270	(1ISP16)	C-310	(8#14)	P-310	(3#12 + 1#12EG)
S-370	(1ISP16)	C-410	(8#14)	P-410	(3#12 + 1#12EG)
S-470	(1ISP16)	C-102	(4#14)	P-102	(3#12 + 1#12EG)
S-180	(1ISP16)	C-150	(4#14)	P-200	(3#12)
S-280	(1ISP16)	C-130	(8#14)	P-160	(3#12)
S-380	(1ISP16)	C-140	(8#14)	P-260	(3#12)
S-480	(1ISP16)	C-250	(4#14)	P-360	(3#12)
S-102A	(1ISP16)	C-230	(8#14)	P-460	(3#12)
S-102B	(2ISP16)	C-240	(8#14)	P-150	(3#12 + 1#12EG)
S-200	(1ISP16)	C-350	(4#14)	P-130	(3#12 + 1#12EG)
S-460	(1ISP16)	C-330	(8#14)	P-140	(3#12 + 1#12EG)
S-360	(1ISP16)	C-340	(8#14)	P-250	(3#12 + 1#12EG)
S-260	(1ISP16)	C-450	(4#14)	P-230	(3#12 + 1#12EG)
S-160	(1ISP16)	C-430	(8#14)	P-240	(3#12 + 1#12EG)
S-150A	(2ISP16)	C-440	(8#14)	P-330	(3#12 + 1#12EG)
S-250A	(2ISP16)	C-120	(8#14)	P-340	(3#12 + 1#12EG)
S-350A	(2ISP16)	C-220	(8#14)	P-350	(3#12 + 1#12EG)
S-450A	(2ISP16)	C-320	(8#14)	P-430	(3#12 + 1#12EG)
S-150B	(2ISP16)	C-420	(8#14)	P-440	(3#12 + 1#12EG)
S-250B	(2ISP16)	C-99	(12#14)	P-450	(3#12 + 1#12EG)
S-350B	(2ISP16)			P-120	(3#12 + 1#12EG)
S-450B	(2ISP16)			P-220	(3#12 + 1#12EG)
S-190	(1ISP16)			P-320	(3#12 + 1#12EG)
S-290	(1ISP16)	COMM	SEE NETWORK	P-420	(3#12 + 1#12EG)
S-390	(1ISP16)		RISER DIAGRAM	P-99	(3#10 + 1#10EG)
S-490	(1ISP16)				
S-98	(2ISP16)				

RECORD DRAWINGS

THESE PLANS RECORD THE ACTUAL CONSTRUCTION CONDITIONS OF THE PROJECT INCLUDING VARIATIONS FROM THE ORIGINAL CONTRACT DOCUMENTS IN ACCORDANCE WITH INFORMATION AVAILABLE TO THE ENGINEER

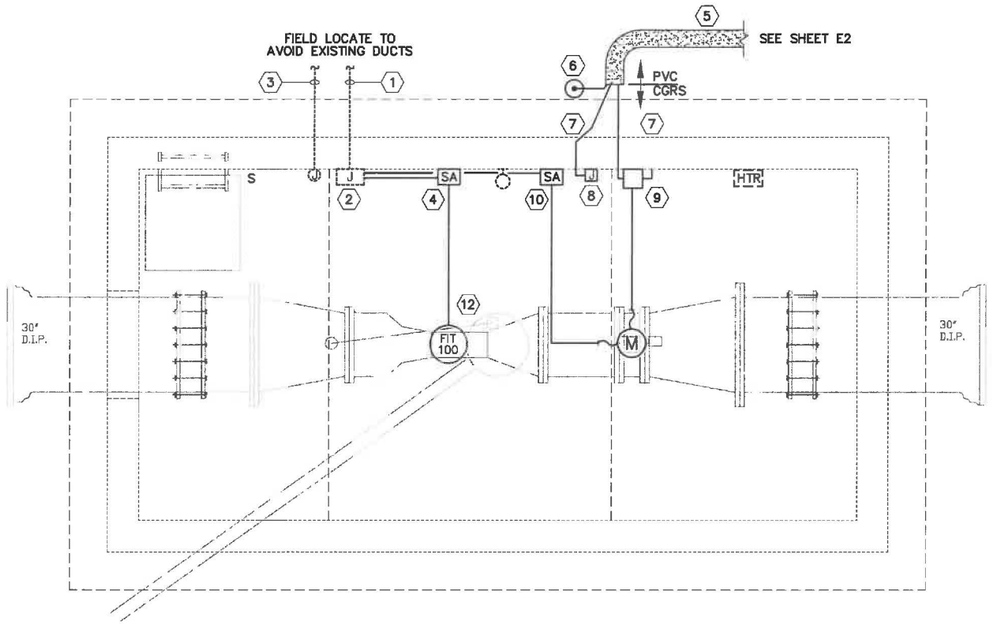
DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN, INC.

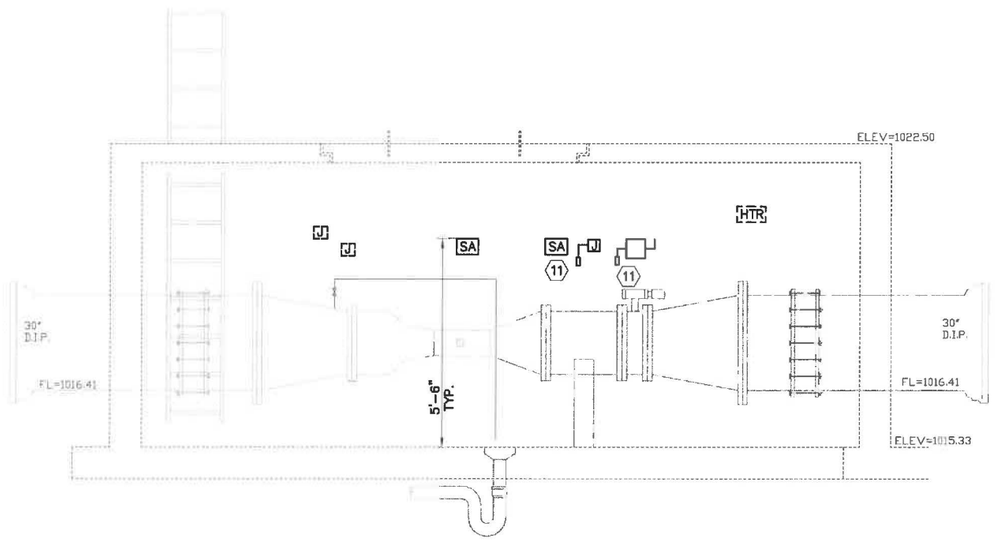
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Holloway, Updike and Bellen, Inc.
818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7881

SHAWNEE WATER TREATMENT PLANT INPROVEMENTS	SCALE:	AS SHOWN	ELECTRICAL FILTER BUILDING SECTION	Detail: CAG	Date: OCT. 2000
SHAWNEE, OKLAHOMA		Ver N/A	Project No. 965033	Check: ECF	Sheet No. E8



1/E9 ELECTRICAL INFLUENT VALVE BOX PLAN
SCALE: 1/2"=1'-0"



2/E9 ELECTRICAL INFLUENT VALVE BOX SECTION
SCALE: 1/2"=1'-0"

KEYED NOTES:

1. EXISTING 4 PAIR SIGNAL CABLES IN 3/4" CONDUIT TO SIGNAL CABINET IN PUMP BUILDING, CONSISTING OF:
   - 1 PAIR – OUTPUT FT-9 TO FX-9 IN CONTROL ROOM INSTRUMENT PANEL – INFLUENT FLOW 4-20 mA
   - 1 PAIR – OUTPUT FIC-9 TO ZC-9 ON INFLUENT VALVE – CONTROL FOR DOUBLE ACTING AIR CYLINDER VALVE POSITIONER 4-20 mA
   - 2 PAIR – SPARES
2. EXISTING SIGNAL CABINET.
3. EXISTING CIRCUIT "LP-15" FOR HEATER AND LIGHT IN INFLUENT VALVE BOX, IN 3/4" CONDUIT TO PANEL LP IN PUMP BUILDING.
4. INSTALL NEMA 4 SIGNAL LINE SURGE ARRESTER FOR 4-20 mA INFLUENT FLOW TRANSMITTER. INSTALL (1SP16) 3/4"CGRSC FROM FT-9 TO EXISTING SIGNAL CABINET. MAKE ALL FINAL CONNECTIONS. MOUNT TO WALL USING STAINLESS STEEL UNISTRUT AND STAINLESS STEEL MOUNTING HARDWARE.
5. INSTALL ELECTRICAL DUCT D4 TO HANDHOLE H2.
6. INSTALL 3/4"x10'-0" ELECTRICAL DUCT BANK GROUND ROD AT END OF DUCT AND CONNECT COUNTERPOISE USING EXOTHERMIC WELDS.
7. CORE DRILL WALL FOR CONDUITS, SEAL WALL PENETRATIONS WATERTIGHT WITH GROUT.
8. INSTALL NEMA 4X STAINLESS STEEL JUNCTION BOXES, SIZED PER NEC, WITH CGRS CONDUIT. MOUNT TO WALL USING STAINLESS STEEL UNISTRUT AND STAINLESS STEEL MOUNTING HARDWARE.
9. INSTALL NEMA 4X STAINLESS STEEL NON-FUSED DISCONNECT SWITCH 30A/3P, WITH CGRS CONDUIT TO EQUIPMENT. MOUNT TO WALL USING STAINLESS STEEL UNISTRUT AND STAINLESS STEEL MOUNTING HARDWARE.
10. INSTALL NEMA 4 SIGNAL LINE SURGE ARRESTER FOR 4-20 mA MODULATING SIGNAL TO ELECTRIC ACTUATOR. INSTALL (1SP16) 3/4"CGRSC FROM ACTUATOR TO EXISTING SIGNAL CABINET. MAKE ALL FINAL CONNECTIONS. MOUNT TO WALL USING STAINLESS STEEL UNISTRUT AND STAINLESS STEEL MOUNTING HARDWARE.
11. INSTALL DRAIN FITTING WITH COVER AT CONDUIT ENTRANCE. ROUTE CONDUIT UP AND OVER TO EQUIPMENT.
12. INSTALL NEW FLOW INDICATING TRANSMITTER WITH 3-VALVE MANIFOLD. SEE SPECIFICATIONS.

RECORD DRAWINGS

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DATE MARCH 2002

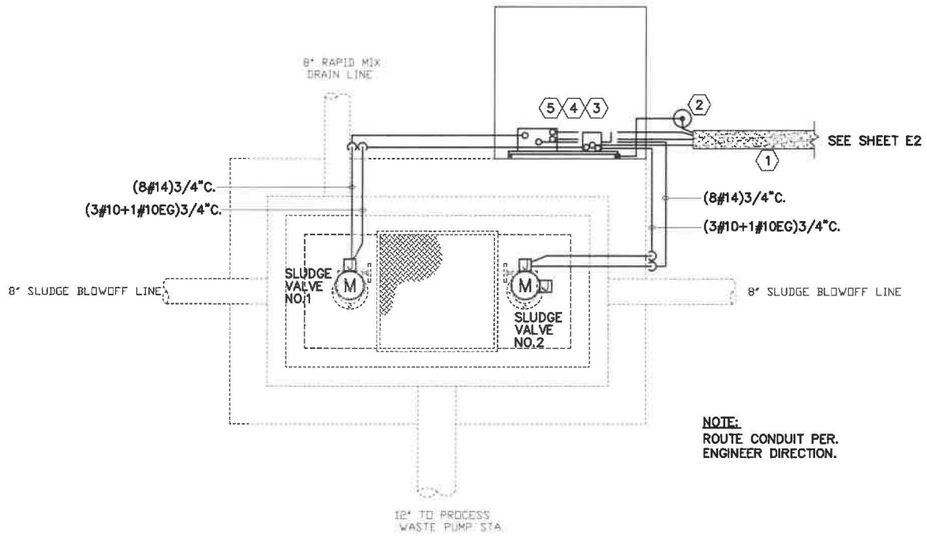
HOLLOWAY, UPDIKE + BELLEN,INC.

SCALE: 1/2" = 1'-0"

24" 12" 0 1' 2' 3' 4' 5' 6'

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Holloway, Updike and Bellen, Inc. 815 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-3611	SHAWNEE WATER TREATMENT PLANT IMPROVEMENTS	SCALE:	AS SHOWN	ELECTRICAL INFLUENT VALVE DETAILS	Detail: CAG	Date: OCT. 2000
	SHAWNEE, OKLAHOMA		Ver N/A	Project No. 965033	Check: ECF	Sheet No. E9



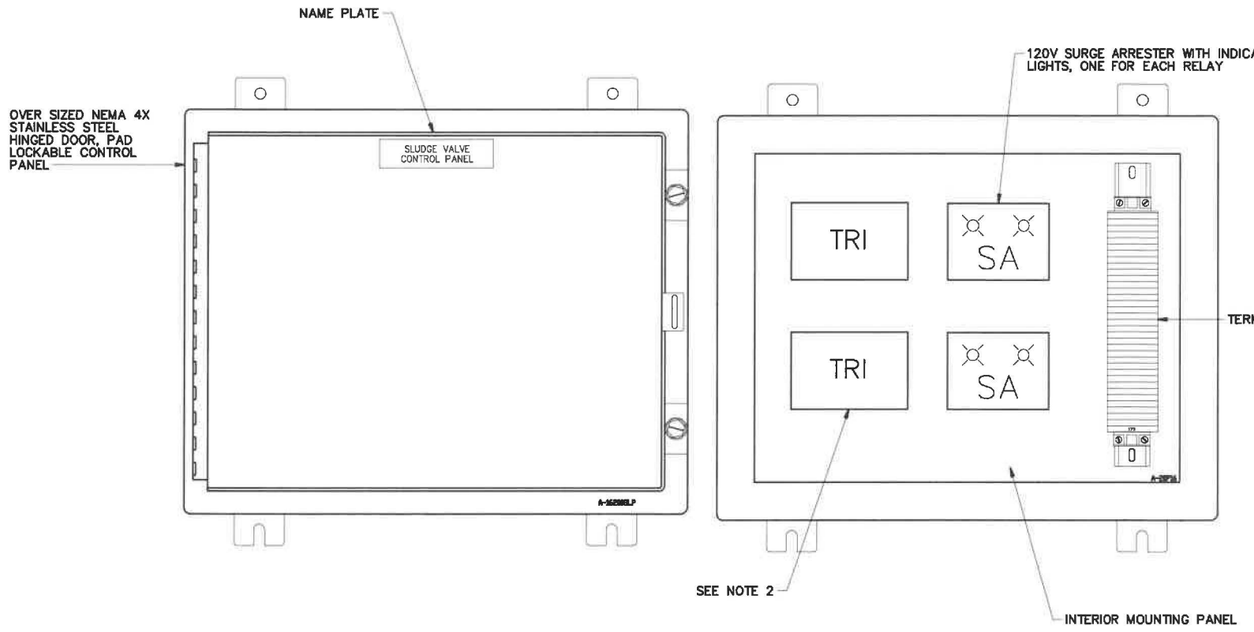
NOTE:
ROUTE CONDUIT PER. ENGINEER DIRECTION.

1 / E10 ELECTRICAL SLUDGE CONTROL BOX PLAN
SCALE: 1/2"=1'-0"

SCALE: 1/2" = 1'-0"
24" 12" 0 1' 2' 3' 4' 5' 6'

KEYED NOTES:

1. INSTALL ELECTRICAL DUCT D2 TO HANDHOLE H1.
2. INSTALL 3/4" x 10'-0" ELECTRICAL DUCT BANK GROUND ROD AT END OF DUCT AND CONNECT TO COUNTERPOISE USING EXOTHERMIC WELD.
3. INSTALL DOUBLE BACKED STAINLESS STEEL ELECTRICAL EQUIPMENT RACK AND 4' x 4' x 6" CONCRETE PAD. BOND RACK TO GROUND ROD USING EXOTHERMIC WELD. 5'-6" TO TOP OF ENCLOSURES. SEE DETAIL 7 ON SHEET E14.
4. INSTALL NEMA 4X STAINLESS STEEL NON-FUSED DISCONNECT SWITCH, 30A/3P WITH CGRS CONDUIT TO EQUIPMENT.
5. INSTALL OVERSIZED NEMA 4X STAINLESS STEEL "SLUDGE VALVE CONTROL PANEL" WITH CGRS CONDUITS TO EQUIPMENT. MAKE ALL FINAL CONNECTIONS.



NOTES:

1. SUBMIT CONTROL PANEL LAYOUT FOR APPROVAL.
2. INSTALL MULTI RANGE, MILTI-FUNCTION TIMING RELAY WITH PIN STYLE TERMINATIONS AND SCREW TERMINAL TUBE BASE SOCKET, ALLEN-BRADLEY TYPE HX, 120V. SET TIMING OF SLUDGE VALVES IN ACCORDANCE WITH ENGINEER/OWNER DIRECTIONS. MAKE ALL FINAL CONNECTIONS TO ELECTRIC OPERATORS. (TYPICAL OF 2)
3. CLEARLY IDENTIFY ALL ITEMS WITHIN CONTROL PANEL. INSTALL IDENTIFICATION TAGS.

2 / E10 SLUDGE VALVE CONTROL PANEL DETAILS
SCALE: NONE

RECORD DRAWINGS

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DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.

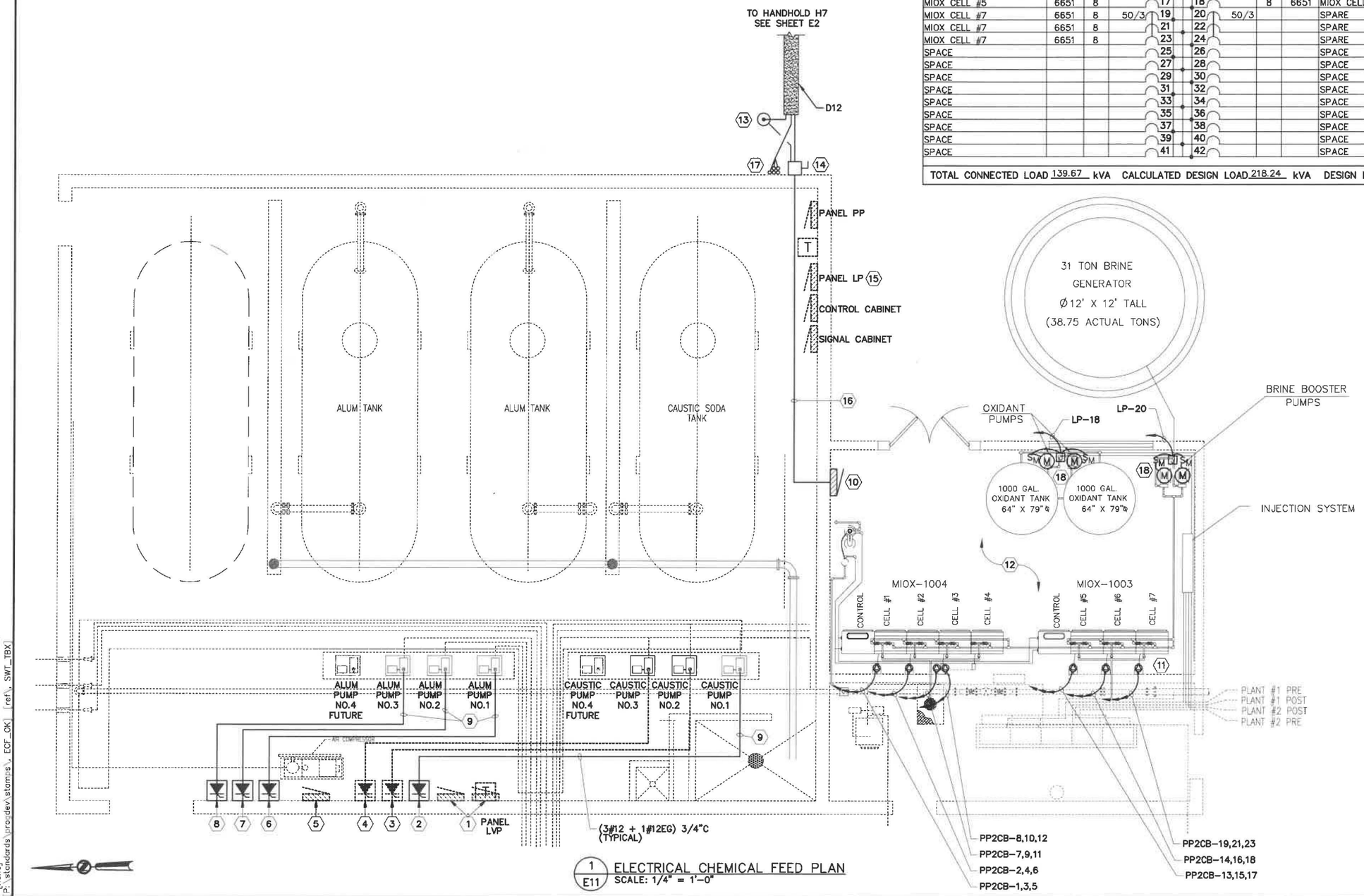
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Holloway, Updike and Bellen, Inc. 515 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-1811	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS	SCALE:	AS SHOWN	ELECTRICAL SLUDGE CONTROL DETAILS	Detail: CAG	Date: OCT. 2000
	SHAWNEE, OKLAHOMA		Ver N/A	Project No. 965033	Check: ECF	Sheet No. E10

PANEL PP2CB LOCATION SOUTH WALL BLDG. CHEMICAL
480/277 VOLTS 3 PHASE 4 WIRE MTG. SURFACE
400 AMP MAIN 250A MCB MIN. INT. CAPACITY 14,000 AIC (U.L. RATING)

DESCRIPTION	LOAD (VA)	WIRE AWG	BREAKER	PHASE A	PHASE B	PHASE C	BREAKER	WIRE AWG	LOAD (VA)	DESCRIPTION
MIOX CELL #1	6651	8	50/3	1	2		50/3	8	6651	MIOX CELL #2
MIOX CELL #1	6651	8		3	4			8	6651	MIOX CELL #2
MIOX CELL #1	6651	8		5	6			8	6651	MIOX CELL #2
MIOX CELL #3	6651	8	50/3	7	8		50/3	8	6651	MIOX CELL #4
MIOX CELL #3	6651	8		9	10			8	6651	MIOX CELL #4
MIOX CELL #3	6651	8		11	12			8	6651	MIOX CELL #4
MIOX CELL #5	6651	8	50/3	13	14		50/3	8	6651	MIOX CELL #6
MIOX CELL #5	6651	8		15	16			8	6651	MIOX CELL #6
MIOX CELL #5	6651	8		17	18			8	6651	MIOX CELL #6
MIOX CELL #7	6651	8	50/3	19	20		50/3			SPARE
MIOX CELL #7	6651	8		21	22					SPARE
MIOX CELL #7	6651	8		23	24					SPARE
SPACE				25	26					SPACE
SPACE				27	28					SPACE
SPACE				29	30					SPACE
SPACE				31	32					SPACE
SPACE				33	34					SPACE
SPACE				35	36					SPACE
SPACE				37	38					SPACE
SPACE				39	40					SPACE
SPACE				41	42					SPACE

TOTAL CONNECTED LOAD 139.67 kVA CALCULATED DESIGN LOAD 218.24 kVA DESIGN LOAD 262.50 A



1/E11 ELECTRICAL CHEMICAL FEED PLAN
SCALE: 1/4" = 1'-0"

KEYED NOTES:

1. EXISTING PANEL "LVP" 120/240V, 3ø, 4W AND 120V SUBPANEL
2. EXISTING CAUSTIC PUMP NO.1 VFD. REPLACE UNIT WITH NEW VFD CONTROLLER, EXTEND AND RECONNECT EXISTING 240V, 3ø POWER AND CONTROL CIRCUITS.
3. RECENTLY REPLACED CAUSTIC PUMP NO.2 VFD TO REMAIN.
4. RECENTLY REPLACED CAUSTIC PUMP NO.3 VFD TO REMAIN.
5. EXISTING CHEMICAL FEED PUMP CONTROL PANEL, MAKE ALL FINAL CONNECTIONS.
6. EXISTING ALUM PUMP NO.1 VFD. REPLACE UNIT WITH NEW VFD CONTROLLER, EXTEND AND RECONNECT 240V, 3ø POWER AND CONTROL CIRCUITS.
7. EXISTING ALUM PUMP NO.2 VFD. REPLACE UNIT WITH NEW VFD CONTROLLER, EXTEND AND RECONNECT 240V, 3ø POWER AND CONTROL CIRCUITS.
8. EXISTING ALUM PUMP NO.3 VFD. REPLACE UNIT WITH NEW VFD CONTROLLER, EXTEND AND RECONNECT 240V, 3ø POWER AND CONTROL CIRCUITS.
9. INSTALL (3#12+1#12EG) 3/4" GRSC (TYPICAL)
10. INSTALL NEW POWER PANEL "PP2CB".
11. INSTALL DEDICATED TWIST LOCK RECEPTACLE (TYPICAL OF 7).
12. RELOCATE EXISTING MECHANICAL EQUIPMENT, LIGHTS AND RECEPTACLES TO ACCESSIBLE AREAS THAT DO NOT CONFLICT WITH NEW WORK. RELOCATE EXISTING DUPLEX RECEPTACLES ON WEST WALL TO NORTH AND SOUTH WALLS AS DIRECTED BY ENGINEER.
13. INSTALL 3/4" x 10'-0" COPPERCLAD GROUND ROD. CONNECT #2 GROUNDING CONDUCTOR AND #4/0 COUNTERPOISE USING EXOTHERMIC WELDS.
14. INSTALL NEMA 4X STAINLESS STEEL, 400A/3P, NON-FUSED DISCONNECT SWITCH.
15. INSTALL TWO 20A/1P BREAKERS FOR OXIDENT AND BRINE BOOSTER PUMPS. MAKE ALL FINAL CONNECTIONS.
16. INSTALL (4#250 + 1#4) 4"C
17. STUB UP SPARES 12" A.F.G. AND CAP WATERTIGHT.
18. ELECTRICAL EQUIPMENT MOUNTED 48" A.F.F.

LEGEND

TWIST LOCK NEMA CS 81-65C GROUNDING TYPE RECEPTACLE MOUNTED 32" A.F.F.

GENERAL NOTES:

1. SECURE ALL NEW AND EXISTING CONDUITS TO WALL AND CEILING.
2. MOUNT NEW VFD UNITS 5'6" TO TOP OF ENCLOSURE.
3. INSTALL NEW NAMEPLATES ON NEW AND EXISTING VFD UNITS.
4. COORDINATE ELECTRICAL POWER SUPPLY WITH EQUIPMENT.
5. EXISTING CHLORINATION SYSTEM SHALL REMAIN FULLY FUNCTIONAL UNTIL NEW MIOX SYSTEM IS COMPLETED AND ACCEPTED.

RECORD DRAWINGS

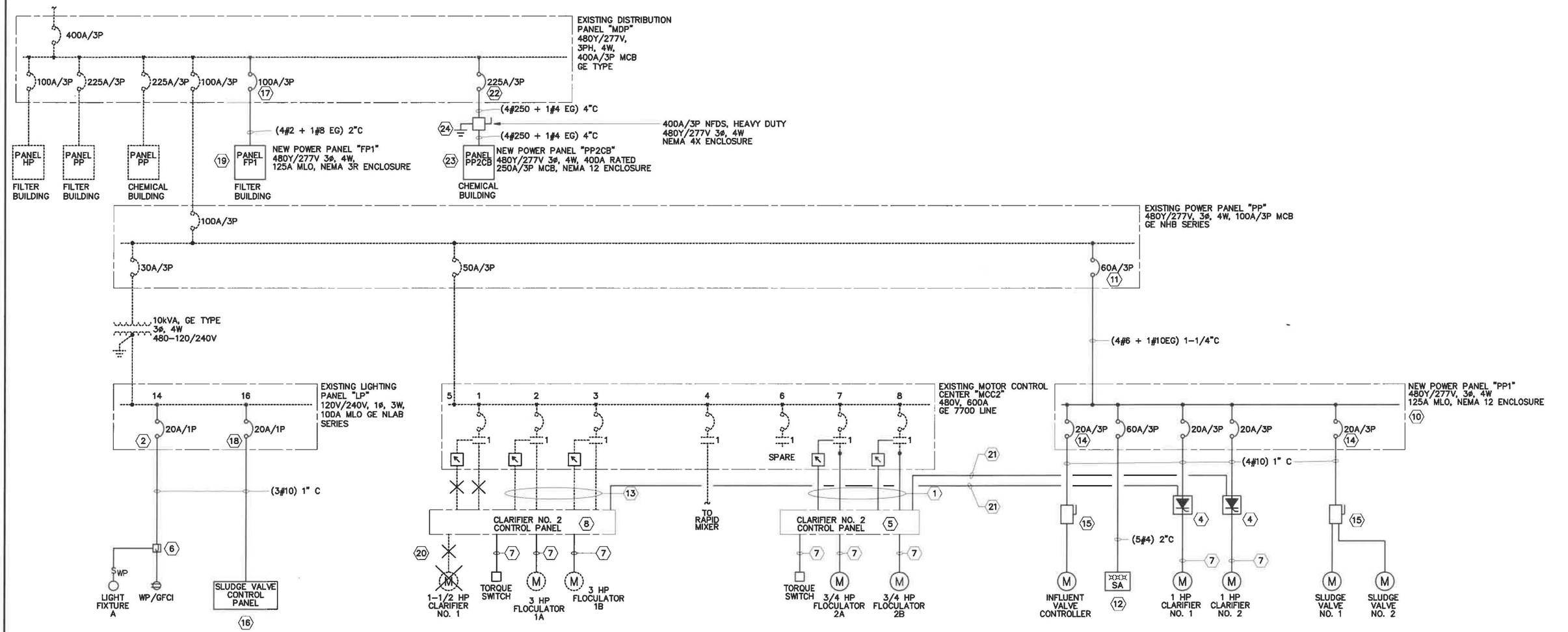
THESE PLANS RECORD THE ACTUAL CONSTRUCTION CONDITIONS OF THE PROJECT INCLUDING VARIATIONS FROM THE ORIGINAL CONTRACT DOCUMENTS IN ACCORDANCE WITH INFORMATION AVAILABLE TO THE ENGINEER

DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN, INC.

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Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-1811	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS SHAWNEE, OKLAHOMA	SCALE:	AS SHOWN Ver N/A	ELECTRICAL CHEMICAL FEED PLAN Project No. 965033	Detail: CAG Check: ECF	Date: OCT. 2000 Sheet No. E11



1 / E12 ELECTRICAL ONE–LINE DIAGRAM
SCALE: NONE

GENERAL NOTES:

COORDINATE ELECTRICAL POWER SUPPLY WITH EQUIPMENT SUPPLIED.

PROVIDE HEAVY-DUTY TYPE, NON–FUSIBLE DISCONNECT SWITCHES (TYPICAL).

THE CONTRACTOR SHALL MAKE ELECTRICAL CONNECTIONS TO EVERYTHING FURNISHED OR INSTALLED BY THIS CONTRACT, WHETHER OR NOT INDICATED ON THE ELECTRICAL DRAWINGS.

INSTALL ALL CONDUCTORS AND CABLES IN CONDUIT UNLESS OTHERWISE NOTED.

ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE CURRENT EDITIONS OF THE NFPA 70 (1999) NATIONAL ELECTRICAL CODE, NFPA 101 (1996) LIFE SAFETY CODE, STATE ELECTRICAL CODE, AND LOCAL ELECTRICAL CODE.

MAINTAIN INTEGRITY OF ALL FIRE RATED WALLS DUE TO CONDUIT WALL PENETRATION.

ALL EXTERIOR EXPOSED CONDUITS SHALL BE PVC COATED GALVANIZED RIGID STEEL.

8. INSTALL AN EQUIPMENT GREEN GROUND WIRE IN ALL BRANCH CIRCUITS.
9. FEEDER AND BRANCH CIRCUIT WIRING SHALL BE A MINIMUM THHN/THWN TYPE.
10. INSTALL TYPED PANEL SCHEDULES WITHIN ALL PANELS.

KEYED NOTES:

(1) FIELD LOCATE AND EXTEND EXISTING 2" CONDUIT STUBOUT FROM "MCC2" IN PUMP BUILDING TO CLARIFIER NO.2 CONTROL PANEL WITH POWER / CONTROL CONDUCTORS.

(2) INSTALL 20A/1P CIRCUIT BREAKER, LABEL AS "CLARIFIER NO. 2 RECEPT/LIGHT".

(3) INSTALL NEMA 4X STAINLESS STEEL JUNCTION BOXES MOUNTED ON EXTERIOR PUMP BUILDING WALL, TYPICAL.

(4) INSTALL CLARIFIER VARIABLE FREQUENCY DRIVE, HAND–OFF–REMOTE, SPEED CONTROL, NEMA 12 ENCLOSURE, FAN VENTILATED, NEMA 12 FILTERS. SEE SPECS FOR DETAILS.

(5) INSTALL NEW CONTROL PANEL WITH NEMA 4X STAINLESS STEEL ENCLOSURE.

(6) INSTALL NEMA 4X STAINLESS STEEL JUNCTION BOXES, TYPICAL.

(7) CGRS CONDUIT WITH FLEXIBLE METAL CONDUIT CONNECTION TO EQUIPMENT (TYPICAL).

(8) REMOVE EXISTING CONTROL PANEL, INSTALL NEW CONTROL PANEL WITH NEMA 4X STAINLESS STEEL ENCLOSURE.

(9) INSTALL ELECTRICAL DUCT D1 TO HANDHOLE H1.

(10) INSTALL NEW POWER PANEL "PP1".

(11) INSTALL 60A/3P CIRCUIT BREAKER WITHIN EXISTING PANEL "PP", LABEL AS "PANEL PP1"

(12) INSTALL SURGE ARRESTER, MAXIMUM FEEDER LENGTH NOT TO EXCEED 18", SEE SPECIFICATIONS.

(13) EXISTING FLOCCULATOR 1A AND 1B POWER AND CONTROL CONDUIT TO REMAIN.

(14) COORDINATE CIRCUIT BREAKER SIZING WITH ELECTRICAL MOTOR OPERATOR MANUFACTURER.

(15) INSTALL NEMA 4X STAINLESS STEEL 30A/3P NON–FUSED DISCONNECT SWITCH.

(16) INSTALL NEMA 4X STAINLESS STEEL SLUDGE VALVE CONTROL PANEL.

(17) INSTALL 100A/3P CIRCUIT BREAKER, LABEL AS "PANEL FP1".

(18) INSTALL 20A/1P CIRCUIT BREAKER, LABEL AS "SLUDGE VALVE CONTROL PANEL".

(19) INSTALL NEW POWER PANEL "FP1".

(20) REMOVE EXISTING POWER/CONTROL WIRING FROM CLARIFIER NO.1.

(21) INSTALL NEW CONTROLS FROM VFD TO CONTROL PANEL IN FIELD.

(22) INSTALL 225A/3P CIRCUIT BREAKER, LABEL AS "PANEL PP2CB".

(23) INSTALL NEW POWER PANEL "PP2CB".

(24) INSTALL NEMA 4X STAINLESS STEEL, 400A/3P, NON–FUSED DISCONNECT SWITCH AND CONNECT GROUND BUS TO GROUND USING (1#2) 3/4"C.

RECORD DRAWINGS

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DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.

Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD - MUSKOGEE, OKLAHOMA - 918/682-1811	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS SHAWNEE, OKLAHOMA	SCALE:	AS SHOWN Ver N/A	ELECTRICAL ONE-LINE DIAGRAM Project No. 965033	Detail: CAG Check: ECF	Date: OCT. 2000 Sheet No. E12

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MOTOR CONTROL CENTER MCC2

EXISTING

480 VOLTS 3ø 3 W 600A MAIN MLO MINIMUM RATING 30,000 AIC RMS SYM.

	CIRCUIT NUMBER	SERVES	HP/kVA	NEC AMPS	NEMA STARTER	OVERCURRENT FUSE	OVERCURRENT POLE	OVERCURRENT RATING	WIRE SIZE PHASE	WIRE SIZE NEUTRAL	WIRE SIZE GROUND	RACEWAY TYPE
(2)	1	SPARE				3	3	20				
	2	FLOCCULATOR NO. 1A	3	4.80	1	7	3	20	12		12	3/4" C
	3	FLOCCULATOR NO. 1B	3	4.80	1	7	3	20	12		12	3/4" C
	4	RAPID MIXER	3	4.80	1	7	3	20	12		12	3/4" C
	5	INCOMING LUGS										
	6	SPARE				3	3	20				
(3)	7	FLOCCULATOR NO. 2A	0.8	1.40	1	3	3	20	12		12	3/4" C
(3)	8	FLOCCULATOR NO. 2B	0.8	1.40	1	3	3	20	12		12	3/4" C
	9	SPACE										
	10	SPACE										

TOTAL CONNECTED LOAD 14.30 kVA CALCULATED DESIGN LOAD 22.34 kVA DESIGN LOAD 26.88 A

NEMA 12 ENCLOSURE

NEW

PANEL PP1 LOCATION NORTH WALL BLDG. PUMP BUILDING
480/277 VOLTS 3 PHASE 4 WIRE MTG. SURFACE
125 AMP MAIN MLO MIN. INT. CAPACITY 14,000 AIC (U.L. RATING)

DESCRIPTION	LOAD (VA)	WIRE AWG	BREAKER	PHASE A	PHASE B	PHASE C	BREAKER	WIRE AWG	LOAD (VA)	DESCRIPTION
INFLUENT VALVE	277	10	20/3	1	2		60/3	4	0	SURGE ARRESTER
INFLUENT VALVE	277	10		3	4			4	0	SURGE ARRESTER
INFLUENT VALVE	277	10		5	6			4	0	SURGE ARRESTER
CLARIFIER NO. 1 VFD	499	10	20/3	7	8		20/3	10	277	SLUDGE VALVES
CLARIFIER NO. 1 VFD	499	10		9	10			10	277	SLUDGE VALVES
CLARIFIER NO. 1 VFD	499	10		11	12			10	277	SLUDGE VALVES
CLARIFIER NO. 2 VFD	499	10	20/3	13	14					SPACE
CLARIFIER NO. 2 VFD	499	10		15	16					SPACE
CLARIFIER NO. 2 VFD	499	10		17	18					SPACE
				19	20					

TOTAL CONNECTED LOAD 4.66 kVA CALCULATED DESIGN LOAD 7.28 kVA DESIGN LOAD 8.75 A

NEMA 3R ENCLOSURE

NEW

PANEL FP1 LOCATION EAST WALL BLDG. FILTER BLDG
480/277 VOLTS 3 PHASE 4 WIRE MTG. SURFACE
125 AMP MAIN MLO MIN. INT. CAPACITY 14,000 AIC (U.L. RATING)

DESCRIPTION	LOAD (VA)	WIRE AWG	BREAKER	PHASE A	PHASE B	PHASE C	BREAKER	WIRE AWG	LOAD (VA)	DESCRIPTION
FILTER 1 VALVES	277	10	20/3	1	2		20/3	10	277	FILTER 2 VALVES
FILTER 1 VALVES	277	10		3	4			10	277	FILTER 2 VALVES
FILTER 1 VALVES	277	10		5	6			10	277	FILTER 2 VALVES
FILTER 3 VALVES	277	10	20/3	7	8		20/3	10	277	FILTER 4 VALVES
FILTER 3 VALVES	277	10		9	10			10	277	FILTER 4 VALVES
FILTER 3 VALVES	277	10		11	12			10	277	FILTER 4 VALVES
SPARE			20/3	13	14		20/3	10	277	BACKWASH FILL VALVE
SPARE				15	16			10	277	BACKWASH FILL VALVE
SPARE				17	18			10	277	BACKWASH FILL VALVE
				19	20					

TOTAL CONNECTED LOAD 4.16 kVA CALCULATED DESIGN LOAD 6.50 kVA DESIGN LOAD 7.81 A

EXISTING

PANEL PP LOCATION WEST WALL BLDG. PUMP BUILDING
480/277 VOLTS 3 PHASE 4 WIRE MTG. SURFACE
100 AMP MAIN 100A MCB MIN. INT. CAPACITY 14,000 AIC (U.L. RATING)

DESCRIPTION	LOAD (VA)	WIRE AWG	BREAKER	PHASE A	PHASE B	PHASE C	BREAKER	WIRE AWG	LOAD (VA)	DESCRIPTION	
UNIT HEATER NO. 1	2500	12	20/3	1	2		20/3	12	2500	UNIT HEATER NO. 2	
UNIT HEATER NO. 1	2500	12		3	4			12	2500	UNIT HEATER NO. 2	
UNIT HEATER NO. 1	2500	12		5	6			12	2500	UNIT HEATER NO. 2	
UNIT HEATER NO. 3	2500	12	20/3	7	8		20/3	12	2500	UNIT HEATER NO. 4	
UNIT HEATER NO. 3	2500	12		9	10			12	2500	UNIT HEATER NO. 4	
UNIT HEATER NO. 3	2500	12		11	12			12	2500	UNIT HEATER NO. 4	
EXHAUST FAN NO. 1	388	12	20/3	13	14		20/3	12	388	EXHAUST FAN NO. 2	
EXHAUST FAN NO. 1	388	12		15	16			12	388	EXHAUST FAN NO. 2	
EXHAUST FAN NO. 1	388	12		17	18			12	388	EXHAUST FAN NO. 2	
10 KVA XFMR	3333	10	30/3	19	20		20/3	12	1667	OVERHEAD CRANE	
10 KVA XFMR	3333	10		21	22			12	1667	OVERHEAD CRANE	
10 KVA XFMR	3333	10		23	24			12	1667	OVERHEAD CRANE	
MCC "MCC2"	4767	4	50/3	25	26		60/3	6	1552	LP "PP1"	(1)
MCC "MCC2"	4767	4		27	28			6	1552	LP "PP1"	
MCC "MCC2"	4767	4		29	30			6	1552	LP "PP1"	

TOTAL CONNECTED LOAD 66.28 kVA CALCULATED DESIGN LOAD 100.76 kVA DESIGN LOAD 121.19 A

EXISTING

PANEL LP LOCATION WEST WALL BLDG. PUMP BUILDING
240/120 VOLTS 1 PHASE 3 WIRE MTG. SURFACE
100 AMP MAIN MLO MIN. INT. CAPACITY 10,000 AIC (U.L. RATING)

DESCRIPTION	LOAD (VA)	WIRE AWG	BREAKER	PHASE ø	PHASE ø	BREAKER	WIRE AWG	LOAD (VA)	DESCRIPTION	
LIGHTING	500	12	20/1	1	2	20/1	12	500	LIGHTING	
LIGHTING	500	12	20/1	3	4	20/1	12	500	RECEPTACLES	
RECEPTACLES	500	12	20/1	5	6	20/1	12	500	BATTERY CHARGER	
DAY TANK	300	12	20/1	7	8	20/1	12	300	COMBUSTION DAMPER	
VENTILATING FAN	696	12	20/1	9	10	20/2	12	500	EXTERIOR LIGHTING	
ROF VAULT	500	12	20/1	11	12		12	500	EXTERIOR LIGHTING	
SPARE			20/1	13	14	20/1	10	180	CLARIFIER 2 RECP/LGT	(1)
SPACE				15	16	20/1	10	300	SLUDGE VALVES CP	(1)
SPACE				17	18				SPACE	
				19	20					

TOTAL CONNECTED LOAD 6.28 kVA CALCULATED DESIGN LOAD 9.49 kVA DESIGN LOAD 39.56 A

LIGHT FIXTURE SCHEDULE

TYPE	DESCRIPTION	MANUFACTURER & CATALOG NUMBER	VOLTAGE	LAMPS	MOUNTING	NOTES
A	AREA LIGHTING FIXTURE POST MOUNT LUMINAIRE HIGH PRESSURE SODIUM	GE P17M-15-S-1-1-L-MS5-GR-U	120	(1)-150W HIGH PRESSURE SODIUM	ROUND STEEL NON-TAPERED 10' POLE, LIGHT SWITCH	L3, L6, L7
B	WET LOCATION, INDUSTRIAL FLUORESCENT, TANDEM IMPACT RESISTANT, 8' LONG	LITHONIA TDMW-432RS-AR-120-CW-GEB10-(EL)	120	(4)-F32T8/SP35/RS 3500K	CEILING	L1, L2, L3, L4, L5, L10
X1 ⊗	LED EXIT SIGN	SURE-LITES CCX-7(0,1,2)-70-RWH-SD	120/277	LED LAMPS FURNISHED	UNIVERAL CANOPY	L4, L9

LIGHT FIXTURE NOTES:

- L1 PROVIDE FIXTURE WITH PENDANT STEMS OF LENGTH TO ACCOMPLISH INDICATED MOUNTING HEIGHT.
- L2 PROVIDE FIXTURE WITH TRIM, ACCESSORIES, AND MODIFICATIONS TO ACCOMPLISH CONTINUOUS ROW MOUNTING AS INDICATED.
- L3 PROVIDE FIXTURE LISTED AND LABELED FOR WET LOCATION.
- L4 PROVIDE FIXTURE WITH LATEST, COLD WEATHER, < 10% THD ELECTRONIC BALLAST.
- L5 PROVIDE FIXTURE WITH INTEGRAL FLUORESCENT LAMP EMERGENCY BATTERY UNIT, 1400 LUMENS, 90 MINUTE EMERGENCY OPERATION REQUIRED WHERE SHOWN ON PLANS.
- L6 PROVIDE POLE WITH HANDHOLE, 18" A.F.F.
- L7 PROVIDE POLE WITH WEATHERPROOF LIGHT SWITCH FOR LIGHT FIXTURE CONTROL, 48" A.F.G.
- L8 PROVIDE FIXTURE WITH UNIVERSAL MOUNTING HARDWARE, INSTALL FIXTURE FOR WALL OR CEILING MOUNTING. PROVIDE FIXTURE WITH SINGLE OR DOUBLE FACE AS INDICATED. PROVIDE ARROWS IF AND AS SHOWN.
- L9 90 MINUTE EMERGENCY OPERATION REQUIRED.
- L10 PROVIDE FIXTURE WITH ENVIRONMENTALLY SAFE FLUORESCENT LAMPS, I.E. GREEN TIPS, PHILIPS ALTO SERIES.

KEYED NOTES:

(1) INSTALL NEW BRANCH CIRCUIT AND BREAKER.

(2) REMOVE EXISTING BRANCH CIRCUIT. UNIT SHALL BE LABLED SPARE.

(3) INSTALL NEW BRANCH CIRCUIT. MAKE ALL POWER AND CONTROL MODIFICATIONS.

GENERAL NOTE:

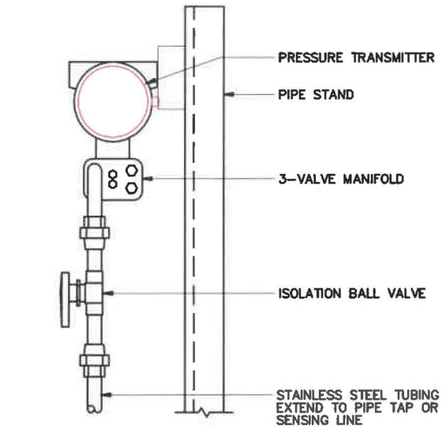
FOR MODIFICATIONS TO EXISTING PANELBOARDS, UTILIZE MATCHING CIRCUIT BREAKERS.

RECORD DRAWINGS

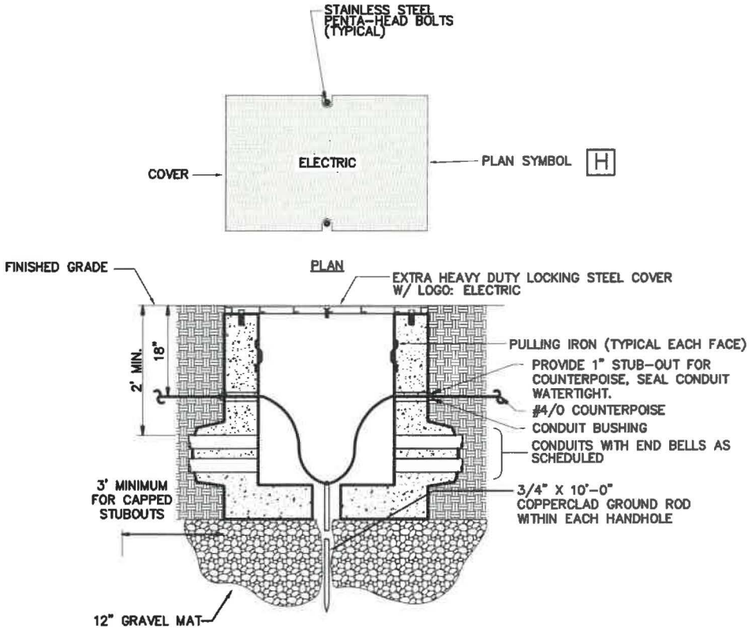
THESE PLANS RECORD THE ACTUAL CONSTRUCTION CONDITIONS OF THE PROJECT INCLUDING VARIATIONS FROM THE ORIGINAL CONTRACT DOCUMENTS IN ACCORDANCE WITH INFORMATION AVAILABLE TO THE ENGINEER

DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.



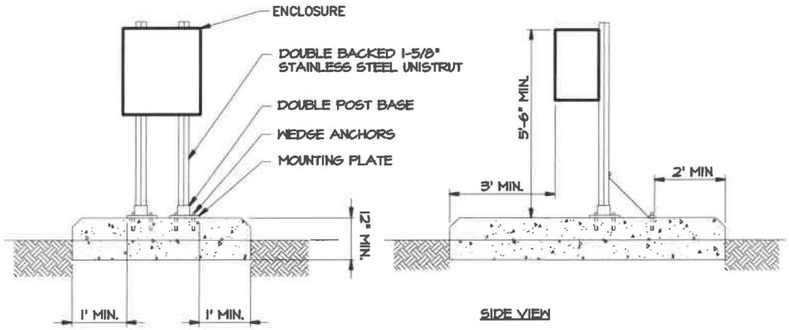
1 / E14 PRESSURE TRANSMITTER INSTALLATION DETAIL
SCALE: NTS



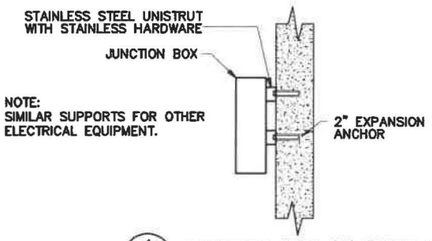
2 / E14 TYPICAL ELECTRIC HANDHOLE DETAIL
SCALE: NONE

HANDHOLE NOTES:

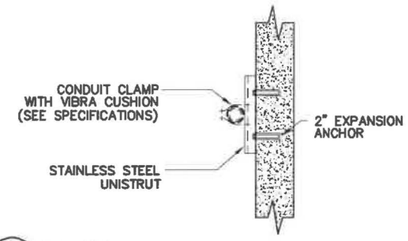
1. HANDHOLE AND EXTRA HEAVY DUTY COVER SHALL BE DESIGNED FOR AN H-20 CONCENTRATED WHEEL LOAD. PROVIDE DALWORTH PRECAST CONCRETE PRODUCTS OR APPROVED EQUAL.
2. PROVIDE MINIMUM 4' SLACK CABLE LOOP FOR EACH CABLE.
3. COLOR CODE, TAG, AND IDENTIFY ALL CABLES IN HANDHOLES.
4. PROVIDE 3' MINIMUM CONDUIT PER CAPPED STUBOUT.
5. SUBMIT LAYOUT OF EACH HANDHOLE FOR APPROVAL BY ENGINEER.
6. CABLE BRACKETS SHALL BE A BRACED CHANNEL STRUT WITH INSULATED CABLE CLAMPS.
7. REINFORCED CONCRETE SHALL BE 4500 PSI.
8. EXCAVATION AND BACKFILL NECESSARY FOR THE CONSTRUCTION OF THE HANDHOLE SHALL BE PERFORMED IN ACCORDANCE WITH THE SPECIFICATIONS.
9. PROVIDE SLEEVES AS INDICATED IN DUCT SCHEDULE FOR EACH HANDHOLE.
10. EXACT LOCATION FOR EACH HANDHOLE SHALL BE APPROVED BY THE ENGINEER/OWNER.
11. SLEEVES AND STUBOUTS SHALL BE CAPPED WATERTIGHT.
12. FOR INTERIOR DIMENSION SIZE SEE SCHEDULE.
13. PROVIDE CONDUIT BUSHINGS AND WATERTIGHT SEALS FOR ALL DIRECT BURIED CABLES AND COUNTERPOISE ENTERING THE HABDHOLE VIA A CONDUIT STUBOUT.



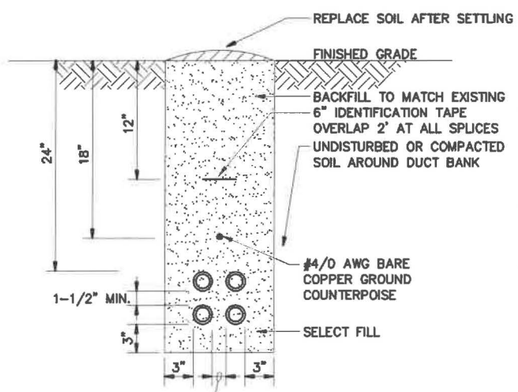
3 / E14 MISC. SUPPORT DETAIL
SCALE: NONE



4 / E14 JUNCTION BOX SUPPORT DETAIL
SCALE: NTS

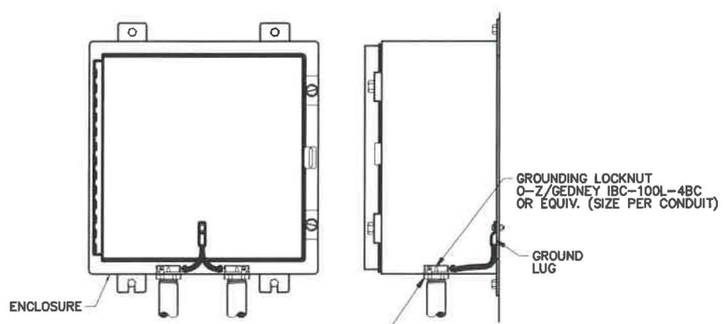


5 / E14 CONDUIT SUPPORT DETAIL (SINGLE CONDUIT SHOWN, MULTIPLE CONDUIT SIMILAR)
SCALE: NONE



NOTE:
1. MINIMUM COVER REQUIREMENT FOR DUCT BANKS UNDER ROADS, DRIVEWAYS AND PARKING LOTS SHALL BE 24".
2. SPACERS EVERY 5 FEET.
3. 2X2 CONFIGURATION WITH 4" PVC CONDUITS SHOWN. SIMILAR FOR OTHER CONFIGURATIONS. SEE DUCT BANK SCHEDULE
4. OFFSETS AND BENDS OVER 10 DEGREES AND ELBOWS IN PVC CONDUIT RUNS SHALL BE PVC COATED GALVANIZED RIGID STEEL CONDUIT (CGRSC).
5. NO PVC SHALL EMERGE FROM THE GROUND OR CONCRETE SLAB OR ENCASEMENT, PVC SHALL CONVERT TO PVC COATED GALVANIZED RIGID STEEL CONDUIT (CGRSC) PRIOR TO ITS EMERGENCE.

6 / E14 NON-ENCASED ELECTRICAL DUCT
SCALE: NONE



NOTE: ALL CONDUIT SHALL BE GROUNDED ON BOTH ENDS.

7 / E14 CONDUIT GROUNDING DETAIL
SCALE: NTS

RECORD DRAWINGS

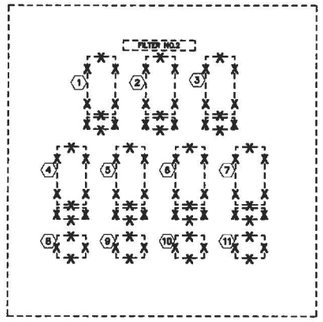
THESE PLANS RECORD THE ACTUAL CONSTRUCTION CONDITIONS OF THE PROJECT INCLUDING VARIATIONS FROM THE ORIGINAL CONTRACT DOCUMENTS IN ACCORDANCE WITH INFORMATION AVAILABLE TO THE ENGINEER

DATE MARCH 2002

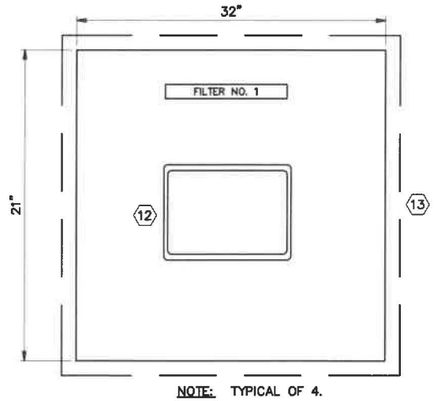
HOLLOWAY, UPDIKE + BELLEN,INC.

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Holloway, Updike and Bellen, Inc. 815 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-1811	SHAWNEE WATER TREATMENT PLANT IMPROVEMENTS SHAWNEE, OKLAHOMA	SCALE:	AS SHOWN Ver N/A	ELECTRICAL DETAILS I Project No. 965033	Detail: CAG Check: ECF	Date: OCT. 2000 Sheet No. E14



1/E15 EXISTING FILTER CONSOLE MODIFICATIONS
SCALE: NONE

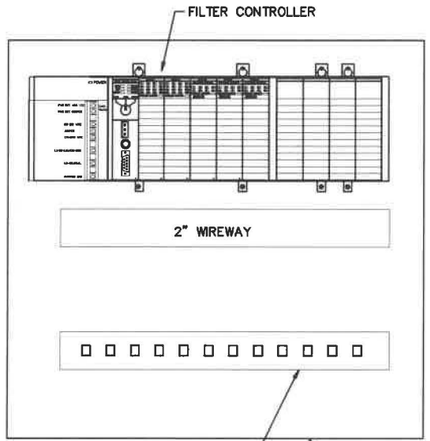


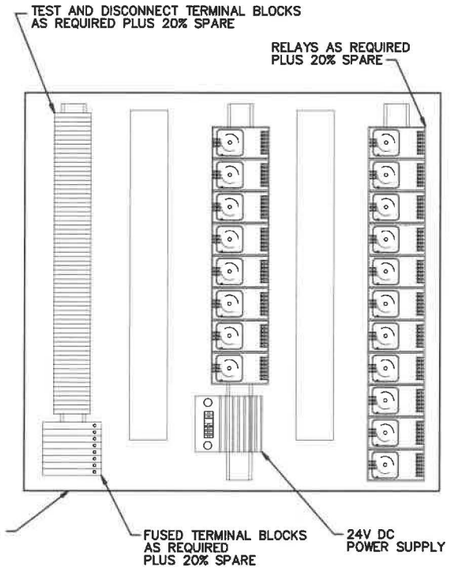
NOTE: TYPICAL OF 4.

2/E15 FILTER CONSOLE FOR FILTER CONTROLLERS
SCALE: NONE

KEY NOTES:

1. EXISTING EFFLUENT FLOW INDICATOR CONTROLLER TO BE REMOVED
2. EXISTING BACKWASH RATE OF FLOW INDICATOR TO BE REMOVED
3. EXISTING LOSS OF HEAD INDICATOR TO BE REMOVED
4. EXISTING WASTE VALVE INDICATOR TO BE BE REMOVED
5. EXISTING AIR WASH VALVE INDICATOR TO BE REMOVED
6. EXISTING WASH WATER VALVE INDICATOR TO BE REMOVED
7. EXISTING INFLUENT WATER VALVE TO BE REMOVED
8. EXISTING WASTE VALVE OPEN/CLOSE SWITCH TO BE REMOVED
9. EXISTING AIR WASH VALVE OPEN/CLOSE SWITCH TO BE REMOVED
10. EXISTING WASH WATER VALVE OPEN/CLOSE SWITCH TO BE REMOVED
11. EXISTING INFLUENT WATER VALVE OPEN/CLOSE SWITCH TO BE REMOVED
12. INSTALL NEW FILTER CONTROLLER/OPERATOR DISPLAY
13. INSTALL NEW CONSOLE COVER FOR MOUNTING NEW TOUCHSCREEN DISPLAY CONTROLLER'S, PRIMED AND PAINTED (FINAL COLOR SELECTION SELECTION BY OWNER/ENGINEER)



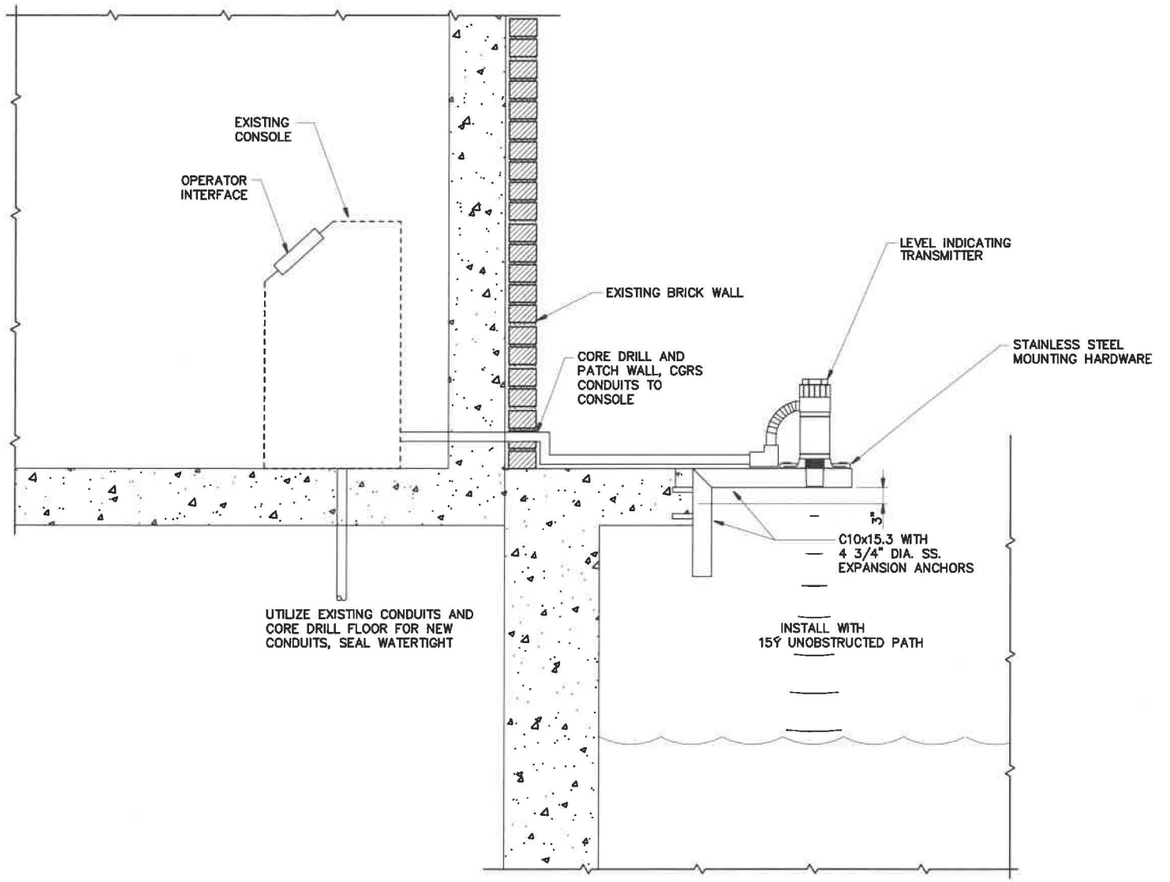


LEFT PANEL RIGHT PANEL

3/E15 FILTER CONSOLE INTERIOR LAYOUT (TYPICAL EACH FILTER)
SCALE: 3"=1'-0"

SCALE: 3" = 1'-0"

6" 3" 0 1'



NOTE:
COORDINATE NEW WORK INSTALLATION
WITH OWNER / ENGINEER.

4/E15 LEVEL SENSOR MOUNTING DETAIL
SCALE: NONE

RECORD DRAWINGS

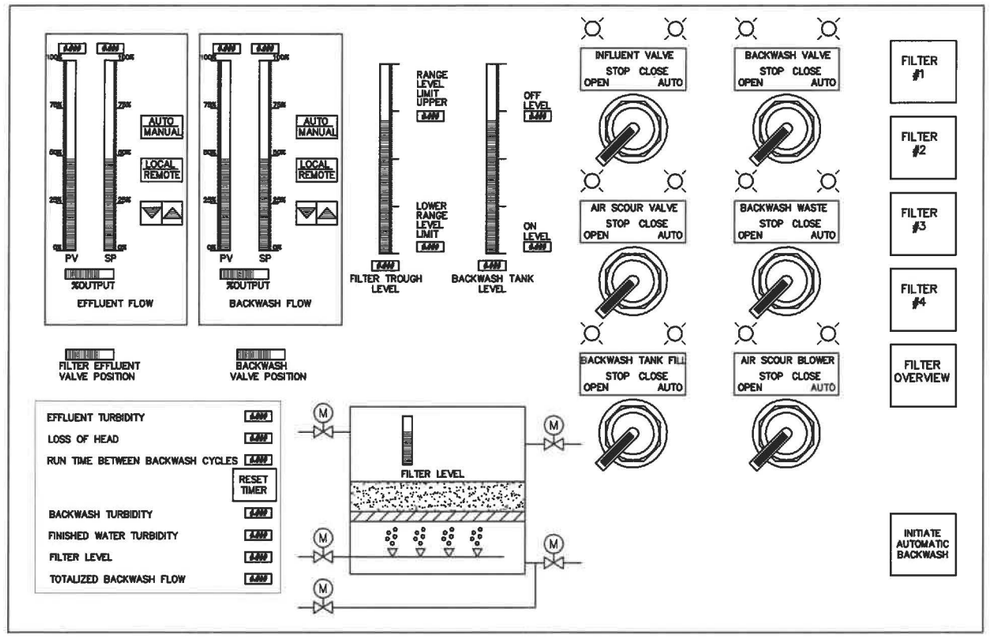
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DATE MARCH 2002

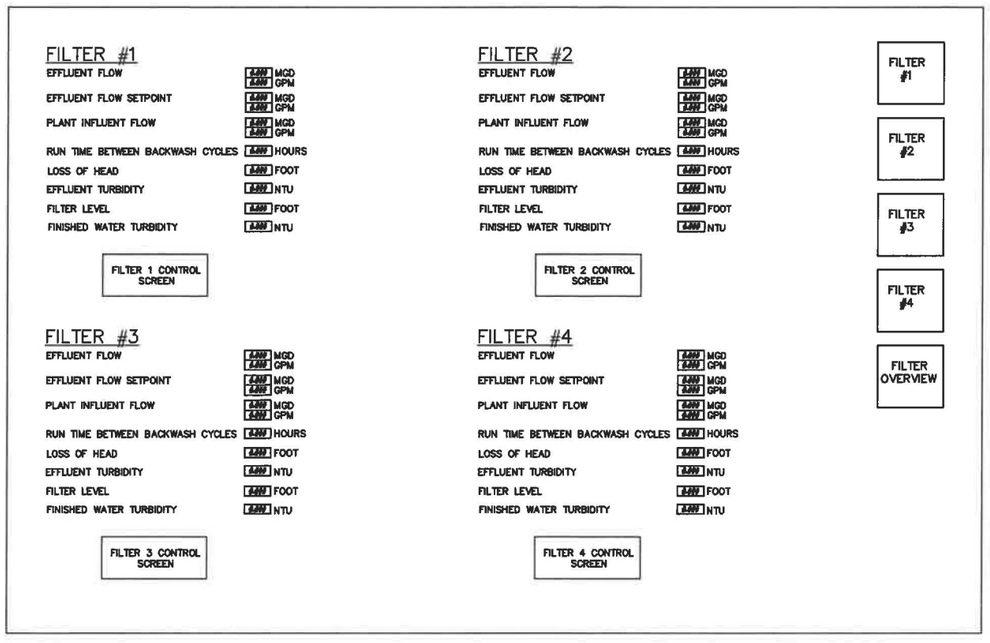
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Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS	SCALE:	AS SHOWN	ELECTRICAL DETAILS II	Detail: CAG	Date: OCT. 2000
	SHAWNEE, OKLAHOMA		Ver N/A	Project No. 965033	Check: ECF	Sheet No. E15



1 / E16 FILTER CONTROL SCREEN (TYPICAL EACH FILTER)
SCALE: NONE



2 / E16 FILTER OVERVIEW SCREEN
SCALE: NONE

GENERAL NOTES:

1. THE CONTRACTOR SHALL CONFIGURE HMI GRAPHICAL SCREENS FOR AUTOMATIC AND MANUAL FILTER/BACKWASH OPERATIONS. SCREENS SHALL BE IDENTICAL FOR ALL FILTER CONSOLES.

RECORD DRAWINGS

THESE PLANS RECORD THE ACTUAL CONSTRUCTION CONDITIONS OF THE PROJECT INCLUDING VARIATIONS FROM THE ORIGINAL CONTRACT DOCUMENTS IN ACCORDANCE WITH INFORMATION AVAILABLE TO THE ENGINEER

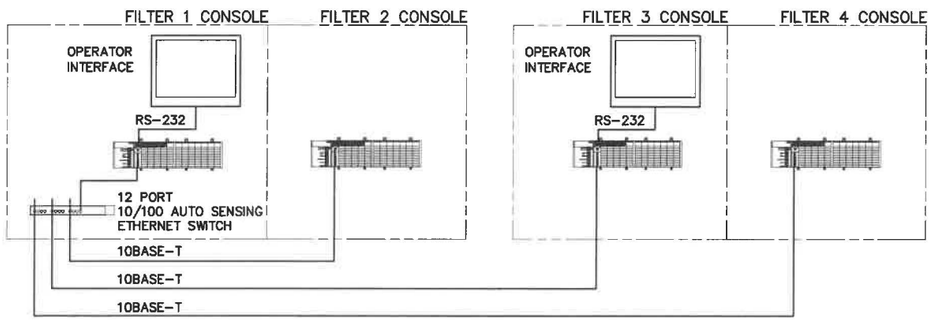
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HOLLOWAY, UPDIKE + BELLEN,INC.

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Holloway, Updike and Bellen, Inc. 86 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7861	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS	SCALE:	AS SHOWN	ELECTRICAL DETAILS III	Detail: CAG	Date: OCT. 2000
	SHAWNEE, OKLAHOMA		Ver N/A	Project No. 965033	Check: ECF	Sheet No. E16

DUCT BANK SCHEDULE

DUCT NO.	DUCT SIZE	CONTENTS	DESCRIPTION	FROM	TO
D1	2"	(26#12+1#10EG)	POWER/CONTROL	MCC2	CLARIFIER NO.2 CONTROL PANEL
	2"	(24#12)	CONTROL	CLARIFIER VFD'S	CLARIFIER CONTROL PANELS
	2"	PULLWIRE	FUTURE CONTROL	PUMP BUILDING	HANDHOLE H1
	2"	(6#10)	POWER	LP	CLARIFIER NO.2, RECEPT/LIGHT, SLUDGE VALVE CONTROL PANEL
	2"	PULLWIRE	FUTURE SIGNAL	PUMP BUILDING	HANDHOLE H1
	1"	(3#10+1#10EG)	POWER (VFD)	CLARIFIER NO.1 VFD	CLARIFIER NO.1
	1"	(3#10+1#10EG)	POWER (VFD)	CLARIFIER NO.2 VFD	CLARIFIER NO.2
	1"	(3#10+1#10EG)	POWER	PP1	INFLUENT VALVE OPERATOR
D2	1"	(3#10)	POWER	PP1	SLUDGE VALVE NO.1 OPERATOR SLUDGE VALVE NO.2 OPERATOR
	1"	(3#10)	POWER	LP	SLUDGE VALVE CONTROL PANEL
	1"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H1	SLUDGE VALVE CONTROL PANEL
D3	2"	(26#12 + 1#10EG)	POWER/CONTROL	MCC2	CLARIFIER NO.2 CONTROL PANEL
	2"	(24#12)	CONTROL	CLARIFIER VFD'S	CLARIFIER CONTROL PANELS
	2"	(3#10)	POWER	LP	CLARIFIER NO.2 RECPT/LIGHTS
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H1	HANDHOLE H2
	1"	(3#10 + 1#10EG)	POWER (VFD)	CLARIFIER NO.1 VFD	CLARIFIER NO.1
	1"	(3#10 + 1#10EG)	POWER (VFD)	CLARIFIER NO.2 VFD	CLARIFIER NO.2
	1"	(3#10 + 1#10EG)	POWER	PP1	INFLUENT VALVE OPERATOR
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H1	HANDHOLE H2
D4	2"	(12#12)	CONTROL	CLARIFIER NO.1 VFD	CLARIFIER NO.1 CONTROL PANEL
	1"	(3#10+1#10EG)	POWER (VFD)	CLARIFIER NO.1 VFD	CLARIFIER NO.1
D5	1"	(3#10+1#10EG)	POWER	PP1	INFLUENT VALVE OPERATOR
	1"	PULLWIRE	FUTURE CONTROL	HANDHOLE H2	INFLUENT VALVE OPERATOR
D6	2"	(26#12+1#10EG)	POWER/CONTROL	MCC2	CLARIFIER NO.2 CONTROL PANEL
	2"	(12#12)	CONTROL	CLARIFIER NO.2 VFD	CLARIFIER NO.2 CONTROL PANEL
	2"	(3#10)	POWER	LP	CLARIFIER NO.2 RECEPT/LIGHTS
	2"	PULLWIRE	FUTURE	HANDHOLE #2	HANDHOLE H3
	1"	(3#10+1#10EG)	POWER (VFD)	CLARIFIER NO.2 VFD	CLARIFIER NO.2



2 / E17 NETWORK DIAGRAM
SCALE: NTS

DUCT BANK SCHEDULE

DUCT NO.	DUCT SIZE	CONTENTS	DESCRIPTION	FROM	TO
D7	2"	(3#10+1#10EG)	POWER	FP1	BACKWASH TANK FILL OPERATOR
	2"	(12#14)	CONTROL	FILTER CONTROLLER CP-F1	BACKWASH TANK FILL OPERATOR
	2"	PULLWIRE	FUTURE CONTROL	NEMA 4X JUNCTION BOX WITHIN FILTER BUILDING	HANDHOLE H4
	2"	PULLWIRE	FUTURE CONTROL	NEMA 4X JUNCTION BOX WITHIN FILTER BUILDING	HANDHOLE H4
	2"	PULLWIRE	FUTURE SIGNAL	NEMA 4X JUNCTION BOX WITHIN FILTER BUILDING	HANDHOLE H4
	2"	PULLWIRE	FUTURE SIGNAL	NEMA 4X JUNCTION BOX WITHIN FILTER BUILDING	HANDHOLE H4
	4"	(4#250+1#4EG)	POWER	MDP	DISCONNECT/PP2CB
	4"	PULLWIRE	FUTURE POWER	NEMA 4X JUNCTION BOX WITHIN FILTER BLDG.	HANDHOLE H4
D8	2"	(3#10+1#10EG)	POWER	FP1	BACKWASH TANK FILL OPERATOR
	2"	(12#14)	CONTROL	FILTER CONTROLLER CP-F1	BACKWASH TANK FILL OPERATOR
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H4	HANDHOLE H5
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H4	HANDHOLE H5
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H4	HANDHOLE H5
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H4	HANDHOLE H5
	4"	(4#250+1#4EG)	POWER	MDP	DISCONNECT/PP2CB
	4"	PULLWIRE	FUTURE POWER	HANDHOLE H4	HANDHOLE H5
D9	2"	(3#10+1#10EG)	POWER	FP1	BACKWASH TANK FILL OPERATOR
	2"	(12#14)	CONTROL	FILTER CONTROLLER CP-F1	BACKWASH TANK FILL OPERATOR
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H5	HANDHOLE H6
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H5	HANDHOLE H6
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H5	HANDHOLE H6
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H5	HANDHOLE H6
	4"	(4#250+1#4EG)	POWER	MDP	DISCONNECT/PP2CB
	4"	PULLWIRE	FUTURE POWER	HANDHOLE H5	HANDHOLE H6
D10	1"	(3#10+1#10EG)	POWER	FP1	BACKWASH TANK FILL OPERATOR
	1"	(12#14)	CONTROL	FILTER CONTROLLER CP-F1	BACKWASH TANK FILL OPERATOR
	1"	PULLWIRE	SPARE	HANDHOLE H6	NEMA JUNCTION BOX WITHIN BACKWASH STRUCTURE
D11	4"	(4#250+1#4EG)	POWER	MDP	DISCONNECT/PP2CB
	4"	PULLWIRE	FUTURE POWER	HANDHOLE H6	HANDHOLE H7
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H6	HANDHOLE H7
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H6	HANDHOLE H7
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H6	HANDHOLE H7
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H6	HANDHOLE H7
D12	4"	(4#250+1#4EG)	POWER	MDP	DISCONNECT/PP2CB
	4"	PULLWIRE	FUTURE POWER	HANDHOLE H7	STUB AND CAP AT CHEM BLDG.
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H7	STUB AND CAP AT CHEM BLDG.
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H7	STUB AND CAP AT CHEM BLDG.
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H7	STUB AND CAP AT CHEM BLDG.
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H7	STUB AND CAP AT CHEM BLDG.

1 / E17 ELECTRICAL DUCT SCHEDULE
SCALE: NTS

RECORD DRAWINGS

THESE PLANS RECORD THE ACTUAL CONSTRUCTION CONDITIONS OF THE PROJECT INCLUDING VARIATIONS FROM THE ORIGINAL CONTRACT DOCUMENTS IN ACCORDANCE WITH INFORMATION AVAILABLE TO THE ENGINEER

DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.

PSRoley SWT_E17.dwg L:\1996\965033\DRAWINGS\ 34x22 1=1 10/27/2000 3:40 pm
Xrefs: [P:\standards\progdev\stamps\ ECF_OK] [ref\ SWT_TBK]
Images: [none]

IDENTIFICATION, GENERAL

SYMBOL	DESCRIPTION
XXXX ####	EQUIPMENT TAG
P-99	SHEET INTERFACE
	SEQUENCE NUMBER
	DRAWING TYPE
P-99 FROM/TO XXXX	SHEET INTERFACE WITH PROCESS FLAG
	PROCESS

PIPING LINE TYPES

LINE	DESCRIPTION
	PROCESS LINE – PRIMARY
	PROCESS LINE – SECONDARY
	PACKAGE BOUNDARY
	AREA/BUILDING BOUNDARY
	SHOWN ELSEWHERE

PIPING, MISCELLANEOUS

SYMBOL	DESCRIPTION
	SLOPE ARROW ARROW DIRECTION DOWN
ST	LINE HEAT TRACED AND INSULATED ST = STEAM TRACED ET = ELECTRIC TRACED
	OUTSIDE GRADE LEVEL

ACCESSORIES AND APPURTENANCES

SYMBOL	DESCRIPTION
	UNION
	PLUG
	BLIND FLANGE
	HOSE CONNECTION
	SPRAY NOZZLE
	DRAIN
	FLEXIBLE CONNECTION, GENERAL
	FLEXIBLE HOSE
	QUICK CONNECTOR
1"	THREADED TAP
	FILTER
	'Y' TYPE STRAINER
	STRAINER
	EXPANSION JOINT

VALVES

SYMBOL	DESCRIPTION
	CHECK VALVE
	GATE VALVE
	BUTTERFLY VALVE
	BALL VALVE
	PLUG VALVE
	NEEDLE VALVE
	ROTARY VALVE
	KNIFE GATE VALVE
	THREE WAY VALVE
	FOUR WAY VALVE
	GLOBE VALVE
	CHARACTERIZED OR VEE–BALL VALVE
	STOP CHECK VALVE
	DIAPHRAM VALVE
	PRESSURE CONTROL VALVE (SELF CONTAINED)
	PRESSURE RELIEF VALVE
	VACUUM–RELIEF VALVE

VALVE OPERATORS

SYMBOL	DESCRIPTION
	HAND OPERATOR
	HAND OPERATOR (LONG)
	CHAIN OPERATOR
F	FLOAT OPERATOR
	AIR DIAPHRAM OPERATOR
	POSITIONER
S	SOLENOID OPERATOR
	CYLINDER OPERATOR
	PRESSURE BALANCED DIAPHRAM OPERATOR
M	MOTOR OPERATOR
D	DIGITAL OPERATOR
E/H	ELECTRO–HYDRAULIC OPERATOR
	FAIL ARROWS INDICATE OPEN PORTS
	LIMIT SWITCH

PROCESS EQUIPMENT

SYMBOL	DESCRIPTION
M	ELECTRIC MOTOR
V	VARIABLE SPEED DRIVE
G	ELECTRIC GENERATOR
	HYDRAULIC MOTOR
	AIR MOTOR
	SHAFT
	COUPLING
	DYNAMIC PUMP
	DYNAMIC COMPRESSOR
	POSITIVE DISPLACEMENT PUMP
	POSITIVE DISPLACEMENT COMPRESSOR
	EDUCTOR/EJECTOR
	HEATER, GENERAL
	HEATER W/FAN (INDUCED DRAFT)
	HEATER W/FAN (FORCED DRAFT)
	HEAT EXCHANGER, GENERAL
	HYDRAULIC CYLINDER
	AIR CYLINDER

INSTRUMENT PRIMARY ELEMENTS

SYMBOL	DESCRIPTION
	THREADED TAP
	THERMOWELL
	SIGHT FLOW INDICATOR
	ROTAMETER
	FLOW ORIFICE
	FLOW ORIFICE IN QUICK CHANGE FITTING
	SINGLE PORT PITOT
	VENTURI TUBE
	AVERAGING PITOT STATION
	FLUME
	WEIR
	TURBINE ELEMENT
	POSITIVE DISPLACEMENT FLOWMETER
	VORTEX SENSOR
	TARGET ELEMENT
MASS	MASS FLOWMETER
	SONIC FLOWMETER
M	MAG. FLOWMETER
	pH ELECTRODE ASSEMBLY

AUXILIARY INSTRUMENTS OR FUNCTIONS

SYMBOL	DESCRIPTION
	TEST POINT, TERMINAL BLOCK WITH SLIDING LINK AND MINI–BANANA SOCKETS
P	PURGE OR FLUSHING DEVICE
I	INTERLOCK LOGIC WITH REFERENCE
	DIAPHRAM SEAL
R	RESET FOR LATCH TYPE OPERATOR
	PANEL MOUNTED PATCHBOARD POINT
	PILOT LIGHT FOR PROCESS SIGNALS
	INSTRUMENTS SHARING COMMON HOUSING
+ – PS	LOOP POWER SUPPLY
pH	POWER OF HYDROGEN
TURB.	TURBIDITY

MEANING OF FUNCTIONAL INSTRUMENT IDENTIFICATION LETTERS

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER FLAME		USER CHOICE	USER CHOICE	USER CHOICE
C	CONDUCTIVITY (ELECTRICAL)			CONTROL	
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL			
E	VOLTAGE (EMF)		PRIMARY ELEMENT		
F	FLOW RATE	RATIO(FRACTION)			
G	GAUGING(DIMENSIONAL)		GLASS		
H	HAND(MANUALLY INITIATED)				HIGH
I	CURRENT(ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME OR TIME–SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT(PILOT)		LOW
M	MOISTURE OR HUMIDITY	MOMENTARY			MIDDLE OR INTERMEDIATE
N	USER CHOICE		USER CHOICE	USER CHOICE	USER CHOICE
O	USER CHOICE		ORIFICE(RESTRICTION)		
P	PRESSURE OR VACUUM		POINT(TEST POINT)		
Q	QUANTITY OR EVENT	INTEGRATE OR TOTALIZE			
R	RADIATION		RECORD OR PRINT		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNC.	MULTIFUNCTION
V	VIBRATION OR MECHANICAL ANALYSIS			VALVE, DAMPER, OR LOUVER	
W	WEIGHT OR FORCE		WELL		
X	UNCLASSIFIED		UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE			RELAY OR COMPUTE	
Z	POSITION			DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

JI SURGE ARRESTOR, SEE SPECIFICATIONS

INSTRUMENTS OR FUNCTIONS

KEY [SYMBOL] BLOCK TAG	PRIMARY LOCATION; OPERATOR ACCESSIBLE	AUXILIARY LOCATION; OPERATOR ACCESSIBLE	LOCATION NOT NORMALLY OPERATOR ACCESSIBLE	FIELD MOUNTED
DISCRETE INSTRUMENTS				
SHARED DISPLAY SHARED CONTROL				
COMPUTER FUNCTION				
PROGRAMMABLE LOGIC CONTROLLER				

SIGNAL CONDITIONERS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
A/D	ANALOG TO DIGITAL	Σ	SUM
D/A	DIGITAL TO ANALOG	Δ	DIFFERENCE
I/P	CURRENT TO PRESSURE	√	SQUARE ROOT
P/I	PRESSURE TO CURRENT	f(x)	CHARACTERIZATION
F/I	FREQUENCY TO CURRENT	∫	INTEGRATION
I/I	CURRENT BOOST/ REPEATER		

FURNISH AND INSTALL

EXISTING

INSTRUMENT LINE TYPES

LINE	DESCRIPTION
	PROCESS CONNECTION
	UNDEFINED SIGNAL
	PNEUMATIC SIGNAL
	ELECTRIC SIGNAL
	HYDRAULIC SIGNAL
	CAPILLARY OR FILLED TUBE
	ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
	ELECTROMAGNETIC OR SONIC SIGNAL (UNGUIDED)
	INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)
	MECHANICAL LINK
	PNEUMATIC BINARY (ON–OFF) SIGNAL
	ELECTRIC BINARY (ON–OFF) SIGNAL

INSTRUMENT POWER SUPPLY

120 PSIG IA – POWER SUPPLY, TYPE AND LEVEL SHOWN, ABBREVIATIONS AS FOLLOWS:
AS – AIR SUPPLY
IA – INSTRUMENT AIR
PA – PLANT AIR
ES – ELECTRIC SUPPLY
GS – GAS SUPPLY
HS – HYDRAULIC SUPPLY
NS – NITROGEN SUPPLY
ST – STEAM SUPPLY
WS – WATER SUPPLY

RECORD DRAWINGS

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DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.

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Xrefs: P:\standards\proj_dev\stamps\ ECF_OK [ref], SWT_TBX

HMI

FILTER CONTROLER CP-F1

LAHL 98 / LIR 98 — LY 98 AI

HS 99 OPEN STOP CLOSE AUTO — YC 99 — YY 99A DO / YY 99B DO

YI 99C OPENED — YY 99C DI

YI 99D CLOSED — YY 99D DI

HS 102A LOCAL SET POINT

FAH 102A / FIRQ 102A — FY 102A AI

HS 102B AUTO/MANUAL LOCAL/REMOTE

FIRQ 102B — FC 102 (SP, PV, CV, PID, RSP) — FY 102B AO

ZI 102C — ZY 102C AI

ZI 102D — ZY 102D AI

ZI 102E — ZY 102E AI

HS 103A — YY 103A DO

KQI 103B / YI 103B ETM — YY 103B DI

FC 100 — FILTER 1 / FILTER 2 / FILTER 3 / FILTER 4

LAHL 101 / LIR 101 — LY 101 AI

HS 101A RATED FILTER FLOW / HS 101B TROUGH OPERATING BAND — FC 101 — 0–100% RATED FLOW DIVIDED BY 4

F3 FILTER NO.1 / F4 FILTER NO.2 / F5 FILTER NO.3 / F6 FILTER NO.4

EXISTING MAIN CONTROL PANEL

CONNECT TO EXISTING CABLE — SA — FIT 100 — FE 100

CONNECT TO EXISTING CABLE — SA — M

RAW WATER

LIT 101 — FILTER INFLUENT TROUGH

F3 FILTER INFLUENT / F4 FILTER INFLUENT / F5 FILTER INFLUENT / F6 FILTER INFLUENT

BLOW 01 — M — AIR SCOUR BLOWER

F3 AIR SCOUR / F4 AIR SCOUR / F5 AIR SCOUR / F6 AIR SCOUR

BACKWASH TANK

FIT 102 — FE 102

FV 102 — M

BACKWASH CONTROLS

F3 FILTER 1 BACKWASH / F4 FILTER 2 BACKWASH / F5 FILTER 3 BACKWASH / F6 FILTER 4 BACKWASH

DIST-RIBUTION

HIGH SERV. PUMPS

RECORD DRAWINGS

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DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.

GENERAL NOTE:

RENOVATE EXISTING FILTER CONTROL CONSOLE AS INDICATED.

Holloway, Updike and Bellen, Inc.
910 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811

SHAWNEE WATER TREATMENT PLANT INPROVEMENTS
SHAWNEE, OKLAHOMA

SCALE: AS SHOWN / Ver N/A

PROCESS AND INSTRUMENTATION DIAGRAM I

Detail: CAG | Check: ECF | Date: OCT. 2000

Project No. 965033 | Sheet No. F2

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Images: [none]
Xrefs: P:\standards\pro_dev\stamps\ ECF_OK [ref\ SWT_TBX]

HMI

FILTER CONTROLER CP-F1

F2 FLOW SET POINT

HS 130 OPEN STOP CLOSE AUTO — YC 130 — YY 130A DO — YY 130B DO
YI 130C OPENED — YY 130C DI
YI 130D CLOSED — YY 130D DI

HS 120 OPEN STOP CLOSE AUTO — YC 120 — YY 120A DO — YY 120B DO
YI 120C OPENED — YY 120C DI
YI 120D CLOSED — YY 120D DI

HS 110 OPEN STOP CLOSE AUTO — YC 110 — YY 110A DO — YY 110B DO
YI 110C OPENED — YY 110C DI
YI 110D CLOSED — YY 110D DI

LI 170 FILTER LEVEL — LY 170 AI — LT 170

DPAH 190 — DPIR 190 — DPY 190 AI — PDIT 190
AAH 160 — AIR 160 — AY 160 AI — AIT 160 TURB
FAH 150 — FIRQ 150 — FY 150 AI — FIT 150
AIR 180 — AY 180 AI — AIT 180 TURB

HS 150B AUTO/MANUAL LOCAL/REMOTE — FY 150 PID (SP, PV, CV) — ZY 150A AO
HS 150A LOCAL SETPOINT
ZI 150B — ZY 150B AI
YI 150C — ZY 150C DI
YI 150D — YY 150D DI

HS 140 OPEN STOP CLOSE AUTO — YC 140 — YY 140A DO — YY 140B DO
YI 140C OPENED — YY 140C DI
YI 140D CLOSED — YY 140D DI

F2 INFLUENT FLUME — FV 110

F2 AIR SCOUR — FV 120

F2 BACKWASH WATER — FV 130

FILT 01 EXISTING FILTER #1

normal / backwash
anthracite
sand
filter block
normal

FV 150 — HV 140 — BACKWASH WASTE

F6 COMBINED EFFLUENT

RECORD DRAWINGS

THESE PLANS RECORD THE ACTUAL CONSTRUCTION CONDITIONS OF THE PROJECT INCLUDING VARIATIONS FROM THE ORIGINAL CONTRACT DOCUMENTS IN ACCORDANCE WITH INFORMATION AVAILABLE TO THE ENGINEER

DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.

GENERAL NOTE:

RENOVATE EXISTING FILTER CONTROL CONSOLE AS INDICATED.

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Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS	SCALE:	AS SHOWN	PROCESS AND INSTRUMENTATION DIAGRAM II	Detail: CAG	Date: OCT. 2000
	SHAWNEE, OKLAHOMA		Ver N/A	Project No. 965033	Check: ECF	Sheet No. F3

HMI

FILTER CONTROLER CP-F2

F2 FLOW SET POINT

HS 230 OPEN STOP CLOSE AUTO
YI 230C OPENED
YI 230D CLOSED
HS 220 OPEN STOP CLOSE AUTO
YI 220C OPENED
YI 220D CLOSED
HS 210 OPEN STOP CLOSE AUTO
YI 210C OPENED
YI 210D CLOSED
LI 270 FILTER LEVEL
DPAH 290 DPIR 290
AAH 260 AIR 260
FAH 250 FIRQ 250
AIR 280
HS 250B AUTO/MANUAL LOCAL/REMOTE
ZI 250B
YI 250C
HS 250A LOCAL SETPOINT
YI 250D
HS 240 OPEN STOP CLOSE AUTO
YI 240C OPENED
YI 240D CLOSED

YC 230
YC 220
YC 210
YC 240
FY 250 PID
SP
PV
CV

YY 230A DO
YY 230B DO
YY 230C DI
YY 230D DI
YY 220A DO
YY 220B DO
YY 220C DI
YY 220D DI
YY 210A DO
YY 210B DO
YY 210C DI
YY 210D DI
LY 270 AI
DPY 290 AI
AY 260 AI
FY 250 AI
AY 280 AI
ZY 250A AO
ZY 250B AI
YY 250C DI
YY 250D DI
YY 240A DO
YY 240B DO
YY 240C DI
YY 240D DI

F2 INFLUENT FLUME
F2 AIR SCOUR
F2 BACKWASH WATER

FV 210
FV 220
FV 230
FV 250
HV 240

LIT 270
PDIT 290
AIT 280 TURB
AIT 260 TURB
FIT 250
FE 250

normal
backwash
anthracite
sand
filter block
normal

FILT 02 EXISTING FILTER #2

BACKWASH WASTE
F6 COMBINED EFFLUENT

RECORD DRAWINGS

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DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.

GENERAL NOTE:

RENOVATE EXISTING FILTER CONTROL CONSOLE AS INDICATED.

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Holloway, Updike and Bellen, Inc. 818 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS	SCALE:	AS SHOWN	PROCESS AND INSTRUMENTATION DIAGRAM III	Detail: CAG	Date: OCT. 2000
	SHAWNEE, OKLAHOMA		Ver N/A	Project No. 965033	Check: ECF	Sheet No. F4

HMI

FILTER CONTROLER CP-F3

F2 FLOW SET POINT

HS 330 OPEN STOP CLOSE AUTO — YC 330 — YY 330A DO — YY 330B DO

YI 330C OPENED — YY 330C DI

YI 330D CLOSED — YY 330D DI

HS 320 OPEN STOP CLOSE AUTO — YC 320 — YY 320A DO — YY 320B DO

YI 320C OPENED — YY 320C DI

YI 320D CLOSED — YY 320D DI

HS 310 OPEN STOP CLOSE AUTO — YC 310 — YY 310A DO — YY 310B DO

YI 310C OPENED — YY 310C DI

YI 310D CLOSED — YY 310D DI

LI 370 FILTER LEVEL — LY 370 AI

DPAH 390 / DPIR 390 — DPY 390 AI

AAH 360 / AIR 360 — AY 360 AI

FAH 350 / FIRQ 350 — FY 350 AI

AIR 380 — AY 380 AI

HS 350B AUTO/MANUAL LOCAL/REMOTE

HS 350A LOCAL SETPOINT

FY 350 PID — SP — PV — CV — ZY 350A AO

ZI 350B — ZY 350B AI

YI 350C — YY 350C DI

YI 350D — YY 350D DI

HS 340 OPEN STOP CLOSE AUTO — YC 340 — YY 340A DO — YY 340B DO

YI 340C OPENED — YY 340C DI

YI 340D CLOSED — YY 340D DI

F2 INFLUENT FLUME

F2 AIR SCOUR

F2 BACKWASH WATER

FV 310 — FV 320 — FV 330

LIT 370

PDIT 390

normal — backwash

anthracite

sand

filter block

normal

FILT 03 EXISTING FILTER #3

AIT 380 TURB

AIT 360 TURB

FIT 350 — FE 350

FV 350

HV 340

BACKWASH WASTE

F6 COMBINED EFFLUENT

RECORD DRAWINGS

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DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.

GENERAL NOTE:

RENOVATE EXISTING FILTER CONTROL CONSOLE AS INDICATED.

Holloway, Updike and Bellen, Inc. 815 EAST 41ST BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS	SCALE:	AS SHOWN	PROCESS AND INSTRUMENTATION DIAGRAM IV	Detail: CAC	Date: OCT. 2000
	SHAWNEE, OKLAHOMA		Ver N/A	Project No. 965033	Check: ECF	Sheet No. F5

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HMI

FILTER CONTROLER CP-F4

HS 430 OPEN STOP CLOSE AUTO — YC 430 — YY 430A DO — YY 430B DO
YI 430C OPENED — YY 430C DI
YI 430D CLOSED — YY 430D DI

HS 420 OPEN STOP CLOSE AUTO — YC 420 — YY 420A DO — YY 420B DO
YI 420C OPENED — YY 420C DI
YI 420D CLOSED — YY 420D DI

HS 410 OPEN STOP CLOSE AUTO — YC 410 — YY 410A DO — YY 410B DO
YI 410C OPENED — YY 410C DI
YI 410D CLOSED — YY 410D DI

LI 470 FILTER LEVEL — LY 470 AI

DPAH 490 / DPIR 490 — DPY 490 AI
AAH 460 / AIR 460 — AY 460 AI
FAH 450 / FIRQ 450 — FY 450 AI
AIR 480 — AY 480 AI

HS 450B AUTO/MANUAL LOCAL/REMOTE
SP — FY 450 — CV
PV — PID
HS 450A LOCAL SETPOINT — ZY 450A AO
ZI 450B — ZY 450B AI
YI 450C — YY 450C DI
YI 450D — YY 450D DI

HS 440 OPEN STOP CLOSE AUTO — YC 440 — YY 440A DO — YY 440B DO
YI 440C OPENED — YY 440C DI
YI 440D CLOSED — YY 440D DI

AAH 200 / AIR 200 — AY 200 AI

FILTER CONTROLER CP-F1

F2 FLOW SET POINT

F2 INFLUENT FLUME — FV 410 — LIT 470 — PDIT 490 — AIT 480 TURB — HV 440 — BACKWASH WASTE

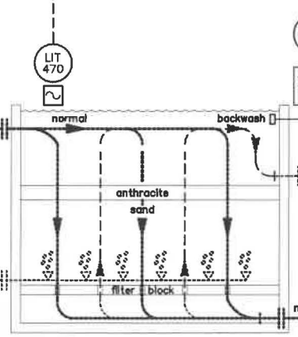
F2 AIR SCOUR — FV 420

F2 BACKWASH WATER — FV 430 — AIT 460 TURB — FIT 450 — FE 450 — FV 450 — AIT 200 — CLEARWELL

F5 FILTER 3 EFFLUENT

F4 FILTER 2 EFFLUENT

F3 FILTER 1 EFFLUENT



FILT 04 EXISTING FILTER #4

GENERAL NOTE:

RENOVATE EXISTING FILTER CONTROL CONSOLE AS INDICATED.

RECORD DRAWINGS

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DATE MARCH 2002

HOLLOWAY, UPDIKE + BELLEN,INC.

Holloway, Updike and Bellen, Inc. 815 EAST SIDE BOULEVARD • MUSKOGEE, OKLAHOMA • 918/682-7811	SHAWNEE WATER TREATMENT PLANT INPROVEMENTS SHAWNEE, OKLAHOMA	SCALE:	AS SHOWN Ver N/A	PROCESS AND INSTRUMENTATION DIAGRAM V Project No. 965033	Detail: CAG Check: ECF	Date: OCT 2000 Sheet No. F6

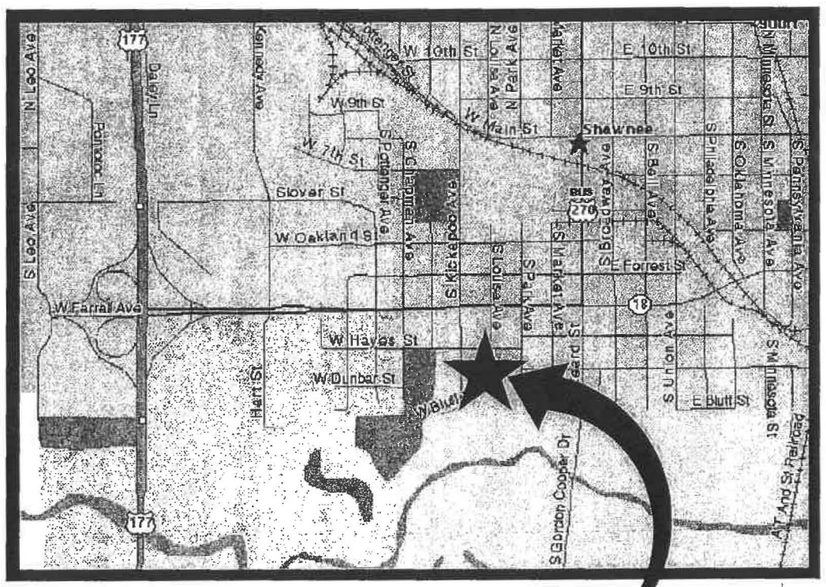
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Xrefs: P:\standards\proj_dev_stamps\ ECF_OK

CITY OF SHAWNEE
WATER TREATMENT PLANT IMPROVEMENTS
PHASE II

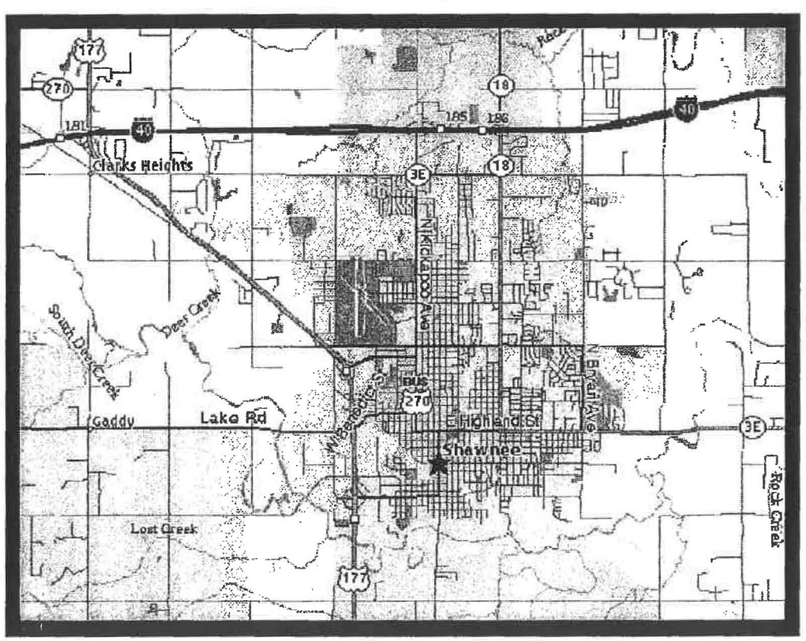
APRIL, 2003



OKLAHOMA STATE MAP



WATER TREATMENT PLANT SITE



AREA MAP

DRAWING INDEX

A1 SITE PLAN I
A2 YARD PIPING
A3 HYDRAULIC PROFILE
A4 GRADING PLAN
A5 PIPING PROFILES I
A6 PIPING PROFILES II
A7 PIPING DETAILS I
A8 ENLARGED SITE PLAN

B1 PRESETTLING BASIN DEMOLITION PLAN
B2 PRESETTLING BASIN MODIFICATIONS PLAN
B3 PRESETTLING BASIN DETAILS
B4 PRESETTLING BASIN BAR SCREEN PLAN & SECTIONS

C1 OZONE CONTACT CHAMBER & BASE SLAB PLAN
C2 OZONE CONTACT CHAMBER SECTIONS
C3 OZONE CONTACT CHAMBER PLAN & SECTIONS @ INJECTOR LEVEL
C4 OZONE CONTACT CHAMBER TOP SLAB PLAN & DETAILS
C5 OZONE BUILDING PLAN & DETAILS
C6 OZONE BUILDING SECTIONS & ELEVATIONS
C7 OZONE BUILDING ROOF FRAMING
C8 OZONE BUILDING DETAILS I
C9 OZONE BUILDING MECHANICAL EQUIPMENT PLAN
C10 OZONE BUILDING MECHANICAL EQUIPMENT SECTIONS
C11 OZONE BUILDING MECHANICAL DETAILS I
C12 OZONE BUILDING MECHANICAL DETAILS II
C13 OZONE BUILDING MECHANICAL DETAILS III
C14 OZONE BUILDING HVAC PLAN
C15 OZONE BUILDING HVAC DETAILS
C16 OZONE BUILDING PIPING SCHEMATIC

D1 FLOW CONTROLLER VAULT PLAN & SECTIONS
D2 FLOW CONTROLLER VAULT MECHANICAL DETAILS
D3 LAGOON RETURN WATER VAULT PLAN
D4 LAGOON RETURN WATER VAULT

F1 SULFURIC ACID FEED PLAN
F2 SULFURIC ACID FEED DETAILS

G1 CONTROL ROOM MODIFICATION PLAN
G2 GENERATOR AND ELECTRICAL BUILDING SITE PLAN

E1 ELECTRICAL LEGEND & ABBREVIATIONS
E2 ELECTRICAL SITE PLAN
E3 OZONE BUILDING LIGHTING PLAN
E4 OZONE BUILDING POWER PLAN
E5 ELECTRICAL PUMP BUILDING PLAN
E6 ELECTRICAL FILTER BUILDING FIRST FLOOR LIGHTING PLAN
E7 ELECTRICAL FILTER BUILDING SECOND FLOOR CONTROL ROOM
E8 ELECTRICAL FILTER BUILDING SECTION
E9 ELECTRICAL CHEMICAL FEED PLAN
E10 ELECTRICAL MAIN CONTROL PANEL LAYOUT
E11 ELECTRICAL FILTER CONSOLE/RTU LAYOUT
E12 ELECTRICAL DETAILS I
E13 ELECTRICAL GENERATOR DETAILS
E14 ELECTRICAL ONE-LINE DIAGRAM
E15 PANEL SCHEDULES
E16 ELECTRICAL CONTROL SCHEMATICS
E17 ELECTRICAL NETWORK RISER DIAGRAM
E18 GATE OPERATOR AND VIDEO SYSTEM RISER DIAGRAMS
E19 GATE OPERATOR AND VIDEO SYSTEM DETAILS
E20 FENCING DETAILS
E21 ELECTRICAL DUCT BANK SCHEDULES
E22 ELECTRICAL DUCT BANK SCHEDULES I
E23 ELECTRICAL RTU INSTALLATION DETAILS

P1 PROCESS AND INSTRUMENTATION DIAGRAM LEGEND AND ABBREVIATIONS
P2 PROCESS AND INSTRUMENTATION DIAGRAM I
P3 PROCESS AND INSTRUMENTATION DIAGRAM II
P4 PROCESS AND INSTRUMENTATION DIAGRAM III
P5 PROCESS AND INSTRUMENTATION DIAGRAM IV
P6 PROCESS AND INSTRUMENTATION DIAGRAM V
P7 PROCESS AND INSTRUMENTATION DIAGRAM VI
P8 PROCESS AND INSTRUMENTATION DIAGRAM VII
P9 PROCESS AND INSTRUMENTATION DIAGRAM VIII
P10 PROCESS AND INSTRUMENTATION DIAGRAM IX
P11 PROCESS AND INSTRUMENTATION DIAGRAM X

REGISTERED PROFESSIONAL ENGINEER — J. Y. ALLIN, III — 17426 — OKLAHOMA — 4-14-03

REGISTERED PROFESSIONAL ENGINEER — MELTON BROWN — 17883 — OKLAHOMA — 4/14/2003

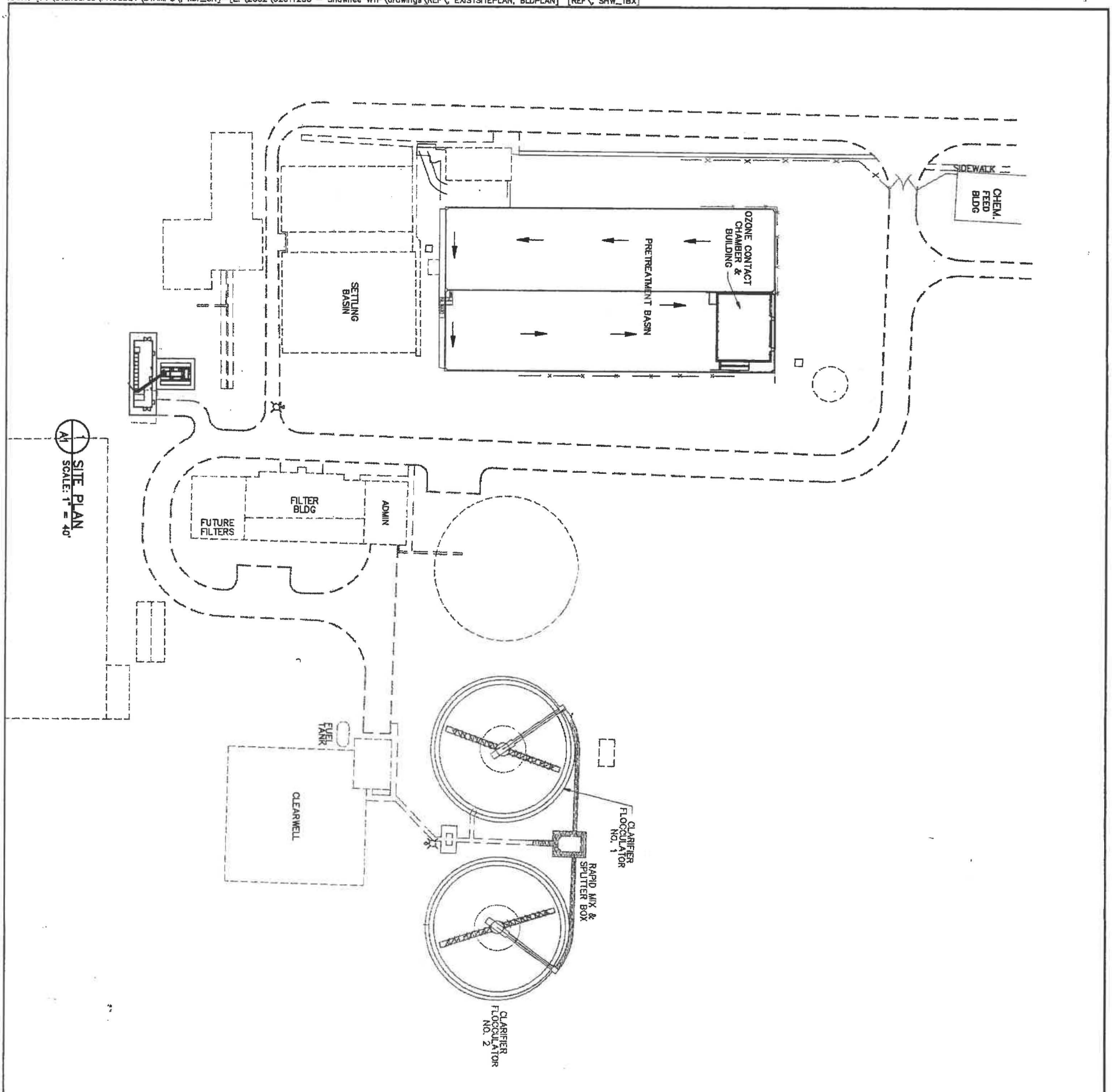
REGISTERED PROFESSIONAL ENGINEER — [illegible] B. Garland — 20702 — OKLAHOMA — 4-14-03

REGISTERED PROFESSIONAL ENGINEER — WESLEY [illegible] — 19212 — OKLAHOMA — 4/14/03

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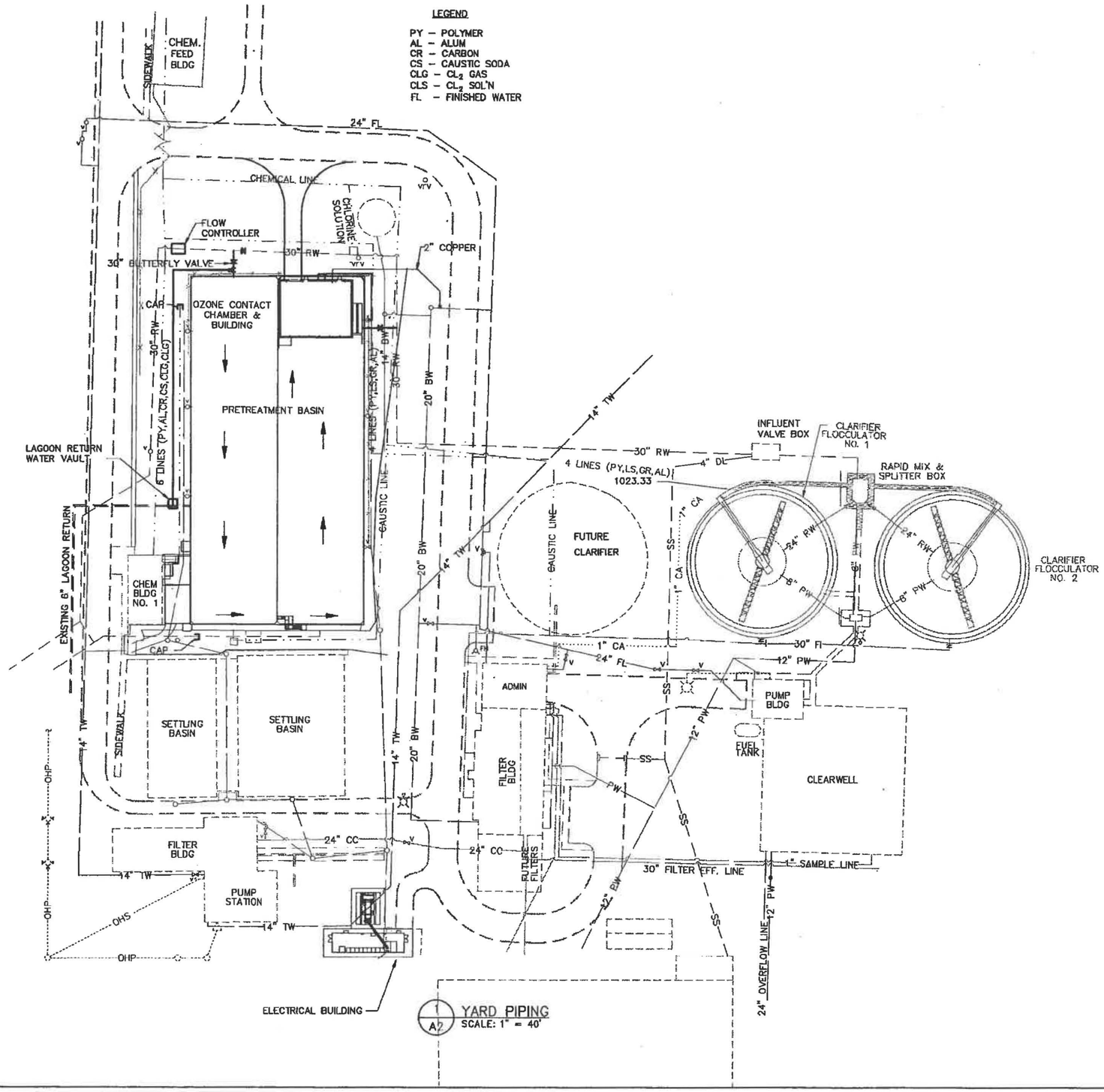
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Sheet Number A1	Job No. 02011280 Date: APRIL, 2003 Designed by: SJG Drawn by: RNF	SITE PLAN	CITY OF SHAWNEE SHAWNEE, OKLAHOMA PHASE II WATER TREATMENT PLANT IMPROVEMENTS

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REGISTERED PROFESSIONAL ENGINEER OKLAHOMA 20702
6-4-03



CAUTION: UNDERGROUND UTILITIES ARE WITHIN AND ADJACENT TO THE LIMITS OF CONSTRUCTION. AN ATTEMPT HAS BEEN MADE TO LOCATE THESE UTILITIES ON THE PLANS. HOWEVER, ALL EXISTING UTILITIES MAY NOT BE SHOWN, AND THE ACTUAL LOCATIONS OF THE UTILITIES MAY VARY FROM THE LOCATIONS SHOWN. PRIOR TO BEGINNING ANY TYPE OF EXCAVATION, THE CONTRACTOR SHALL CONTACT THE UTILITIES INVOLVED AND MAKE ARRANGEMENTS FOR THE LOCATION OF THE UTILITIES ON THE GROUND. THE CONTRACTOR SHALL MAINTAIN THE UTILITY LOCATION MARKINGS UNTIL THEY ARE NO LONGER NECESSARY.

ARKANSAS STATE LAW, THE UNDERGROUND FACILITIES DAMAGE PREVENTION ACT, REQUIRES TWO WORKING DAYS ADVANCE NOTIFICATION THROUGH THE ARKANSAS ONE-CALL SYSTEM CENTER BEFORE EXCAVATING USING MECHANIZED EQUIPMENT OR EXPLOSIVES (EXCEPT IN THE CASE OF AN EMERGENCY). THE ONE-CALL SYSTEM PHONE NUMBER IS 1-800-482-8998. THE CONTRACTOR IS ADVISED THAT THERE IS A SEVERE PENALTY FOR NOT MAKING THIS CALL. NOT ALL UTILITY COMPANIES ARE MEMBERS OF THE ARKANSAS ONE-CALL SYSTEM; THEREFORE, THE CONTRACTOR IS ADVISED TO CONTACT ALL NON-MEMBER UTILITIES AS WELL AS THE ONE-CALL SYSTEM.

REGISTERED PROFESSIONAL ENGINEER
Kirby B. Rowland
20702
OKLAHOMA

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CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

YARD PIPING

Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RNF

Sheet Number
A2

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NORMAL MAX. WATER SURFACE EL. 1073.50

MIN. WATER SURFACE EL. 1048.50

EXISTING 30" RAW WATER LINE

FLOW RATE 9MGD

NORMAL W.S.E. 1031.11

NORMAL W.S.E 1035.36

MAX. W.S.E. 1035.42

MIN. W.S.E. 1035.00

OZONE CONTACT BASIN

EXISTING PRE-TREATMENT TANK

200,000 GALLON BACKWASH WATER STORAGE TANK

SHAWNEE WATER TREATMENT PLANT

MIN. W.S.E. 1076.00

EL. 1037.00

RAPID MIX AND FLOW SPLITTER BASIN

NORMAL W.S.E. 1027.17

VENTURI METER AND FLOW THROTTLING VALVE

CLARIFIER - FLOCCULATOR

NORMAL W.S.E. 1027.00

FILTER BUILDING

ADMIN. OFFICE AND LAB.

OPERATING LEVEL

EL. 1023.50

FILTER INFLUENT FLUME

PIPE GALLERY

4" DRAIN LINE

30" RAW WATER LINE

24"

SLUDGE COLLECTION BOX

24"DIP

24"

30" DIP

EL. 1009.50

CLEARWELL

FLOW METER

FEEDER MAIN (TO DISTRIBUTION)

MAX. W.S.E. 1008.00

OVERFLOW LINE

EXISTING 20" BACKWASH LINE

24" CONNECTION TO EXISTING CLEARWELL

EL. 996.25

12" DRAIN LINE

24" OVERFLOW LINE

20"

20" BUTTERFLY VALVE

TO EXISTING PRE-TREATMENT BASIN

TOP OF DIKE EL. 995.0

W.S.E. 992.00

EXISTING SUPERNATANT RETURN PUMP STATION AND RETURN LINE

EXISTING 600 GPM PROCESS WASTEWATER PUMP STATION AND DISCHARGE LINE

LAGOON

BOTTOM EL. 980.00

1080 1070 1060 1050 1040 1030 1020 1035 1025 1015 1010 1005 1000 995 990 985 980

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REGISTERED PROFESSIONAL ENGINEER 10702 OKLAHOMA
4-14-03

CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

HYDRAULIC PROFILE

Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RDR

Sheet Number
A3

Xrefs: [P:\Standards\PROGDEV\STAMPS\ kar_CAC] [L:\2002\02011280 - Shawnee WTP\drawings\ 24X22 1=1U 4/14/03 4:17 pm
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1 / A1 GRADING PLAN
SCALE: 1" = 10'

SCALE: 1" = 10'
10 5 0 10 20 30

REMOVE EXISTING GATES

INSTALL ELECTRIC GATE

GATE OPENS

REMOVE DIRT TO EL. 1032 ±
FILL BACK W/ GRAVEL USE
FILL AROUND NEW DRIVEWAY
TO BRING UP TO TOP OF
NEW CURB & GUTTER

USE CUT MATERIAL FROM
DRIVEWAY TO FILL OUT SIDE
OF NEW DRIVEWAY

REMOVE EXISTING CURB

NEW ASPHALT DRIVE
MATCH EXISTING EDGE
OF PAVEMENT

CHEMICAL LINE

USE CONCRETE PAVER BLOCKS TO
BUILD RETAINING WALL 36" HIGH,
STEP BACK EACH COURSE 1/2 BLOCK

R. = 36'

R. = 36'

CHLORINE SOLUTION

NOTE:
SLOPE EXISTING GRADE
TO TOP NEW CURB

SLOPE 0.032 ft/ft

SLOPE GRADE TO DRAIN AWAY
FROM PRESETTLING BASIN

OZONE CONTACT
CHAMBER &
BUILDING

OZONE CONTACT CHAMBER
& BUILDING

PRETREATMENT BASIN

30" RW

RW

1035.06±
1036.35±
1037.81±
1035.06
1035.65
1036.74
1037.07
1038.58
1039.96
1034.86
1035.56
1036.49
1037.98
1037.80
1035.77
1036.09
1037.14
1037.83
1037.76
1037.95
1037.86
1037.09
1037.22
1036.82
1036.75
1032
1033
1034
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1036
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1038
1039

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OKLAHOMA
10702
4-14-03

CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

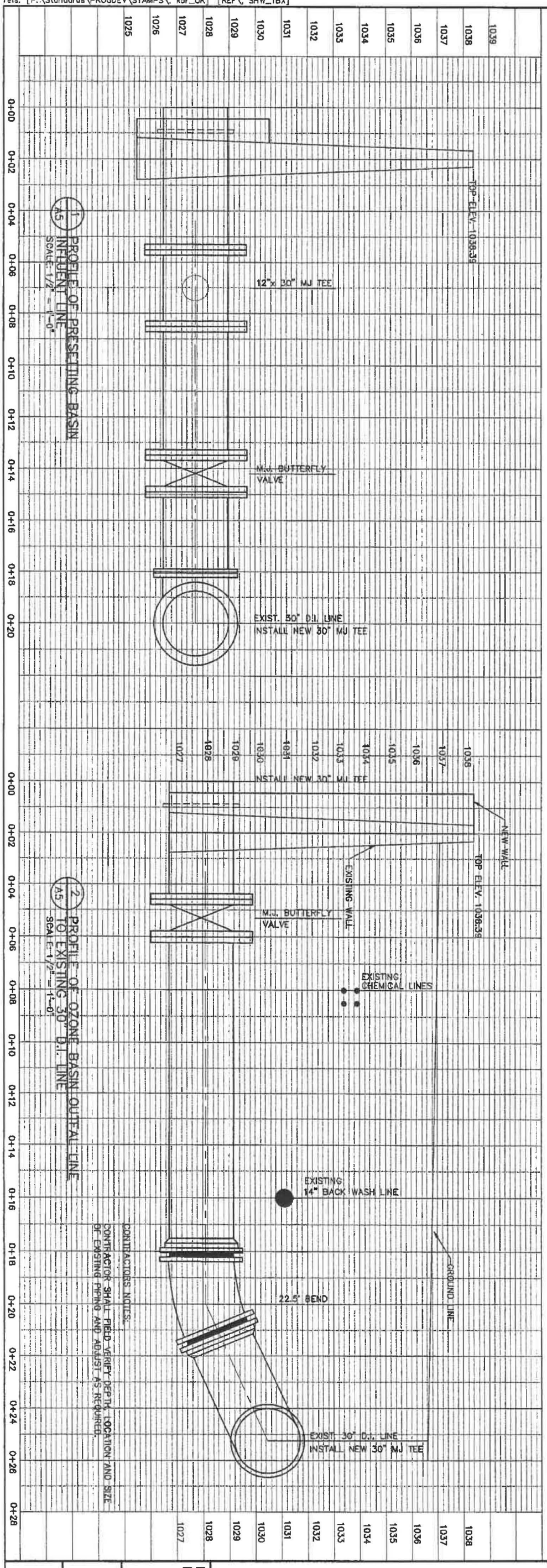
GRADING PLAN

Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RNF

Sheet Number
A4

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1 A5 PROFILE OF PRESETTING BASIN INFLUENT LINE
SCALE: 1/2" = 1'-0"

2 A5 PROFILE OF OZONE BASIN OUTFALL LINE TO EXISTING 30" D.I. LINE
SCALE: 1/2" = 1'-0"

PIPING PROFILES

Job No. 02011280
Date: APRIL 2003
Designed by: SJG
Drawn by: RDR

Sheet Number
A5

CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

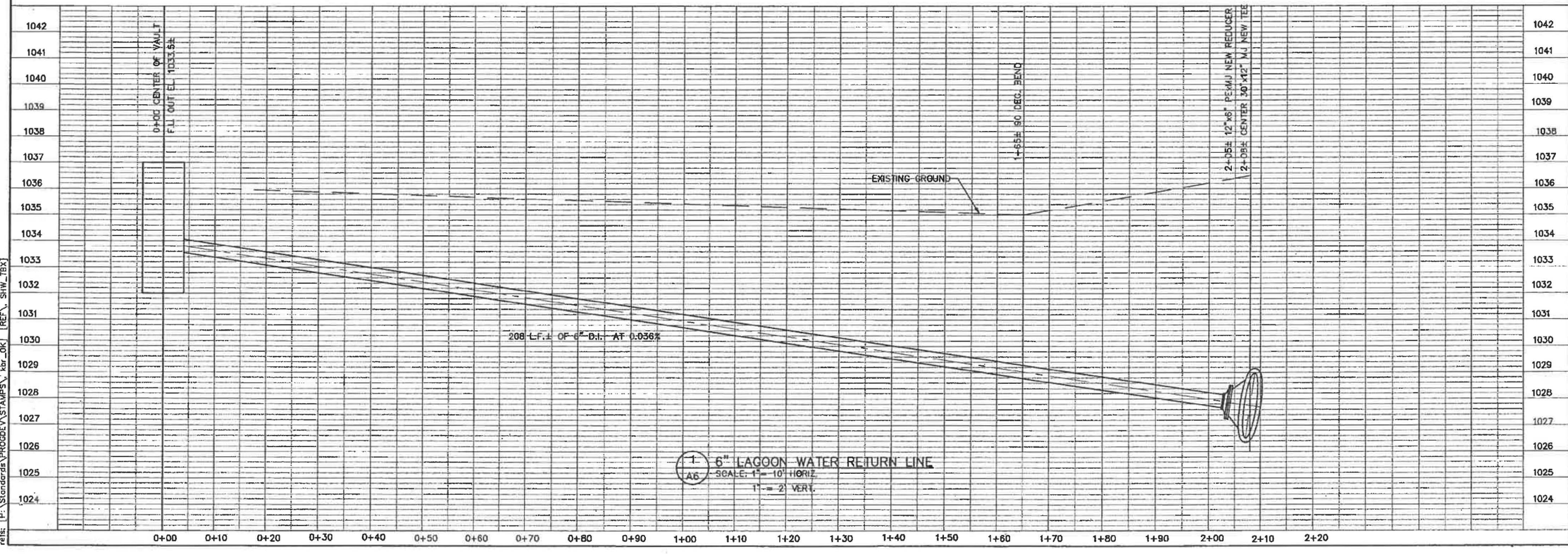
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

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OKLAHOMA
10702

CONTRACTORS NOTES:

CONTRACTOR SHALL FIELD VERIFY DEPTH, LOCATION AND SIZE OF EXISTING PIPING AND ADJUST AS REQUIRED.



1 / A6 6" LAGOON WATER RETURN LINE
SCALE: 1"= 10' HORIZ.
1"= 2' VERT.

REGISTERED PROFESSIONAL ENGINEER OKLAHOMA
Jason Garland
19702
4-14-03

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SHAWNEE, OKLAHOMA

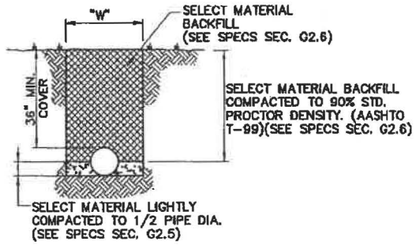
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PIPING
PROFILES II

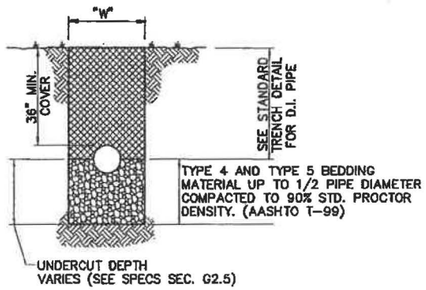
Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RDR

Sheet Number
A6

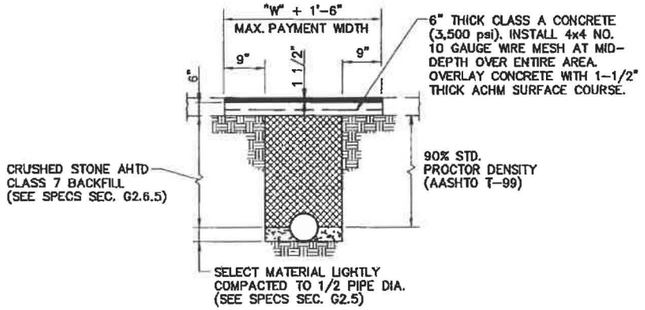
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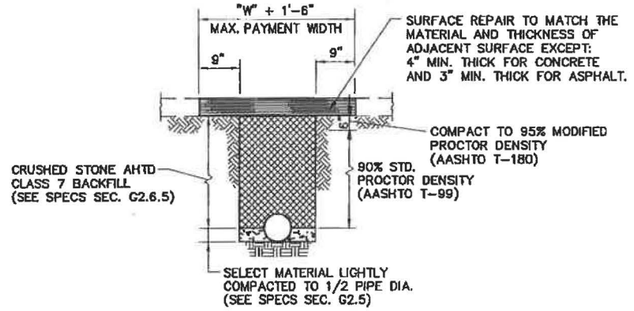
1 / A7 STANDARD TRENCH BEDDING DETAIL D.I. PIPE IN NATURAL OR UNSURFACED AREAS
SCALE: N.T.S.



2 / A7 UNDERCUT TRENCH FOR D.I. PIPE
SCALE: NTS



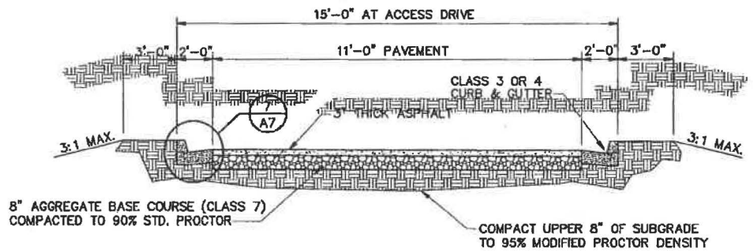
3 / A7 TRENCH DETAIL – TRENCH IN ASPHALT CITY STREETS
SCALE: N.T.S.



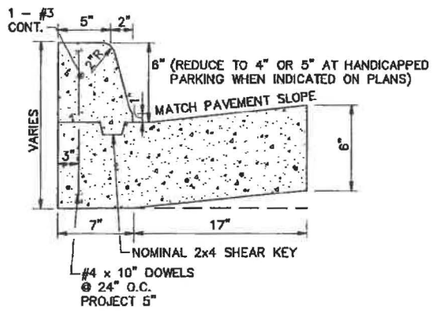
4 / A7 TRENCH DETAIL – TRENCH IN CONCRETE OR ASPHALT SURFACES OTHER THAN CITY STREETS
SCALE: N.T.S.

MAXIMUM PAYMENT WIDTHS	
PIPE DIA.	"W" MAX.
2"	2'-0"
4"	2'-0"
6"	2'-0"
8"	2'-0"
10"	2'-2"
12"	2'-4"

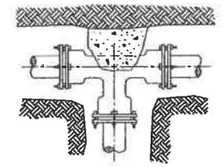
TRENCH WIDTH SCHEDULE



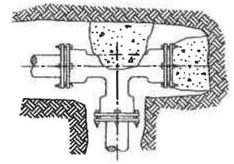
6 / A7 TYPICAL PAVING SECTION – STREET
SCALE: NTS



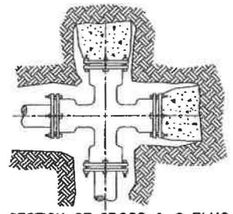
7 / A7 TYPICAL DETAIL – CURB & GUTTER
SCALE: NTS



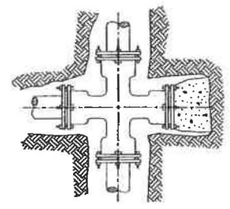
BLOCKING FOR TEE



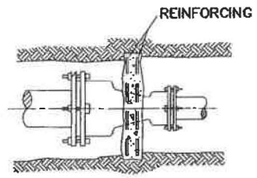
SPECIAL BLOCKING FOR TEE WITH PLUG (WHEN DIRECTED BY ENGINEER)



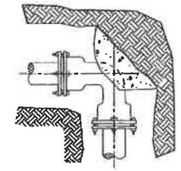
TYPICAL SECTION OF CROSS & 2 PLUG BLOCKING (WHEN DIRECTED BY ENGINEER)



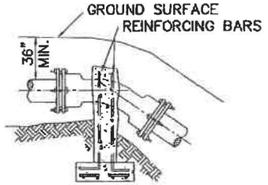
TYPICAL SECTION OF CROSS & BLOCKING (WHEN DIRECTED BY ENGINEER)



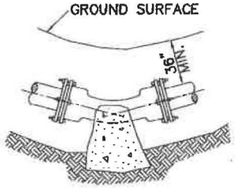
THRUST SUPPORT FOR REDUCER CONNECTION (SIZE TO BE DETERMINED BY ENGINEER)



TYPICAL BLOCKING FOR HORIZONTAL BENDS



TYPICAL BLOCKING FOR VERTICAL BENDS



TYPICAL BLOCKING FOR VERTICAL BENDS

NOTES ON THRUST BLOCKING:

1. ALL BLOCKING SHALL BE AGAINST UNDISTURBED HAND DUG SOIL.
2. WHERE SOIL CONDITIONS MAKE IT NECESSARY TO POUR CONCRETE BLOCKING OVER JOINTS. THE ENDS OF THE ADJACENT PIPES MUST HAVE A KICKER BLOCK TO RESIST MOVEMENT OF THESE JOINTS.
3. WEIGHT CALCULATIONS TO BE BASED ON THRUST DUE TO TEST PRESSURE + 50% THRUST = 2AP SIN 1/2 ø WHERE A = AREA OF PIPE, P = WATER PRESSURE.
4. WHERE BLOCKING OVER PLUG, PLUG SHOULD BE COVERED WITH PAPER TO PREVENT BINDING OF CONCRETE.
5. WHERE SHEAR BECOMES A PROBELM, PROPER REINFORCING MUST BE INSTALLED INTO THE BLOCKING.
6. CLEARANCE SHALL BE A MINIMUM OF 6" BETWEEN PIPE AND ANY OBSTRUCTION.

5 / A7 THRUST BLOCKING DETAILS
SCALE: NONE

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CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PIPING DETAILS I

Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RNF

Sheet Number
A7

Xrefs: [REF_SHW_TBX]
Images: [none]
Xrefs: Shw-Ad1.dwg
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1 / A1 SITE PLAN
SCALE: 1" = 10'

SCALE: 1" = 10'
10 5 0 10 20 30

24" FINISH WATER

CHEMICAL LINES

CHLORINE SOLUTION

BACK WASH TANK

NEW 30" TEE

EXIST. 30" RW

NEW SLEEVE

NEW 30" BUTTERFLY VALVE

NEW 30"x12" TEE

NEW 6" D.I. LINE

NEW 12"x6" REDUCER

NEW ACID FEED LINE

NEW 2" COPPER

NEW 6" D.I. LINE

30" RW

6 LINES (PY, AL, GR, CS, CLG, CLG)

NEW 6" LAGOON RETURN LINE

6" D.I.

OZONE CONTACT CHAMBER & BUILDING

4 LINES (PY, LS, GR, AL)

30" RW

EXISTING 12"

NEW SLEEVE

NEW 12" x 2" SADDLE TAP WITH VALVE BOX

NEW 30" TEE

NEW 30" BUTTERFLY VALVE

NEW OUTFALL PIPE

DRAIN LINE

14" BW

20" BW

PRETREATMENT BASIN

REGISTERED PROFESSIONAL ENGINEER
Jeffrey B. Rowland
10702
OKLAHOMA
4-14-03

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CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

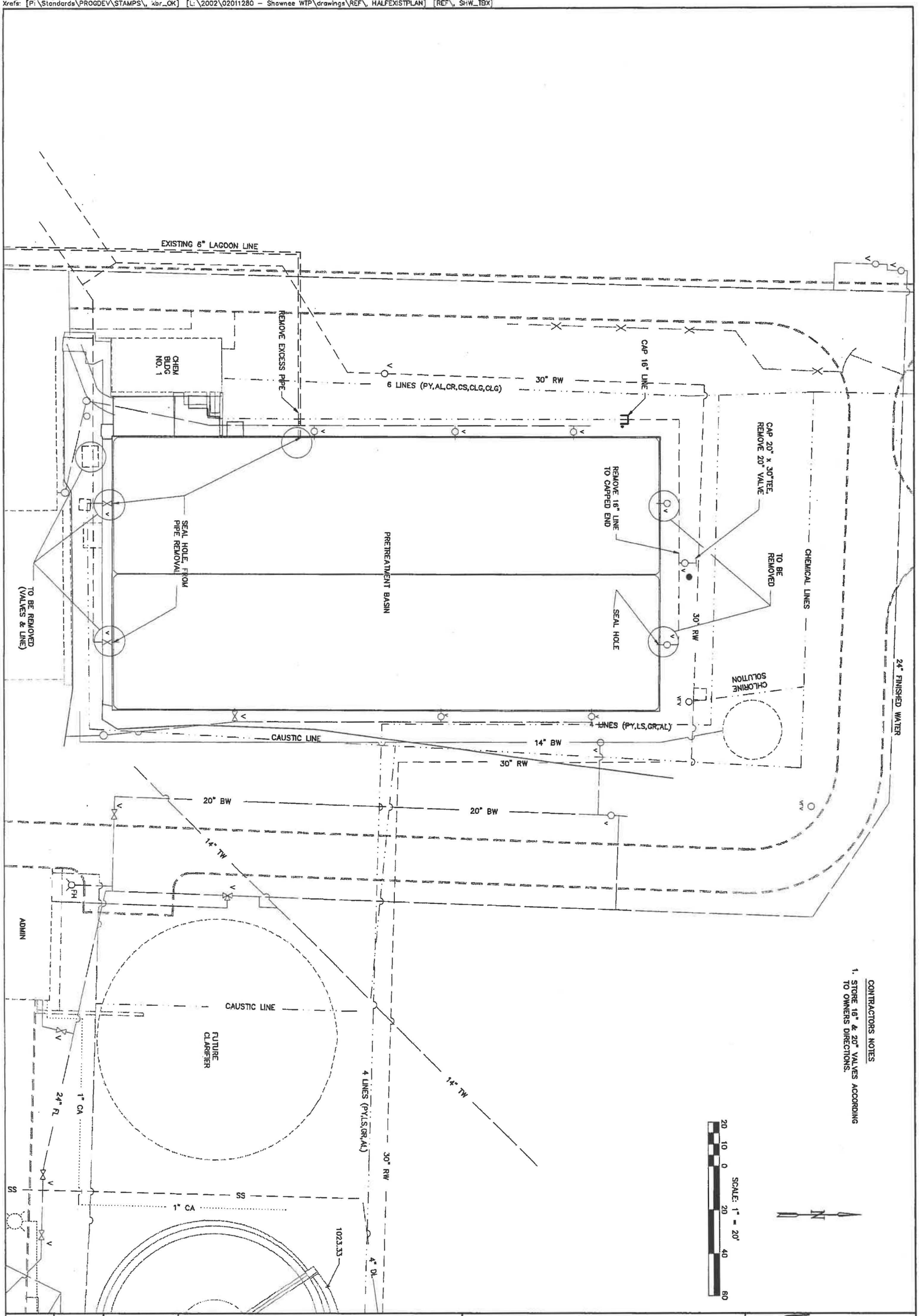
ENLARGED SITE PLAN

Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RNF

Sheet Number
A8

rdross shw-cdl8.dwg L:\2002\02011280 - Shawnee WTP\drawings\ 34x22 1=10 4/14/03 2:41 pm
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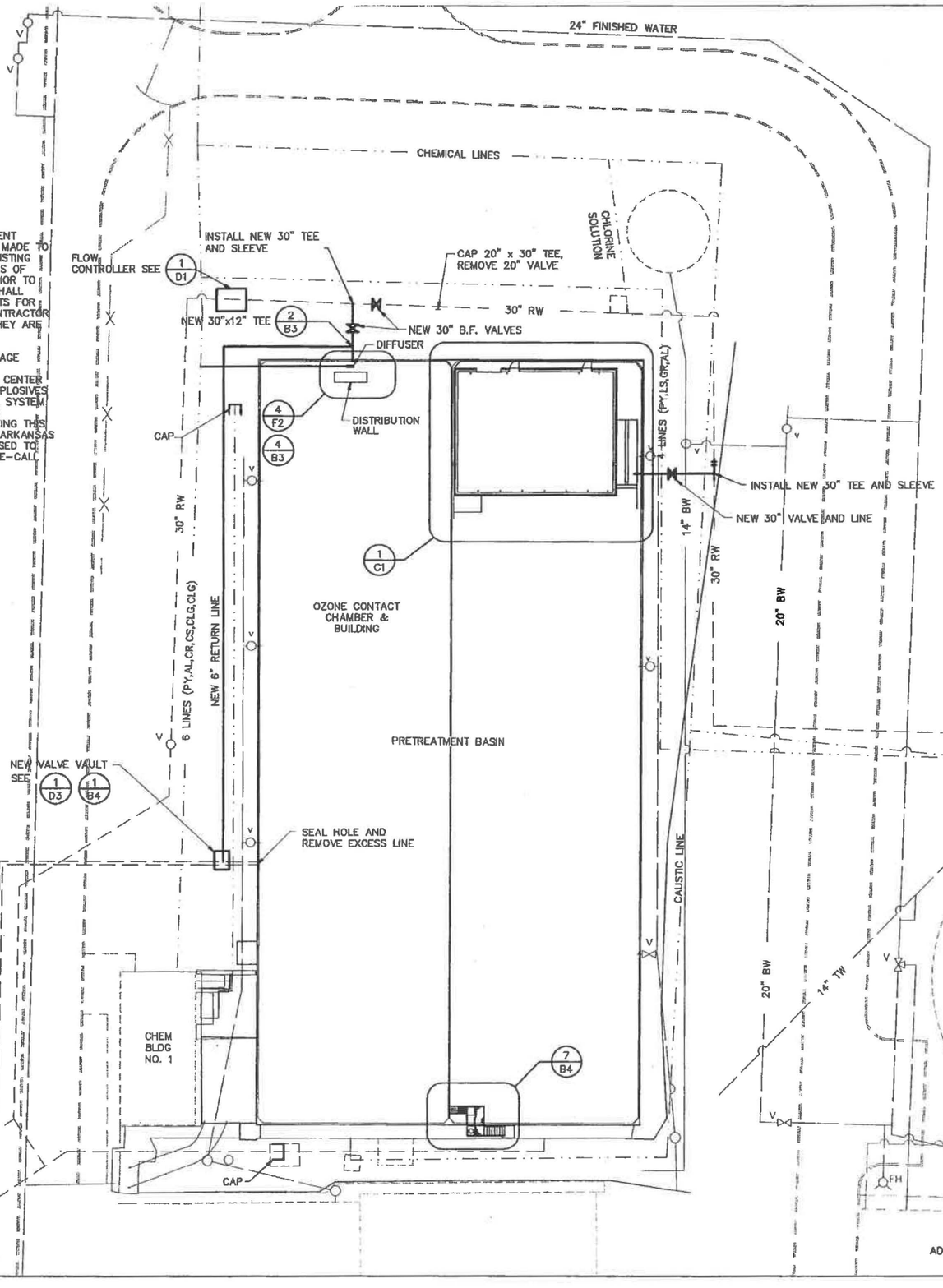


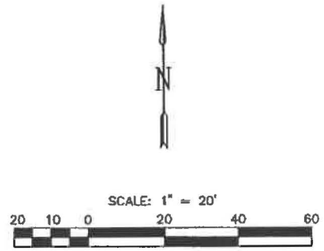
Sheet Number **B1**	Job No. 02011280 Date: APRIL, 2003 Designed by: SJG Drawn by: RDR	PRESETTLING BASIN DEMOLITION PLAN	CITY OF SHAWNEE SHAWNEE, OKLAHOMA PHASE II WATER TREATMENT PLANT IMPROVEMENTS	**GARVER | ENGINEERS** *"Engineers Since 1919"* 1010 BATTERY STREET • LITTLE ROCK, ARKANSAS 72202 (501) 376-3833 www.garverinc.com	REGISTERED PROFESSIONAL ENGINEER OKLAHOMA 19702 4-14-03

CONTRACTORS NOTES:

1. CONTRACTOR SHALL TIE INTO EXISTING STAINLESS STEEL CHEMICAL LINE TO A NEW 1" – 316 STAINLESS STEEL SULFURIC ACID FEED LINE.
2. NEW FLOW CONTROL VAULT SHALL BE IN SERVICE BEFORE PRETREATMENT BASIN IS TAKEN OUT OF SERVICE.
3. CAUTION: UNDERGROUND UTILITIES ARE WITHIN AND ADJACENT TO THE LIMITS OF CONSTRUCTION. AN ATTEMPT HAS BEEN MADE TO LOCATE THESE UTILITIES ON THE PLANS. HOWEVER, ALL EXISTING UTILITIES MAY NOT BE SHOWN, AND THE ACTUAL LOCATIONS OF THE UTILITIES MAY VARY FROM THE LOCATIONS SHOWN. PRIOR TO BEGINNING ANY TYPE OF EXCAVATION, THE CONTRACTOR SHALL CONTACT THE UTILITIES INVOLVED AND MAKE ARRANGEMENTS FOR THE LOCATION OF THE UTILITIES ON THE GROUND. THE CONTRACTOR SHALL MAINTAIN THE UTILITY LOCATION MARKINGS UNTIL THEY ARE NO LONGER NECESSARY.

   ARKANSAS STATE LAW, THE UNDERGROUND FACILITIES DAMAGE PREVENTION ACT, REQUIRES TWO WORKING DAYS ADVANCE NOTIFICATION THROUGH THE ARKANSAS ONE-CALL SYSTEM CENTER BEFORE EXCAVATING USING MECHANIZED EQUIPMENT OR EXPLOSIVES (EXCEPT IN THE CASE OF AN EMERGENCY). THE ONE-CALL SYSTEM PHONE NUMBER IS 1-800-482-8998. THE CONTRACTOR IS ADVISED THAT THERE IS A SEVERE PENALTY FOR NOT MAKING THIS CALL. NOT ALL UTILITY COMPANIES ARE MEMBERS OF THE ARKANSAS ONE-CALL SYSTEM; THEREFORE, THE CONTRACTOR IS ADVISED TO CONTACT ALL NON-MEMBER UTILITIES AS WELL AS THE ONE-CALL SYSTEM.





REGISTERED PROFESSIONAL ENGINEER
Kirby B. Garver
Maryland
20702
OKLAHOMA
4-14-03

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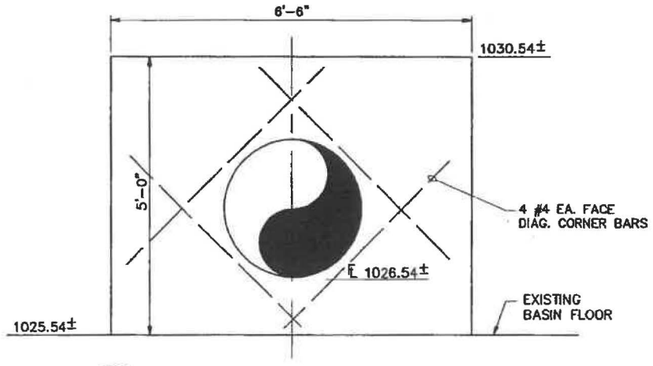
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PRESETTLING BASIN MODIFICATIONS PLAN

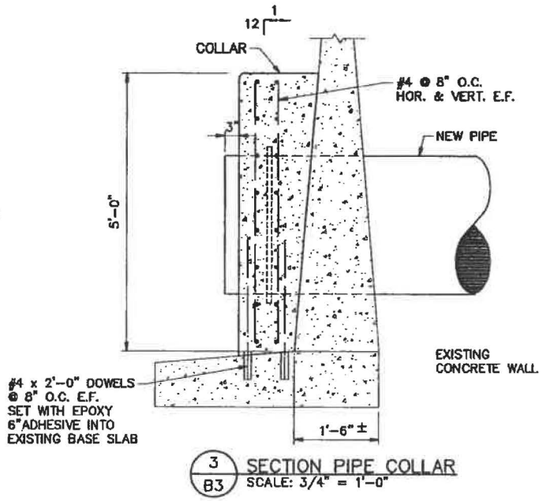
Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RNF

Sheet Number
B2

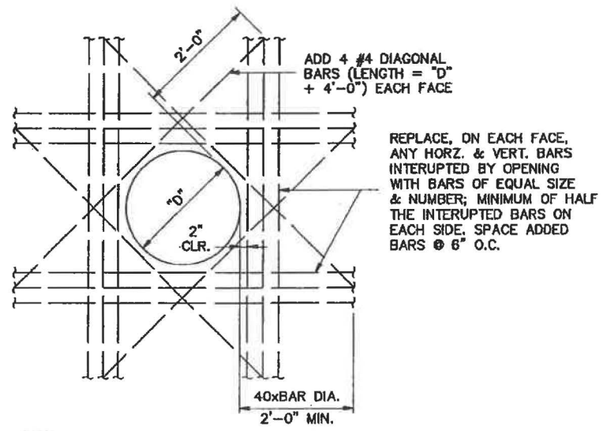
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Shw-B02.dwg L:\2002\02011280 - Shawnee WTP\drawings\ 34x22 1=20 4/14/03 3:01 pm



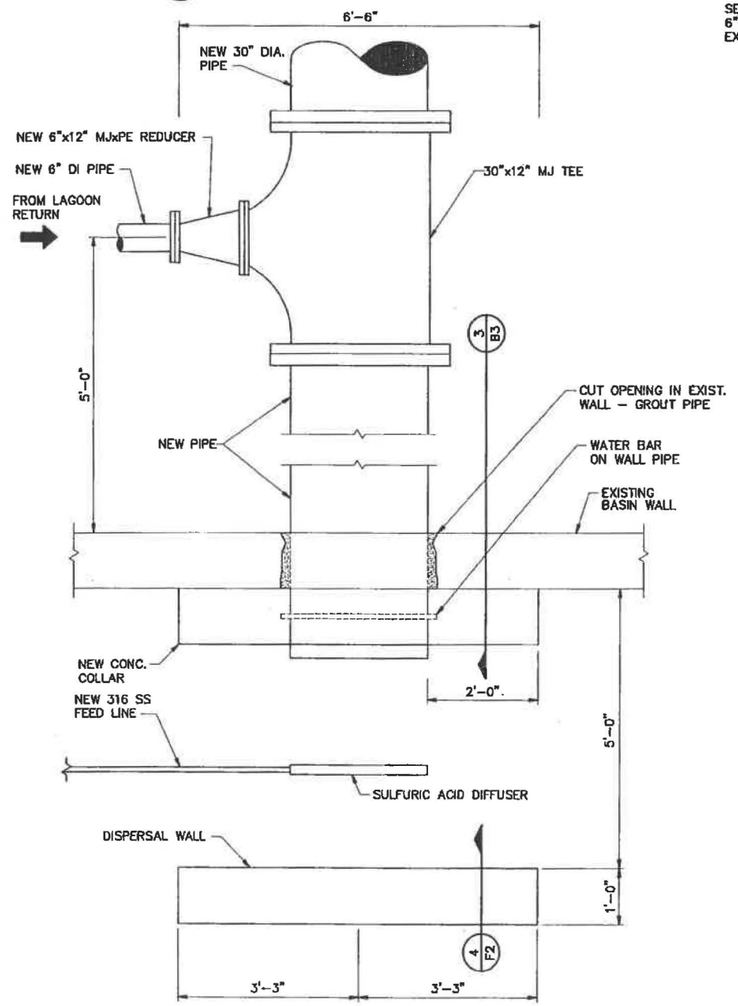
1/B3 SETTLING BASIN INFLUENT PROFILE
SCALE: 3/4" = 1'-0"



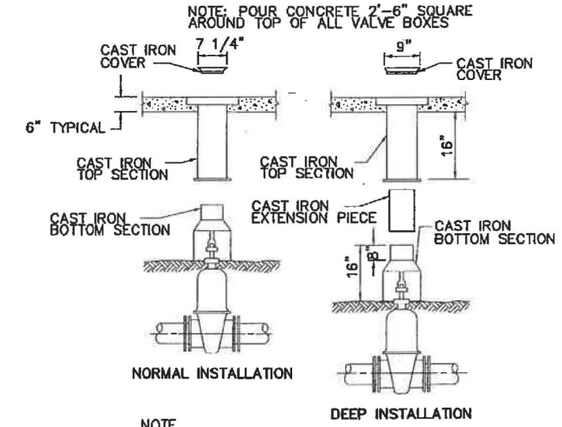
3/B3 SECTION PIPE COLLAR
SCALE: 3/4" = 1'-0"



4/B3 ADDED REINF. @ ROUND OPENING IN WALL OR SLAB
SCALE: 3/8" = 1'-0"



2/B3 SETTLING BASIN INFLUENT PLAN
SCALE: 3/4" = 1'-0"



NOTE
EXTENSION PIECE CAN BE CUT TO LENGTH REQUIRED WITH HANDSAW

5/B3 VALVE BOX INSTALLATION
SCALE: NONE

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REGISTERED PROFESSIONAL ENGINEER
Richard Garland
21702
OKLAHOMA
4-14-03

CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

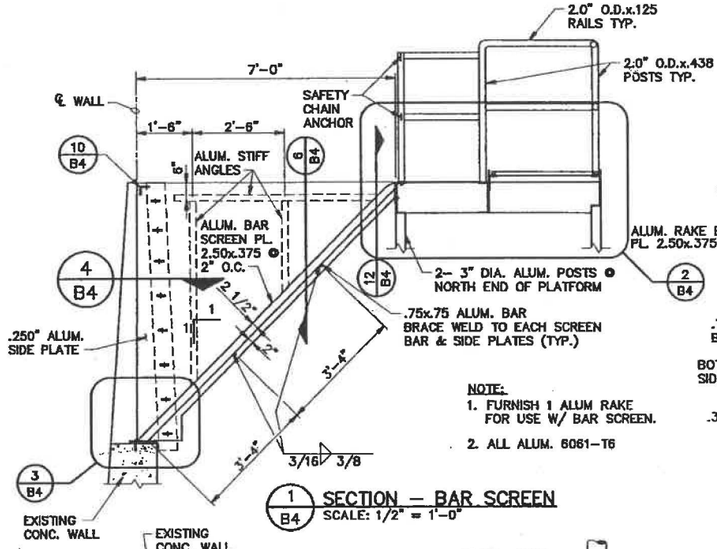
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PRESETTLING BASIN DETAILS

Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RJS

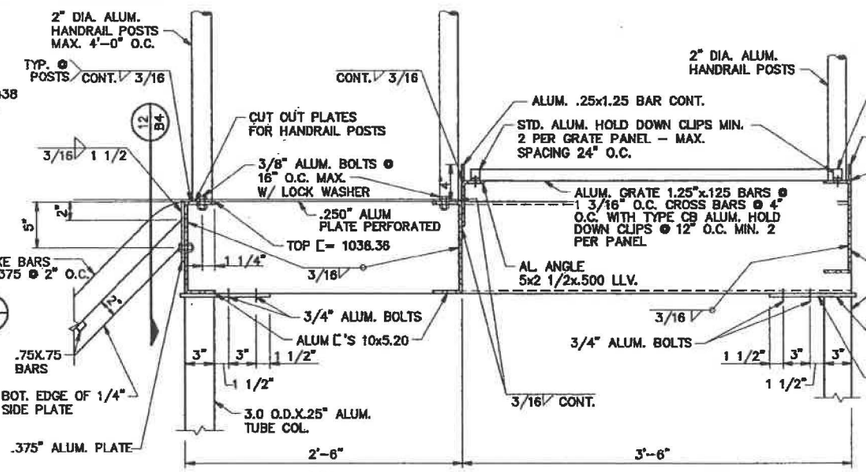
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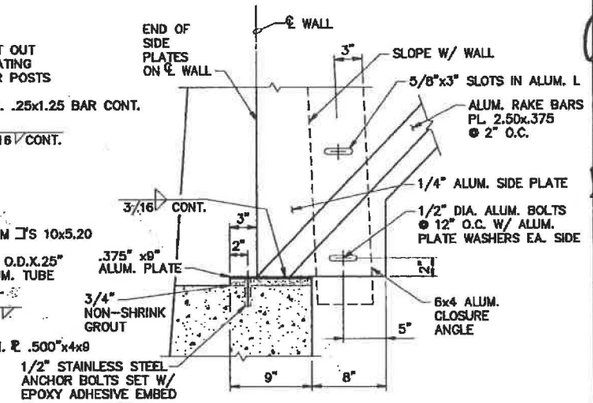


NOTE:
1. FURNISH 1 ALUM RAKE FOR USE W/ BAR SCREEN.
2. ALL ALUM. 6061–T6

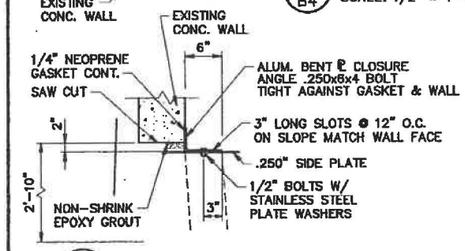
1 / B4 SECTION – BAR SCREEN
SCALE: 1/2" = 1'-0"



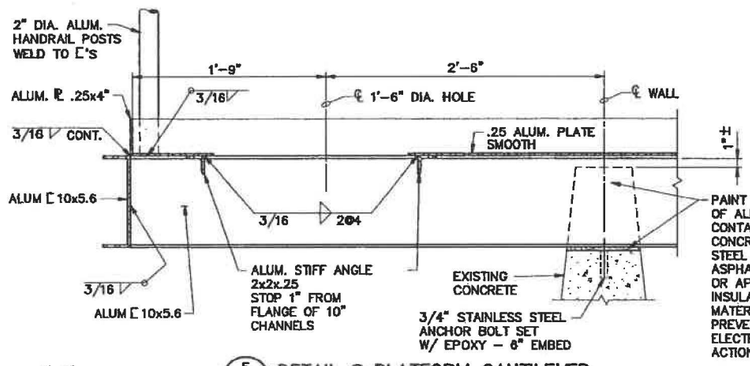
2 / B4 SECTION THRU PLATFORM
SCALE: 1 1/2" = 1'-0"



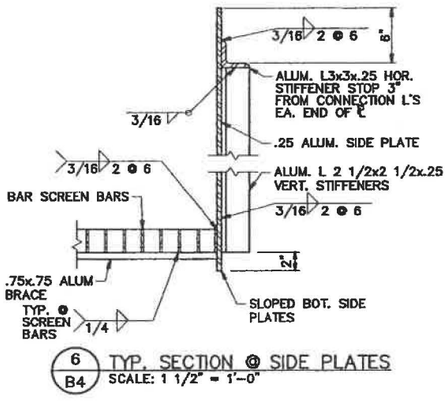
3 / B4 CONN. DETAIL SCREEN @ EXIST. WALL
SCALE: 1 1/2" = 1'-0"



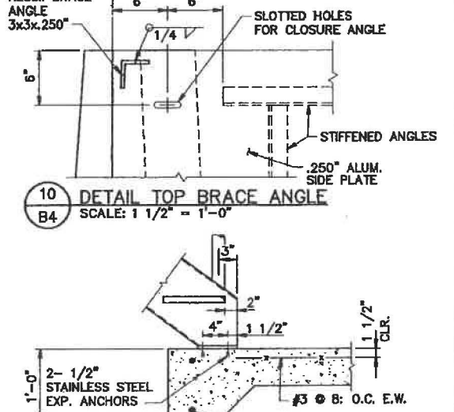
4 / B4 SECTION – CLOSURE ANGLE
SCALE: 3/4" = 1'-0"



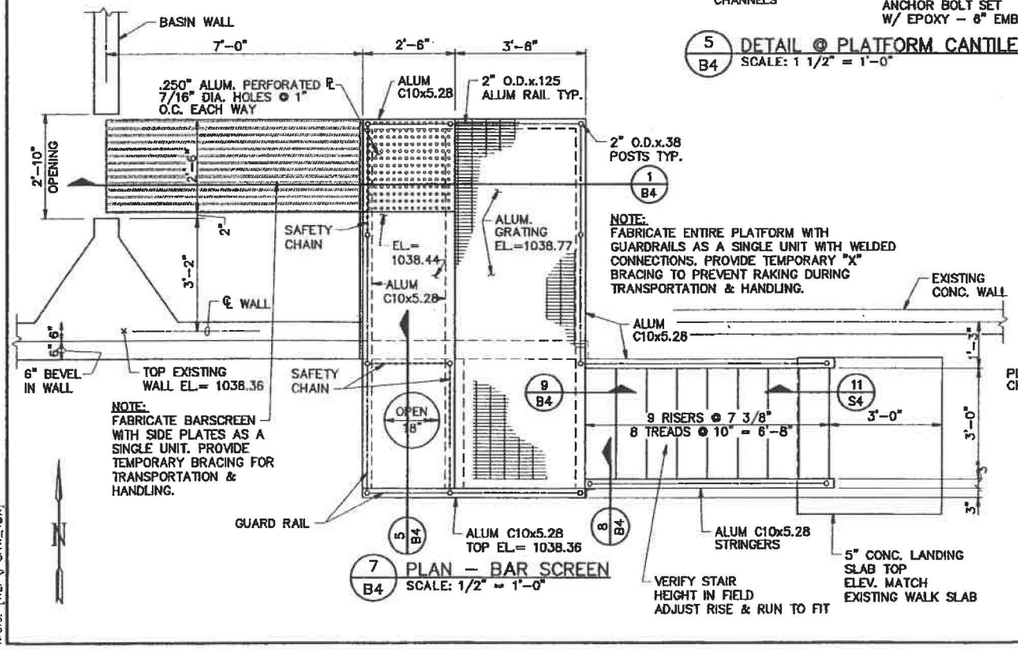
5 / B4 DETAIL @ PLATFORM CANTILEVER
SCALE: 1 1/2" = 1'-0"



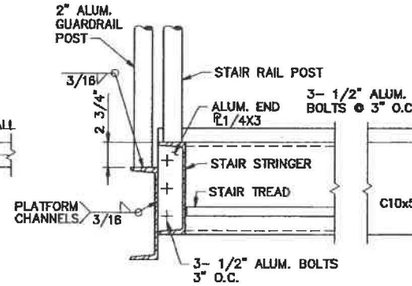
6 / B4 TYP. SECTION @ SIDE PLATES
SCALE: 1 1/2" = 1'-0"



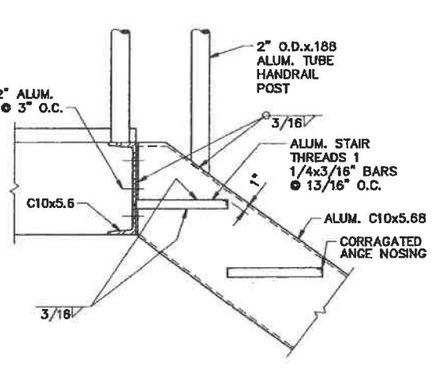
10 / B4 DETAIL TOP BRACE ANGLE
SCALE: 1 1/2" = 1'-0"



7 / B4 PLAN – BAR SCREEN
SCALE: 1/2" = 1'-0"

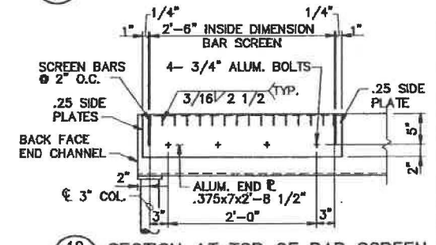


8 / B4 CONN. DETAIL OUTSIDE CORNER @ STAIR STRINGER
SCALE: 1 1/2" = 1'-0"

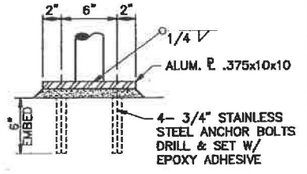


9 / B4 CONN. DETAIL STAIR STRINGER TO PLATFORM
SCALE: 1 1/2" = 1'-0"

11 / B4 DETAIL STAIR LANDING
SCALE: 1" = 1'-0"



12 / B4 SECTION AT TOP OF BAR SCREEN
SCALE: 1" = 1'-0"



13 / B4 BASE PLATE DETAIL 3" ALUM. COL.
SCALE: 1 1/2" = 1'-0"

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REGISTERED PROFESSIONAL ENGINEER
J. T. McMILLIN, III
17426
OKLAHOMA
4-14-03

REGISTERED PROFESSIONAL ENGINEER
R. R. [illegible]
20702
OKLAHOMA

CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

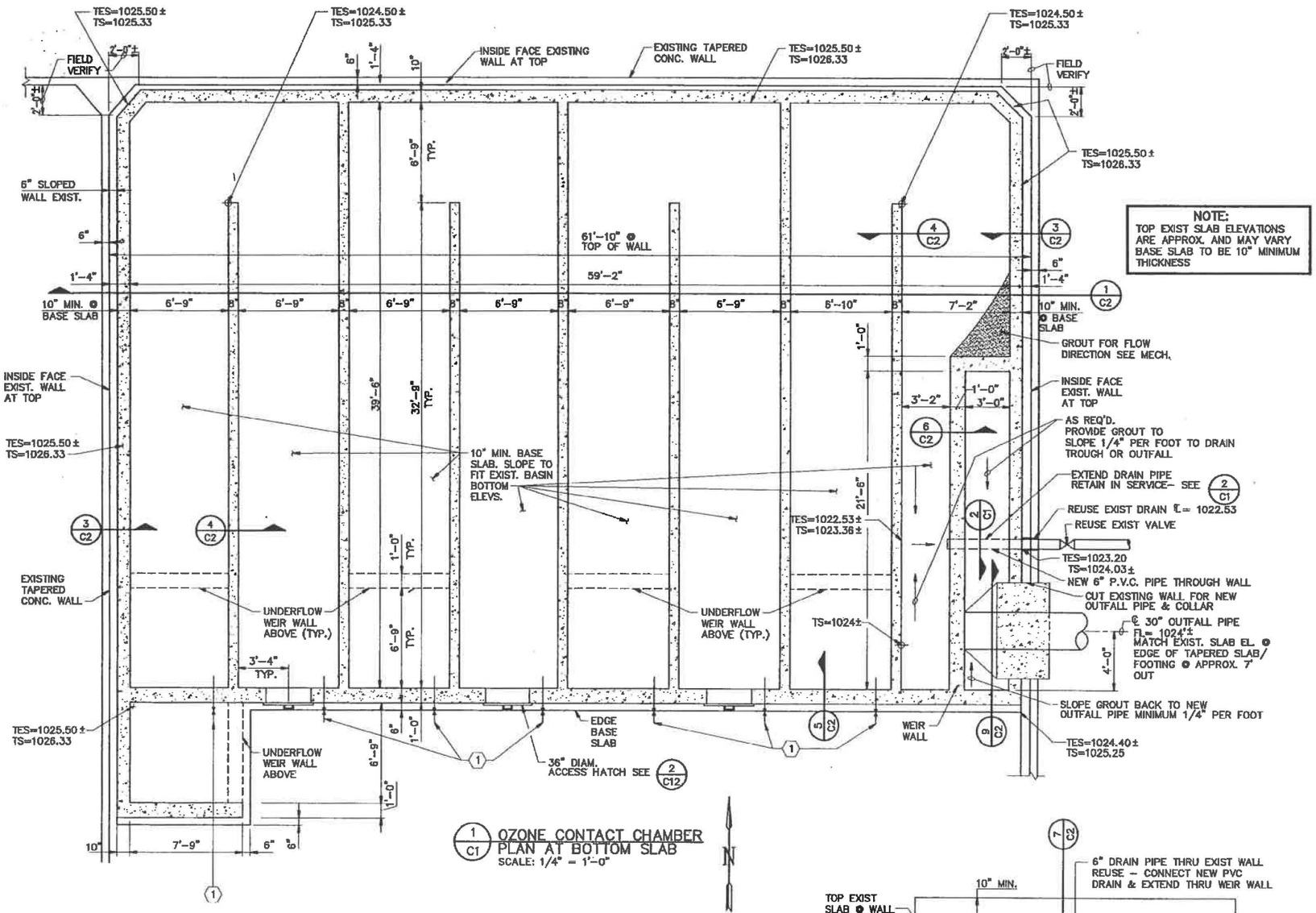
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PRESETTLING BASIN
BAR SCREEN
PLAN AND SECTION

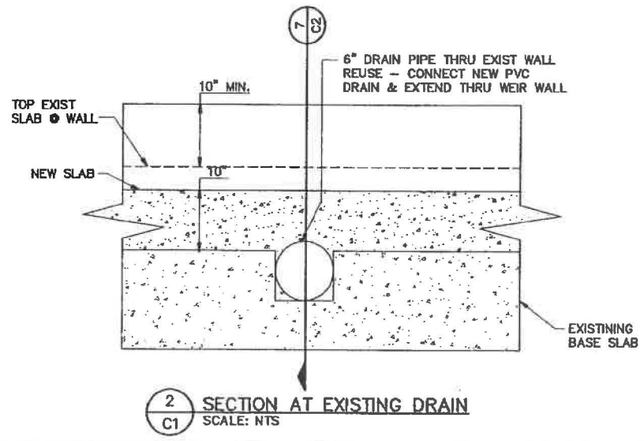
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Date: APRIL, 2003
Designed by: SJG
Drawn by: RNF

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X-refs: [REF_SHW_TBX]



1/C1 OZONE CONTACT CHAMBER PLAN AT BOTTOM SLAB
SCALE: 1/4" = 1'-0"



2/C1 SECTION AT EXISTING DRAIN
SCALE: NTS

T.E.S. = TOP EXISTING SLAB ELEV.
T.S. = TOP NEW SLAB ELEV.
T.W. = TOP NEW WALL ELEV.
T.E.W. = TOP EXISTING WALL ELEV.
T.G. = TOP GROUT ELEV.

KEYED NOTES:
(1) 4" ST. STL. DRAIN WITH ST. STL. GATE VALVE. EXTEND VALVE OPERATOR STEM UP THROUGH CONTACT CHAMBER TOP SLAB WITH OPERATOR.

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REGISTERED PROFESSIONAL ENGINEER OKLAHOMA A. I. MCMILLIN, III 17426
4-14-03

CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

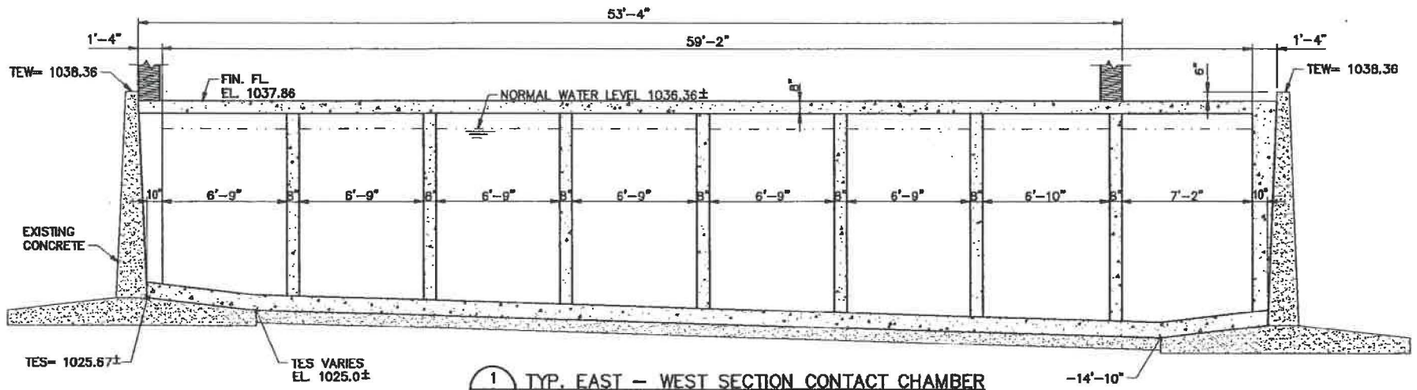
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE CONTACT CHAMBER PLAN & BASE SLAB

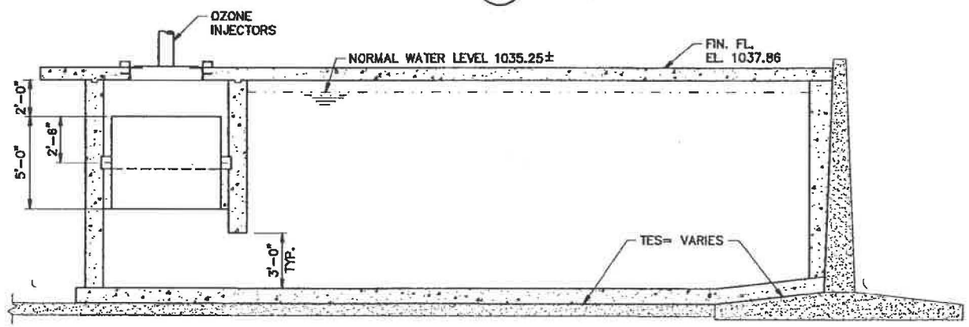
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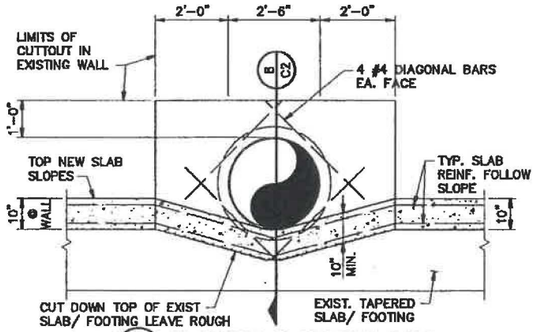
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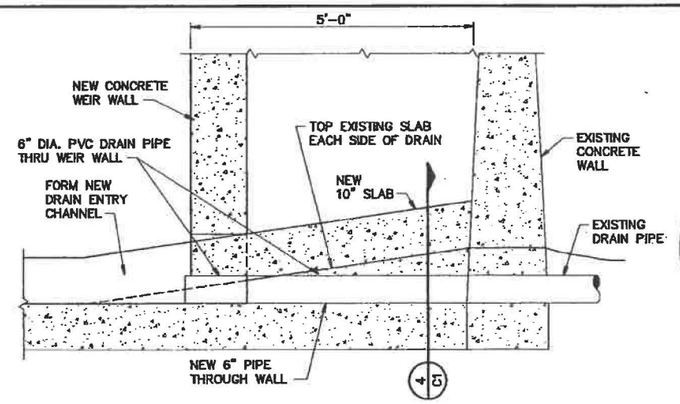
1 / C2 TYP. EAST – WEST SECTION CONTACT CHAMBER
SCALE: 1/4" = 1'-0"



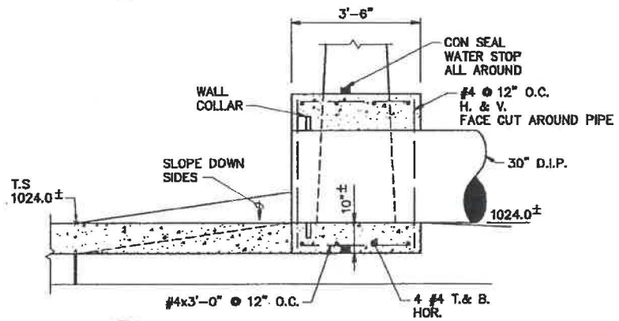
2 / C2 TYP. NORTH – SOUTH SECTION CONTACT CHAMBER
SCALE: 1/4" = 1'-0"



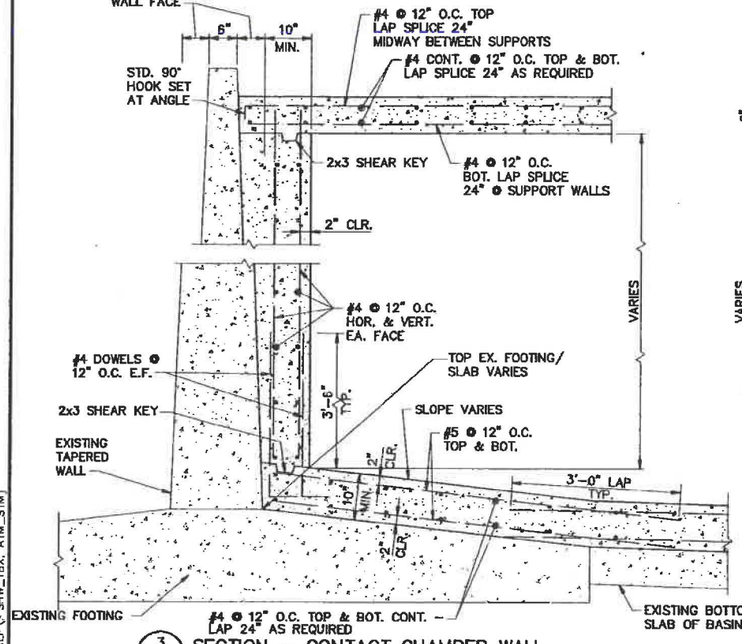
9 / C2 ELEVATION @ OUTFALL PIPE
SCALE: 3/4" = 1'-0"



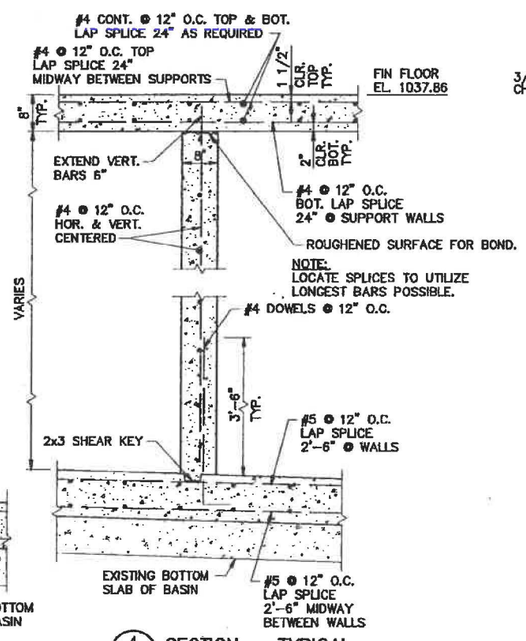
7 / C2 SECTION THRU EFFLUENT DRAIN
SCALE: 3/4" = 1'-0"



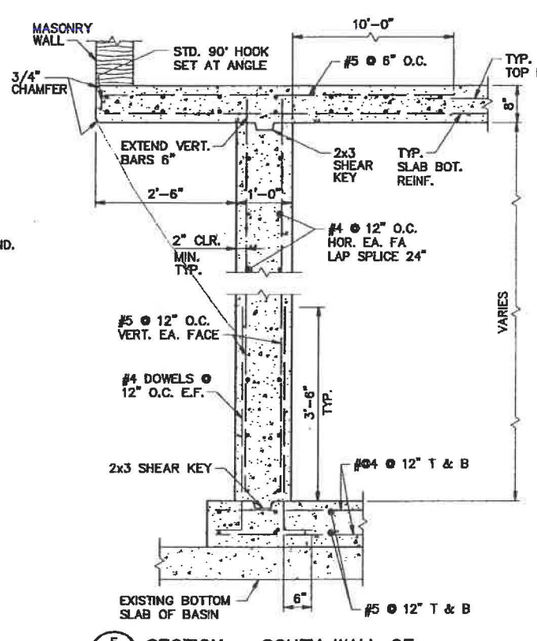
8 / C2 SECTION @ NEW OUTFALL PIPE
SCALE: 1/2" = 1'-0"



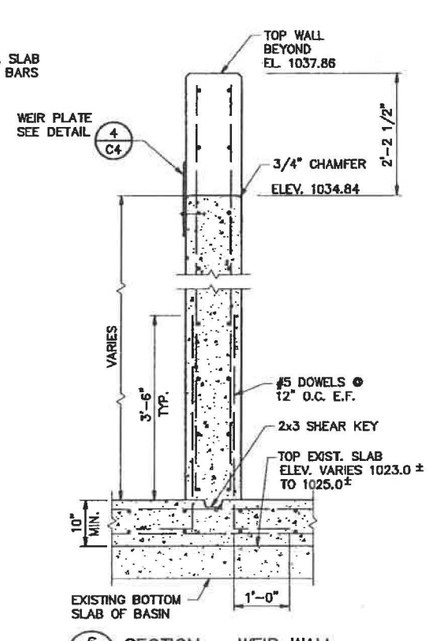
3 / C2 SECTION – CONTACT CHAMBER WALL AT EXIST BASIN WALL
SCALE: 3/4" = 1'-0"



4 / C2 SECTION – TYPICAL INTERIOR CHAMBER WALL
SCALE: 3/4" = 1'-0"



5 / C2 SECTION – SOUTH WALL OF CONTACT CHAMBER
SCALE: 3/4" = 1'-0"



6 / C2 SECTION – WEIR WALL
SCALE: 3/4" = 1'-0"

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REGISTERED PROFESSIONAL ENGINEER
R. J. MCMILLIN, III
17428
OKLAHOMA
4-14-03

CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

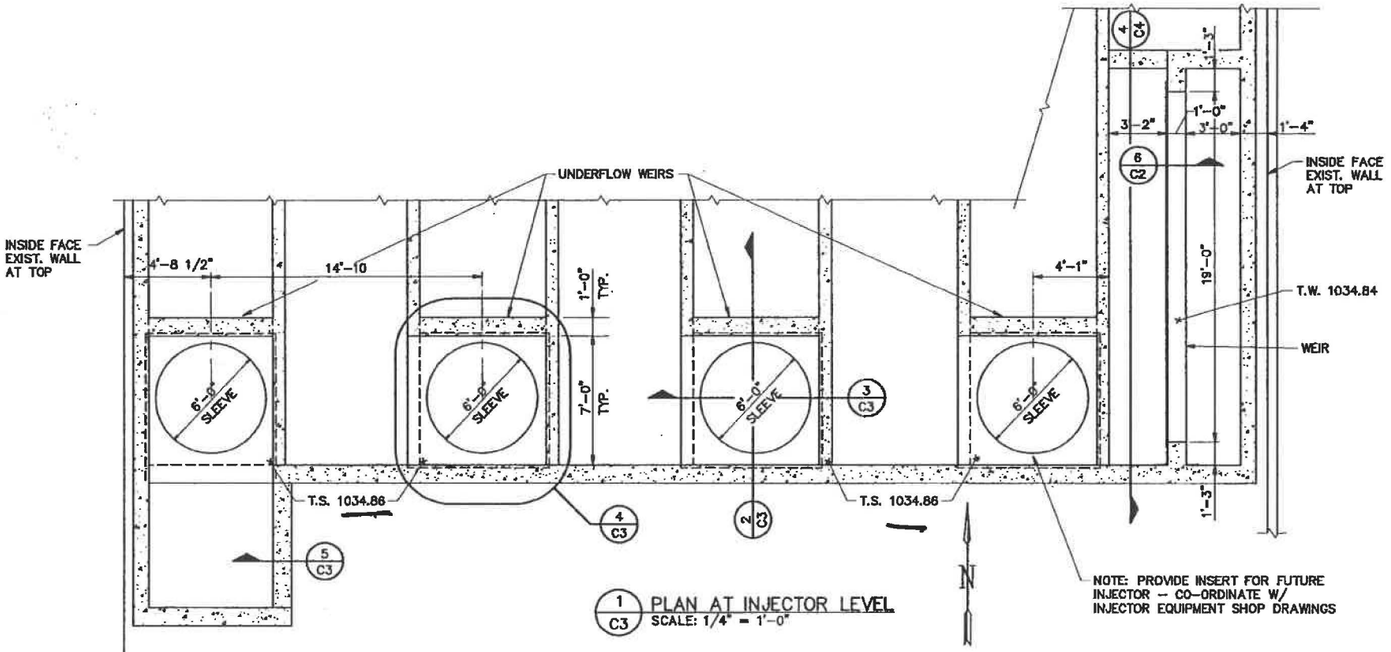
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE
CONTACT
CHAMBER
SECTIONS

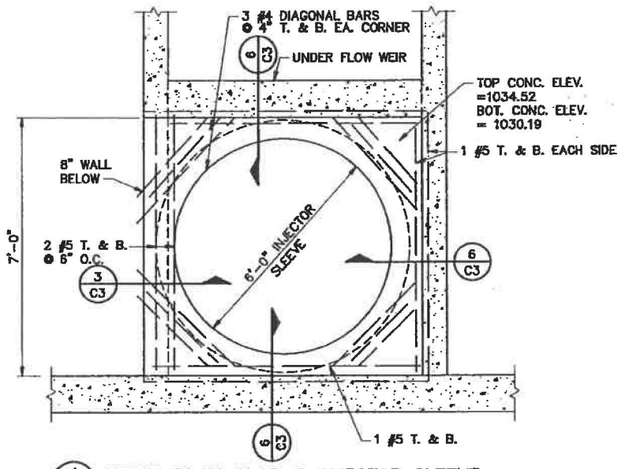
Job No. 02011280
Date: APRIL, 2003
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Drawn by: RJS

Sheet Number
C2

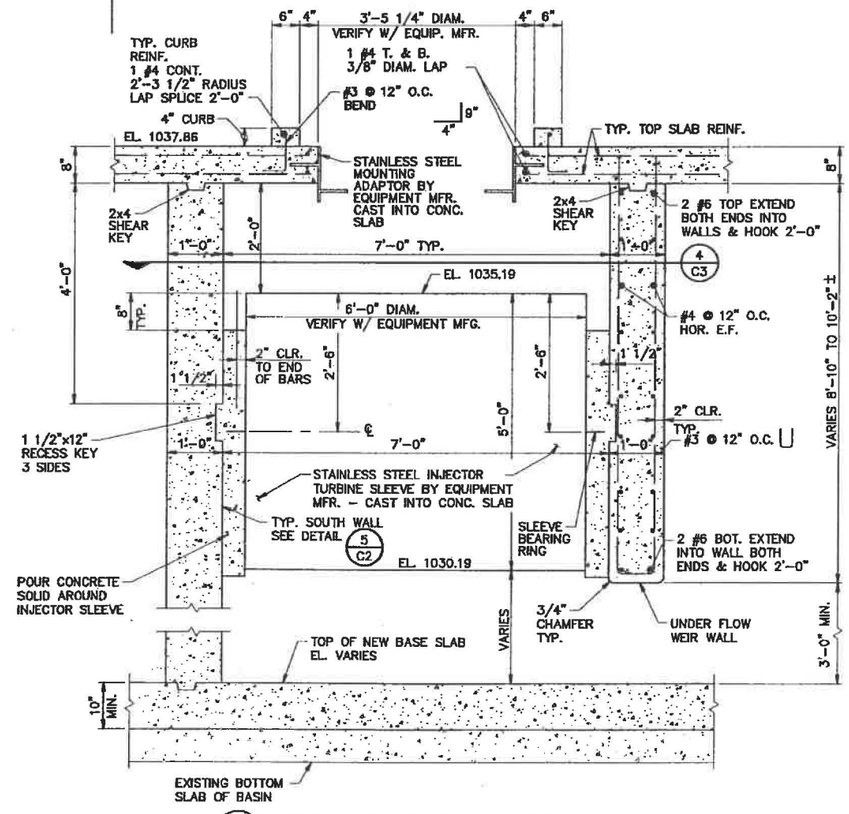
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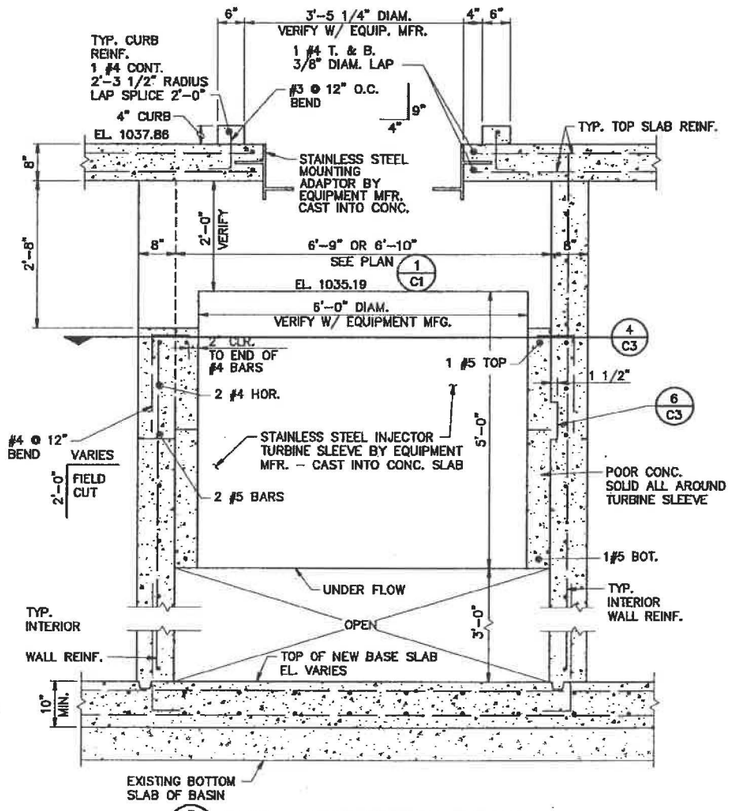
1 / C3 PLAN AT INJECTOR LEVEL
SCALE: 1/4" = 1'-0"



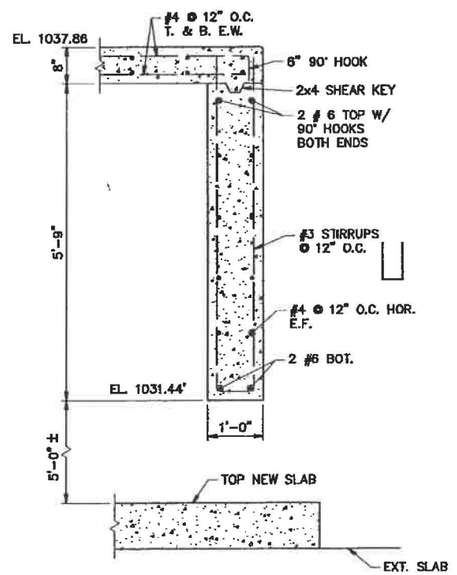
4 / C3 REINF. PLAN SLAB @ INJECTOR SLEEVE
SCALE: 1/2" = 1'-0"



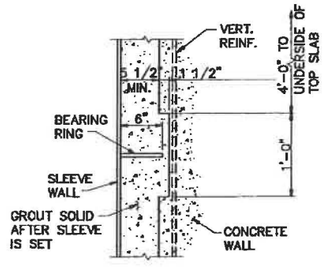
2 / C3 NORTH -- SOUTH SECTION THROUGH INJECTOR CHAMBER
SCALE: 3/4" = 1'-0"



3 / C3 EAST -- WEST SECTION THROUGH INJECTOR CHAMBER
SCALE: 3/4" = 1'-0"



5 / C3 SECTION @ ENTRY UNDER FLOW WEIR
SCALE: 3/4" = 1'-0"



6 / C3 DETAIL BEARING RING AND KEYWAY @ WALLS
SCALE: 1 1/2" = 1'-0"

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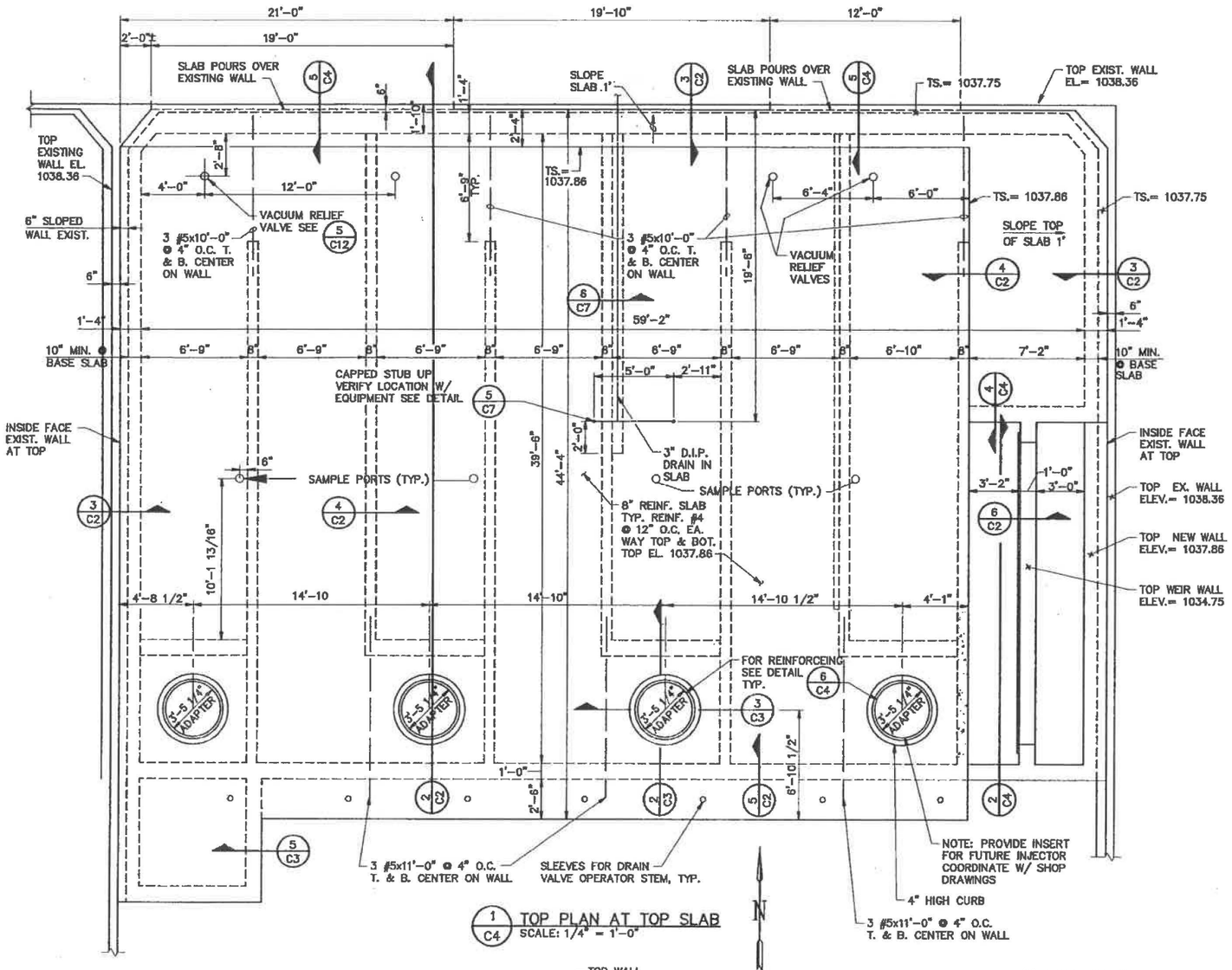
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE CONTACT CHAMBER PLAN & SECTIONS & INJECTOR LEVEL

Job No. 02011280
Date: APRIL, 2003
Designed by: ATM
Drawn by: RDR

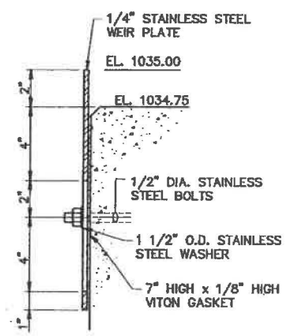
Sheet Number
C3

rjelkins Shw-C03.dwg L:\2002\02011280 - Shawnee WTP\drawings\ 34X22 1=16 4/14/2003 1:24 pm
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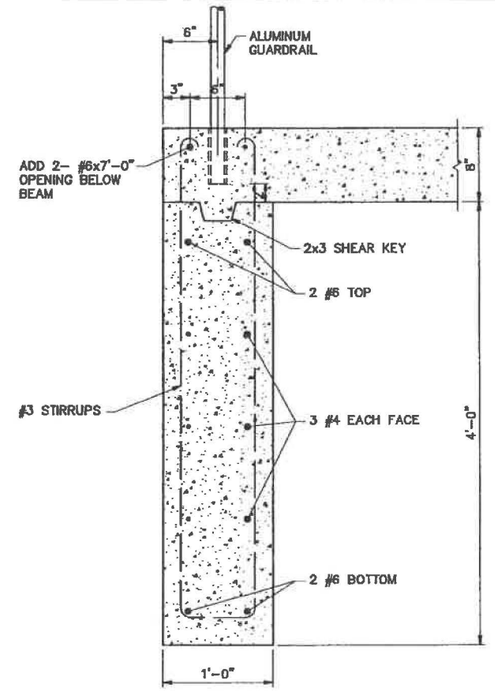


1/C4 TOP PLAN AT TOP SLAB
SCALE: 1/4" = 1'-0"

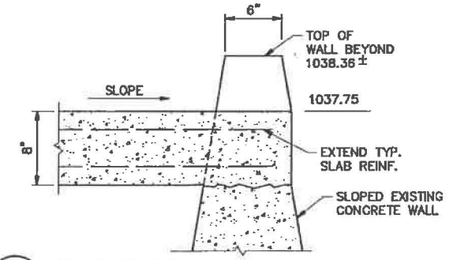
2/C4 ELEVATION DETAIL OF BASIN OUTFALL WEIR
SCALE: 3/4" = 1'-0"



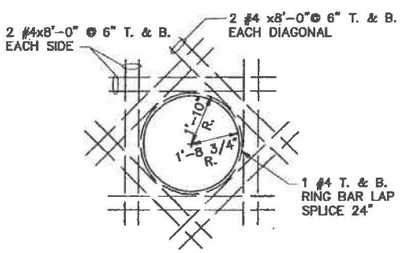
3/C4 OUTFALL WEIR PLATE DETAIL
SCALE: 3" = 1'-0"



4/C4 SECTION @ SLAB EDGE
SCALE: 1 1/2" = 1'-0"



5/C4 DETAIL CUTOUT TOP OF WALL AT DOORWAYS & DRIVE
SCALE: 1 1/2" = 1'-0"



6/C4 TYP. ADDED REINF. — TOP SLAB AT INJECTOR
SCALE: 3/8" = 1'-0"

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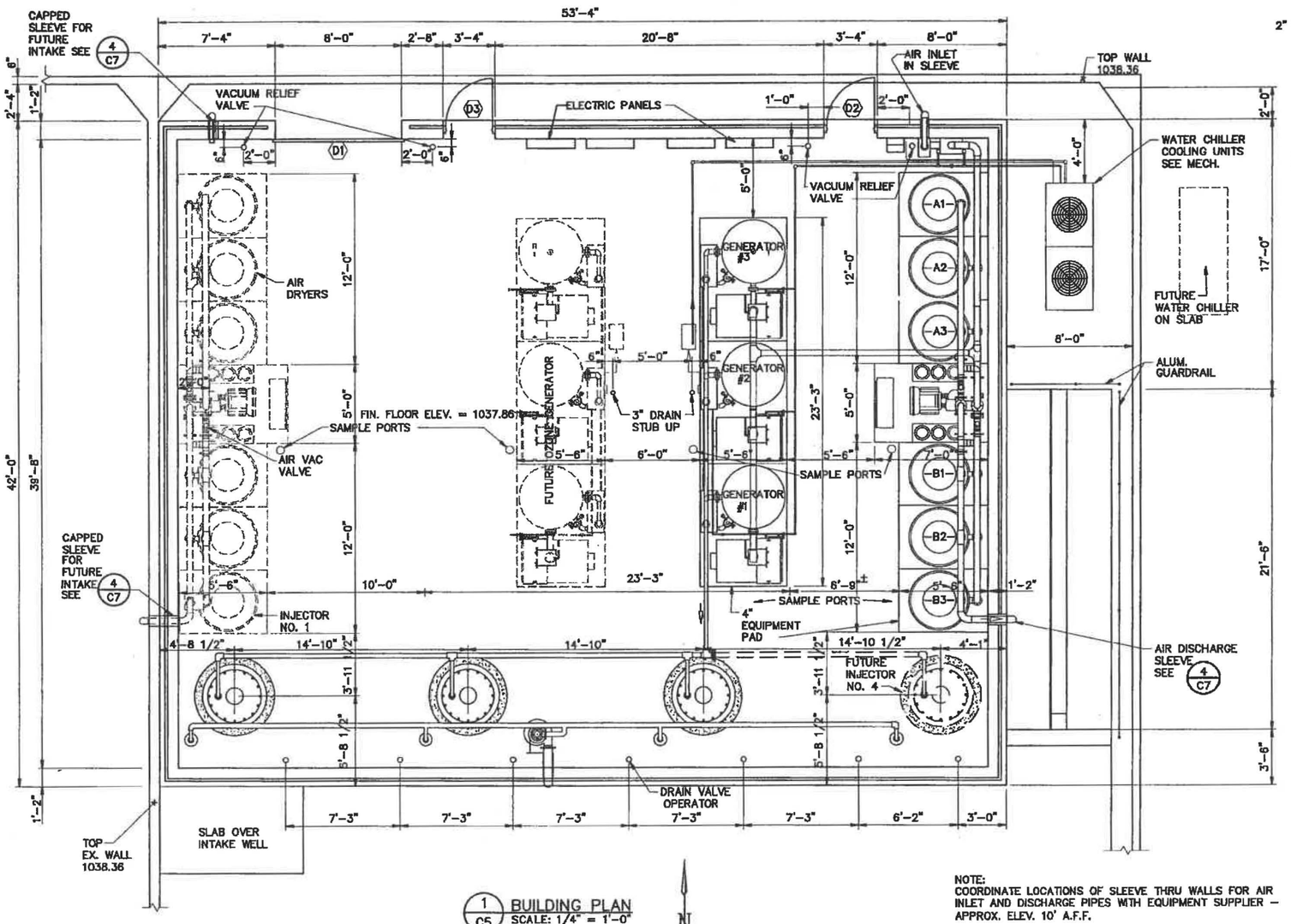
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE CONTACT CHAMBER TOP SLAB PLAN AND DETAILS

Job No. 02011280
Date: APRIL, 2003
Designed by: ATM
Drawn by: RJS

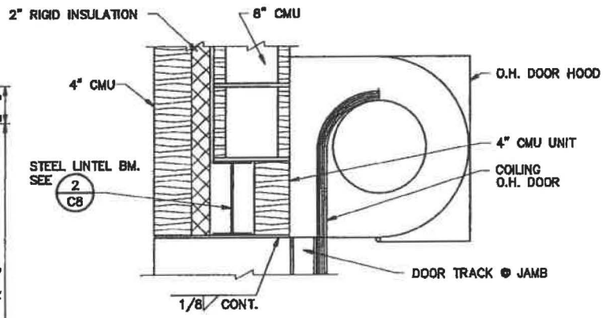
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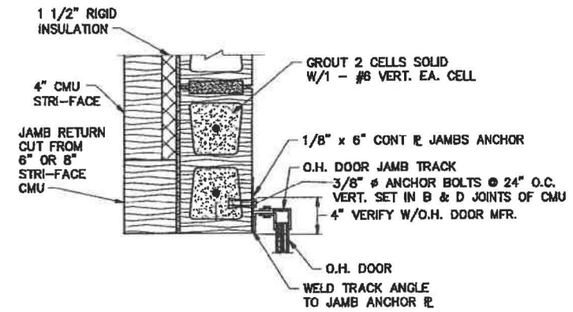


1 / C5 BUILDING PLAN
SCALE: 1/4" = 1'-0"

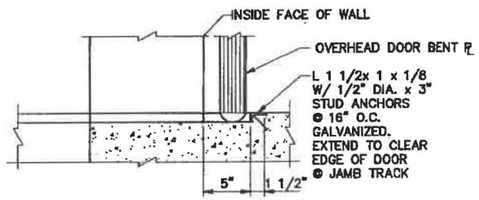
NOTE:
COORDINATE LOCATIONS OF SLEEVE THRU WALLS FOR AIR INLET AND DISCHARGE PIPES WITH EQUIPMENT SUPPLIER – APPROX. ELEV. 10' A.F.F.



2 / C5 HEAD – OVERHEAD DOOR @ MASONRY
SCALE: 1 1/2" = 1'-0"



3 / C5 JAMB – OVERHEAD DOOR @ MASONRY
SCALE: 1 1/2" = 1'-0"

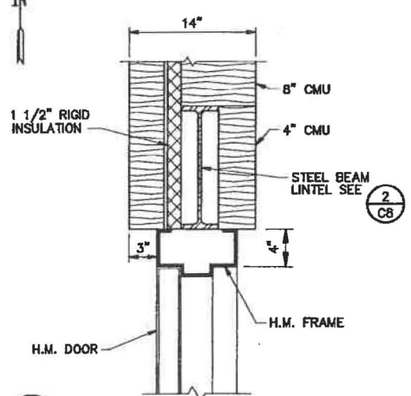


4 / C5 SILL @ OVERHEAD DOOR
SCALE: 1 1/2" = 1'-0"

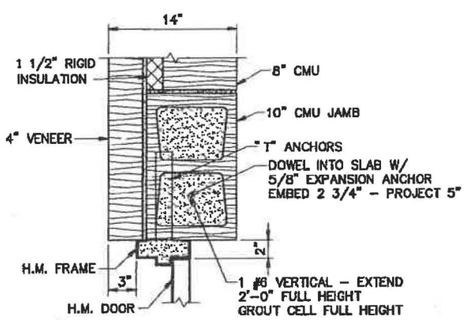
FINISH SCHEDULE
CONCRETE FLOOR – SEALER – HARDENER
INTERIOR WALLS – PAINT
EXPOSED STEEL & DECK – PAINT
ALL DOORS & FRAMES – PAINT
EQUIPMENT – PAINT IF ONLY PRIMED.

DOOR SCHEDULE

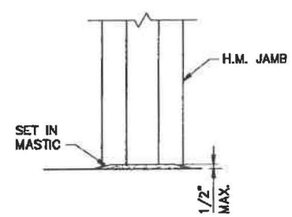
DR NO	DOOR SIZE WD x HT	DOOR TH	DOOR MA TL	DOOR TY PE	FRAME MA TL	FRAME SILL	FRAME HEAD	FRAME JAMB	HW SET	REMARKS 1	2	3	4	5
D1	8'-0"x10'-0"		STL	COIL	STL	4/C5	2/C5	3/C5	HW2					
D2	3'-0"x7'-0"	1 3/4	HM	FL	HM	7/C5	5/C5	6/C5	HW1					
D3	3'-0"x7'-0"	1 3/4	HM	FL	HM	7/C5	5/C5	6/C5	HW1					
D4	3'-0"x7'-0"	1 3/4	HM	FL	HM	7/C5	2/G1	2/G1	HW1					



5 / C5 HM DOOR HEAD – @ CAVITY WALL
SCALE: 1 1/2" = 1'-0"



6 / C5 HM DOOR JAMB – @ CAVITY WALL
SCALE: 1 1/2" = 1'-0"



7 / C5 HM TYP. DOOR SILL
SCALE: 1 1/2" = 1'-0"

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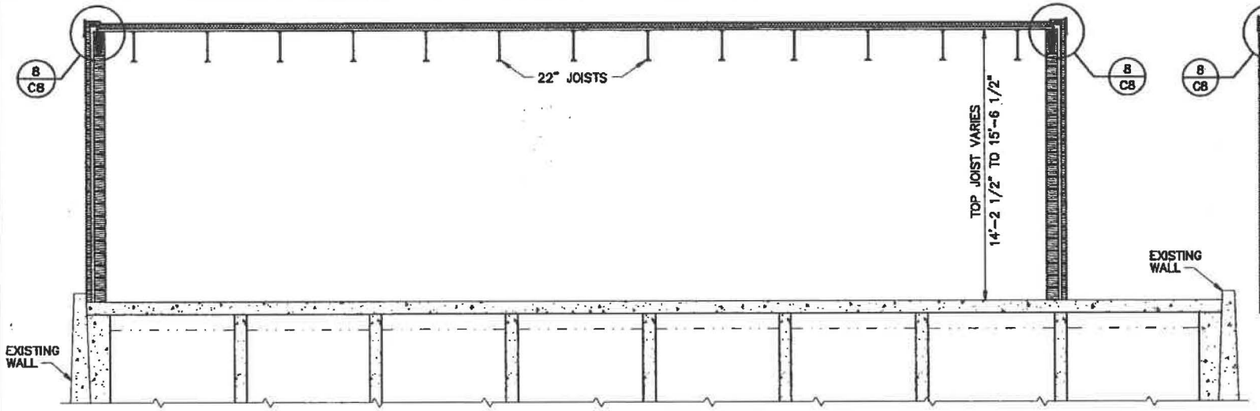
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE BUILDING PLAN AND DETAILS

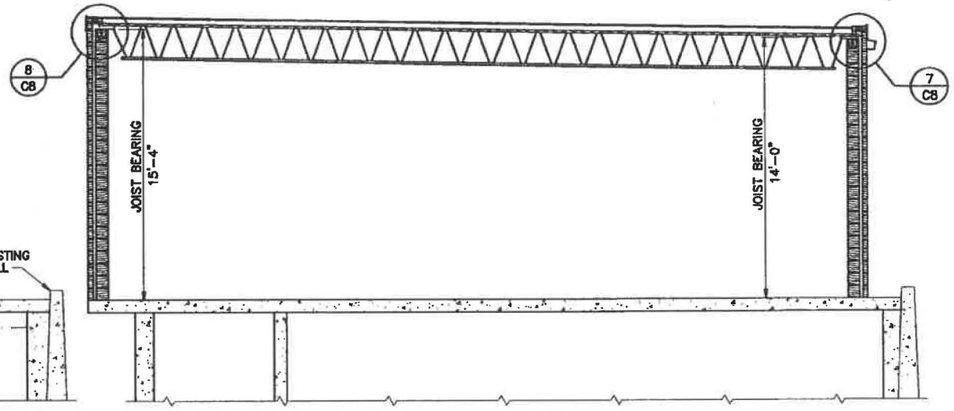
Job No. 02011280
Date: APRIL, 2003
Designed by: ATM
Drawn by: RJS

Sheet Number
C5

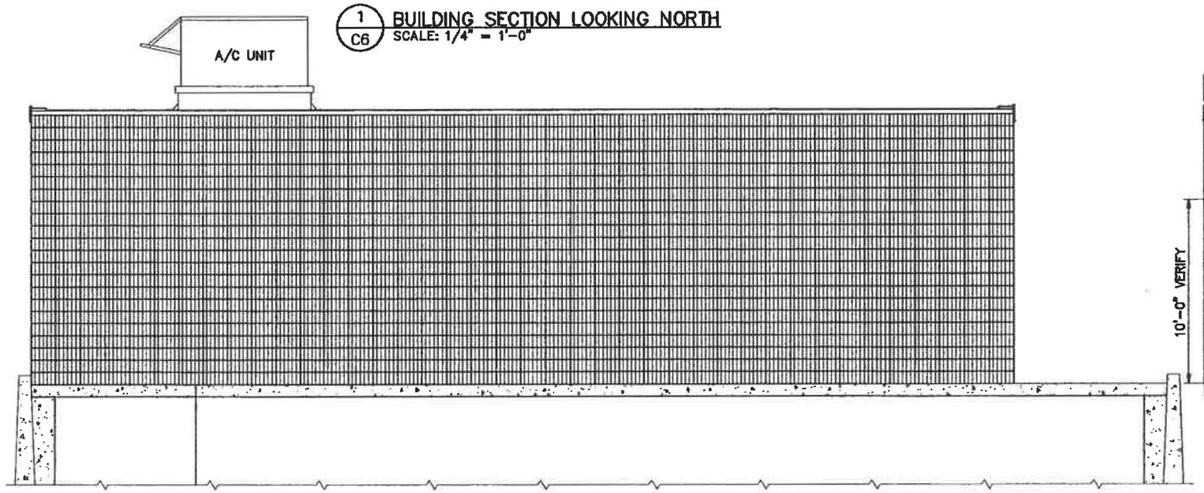
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nces: (REF's SHW_TBX, BLDPLAN, ATM_STM)



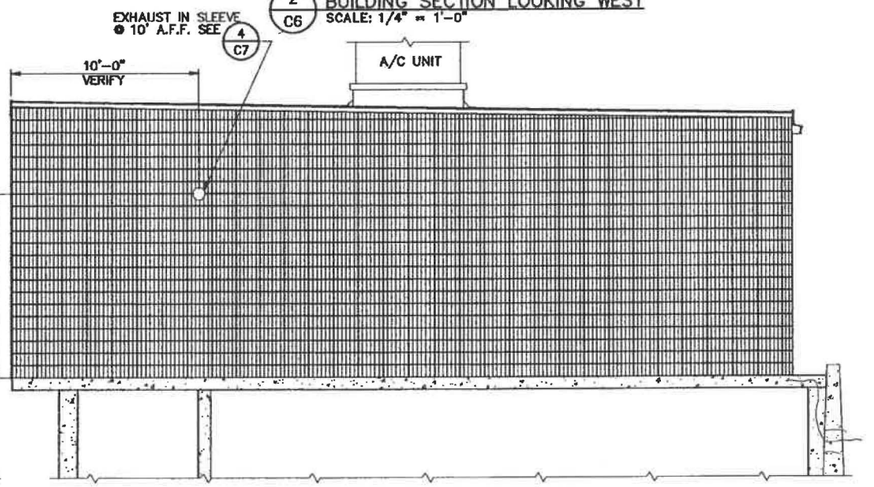
1 C6 BUILDING SECTION LOOKING NORTH
SCALE: 1/4" = 1'-0"



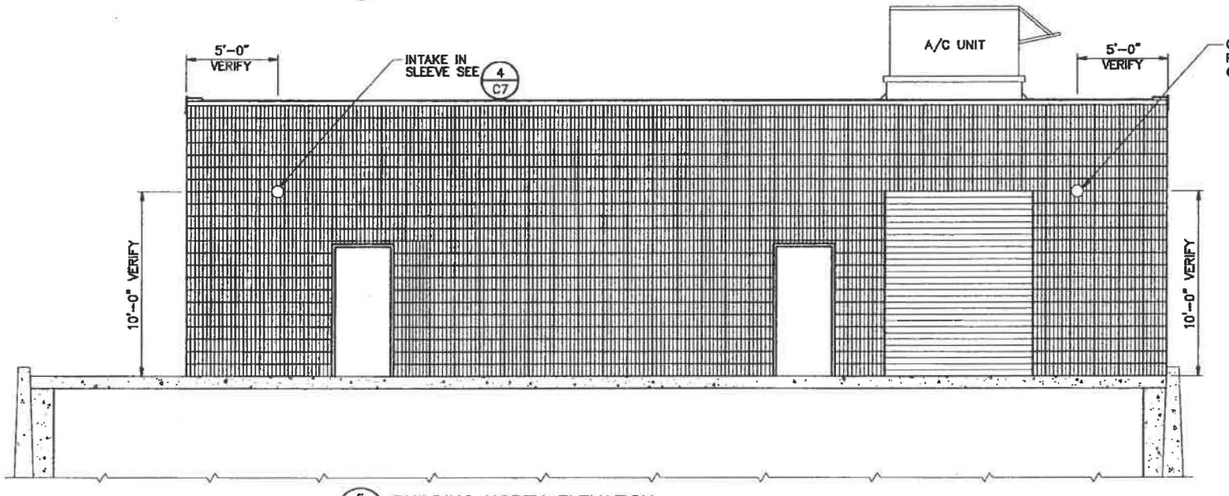
2 C6 BUILDING SECTION LOOKING WEST
SCALE: 1/4" = 1'-0"



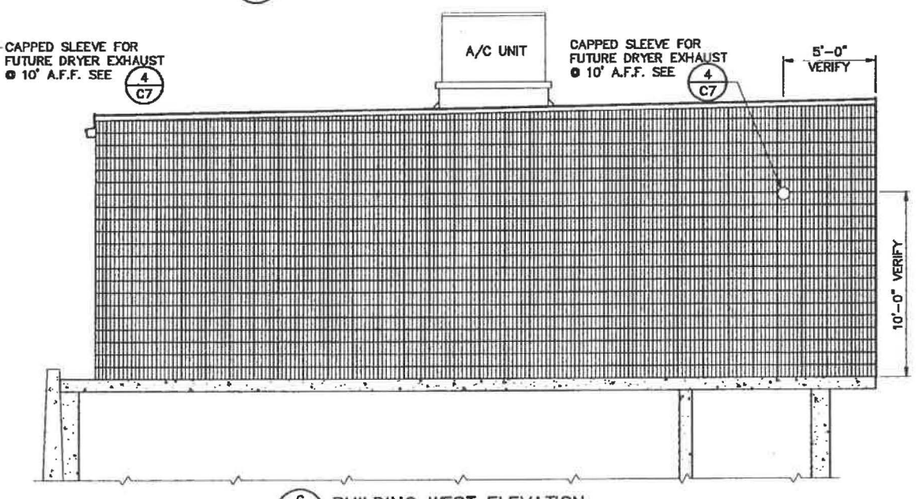
3 C6 BUILDING SOUTH ELEVATION
SCALE: 1/4" = 1'-0"



4 C6 BUILDING EAST ELEVATION
SCALE: 1/4" = 1'-0"



5 C6 BUILDING NORTH ELEVATION
SCALE: 1/4" = 1'-0"



6 C6 BUILDING WEST ELEVATION
SCALE: 1/4" = 1'-0"

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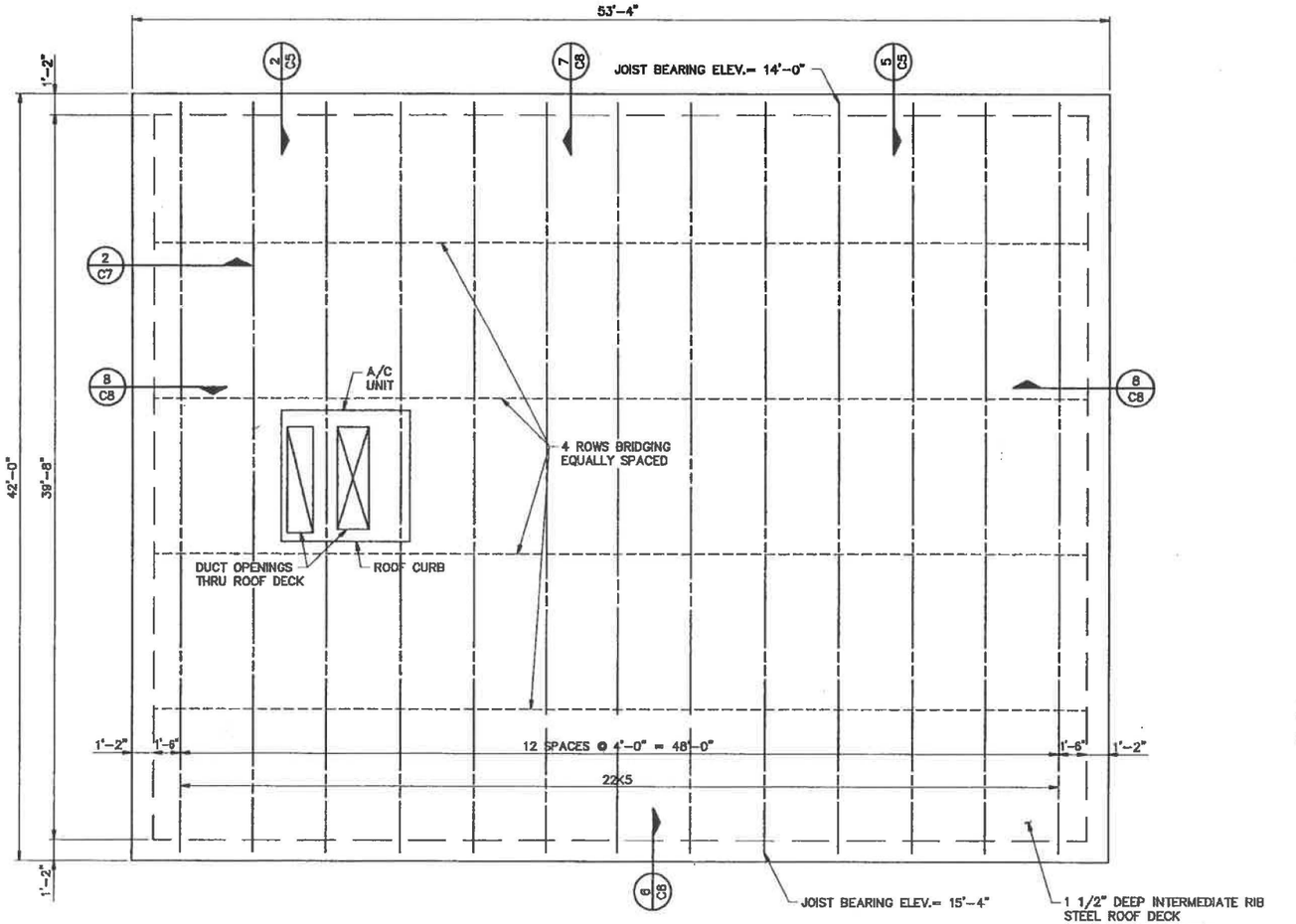
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE BUILDING SECTIONS AND ELEVATIONS

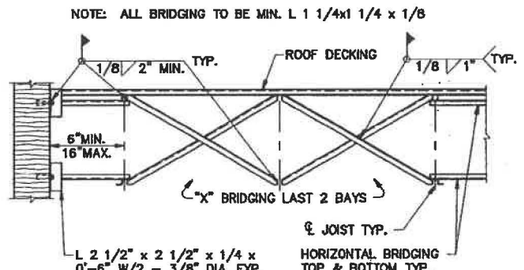
Job No. 02011280
Date: APRIL, 2003
Designed by: ATM
Drawn by: RJS

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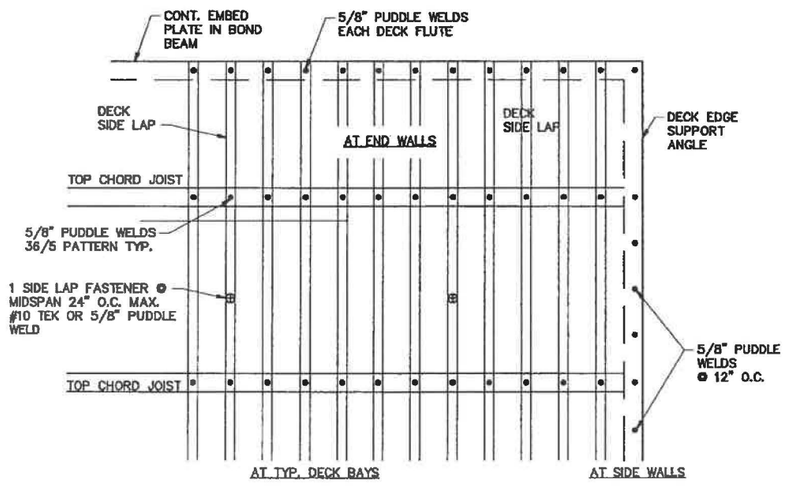
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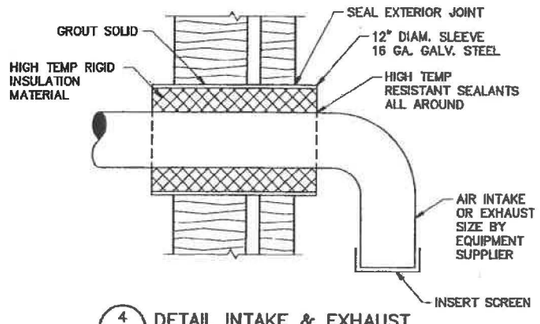
1 C7 ROOF FRAMING PLAN
SCALE: 1/4" = 1'-0"



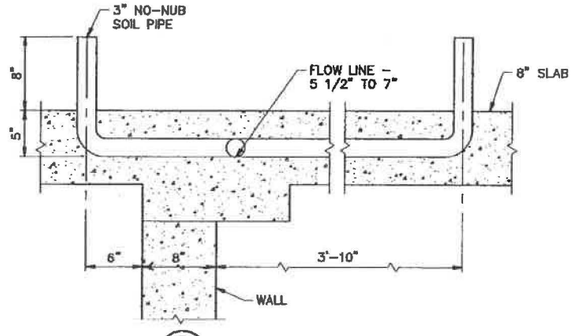
2 C7 TYP. ROOF JOIST BRIDGING ANCHOR @ MASONRY
SCALE: 3/4" = 1'-0"



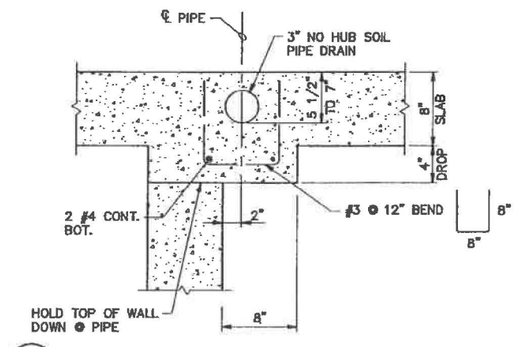
3 C7 ROOF DECK ANCHORAGE PATTERN DETAIL
SCALE: NONE



4 C7 DETAIL INTAKE & EXHAUST SLEEVE THRU MASONRY WALL
SCALE: 1 1/2" = 1'-0"



5 C7 TYPICAL INTERIOR PIPE STUB UP
SCALE: 1 1/2" = 1'-0"



6 C7 SECTION THRU DRAIN COLLECTOR PIPE IN SLAB
SCALE: 1 1/2" = 1'-0"

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ATM MILLER, III
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OKLAHOMA
4-14-03

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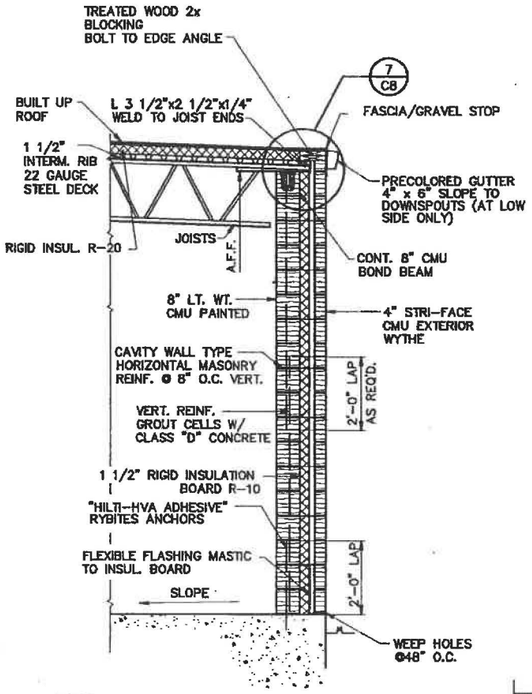
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE BUILDING ROOF FRAMING

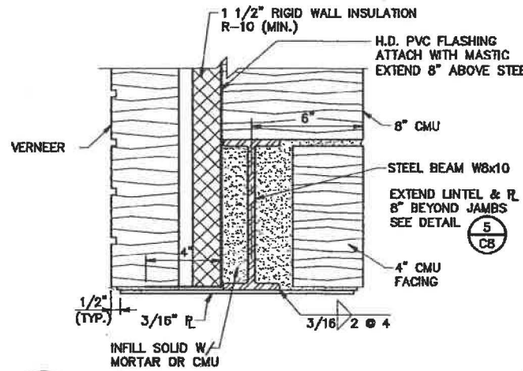
Job No. 02011280
Date: APRIL, 2003
Designed by: ATM
Drawn by: RJS

Sheet Number
C7

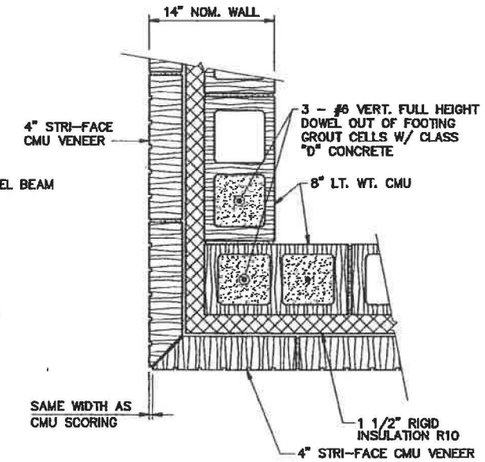
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1 C8 TYP. EXTERIOR WALL SECTION
SCALE: 1/2" = 1'-0"



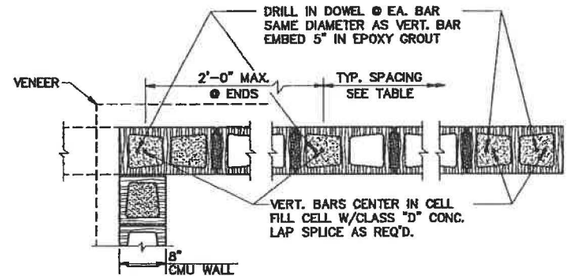
2 C8 STEEL BEAM LINTEL EXTERIOR WALLS
SCALE: 3" = 1'-0"



3 C8 PLAN - EXTERIOR CORNER CMU CAVITY WALL
SCALE: 1 1/2" = 1'-0"

MASONRY WALL REINF. TABLE						
	EXTERIOR AND BEARING WALL			INTERIOR AND NON-BEARING WALL		
WALL HEIGHT	BAR SIZE	TYPICAL SPACING	LAP SPLICE	BAR SIZE	TYPICAL SPACING	LAP SPLICE
12'	#4	48"	22"	#4	72"	22"
16'	#5	32"	27"	#4	60"	22"
20'	#6	24"	32"	#5	60"	27"

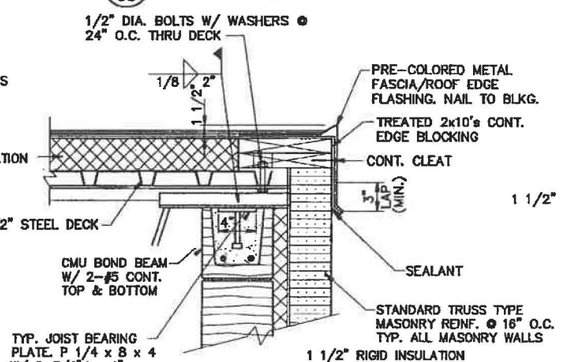
MIN. HORIZONTAL WALL REINF. - TRUSS TYPE STANDARD WEIGHT WELDED WIRE MASONRY REINF. @ 8" O.C. VERTICALLY UNLESS SHOWN OTHERWISE.



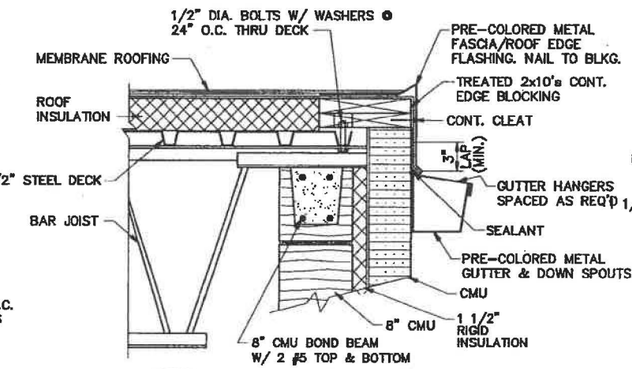
4 C8 TYPICAL CMU WALL REINF.
SCALE: 1" = 1'-0"

5 C8 END BEARING - BEAM LINTEL
SCALE: 3" = 1'-0"

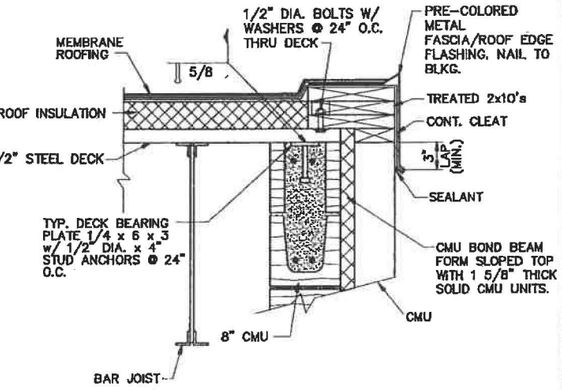
9 C8 TYP. EXTERIOR WALL BASE DETAIL
SCALE: 1 1/2" = 1'-0"



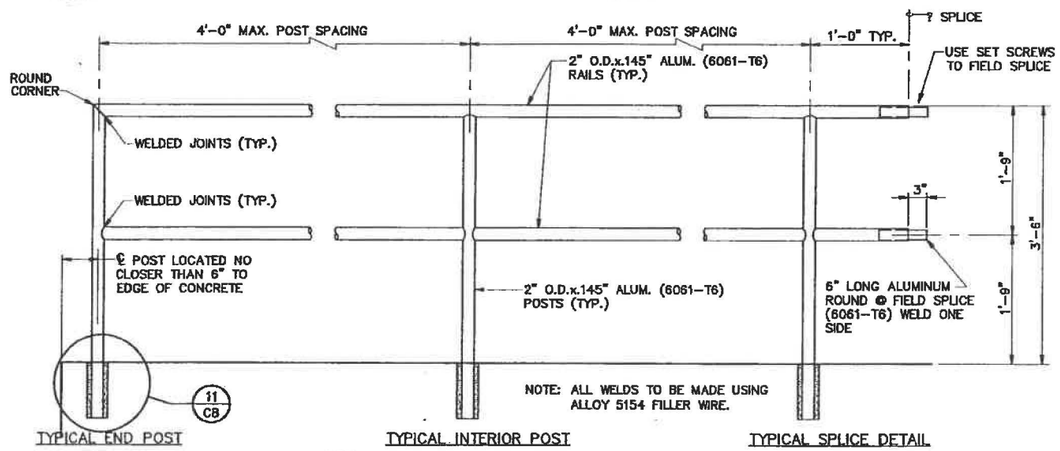
6 C8 TYPICAL ROOF EDGE
SCALE: 1 1/2" = 1'-0"



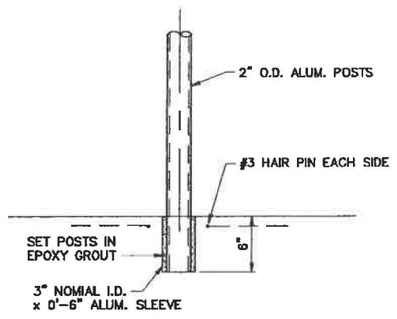
7 C8 TYPICAL ROOF EDGE @ GUTTERS
SCALE: 1 1/2" = 1'-0"



8 C8 TYPICAL ROOF EDGE ALONG SLOPE
SCALE: 1 1/2" = 1'-0"



10 C8 TYPICAL ALUMINUM PIPE HANDRAIL
SCALE: 1" = 1'-0"



11 C8 EMBEDED POST DETAIL
SCALE: 1 1/2" = 1'-0"

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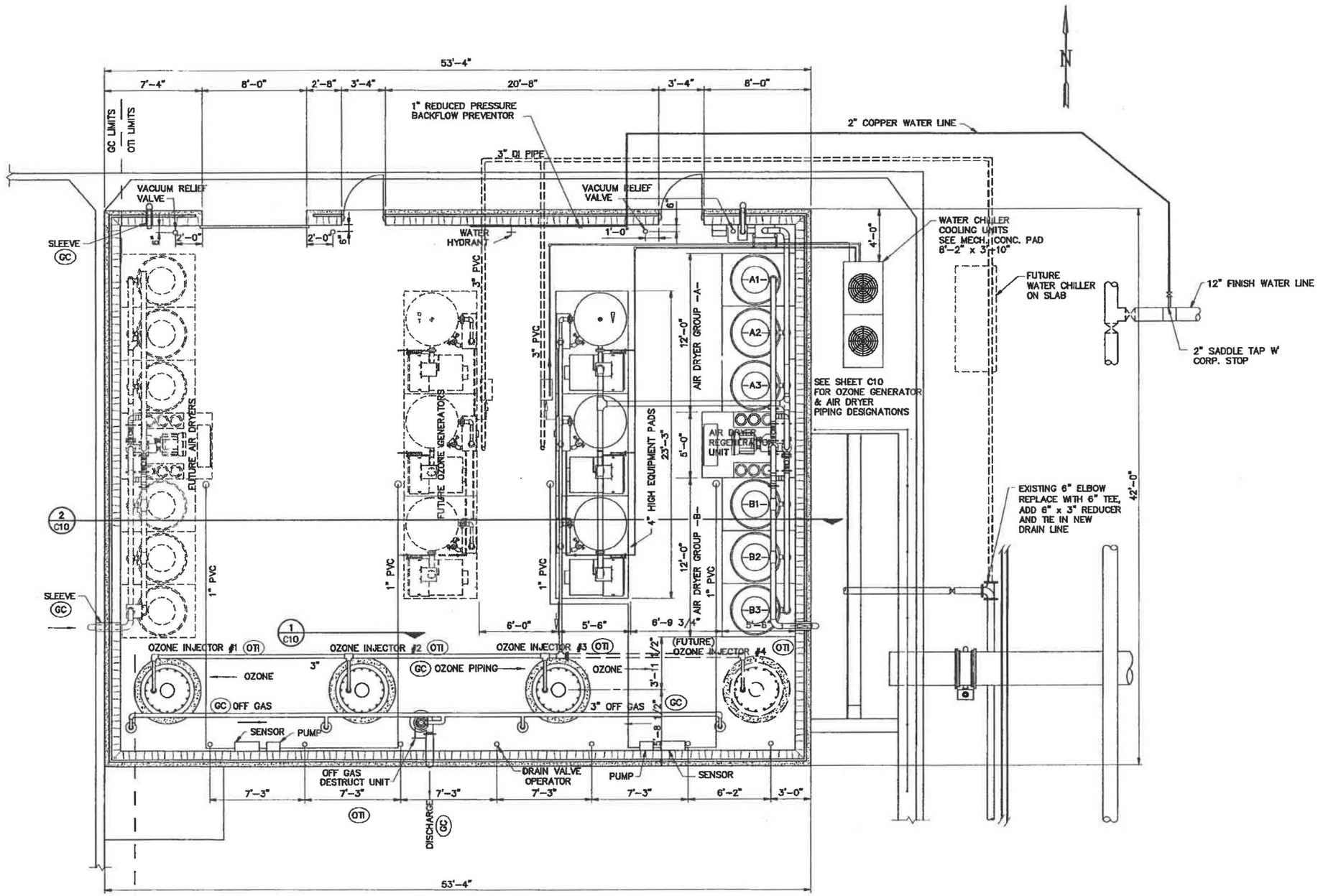
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE BUILDING DETAILS I

Job No. 02011280
Date: APRIL, 2003
Designed by: ATM
Drawn by: RJS

Sheet Number
C8

rjelkins Shw-C08.dwg L:\2002\02011280 - Shawnee WTP\drawings\ 34x22 1=8 4/14/2003 9:10 am
Images: [none]
Xrefs: [REF]: ShW_T3X, ATM_STM]



1/C9 MECHANICAL EQUIPMENT PLAN
SCALE: 1/4" = 1'-0"

LEGEND:

GC LIMITS = MATERIALS FURNISHED AND INSTALLED BY GENERAL CONTRACTOR.
OTI LIMITS = MATERIALS FURNISHED BY OWNER AND INSTALLED BY GENERAL CONTRACTOR.

(OTI) = EQUIPMENT FURNISHED BY OWNER AND INSTALLED BY GENERAL CONTRACTOR.

(GC) = EQUIPMENT FURNISHED AND INSTALLED BY GENERAL CONTRACTOR.

SEE SHEET C16 FOR PIPING SCHEDULE

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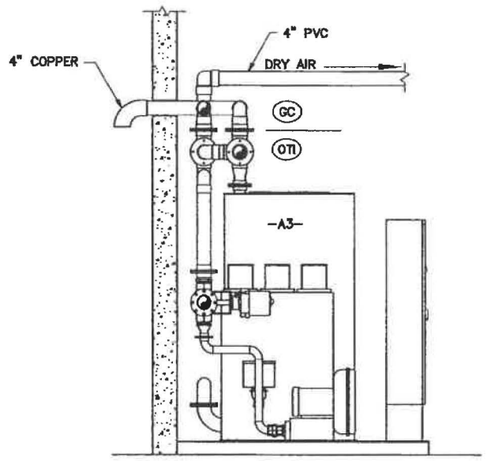
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE MECHANICAL EQUIPMENT PLAN

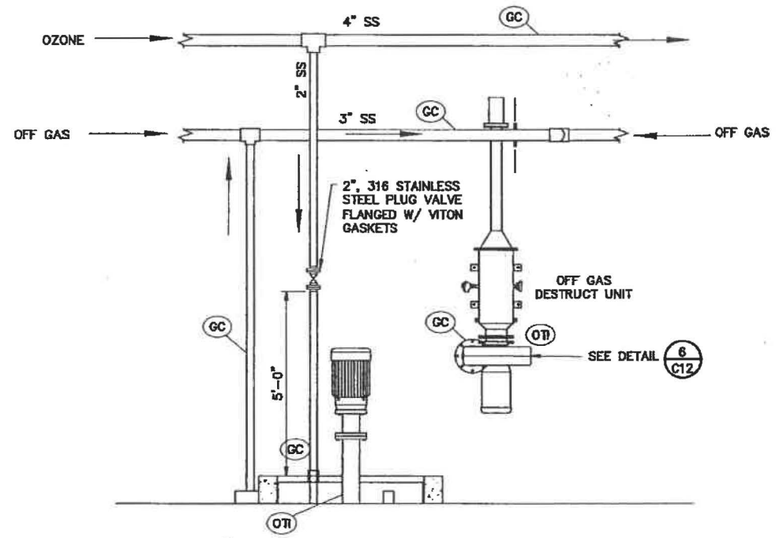
Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RJS

Sheet Number
C9

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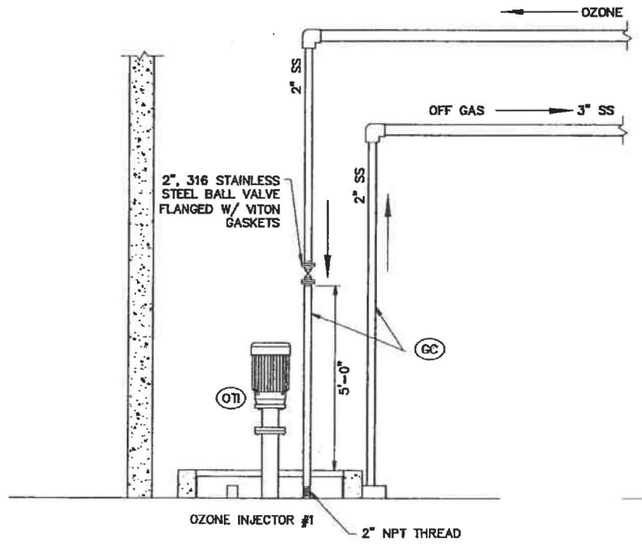
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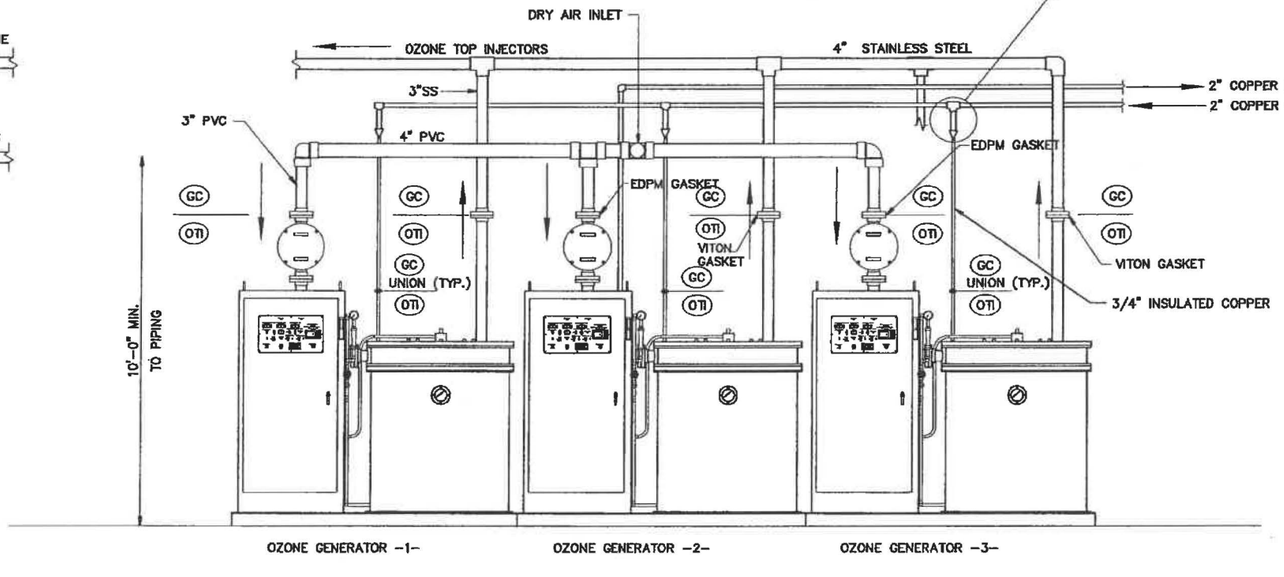


1/C10 OZONE INJECTOR #3
SCALE: 1/2" = 1'-0"

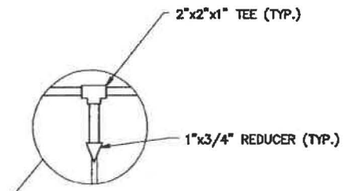
CONTRACTOR NOTES:

1. ALL OZONE PIPING SHALL BE SEALED WITH VITON GASKETS.
2. ALL OVER HEAD PIPING SHALL BE RACKED & SECURED EVERY 8'.
3. COOLING WATER LINES SHALL BE INSULATED COPPER WITH UNIONS AND BALL VALVES AT THE OZONE GENERATOR'S.
4. ALL COOLING WATER LINES SHALL BE INSULATED.





2/C10 OZONE SECTION
SCALE: 1/2" = 1'-0"



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REGISTERED PROFESSIONAL ENGINEER — Steven J. Rayland — 20702 — OKLAHOMA
4-14-03

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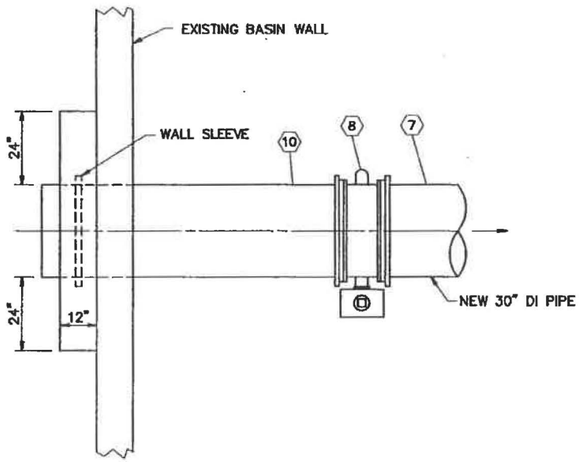
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE BUILDING MECHANICAL EQUIPMENT SECTIONS

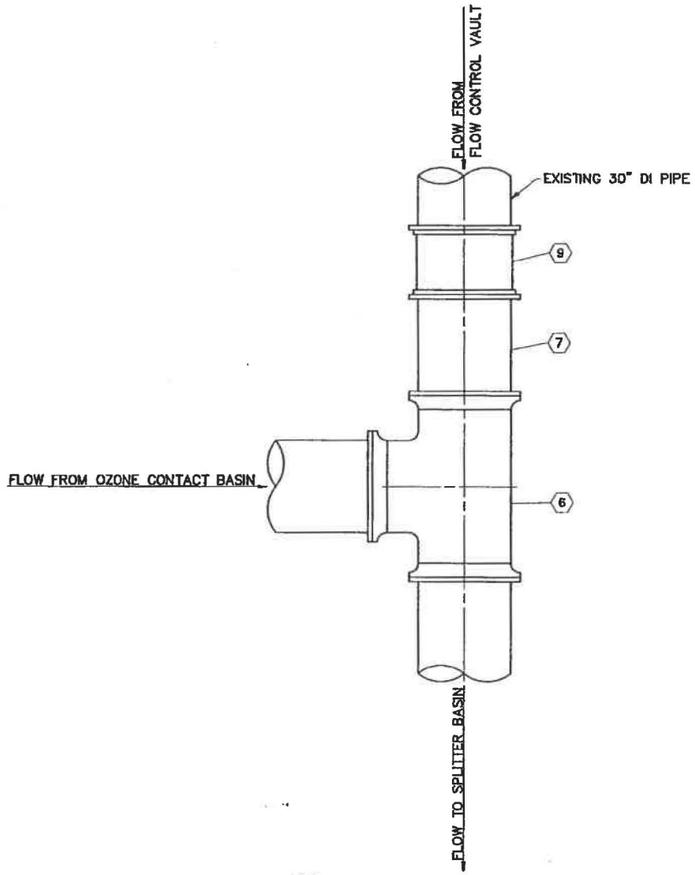
Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RJS

Sheet Number
C10

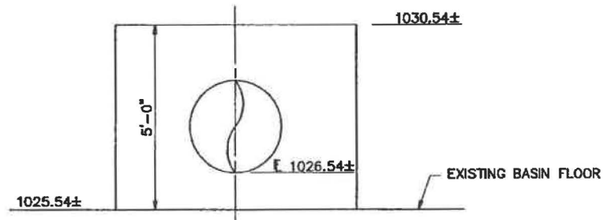
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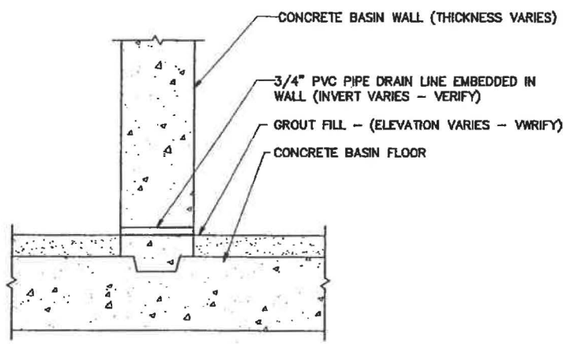
1 / C11 OZONE CONTACT CHAMBER OUTFALL PIPING PLAN
SCALE: 1/2" = 1'-0"



2 / C11 OZONE CONTACT OUTFALL TIE IN PLAN
SCALE: 1/2" = 1'-0"



3 / C11 SETTLING BASIN OUTFALL PROFILE
SCALE: 1/2" = 1'-0"



4 / C11 BASIN DRAIN LINE DETAIL
SCALE: NTS

PIPE LEGEND	
⬡	DESCRIPTION
1	30" DRESSER STEEL COUPLING STYLE 38 (OR EQUAL)
2	30" FLG X PE SPOOL AS REQ'D.
3	1" TAPPED HOLE FOR CHLORINE INJECTION
4	30" PRATT BUTTERFLY VALVE
5	TRITON XR-70 WITH ELECTRIC OPERATOR WITH MANUAL OVERRIDE
6	30" MJ TEE
7	30" PE X PE SPOOL (AS REQ'D.)
8	30" MJ GROUNDHOG BUTTERFLY VALVE WITH 2" SQ. AWWA NUT WITH EXTENSION
9	30" MJ SOLID SLEEVE
10	30" WALL SLEEVE LENGTH AS REQ'D.
11	SUMP PIT W/ GRATE – SEE DETAILS 5/D2
12	2" PVC SPOOL
13	2" PVC TEE W/ THREADED PLUG
14	2" PVC TRUE UNION WITH BALL VALVE, SCH. 80
15	2" PVC CHECK VALVE W/ UNIONS, SCH. 80
16	1 1/4" X 2" PVC REDUCER
17	1 1/4" SPOOL (AS REQ'D.)
18	LIMITORQUE LS 120
19	VALVE STEM HOUSING (LENGTH AS REQ'D.)
20	1" SCH 80 PVC TRUE UNION BALL VALVE
21	1" SCH 80 PVC UNION
22	1" SCH 80 PVC SPOOL AS REQ'D.

REGISTERED PROFESSIONAL ENGINEER
Kirby B. Rowland
20702
OKLAHOMA

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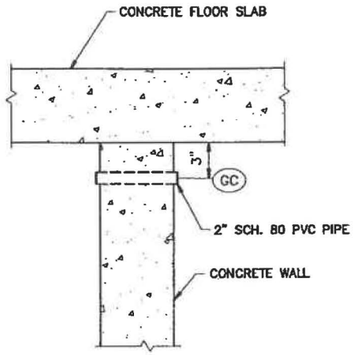
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE
BUILDING
MECHANICAL
DETAILS I

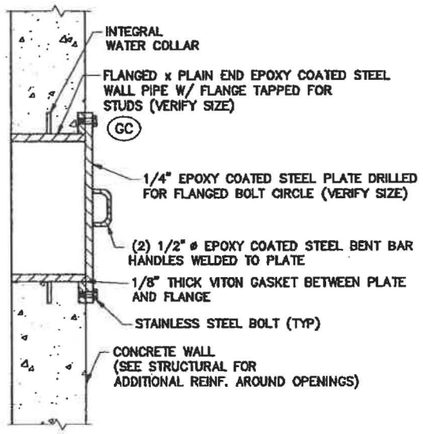
Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RNF

Sheet Number
C11

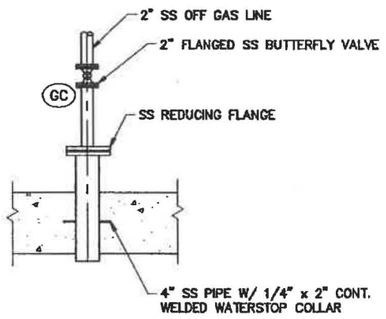
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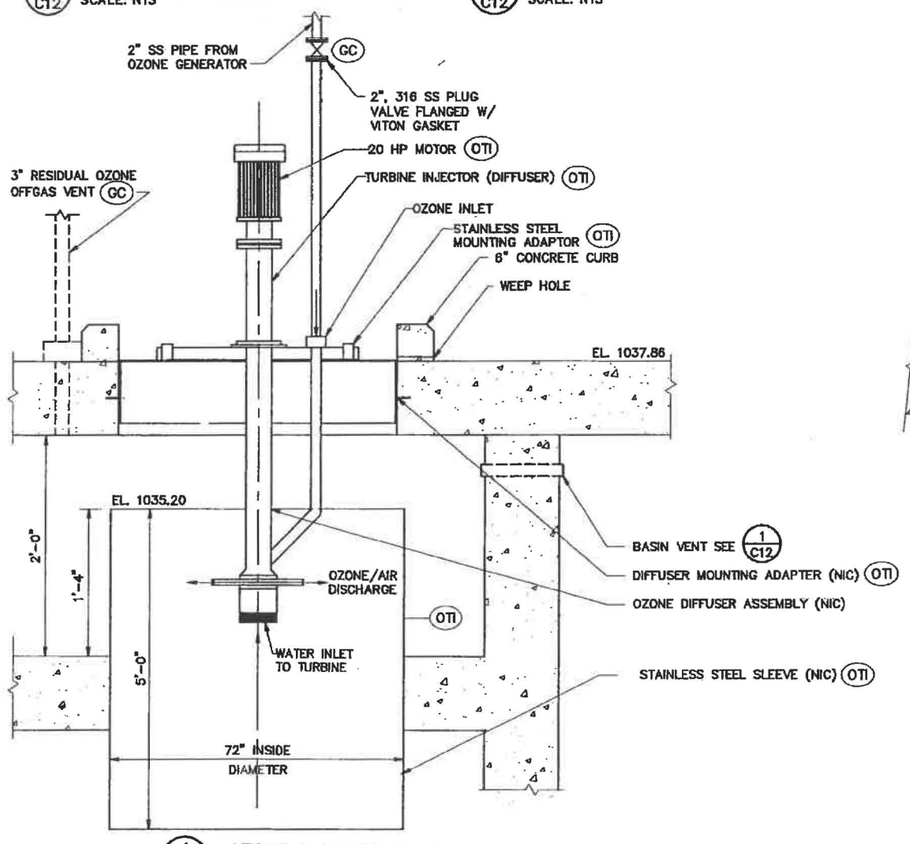
1 C12 BASIN VENT DETAIL
SCALE: NTS



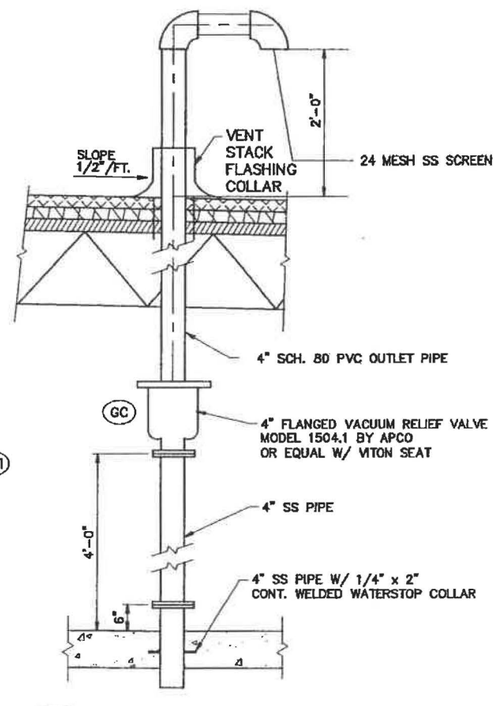
2 C12 ACCESS HATCH DETAIL
SCALE: NTS



3 C12 OFF GAS PORT DETAIL
SCALE: NTS



4 C12 OZONE DIFFUSER DETAIL
SCALE: NTS



5 C12 VACUUM RELIEF VALVE DETAIL
SCALE: NTS

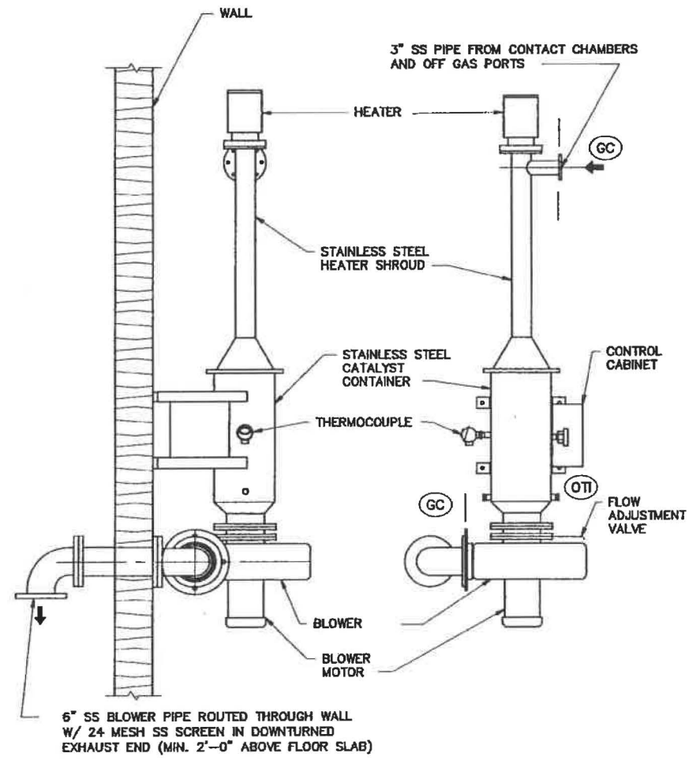
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SS = STAINLESS STEEL
(NIC) = NOT IN CONTRACT



6 C12 OZONE DESTRUCT UNIT DETAIL (NIC)
SCALE: NTS

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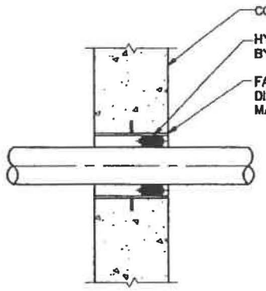
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE BUILDING MECHANICAL DETAILS II

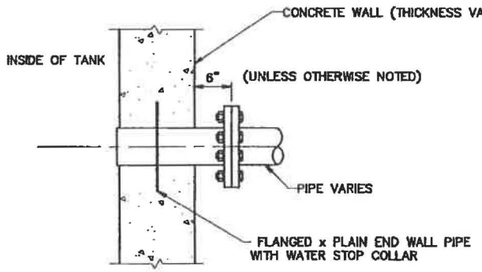
Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RNF

Sheet Number
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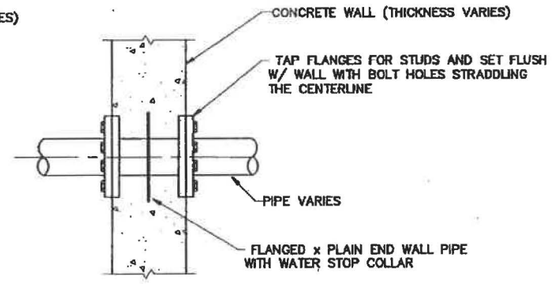
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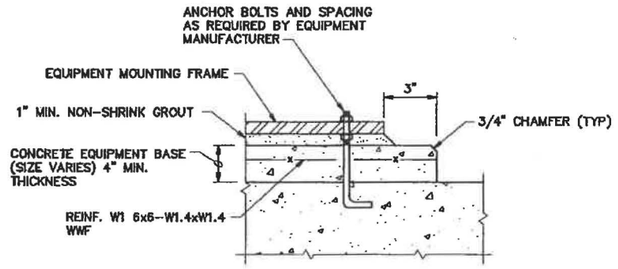
1 / C13 SEALED WALL SLEEVE DETAIL
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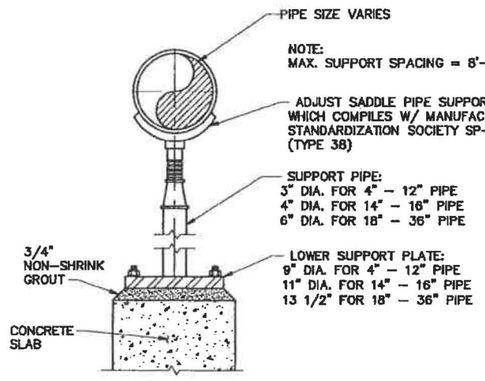
2 / C13 FL X PE WALL PIPE DETAIL
SCALE: NTS



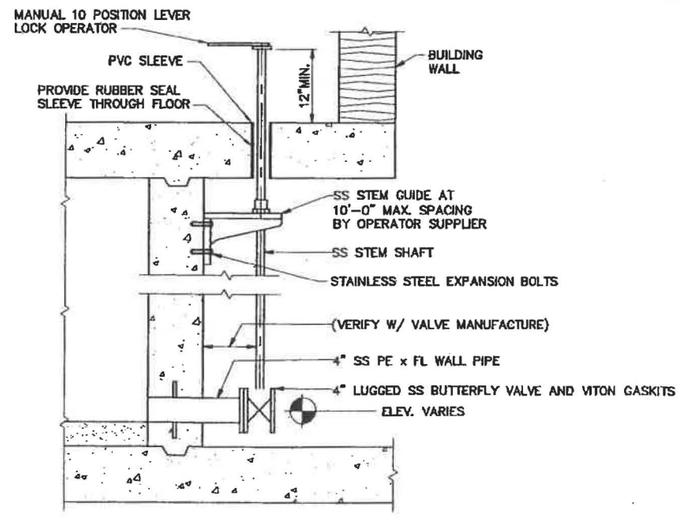
3 / C13 FL X FL WALL PIPE DETAIL
SCALE: NTS



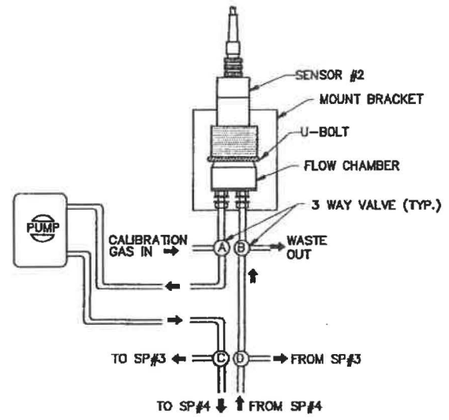
5 / C13 EQUIPMENT BASE DETAIL
SCALE: NTS



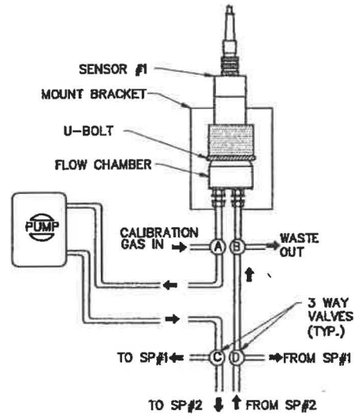
6 / C13 PIPE SUPPORT DETAIL AT FLOOR
SCALE: NTS



8 / C13 DRAIN VALVE DETAIL
SCALE: NTS

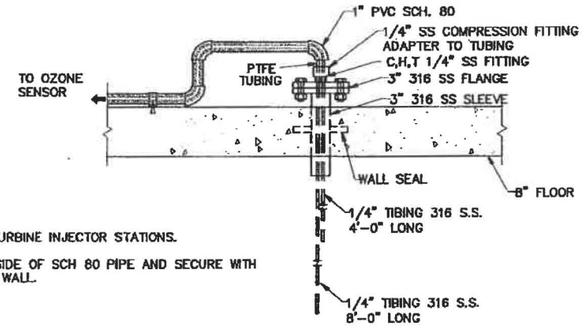


SENSOR #2



SENSOR #1

7 / C13 SENSOR SCHEMATIC
SCALE: NTS



CONTRACTOR NOTES:

1. SAMPLE PORT AT ALL TURBINE INJECTOR STATIONS.
2. RUN SAMPLE TUBING INSIDE OF SCH 80 PIPE AND SECURE WITH CLAMPS TO FLOOR AND WALL.

8 / C13 OZONE SAMPLING PORT TYPICAL
SCALE: NTS

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REGISTERED PROFESSIONAL ENGINEER
Jeffrey B. Haviland
20702
OKLAHOMA
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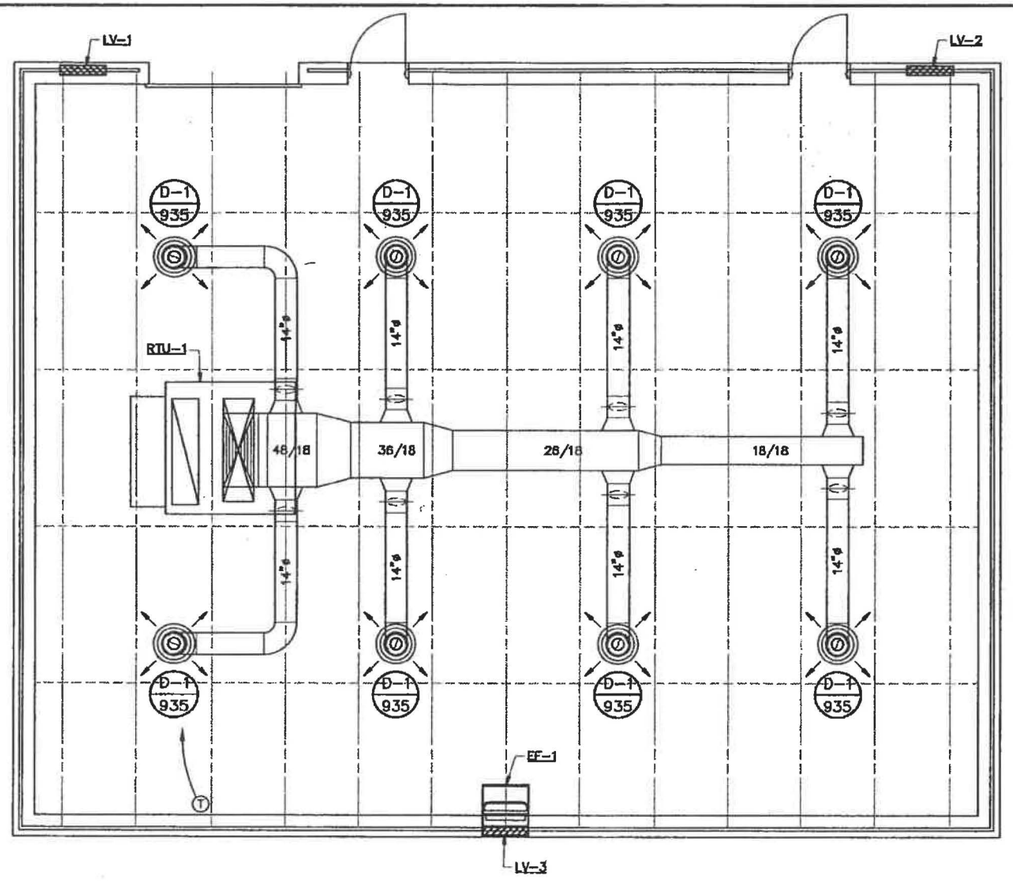
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE BUILDING MECHANICAL DETAILS III

Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RDR

Sheet Number
C13

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1 / C7 HVAC PLAN
SCALE: 1/4" = 1'-0"

MECHANICAL GENERAL NOTES:

1. REFER TO SPECIFICATIONS AND PROJECT MANUAL FOR ADDITIONAL INFORMATION AND REQUIREMENTS.
2. REFER TO ALL PROJECT DRAWINGS FOR DETAILS OF CONSTRUCTION AND INSTALLATION REQUIREMENTS.
3. REFER TO GENERAL CONDITIONS AND SUPPLEMENTARY GENERAL CONDITIONS FOR THE CONTRACT. THE GENERAL CONTRACTOR IS RESPONSIBLE FOR FULL COORDINATION OF PROJECT INCLUDING THE EQUIPMENT AND INSTALLATION OF THE MECHANICAL WORK.
4. CONTRACTOR SHALL BECOME, PRIOR TO BID, THOROUGHLY FAMILIAR WITH THE REQUIREMENTS OF THESE NOTES AS WELL AS OTHER NOTES SHOWN ON THE CONTRACT DOCUMENTS.
5. ALL DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL ARRANGEMENTS OR GEOMETRICAL RELATIONSHIPS OF EQUIPMENT AND SERVICES. THEY ARE NOT INTENDED TO SPECIFY OR SHOW EVERY OFFSET, SEQUENCE, DEVICE, OPTION, FITTING, OR COMPONENT.
6. INFORMATION AND COMPONENTS SHOWN ON RISER DIAGRAMS OR DETAILS, BUT NOT SHOWN ON PLANS, AND VICE VERSA, SHALL BE PROVIDED AS IF EXPRESSLY REQUIRED BY BOTH.
7. CONTRACTOR SHALL NOT SCALE DRAWINGS. DRAWINGS SPECIFIC TO THIS DISCIPLINE DO NOT LIMIT THE RESPONSIBILITY OF WORK REQUIRED BY THE CONTRACT DOCUMENTS.
8. UNLESS NOTED OTHERWISE, THE INDICATION AND/OR DESCRIPTION OF ANY ITEM, IN THE DRAWINGS OR SPECIFICATIONS CARRIES WITH IT THE INSTRUCTION TO FURNISH AND INSTALL THE ITEM.
9. EXACT LOCATIONS OF ALL EQUIPMENT, DUCTS, DIFFUSERS, ETC. SHALL BE COORDINATED WITH OTHER TRADES. CEILING MOUNTED LIGHTING AND/OR OTHER ELECTRICAL REQUIREMENTS TAKE PRECEDENCE OVER CEILING MOUNTED MECHANICAL REQUIREMENTS.
10. SEE ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR BUILDING DETAILS AND DIMENSIONS. COORDINATE PLACEMENT OF ALL THERMOSTATS, ROOF MOUNTED EQUIPMENT, ETC. WITH ARCHITECTURAL AND STRUCTURAL TRADES.
11. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL WORK WITH THAT OF OTHER TRADES. REFER TO ARCHITECTURAL, STRUCTURAL, ELECTRICAL, AND OTHER DRAWINGS FOR COMPLETE INFORMATION PRIOR TO BID.
12. NO OTHER TRADES, I.E., ELECTRICAL, CEILING, PLUMBING, ETC., SHALL BE SUSPENDED, HUNG, OR SUPPORTED FROM DUCTWORK OR PIPING.

HVAC NOTES:

1. REFER TO GENERAL NOTES ON DRAWING FOR ADDITIONAL REQUIREMENTS.
2. SEE STRUCTURAL PLANS FOR EXACT DIMENSIONS AND DETAILS OF THE BUILDING.
3. ALL HVAC WORK TO BE PER SMACNA AND ALL APPLICABLE CODES.
4. ALL DUCTS SHALL BE MOUNTED HIGH AS POSSIBLE AGAINST BOTTOM OF BEAMS EXCEPT AS REQUIRED TO AVOID CONFLICTS WITH INTERSECTING DUCTS. DIAGONALLY OFFSET DUCTS IMMEDIATELY BEFORE AND AFTER PASSING UNDER INTERSECTING DUCTS OR LARGE STRUCTURAL MEMBERS TO MAINTAIN DUCT TIGHT TO STRUCTURE.
5. PROVIDE TURNING VANES AT ALL ELBOWS GREATER THAN 45°. TURNING VANES SHALL BE DOUBLE THICKNESS.
6. EXPOSED DUCTWORK, ETC. SHALL BE FURNISHED SUITABLE FOR PAINTING, AND SHALL BE PAINTED AS REQUIRED BY ARCHITECTURAL SPECIFICATIONS.
7. PROVIDE AIR TIGHT FITTING AND DAMPER AT EACH CONNECTION OF ROUND BRANCH DUCTS TO A RECTANGULAR DUCT.
8. PROVIDE FLEXIBLE CONNECTIONS AND TRANSITIONS ON DUCT INLET AND OUTLET CONNECTIONS TO ALL RTU'S, FANS, ETC.. WHERE EQUIPMENT HAS ROTATING PARTS (MOTORS, ETC.).
9. INSTALL SCHEDULED FILTERS AT THE COMPLETION OF CONSTRUCTION. USE ONE SET OF SCHEDULED FILTERS DURING CONSTRUCTION INSTALL FINAL SET PRIOR TO TEST AND BALANCE.
10. BALANCE AIR SYSTEM TO PROVIDE INDICATED AIR FLOWS. SEE SPECIFICATIONS FOR OTHER TEST AND BALANCE REQUIREMENTS. SUBMIT FINAL BALANCE OF AIR SYSTEMS (FLOW AND TEMPERATURE) FOR REVIEW.
11. THE CONTRACTOR SHALL COORDINATE AND VERIFY THE FOLLOWING WITH DIVISIONS 15 AND 16 PRIOR TO BID:

    DISCONNECTS:
    WHERE NOT FURNISHED WITH EQUIPMENT: FURNISHED UNDER DIVISION 16, INSTALLED UNDER DIVISION 16.
    WHERE FURNISHED WITH EQUIPMENT: FURNISHED UNDER DIVISION 15, INSTALLED UNDER DIVISION 16.
12. COORDINATE FINAL PLACEMENT OF ALL THERMOSTATS WITH ENGINEER. ANY THERMOSTAT THAT IS REQUIRED TO BE MOUNTED ON AN EXTERIOR WALL SHALL BE MOUNTED ON AN INSULATED PAD.
13. CONTRACTOR SHALL PROVIDE 2-STAGE HEATING AND COOLING THERMOSTAT FOR OPERATION OF SPECIFIED ROOF TOP UNIT. THERMOSTAT SHALL BE SUITABLE FOR AUTOMATIC CHANGEOVER FROM HEATING TO COOLING.

ROOF TOP SCHEDULE	
DESCRIPTION	SINGLE PACKAGE ROOFTOP UNIT
MARK	RTU-1
MANFACTURER	CARRIER
MODEL	50HG B 024 A
NOM. HEATING CAPACITY BTUH	172,000/90,000
NOM.COOLING CAPACITY BTUH	172,000
MIN. EER	9.3
VOLTAGE/PHASE	460/3ø
ZONE TOTAL HEATING BTUH	91,300
ZONE TOTAL COOLING BTUH	162,500
ZONE TOT. SENS. COOL. BTUH	152,300
OA (DB/WB)	99/76
EAT (DB/WB)	83/67
LAT (DB/WB)	61/60
COOLING CFM	7500
ESP (EXTERNAL) IN WC	1.2
FAN MOTOR HP	5
VOLTS/PH	460/3ø
EQUIPMENT WEIGHT	2500 LBS
REMARKS	W/ECONOMIZER, POWER EXHAUST, AND ALTERNATE DRIVE. PROVIDE WITH ROOF CURB AND CONVENIENCE OUTLET. UNIT SHALL HAVE TWO COMPRESSORS TO PROVIDE FOR TWO STAGES OF HEATING AND COOLING.

EXHAUST FAN SCHEDULE	
MARK	EF-1
MANUF.	CARNES
TYPE	SIDE WALL PROPELLER
MODEL	LWBK24
CFM	3000
S.P.(IN. W.C.)	0.375"
HP	3/4
RPM (FAN)	885
VOLT/PH	120/1
REMARKS	BELT DRIVE FAN W/ WALL COLLAR AND OSHA GUARD. INTERLOCK W/ LV-1, LV-2 AND LV-3 (SEE NOTE BELOW).

NOTE: EXHAUST FAN AND LOUVERS SHALL BE PROVIDED WITH CONTROLS THAT ENERGIZE THESE COMPONENTS UPON SIGNAL FROM THE OZONE DETECTOR. IN ADDITION, THE CONTROLS SHALL INCLUDE AN EXTERIOR, WALL-MOUNTED HAND SWITCH ADJACENT TO BOTH OF THE EXTERIOR PERSONNEL DOORS FOR ACTIVATION OF THE VENTILATION SYSTEM BEFORE ENTERING THE BUILDING.

DIFFUSER AND GRILLE SCHEDULE	
MARK	D-1
DESCRIPTION	ROUND CEILING DIFFUSER
MOUNTING	DUCT MOUNT
TYPE	SUPPLY
NECK	14"ø
MAX CFM	935
MAX P.D. (IN. W.C.)	0.15"
REFERENCE PRODUCT	TUTTLE & BAILEY P3-14-RBD-WH
REMARKS	W/ BUTTERFLY DAMPER

LOUVER SCHEDULE		
MARK	LV-1, 2	LV-3
MANUFACTURER	CARNES	CARNES
MODEL	FLTA	FLTA
SIZE (W"xH")	32"x24"	32"x32"
FREE AREA (SF)	2.50	3.60
CFM	1500	3000
MAX P.D. (IN. W.C)	0.07"	0.15"
FINISH	SEE NOTE	SEE NOTE
MOUNTING HEIGHT, BOTTOM (AFF)	0'-8"	10'-8"
REMARKS	INTERLOCK W/ EF-1, 120V/1PH ELECTRIC ACTUATOR.	INTERLOCK W/ EF-1, 120V/1PH ELECTRIC ACTUATOR.

NOTE: LOUVERS SHALL BE FACTORY PREP COATED FOR FIELD PAINTING BY CONTRACTOR TO MATCH EXTERIOR DOORS.

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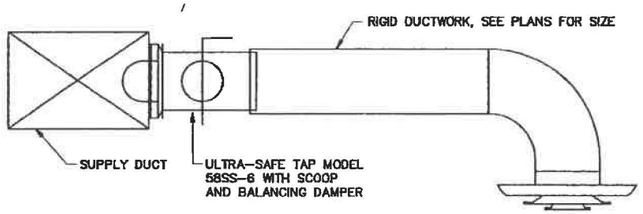
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE BUILDING MECHANICAL HVAC PLAN

Job No. 02011280
Date: APRIL, 2003
Designed by: ATM
Drawn by: RJS

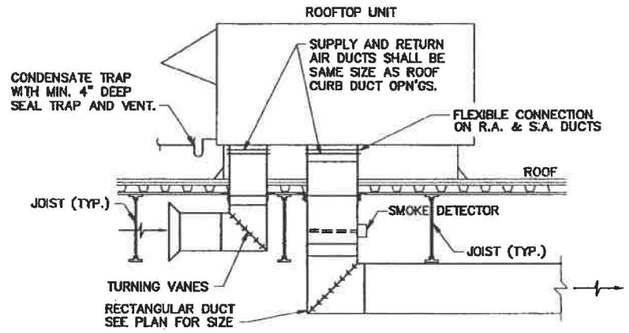
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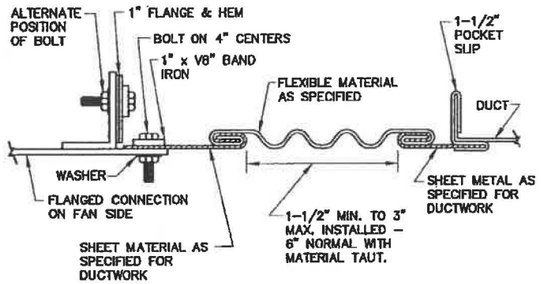


NOTE:
DUCT WORK SHALL BE SUPPORTED PER SMACNA RECOMMENDATIONS.

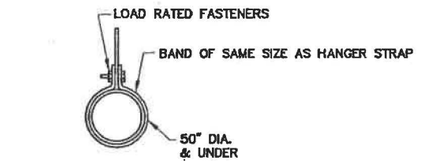
1/C15 ROUND DUCT TAP DETAIL
SCALE: NONE

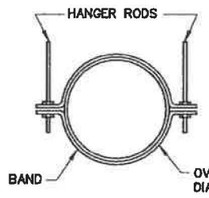


2/C15 RTU ELEVATION
SCALE: NONE



3/C15 RECTANGULAR FLEXIBLE CONNECTION
SCALE: NONE



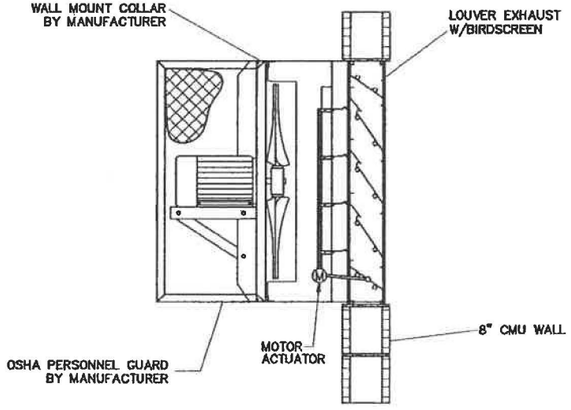


HANGER STRAPS OR RODS

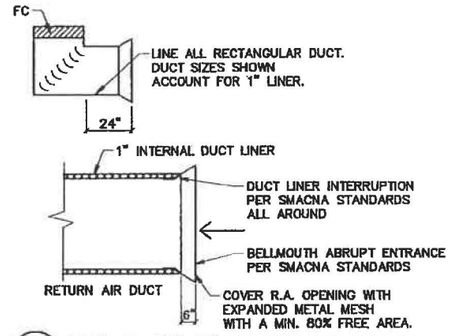
MAX. DUCT DIA.	HANGER	MAX. LOAD LBS.	MAX. SPACING FT.
26"	ONE 1" x 22 GA. STRAP	260	12
36"	ONE 1" x 18 GA. STRAP	420	12
50"	ONE 1" x 16 GA. STRAP	700	12
60"	TWO 3/8" DIA. RODS	1320	12
84"	TWO 1/2" DIA. RODS	2500	12

NOTE:
TABULATED DATA FROM SMACNA ALLOWS FOR DUCT REINFORCING AND INSULATION BUT NO EXTERNAL LOAD.

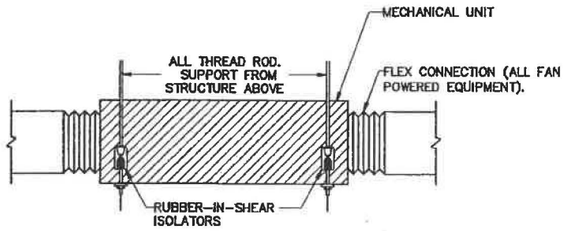
4/C15 ROUND DUCT HANGERS
SCALE: NONE



5/C15 EXHAUST/SUPPLY FAN DETAIL
SCALE:



6/C15 TYPICAL R.A. DUCT OPENING DETAIL
SCALE: NONE



7/C15 MECHANICAL EQUIPMENT SUPPORT
SCALE: NONE

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PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE BUILDING MECHANICAL HVAC DETAILS

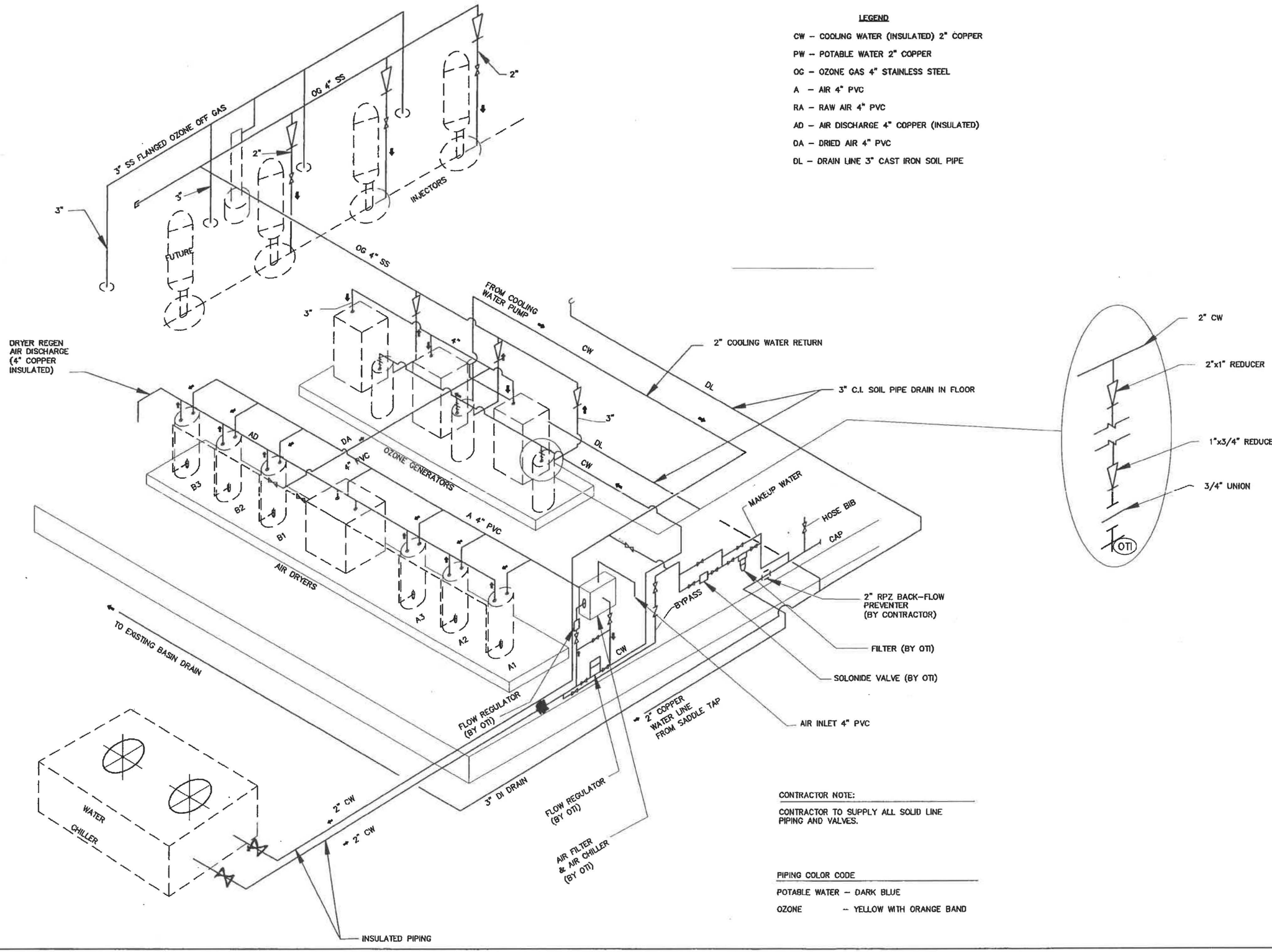
Job No. 02011280
Date: APRIL, 2003
Designed by: WDD
Drawn by: CAG

Sheet Number
C15

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Images: [none]
Xrefs: [REF_ SHW_TBA, WDD_STM]

LEGEND

CW – COOLING WATER (INSULATED) 2" COPPER
PW – POTABLE WATER 2" COPPER
OG – OZONE GAS 4" STAINLESS STEEL
A – AIR 4" PVC
RA – RAW AIR 4" PVC
AD – AIR DISCHARGE 4" COPPER (INSULATED)
DA – DRIED AIR 4" PVC
DL – DRAIN LINE 3" CAST IRON SOIL PIPE



CONTRACTOR NOTE:

CONTRACTOR TO SUPPLY ALL SOLID LINE PIPING AND VALVES.

PIPING COLOR CODE

POTABLE WATER – DARK BLUE
OZONE – YELLOW WITH ORANGE BAND

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20702

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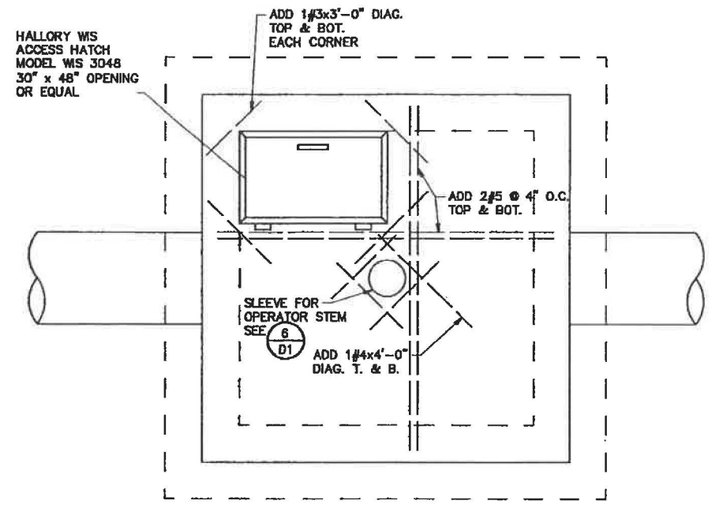
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE BUILDING PIPING SCHMETIC

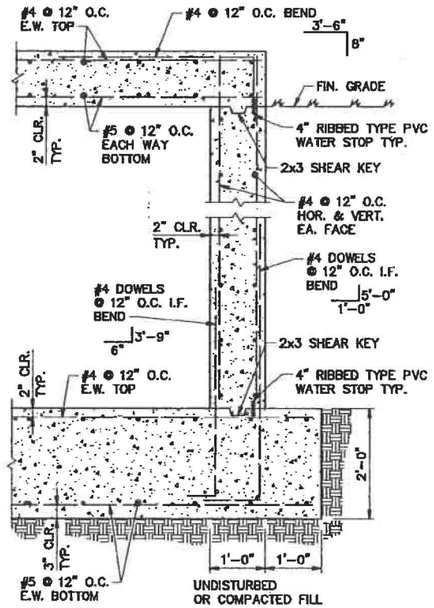
Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RDR

Sheet Number
C16

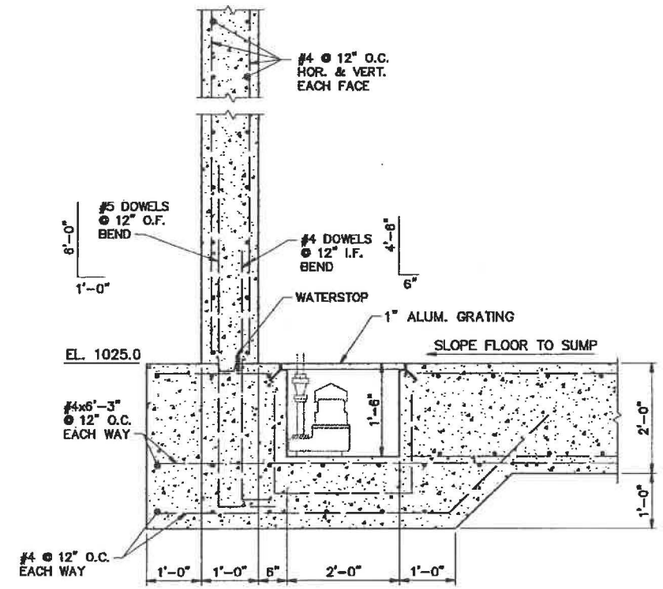
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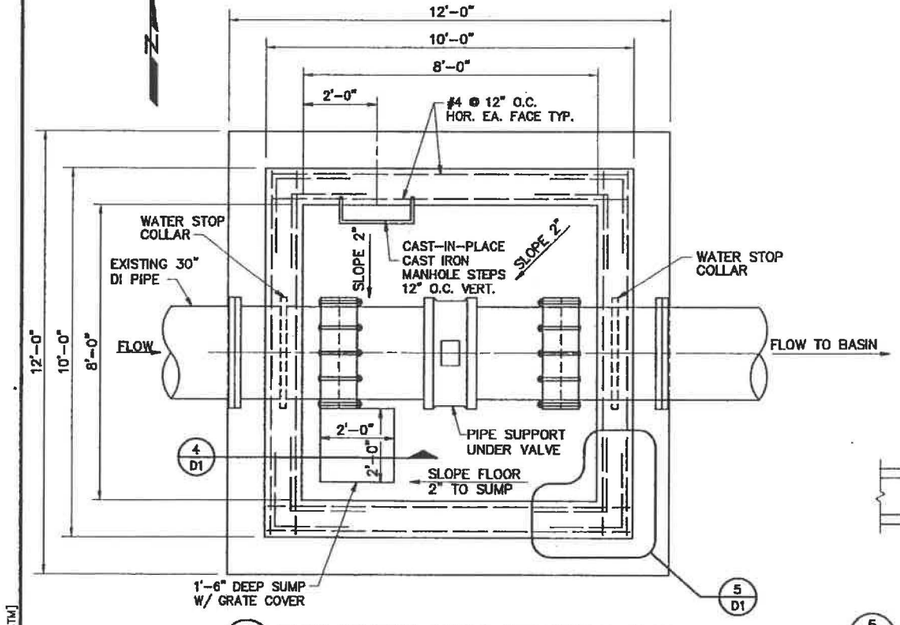
1/D1 FLOW CONTROL VAULT TOP SLAB PLAN
SCALE: 1/2" = 1'-0"



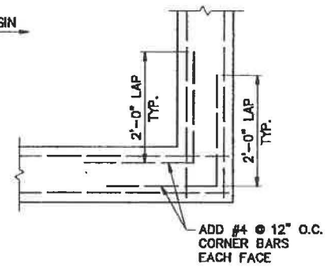
3/D1 TYP. WALL SECTION
SCALE: 3/4" = 1'-0"



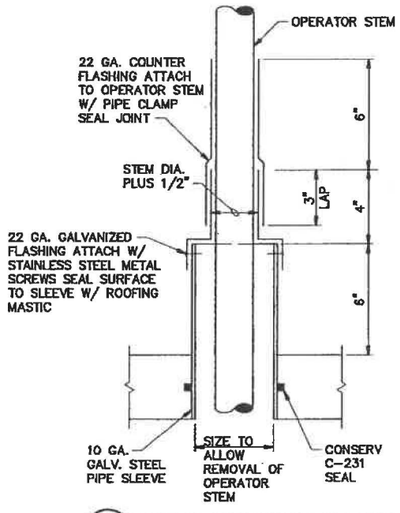
4/D1 SECTION @ SUMP
SCALE: 3/4" = 1'-0"



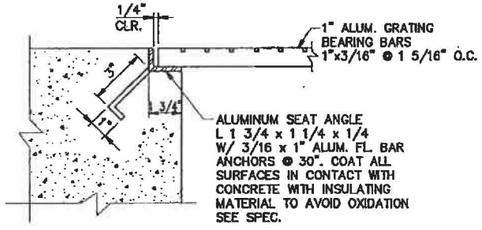
2/D1 FLOW CONTROL VAULT STRUCTURAL PLAN
SCALE: 1/2" = 1'-0"



5/D1 TYP. CORNER REINF. DETAIL
SCALE: 3/4" = 1'-0"



6/D1 DETAIL OPERATOR SLEEVE
SCALE: 3" = 1'-0"



7/D1 TYPICAL CONCRETE BEARING ANGLE @ 1" ALUM. GRATING UP TO 4'-0" SPAN
SCALE: 3" = 1'-0"

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ANTHONY T. MARTIN, III
17426
OKLAHOMA
4-14-03

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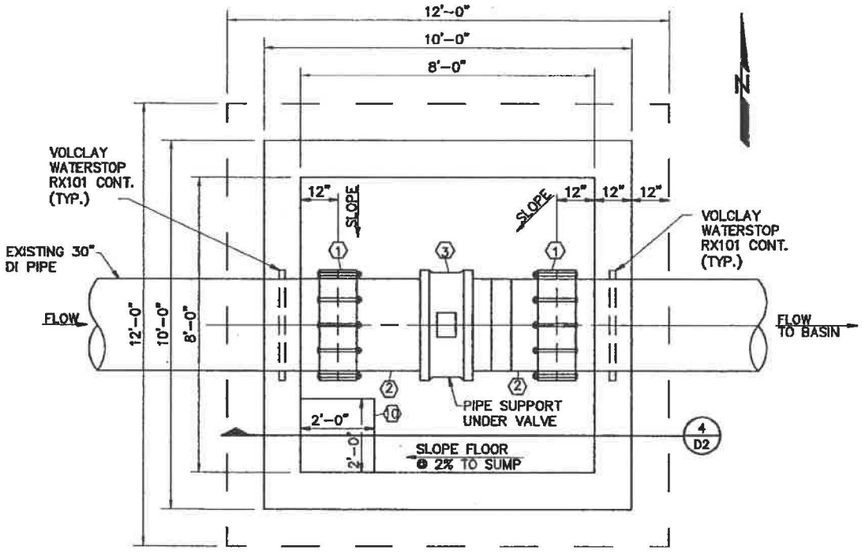
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

FLOW CONTROLLER VAULT PLAN & SECTIONS

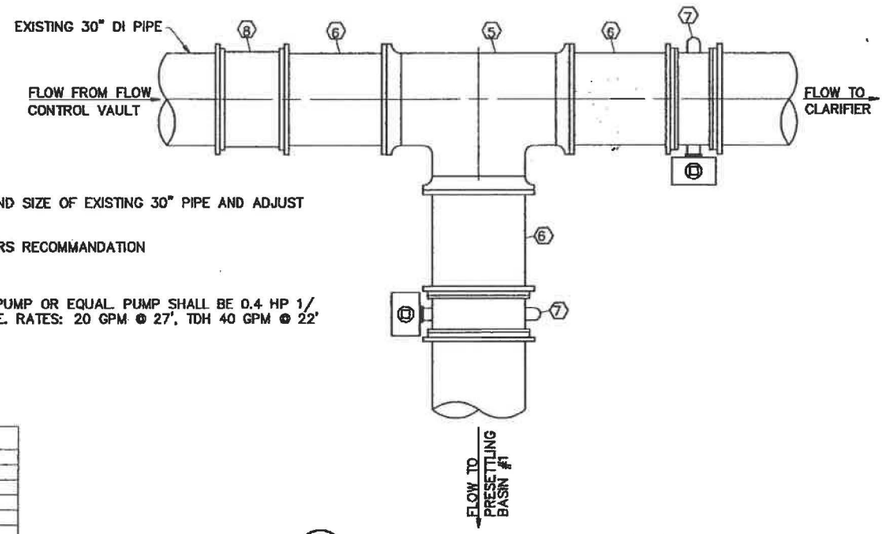
Job No. 02011280
Date: APRIL, 2003
Designed by: ATM
Drawn by: RJS

Sheet Number
D1

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Images: [none]
Xrefs: [REF] ShW_TBX, ATM_STW]



1 / D2 FLOW CONTROL VAULT PLAN
SCALE: 1/2" = 1'-0"

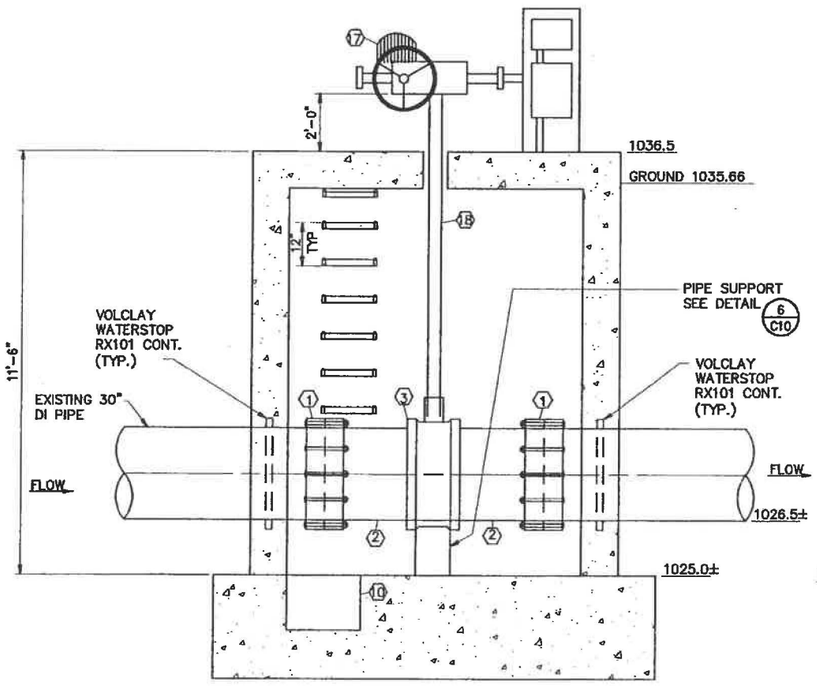


2 / D2 PRESETTLING BASIN INFLOW PIPE
SCALE: 1/2" = 1'-0"

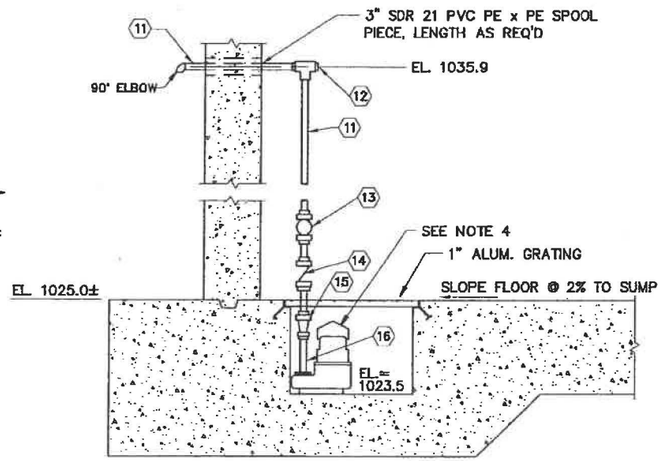
CONTRACTOR NOTES:

1. CONTRACTOR SHALL FIELD VERIFY LOCATION, DEPTH AND SIZE OF EXISTING 30" PIPE AND ADJUST PIPING ELEVATION AND VAULT AS REQUIRED.
2. INSTALL ACCESS HATCH ACCORDING TO MANUFACTURERS RECOMMANDATION
3. RUN DRAIN FROM HATCH TO OUTSIDE OF VAULT
4. SUMP PUMP TO BE ABS MODEL SE-4V SUBMERSIBLE PUMP OR EQUAL. PUMP SHALL BE 0.4 HP 1/ 120V 3450 RPM 60HZ PASSING 3/4" SOLID DISCHARGE. RATES: 20 GPM @ 27', TDH 40 GPM @ 22' TDH AND 60 GPM @ 15' TDH. SEE DETAIL 5/D2

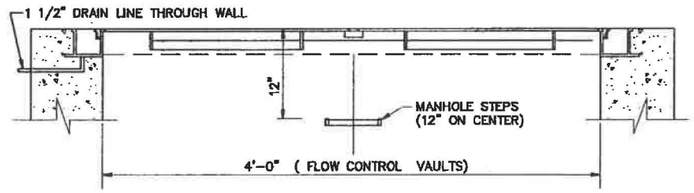
PIPE LEGEND	
⬡	DESCRIPTION
1	30" DRESSER STEEL COUPLING STYLE 38 (OR EQUAL)
2	30" FLG X PE SPOOL AS REQ'D.
3	30" PRATT BUTTERFLY VALVE
4	TRITON XR-70 WITH ELECTRIC OPERATOR WITH MANUAL OVERRIDE
5	30" MJ TEE
6	30" PE X PE SPOOL (AS REQ'D.)
7	30" MJ GROUNDHOG BUTTERFLY VALVE WITH 2" SQ. AWWA NUT WITH EXTENSION
8	30" MJ SOLID SLEEVE
9	30" WALL SLEEVE LENGTH AS REQ'D.
10	SUMP PIT W/ GRATE - SEE DETAILS 5/D2
11	2" PVC SPOOL
12	2" PVC TEE W/ THREADED PLUG
13	2" PVC TRUE UNION WITH BALL VALVE, SCH. 80
14	2" PVC CHECK VALVE W/ UNIONS, SCH. 80
15	1 1/4" X 2" PVC REDUCER
16	1 1/4" SPOOL (AS REQ'D.)
17	LIMITORQUE LS 120
18	VALVE STEM HOUSING (LENGTH AS REQ'D.)



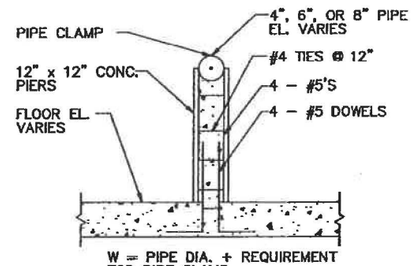
3 / D2 PROPOSED FLOW CONTROL VAULT
SCALE: 1/2" = 1'-0"



4 / D2 SUMP DETAIL
SCALE: 3/4"=1'-0"



5 / D2 HATCH COVER - SECTION
SCALE: NTS



6 / D2 TYPICAL CONCRETE PIER PIPE SUPPORT DETAIL
SCALE: NONE

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20702
OKLAHOMA
4-14-03

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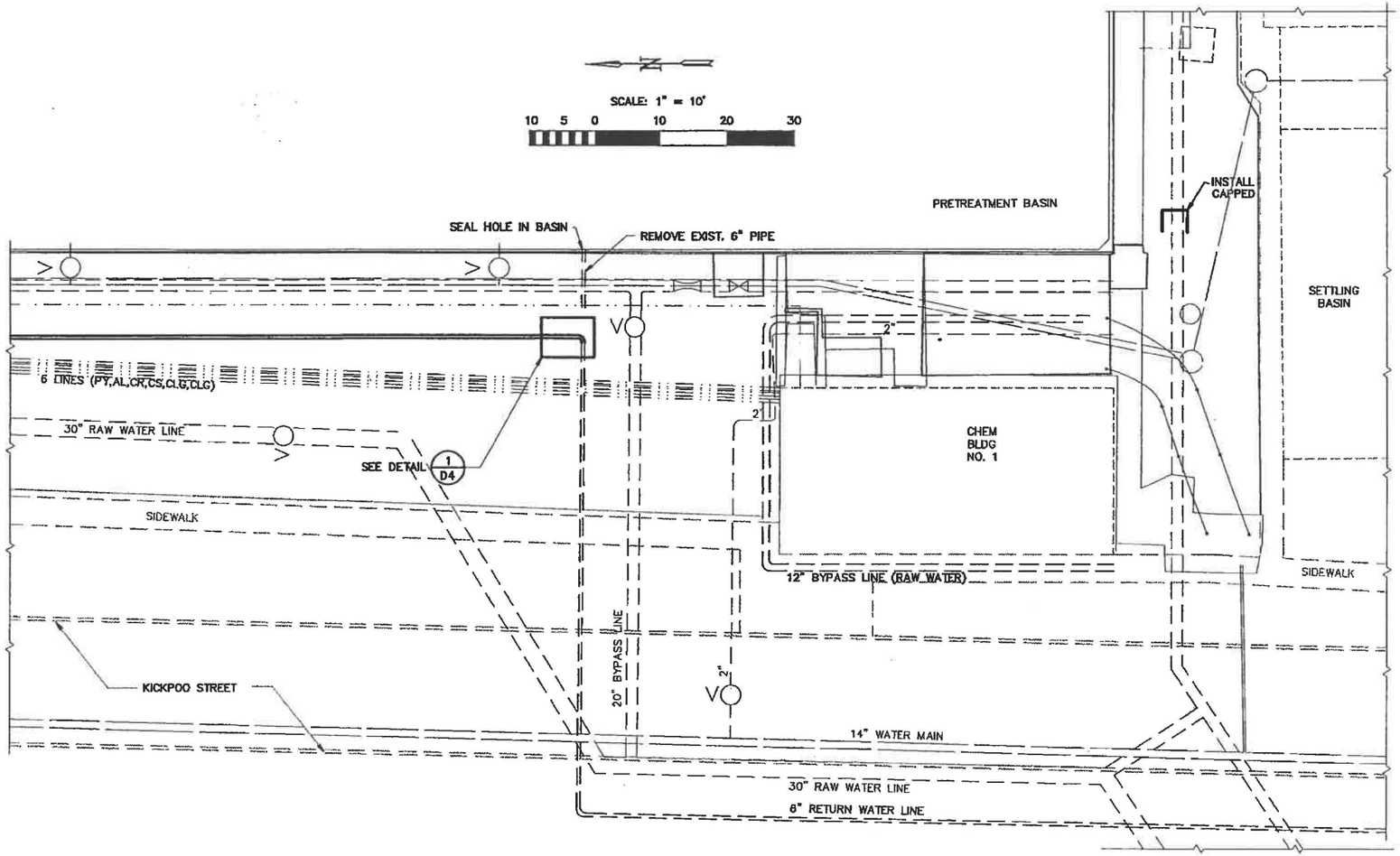
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

FLOW CONTROLLER VAULT MECHANICAL DETAILS

Job No. 02011280
Date: APRIL, 2003
Designed by: SBG
Drawn by: RNF

Sheet Number
D2

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1/D3 LAGOON RETURN WATER VAULT PIPING PLAN
SCALE: 1" = 10'

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Kirk Ireland
20702
OKLAHOMA
4-14-03

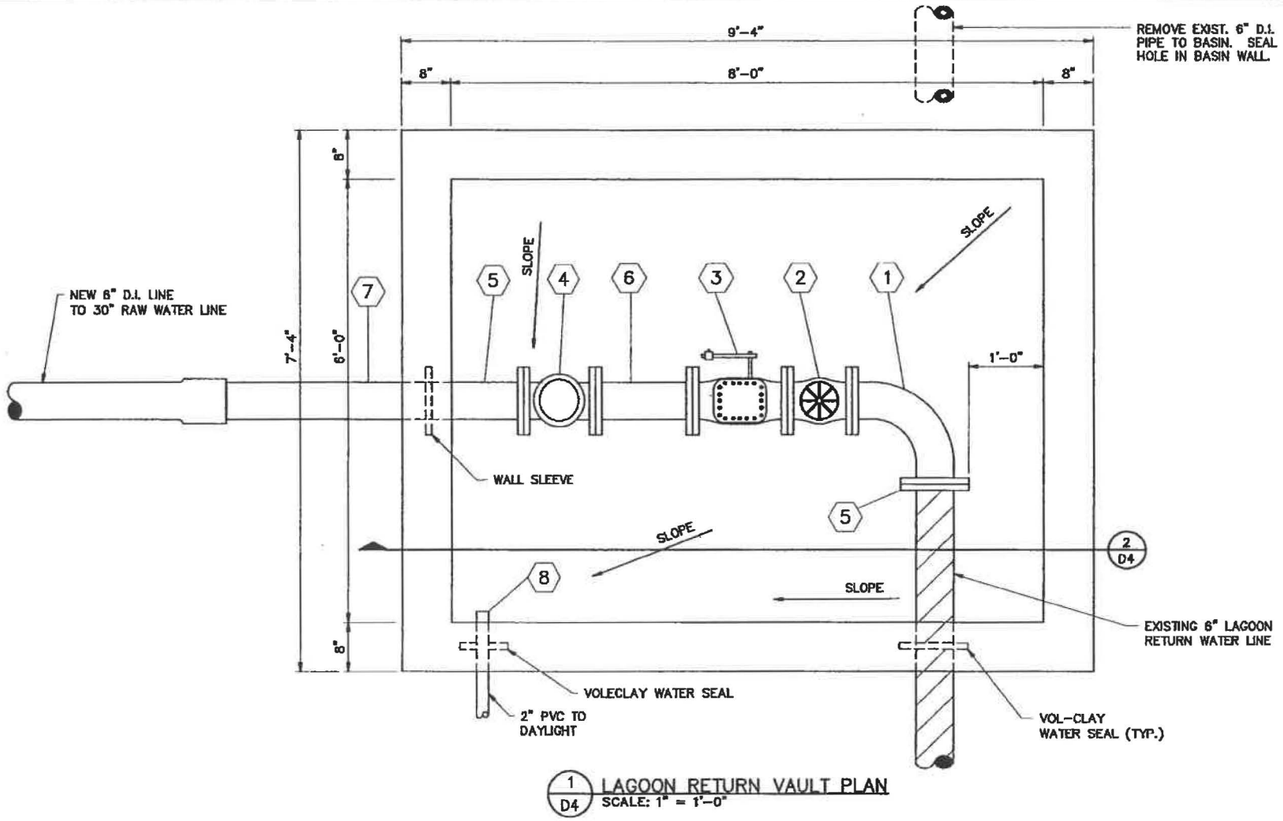
CITY OF SHAWNEE
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PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

LAGOON RETURN WATER VAULT PLAN

Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RDR

Sheet Number
D3

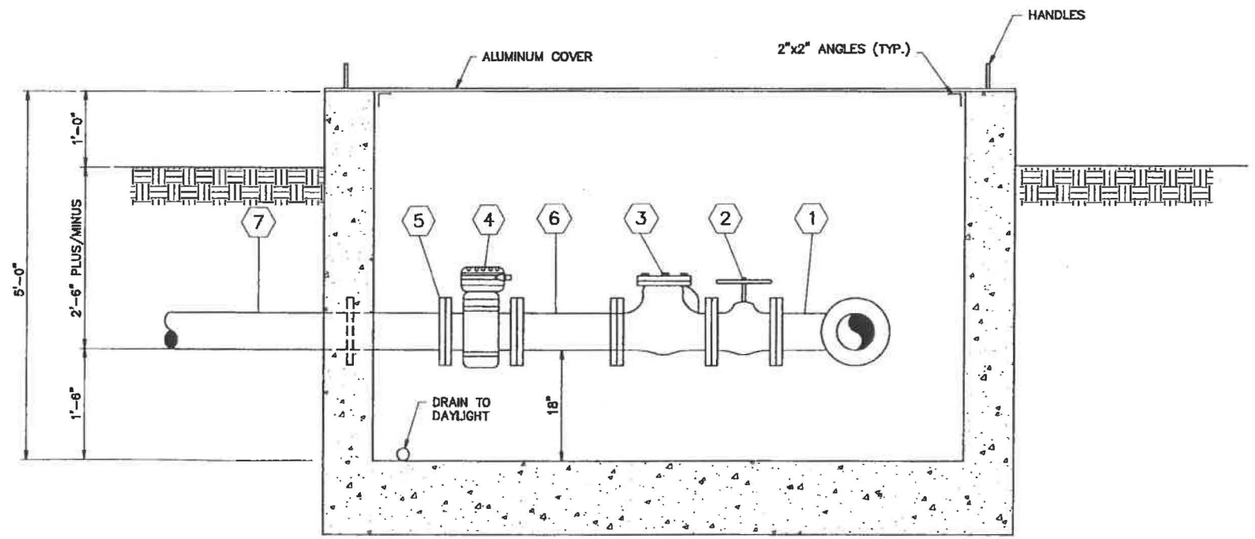


1 D4 LAGOON RETURN VAULT PLAN
SCALE: 1" = 1'-0"

PIPE LEGEND	
MARK	DESCRIPTION
1.	6" FLG LONG RADIUS 90° BEND
2.	6" FLG GATE VALVE(HANDWHEEL OPERATED)
3.	6"FLG CHECK VALVE (LEVER AND WEIGHT)
4.	6" FLOW METER (FLANGED, MAGNETIC)
5.	6" UNI-FLANGE
6.	6" FLG x FLG SPOOL, LENGHT AS REQUIRED
7.	6" WALL SLEEVE
8.	2" PVC SDR 21 TO DAYLIGHT

CONTRACTOR NOTES:

1. FIELD VERIFY LOCATION DEPTH AND SIZE OF PIPE PRIOR TO TRENCHING AND CONSTRUCTION ADJUST PIPING ELEVATION AND VAULT AS REQUIRED.



1 D4 LAGOON RETURN VAULT SECTION
SCALE: 1" = 1'-0"

REGISTERED PROFESSIONAL ENGINEER
KIRK B. RICHMOND
20702
OKLAHOMA
4-14-03

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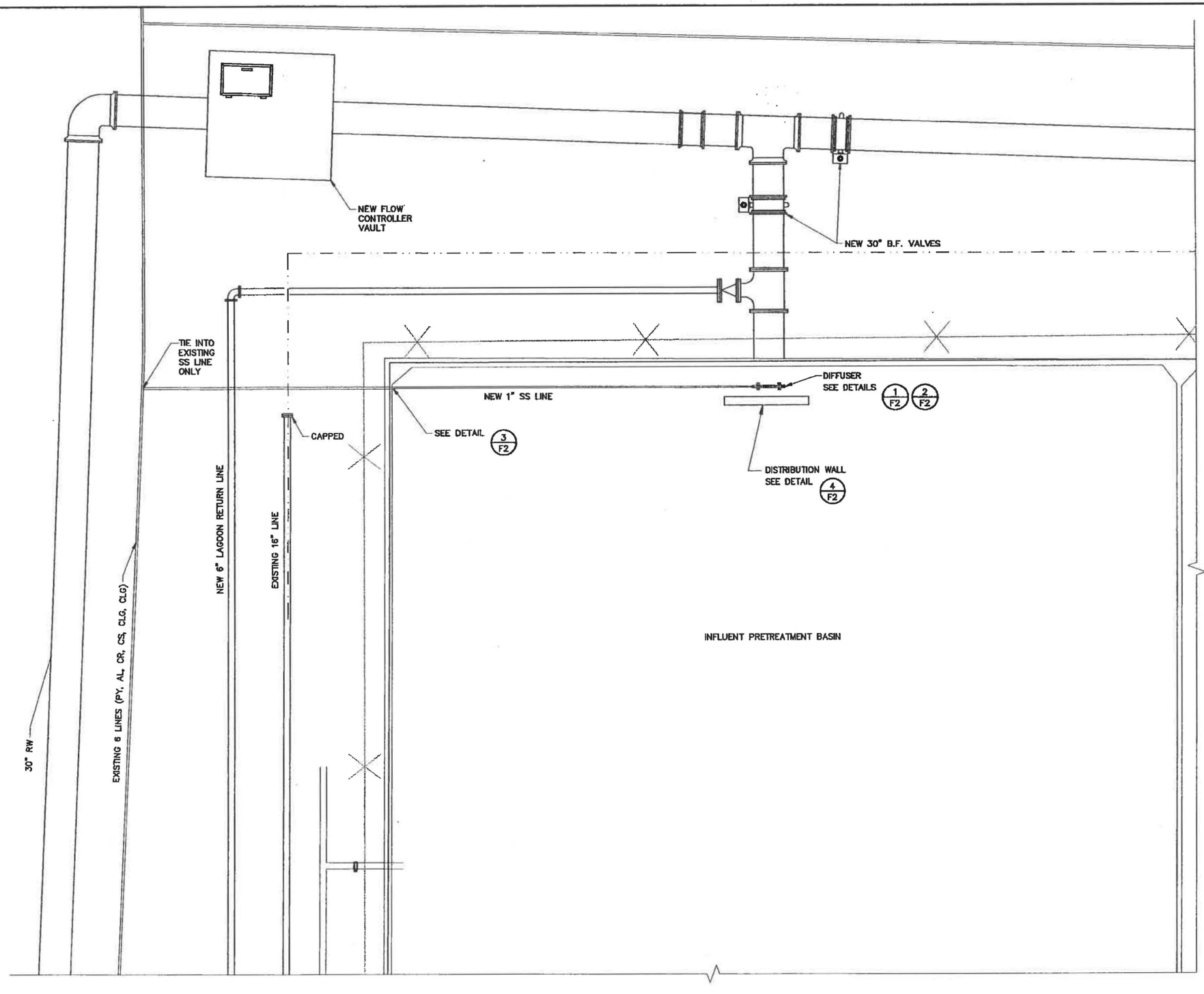
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

LAGOON RETURN WATER VAULT DETAILS

Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RDR

Sheet Number
D4

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images: [none]



1/F1 SULFURIC ACID FEED PLAN
SCALE: 1/4" = 1'-0"

CONTRACTORS NOTES:

1. CONTRACTOR SHALL TIE INTO EXISTING STAINLESS STEEL CHEMICAL LINE TO A NEW 1" ~ 316 STAINLESS STEEL SULFURIC ACID FEED LINE.

CAUTION

2. PROTECTIVE SAFETY GEAR MUST BE WORN WHEN TYING INTO EXISTING CHEMICAL LINES.

REGISTERED PROFESSIONAL ENGINEER
KEITH N. RICHARD
20702
OKLAHOMA
4-14-03

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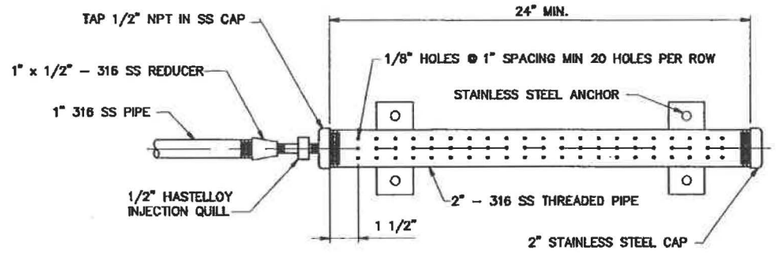
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

SULFURIC ACID FEED PLAN

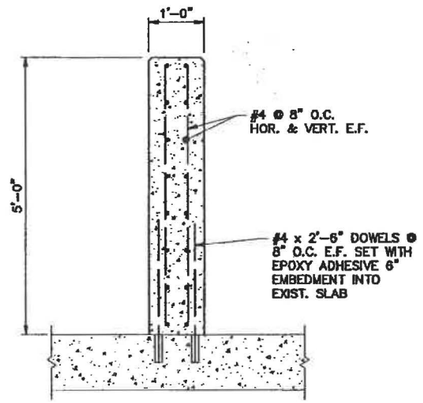
Job No. 020112B0
Date: APRIL, 2003
Designed by: SJG
Drawn by: RNF

Sheet Number
F1

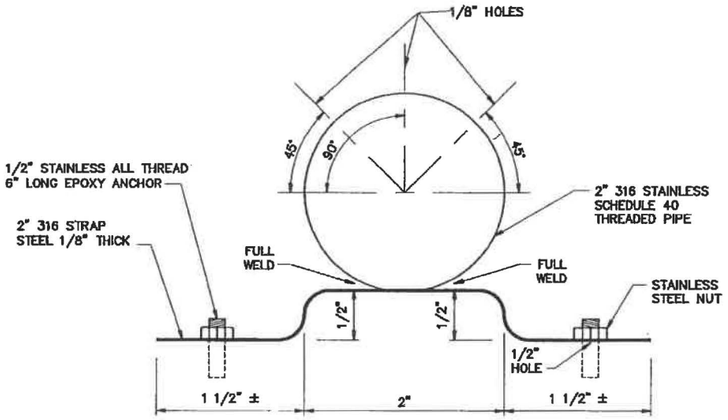
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Xrefs: P:\Standards\PROGDEV\STAMPS_kbr_OK] [L:\2002\020112B0 - Shawnee WTP\drawings\REF_BLDPLAN, EXISTSITEPLAN] [REF_SHW_TBX]



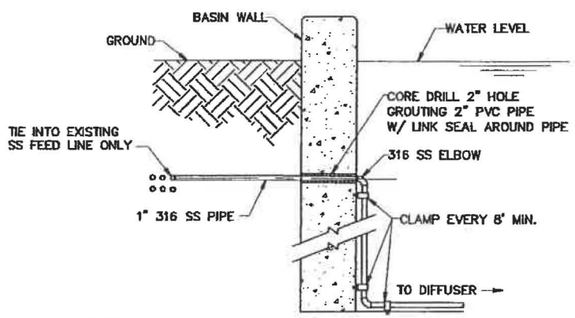
1 / F2 ACID DIFFUSER
SCALE: 3" = 1'–0"



4 / F2 SECTION DISPERSAL WALL
SCALE: 3/4" = 1'–0"



2 / F2 H_2SO_4 ACID DIFFUSER
SCALE: NTS



CONTRACTORS NOTE:

1. FIELD VERIFY PIPE LOCATIONS & DEPTH AND ADJUST AS REQUIRED.

3 / F2 ACID FEED PIPE
SCALE: NTS

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REGISTERED PROFESSIONAL ENGINEER
KIM R. RACHUY
20702
OKLAHOMA
4-14-03

CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

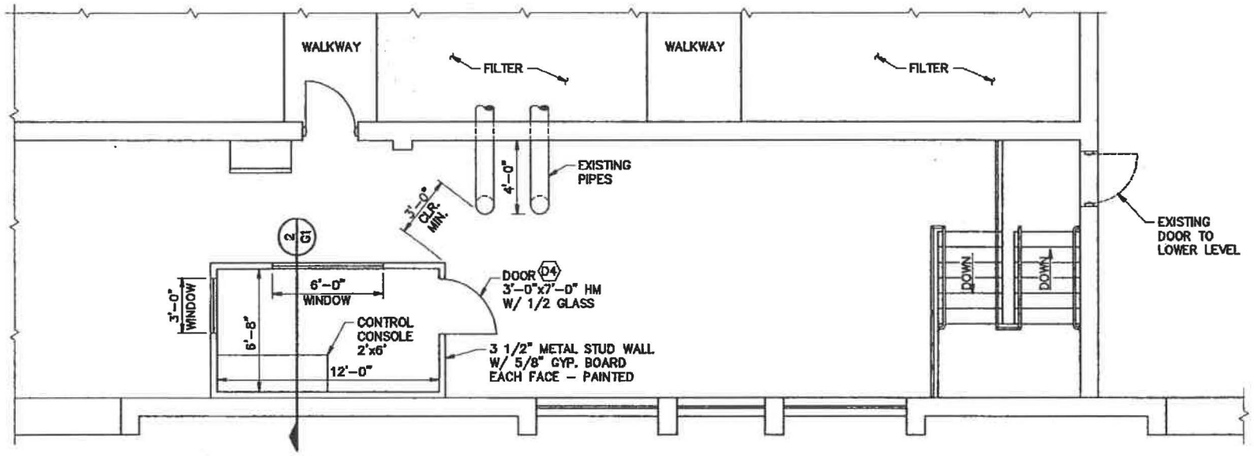
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

SULFURIC ACID FEED DETAILS

Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RJS

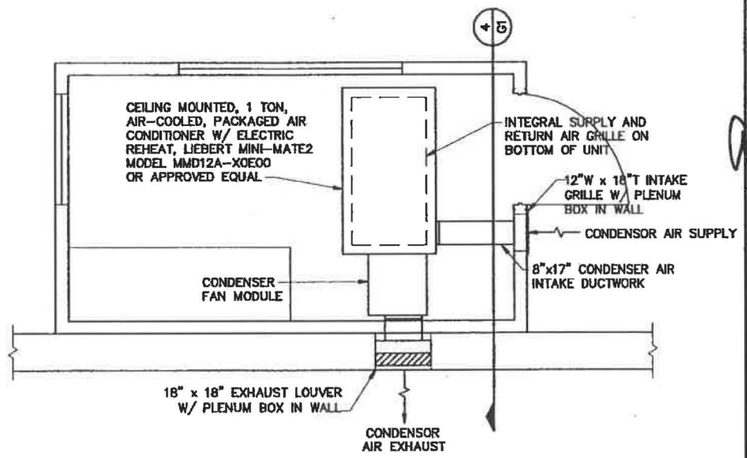
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F2

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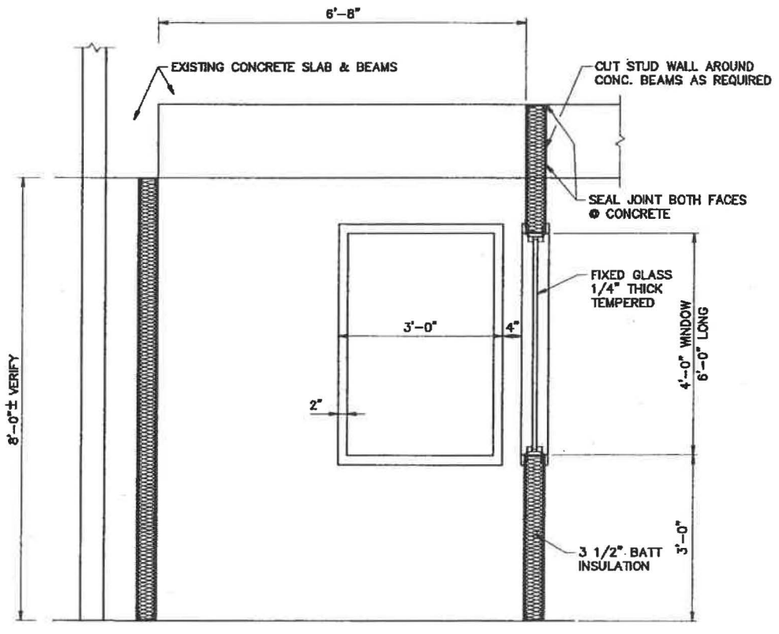


1 G1 CONTROL ROOM PLAN - UPPER FLOOR
SCALE: 1/4" = 1'-0"

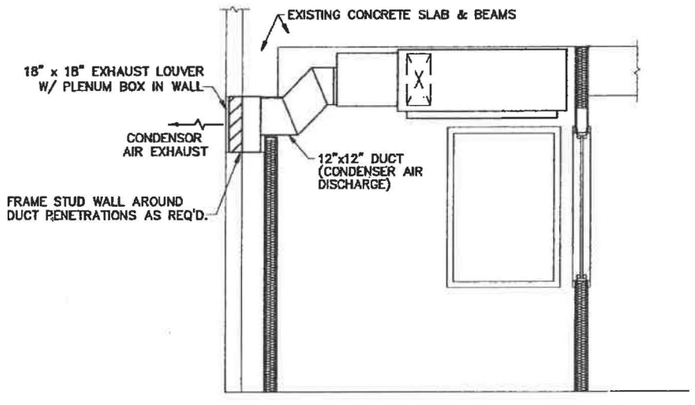
SCALE: 1/4" = 1'-0"
48" 24" 0 2' 4' 6' 8' 10' 12'



3 G1 CONTROL ROOM HVAC PLAN
SCALE: 1/2" = 1'-0"



2 G1 SECTION THRU CONTROL ROOM - FILTER BBUILDING
SCALE: 3/4" = 1'-0"



NOTE: SEE SHEET C15 FOR MECHANICAL EQUIPMENT SUPPORT DETAIL.

4 G1 SECTION THRU CONTROL ROOM - HVAC INSTALLATION
SCALE: 1/2" = 1'-0"

REGISTERED PROFESSIONAL ENGINEER
WESLEY D. DAVIS
18212
OKLAHOMA
4-1-03

REGISTERED PROFESSIONAL ENGINEER
RICHARD J. SCHMITT
17426
OKLAHOMA

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PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

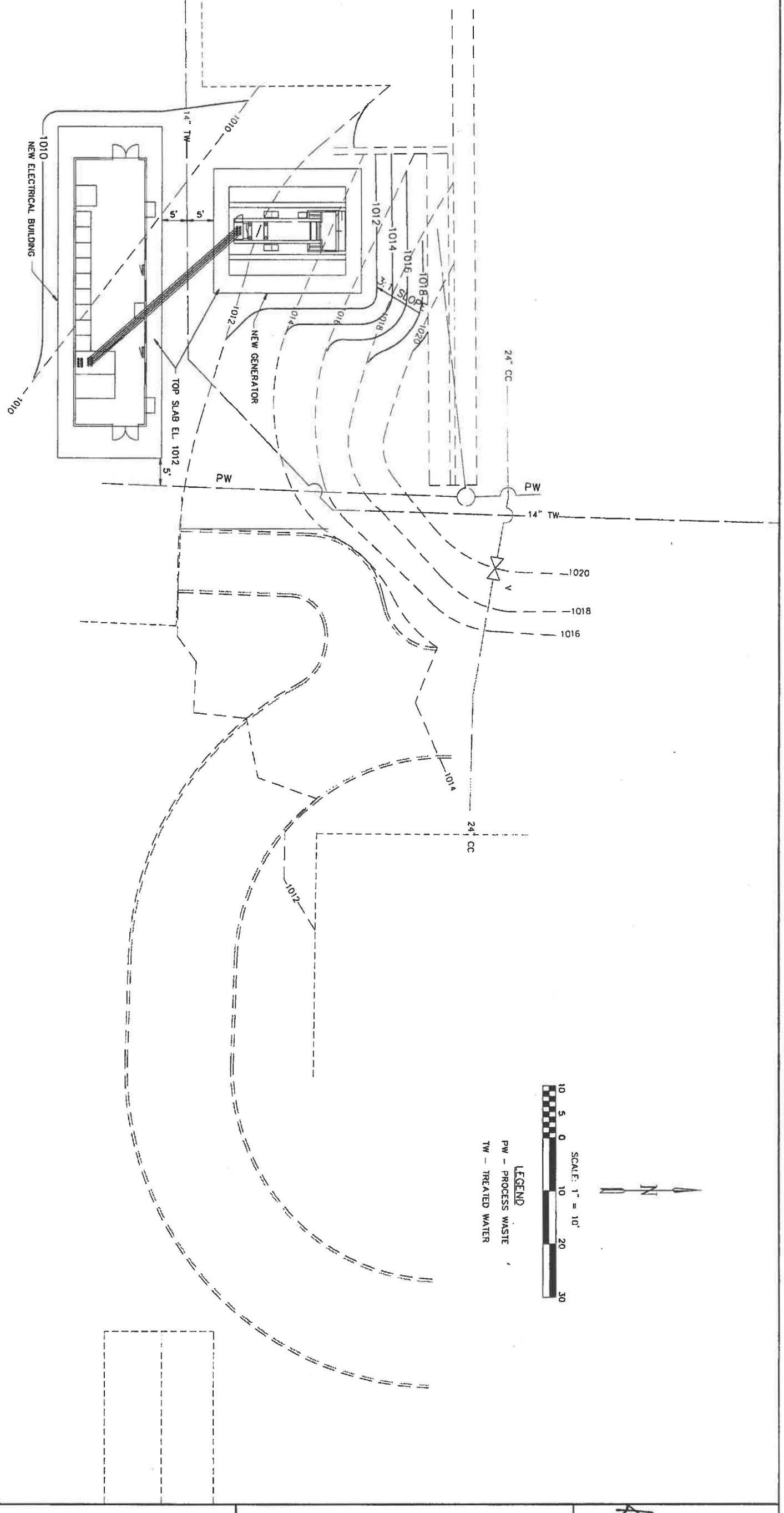
CONTROL ROOM MODIFICATION - MECHANICAL PLAN

Job No. 02011280
Date: APRIL, 2003
Designed by: ATM
Drawn by: RJS

Sheet Number
G1

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Images: [none]



GENERATOR AND ELECTRICAL BUILDING SITE PLAN

Job No. 02011280
Date: APRIL, 2003
Designed by: SJG
Drawn by: RDR

Sheet Number
G2

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------PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

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REGISTERED PROFESSIONAL ENGINEER
Kirk Bland
10702
OKLAHOMA
ENGINEER
4-14-03

POWER, LIGHTING & SYSTEM LEGEND

- UNDER CABINET LIGHT FIXTURE
- 1x4 FLUORESCENT LIGHT
- 2x4 FLUORESCENT LIGHT
- EL — FLUORESCENT LIGHT WITH EMERGENCY LIGHT (EL) BATTERY 1400 LUMENS MINIMUM FOR 2 LAMPS
- 2x2 FLUORESCENT LIGHT
- RECESSED LIGHT, UNLESS OTHERWISE SHOWN
- WALL MOUNTED LIGHT–MOUNTING HEIGHT AS INDICATED
- LED EXIT LIGHT CEILING MOUNTED, DARKENED AREA INDICATES FACE, ARROWS INDICATE DIRECTION OF EGRESS
- 4 FT. STRIP FLUORESCENT LIGHT
- S — LIGHT SWITCH, MTD. 4'–0" A.F.F.
- S_2 — LIGHT SWITCH, 2 POLE, MTD 4'–0" A.F.F.
- S_3 — LIGHT SWITCH, 3–WAY, MTD. 4'–0" A.F.F.
- S_4 — LIGHT SWITCH, 4–WAY, MTD. 4'–0" A.F.F.
- S_P — LIGHT SWITCH WITH PILOT LIGHT, MTD. 4'–0" A.F.F.
- 20 AMP DUPLEX RECEPTACLE MTD. HORIZ. 6" ABOVE COUNTER TOP UNLESS OTHERWISE SHOWN
- 20 AMP DUPLEX RECEPTACLE MTD. 18" A.F.F., WITH #12 GROUND WIRE, GFCI INDICATES GROUND FAULT CIRCUIT INTERRUPTER, WP INDICATES WEATHERPROOF ENCLOSURE AND COVER
- SINGLE RECEPTACLE, RATINGS AS NOTED
- S_M — HP RATED TOGGLE SWITCH, 1 OR 2 POLES AS REQUIRED W/OVERLOADS
- OR — NON–FUSED DISCONNECT SWITCH, SIZE AS NOTED
- OR — COMBINATION DISCONNECT AND MOTOR STARTER, SIZE AS NOTED. FUSED TYPE SHOWN.
- F OR — FUSED DISCONNECT SWITCH, SIZE AS NOTED
- PUSHBUTTON STATION, NEMA 4X
- ELECTRICAL PANEL, SURFACE MOUNTED, 5'–6" TO TOP OF ENCLOSURE
- ELECTRICAL PANEL, RECESSED MOUNTED, 5'–6" TO TOP OT ENCLOSURE
- EQUIPMENT CABINET SIZE AS NOTED, RECESSED MOUNTED, 5'–6" TO TOP OF ENCLOSURE
- EQUIPMENT CABINET SIZE AS NOTED, SURFACE MOUNTED, 5'–6" TO TOP OF ENCLOSURE
- L–1 — HOME RUN TO PANEL, RECEPTACLES AND EQUIPMENT SHALL HAVE GREEN GROUND WIRE. NUMBER OF ARROWS INDICATES NUMBER OF PHASE CONDUCTORS, LETTER(S) INDICATE NAME OF PANEL, NUMBER(S) INDICATE CIRCUIT NUMBERS
- BRANCH CIRCUIT WITH PHASE, NEUTRAL, SWITCHED PHASE AND EQUIPMENT GROUNDING CONDUCTORS
- W — TELEPHONE OUTLET, SINGLE GANG BOX MTD. 18" A.F.F. WITH 3/4"C STUB TO ABOVE LAY–IN CEILING. "W" INDICATES 4'–6" MTD. HEIGHT FOR WALL PHONE.

- 3/4" PLYWOOD TELEPHONE BACKBOARD, SIZE AS NOTED, MTD. 5'–6" TO TOP
- JUNCTION BOX 42 CUBIC INCH MINIMUM CAPACITY
- SH — SMOKE DETECTOR, WALL MTD.
- S — SMOKE DETECTOR, CEILING MTD.
- F — FIRE ALARM PULL STATION MTD. 4'–0" A.F.F.
- F — FIRE ALARM PULL STATION MTD. 4'–0" A.F.F. AND HORN MTD. 7'–0" A.F.F.
- D — SMOKE DETECTOR, HVAC DUCT MTD.
- C — FIRE ALARM CHIME 7'–0" A.F.F.
- FS — SPRINKLER FLOW SWITCH
- FLOOR TELEPHONE OUTLET, CAST JUNCTION–BOX
- WALL TELEPHONE OUTLET
- S — DOOR SWITCH MOUNTED IN DOOR JAMB
- DOOR BUTTON WEATHER PROOF, 50" A.F.F.
- B — DOOR BUZZER MTD 7'–0" A.F.F.
- H, H1 — HANDHOLE, IDENTIFIER SHOWN, REFER TO HANDHOLE SCHEDULE FOR SIZE
- CIRCUIT BREAKER, TRIP RATING SHOWN, 3–POLE UNLESS NOTED
- FUSE, CURRENT LIMITING, RATING AS SHOWN
- TRANSFORMER, RATINGS AS SHOWN
- M, 10 HP — ELECTRIC MOTOR, HORSEPOWER SHOWN
- MOTOR STARTER, SIZE AS SHOWN OR REQUIRED. FVNR UNLESS NOTED
- VFD — VARIABLE FREQUENCY DRIVE
- 4–4" — DUCT BANK, IDENTIFIER SHOWN. REFER TO DUCT BANK SCHEDULE FOR SIZE AND CONFIGURATION.
- 3/4" x 10' COPPER CLAD GROUND ROD
- SA — SURGE ARRESTOR
- G, * kW — GENERATOR
- ATS/BP/1S 3P400 — ATS
- WEATHERHEAD
- CABLE CONNECTION

2(3#8 + 1#8 + 1#10EG) 3/4" GRS

- CONDUIT TYPE (SEE ABBREVIATIONS) REFER TO SPECIFICATIONS IF NOT SHOWN
- CONDUIT SIZE
- GROUNDING (GROUND) CONDUCTOR, NUMBER AND SIZE
- GROUNDED (NEUTRAL) CONDUCTOR, NUMBER AND SIZE
- PHASE (HOT) CONDUCTOR, NUMBER AND SIZE
- NUMBER OF SETS

ABBREVIATIONS

A	AMP
ACU	AIR CONDITIONING UNIT
AFF	ABOVE FINISHED FLOOR
AIC	AMPS INTERRUPTING CAPACITY
AM	AMP–METER
ANN	ANNUNCIATOR
AP	AERIAL PRIMARY
AS	AERIAL SECONDARY
AUX	AUXILIARY
BFI	BLOWN FUSE INDICATOR
BKR	BREAKER
C	CONDUIT
CGRS	PVC COATED GALVANIZED RIGID STEEL
CKT	CIRCUIT
COM	COMMON
CONT	CONTINUOUS
CP	CONTROL PANEL
CPT	CONTROL POWER TRANSFORMER
CR	CONTROL RELAY
CS	CORD SET
CU	COEFFICIENT OF UTILIZATION
DEB	DIRECT EARTH BURIED
EC	EMPTY OR EMBEDDED CONDUIT
EF	EXHAUST FAN
EG	EQUIPMENT GROUND
EL	ELEVATION
EMT	ELECTRICAL METALLIC TUBING
ETM	ELASPED TIME METER
FA	FIRE ALARM
FAP	FIRE ALARM PANEL
FC	FAN COIL
FLR	FLOOR
FOC	FIBER OPTIC CABLE
FS	FLOAT SWITCH
FT	FEET
FVNR	FULL VOLTAGE NON–REVERSING STARTER
FVR	FULL VOLTAGE REVERSING STARTER
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GND	GROUND
GRS	GALVANIZED RIGID STEEL
HOA	HAND–OFF–AUTO
HP	HORSEPOWER OR HEAT PUMP
HR	HOUR
JB	JUNCTION BOX
kVA	KILOVOLT–AMPERE
kVAR	KILOVOLT–AMPERE, REACTIVE
kW	KILOWATT
LA	LIGHTNING ARRESTOR
L.O.	LUGS ONLY
LV	LOW VOLTAGE
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MFR	MANUFACTURER
MIN	MINIMUM
MS	MOTOR STARTER
MTD	MOUNTED
NFDS	NON–FUSED DISCONNECT SWITCH
NTS	NOT TO SCALE
OC	ON CENTER
OH	OVERHEAD
OL	OVERLOAD
PB	PUSH BUTTON
PEC	PHOTO ELECTRIC CELL
PF	POWER FACTOR
PL	PILOT LIGHT
PMR	PHASE MONITOR RELAY
PNL	PANEL
PTT	PUSH–TO–TEST
PVC	SCHEDULE 40 POLYVINYL CONDUIT
RECPT	RECEPTACLE
RM	ROOM
RVAT	REDUCED VOLTAGE AUTO–TRANSFORMER STARTER
S	SECOND
SA	SURGE ARRESTER
SDBC	SOFT DRAWN BARE COPPER
SE	SERVICE ENTRANCE
SHT	SHEET
SN	SOLID NEUTRAL
SS	STAINLESS STEEL
STA	STATION
SW	SWITCH
TEL	TELEPHONE
TD	TIME DELAY
TDD	TIME DELAY ON DE–ENERGIZATION
TDE	TIME DELAY ON ENERGIZATION
TYP	TYPICAL
TC	TIME CLOCK
UG	UNDER GROUND
UH	UNIT HEATER
UP	UNDERGROUND PRIMARY
US	UNDERGROUND SECONDARY
VA	VOLT–AMP
VFD	VARIABLE FREQUENCY DRIVE
VM	VOLT–METER
W	WATT OR WIRE
WH	WEATHER HEAD
WM	WATT METER
WP	WEATHERPROOF
W/	WITH
XMFR	TRANSFORMER

GENERAL NOTES:

1. SOME SYMBOLS OR ABBREVIATIONS MAY APPEAR ON THIS SHEET AND NOT BE UTILIZED ON THE PROJECT.

CONTROL SCHEMATIC LEGEND

- WIRING WITHIN PANEL
- WIRING TO FIELD DEVICE
- PUSHBUTTON SWITCH, NORMALLY OPEN
- PUSHBUTTON SWITCH, NORMALLY CLOSED
- SELECTOR SWITCH, NUMBER OF POSITIONS AND CONTACTS AS SHOWN
- RELAY CONTACT, NORMALLY OPEN
- RELAY CONTACT, NORMALLY CLOSED
- TIME DELAY CONTACT, CLOSE ON ENERGIZATION
- TIME DELAY CONTACT, OPEN ON ENERGIZATION
- TIME DELAY CONTACT, OPEN ON DE–ENERGIZATION
- TIME DELAY CONTACT, CLOSE ON DE–ENERGIZATION
- LEVEL SWITCH
- PRESSURE SWITCH
- LIMIT SWITCH CONTACT, NORMALLY OPEN
- LIMIT SWITCH CONTACT, NORMALLY CLOSED
- LIMIT SWITCH CONTACT, HELD OPEN
- LIMIT SWITCH CONTACT, HELD CLOSED
- RELAY COIL, "TR" INDICATES "TIMING RELAY"
- PILOT LIGHT; "A" INDICATES "AMBER LENS" "G" INDICATES "GREEN LENS" "R" INDICATES "RED LENS"
- SOLENOID
- ETM — ELAPSED TIME METER
- TERMINAL BLOCK
- ELECTRICAL CONNECTION
- FUSE, AMPERE RATING AS SHOWN OR REQUIRED "BFI" INDICATES "BLOWN FUSE INDICATOR" TYPE
- GROUND CONNECTION TO ENCLOSURE GROUND BAR

LINE TYPES

- FURNISH + INSTALL
- EXISTING

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REGISTERED PROFESSIONAL ENGINEER — DELTO BROWN — 18183 — 4/14/2003

CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL LEGEND AND ABBREVIATIONS

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: CAG

Sheet Number
E1

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Xrefs: [P:\Standards\PRODDEV\STAMPS\ DLB_OK] [L:\2002\02011280 - Shawnee WTP\drawings\REF\ xrf_db] [REF\ SHW_TBX]

ROUTE (3#12)1"C FROM GATE OPERATOR AND (3#12) FROM KEYPAD TO POWER PANEL INSIDE

INSTALL CCTV CAMERA ROUTE (3#12)1"C TO POWER PANEL IN CHEM BUILDING

KEYPAD/INTERCOM

ROUTE FIBER OPTIC CABLE FROM KEYPAD THROUGH CHEMICAL BUILDING TO DUCT SYSTEM

NEW FLOW CONTROL VALVE

EXISTING DISCONNECT

NEW TRANSFORMER XFMR-T2

WARNING!! HIGH VOLTAGE CROSSING

NEW TRANSFORMER XFMR-T3

POWER PANEL "PP"

BACKWASH TANK SCADA ANTENNA

INSTALL CCTV CAMERA ROUTE (3#12)1"C TO PANEL MPC

MINI POWER CENTER

BACKWASH TANK RADIO

CHEMICAL LINE

CHLORINE SOLUTION

OZONE CONTACT CHAMBER & BUILDING

OZONE

AIT 100 pH

LIT 100

PRETREATMENT BASIN

WARNING!! HIGH VOLTAGE CROSSING

FIT 008

6" LINES (PY,ALOR,CS,GR,CLG)

4" LINES (PY,LS,GR,AL) 1023.33

CAUSTIC LINE

INFLUENT VALVE PIT

CLARIFIER FLOCCULATOR NO. 1

RAPID MIX & SPLITTER BOX

FUTURE CLARIFIER

CLARIFIER FLOCCULATOR NO. 2

CHEM BLDG NO. 1

SETTLING BASIN

SETTLING BASIN

ADMIN

PUMP BLDG

FUEL TANK

CLEARWELL

FILTER BLDG

NEW MAIN CONTROL PANEL

FILTER BLDG

FUTURE FILTERS

NEW HAND HOLE

NEW GENERATOR

PUMP STATION

NEMA 4X STAINLESS STEEL JUNCTION BOX SIZED PER NEC.

WARNING!! HIGH VOLTAGE CROSSING

30" FILTER EFF. LINE

1" SAMPLE LINE

24" OVERFLOW LINE

12" PW

NEW ELECTRICAL BUILDING

OHP

OHS

SIDEWALK

1 / E2 ELECTRICAL SITE PLAN
SCALE: 1" = 40'

HANDHOLE SCHEDULE

HANDHOLE	SIZE (IN.) INTERIOR L x W x H	FUTURE CONDUIT STUB-OUTS				
		NORTH	SOUTH	EAST	WEST	
H1	36"X24"X36"	2-2"	2-2"	2-2"	2-2"	EXISTING HANDHOLES
H2	36"X24"X36"	2-2"	2-2"	2-2"	2-2"	
H3	36"X24"X36"	2-2"	2-2"	2-2"	2-2"	
H4	36"X24"X36"	2-2"	8-2"	8-2"	2-2"	
H5	36"X24"X36"	2-2"	2-2"	8-2"	8-2"	
H6	36"X24"X36"	2-2"	2-2"	8-2"	6-2"	
H7	36"X24"X36"	8-2"	2-2"	8-2"	2-2"	
H8	36"X24"X36"	2-2"	2-2"	2-2"	2-2"	NEW HANDHOLES
H9	36"X24"X36"	2-2"	2-2"	2-2"	2-2"	
H10	36"X24"X36"	2-2"	2-2"	2-2"	2-2"	
H11	12"X24"X24"	2-2"	2-2"	2-2"	2-2"	

CAUTION:

UNDERGROUND UTILITIES EXIST WITHIN AND ADJACENT TO THE LIMITS OF CONSTRUCTION. AN ATTEMPT HAS BEEN MADE TO LOCATE THESE UTILITIES ON THE PLANS, HOWEVER, ALL EXISTING UTILITIES MAY NOT BE SHOWN AND THE ACTUAL LOCATIONS OF THE UTILITIES MAY VARY FROM THE LOCATIONS SHOWN. PRIOR TO BEGINNING ANY TYPE OF EXCAVATION, THE CONTRACTOR SHALL CONTACT THE UTILITIES INVOLVED AND MAKE ARRANGEMENTS FOR THE LOCATION OF THE UTILITIES ON THE GROUND. THE CONTRACTOR SHALL MAINTAIN THE UTILITY LOCATION MARKINGS UNTIL THEY ARE NO LONGER NECESSARY.

SCALE: 1" = 40'

40 20 0 40 80 120

REGISTERED PROFESSIONAL ENGINEER DELTON L. BROWN 18183 OKLAHOMA 4/14/2003

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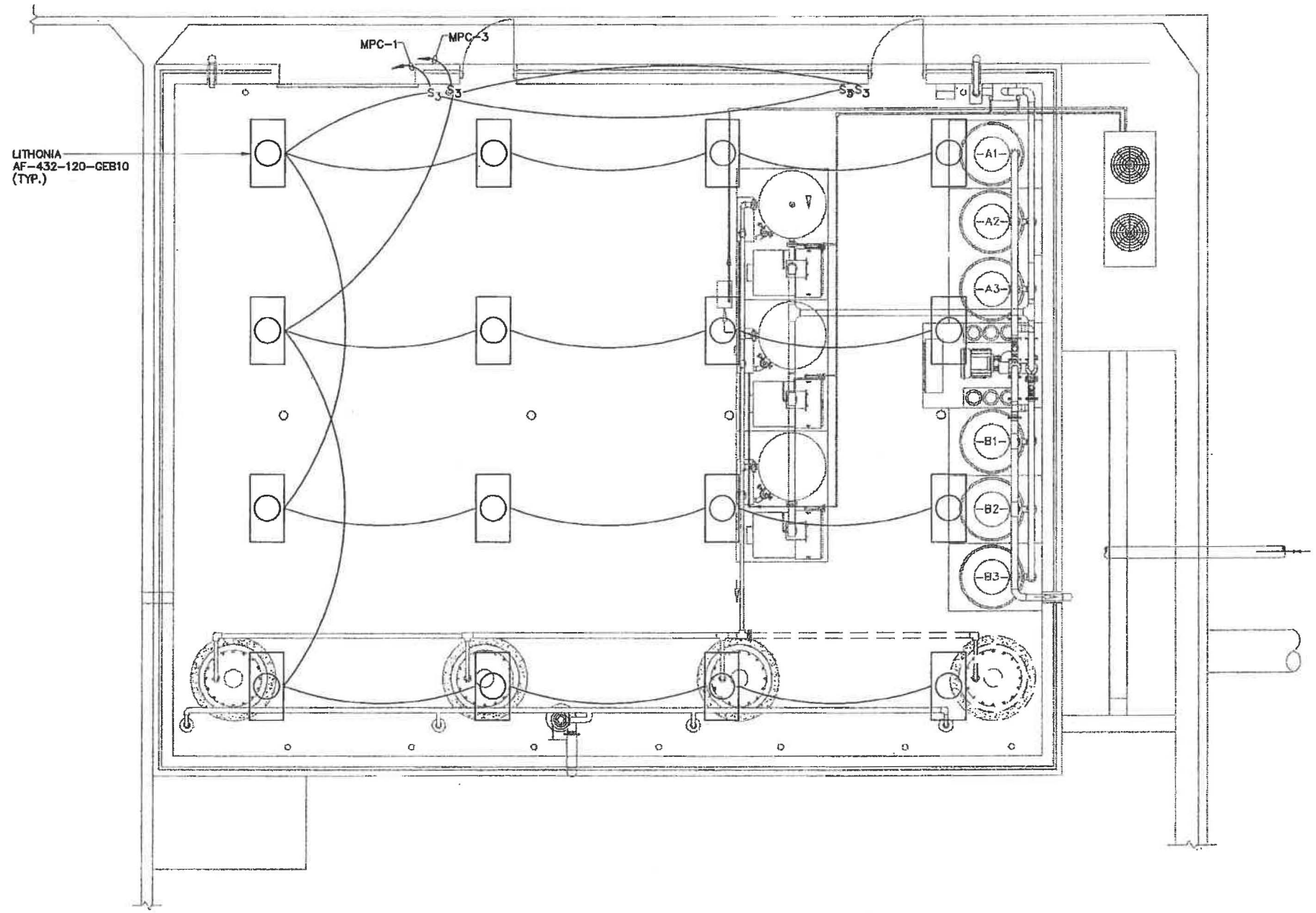
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL SITE PLAN

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: CAG

Sheet Number
E2

Plotted: 14-APR-03 10:33
By: Whitbrown SHW-LO2.dwg L:\2002\02011280 - Shawnee WTP\drawings\ 34x22 1=40 4/14/03 10:33 pm
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Xrefs: [P:\Standards\PROGDEV\STAMPS\ DLB_OK] [L:\2002\02011280 - Shawnee WTP\drawings\REF\ EXISTSITEPLAN, BLDPLAN, xrf_dlb] [REF\ SHW_TBX]



1 / E3 OZONE BLDG LIGHTING PLAN
SCALE: 1/4" = 1'-0"

SCALE: 1/4" = 1'-0"
48" 24" 0 2' 4' 6' 8' 10' 12'

N

REGISTERED PROFESSIONAL ENGINEER
DELTON BROWN
8183
OKLAHOMA

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CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

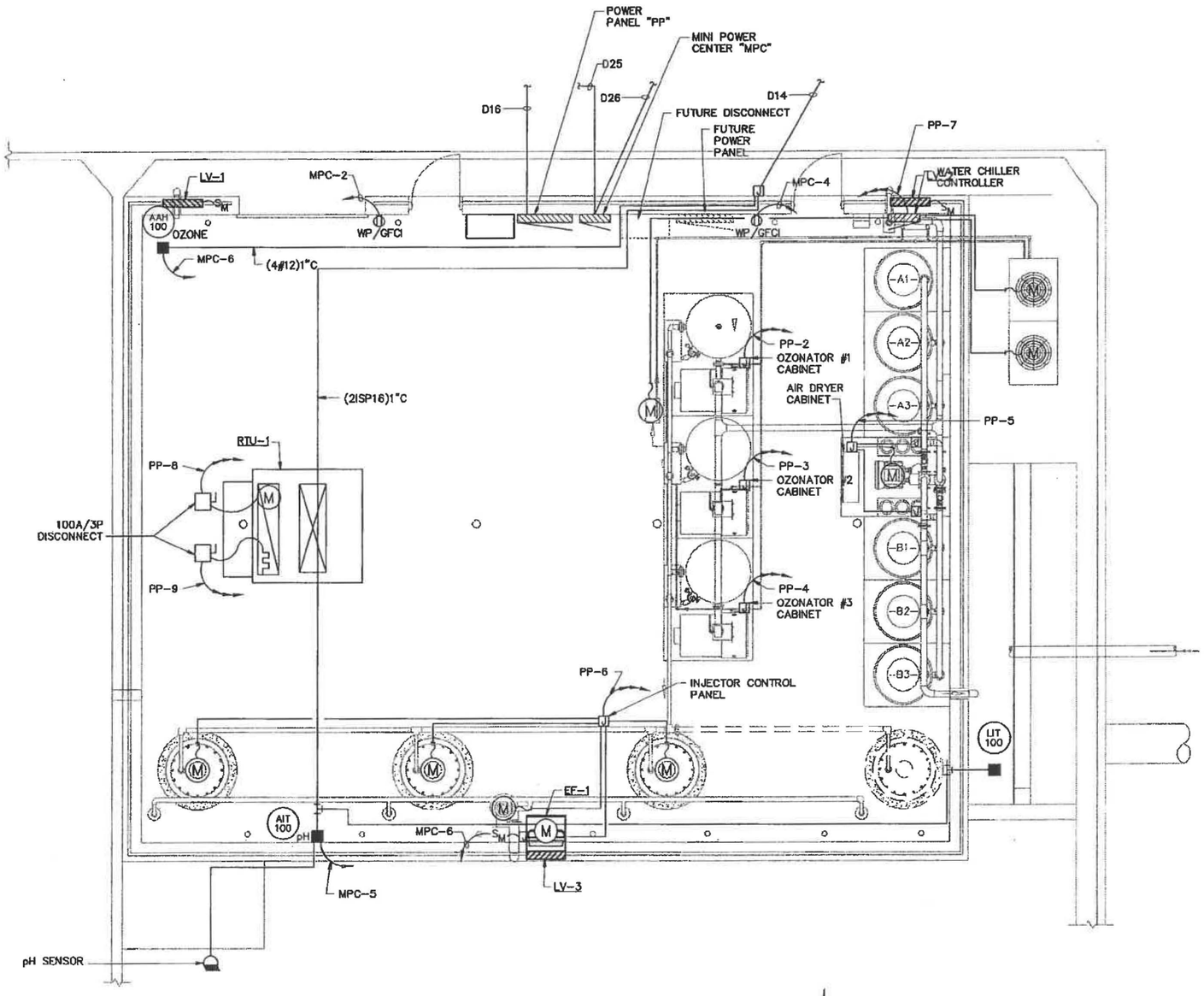
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE
BUILDING
LIGHTING PLAN

Job No. 02011280
Date: APRIL, 2003
Designed by: SBG
Drawn by: RJS

Sheet Number
E3

Xrefs: [P:\Standards\PROGDEV\STAMPS_DLB_OK] [L:\2002\02011280 - Shawnee WTP\drawings\REF_BLDPLAN_xrf_dlb] [REF_SHW_TBX]
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Plotted by: Shw-E03.dwg L:\2002\02011280 - Shawnee WTP\drawings\ 34x22 1=48 4/14/2003 3:57 pm



1/E4 OZONE BLDG POWER PLAN
SCALE: 1/4" = 1'-0"
SCALE: 1/4" = 1'-0"
48" 24" 0 2' 4' 6' 8' 10' 12'

N

GENERAL NOTE:

CONTRACTOR SHALL PROVIDE ALL CONDUIT, CONDUCTORS AND OTHER ELECTRICAL MATERIALS NECESSARY TO MAKE ALL FINAL CONNECTIONS TO THE OZONE EQUIPMENT IN ACCORDANCE WITH MANUFACTURERS RECOMMENTATIONS. CONTRACTOR SHALL MAKE ALL CONNECTIONS NECESSARY FOR A COMPLETE AND FUNCTIONING SYSTEM.

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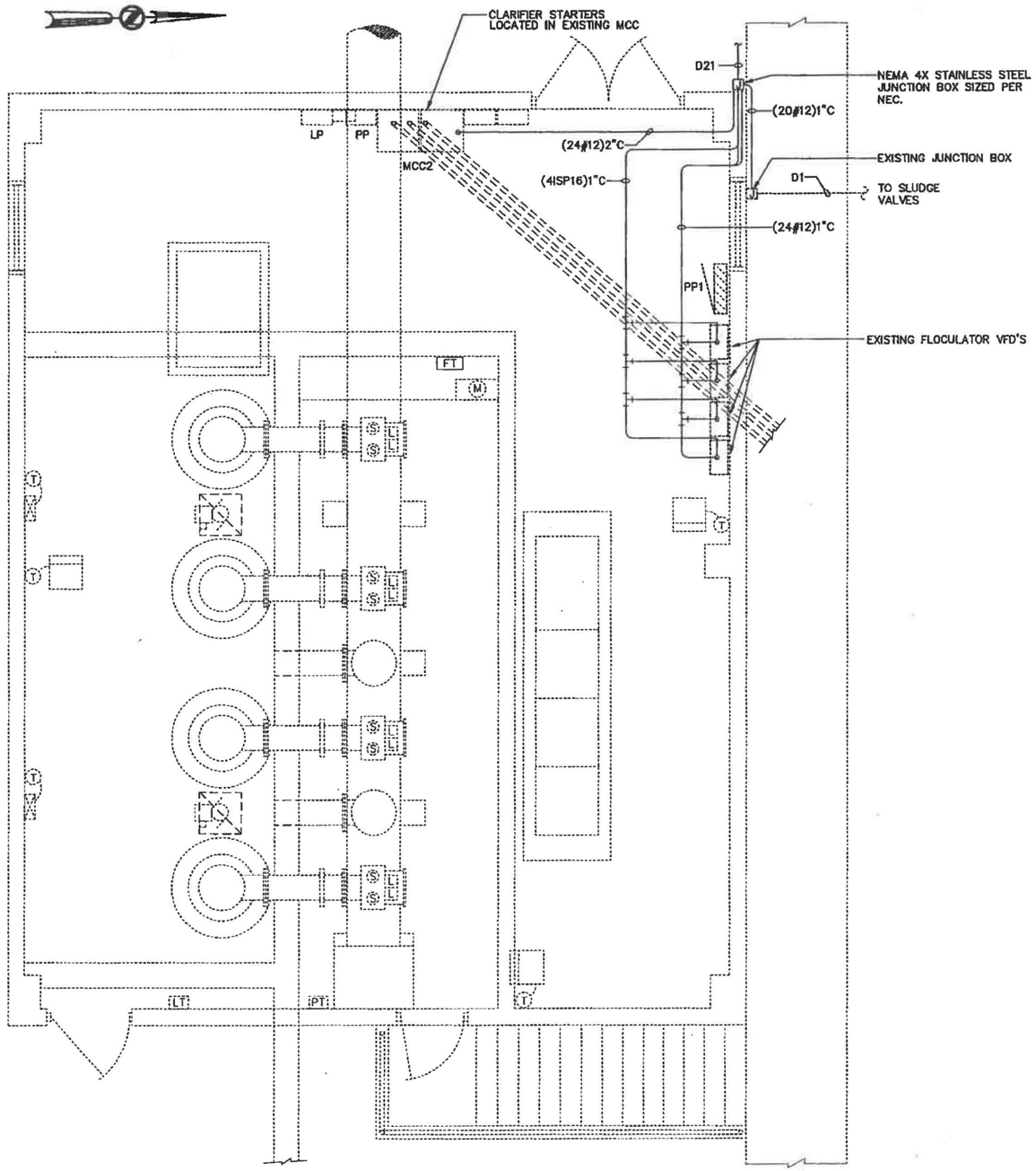
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

OZONE BUILDING POWER PLAN

Job No. 02011280
Date: APRIL, 2003
Designed by: SBC
Drawn by: RJS

Sheet Number
E4

Wdrawn Shw-Ltr4.dwg L:\2002\02011280 - Shawnee WTP\drawings\ 24x22 1=48 4/14/03 10:48 pm
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1/E5 ELECTRICAL PUMP BUILDING PLAN
SCALE: 3/8"=1'-0"

SCALE: 3/8" = 1'-0"
36" 24" 12" 0 2' 4' 6' 8'

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DEL O. L. BROWN
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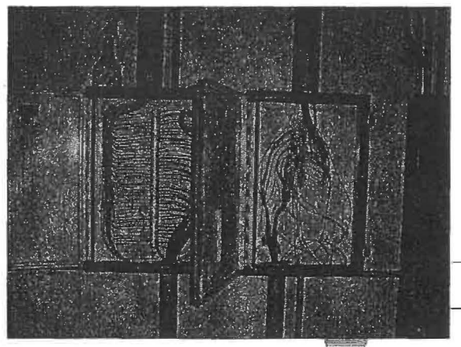
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL
PUMP BUILDING
PLAN

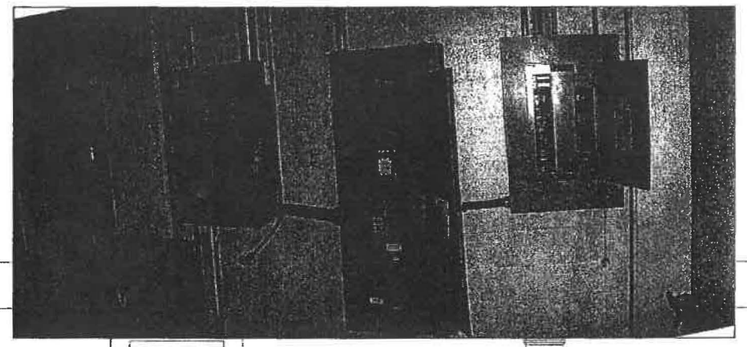
Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: CAG

Sheet Number
E5

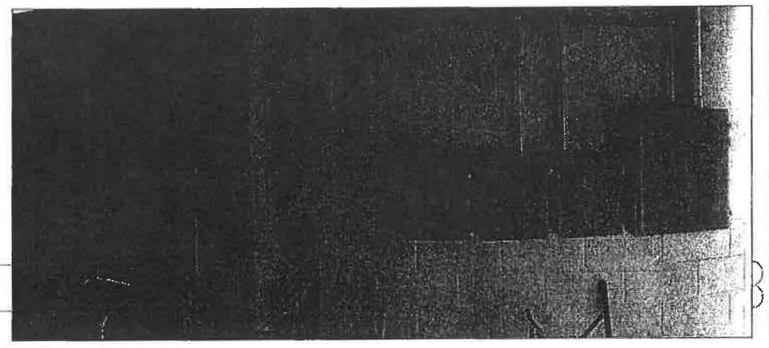
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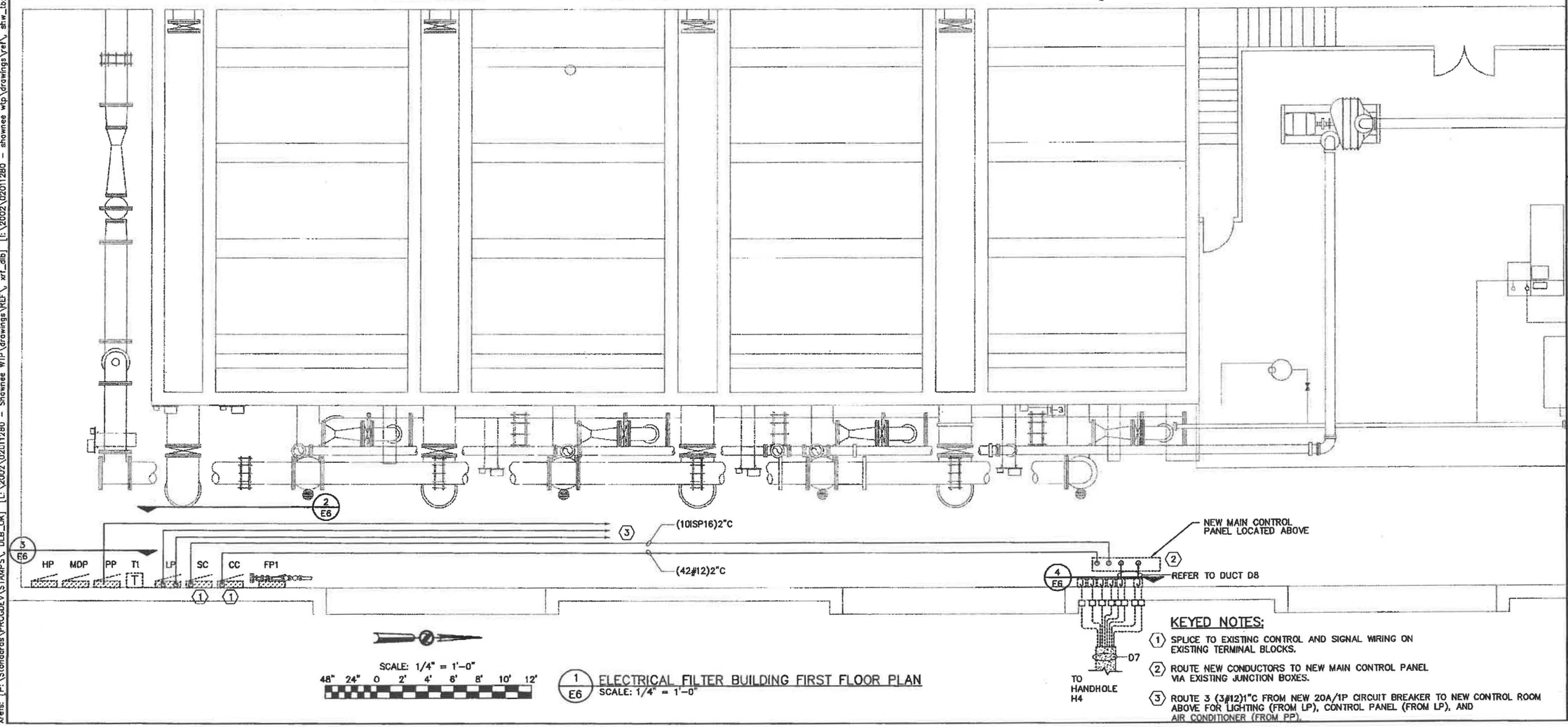
2 E6 CONTROL AND SIGNAL JUNCTION BOX
SCALE: NONE



3 E6 POWER PANELS
SCALE: NONE



4 E6 JUNCTION BOX
SCALE: NONE



SCALE: 1/4" = 1'-0"
48" 24" 0 2' 4' 6' 8' 10' 12'

1 E6 ELECTRICAL FILTER BUILDING FIRST FLOOR PLAN
SCALE: 1/4" = 1'-0"

KEYED NOTES:

1. SPLICE TO EXISTING CONTROL AND SIGNAL WIRING ON EXISTING TERMINAL BLOCKS.
2. ROUTE NEW CONDUCTORS TO NEW MAIN CONTROL PANEL VIA EXISTING JUNCTION BOXES.
3. ROUTE 3 (3#12)1"C FROM NEW 20A/1P CIRCUIT BREAKER TO NEW CONTROL ROOM ABOVE FOR LIGHTING (FROM LP), CONTROL PANEL (FROM LP), AND AIR CONDITIONER (FROM PP).

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18183
OKLAHOMA
4-14-03

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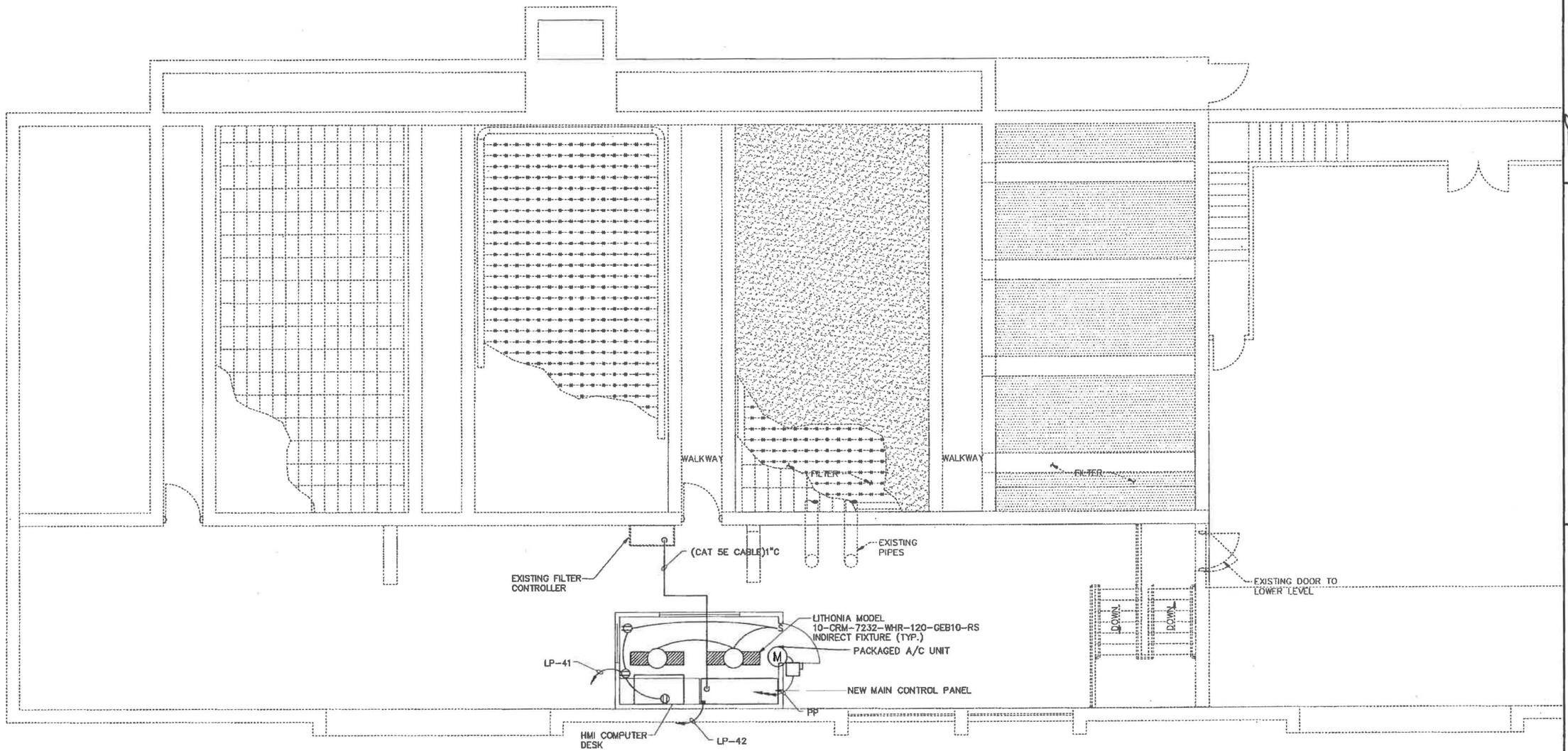
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL
FILTER BUILDING
FIRST FLOOR
LIGHTING PLAN

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: CAG

Sheet Number
E6

BWbrown Shw=t.ub5.dwg L:\2002\02011280 - Shownee WTP\drawings\ 34x22 1=48 4/14/03 10:51 am
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1/E7 CONTROL ROOM PLAN – UPPER FLOOR
SCALE: 1/4" = 1'-0"

SCALE: 1/4" = 1'-0"
48" 24" 0 2' 4' 6' 8' 10' 12'

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6183
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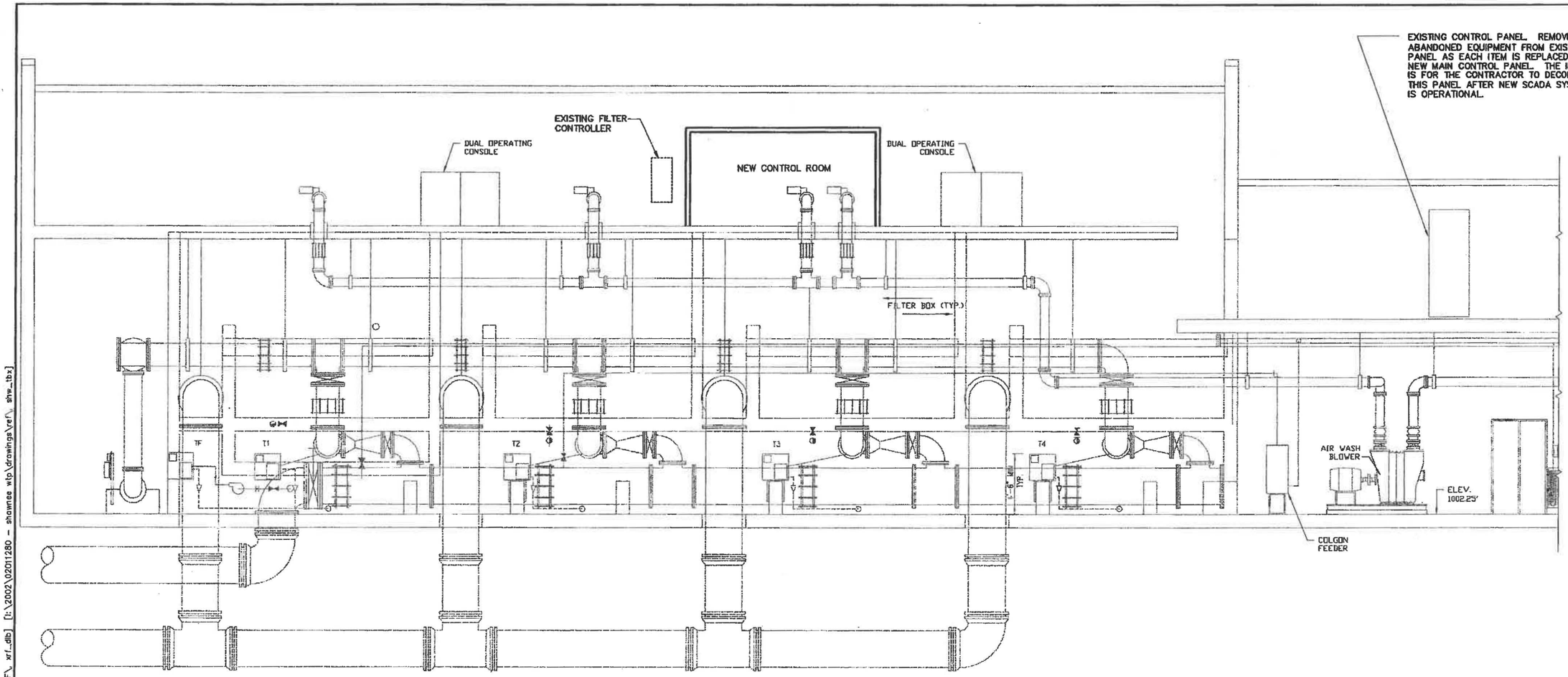
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL
FILTER BUILDING
SECOND FLOOR
CONTROL ROOM

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: CAG

Sheet Number
E7

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1/E8 ELECTRICAL FILTER BUILDING SECTION
SCALE: 1/4" = 1'-0"

SCALE: 1/4" = 1'-0"
48" 24" 0 2' 4' 6' 8' 10' 12'

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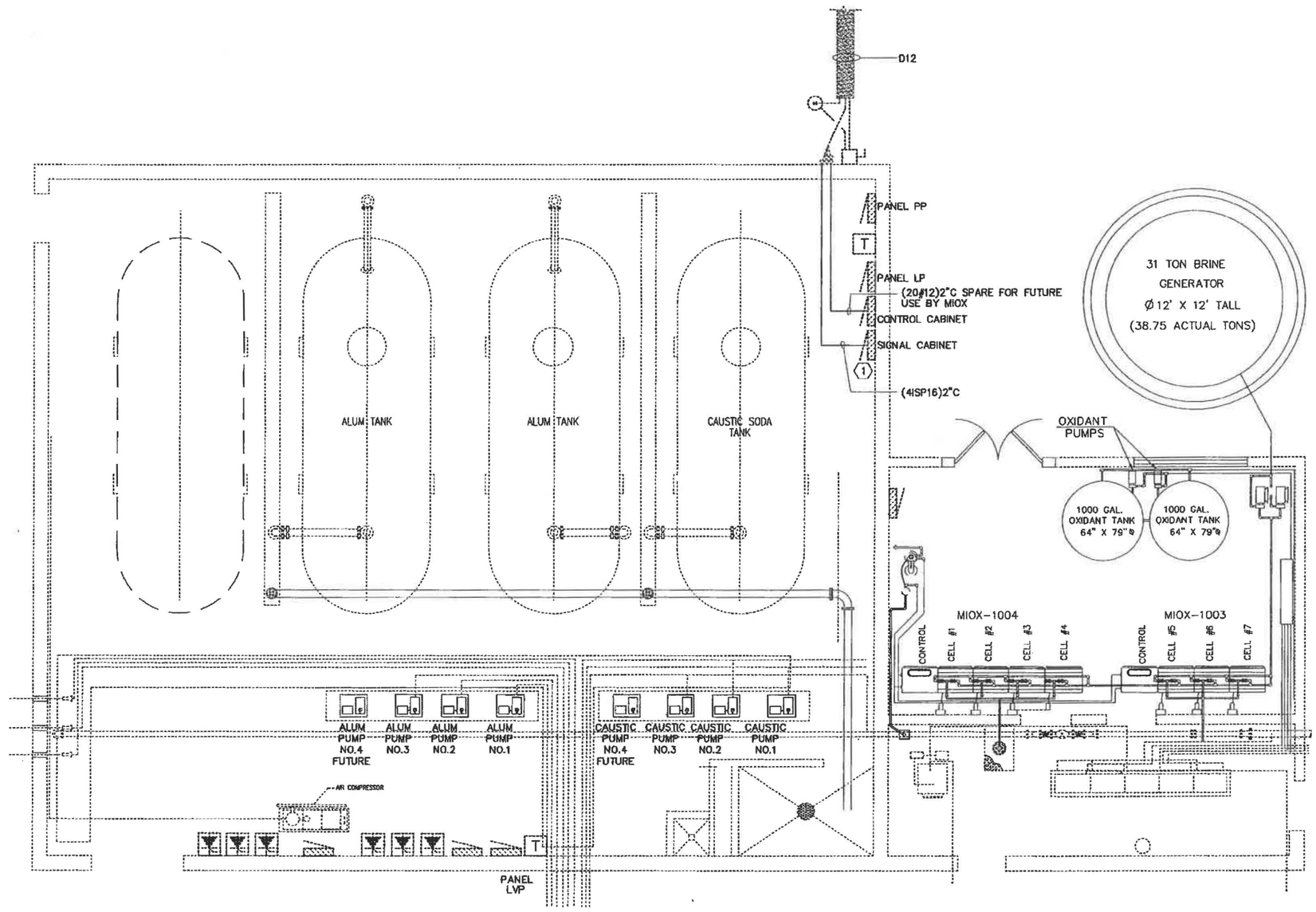
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL
FILTER BUILDING
SECTION

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: CAG

Sheet Number
E8

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KEYED NOTE:

1 CONNECT NEW PLANT FLOW SIGINAL TO EXISTING SIGNAL CABLES FOR EXISTING 6 CHEMICAL FEED PUMPS.

1/E9 ELECTRICAL CHEMICAL FEED PLAN
SCALE: 1/4" = 1'-0"

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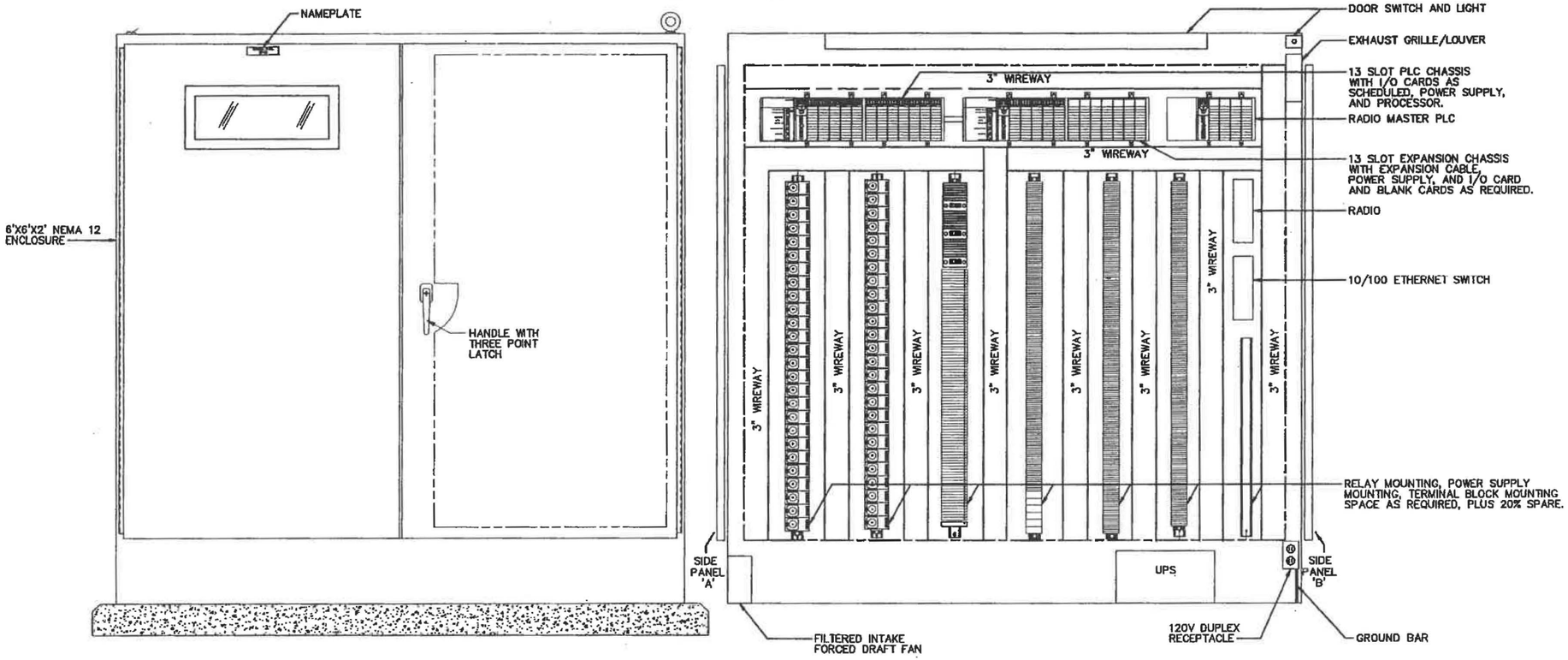
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL
CHEMICAL FEED
PLAN

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: CAG

Sheet Number
E9

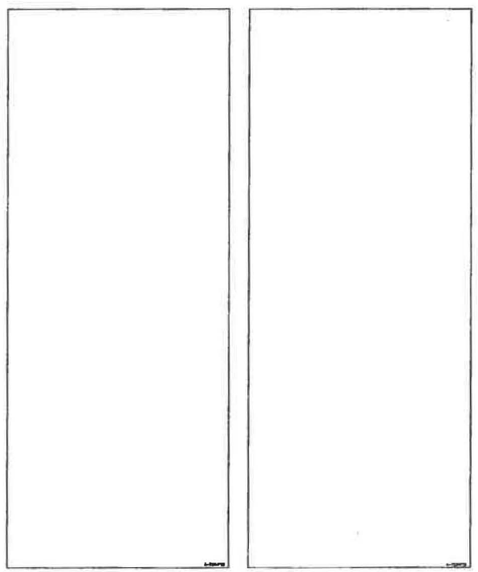
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SEE SPECIFICATIONS FOR SPARE AND OTHER REQUIREMENTS

1 / E10 MAIN CONTROL PANEL LAYOUT
SCALE: 1-1/2" = 1'-0"

SCALE: 1 1/2" = 1'-0"
9" 6" 3" 0 1' 2'



2 / E10 SIDE PANEL 'A'
SCALE: 1 1/2" = 1'-0"

3 / E10 SIDE PANEL 'B'
SCALE: 1 1/2" = 1'-0"

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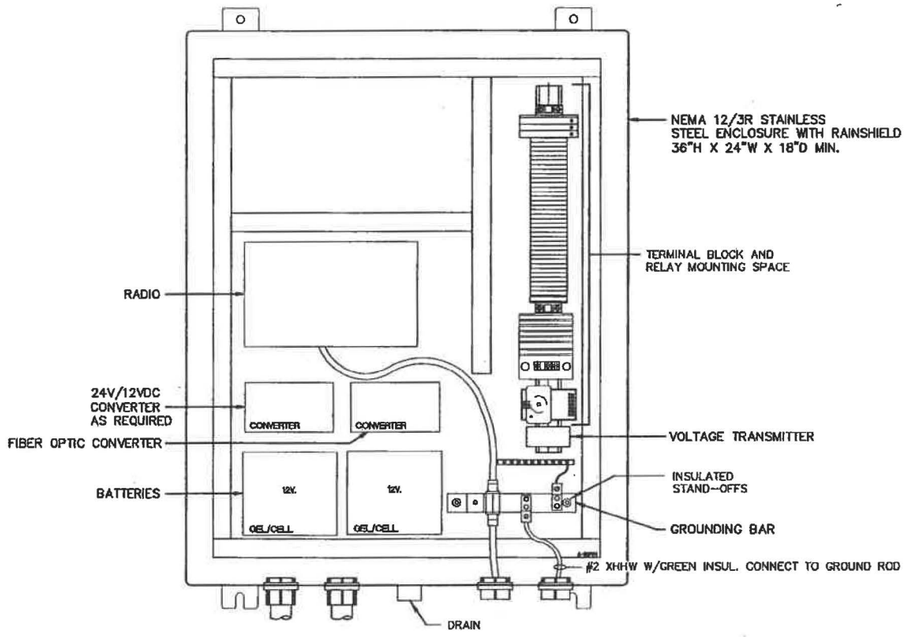
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL
MAIN CONTROL
PANEL LAYOUT

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: CAG

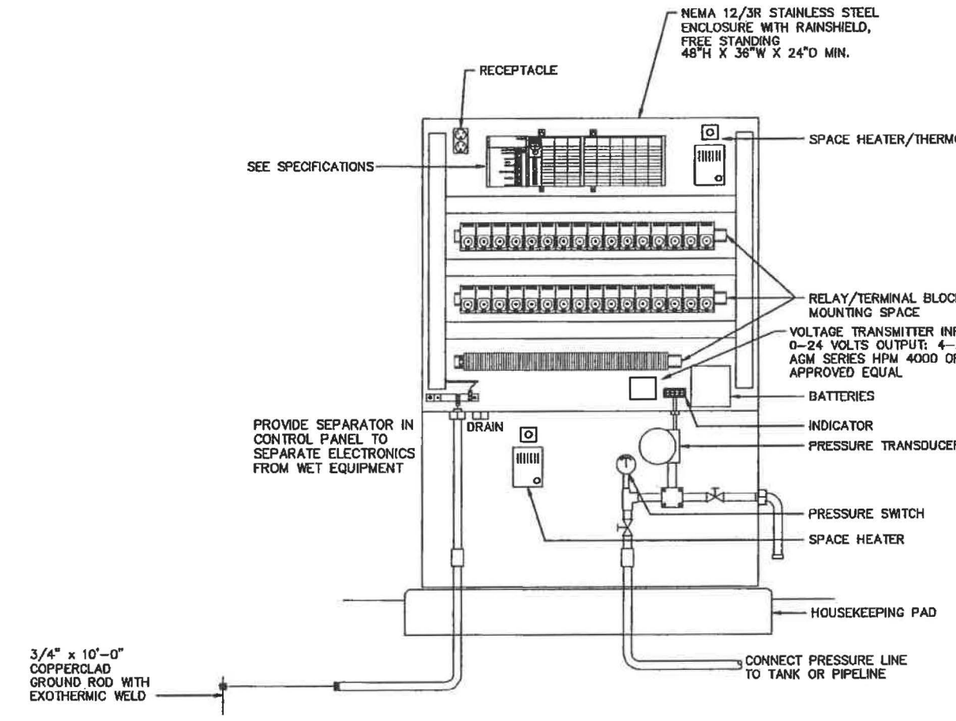
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1 / E11 BACKWASH TANK RADIO PANEL LAYOUT (TYPICAL OF 1)
SCALE: 3" = 1'

SCALE: 3" = 1'-0"
6" 3" 0 1'



2 / H11 RTU PANEL LAYOUT (TYPICAL OF 5)
SCALE: 1-1/2" = 1'-0"

SCALE: 1 1/2" = 1'-0"
9" 6" 3" 0 1' 2'

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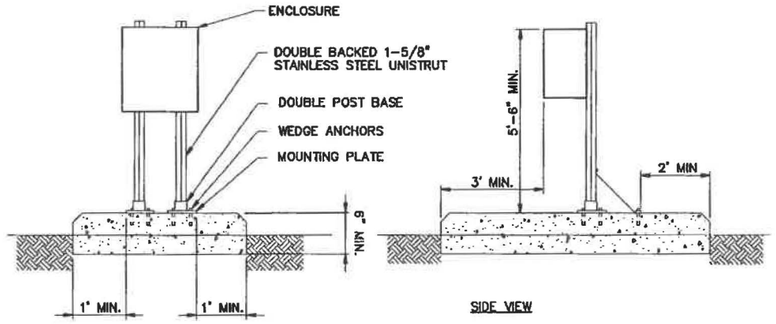
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL
FILTER CONSOLE/
RTU LAYOUT

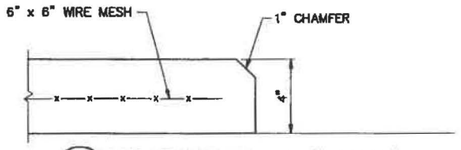
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Date: APRIL, 2003
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Sheet Number
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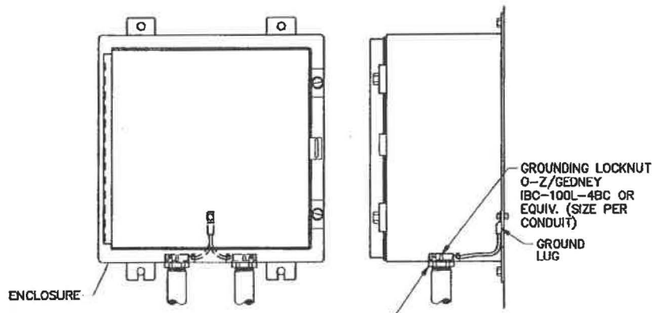
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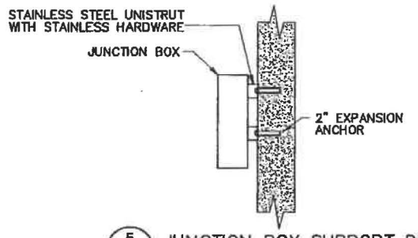
1 / E12 MISC. SUPPORT DETAIL
SCALE: NONE



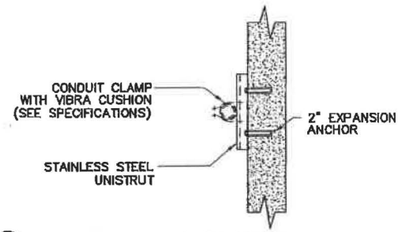
2 / E12 HOUSEKEEPING PAD (TYPICAL)
SCALE: NTS



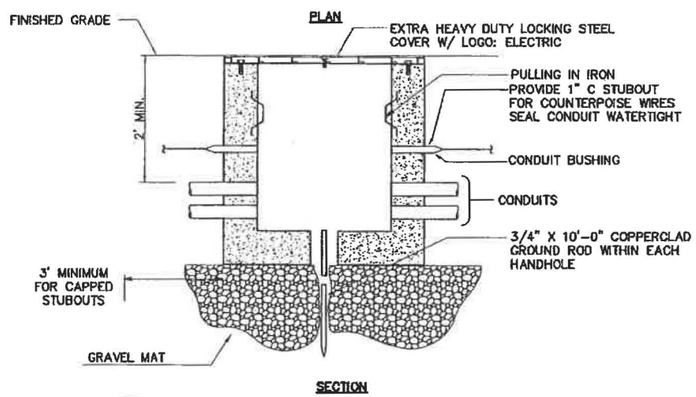
3 / E12 CONDUIT GROUNDING DETAIL
SCALE: NTS



5 / E12 JUNCTION BOX SUPPORT DETAIL
SCALE: NTS



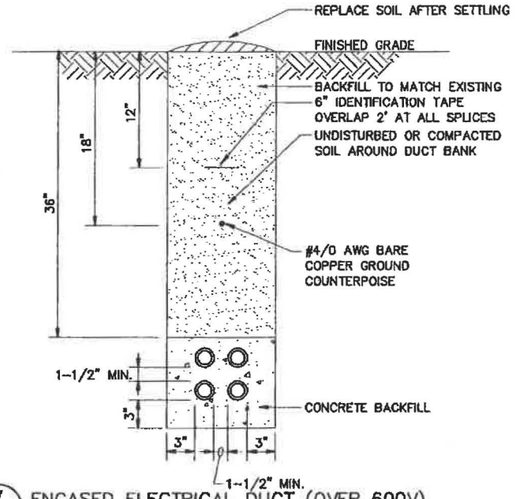
6 / E12 CONDUIT SUPPORT DETAIL (SINGLE CONDUIT SHOWN, MULTIPLE CONDUIT SIMILAR)
SCALE: NONE



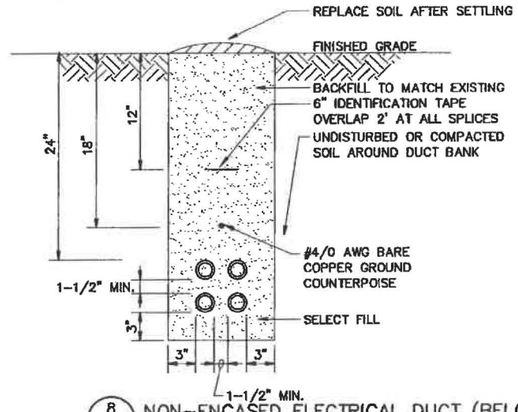
HANDHOLE NOTES:

1. HANDHOLE AND HEAVY DUTY COVER SHALL BE DESIGNATED FOR A H-20 LOADING. DALWORTH PRECAST CONCRETE PRODUCTS CONCRETE PRODUCTS, OR EQUAL.
2. PROVIDE 3" MINIMUM CONDUIT PER CAPPED STUBOUT.
3. SUBMIT LAYOUT OF EACH HANDHOLE FOR APPROVAL BY ENGINEER.
4. PROVIDE CONDUIT BUSHINGS AND WATERTIGHT SEALS FOR ALL DIRECT BURIED CABLES AND COUNTERPOISE ENTERING THE HANDHOLE VIA A CONDUIT STUBOUT.

4 / E12 HAND HOLE DETAIL
SCALE: NTS



7 / E12 ENCASED ELECTRICAL DUCT (OVER 600V)
SCALE: NONE



NOTE:
1. MINIMUM COVER REQUIREMENT FOR DUCT BANKS UNDER ROADS, DRIVEWAYS AND PARKING LOTS SHALL BE 24".
2. SPACERS EVERY 5 FEET.
3. 2X2 CONFIGURATION WITH 4" PVC CONDUITS SHOWN. SIMILAR FOR OTHER CONFIGURATIONS. SEE DUCT BANK SCHEDULE
4. OFFSETS AND BENDS OVER 10 DEGREES AND ELBOWS IN PVC CONDUIT RUNS SHALL BE PVC COATED GALVANIZED RIGID STEEL CONDUIT (CGRSC).
5. NO PVC SHALL EMERGE FROM THE GROUND OR CONCRETE SLAB OR ENCASEMENT. PVC SHALL CONVERT TO PVC COATED GALVANIZED RIGID STEEL CONDUIT (CGRSC) PRIOR TO ITS EMERGENCE.

8 / E12 NON-ENCASED ELECTRICAL DUCT (BELOW 600V)
SCALE: NONE

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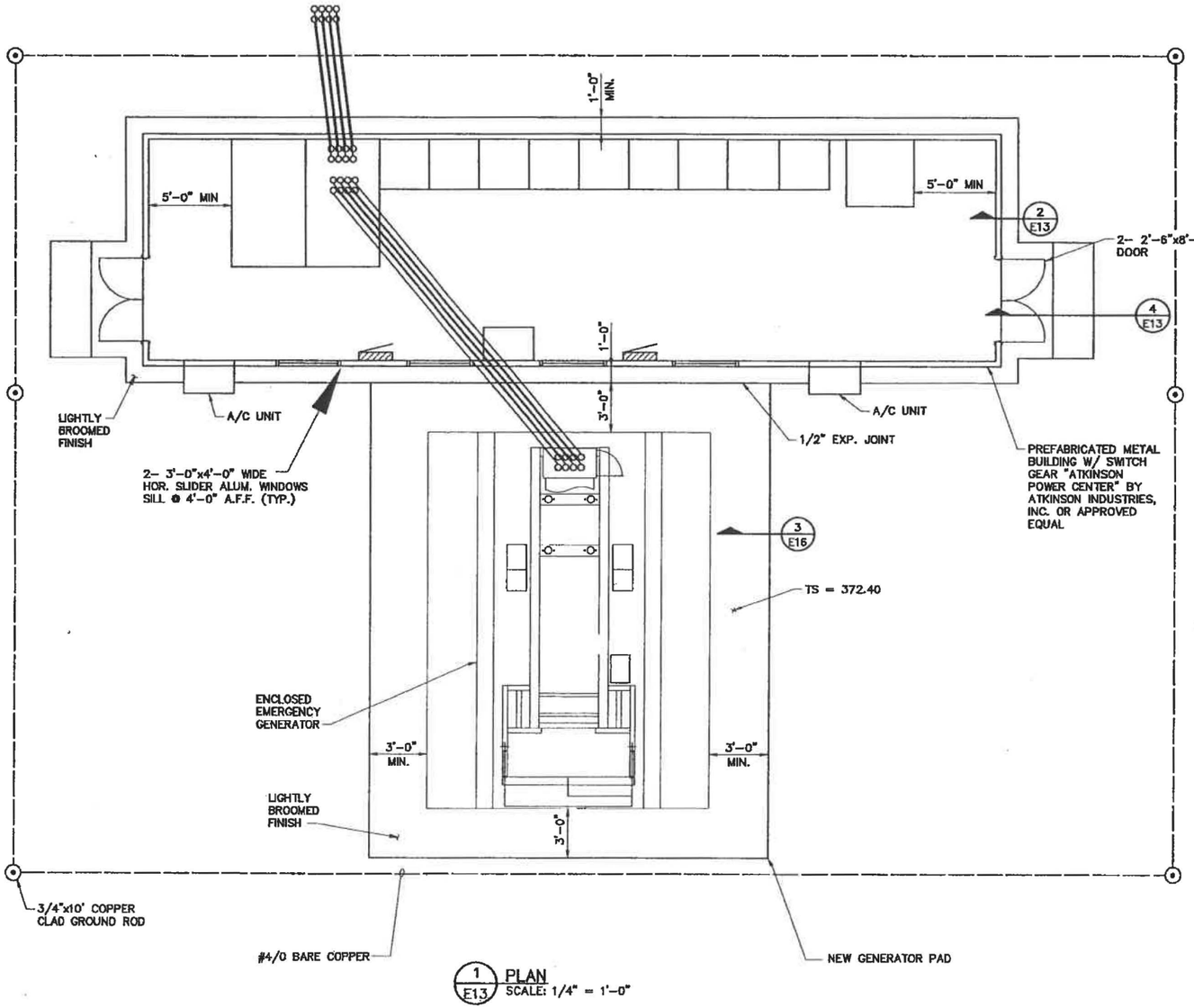
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL DETAILS I

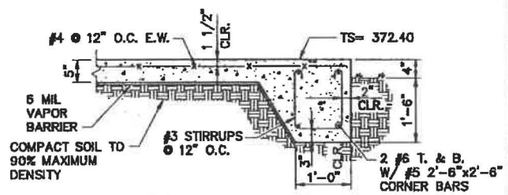
Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: CAG

Sheet Number
E12

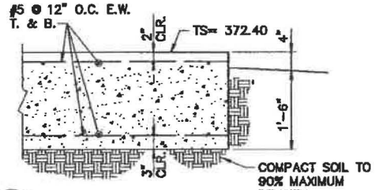
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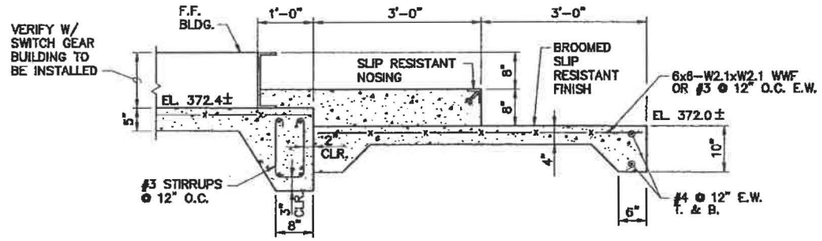
1 E13 PLAN
SCALE: 1/4" = 1'-0"



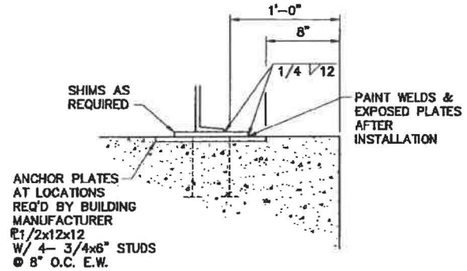
2 E13 SECTION
SCALE: 3/4" = 1'-0"



3 E13 SECTION @ GENERATOR PAD
SCALE: 3/4" = 1'-0"



4 E13 SECTION @ STEPS TO ELECT. EQUIP. BLDG.
SCALE: 3/4" = 1'-0"



5 E13 TYP. BUILDING ANCHOR DETAIL
SCALE: 1 1/2" = 1'-0"

SCALE: 3/4" = 1'-0"
18" 12" 6" 0 1' 2' 3' 4'

SCALE: 1/4" = 1'-0"
48" 24" 0 2' 4' 6' 8' 10' 12'

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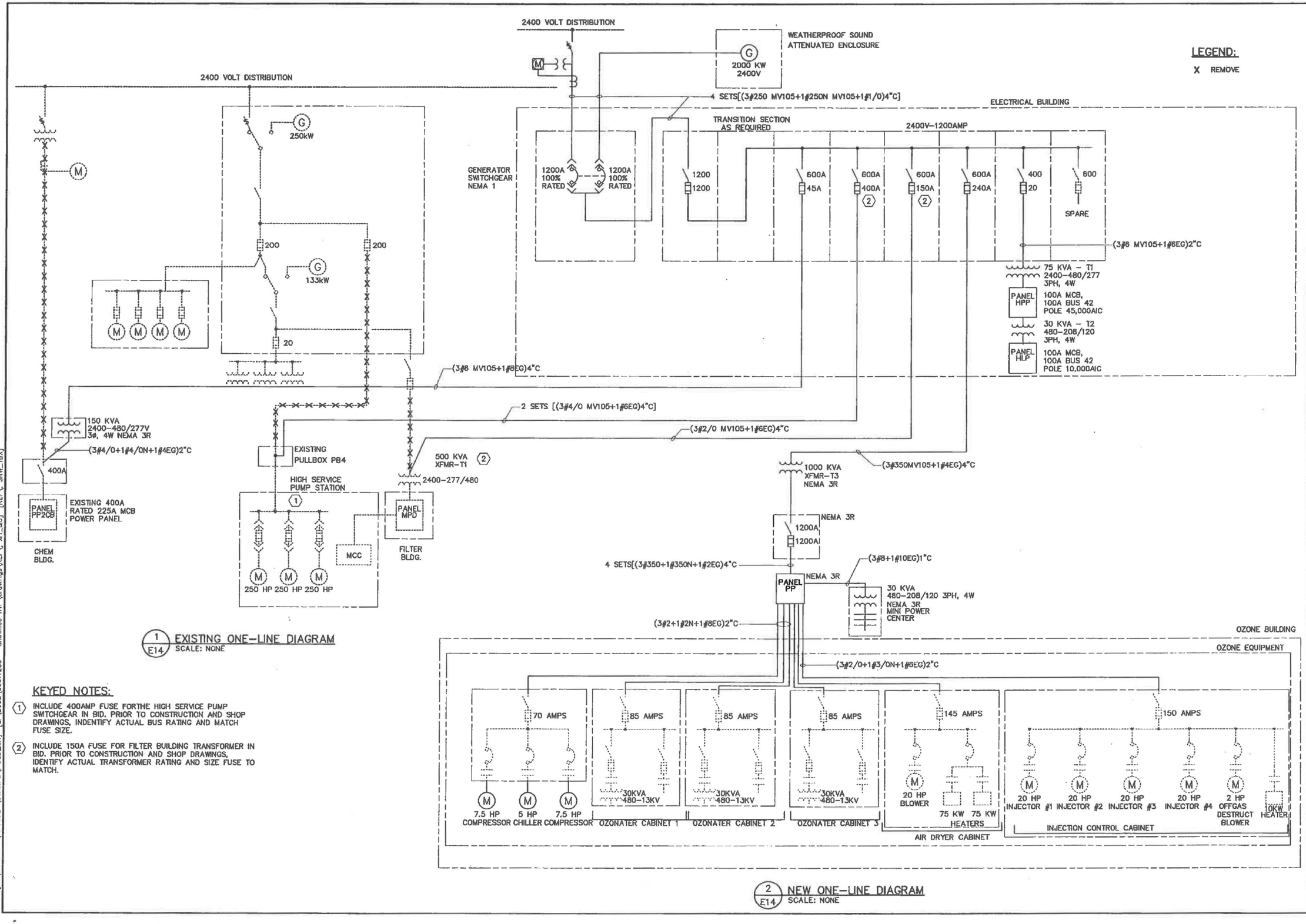
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL GENERATOR & SWITCH GEAR BUILDING

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: BB

Sheet Number
E13

rjsikora Shw-e13.dwg L:\2002\02011280 - Shawnee WTP\drawings\ 34x22 1=8 4/14/2003 1:11 pm
Images: [none]
Xrefs: [L:\2002\02011280 - Shawnee WTP\drawings\REF\, DLB_STM] [REF\, SHW_TBX, ATM_STM]



1 / E14 EXISTING ONE–LINE DIAGRAM
SCALE: NONE

2 / E14 NEW ONE–LINE DIAGRAM
SCALE: NONE

KEYED NOTES:

1. INCLUDE 400AMP FUSE FORTHE HIGH SERVICE PUMP SWITCHGEAR IN BID. PRIOR TO CONSTRUCTION AND SHOP DRAWINGS, INDENTIFY ACTUAL BUS RATING AND MATCH FUSE SIZE.
2. INCLUDE 150A FUSE FOR FILTER BUILDING TRANSFORMER IN BID. PRIOR TO CONSTRUCTION AND SHOP DRAWINGS, IDENTIFY ACTUAL TRANSFORMER RATING AND SIZE FUSE TO MATCH.

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REGISTERED PROFESSIONAL ENGINEER
DELTON BROWN, JR.
18183
OKLAHOMA
4/14/2003

CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL
ONE-LINE DIAGRAM

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: CAG

Sheet Number
E14

LWBrown Shw-e14.dwg L:\2002\02011280 - Shawnee WTP\drawings\ J4x22 1=1 4/14/03 11:08 pm
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Xrefs: [P:\Standards\PROGDEV\STAMPS_DLB_OK] [L:\2002\02011280 - Shawnee WTP\drawings\REF_xrf_dlb] [REF_SHW_TBX]

DISTRIBUTION PANEL PP

480/277 VOLTS 3ø 4 W 1200A MAIN MLO ENCLOSURE MINIMUM RATING ____ AIC RMS SYM. GROUND BUS. ☐ NEUTRAL BUS. ☐

CIRCUIT NUMBER	SERVES	CONNECT. LOAD (kVA)	DESIGN LOAD (kVA)	DESIGN LOAD (AMPS)	OVERCURRENT TRIP/FUSE	OVERCURRENT POLE	OVERCURRENT FRAME/SWITCH	WIRE SIZE SETS	WIRE SIZE PHASE	WIRE SIZE NEUTRAL	WIRE SIZE GROUND	RACEWAY TYPE
1	MINI POWER CE	30.0	37.5	45.1	20	3		1	8		10	
2	OZONE #1	70.7	88.3	106.2	100	3		1	2	2	8	
3	OZONE #2	70.7	88.3	106.2	100	3		1	2	2	8	
4	OZONE #3	70.7	88.3	106.2	100	3		1	2	2	8	
5	AIR DRYER	120.6	150.7	181.2	200	3		1	3/0	3/0	6	
6	INJECTION CON	124.7	155.9	187.5	200	3		1	3/0	3/0	6	
7	CHILLER	58.2	72.7	87.5	100	3		1	2	2	8	
8	RTU-1	49.9	62.4	75.0	75	3		1	2			
9	RTU-1 FAN	6.3	7.9	9.5	20	3		1	12			
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												

TOTAL CONNECTED LOAD 601.66 kVA CALCULATED DESIGN LOAD 940.09 kVA DESIGN LOAD 1130.7 A

PANEL MPC LOCATION _____ BLDG. _____
208/120 VOLTS 3 PHASE 4 WIRE MTG. _____
100 AMP MAIN _____ MIN. INT. CAPACITY _____ AIC (U.L. RATING)

DESCRIPTION	LOAD (VA)	WIRE AWG	BREAKER	PHASE A			BREAKER	WIRE AWG	LOAD (VA)	DESCRIPTION
LIGHTING	896	12	20/1	1		2	20/1	12	180	RECPT
LIGHTING	896	12	20/1	3		4	20/1	12	180	RECPT
AIT-100	500	12	20/1	5		6	20/1	12	1920	EF-1
SUMP PUMP	1920	12	20/1	7		8	20/1	12	500	BACKWASH PTZ CAMERA
VAULT RECPT	180	12	20/1	9		10				
				11		12				
				13		14				
				15		16				
				17		18				
				19		20				
				21		22				
				23		24				
				25		26				
				27		28				
				29		30				
				31		32				
				33		34				
				35		36				
				37		38				
				39		40				
				41		42				

TOTAL CONNECTED LOAD 7.17 kVA CALCULATED DESIGN LOAD 11.04 kVA DESIGN LOAD 30.64 A

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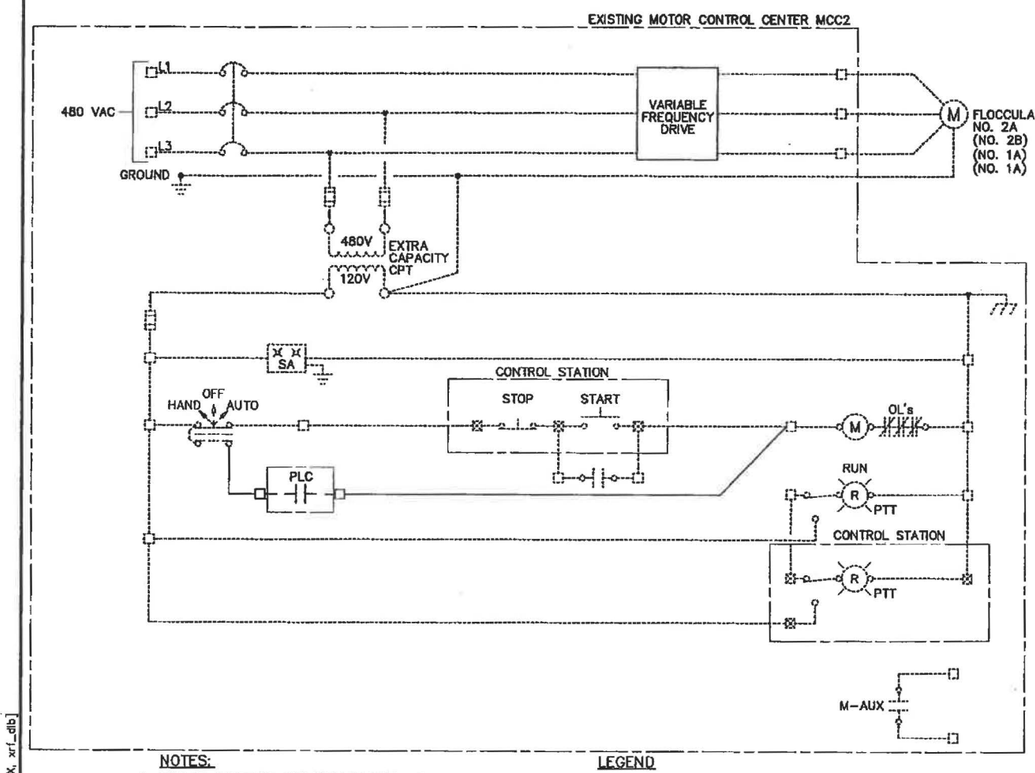
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PANEL SCHEDULES

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: CAG

Sheet Number
E15

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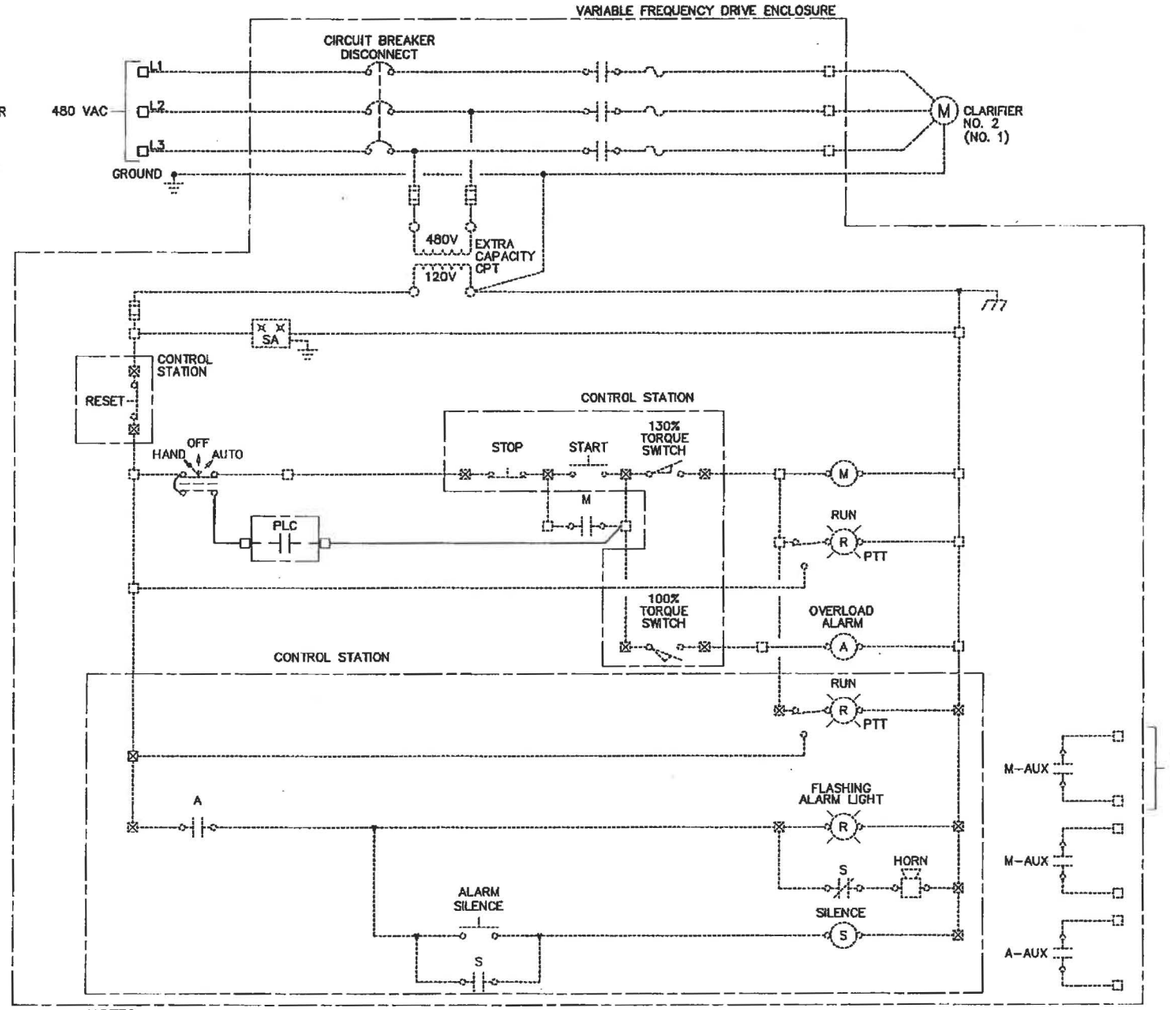
NOTES:

1. SIMILAR CONTROLS FOR FLOCCULATOR 2B.
2. REPLACE MCC "START" PUSHBUTTON WITH NEW H-O-A SELECTOR SWITCH AND MAKE ALL FINAL CONNECTIONS.
3. RECONNECT CONTROLS AS SHOWN.
4. REMOVE "STOP" PUSHBUTTON AND INSTALL BLANK COVER.
5. MODIFY EXISTING CONTROLS FOR FOCULATOR 1A AND 1B AS SHOWN ABOVE.

LEGEND

- EXISTING
- FURNISH AND INSTALL
- FIELD WIRING
- EQUIPMENT BOUNDARY
- CONTROL STATION TERMINAL
- MCC TERMINAL

1/E4 FLOCULATOR SCHEMATIC DIAGRAM
SCALE: NONE



NOTES:

1. SIMILAR CONTROLS FOR CLARIFIER NO. 1.
2. REPLACE MCC "START" PUSHBUTTON WITH NEW H-O-A SELECTOR SWITCH AND MAKE ALL FINAL CONNECTIONS.
3. RECONNECT CONTROLS AS SHOWN.

2/E4 CLARIFIER SCHEMATIC DIAGRAM
SCALE: NONE

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PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL CONTROL SCHEMATICS

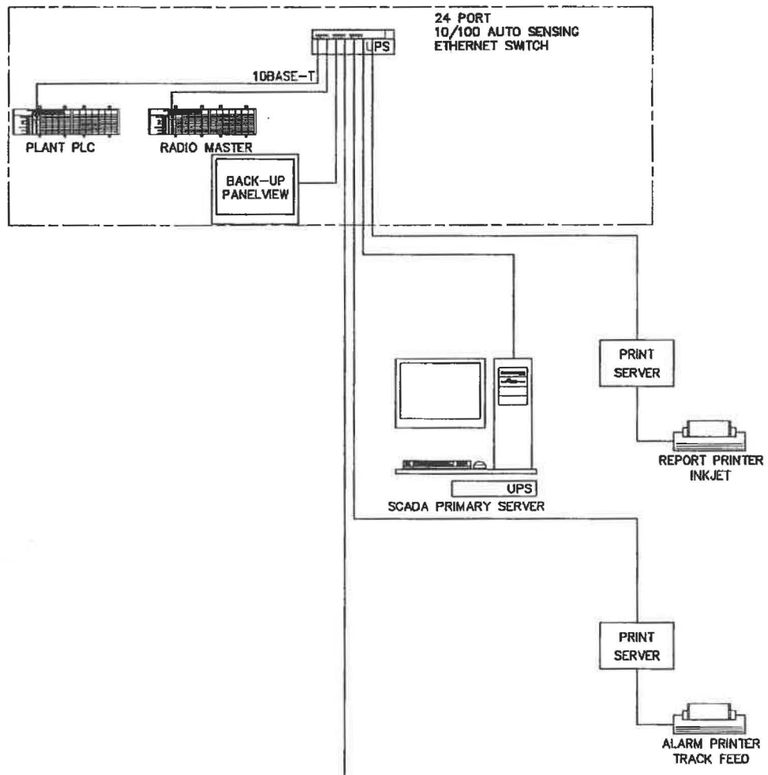
Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: BB

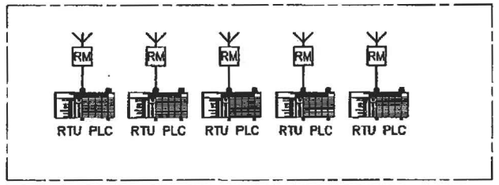
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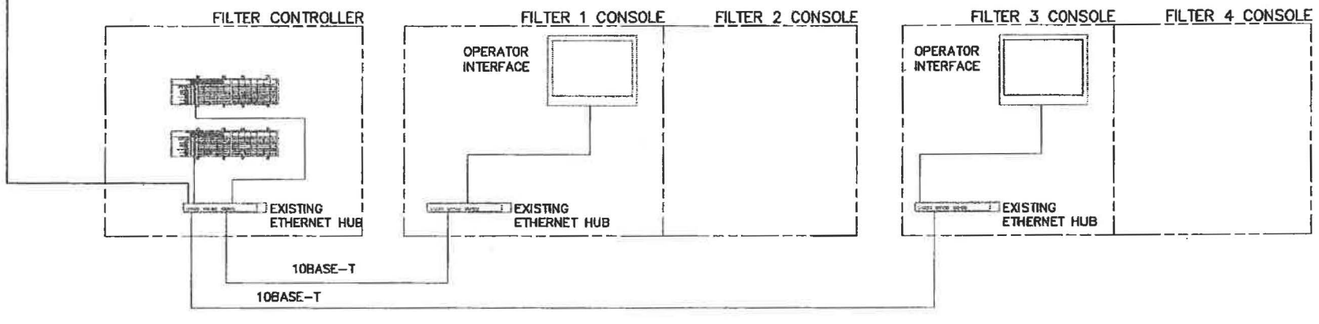
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NEW LAB/CONTROL BUILDING

MAIN CONTROL PANEL







1 / E17 NETWORK RISER DIAGRAM
SCALE: N.T.S.

NOTES:

1. THE CONTRACTOR / SYSTEM INTEGRATOR SHALL SUBMIT A NETWORK CONTROL DIAGRAM OF HMI AND MAIN CONTROL PANEL PLC. THE NETWORK DIAGRAM SHALL SHOW INTERCONNECTIONS OF ALL EQUIPMENT, PROPOSED CABLE TYPE, PROTOCOLS USED, AND MANUFACTURER MAKE AND MODEL NUMBERS FOR MAJOR EQUIPMENT COMPONENTS.
2. THE INTENT IS TO PROVIDE A FULLY FUNCTIONAL SCADA SYSTEM WITH OPERATOR VIEW/CONTROL CAPABILITY FROM THE HMI SCREENS.

REGISTERED PROFESSIONAL ENGINEER
DELTON L. BROWN, JR.
No. 13683
4/14/03

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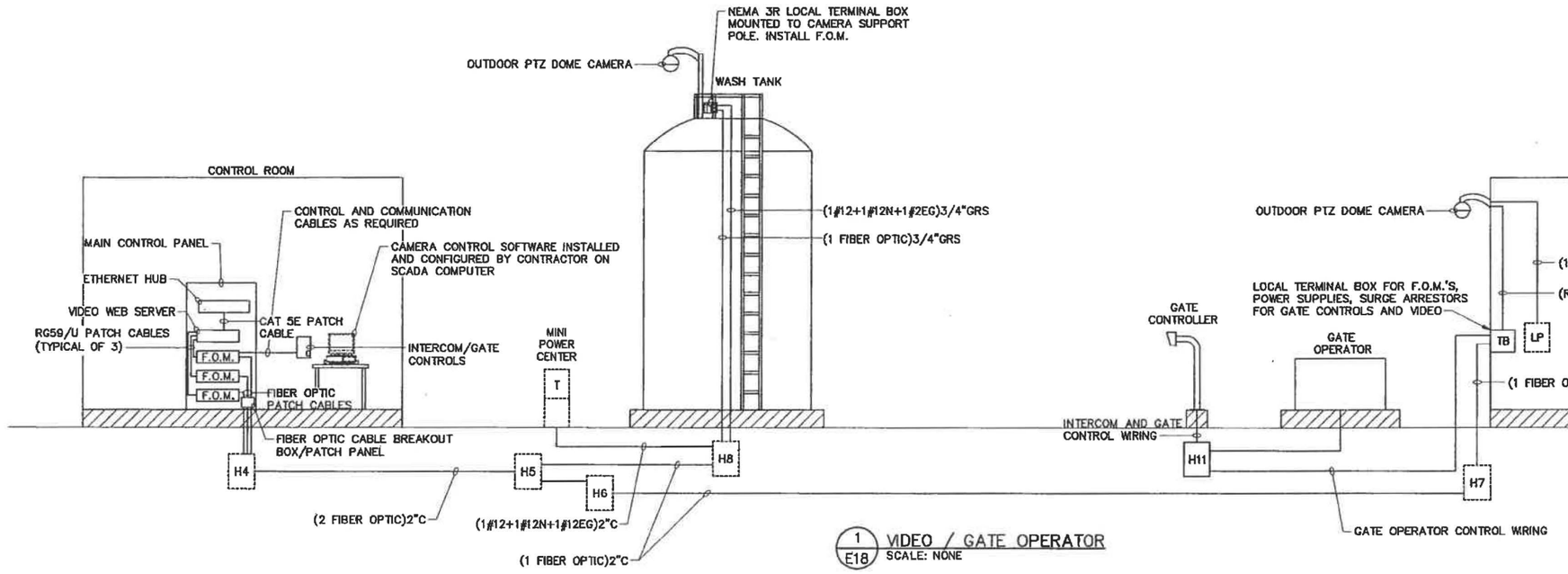
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL
NETWORK
RISER DIAGRAM

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: CAG

Sheet Number
E17

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1 / E18 VIDEO / GATE OPERATOR
SCALE: NONE

LEGEND:

EC	EMPTY CONDUIT
-------	EXISTING EQUIPMENT
———	NEW EQUIPMENT AND WIRING TO BE FURNISHED AND INSTALLED.
F.O.M.	FIBER OPTIC CONVERTER MODULE

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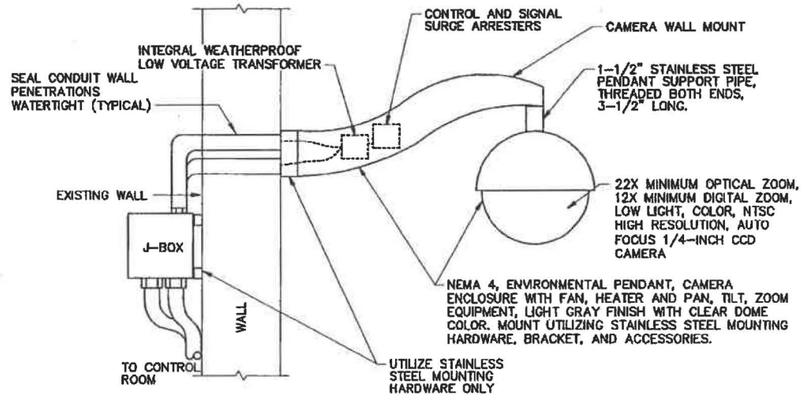
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

GATE OPERATOR AND VIDEO SYSTEM/ RISER DIAGRAMS

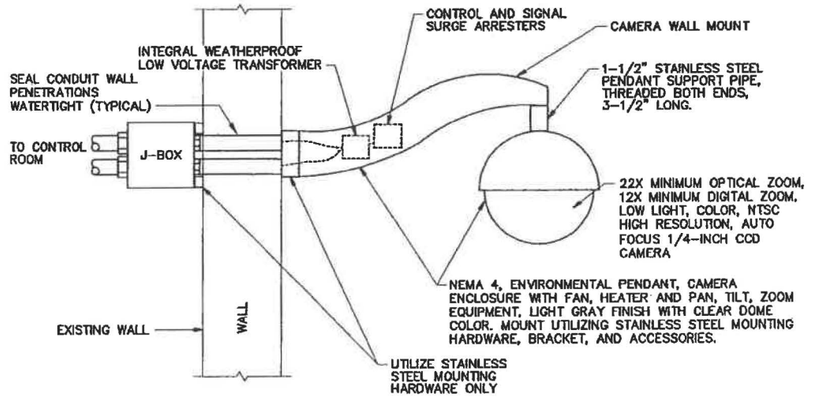
Job No. 02011280
Date: APRIL, 2003
Designed by: MLK
Drawn by: CED

Sheet Number
E18

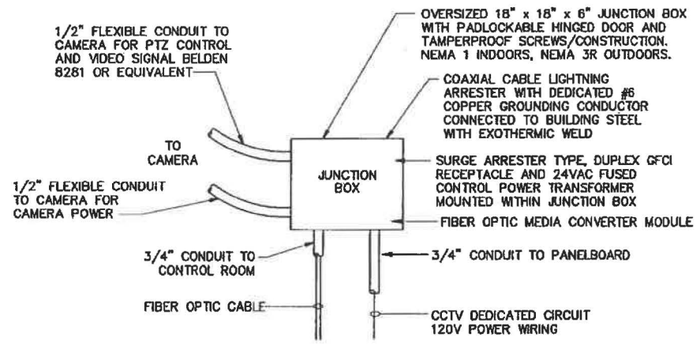
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1/E19 OUTDOOR PTZ CAMERA WALL MOUNTING DETAIL
SCALE: NONE



2/E19 OUTDOOR PTZ CAMERA WALL MOUNTING DETAIL
SCALE: NONE



CCTV JUNCTION BOX NOTE:
MOUNT AND SECURE ITEMS WITHIN THE CCTV JUNCTION BOX TO THE BACK PANEL NEATLY TRAIN AND LACE ALL CABLES AND CONDUCTORS. INSTALL PREPRINTED SELF LAMINATING LABELS TO IDENTIFY ALL CABLES AND TERMINAL BLOCKS.

3/E19 SECURITY CCTV JUNCTION BOX DETAIL FOR PTZ CAMERAS
SCALE: NONE

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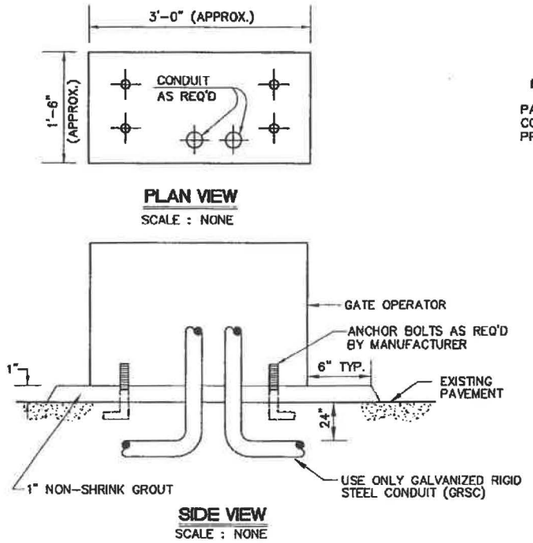
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

GATE OPERATOR AND VIDEO SYSTEM DETAILS

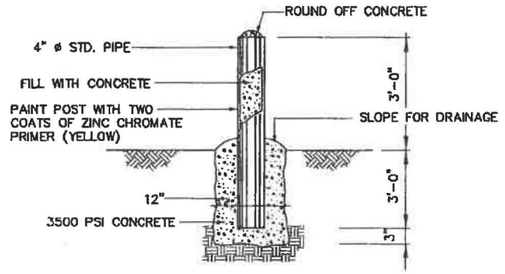
Job No. 02011280
Date: APRIL, 2003
Designed by: MLK
Drawn by: CED

Sheet Number
E19

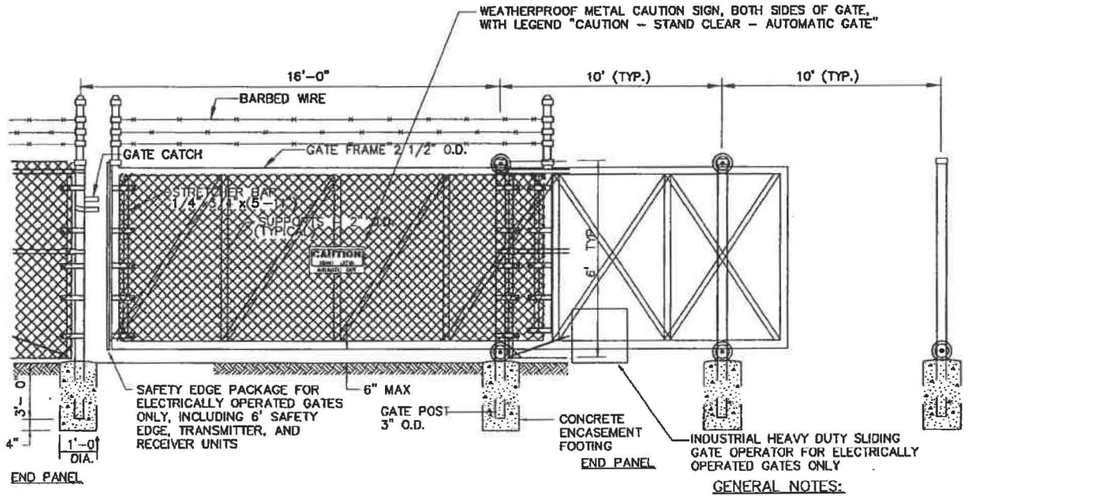
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1 E20 SLIDING GATE OPERATOR INSTALLATION
SCALE: NONE



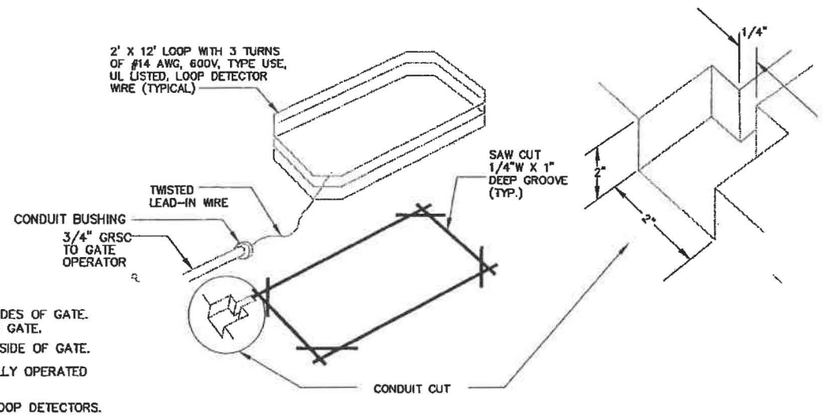
2 E20 GUARD GATE OPERATOR INSTALLATION
SCALE: NONE



3 E20 ELECTRICALLY OR MANUALLY OPERATED SINGLE CANTILEVERED SLIDING GATE
SCALE: NONE

GENERAL NOTES:

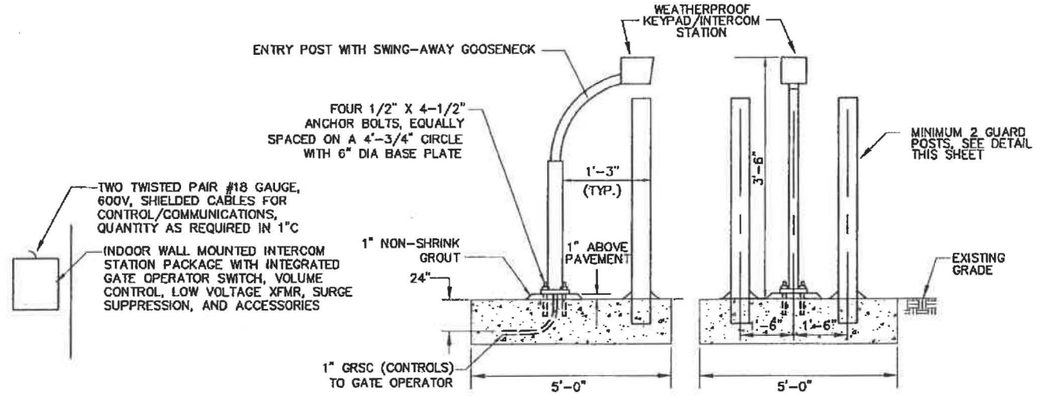
1. POWER SUPPLY TO ELECTRICALLY OPERATED GATES SHALL NOT BE PAID FOR SEPARATELY, BUT SHALL BE CONSIDERED SUBSIDIARY TO THE GATE ITEM.
2. MAKE ALL FINAL CONNECTIONS FOR A COMPLETE AND FULLY OPERATIONAL SYSTEM. KEYPAD CODE PROVIDED BY OWNER DURING CONSTRUCTION.
3. VERIFY ALL DIMENSIONS WITH ELECTRICALLY OPERATED GATE MANUFACTURER PRIOR TO CONSTRUCTION.
4. INSTALL TRANSMITTER/RECEIVER/SAFETY EDGE PACKAGE FOR ELECTRICALLY OPERATED GATES.



NOTES:

1. LOOPS SHALL BE INSTALLED ON BOTH SIDES OF GATE. EACH LOOP SHALL BE LOCATED 8' FROM GATE.
2. FREE EXIT LOOP SHALL BE INSTALLED INSIDE OF GATE.
3. VERIFY ALL DIMENSIONS WITH ELECTRICALLY OPERATED GATE MANUFACTURER PRIOR TO WORK.
4. CALIBRATE, FINE TUNE, AND TEST ALL LOOP DETECTORS.
5. LOOP DETECTOR LEAD WIRE SHALL BE 80' OR LESS. VERIFY LOOP CONFIGURATION WITH GATE OPERATOR MANUFACTURER PRIOR TO INSTALLATION.
6. LOOP INSTALL LOOP DETECTOR LEAD WIRE AND FILL GROVE WITH OSI RUBBER-BASED CAULK, COLORED TO MATCH CONCRETE OR ASPHALT SURFACE, CAULK TO BE OF OIL GAS RESISTENT TYPE INTENDED FOR USE ON ROADWAYS.

4 E20 VEHICLE DETECTOR LOOP DETAIL
SCALE: NONE



5 E20 KEYPAD/INTERCOM STATION DETAIL
SCALE: NONE

NOTES:

1. MOUNT 9 FEET IN FRONT OF GATE
2. MOUNTING POST SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION.
3. ALL DIMENSIONS ARE APPROXIMATE. VERIFY WITH MANUFACTURER PRIOR TO CONSTRUCTION.

SEQUENCE OF GATE OPERATION

ENTRY

1. VEHICLE APPROACHES GATE CONTROL PEDESTAL.
2. ENTRY LOOP DETECTS PRESENCE OF VEHICLE. DRIVER OPENS GATE BY ENTERING PROPER CODE ON KEYPAD.
3. ELSE, DRIVER PUSHES CALL BUTTON. OPERATIONS PERSONNEL CHECK IDENTITY VIA VOICE COMMUNICATIONS AND CCTV CAMERA TO GRANT ACCESS.
4. GATE CLOSES AUTOMATICALLY PER VEHICLE PASSING OVER EXIT LOOP OR SPECIFIED TIME DELAY PERIOD TO ALLOW VEHICLE TO ENTER.

EXIT

1. VEHICLE PASSES OVER EXIT DETECTOR LOOP INSIDE GATE, CAUSING GATE TO OPEN.
2. GATE CLOSES AUTOMATICALLY PER VEHICLE PASSING OVER ENTRY LOOP OR SPECIFIED TIME DELAY PERIOD TO ALLOW VEHICLE TO EXIT.

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PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

FENCING DETAILS

Job No. 02011280
Date: APRIL, 2003
Designed by: MLK
Drawn by: CED

Sheet Number
E20

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ages: [none]

DUCT BANK SCHEDULE

DUCT NO.	DUCT SIZE	CONTENTS	DESCRIPTION	FROM	TO
D1 8-WAY	2"	(26#12+1#10EG) (3#10+1#10EG)	POWER/CONTROL POWER	MCC2 MCC2	CLARIFIER NO.2 CONTROL PANEL CLARIFIER NO.1
	2"	(24#12)	CONTROL	FLOC VFD'S	CLARIFIER NO. 2 CONTROL PANEL
	2"	PULLWIRE	FUTURE CONTROL	PUMP BUILDING	HANDHOLE H3
EXISTING DUCT	2"	(6#10) (3#10+1#10EG)	POWER POWER	LP PP1	CLAR NO.2, RECPT/LGT. SLUDGE CP SLUDGE VALVE OPERATORS
	2"	**(20#12)**	**CONTROL**	**MAIN CONTROL PANEL**	**SLUDGE VALVE CONTROL PANEL**
	1"	(3#10+1#10EG)	POWER (VFD)	FLOC. NO.1 VFD	FLOC. NO.1
	1"	(3#10+1#10EG)	POWER (VFD)	FLOC. NO.2 VFD	FLOC. NO.2
	1"	(3#10+1#10EG)	POWER	PP1	INFLUENT VALVE OPERATOR
D2 3-WAY	1"	(3#10+1#10EG)	POWER	PP1	SLUDGE VALVE NO.1 OPERATOR SLUDGE VALVE NO.2 OPERATOR
	1"	(3#10)	POWER	LP	SLUDGE VALVE CONTROL PANEL
EXISTING DUCT	1"	**(20#12)**	**CONTROL**	**MAIN CONTROL PANEL**	**SLUDGE VALVE CONTROL PANEL**
D3 8-WAY	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H1	HANDHOLE H2
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H1	HANDHOLE H2
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H1	HANDHOLE H2
EXISTING DUCT	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H1	HANDHOLE H2
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H1	HANDHOLE H2
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H1	HANDHOLE H2
	2"	(3#10+1#10EG)	POWER	PP1	INFLUENT VALVE OPERATOR
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H1	HANDHOLE H2
D4 2-WAY	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H3	CLARIFIER NO.1 CONTROL PANEL
EXISTING DUCT	1"	(3#10+1#10EG)	POWER	MCC2	CLARIFIER NO.1
D5 2-WAY	1"	(3#10+1#10EG)	POWER	PP1	INFLUENT VALVE OPERATOR
EXISTING DUCT	1"	PULLWIRE	FUTURE CONTROL	HANDHOLE H2	INFLUENT VALVE OPERATOR
D6 5-WAY	2"	(20#12+1#10EG)	POWER/CONTROL	MCC2	CLARIFIER NO.2 CONTROL PANEL
	2"	(24#12)	CONTROL	FLOC. VFD'S	CLARIFIER NO.2 CONTROL PANEL
	2"	(3#10)	POWER	LP	CLARIFIER NO.2 RECEPT/LIGHTS
EXISTING DUCT	1"	(3#10+1#10EG)	POWER (VFD)	FLOC. NO.1 VFD	FLOC. NO.1
	1"	(3#10+1#10EG)	POWER (VFD)	FLOC. NO.2 VFD	FLOC. NO. 2
D7	2"	(3#10+1#10EG)	POWER	FP1	BACKWASH TANK FILL OPERATOR
	2"	(12#14)	CONTROL	FILTER CONTROLLER CP-F1	BACKWASH TANK FILL OPERATOR
EXISTING DUCT	2"	PULLWIRE	FUTURE CONTROL	NEMA 4X JUNCTION BOX WITHIN FILTER BUILDING	HANDHOLE H4
	2"	**(12 STRAND FIBER)**	**DATA**	**CHEM BUILDING**	**MAIN CONTROL PANEL**
		(1ISP16)	**SIGNAL**	**CHEM BUILDING**	**MAIN CONTROL PANEL**
		(1ISP16)	**SIGNAL**	**FIT-008**	**MAIN CONTROL PANEL**
		(1ISP16)	**SIGNAL**	**FLOW VALVE**	**MAIN CONTROL PANEL**
		(1ISP16)	**SIGNAL**	**LIT-100**	**MAIN CONTROL PANEL**
		(1ISP16)	**SIGNAL**	**AIT-100**	**MAIN CONTROL PANEL**
		(12 STRAND FIBER)	**DATA**	**BACKWASH TANK RADIO**	**MAIN CONTROL PANEL**
		(4ISP16)	**SIGNAL**	**EXISTING FLOCC VFD'S**	**MAIN CONTROL PANEL**

DUCT BANK SCHEDULE

DUCT NO.	DUCT SIZE	CONTENTS	DESCRIPTION	FROM	TO
D7 CONT'D.					
EXISTING DUCT	2"	**(3#12)**	**STATUS**	**AAH-100**	**MAIN CONTROL PANEL**
		(20#12)	**CONTROL**	**SLUDGE VALVE CONTROL PANEL**	
		(12#12)	**CONTROL**	**EXISTING MCC**	**MAIN CONTROL PANEL**
		(16#12)	**CONTROL**	**EXISTING FLOCC VFD'S**	**MAIN CONTROL PANEL**
	2"	PULLWIRE	FUTURE SIGNAL	NEMA 4X JUNCTION BOX WITHIN FILTER BUILDING	HANDHOLE H4
	4"	(4#250+1#4EG)	POWER	MDP	DISCONNECT/PP2CB
	4"	PULLWIRE	FUTURE POWER	NEMA 4X JUNCTION BOX WITHIN FILTER BLDG.	HANDHOLE H4
D8	2"	(3#10+1#10EG)	POWER	FP1	BACKWASH TANK FILL OPERATOR
	2"	(12#14)	CONTROL	FILTER CONTROLLER CP-F1	BACKWASH TANK FILL OPERATOR
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H4	HANDHOLE H5
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H4	HANDHOLE H5
EXISTING DUCT	2"	**(12 STRAND FIBER)**	**DATA**	**CHEM BUILDING**	**MAIN CONTROL PANEL**
		(1ISP16)	**SIGNAL**	**CHEM BUILDING**	**MAIN CONTROL PANEL**
		(1ISP16)	**SIGNAL**	**FIT-008**	**MAIN CONTROL PANEL**
		(1ISP16)	**SIGNAL**	**FLOW VALVE**	**MAIN CONTROL PANEL**
		(1ISP16)	**SIGNAL**	**LIT-100**	**MAIN CONTROL PANEL**
		(1ISP16)	**SIGNAL**	**AIT-100**	**MAIN CONTROL PANEL**
		(12 STRAND FIBER)	**DATA**	**BACKWASH TANK RADIO**	**MAIN CONTROL PANEL**
		(4ISP16)	**SIGNAL**	**EXISTING FLOCC VFD'S**	**MAIN CONTROL PANEL**
	2"	**(3#12)**	**STATUS**	**AAH-100**	**MAIN CONTROL PANEL**
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H4	HANDHOLE H5
	4"	(4#250+1#4EG)	POWER	MDP	DISCONNECT/PP2CB
	4"	PULLWIRE	FUTURE POWER	HANDHOLE H4	HANDHOLE H5
D9	2"	(3#10+1#10EG)	POWER	FP1	BACKWASH TANK FILL OPERATOR
	2"	(12#14)	CONTROL	FILTER CONTROLLER CP-F1	BACKWASH TANK FILL OPERATOR
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H5	HANDHOLE H6
EXISTING DUCT	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H5	HANDHOLE H6
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H5	HANDHOLE H6
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H5	HANDHOLE H6
	4"	(4#250+1#4EG)	POWER	MDP	DISCONNECT/PP2CB
	4"	PULLWIRE	FUTURE POWER	HANDHOLE H5	HANDHOLE H6
D10	1"	(3#10+1#10EG)	POWER	FP1	BACKWASH TANK FILL OPERATOR
EXISTING DUCT	1"	(12#14)	CONTROL	FILTER CONTROLLER CP-F1	BACKWASH TANK FILL OPERATOR
	1"	PULLWIRE	SPARE	HANDHOLE H6	NEMA JUNCTION BOX WITHIN BACKWASH STRUCTURE

1 / E21 ELECTRICAL DUCT SCHEDULE
SCALE: NTS

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DELTON BROOKS
8183
4/14/2003

CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL
DUCT BANK
SCHEDULE I

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: CAG

Sheet Number
E21

BWdrawn Shw=E21.dwg L:\2002\02011280 - Shawnee WTP\drawings\ 34X22 1=1 4/14/03 10:40 pm
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DUCT BANK SCHEDULE

DUCT NO.	DUCT SIZE	CONTENTS	DESCRIPTION	FROM	TO
D11	4"	(4#250+1#4EG)	POWER	MDP	DISCONNECT/PP2CB
	4"	PULLWIRE	FUTURE POWER	HANDHOLE H6	HANDHOLE H7
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H6	HANDHOLE H7
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H6	HANDHOLE H7
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H6	HANDHOLE H7
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H6	HANDHOLE H7
D12	4"	(4#250+1#4EG)	POWER	MDP	DISCONNECT/PP2CB
	4"	PULLWIRE	FUTURE POWER	HANDHOLE H7	STUB AND CAP AT CHEM BLDG.
	2"	SEE ONE-LINE	POWER	CHEM BLDG.	TRANSFORMER T2
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H7	STUB AND CAP AT CHEM BLDG.
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H7	STUB AND CAP AT CHEM BLDG.
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H7	STUB AND CAP AT CHEM BLDG.
D13A 8-WAY	2"	(3#10+1#10EG)	POWER	PP1	SLUDGE VALVE NO.1 OPERATOR SLUDGE VALVE NO.2 OPERATOR
	2"	(3#10)	POWER	LP	SLUDGE VALVE CONTROL PANEL
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H3	HANDHOLE H1
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H3	HANDHOLE H1
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H3	HANDHOLE H1
	2"	PULLWIRE	FUTURE CONTROL	HANDHOLE H3	HANDHOLE H1
	2"	(3#10+1#10EG)	POWER	PP1	INFLUENT VALVE OPERATOR
	2"	PULLWIRE	FUTURE SIGNAL	HANDHOLE H3	HANDHOLE H1
D13B	2"	SEE ONE LINE	POWER	CHEM BLDG	XFMR-T2
D14	2"	(1ISP16)	SIGNAL	LIT-100	MAIN CONTROL PANEL
		(1ISP16)	SIGNAL	AIT-100	MAIN CONTROL PANEL
	2"	(3#12)	STATUS	AAH-100	MAIN CONTROL PANEL
D15	4"	SEE ONE-LINE	POWER	SWITCHGEAR	TRANSFORMER T3
D16	4-2"	SEE ONE-LINE	POWER	PANEL 'PP'	TRANSFORMER T3
D17	4"	SEE ONE-LINE	POWER	SWITCHGEAR	TRANSFORMER T3
	4"	SEE ONE-LINE	POWER	SWITCHGEAR	TRANSFORMER T2
	2-4"	PULL STRING	SPARE	SWITCHGEAR	HANDHOLE H10
D18	4"	SEE ONE-LINE	POWER	SWITCHGEAR	EXISTING TRANSFORMER T1
	2"	PULL STRING	SPARE	SWITCHGEAR	MAIN CONTROL PANEL
D19	2-4"	SEE ONE-LINE	POWER	SWITCHGEAR	EXISTING PULLBOX PB4 SPLICE TO EXISTING CONDUCTORS
D20	4"	SEE ONE-LINE	POWER	SWITCHGEAR	TRANSFORMER T3
	4"	SEE ONE-LINE	POWER	SWITCHGEAR	TRANSFORMER T2
	4"	SEE ONE-LINE	POWER	SWITCHGEAR	EXISTING PULLBOX PB4
	4"	SEE ONE-LINE	POWER	SWITCHGEAR	EXISTING TRANSFORMER T1
	2"	PULL STRING	SPARE	SWITCHGEAR	MAIN CONTROL PANEL
	2-4"	PULL STRING	SPARE	SWITCHGEAR	HANDHOLE H10
D21	2"	(20#12)	CONTROL	SLUDGE VALVE CONTROL PANEL	MAIN CONTROL PANEL
		(12#12)	CONTROL	EXISTING MCC	MAIN CONTROL PANEL
		(16#12)	CONTROL	EXISTING FLOCC VFD'S	MAIN CONTROL PANEL
	2"	(4ISP16)	SIGNAL	EXISTING FLOCC VFD'S	MAIN CONTROL PANEL
	2"	PULL STRING	SPARE	JUNCTION BOX	MAIN CONTROL PANEL
D22	2"	(1ISP16)	SIGNAL	FIT-008	MAIN CONTROL PANEL

DUCT BANK SCHEDULE

DUCT NO.	DUCT SIZE	CONTENTS	DESCRIPTION	FROM	TO
D23	2"	(1ISP16)	SIGNAL	FIT-008	MAIN CONTROL PANEL
		(1ISP16)	SIGNAL	FLOW VALVE	MAIN CONTROL PANEL
D24	2"	(1ISP16)	SIGNAL	FIT-008	MAIN CONTROL PANEL
		(1ISP16)	SIGNAL	FLOW VALVE	MAIN CONTROL PANEL
		(1ISP16)	SIGNAL	LIT-100	MAIN CONTROL PANEL
		(1ISP16)	SIGNAL	AIT-100	MAIN CONTROL PANEL
	2"	(3#12)	STATUS	AAH-100	MAIN CONTROL PANEL
		(12 STRAND FIBER)	DATA	BACKWASH TANK RADIO	MAIN CONTROL PANEL
D25	2"	(3#12)	POWER	SUMP PUMP	PANEL MPC
		(3#12)	POWER	RECPT.	PANEL MPC
	2"	(3#12)	POWER	FLOW VALVE	PANEL MPC
D26	2"	(3#12)	POWER	BACKWASH TANK RADIO	PANEL MPC
D27	2"	(12 STRAND FIBER)	DATA	BACKWASH TANK RADIO	MAIN CONTROL PANEL
D28	4"	SEE ONE-LINE	POWER	SWITCHGEAR	TRANSFORMER T2
D29	4-4"	SEE ONE-LINE	POWER	SWITCHGEAR	UTILITY
	4-4"	PULL STRING	SPARE	SWITCHGEAR	UTILITY

1 E22 ELECTRICAL DUCT SCHEDULE
SCALE: NTS

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4/14/2003

CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

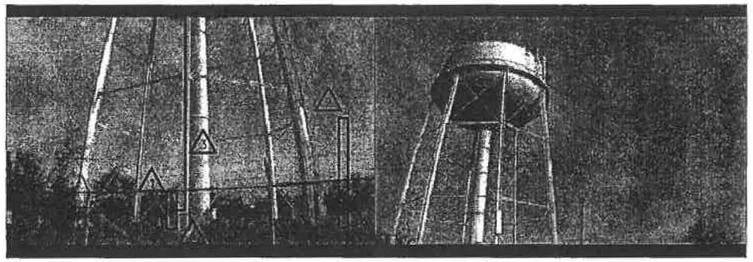
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL
DUCT BANK
SCHEDULE II

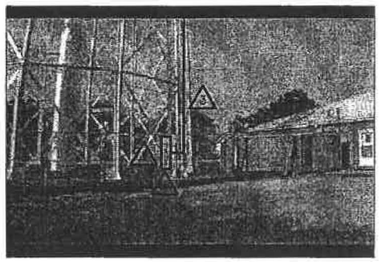
Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: PSR

Sheet Number
E22

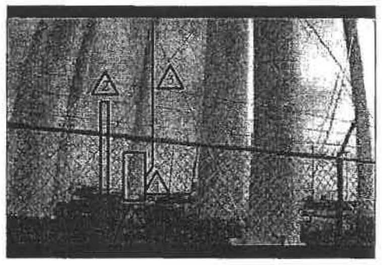
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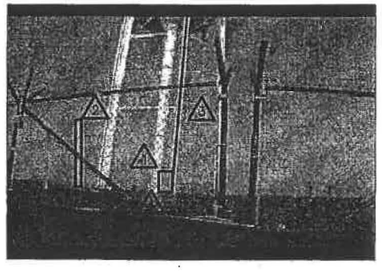
1 E23 EDWARDS TANK RTU INSTALLATION
SCALE: NTS



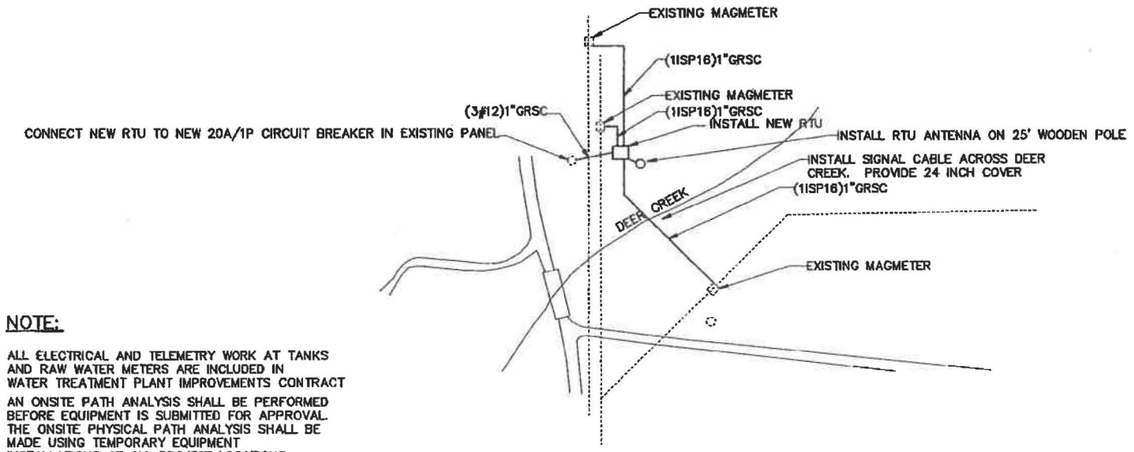
2 E23 PARK TANK RTU INSTALLATION
SCALE: NTS



3 E23 AIRPORT TANK RTU INSTALLATION
SCALE: NTS



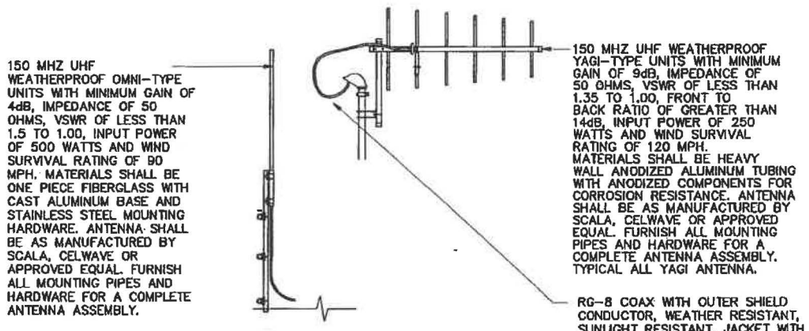
4 E23 WOLVERINE TANK RTU INSTALLATION
SCALE: NTS



5 E23 RAW WATER RTU INSTALLATION
SCALE: NTS

NOTE:

1. ALL ELECTRICAL AND TELEMETRY WORK AT TANKS AND RAW WATER METERS ARE INCLUDED IN WATER TREATMENT PLANT IMPROVEMENTS CONTRACT
2. AN ONSITE PATH ANALYSIS SHALL BE PERFORMED BEFORE EQUIPMENT IS SUBMITTED FOR APPROVAL. THE ONSITE PHYSICAL PATH ANALYSIS SHALL BE MADE USING TEMPORARY EQUIPMENT INSTALLATIONS AT ALL PROJECT LOCATIONS. SUBMIT RADIO PATH RECEIVED SIGNAL STRENGTH AND REQUIRED ANTENNA HEIGHT AT ALL LOCATIONS TO ACHIEVE 30dB FADE MARGIN.
3. ACTUAL ANTENNA MOUNTING HEIGHTS SHALL BE ADJUSTED AS REQUIRED TO PROVIDE SPECIFIED FADE MARGINS FOR ALL SITES.
4. REMOTE SITES SHALL PROVIDE 30dB OF PAD TO INSURE OPERATION UNDER ALL WEATHER CONDITIONS. THE 30dB OF PAD REQUIREMENT SHALL BE DEMONSTRATED TO THE ENGINEER (AT NO ADDITIONAL COST) UPON REQUEST.
5. CONTRACTOR SHALL SUBMIT RESULTS OF ON SITE RADIO PATH STUDY AS WELL AS PROPOSED SYSTEM DIAGRAM. THE SYSTEM DIAGRAM SHALL SHOW ALL RADIO LOCATIONS, REQUIRED ANTENNA HEIGHTS, REPEATER LOCATIONS, MASTER LOCATION, POLLING STRUCTURE, EQUIPMENT USED AT EACH LOCATION, REQUIRED SIGNAL STRENGTH AT EACH SITE.



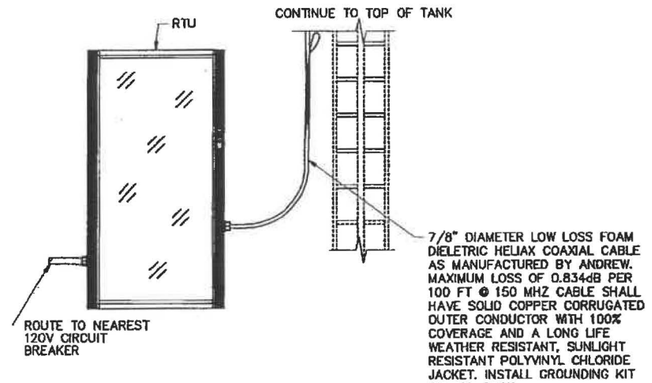
6 E23 ANTENNA DETAIL
SCALE: NONE

WATER TANK KEYED NOTES:

1. INSTALL (3#12)3/4"C FROM NEW RTU TO POWER PANEL.
2. INSTALL NEW ELECTRICAL SERVICE ENTRANCE. PROVIDE 120/240 VOLT SERVICE, MAIN DISCONNECT, METER SOCKET, RISER POLE, WEATHERHEAD, LIGHTING PANEL, AND COORDINATE WITH ALL OTHER UTILITY REQUIREMENTS. GROUND SERVICE ENTRANCE ACCORDING TO NEC.
3. INSTALL COAX AND ANTENNA ON TOP OF TANK ESTABLISH COMMUNICATION BACK TO WATER TREATMENT PLANT. REFER TO DETAIL SHEET FOR ANTENNA DETAILS. PROVIDE GROUNDING KIT ON COAX AT TOP AND BOTTOM OF TANK. SUPPORT COAX AT NO GREATER THAN 5' INTERVALS. PROVIDE STAINLESS STEEL ATTACHMENT BANDS AND CABLE HANGERS. PROVIDE #2 GROUNDING JUMPER FOR GROUNDING KIT.
4. TAP PRESSURE LINE FOR TANK LEVEL TRANSMITTER.

GENERAL NOTES:

1. REFER TO PID DRAWINGS FOR COMPLETE I/O COUNT. CONNECT ALL I/O AS SHOWN ON PID.



7 E23 RTU COAX INSTALLATION
SCALE: NONE

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CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

ELECTRICAL
RTU INSTALLATION
DETAILS

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: PSR

Sheet Number
E23

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Xrefs: [P:\Standards\PROGDEV\STAMPS\ DLB_OK] [L:\2002\02011280 - Shawnee WTP\drawings\REF\ xrf_d15]

IDENTIFICATION, GENERAL

SYMBOL	DESCRIPTION
XXXX ###	EQUIPMENT TAG
P-99	SHEET INTERFACE
	SEQUENCE NUMBER
	DRAWING TYPE
P-99 FROM/TO XXXX	SHEET INTERFACE WITH PROCESS FLAG
	PROCESS

PIPING LINE TYPES

LINE	DESCRIPTION
	PROCESS LINE – PRIMARY
	PROCESS LINE – SECONDARY
	PACKAGE BOUNDARY
	AREA/BUILDING BOUNDARY
	SHOWN ELSEWHERE

PIPING, MISCELLANEOUS

SYMBOL	DESCRIPTION
	SLOPE ARROW ARROW DIRECTION DOWN
ST	LINE HEAT TRACED AND INSULATED ST = STEAM TRACED ET = ELECTRIC TRACED
	OUTSIDE GRADE LEVEL

ACCESSORIES AND APPURTENANCES

SYMBOL	DESCRIPTION
	UNION
	PLUG
	BLIND FLANGE
	HOSE CONNECTION
	SPRAY NOZZLE
	DRAIN
	FLEXIBLE CONNECTION, GENERAL
	FLEXIBLE HOSE
	QUICK CONNECTOR
1"	THREADED TAP
	FILTER
	'Y' TYPE STRAINER
	STRAINER
	EXPANSION JOINT

VALVES

SYMBOL	DESCRIPTION
	CHECK VALVE
	GATE VALVE
	BUTTERFLY VALVE
	BALL VALVE
	PLUG VALVE
	NEEDLE VALVE
	ROTARY VALVE
	KNIFE GATE VALVE
	THREE WAY VALVE
	FOUR WAY VALVE
	GLOBE VALVE
	CHARACTERIZED OR VEE–BALL VALVE
	STOP CHECK VALVE
	DIAPHRAM VALVE
	PRESSURE CONTROL VALVE (SELF CONTAINED)
	PRESSURE RELIEF VALVE
	VACUUM–RELIEF VALVE

VALVE OPERATORS

SYMBOL	DESCRIPTION
	HAND OPERATOR
	HAND OPERATOR (LONG)
	CHAIN OPERATOR
F	FLOAT OPERATOR
	AIR DIAPHRAM OPERATOR
	POSITIONER
S	SOLENOID OPERATOR
	CYLINDER OPERATOR
	PRESSURE BALANCED DIAPHRAM OPERATOR
M	MOTOR OPERATOR
D	DIGITAL OPERATOR
EH	ELECTRO–HYDRAULIC OPERATOR
	FAIL ARROWS INDICATE OPEN PORTS
	LIMIT SWITCH

PROCESS EQUIPMENT

SYMBOL	DESCRIPTION
M	ELECTRIC MOTOR
V	VARIABLE SPEED DRIVE
G	ELECTRIC GENERATOR
	HYDRAULIC MOTOR
	AIR MOTOR
	SHAFT
	COUPLING
	DYNAMIC PUMP
	DYNAMIC COMPRESSOR
	POSITIVE DISPLACEMENT PUMP
	POSITIVE DISPLACEMENT COMPRESSOR
	EDUCTOR/EJECTOR
	HEATER, GENERAL
	HEATER W/FAN (INDUCED DRAFT)
	HEATER W/FAN (FORCED DRAFT)
	HEAT EXCHANGER, GENERAL
	HYDRAULIC CYLINDER
	AIR CYLINDER

INSTRUMENT PRIMARY ELEMENTS

SYMBOL	DESCRIPTION
	THREADED TAP
	THERMOWELL
	SIGHT FLOW INDICATOR
	ROTAMETER
	FLOW ORIFICE
	FLOW ORIFICE IN QUICK CHANGE FITTING
	SINGLE PORT PITOT
	VENTURI TUBE
	AVERAGING PITOT STATION
	FLUME
	WEIR
	TURBINE ELEMENT
	POSITIVE DISPLACEMENT FLOWMETER
	VORTEX SENSOR
	TARGET ELEMENT
MASS	MASS FLOWMETER
	SONIC FLOWMETER
M	MAG. FLOWMETER
	pH ELECTRODE ASSEMBLY

AUXILIARY INSTRUMENTS OR FUNCTIONS

SYMBOL	DESCRIPTION
	TEST POINT, TERMINAL BLOCK WITH SLIDING LINK AND MINI–BANANA SOCKETS
P	PURGE OR FLUSHING DEVICE
I	INTERLOCK LOGIC WITH REFERENCE
	DIAPHRAM SEAL
R	RESET FOR LATCH TYPE OPERATOR
	PANEL MOUNTED PATCHBOARD POINT
	PILOT LIGHT FOR PROCESS SIGNALS
	INSTRUMENTS SHARING COMMON HOUSING
+ PS –	LOOP POWER SUPPLY
pH	POWER OF HYDROGEN
TURB.	TURBIDITY

MEANING OF FUNCTIONAL INSTRUMENT IDENTIFICATION LETTERS

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER FLAME		USER CHOICE	USER CHOICE	USER CHOICE
C	CONDUCTIVITY (ELECTRICAL)			CONTROL	
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL			
E	VOLTAGE (EMF)		PRIMARY ELEMENT		
F	FLOW RATE	RATIO(FRACTION)			
G	GAUGING(DIMENSIONAL)		GLASS		
H	HAND(MANUALLY INITIATED)				HIGH
I	CURRENT(ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME OR TIME–SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT(PILOT)		LOW
M	MOISTURE OR HUMIDITY	MOMENTARY			MIDDLE OR INTERMEDIATE
N	USER CHOICE		USER CHOICE	USER CHOICE	USER CHOICE
O	USER CHOICE		ORIFICE(RESTRICTION)		
P	PRESSURE OR VACUUM		POINT(TEST POINT)		
Q	QUANTITY OR EVENT	INTEGRATE OR TOTALIZE			
R	RADIATION		RECORD OR PRINT		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNC.	MULTIFUNCTION
V	VIBRATION OR MECHANICAL ANALYSIS			VALVE, DAMPER, OR LOUVER	
W	WEIGHT OR FORCE		WELL		
X	UNCLASSIFIED		UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE			RELAY OR COMPUTE	
Z	POSITION			DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

JI SURGE ARRESTOR, SEE SPECIFICATIONS

INSTRUMENTS OR FUNCTIONS

KEY [SYMBOL] BLOCK TAG	PRIMARY LOCATION; OPERATOR ACCESSIBLE	AUXILIARY LOCATION; OPERATOR ACCESSIBLE	LOCATION NOT NORMALLY OPERATOR ACCESSIBLE	FIELD MOUNTED
DISCRETE INSTRUMENTS				
SHARED DISPLAY SHARED CONTROL				
COMPUTER FUNCTION				
PROGRAMMABLE LOGIC CONTROLLER				

SIGNAL CONDITIONERS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
A/D	ANALOG TO DIGITAL	Σ	SUM
D/A	DIGITAL TO ANALOG	Δ	DIFFERENCE
I/P	CURRENT TO PRESSURE	√	SQUARE ROOT
P/I	PRESSURE TO CURRENT	fx	CHARACTERIZATION
F/I	FREQUENCY TO CURRENT	∫	INTEGRATION
I/I	CURRENT BOOST/ REPEATER		

INSTRUMENT LINE TYPES

LINE	DESCRIPTION
	PROCESS CONNECTION
	UNDEFINED SIGNAL
	PNEUMATIC SIGNAL
	ELECTRIC SIGNAL
	HYDRAULIC SIGNAL
	CAPILLARY OR FILLED TUBE
	ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
	ELECTROMAGNETIC OR SONIC SIGNAL (UNGUIDED)
	INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)
	MECHANICAL LINK
	PNEUMATIC BINARY (ON–OFF) SIGNAL
	ELECTRIC BINARY (ON–OFF) SIGNAL
	FURNISH AND INSTALL
	EXISTING
	SPLICE IN EXISTING TERMINAL BOX

INSTRUMENT POWER SUPPLY

120 PSIG – JA – POWER SUPPLY, TYPE AND LEVEL SHOWN, ABBREVIATIONS AS FOLLOWS:
AS – AIR SUPPLY
IA – INSTRUMENT AIR
PA – PLANT AIR
ES – ELECTRIC SUPPLY
GS – GAS SUPPLY
HS – HYDRAULIC SUPPLY
NS – NITROGEN SUPPLY
ST – STEAM SUPPLY
WS – WATER SUPPLY

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PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PROCESS AND INSTRUMENTATION DIAGRAM LEGEND AND ABBREVIATIONS

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: BB

Sheet Number
P1

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PANEL VIEW

PLANT HMI

PLANT CONTROLER

YA 100 MINOR ALARM
YA 100 MAJOR ALARM
YY 100 NORMAL POSITION
YY 100 EMEERGENCY POSITION
FIRQ 001
FIRQ 002
FIRQ 003
LAL 004 POWER FAIL
EI 005 DC VOLTAGE LEVEL
FIRQ 008
YI 100A FULL OPENED
YI 100B FULL CLOSED
ZI 100 POSITION INDICATOR
HS 100D OPEN/CLOSE
HS 100A LOCAL/REMOTE
HS 100B AUTO/MANUAL
HS 100C SP
LIR 100 BASIN LEVEL
HS 100D LOCAL/REMOTE
HS 100E AUTO/MANUAL
HS 100F SP
YI 100
ITS 100 PLANT START
AAH 100 OZONE ALARM

I1 I2 I3 I4 I5 I6 I7 I8 I9 I10 I11 I12 I13 I14 I15 I16 I17 I18 I19 I20 I21 I22

FY 001 AI
FY 002 AI
FY 003 AI
YY 004 DI
EY 005 AI RAW WATER RTU
FY 008 AI
YY 100A DI
YY 100B DI
ZY 100 AI
PID 100A BASIN LEVEL CONTROLLER SP PV CV 1
ZY 100 AO
LY 100 AI
FC
FY 100 AO
YY 100C DO
PID 100B BASIN LEVEL CONTROLLER SP PV CV 1
YY 100 AI
AY 100 AI
FY 100B AO
YY 100 DO
YY DI
YY DI

YY 004 POWER FAIL
ET 005 VOLTAGE LEVEL

GENERATOR
ATS

SA 100G
SA 100A
SA 100C
SA 100B
SA 100I
SA 100J
SA 100E
SA 100D
SA 100H
SA 100K
SA 100A
SA 100F

CP-PH
AD
HS
YY
HOA
Q
M
PH ADJUSTMENT
AIT 100
OZONE CONTROL PANEL
LIT 100
AAH 100 OZONE DETECTOR

RAW WATER
FIT 001
FIT 002
FIT 003
M
LAKES
RAW WATER METERS

FV 100
BASIN INFLUENT
SETTLING BASIN
OZONE EQUIPMENT
RAW WATER

FIT 008
LAGOON

KEYED NOTES:

1. CONTROLLER SHALL MONITOR BASIN LEVEL AND GENERATE A CONTROL SIGNAL FOR BASIN INFLUENT FLOW. CONTROLLER SHALL MAINTAIN LEVEL IN BASIN.
2. CONTROLLER SHALL MONITOR BASIN PH AND GENERATE A CONTROL SIGNAL FOR BASIN PH ADJUSTMENT. CONTROLLER SHALL START, STOP, AND CONTROL THE FLOW RATE OF CHEMICAL FEED PUMP.

RTU INTERLOCKS

- I1 RAW WATER LAKE #1 FLOW
- I2 NOT USED
- I3 NOT USED
- I4 RAW WATER LAKE #2 FLOW
- I5 RAW WATER LAKE #3 FLOW
- I6 RAW WATER 2&3 RTU POWERFAIL
- I7 RAW WATER 2&3 RTU DC POWER LEVEL
- I8 CLEARWELL LEVEL
- I9 NORTH TANK LEVEL
- I10 NORTH TANK POWER FAIL
- I11 NORTH TANK VOLTAGE LEVEL
- I12 EAST TANK LEVEL
- I13 EAST TANK POWER FAIL
- I14 EAST TANK VOLTAGE LEVEL
- I15 AIRPORT TANK LEVEL
- I16 AIRPORT TANK POWER FAIL
- I17 AIRPORT TANK VOLTAGE LEVEL
- I18 SOUTH TANK LEVEL
- I19 SOUTH TANK POWER FAIL
- I20 SOUTH TANK VOLTAGE LEVEL
- I21 PLANT INFLUENT FLOW
- I22 OZONE PERMISSIVE/START FLOW

LEGEND:

- EXISTING EQUIPMENT
- FURNISH AND INSTALL
- EXISTING INSTRUMENTATION

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PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PROCESS AND INSTRUMENTATION DIAGRAM I

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: BB

Sheet Number
P2

plotted: 4/15/2003 7:31 am
by: aggarr
file: [L:\2002\02011280 - Shawnee WTP\drawings\SHW-H02.dwg]
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PANEL VIEW

PLANT HMI

PLANT CONTROLER

FI 101 RAW FLOW

PID FACEPLATE
HS 101A LOCAL/REMOTE
HS 101B AUTO/MANUAL
HS 101C 0-100%

FC 101 RAW FLOW CONTROLLER
I 8
I 22
1
RSP
SP
PV
CV
PID 101

FY 101 AI
I 2
FY 101 AO

HS 1010 OPEN/CLOSE
KI 102 ETM
KQ 102
YI 102 RUNNING
YY 102A DI
HS 102 STT/STP
YY 102B DO

HS 1020 OPEN/CLOSE
HS 1030 START/STOP
HS 103 STT/STP
KI 103 ETM
KQ 103
YI 103 RUNNING
YY 103A DO
YY 103B DI
SI 103 SPEED
SY 103 AI

HS 1040 START/STOP
HS 104 STT/STP
KI 104 ETM
KQ 104
YI 104 RUNNING
YA 104 OVER TORQUE
YY 104A DO
YY 104B DI
YY 104C DI

KI 105 ETM
KQ 105
YI 105 RUNNING
YY 105A DI
SI 105 SPEED
SY 105 AI

HS 1050 START/STOP
HS 1060 START/STOP
HS 105 STT/STP
HS 106 STT/STP
KI 106 ETM
KQ 106
YI 106 RUNNING
YY 105B DO
YY 106A DO
YY 106B DI
SI 106 SPEED
SY 106 AI

HS 1070 START/STOP
HS 107 STT/STP
KI 107 ETM
KQ 107
YI 107 RUNNING
YA 107 OVER TORQUE
YY 107A DO
YY 107B DI
YY 107C DI

KI 108 ETM
KQ 108
YI 108 RUNNING
SI 108 SPEED
HS 108 STT/STP
YY 108A DI
SY 108 AI
YY 108B DO

HS 1080 START/STOP
YI 109A FULL CLOSED
YI 109B FULL OPENED
HS 109 OPEN/STOP/CLOSE TIME
KQ 109
YC 109
YY 109A DI
YY 109B DI
YY 109C DO

HS 110 OPEN/STOP/CLOSE/TIME
KQ 110
YC 110
YI 110A FULL OPENED
YI 110B FULL CLOSED
YY 110A DO
YY 110B DO
YY 110C DI
YY 110D DI

LIR 111B
LAHL 111B
LAHL 111A
LIR 111A
LY 111 AI
LIT 111

EX FILTER CONSOLE
EX FILTER CONTROLLER
HS 111A RATED FILTER FLOW
HS 111B TROUGH LEVEL OPERATING BAND
FC 111 0-100% RATED FLOW DIVIDED BY 4

F3 FILTER NO.1
F4 FILTER NO.2
F5 FILTER NO.3
F6 FILTER NO.4

FILTER INFLUENT TROUGH LEVEL

F3 FILTER INFLUENT
F4 FILTER INFLUENT
F5 FILTER INFLUENT
F6 FILTER INFLUENT

SA 101B
SA 101A
FIT 101
SA 101D
SA 101C
RAW WATER
INFLUENT FLOW CONTROL
FLASH MIX

SA 103B
SA 103A
SA 105B
SA 105A
SA 106B
SA 106A
SA 108B
SA 108A

M

LEGEND:

- EXISTING EQUIPMENT
- FURNISH AND INSTALL
- EXISTING INSTRUMENTATION

KEYED NOTES:

(1) CONTROLLER SHALL MONITOR CLEARWELL LEVEL AND GENERATE A REMOTE SETPOINT FOR RAW WATER FLOW. REMOTE SETPOINT SHALL BE INVERSELY PROPORTIONAL TO CLEARWELL LEVEL (I.E. AS CLEARWELL LEVEL DROPS, RAW FLOW INCREASES.) CONTROLLER SHALL BE INTERLOCKED WITH OZONE SENSORS.

RTU INTERLOCKS

I1 RAW WATER LAKE #1 FLOW
I2 RAW WATER #1 RTU POWERFAIL
I3 RAW WATER RTU DC VOLTAGE LEVEL
I4 RAW WATER LAKE #2 FLOW
I5 RAW WATER LAKE #3 FLOW
I6 RAW WATER 2&3 RTU POWERFAIL
I7 RAW WATER 2&3 RTU DC POWER LEVEL
I8 CLEARWELL LEVEL
I9 NORTH TANK LEVEL
I10 NORTH TANK POWER FAIL
I11 NORTH TANK VOLTAGE LEVEL
I12 EAST TANK LEVEL
I13 EAST TANK POWER FAIL
I14 EAST TANK VOLTAGE LEVEL
I15 AIRPORT TANK LEVEL
I16 AIRPORT TANK POWER FAIL
I17 AIRPORT TANK VOLTAGE LEVEL
I18 SOUTH TANK LEVEL
I19 SOUTH TANK POWER FAIL
I20 SOUTH TANK VOLTAGE LEVEL
I21 PLANT INFLUENT FLOW
I22 OZONE PERMISSIVE/START FLOW

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PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PROCESS AND INSTRUMENTATION DIAGRAM II

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: BB

Sheet Number
P3

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PLANT HMI

FILTER CONTROLER CP-F1

F2 FLOW SET POINT

Yl 105 OPENED
Yl 106 CLOSED
Yl 108 OPENED
Yl 109 CLOSED
Yl 111 OPENED
Yl 112 CLOSED
LI 113 FILTER LEVEL
PDAH 114 / PDIR 114
AAH 115 / AIR 115
FAH 116 / FIRO 116
AIR 117
ZI 119
Yl 120
Yl 121
Yl 123 OPENED
Yl 124 CLOSED

YC 104, YC 107, YC 110, YC 122

YY 104A DO, YY 104B DO, YY 105 DI, YY 106 DI, YY 107A DO, YY 107B DO, YY 108 DI, YY 109 DI, YY 110A DO, YY 110B DO, YY 111 DI, YY 112 DI, LY 113 AI, DPY 114 AI, AY 115 AI, FY 116 AI, AY 117 AI, RSP, FY 118 PV, CV, PID, ZY 118 AO, ZY 119 AI, YY 120 DI, YY 121 DI, YY 122A DO, YY 122B DO, FY 123 DI, YY 124 DI

F2 INFLUENT FLUME

F2 AIR SCOUR

F2 BACKWASH WATER

FV 104, FV 107, FV 110

LIT 113

PDIT 114

AIT 117 TURB

HV 122

BACKWASH WASTE

normal / backwash

anthracite

sand

filter block

FILT 01 EXISTING FILTER #1

normal

AIT 115 TURB

FIT 116

PE 116

FV 118

F6 COMBINED EFFLUENT

LEGEND:

- EXISTING EQUIPMENT
- FURNISH AND INSTALL
- EXISTING INSTRUMENTATION

RTU INTERLOCKS

I1 RAW WATER LAKE #1 FLOW
I2 RAW WATER #1 RTU POWERFAIL
I3 RAW WATER RTU DC VOLTAGE LEVEL
I4 RAW WATER LAKE #2 FLOW
I5 RAW WATER LAKE #3 FLOW
I6 RAW WATER 2&3 RTU POWERFAIL
I7 RAW WATER 2&3 RTU DC POWER LEVEL
I8 CLEARWELL LEVEL
I9 NORTH TANK LEVEL
I10 NORTH TANK POWER FAIL
I11 NORTH TANK VOLTAGE LEVEL
I12 EAST TANK LEVEL
I13 EAST TANK POWER FAIL
I14 EAST TANK VOLTAGE LEVEL
I15 AIRPORT TANK LEVEL
I16 AIRPORT TANK POWER FAIL
I17 AIRPORT TANK VOLTAGE LEVEL
I18 SOUTH TANK LEVEL
I19 SOUTH TANK POWER FAIL
I20 SOUTH TANK VOLTAGE LEVEL
I21 PLANT INFLUENT FLOW

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PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PROCESS AND INSTRUMENTATION DIAGRAM III

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: BB

Sheet Number
P4

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PLANT HMI

FILTER CONTROLER CP-F1

F2 FLOW SET POINT

YI 205 OPENED
YI 206 CLOSED
YI 208 OPENED
YI 209 CLOSED
YI 211 OPENED
YI 212 CLOSED
LI 213 FILTER LEVEL
PDAH 214
PDIR 214
AAH 215
AIR 215
FAH 216
FIRQ 216
AIR 217
ZI 219
YI 220
YI 221
YI 223 OPENED
YI 224 CLOSED

YC 204
YC 107
YC 210
YC 222

YY 204A DO
YY 204B DO
YY 205 DI
YY 206 DI
YY 207A DO
YY 207B DO
YY 208 DI
YY 209 DI
YY 210A DO
YY 210B DO
YY 211 DI
YY 212 DI
LY 213 AI
DPY 214 AI
AY 215 AI
FY 216 AI
AY 217 AI
RSP
FY 218
CV
PV
PID
ZY 218 AO
ZI 219 AI
YY 220 DI
YY 221 DI
YY 222A DO
YY 222B DO
YY 223 DI
YY 224 DI

F2 INFLUENT FLUME

LIT 213

PDIT 214

FV 210

normal
backwash
anthracite
sand
filter N block
normal

FILT 02 EXISTING FILTER #2

AIT 217 TURB

HV 222

BACKWASH WASTE

F2 AIR SCOUR

FV 207

F2 BACKWASH WATER

FV 204

AIT 215 TURB

FIT 216

FE 216

FV 218

F6 COMBINED EFFLUENT

LEGEND:

- EXISTING EQUIPMENT
- FURNISH AND INSTALL
- EXISTING INSTRUMENTATION

RTU INTERLOCKS

I1 RAW WATER LAKE #1 FLOW
I2 RAW WATER #1 RTU POWERFAIL
I3 RAW WATER RTU DC VOLTAGE LEVEL
I4 RAW WATER LAKE #2 FLOW
I5 RAW WATER LAKE #3 FLOW
I6 RAW WATER 2&3 RTU POWERFAIL
I7 RAW WATER 2&3 RTU DC POWER LEVEL
I8 CLEARWELL LEVEL
I9 NORTH TANK LEVEL
I10 NORTH TANK POWER FAIL
I11 NORTH TANK VOLTAGE LEVEL
I12 EAST TANK LEVEL
I13 EAST TANK POWER FAIL
I14 EAST TANK VOLTAGE LEVEL
I15 AIRPORT TANK LEVEL
I16 AIRPORT TANK POWER FAIL
I17 AIRPORT TANK VOLTAGE LEVEL
I18 SOUTH TANK LEVEL
I19 SOUTH TANK POWER FAIL
I20 SOUTH TANK VOLTAGE LEVEL
I21 PLANT INFLUENT FLOW

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PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PROCESS AND INSTRUMENTATION DIAGRAM IV

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: BB

Sheet Number
P5

LICENSED PROFESSIONAL ENGINEER
BRADLEY D. BALTON
No. 19183
4/14/2003

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PLANT HMI

FILTER CONTROLER CP-F2

F2 FLOW SET POINT

YI 305 OPENED
YI 306 CLOSED
YI 308 OPENED
YI 309 CLOSED
YI 311 OPENED
YI 312 CLOSED
LI 313 FILTER LEVEL
PDAH 314 / PDIR 314
AAH 315 / AIR 315
FAH 316 / FIRQ 316
AIR 317
ZI 319
YI 320
YI 321
YI 323 OPENED
YI 324 CLOSED

YC 304 — YY 304A DO, YY 304B DO
YC 307 — YY 305 DI, YY 306 DI, YY 307A DO, YY 307B DO
YC 310 — YY 308 DI, YY 309 DI, YY 310A DO, YY 310B DO
YY 311 DI, YY 312 DI, LY 313 AI
DPY 314 AI, AY 315 AI, FY 316 AI, AY 317 AI
FY 318 (RSP, SP, CV, PV, PID) — ZY 318 AO
ZY 319 AI, YY 320 DI
YC 322 — YY 321 DI, YY 322A DO, YY 322B DO, YY 323 DI, YY 324 DI

F2 INFLUENT FLUME
F2 AIR SCOUR
F2 BACKWASH WATER

FV 310, FV 307, FV 304

LIT 313
PDIT 314
normal / backwash
anthracite
sand
filter media
normal
FILT 03 EXISTING FILTER #3

AIT 317 TURB
AIT 315 TURB
FIT 316
FE 316
FV 318

HV 322
BACKWASH WASTE
F6 COMBINED EFFLUENT

LEGEND:

- EXISTING EQUIPMENT
- FURNISH AND INSTALL
- EXISTING INSTRUMENTATION

RTU INTERLOCKS

I1 RAW WATER LAKE #1 FLOW
I2 RAW WATER #1 RTU POWERFAIL
I3 RAW WATER RTU DC VOLTAGE LEVEL
I4 RAW WATER LAKE #2 FLOW
I5 RAW WATER LAKE #3 FLOW
I6 RAW WATER 2&3 RTU POWERFAIL
I7 RAW WATER 2&3 RTU DC POWER LEVEL
I8 CLEARWELL LEVEL
I9 NORTH TANK LEVEL
I10 NORTH TANK POWER FAIL
I11 NORTH TANK VOLTAGE LEVEL
I12 EAST TANK LEVEL
I13 EAST TANK POWER FAIL
I14 EAST TANK VOLTAGE LEVEL
I15 AIRPORT TANK LEVEL
I16 AIRPORT TANK POWER FAIL
I17 AIRPORT TANK VOLTAGE LEVEL
I18 SOUTH TANK LEVEL
I19 SOUTH TANK POWER FAIL
I20 SOUTH TANK VOLTAGE LEVEL
I21 PLANT INFLUENT FLOW

REGISTERED PROFESSIONAL ENGINEER
STATE OF OKLAHOMA
18183
4/14/2003

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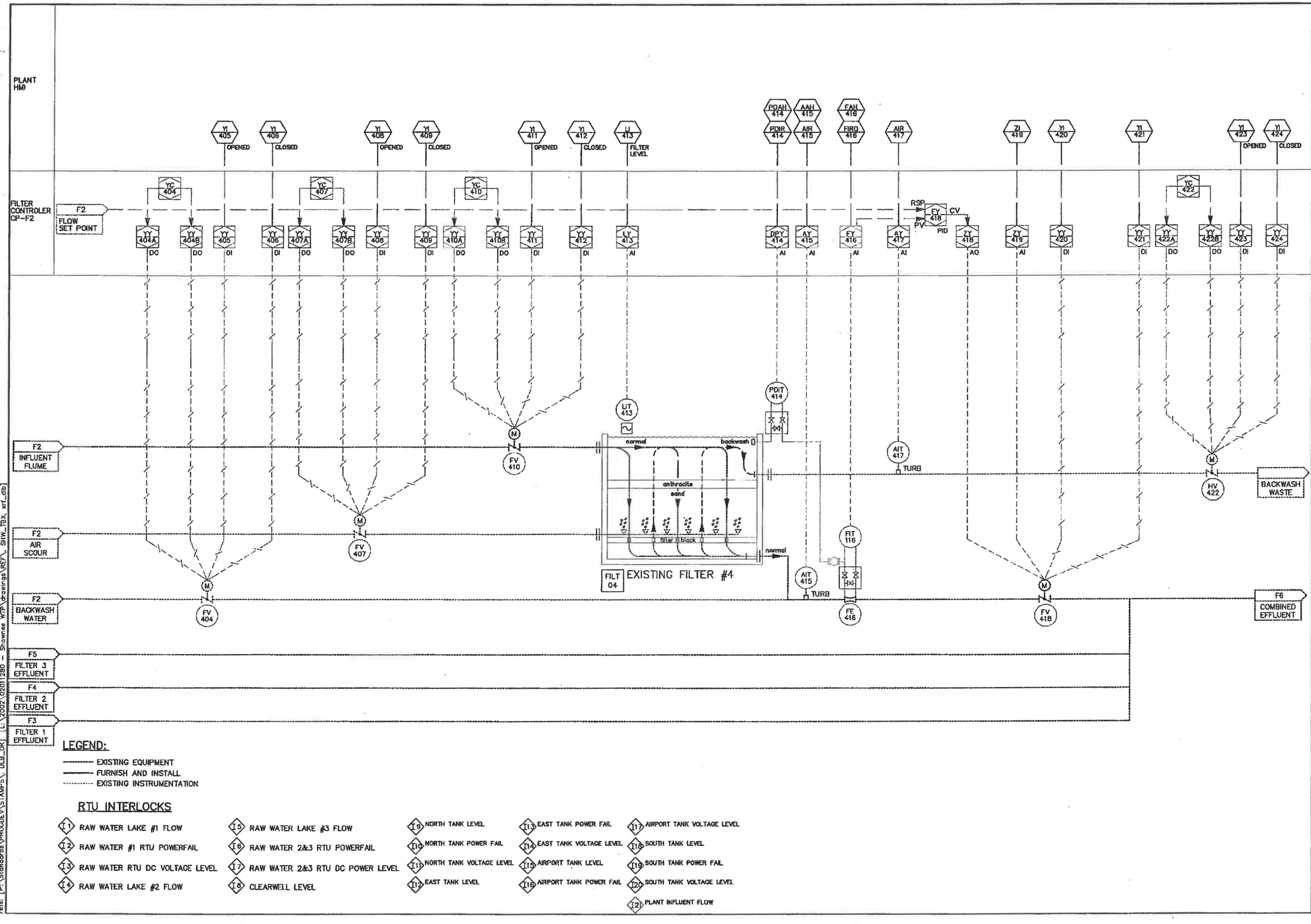
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PROCESS AND INSTRUMENTATION DIAGRAM V

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: BB

Sheet Number
P6

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LEGEND:

- EXISTING EQUIPMENT
- FURNISH AND INSTALL
- EXISTING INSTRUMENTATION

RTU INTERLOCKS

- I1 RAW WATER LAKE #1 FLOW
- I2 RAW WATER #1 RTU POWERFAIL
- I3 RAW WATER RTU DC VOLTAGE LEVEL
- I4 RAW WATER LAKE #2 FLOW
- I5 RAW WATER LAKE #3 FLOW
- I6 RAW WATER 2&3 RTU POWERFAIL
- I7 RAW WATER 2&3 RTU DC POWER LEVEL
- I8 CLEARWELL LEVEL
- I9 NORTH TANK LEVEL
- I10 NORTH TANK POWER FAIL
- I11 NORTH TANK VOLTAGE LEVEL
- I12 EAST TANK LEVEL
- I13 EAST TANK POWER FAIL
- I14 EAST TANK VOLTAGE LEVEL
- I15 AIRPORT TANK LEVEL
- I16 AIRPORT TANK POWER FAIL
- I17 AIRPORT TANK VOLTAGE LEVEL
- I18 SOUTH TANK LEVEL
- I19 SOUTH TANK POWER FAIL
- I20 SOUTH TANK VOLTAGE LEVEL
- I21 PLANT INFLUENT FLOW

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PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PROCESS AND INSTRUMENTATION DIAGRAM VI

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: BB

Sheet Number
P7

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PANEL VIEW

PLANT HMI

PLANT PLC

5030 START/STOP

504D START/STOP

505D START/STOP

LAHL 501

UR 501

HS 502C PUMP 1 START/STOP

HS 502D PUMP 2 START/STOP

HS 502E PUMP 3 START/STOP

YI 503A HIGH SERVICE PUMP 1 FAIL TO START

YI 503B HIGH SERVICE PUMP 1 ETM

YI 503C HIGH SERVICE PUMP 1 RUNNING

YI 504A HIGH SERVICE PUMP 2 FAIL TO START

YI 504B HIGH SERVICE PUMP 2 ETM

YI 504C HIGH SERVICE PUMP 2 RUNNING

YI 505A HIGH SERVICE PUMP 3 FAIL TO START

YI 505B HIGH SERVICE PUMP 3 ETM

YI 505C HIGH SERVICE PUMP 3 RUNNING

AIRPORT TANK LEVEL

YC 500 ①

YC 501 ②

FILTER CONTROLLER

LY 501 AI

I 8

YY 503A DO STT/STP

YY 503B DI

YY 504A DO STT/STP

YY 504B DI

YY 505A DO STT/STP

YY 505B DI

KI 507 ETM

YI 507

LAHL 508

UR 508

HS 509 OPEN STOP CLOSE AUTO

YI 510 OPENED

YI 511 CLOSED

FIRO 512

FIRO 513

YI 715 FULL OPENED

YI 716 FULL CLOSED

ZI 717 POSITION INDICATOR

EX FILTER CONTROLLER

YY 506 DO

YY 507 DI

KQ 507

LY 508 AI

YC 509

YY 509A DO

YY 509 DO

YY 510 DI

YY 511 DI

FY 512 AI

FY 513 AI

PID 500 PV

BACKWASH FLOW CONTROLLER

YY 715 DI

YY 716 DI

ZY 717 AI

SA

15 SPARE CONDUITS

HS 503 HOA

YY 503

HS 504 HOA

YY 504

HS 505 HOA

YY 505

EXISTING MAIN CONTROL PANEL TO BE REMOVED

FIT 512

UT 501

LE 501

HSP 01

HSP 02

HSP 03

M

DIST. SYSTEM

LT

BACKWASH TANK

FIT 513

FILTER BACKWASH

BLOW 01

AIR SCOUR BLOWER

F3 FILTER AIR SCOUR

G4 FILTER 1

G5 FILTER 2

G6 FILTER 3

G7 FILTER 4

HIGH SERVICE PUMP STATION

KEYED NOTES:

① CONTROLLER SHALL STAGE THE STARTING OF ALL HIGH SERVICE PUMPS. START AND STOP SHALL BE BASED ON CONTROL TANK LEVEL AND BE CONFIGURABLE FROM HMI SCREEN AND SHALL BE INTERLOCKED WITH LOW CLEARWELL LEVEL.

② CONTROLLER SHALL GENERATE PUMP FAIL TO START ALARM AND DISPLAY RUN STATUS AND ELAPSED RUN TIME.

RTU INTERLOCKS

I1 RAW WATER LAKE #1 FLOW

I2 RAW WATER #1 RTU POWERFAIL

I3 RAW WATER RTU DC VOLTAGE LEVEL

I4 RAW WATER LAKE #2 FLOW

I5 RAW WATER LAKE #3 FLOW

I6 RAW WATER 2&3 RTU POWERFAIL

I7 RAW WATER 2&3 RTU DC POWER LEVEL

I8 CLEARWELL LEVEL

I9 NORTH TANK LEVEL

I10 NORTH TANK POWER FAIL

I11 NORTH TANK VOLTAGE LEVEL

I12 EAST TANK LEVEL

I13 EAST TANK POWER FAIL

I14 EAST TANK VOLTAGE LEVEL

I15 AIRPORT TANK LEVEL

I16 AIRPORT TANK POWER FAIL

I17 AIRPORT TANK VOLTAGE LEVEL

I18 SOUTH TANK LEVEL

I19 SOUTH TANK POWER FAIL

I20 SOUTH TANK VOLTAGE LEVEL

I21 PLANT INFLUENT FLOW

LEGEND:

——— EXISTING EQUIPMENT

——— FURNISH AND INSTALL

- - - - - EXISTING INSTRUMENTATION

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SHAWNEE, OKLAHOMA

PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PROCESS AND INSTRUMENTATION DIAGRAM VII

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: BB

Sheet Number
P8

BWBrown Shw-pids.dwg L:\2002\02011280 - Shawnee WTP\drawings\ 34x22 1=1 4/14/03 11:39 pm
Images: [none]
Xrefs: [P:\Standards\PROGDEV\STAMPS\ DLB_OK] [L:\2002\02011280 - Shawnee WTP\drawings\REF\ SHW_TBX. xrf_dib]

HMI

PLC

LAHL 600 / LIR 600 — LAHL 601 POWER FAIL — EI 602 DC VOLTAGE LEVEL

LAHL 603 / LIR 603 — LAHL 604 POWER FAIL — EI 605 DC VOLTAGE LEVEL

LAHL 606 / LIR 606 — LAHL 607 POWER FAIL — EI 608 DC VOLTAGE LEVEL

LAHL 608 / LIR 609 — LAHL 610 POWER FAIL — EI 611 DC VOLTAGE LEVEL

RTU INTERLOCKS

- I1 RAW WATER LAKE #1 FLOW
- I2 RAW WATER #1 RTU POWERFAIL
- I3 RAW WATER RTU DC VOLTAGE LEVEL
- I4 RAW WATER LAKE #2 FLOW
- I5 RAW WATER LAKE #3 FLOW
- I6 RAW WATER 2&3 RTU POWERFAIL
- I7 RAW WATER 2&3 RTU DC POWER LEVEL
- I8 CLEARWELL LEVEL
- I9 NORTH TANK LEVEL
- I10 NORTH TANK POWER FAIL
- I11 NORTH TANK VOLTAGE LEVEL
- I12 EAST TANK LEVEL
- I13 EAST TANK POWER FAIL
- I14 EAST TANK VOLTAGE LEVEL
- I15 AIRPORT TANK LEVEL
- I16 AIRPORT TANK POWER FAIL
- I17 AIRPORT TANK VOLTAGE LEVEL
- I18 SOUTH TANK LEVEL
- I19 SOUTH TANK POWER FAIL
- I20 SOUTH TANK VOLTAGE LEVEL
- I21 PLANT INFLUENT FLOW

AIRPORT

G8 NORTH TANK LEVEL — I9, I10, I11

LY 600 AI — YY 601 DI — EY 602 AI — TANK RTU

LIT 600 — YY 601 — ET 602

DRAIN

EDWARDS

G8 EAST TANK LEVEL — I12, I13, I14

LY 603 AI — YY 604 DI — EY 605 AI — TANK RTU

LIT 603 — YY 604 — ET 605

DRAIN

PARK

G8 AIRPORT TANK LEVEL — I15, I16, I17

LY 606 AI — YY 607 DI — EY 608 AI — TANK RTU

LIT 606 — YY 607 — ET 608

DRAIN

WOLVERINE

G8 SOUTH TANK LEVEL — I18, I19, I20

LY 609 AI — YY 610 DI — EY 611 AI — TANK RTU

LIT 609 — YY 610 — ET 611

DRAIN

LEGEND:

---------- EXISTING EQUIPMENT

——— FURNISH AND INSTALL

---------- EXISTING INSTRUMENTATION

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CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

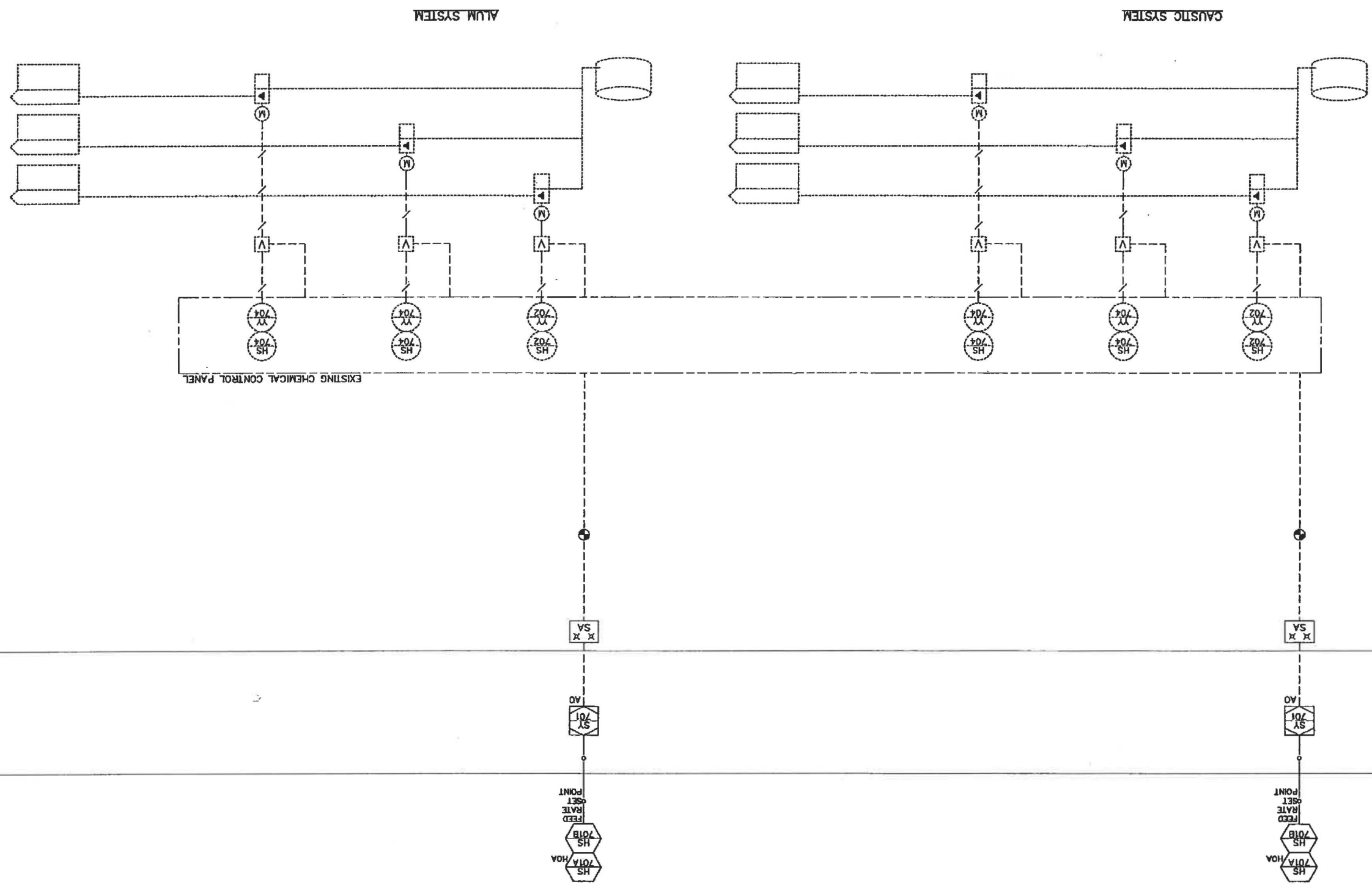
PROCESS AND INSTRUMENTATION DIAGRAM VIII

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: BB

Sheet Number
P9

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CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

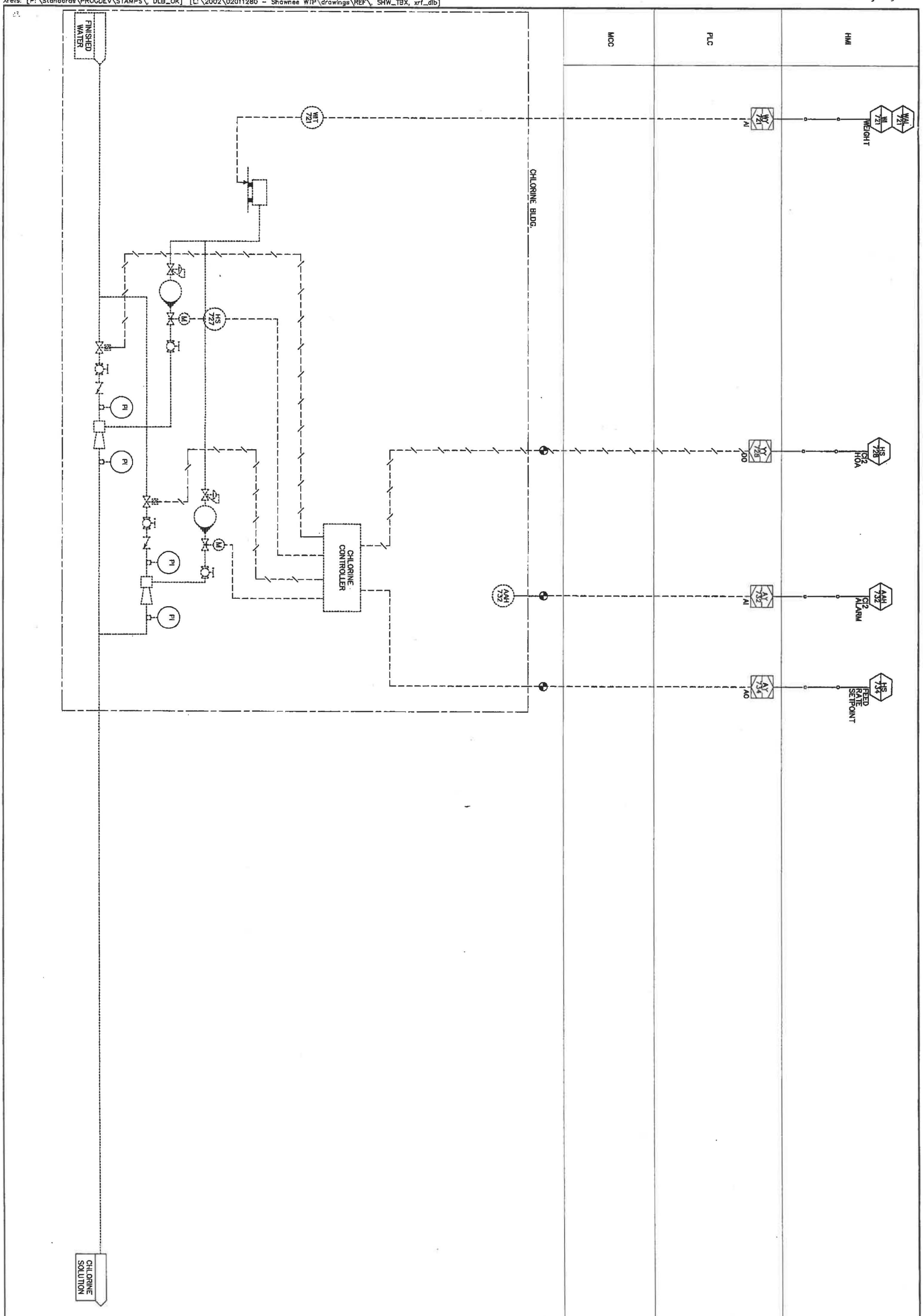
PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

PROCESS AND INSTRUMENTATION DIAGRAM IX

Job No. 02011280
Date: APRIL 2003
Designed by: BB
Drawn by: BB

Sheet Number
P10

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PROCESS AND INSTRUMENTATION DIAGRAM X

Job No. 02011280
Date: APRIL, 2003
Designed by: BB
Drawn by: BB

Sheet Number
P11

CITY OF SHAWNEE
SHAWNEE, OKLAHOMA

PHASE II
WATER TREATMENT PLANT IMPROVEMENTS

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REGISTERED PROFESSIONAL ENGINEER
DELTON BROWN
83

Present Sewer

10" Sluice Gate

Elev 1002.5

New 4'x4' Brick Manhole

10 Cl Sewer Pipe

Elev 1010

N E W B A S I N

See Sheet # 17

631000 GAL.

INFLUENT

EFFLUENT

New 12" Sewer

3'x3' Conc. Flume

Present Manhole

New 12" Sewer

1½ pipe handrails to be put on basin walls under Item 20

New 4'0" Brick Manhole

B A S I N S

S T O R A G E

Present Pipe to be cut and Connected to Flume

Existing Valves

INFLUENT

EFFLUENT

341000 GAL

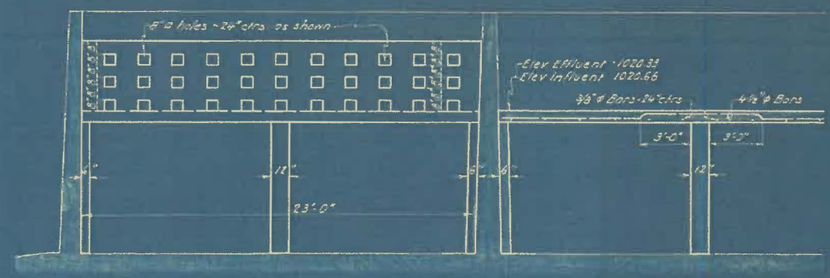
Remove Old Baffle Walls

Remove Wood Cover from this Basin

Chemical Bldg.

Plan of Coagulation Basins

1" = 10'

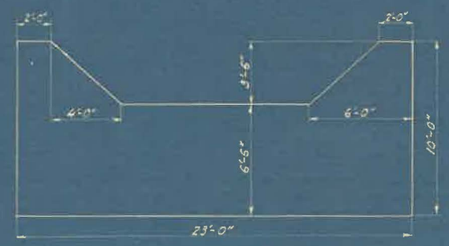


Section C-C
Elevation of Flume

¼" = 1'-0"

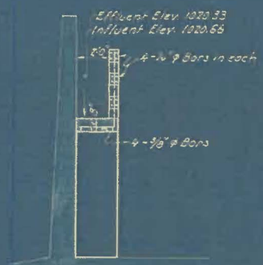
Section D-D
Part Section of Flume

¼" = 1'-0"

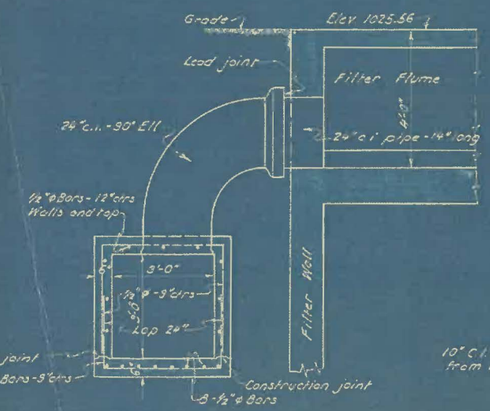


Part Section B-B
Baffle Walls in Old Basins
(4 of these to be removed)

¼" = 1'-0"

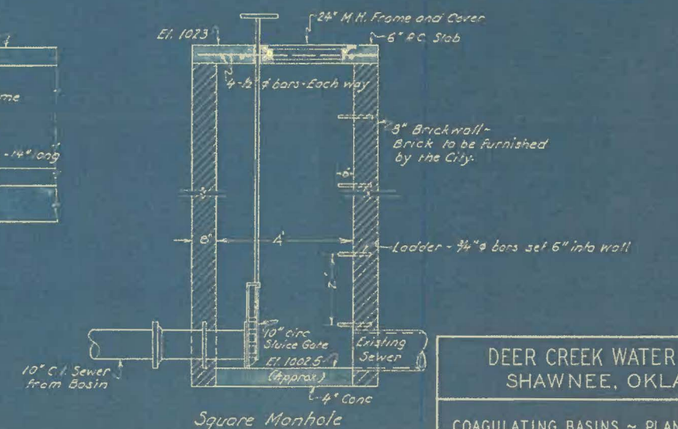


Section A-A
Section Through Flume



Settled Water Flume

½" = 1'-0"



Square Manhole

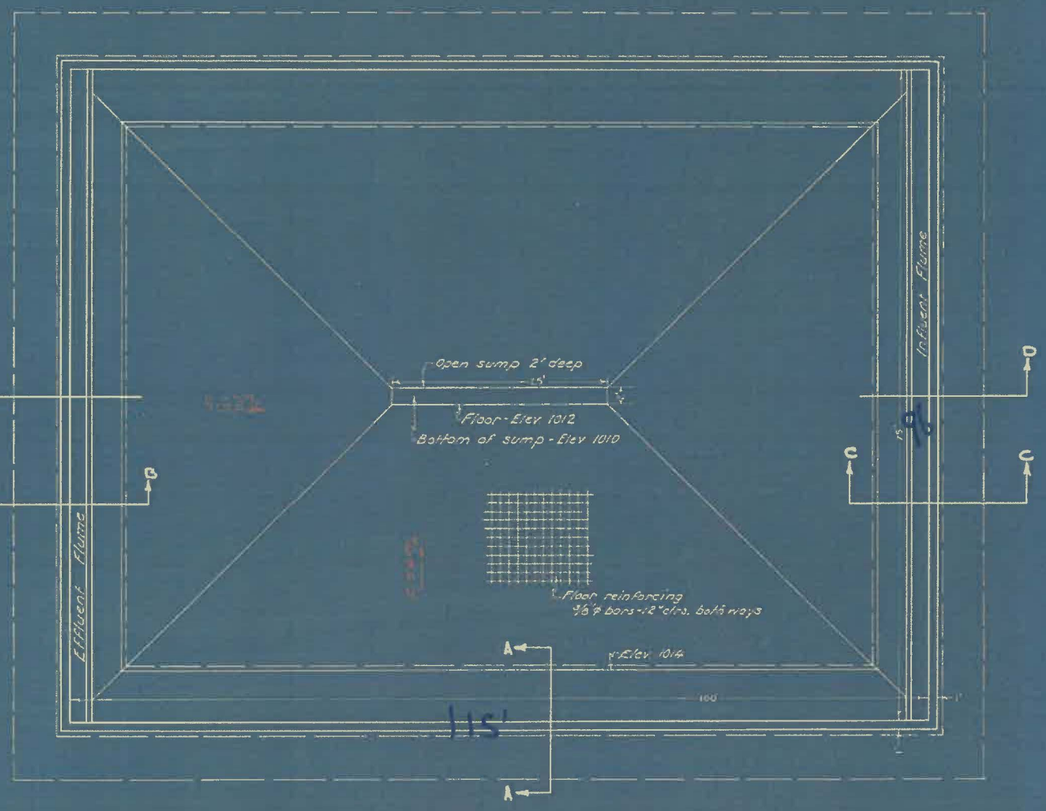
½" = 1'-0"

To be built under Item # 20

DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

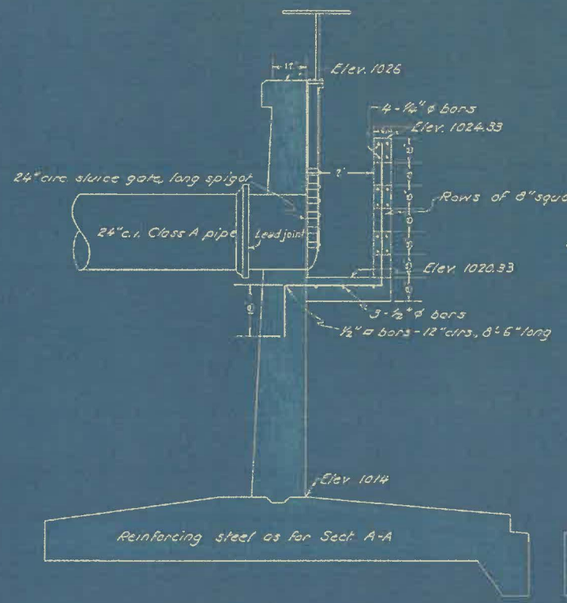
COAGULATING BASINS ~ PLAN AND SECTIONS

T. E. Thompson, City Mgr.	SCALES: As Noted
E. F. Edge, City Engr.	November, 1934
W. R. Holway, Consulting Engineer	SHEET NO. 16 OF 28 SHEETS



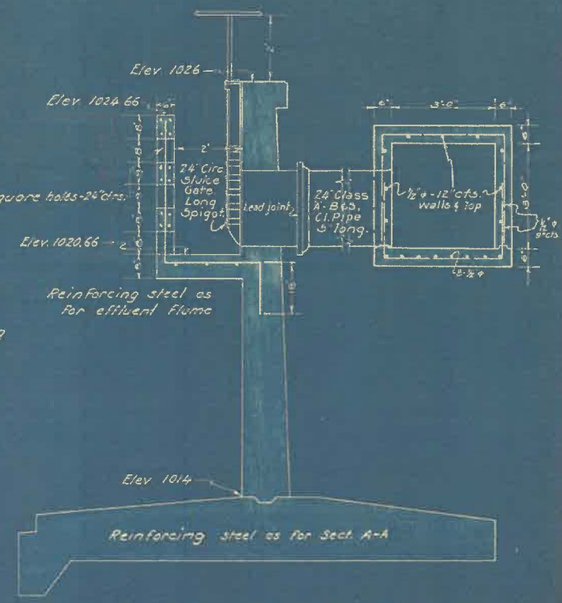
Plan of New Basin

⅛" = 1'-0"



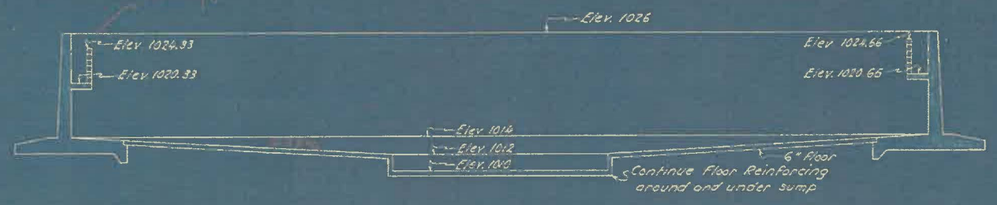
Effluent Flume - Section B-B

½" = 1'-0"



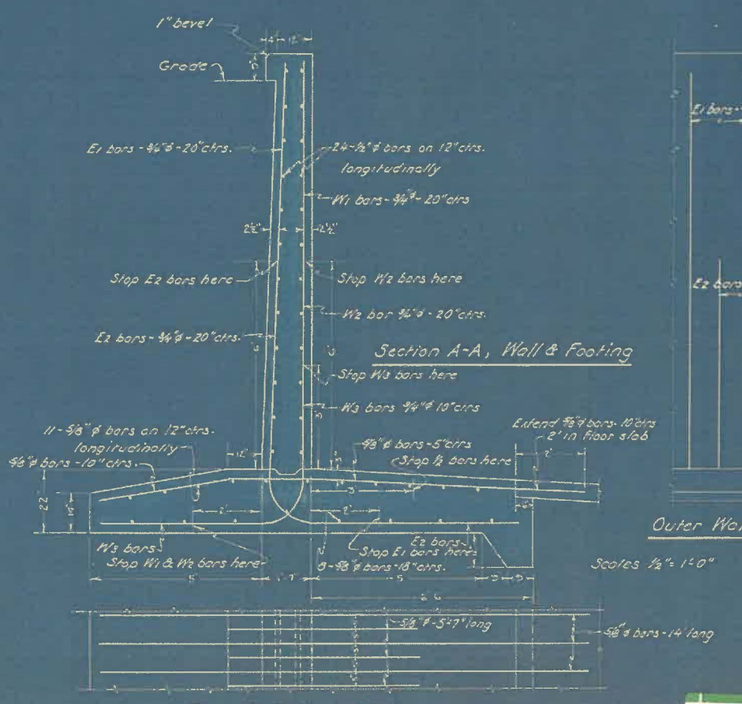
Influent Flume - Section C-C'

½" = 1'-0"



Longitudinal Section D-D

⅛" = 1'-0"



Plan of Footing Reinforcement

Outer Wall Face



Inner Wall Face

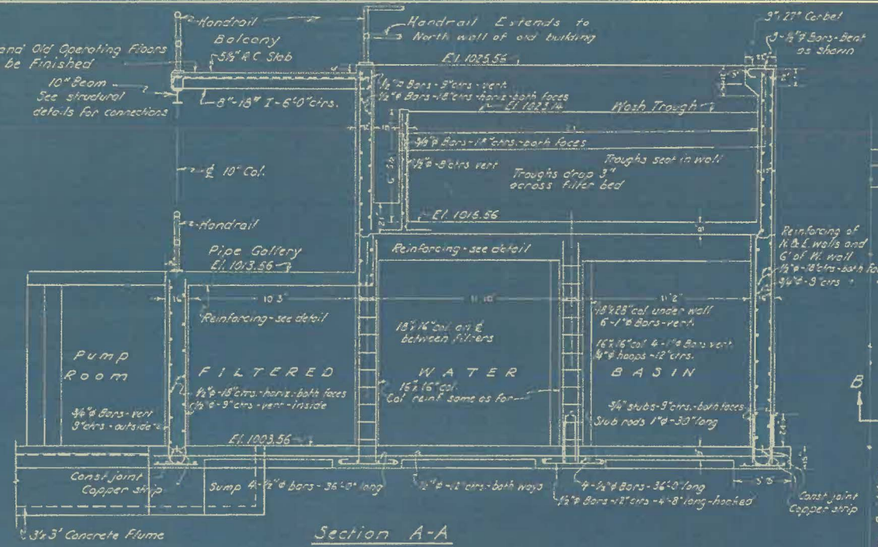
Scales ½" = 1'-0"

170

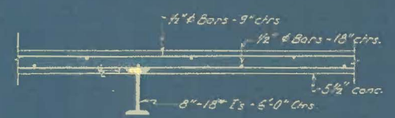
DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

NEW BASIN ~ PLAN AND SECTION

T. E. Thompson, City Mgr.	SCALES As Noted
E. F. Edge, City Engr.	November 1934
W. R Holway, Consulting Engineer	SHEET NO. 17 OF 28 SHEETS



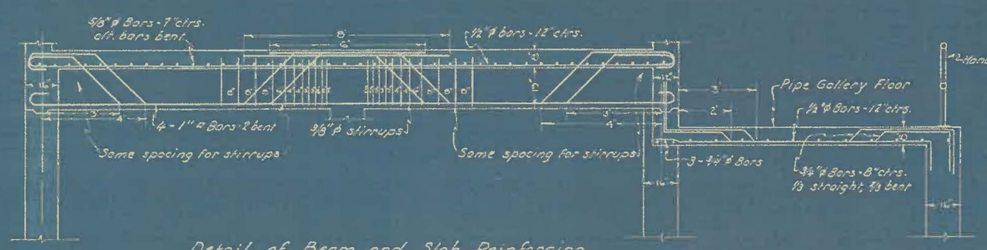
Section A-A



Detail of Balcony Slab

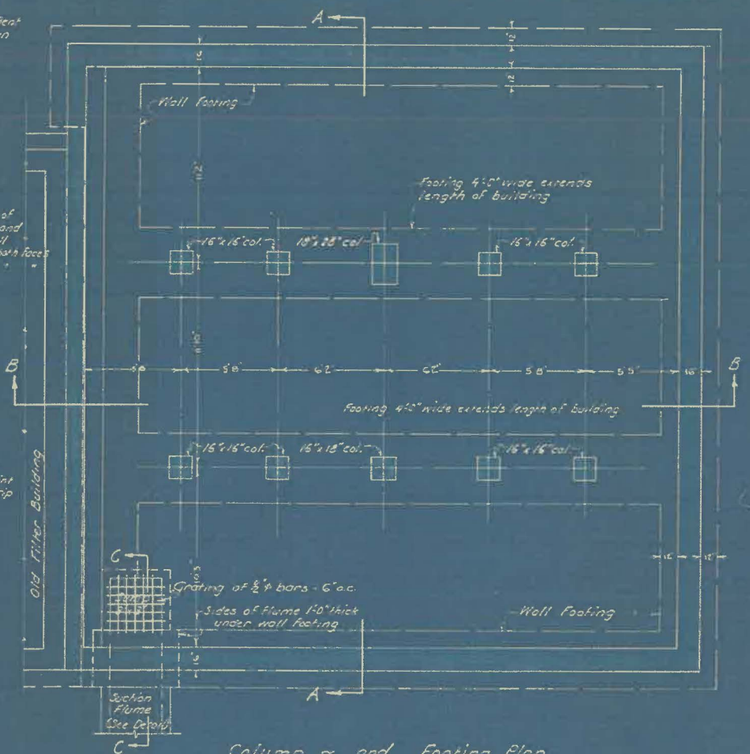
1" = 1'-0"

Plan of Beam and Slab Reinforcing

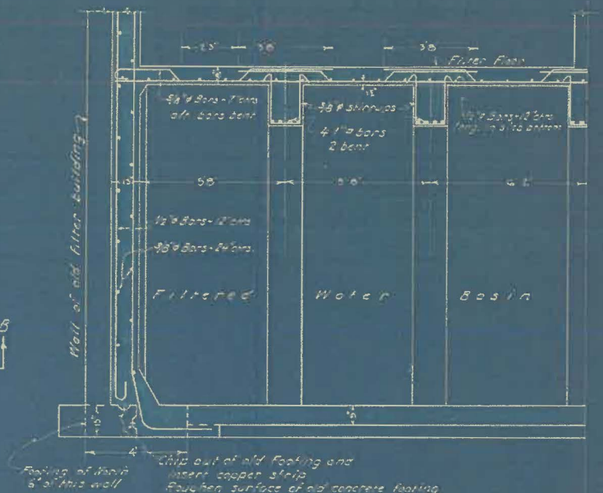


Detail of Beam and Slab Reinforcing

⅜" = 1'-0"

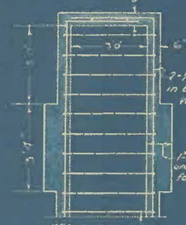


Column ~ and Footing Plan

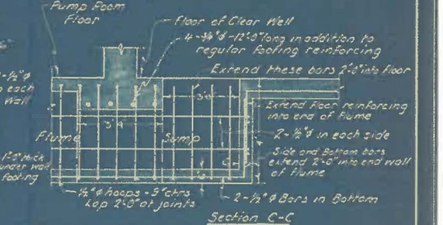


Detail of Filter Floor and West Wall Reinforcing

⅜" = 1'-0"

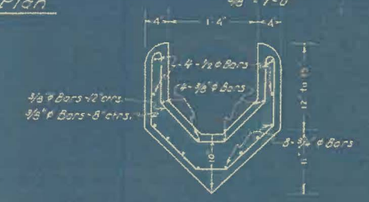


Plan



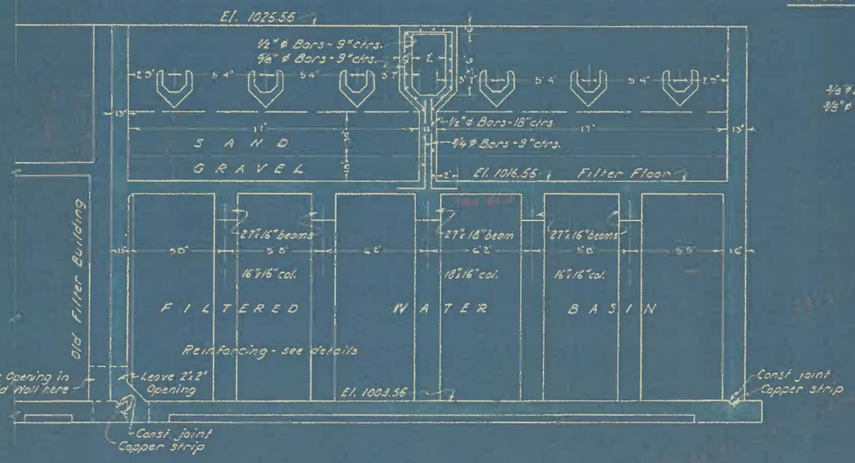
Details of Suction Flume

⅜" = 1'-0"



Detail of Wash Trough

1" = 1'-0"

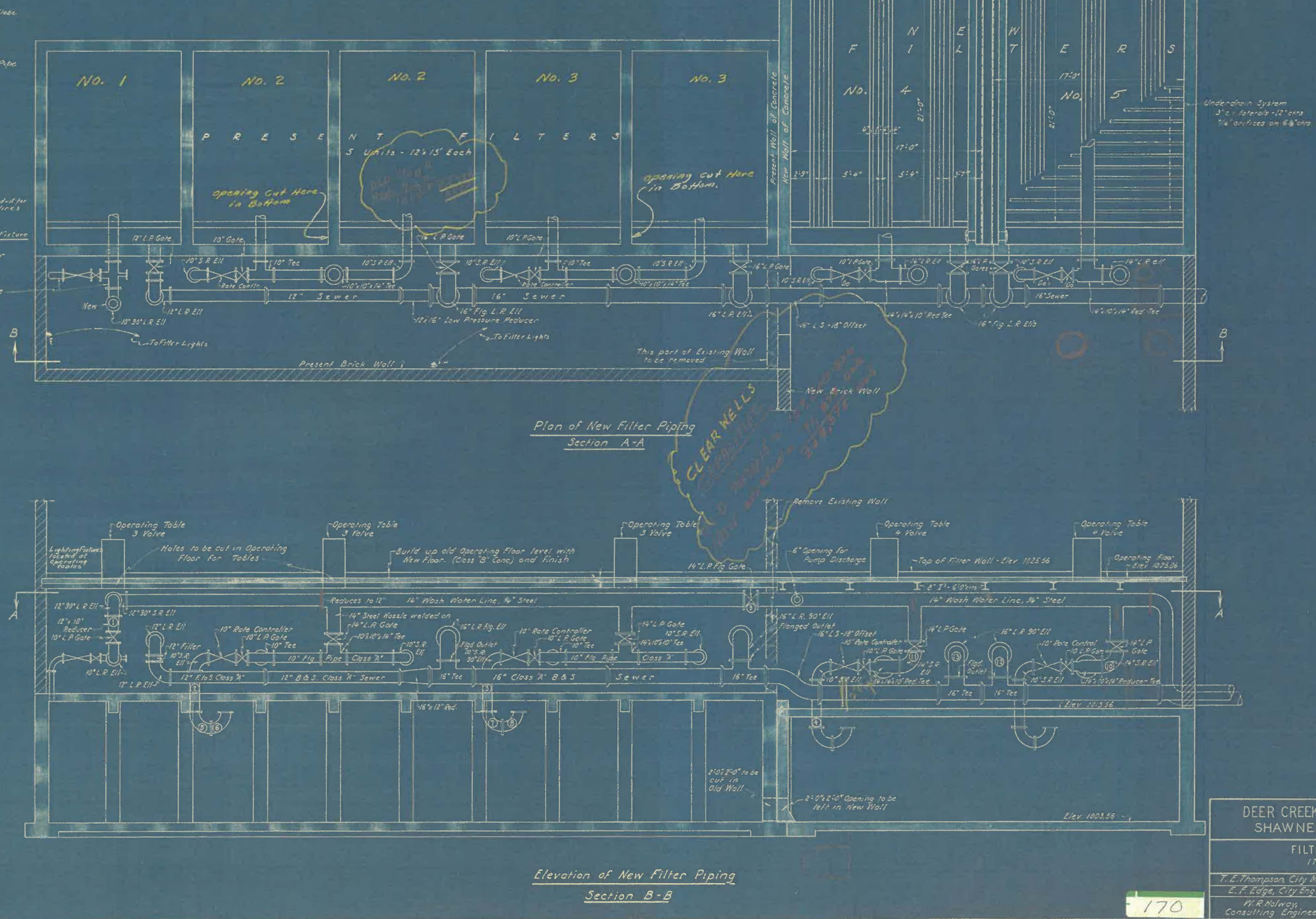


Section B-B

DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

NEW FILTERS ~ DETAILS AND SECTIONS

T. E. Thompson, City Mgr.	SCALES: ¼" = 1'-0" unless Noted
E. F. Edge, City Engr.	November 1934
W. R. Holway, Consulting Engineer	SHEET NO. 18 OF 28 SHEETS

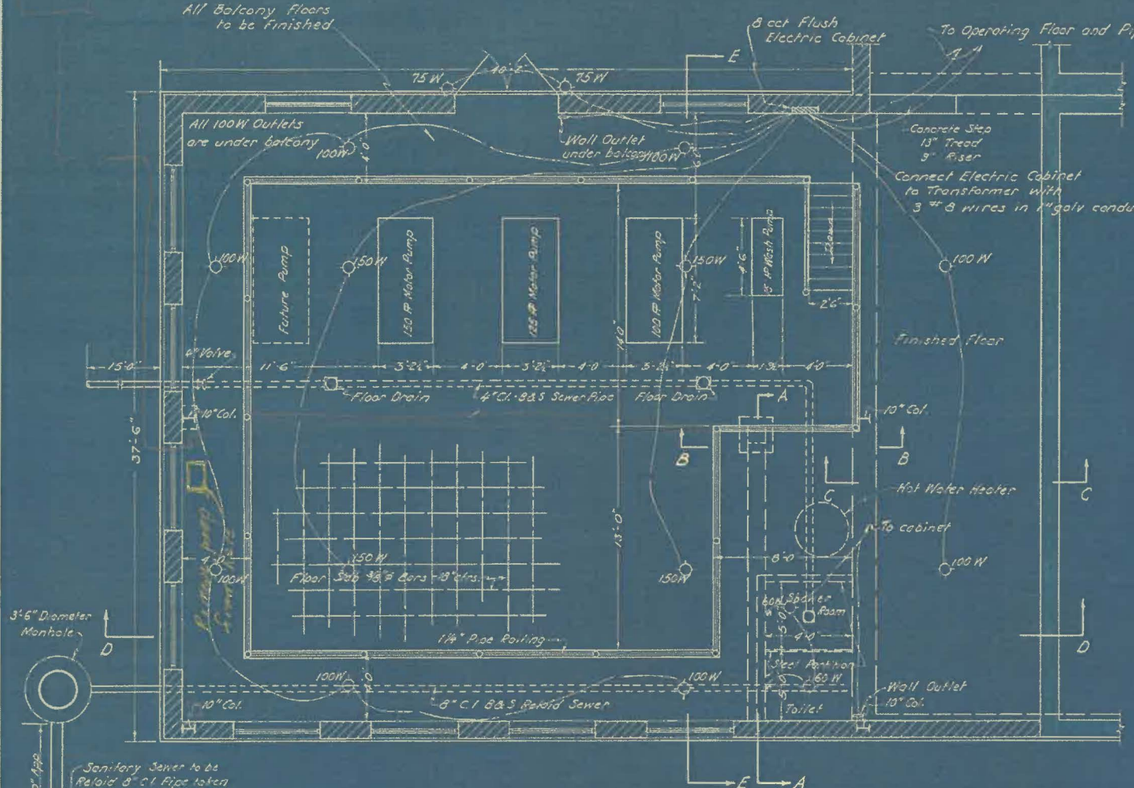


DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

FILTER PIPING
ITEM #13

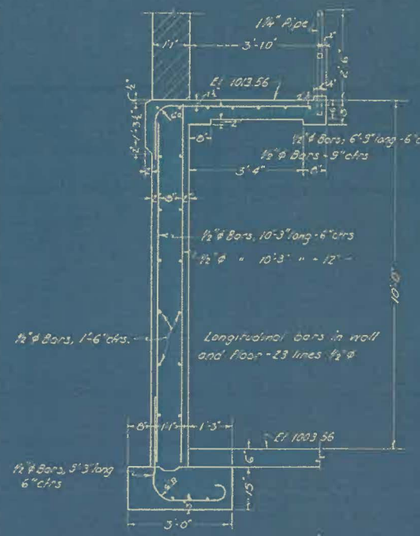
T. E. Thompson, City Mgr.	SCALES: 1/4" = 1'-0"
E. F. Edge, City Engr.	November, 1934
W. R. Holway, Consulting Engineer	SHEET NO. 1 OF 28 SHEETS

170



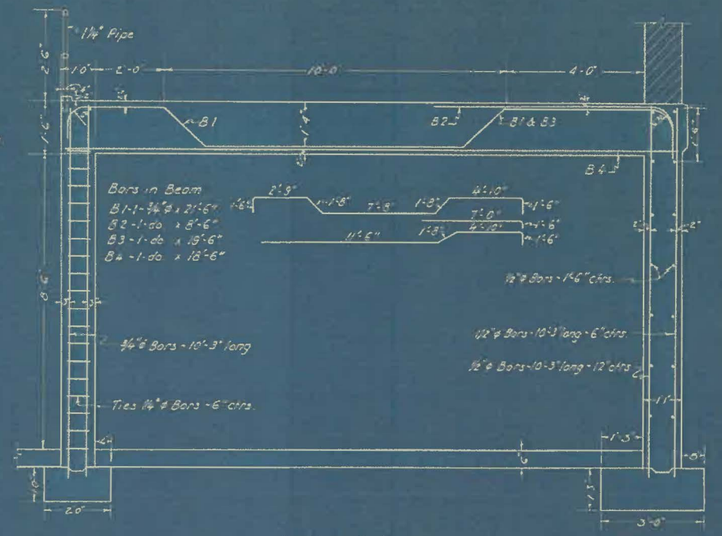
Pump Room Floor Plan

1/4" = 1'-0"



Pump Room Wall Section

1/2" = 1'-0"

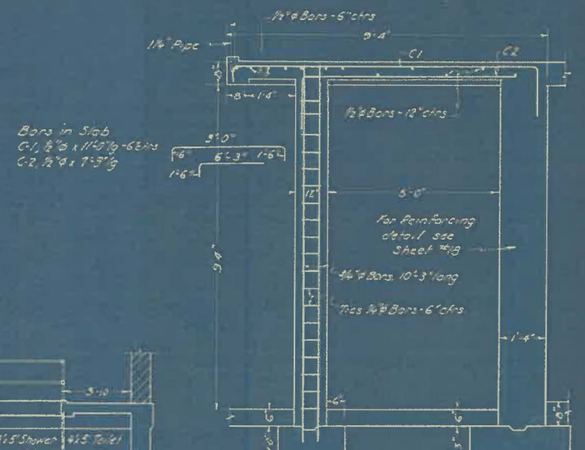


Section A-A

1/2" = 1'-0"

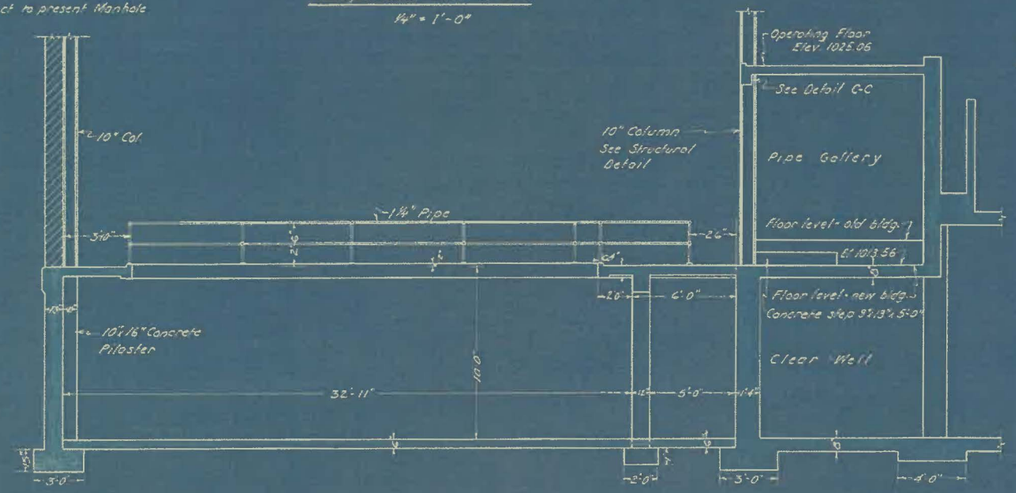
Section C-C

1/4" = 1'-0"



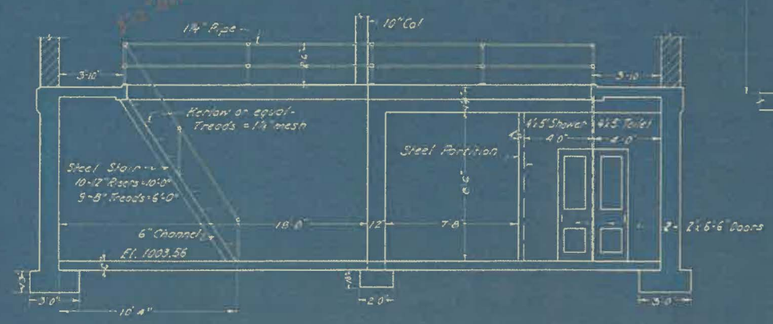
Section B-B

1/2" = 1'-0"



Section D-D

1/4" = 1'-0"



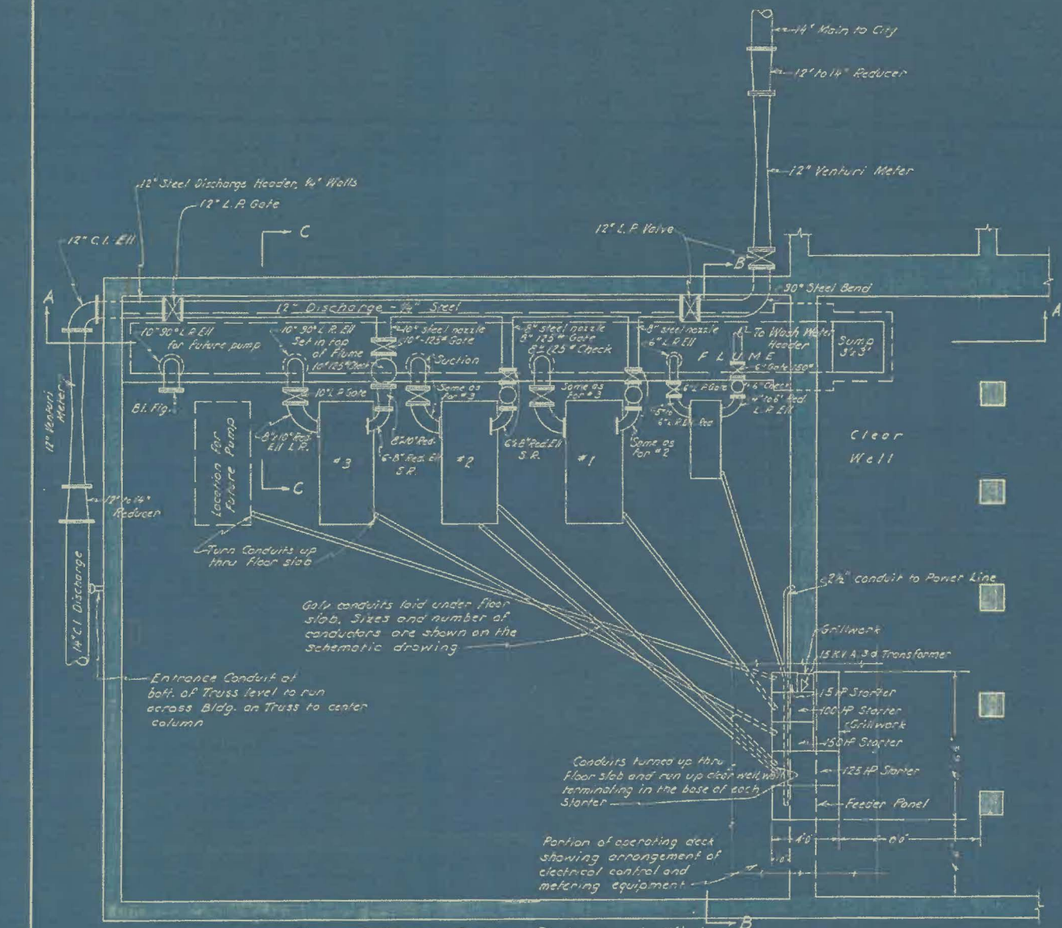
Section E-E

1/4" = 1'-0"

DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

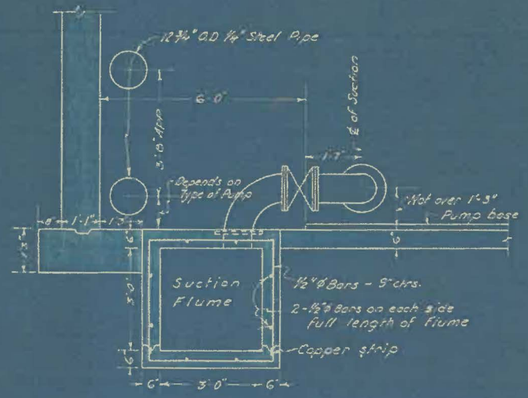
PUMP STATION
PLAN AND SECTION

T. E. Thompson, City Mgr.	SCALES: As Noted
E. F. Edge, City Engr.	November 1934
W. R. Holway, Consulting Engineer	SHEET NO. 20 OF 28 SHEETS



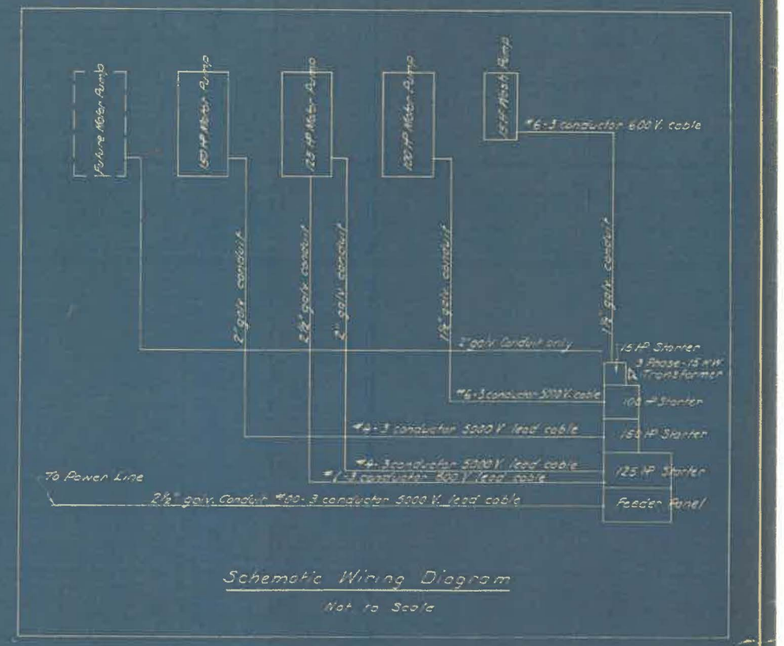
Plan of Pump Station Piping and Wiring

1/4" = 1'-0"



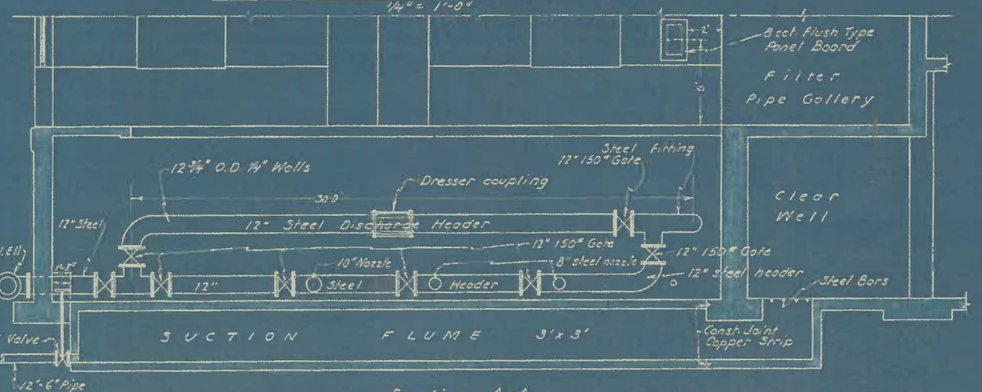
Section C-C

1/2" = 1'-0"



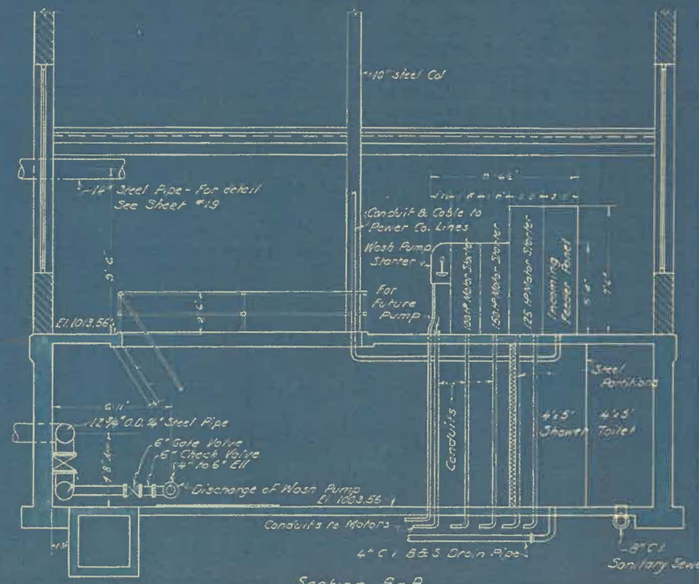
Schematic Wiring Diagram

Not to Scale



Section A-A

1/4" = 1'-0"



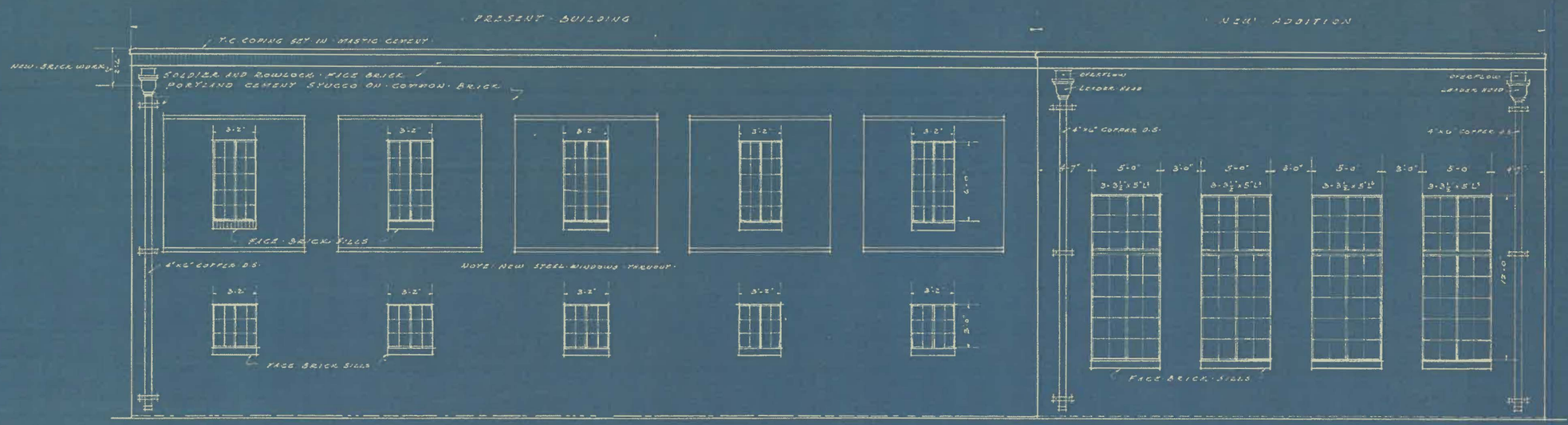
Section B-B

1/4" = 1'-0"

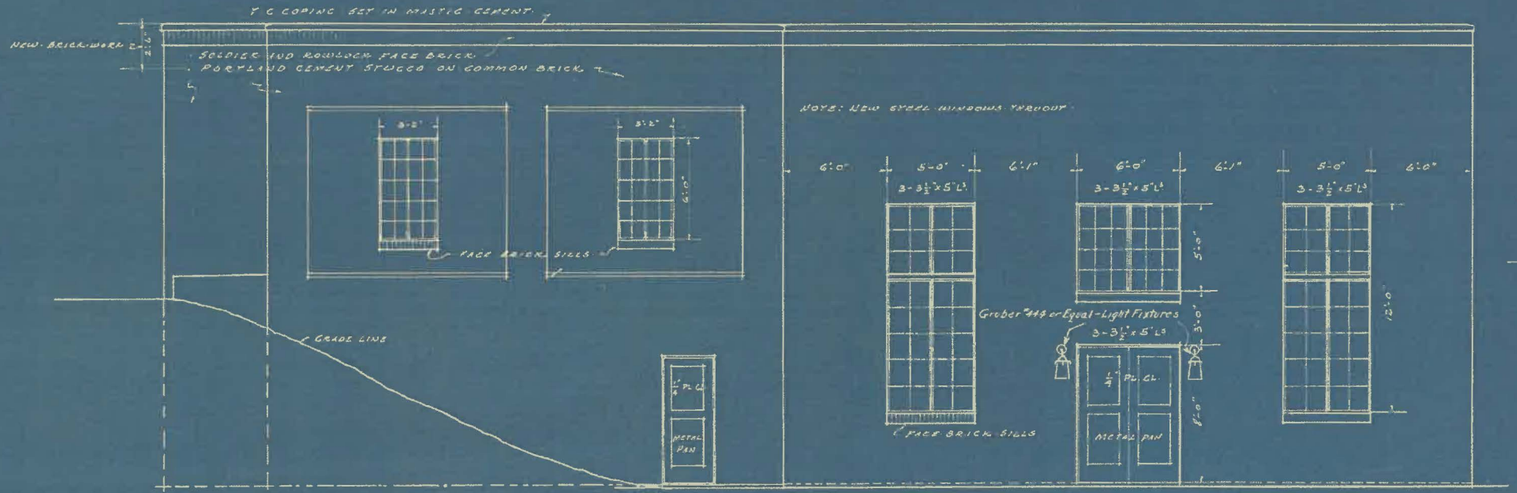
DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

PUMP STATION
PIPING AND WIRING

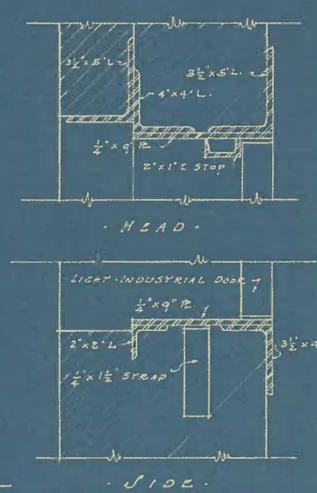
T. E. Thomason, City Mgr.	SCALES: ¼" & 1/2"-0" as Shown
E. F. Edge, City Engr.	November, 1934
W. R. Holway, Consulting Engineer	SHEET NO. 21 OF 28 SHEETS



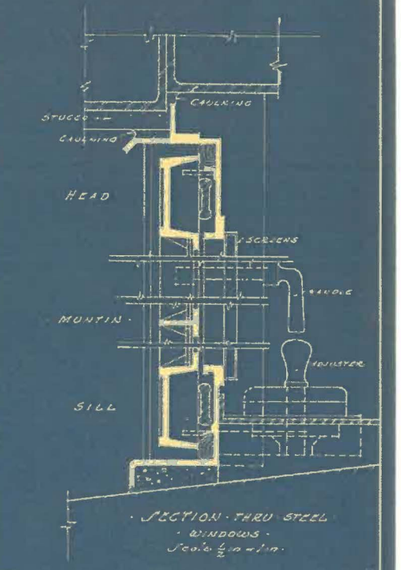
SOUTH ELEVATION
Scale ¼ in = 1 ft.

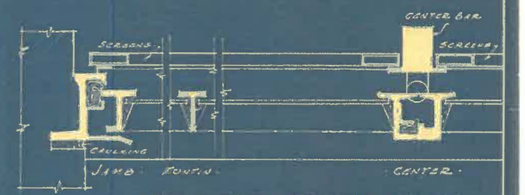


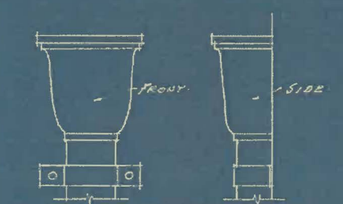
WEST ELEVATION
Scale ¼ in = 1 ft.



DETAIL OF SWING-UP DOOR IN CHEMICAL HOUSE
Scale 1" = 1"





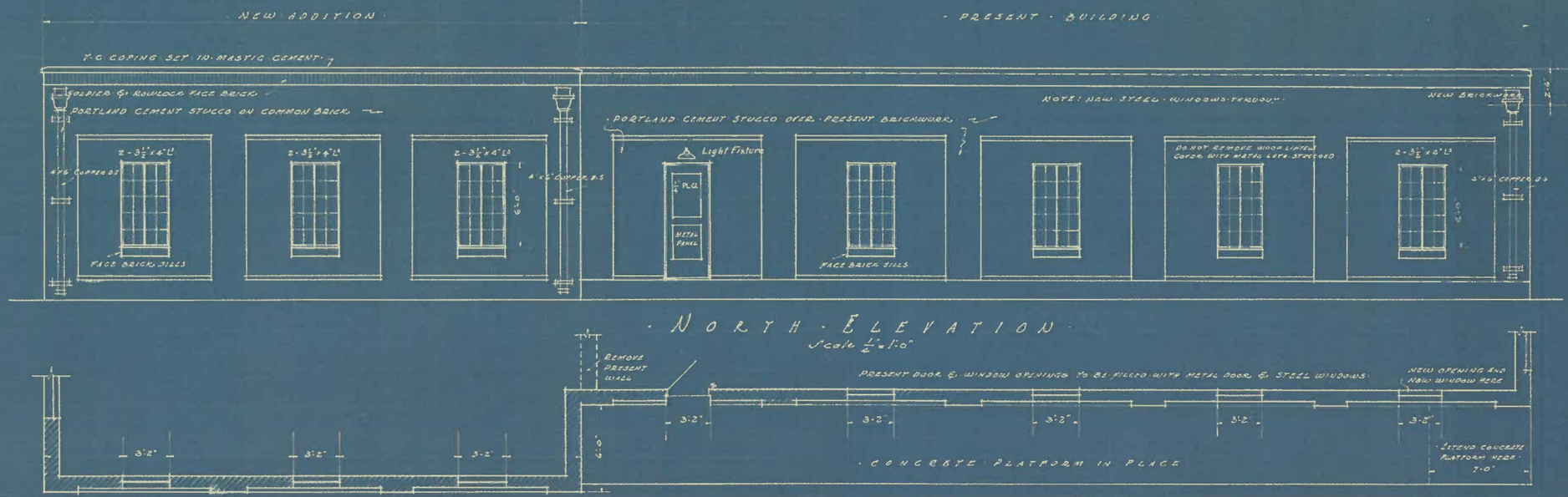


DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

FILTER AND PUMP BUILDING

T. E. Thomason, City Mgr.	SCALES: As Noted
E. F. Edge, City Engr.	November 1934
W. R. Halvey, Consulting Engineer	SHEET NO. 22 OF 28 SHEETS

L. P. Nygord, Architect
Shawnee, Oklahoma

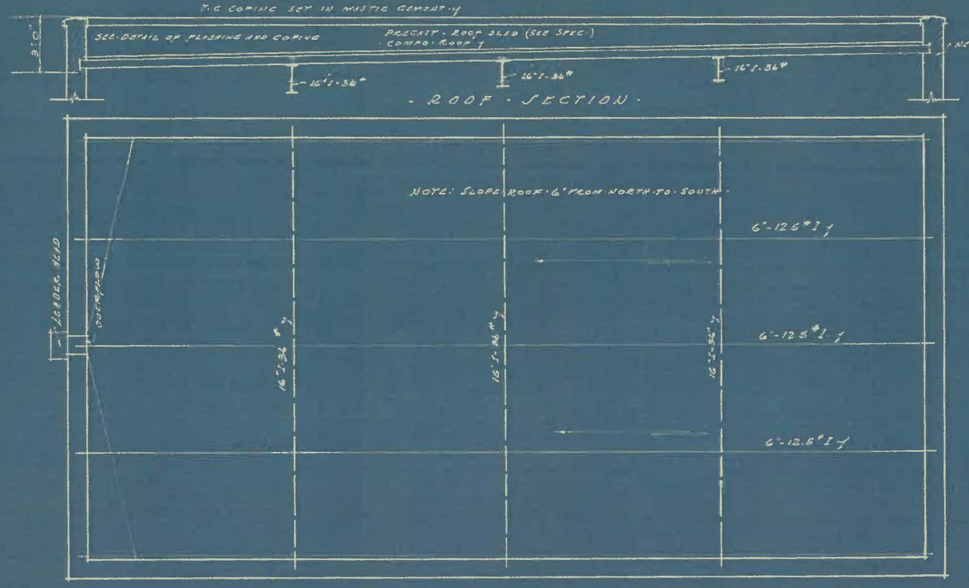


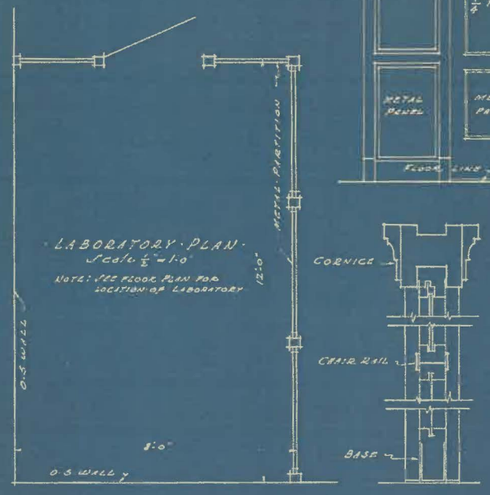
DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

FILTER AND PUMP BUILDING

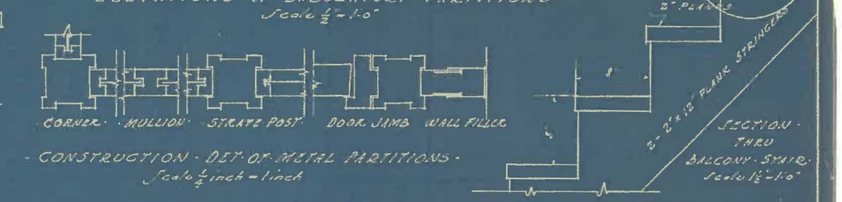
T. E. Thompson, City Mgr.	SCALES: As Noted
E. F. Edge, City Engr.	November 1934
W. R. Holway, Consulting Engineer	SHEET NO. 23 OF 28 SHEETS

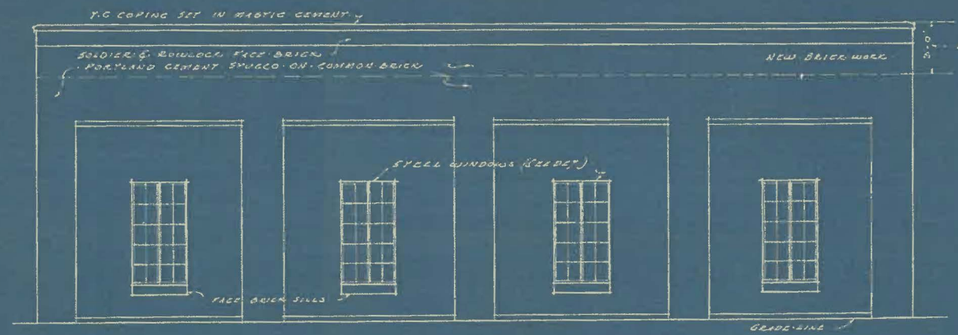
L. P. Nygord, Architect, Shawnee, Oklahoma

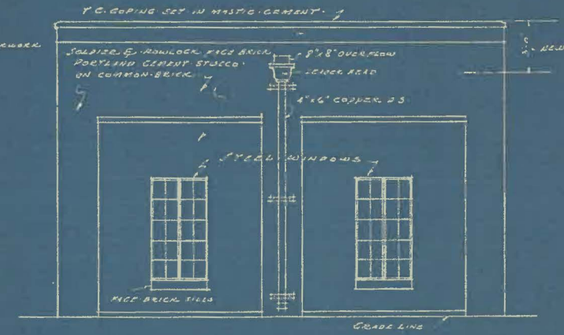


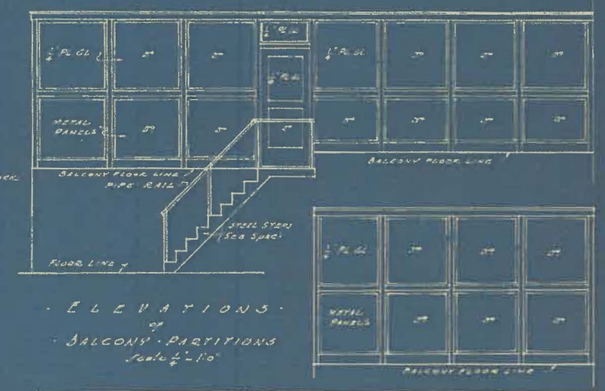


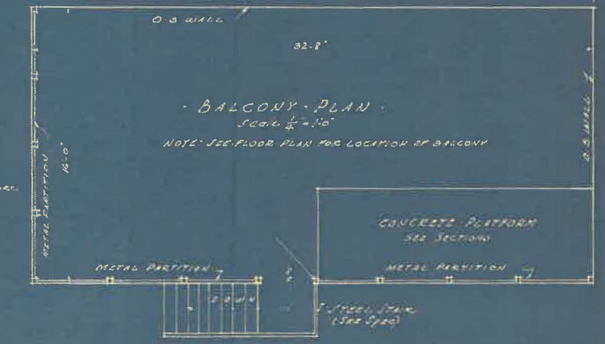


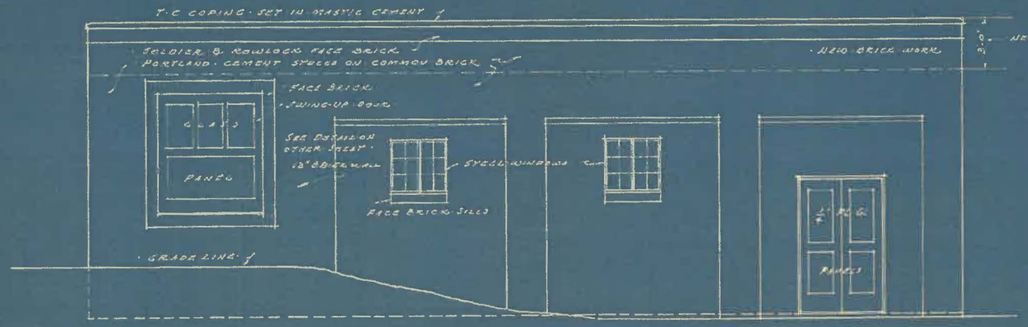


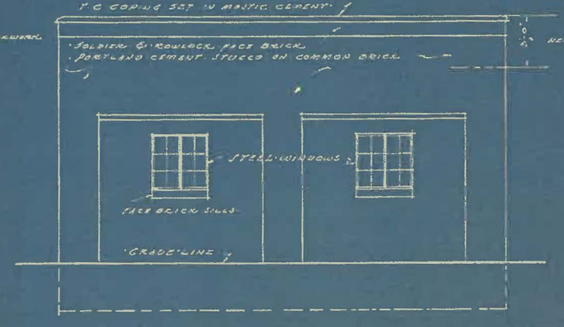










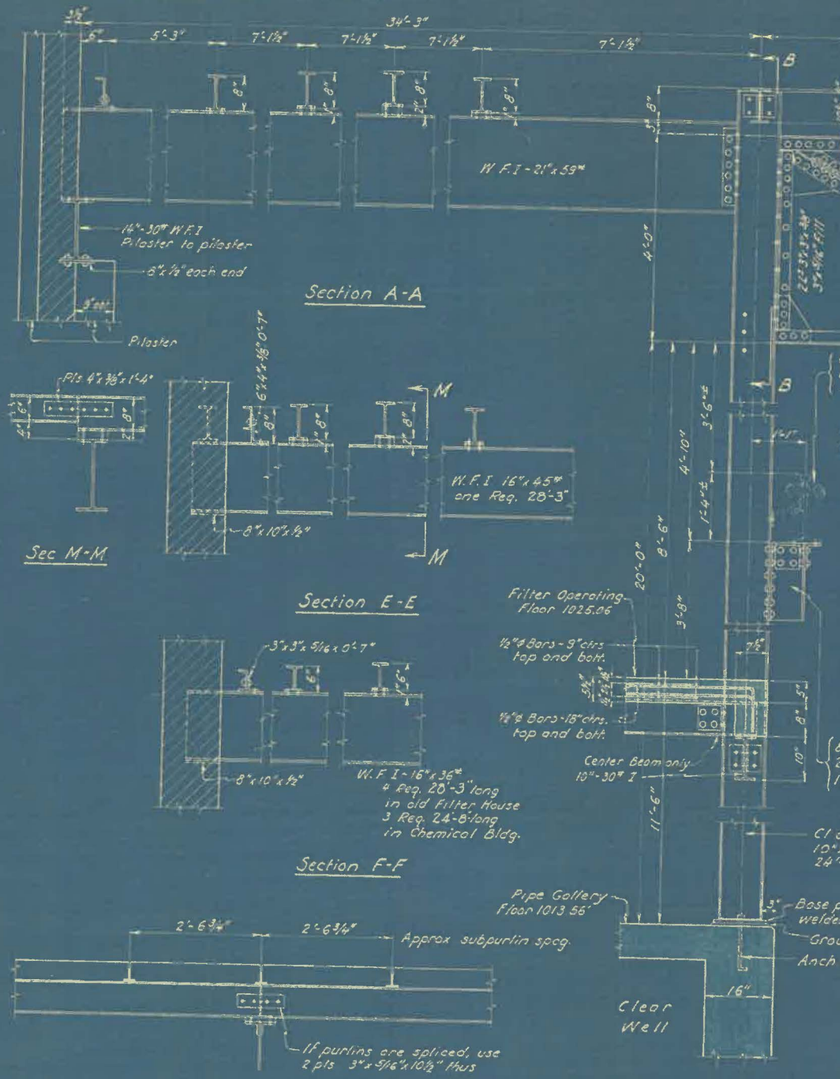


L.P. Nygard, Architect
Shawnee, Oklahoma

DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

CHEMICAL HOUSE

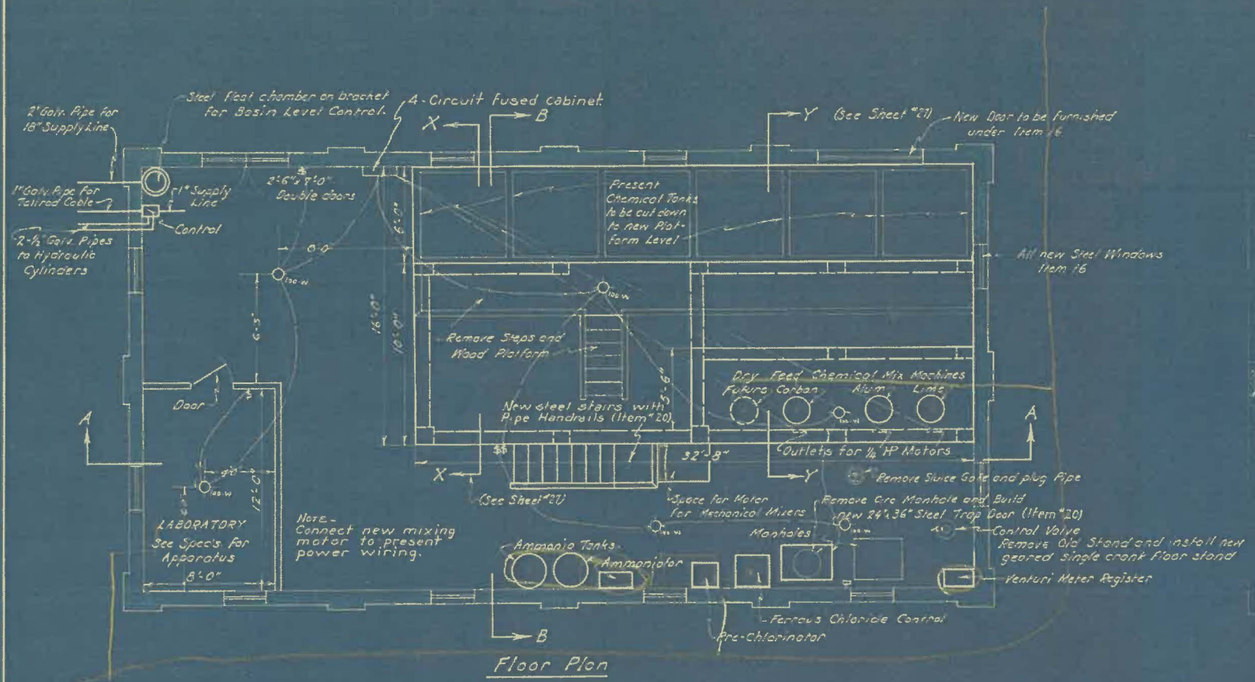
T.E. Thompson, City Mgr.	SCALES: As Noted
E.F. Edge, City Engr.	
W.R. Holway, Consulting Engineer	SHEET NO. 24 OF 28 SHEETS

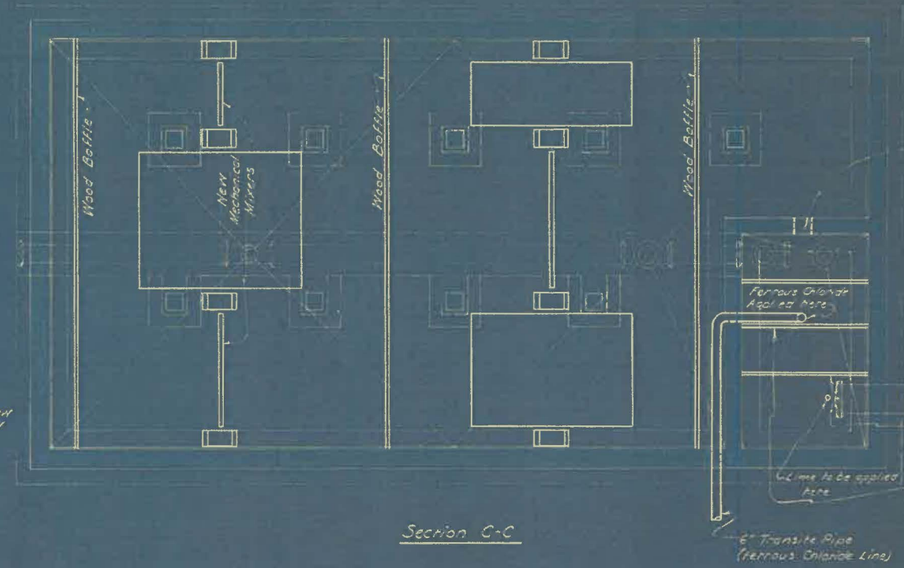


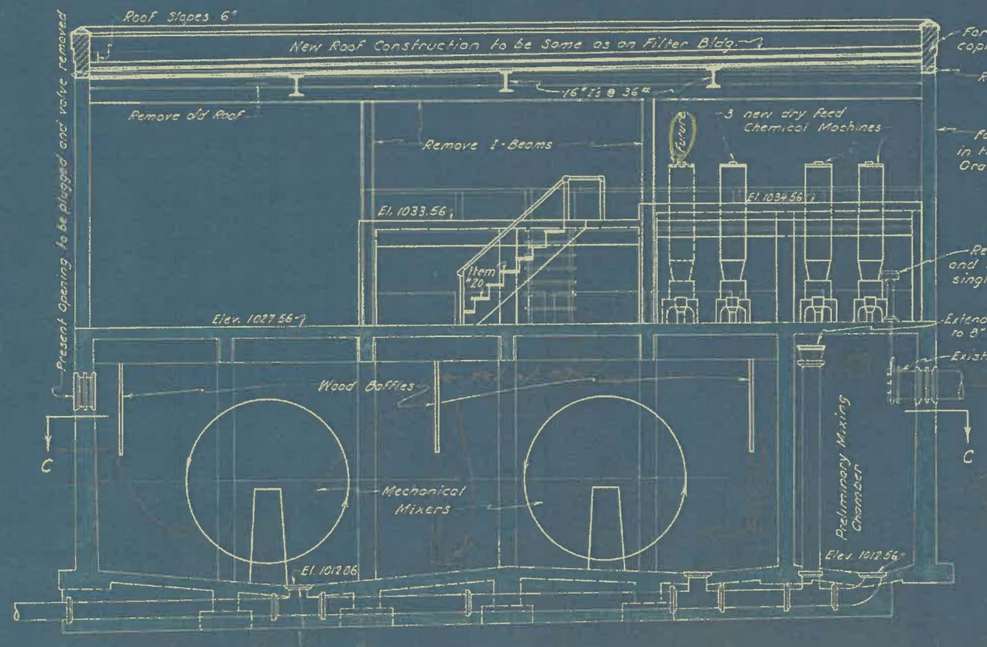
DEER CREEK WATER PROJECT
SHAWNEE. OKLAHOMA

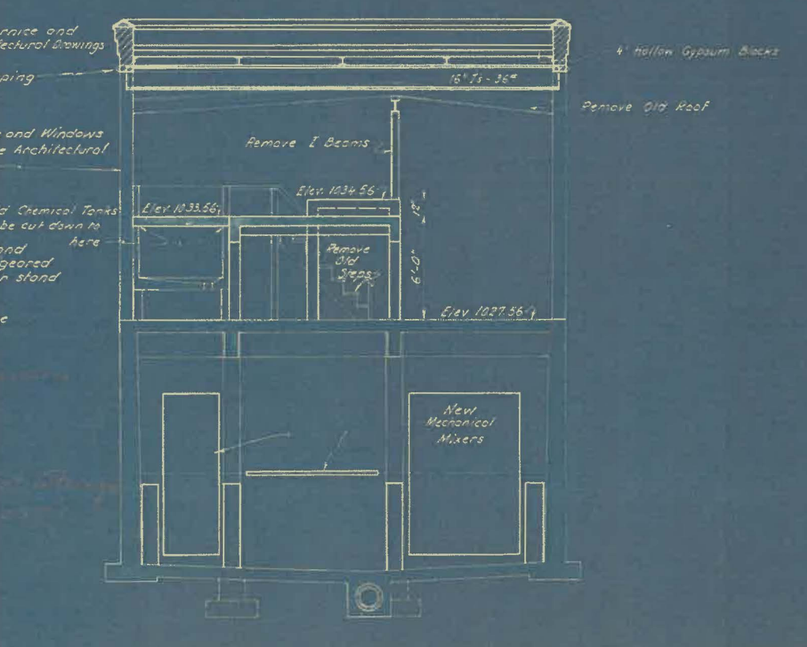
FILTER AND PUMP BUILDING
STRUCTURAL STEEL

T. E. Thompson, City Mgr.	SCALES: 3/4"=1'-0" unless Noted
E. F. Edge, City Engr.	November 1934
W. R. Holway, Consulting Engineer	SHEET NO. 25 OF 28 SHEETS





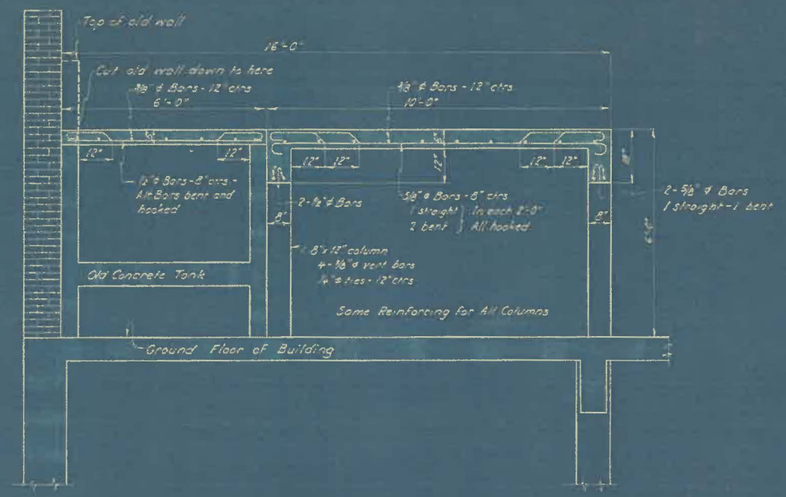




DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

CHEMICAL HOUSE

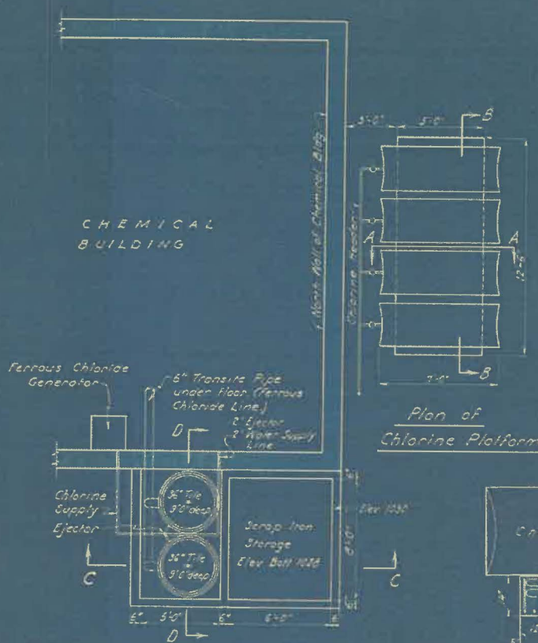
T. E. Thompson City Mgr.	SCALES: 1/8" = 1'-0"
E. F. Edge, City Engr.	November 1934
W. R. Holway, Consulting Engineer	SHEET NO. 26 OF 28 SHEETS



Concrete Platform in Chemical Building

Section X-X

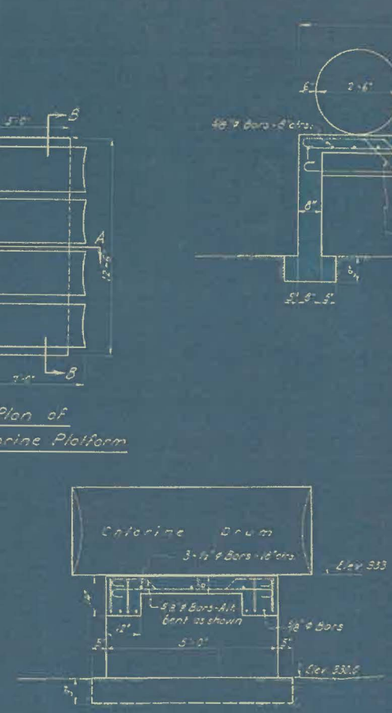
½" = 1'-0"



Plan of

Ferrous Chloride Plant

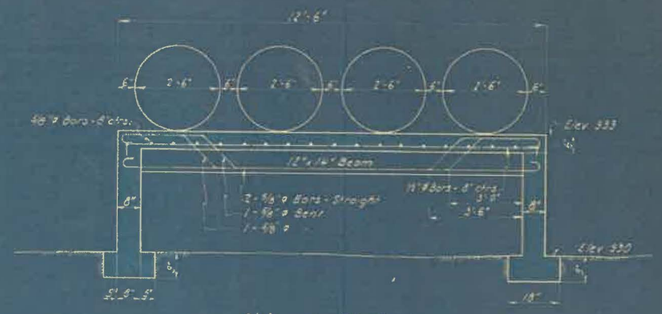
½" = 1'-0"



Chlorine Platform

Section A-A

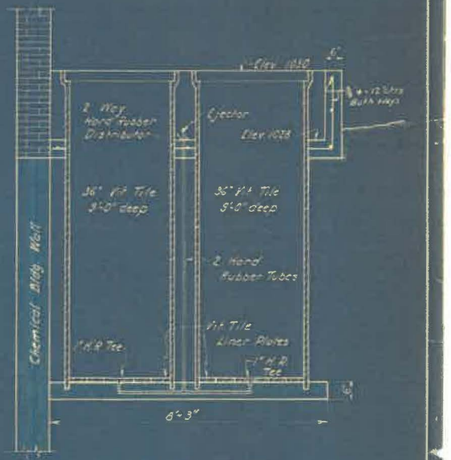
½" = 1'-0"



Chlorine Platform

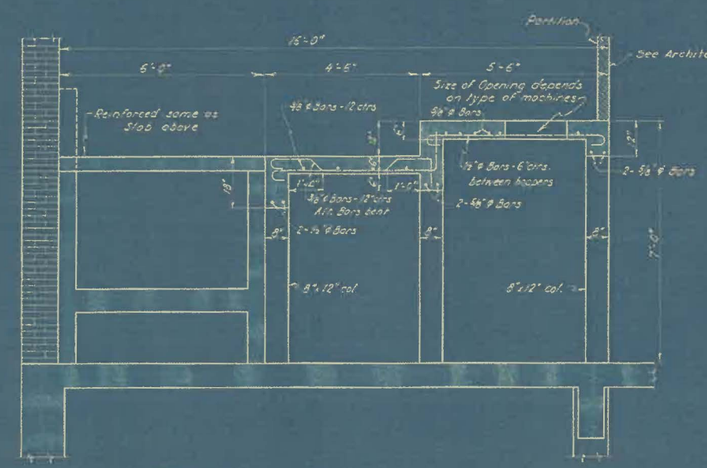
Section B-B

½" = 1'-0"



Section D-D

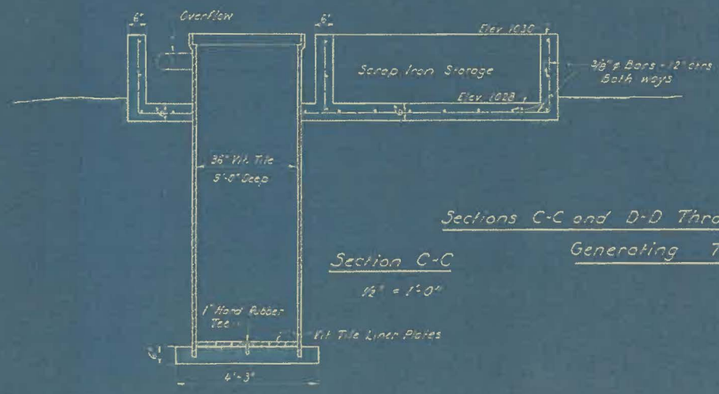
½" = 1'-0"



Concrete Platform in Chemical Building

Section Y-Y

½" = 1'-0"



Section C-C

½" = 1'-0"

Sections C-C and D-D Through Ferrous Chloride Generating Towers

DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

FERROUS CHLORIDE GENERATING PLANT
PLAN AND DETAIL

T. E. Thompson, City Mgr.	SCALES: As Noted
E. P. Edge, City Engr.	November 1934
W. R. Holway, Consulting Engineer	SHEET NO. 27 OF 28 SHEETS

WASH TANK

Existing 14" water main

14"x4" TC's

5'

Set tee 45° off horiz. and use 45° bend to install hyd. @ proper elevation.

Set 4" hyd. @ edge of sidewalk

23'

STORAGE BASINS

COAGULATION BASINS
(See plans for remodeling)

New cross connection between 14" mains

COAGULATION BASIN
(See plans for remodeling)

New meter vault
(See details)

25'

8" 6" 4" 3/4"

2"

CHEMICAL BLDG.
(See plans for remodeling)

Existing 14" water main

section line

FILTER BUILDING

PUMP ROOM

5 1½" disch.

1½" drain

1½" suct.

5000 gal. fuel tank

Connected overflow line to new tank

3" supply line

CONCRETE BASIN

Fill Pipe

Existing 8" oil line

New Valve Box

GENERAL LAYOUT
Scale 1"=20'-0"

C.I. frame and cover w/ hasp and padlock 22"x30" Clow F-3600 Size 2A or equal.

6" 21.6" 6"

No. 3 bars @ 10" c.c. around entire box.

No. 3 bars @ 10" c.c. each way

New 3" line to new oil storage tank.

3" gate valve.

Cut into 3" tee and 3" gate valve.

Existing 3" line to existing conc. oil storage tank.

PLAN
VALVE BOX
Scale ½"=1'-0"

El. existing ground 1013.00±

See plan above for supply line to tank.

5'-0"

El. pump floor 1009.56

El. balcony 1013.56

Tie new discharge to existing line inside bldg. below balcony and into suction side of existing pump

Installed new pump in new pump pit outside bldg. Make all necessary extensions of wiring and piping.

Three valves @ this point.

6000 gal. steel fuel oil tank 21'-6" min. cover.

10'-0"

1½" suction

1½" discharge

Vent.

Pump Pit

1½" drain line

PLAN
FUEL OIL SYSTEM
Scale ½"=1'-0"

Bypass

Union

1½" discharge to existing piping inside bldg.

No. 3 @ 8" c.c.

4'-0"

7"

5'-0"

Vent.

2"

Provide drainage for oil.

6 No. 3 @ 10½" c.c.
4 No. 3 @ 12" c.c.

C.I. frame and cover with hasp and padlock 22"x30" Clow F-3600 Size 2A or equal.

⅝" ϕ smooth bar steps @ 15" c.c.

No. 3 @ 12" c.c. horiz. & vert.

Existing ground el. approx. 1013.00±

Tank to be 21'6" below ground level @ all points

1½" suction

1½" C.I. drain pipe slope floor 1" to drain.

Existing pump now in operation inside bldg to be removed and installed in conc. box outside bldg.

SECTION A-A
Scale ½"=1'-0"

7" 4'-0" 7"

Vent.

1½" suction

1½" discharge

A

2'-6"

7"

Ventilators to be Cast-Aluminum adjustable, with closing slide or door and bronze insect screen 8"x5¾" Donley Bros. Co. or equal

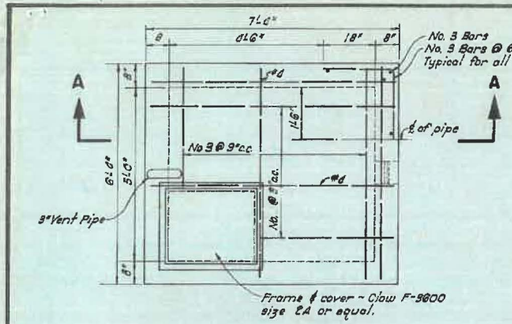
PLAN
PUMP PIT
Scale ½"=1'-0"

REVISED FOR RECORD DRAWING 10-11-54

DATE 12-15-52	WATER TREATMENT PLANT
SCALE AS SHOWN	WATERWORKS IMPROVEMENTS
DRAWN BY V. K.	SHAWNEE, OKLA.
TRACED BY J. R.	BENHAM ENGINEERING CO. CONSULTING ENGINEERS
CHECKED BY H.W.N.	AMERICAN NATIONAL BLDG.
APPROVED	OKLAHOMA CITY, OKLA.
SHEET 29 OF 38	

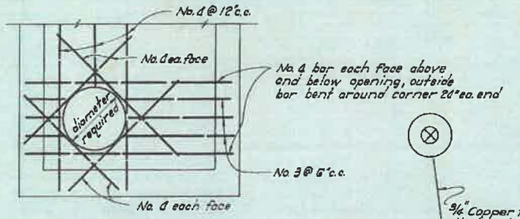
177

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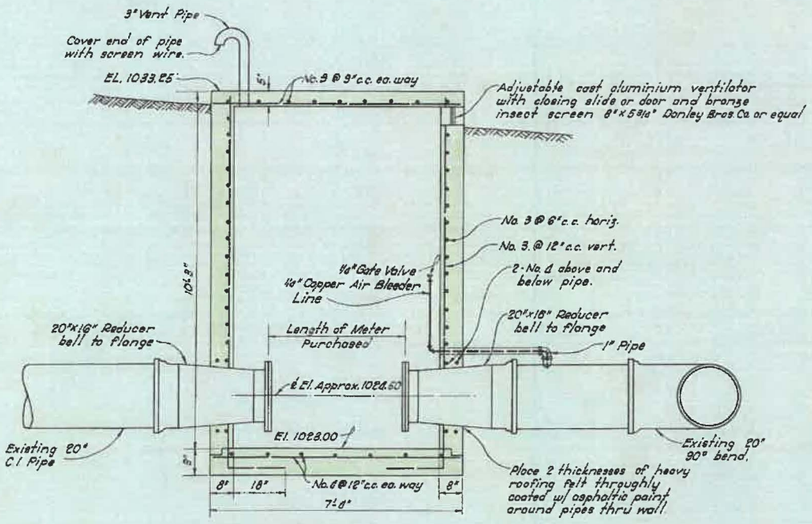
PLAN METER VAULT

Scale 1/2"=1'-0"



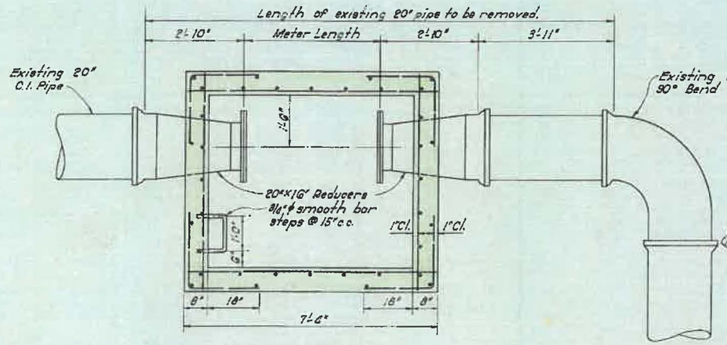
REINFORCING DETAIL AT PIPE OPENING

Scale 1/2"=1'-0"



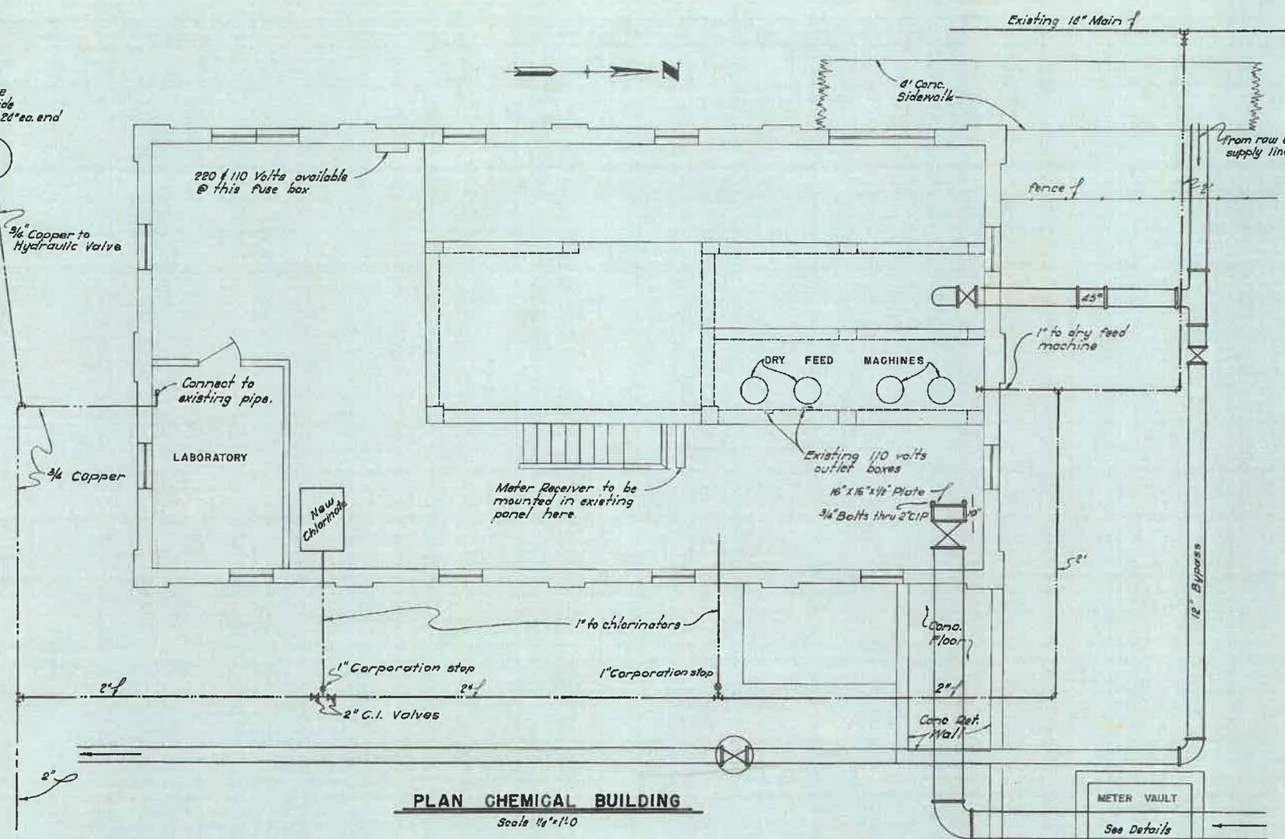
SECTION A-A

Scale 1/2"=1'-0"



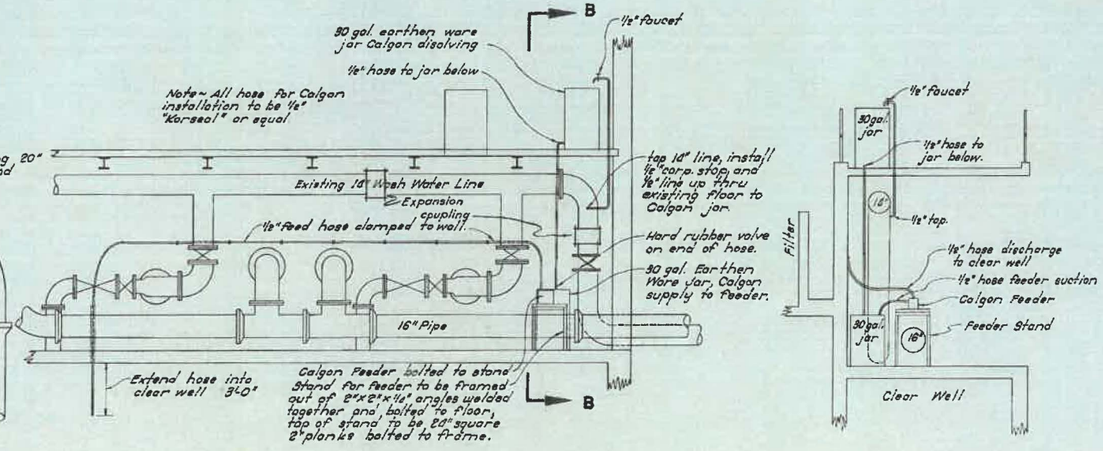
PLAN SECTION

Scale 1/2"=1'-0"



PLAN CHEMICAL BUILDING

Scale 1/4"=1'-0



DETAILS OF CALGON INSTALLATION

Location on pipe gallery in filter building.
Scale 1/2"=1'-0"

SECTION B-B

Scale 1/2"=1'-0"

REVISED FOR RECORD DRAWING 10-11-54

DATE 12-15-52	**WATER TREATMENT PLANT**
SCALE AS SHOWN	WATERWORKS IMPROVEMENTS
DRAWN BY V. K.	**SHAWNEE, OKLA.**
TRACED BY J. R.	BENHAM ENGINEERING CO.
CHECKED BY H.W.N.	CONSULTING ENGINEERS
APPROVED	AMERICAN NATIONAL BLDG.
SHEET 30 OF 38	OKLAHOMA CITY, OKLA.

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164.23

NOTE:
ALUM, LIME, SPARE and CHLORINE machines are provided with 3 way feed:
1. To M.H. outside chimical building.
2. To flocculation chamber.
3. To premixing chamber (regular).

Remove existing machines & install new machines.

1/8" drop to each machine.

to ceiling

1" C.W. thru wall @ floor level.

2" C.I. Pipe Feed Lines support pipes on baffles.

Spare

Alum

Lime

Tee & Blind Flange

Install new Machine

(1) (2) (3)

Tee & Blind Flange

PRIMARY MIXING CHAMBER BELOW

Meter Receiver

A

A

1/4" copper

Disconnect and hook up new water feed.

Anchor Hose

Remove existing valve stand, and install new stand. Distance from ℄ of valve to fin. floor is approx. 9'9"

NOTE: See sheet 30 for new chlorinator

Existing Chlorinator

New 1" hose for existing chlorinator.

Lifting Ring

1" chlorine feed hose

1" hose

1" C.W. Supply to chlorinator thru wall @ fl. level

Drill holes thru floor and mixing chamber wall for hose.

Install hook of proper location to hold trap door open.

Replace existing trap door with 1/8" checkered plate, with hinges welded to plate and existing metal frame.

PLAN NORTHEAST CORNER
CHEMICAL BLDG.
Scale 1/2"=1'-0"

Cut new opening thru existing wall 6'0" wide and 7'0" high. El. bottom of opening to be 1022.00

12"

M.H.

El. top of baffle 1025.33 2'x2' opening @ bottom.

El. top of baffle 1022.00 2'x2' opening @ bottom closed w/ trap door.

3 Existing baffles to be completely removed. Build 3 baffles of 2" redwood planks w/ 2"x4" redwood posts @ each wall, anchored to wall w/ 1/2" exp. bolts @ 18" c.c. Planks will be fastened to posts w/ 20# galv. nails 3 to each end of each plank.

El. top of baffle 1025.33 1'x1' opening @ bottom

16"x16"x1/2" plate

4 3/4"x14" bolts thru 2" C.I.P.

10"

Existing 20" C.I. Pipe

Remove existing 20" gate valve and nipple and install new 20x16 reducer, 16" rising stem gate valve and splash plate. Valve operated from stand above floor.

PLAN SECTION
PRIMARY MIXING CHAMBER
Scale 1/2"=1'-0"

2"x4" Each side of opening fastened to baffle & anchored to floor W/ clip angles 3"x3"x1/4"x3".

2'-0"

2"x4"

2-1/2" Carriage bolts W/ brass thumb nuts each side trap door.

2"x6" Fastened to trap door over topping baffle 2"x4" @ top.

1/2" Space around trap door.

3-12" Planks = Height

12" sq. opening in trap doors for end baffles Center trap door solid.

BAFFLE TRAP DOOR DETAIL
Scale 1"=1'0"

Spare

Carbon

Alum

Lime

Tee & Blind Flange

Tee & Blind Flange

Fl. El. 1027.66

1" C.W. Supply to dry feed machines.

(1) (2) (3) (4)

2" C.I. Pipe Feed Lines

El. top of end baffles 1025.33

El. top of center baffle 1023.00

Existing Opening

Cut new opening 6'0" wide 7'0" high.

Openings in baffles.

See Detail

Note - Shape bottom of baffles to floor.

El. 1012.56

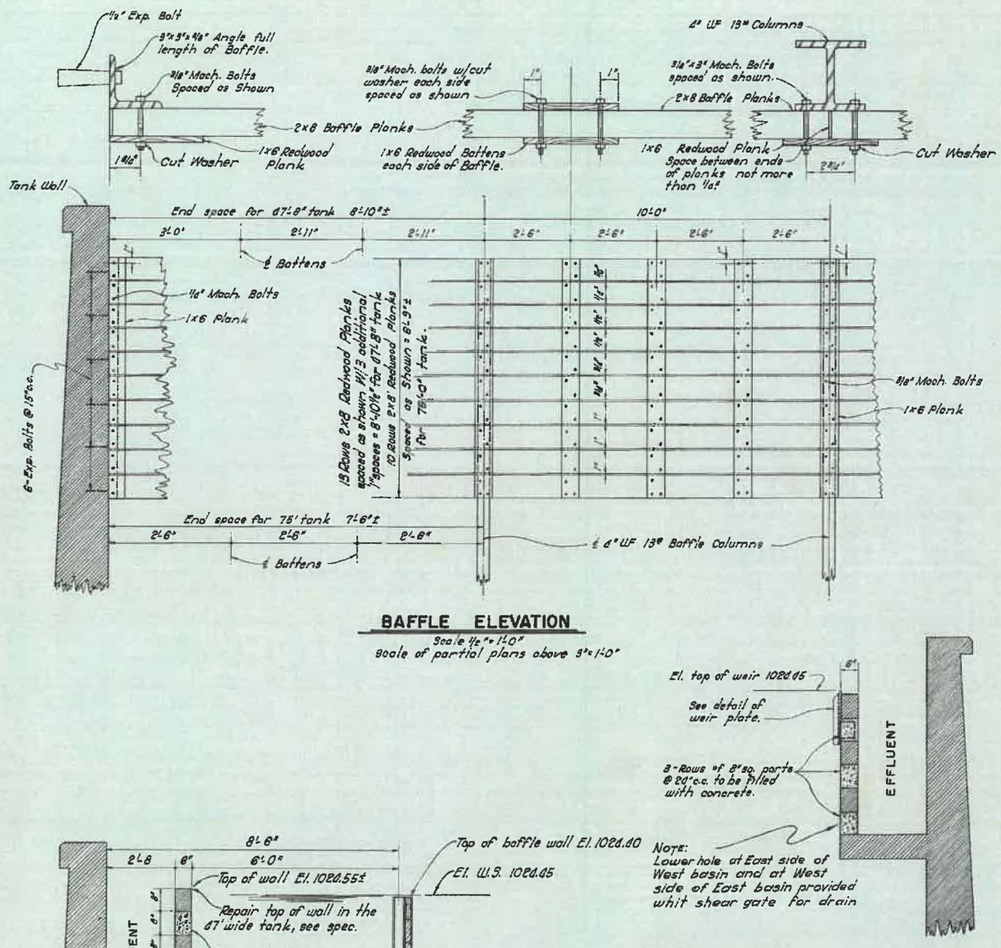
SECTION A-A
Scale 1/2"=1'-0"

REVISED FOR RECORD DRAWING 10-11-54

DATE 12-15-52	WATER TREATMENT PLANT
SCALE AS SHOWN	WATERWORKS IMPROVEMENTS
DRAWN BY V. K.	SHAWNEE, OKLA.
TRACED BY J. R.	BENHAM ENGINEERING CO. CONSULTING ENGINEERS
CHECKED BY H.W.N.	AMERICAN NATIONAL BLDG.
APPROVED	OKLAHOMA CITY, OKLA.
SHEET 31 OF 38	

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10-9-23

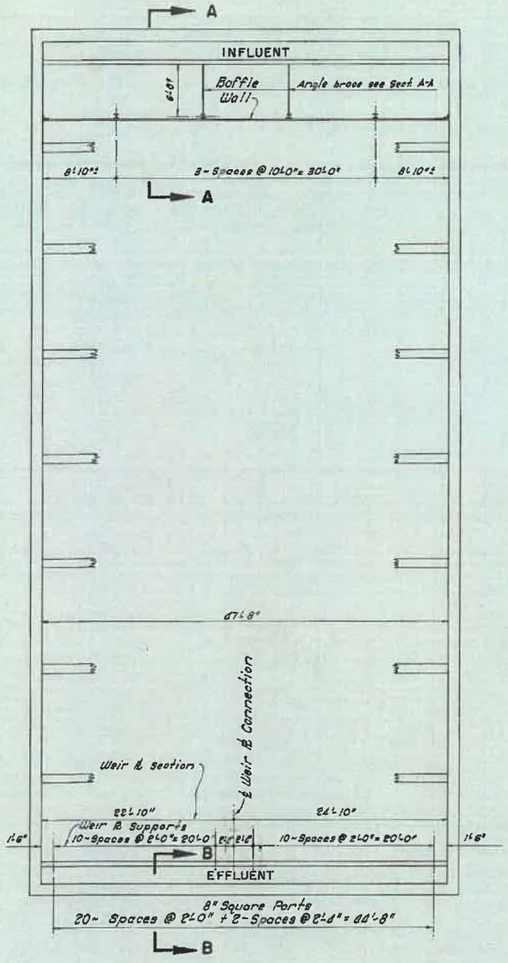


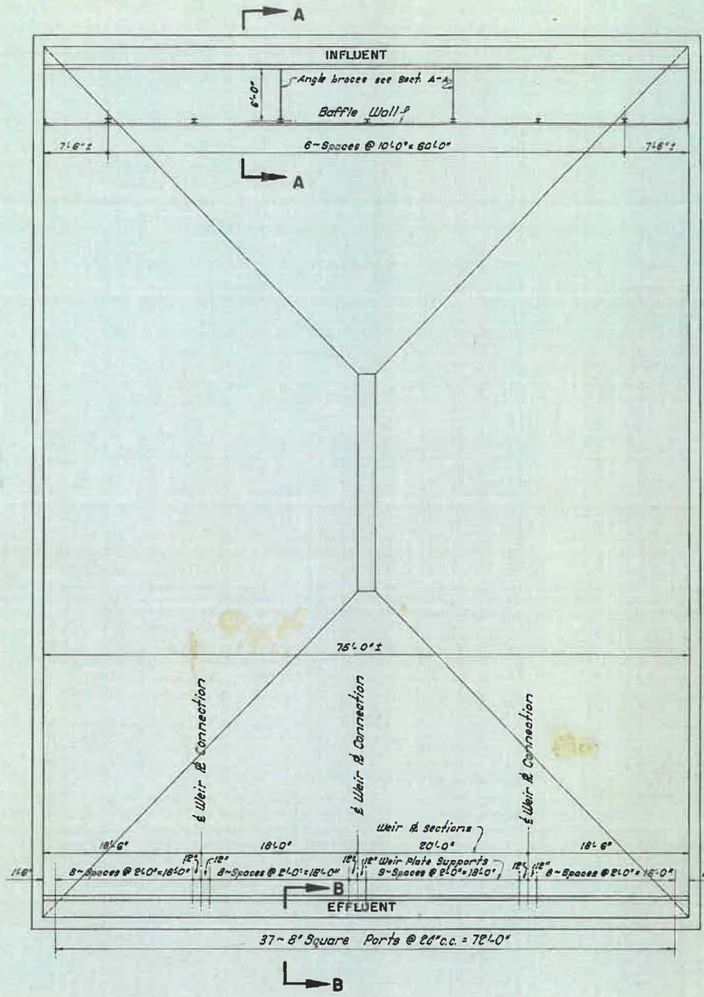
BAFFLE ELEVATION

Scale ½"=1'-0"
Scale of partial plans above 3"=1'-0"

SECTION B-B

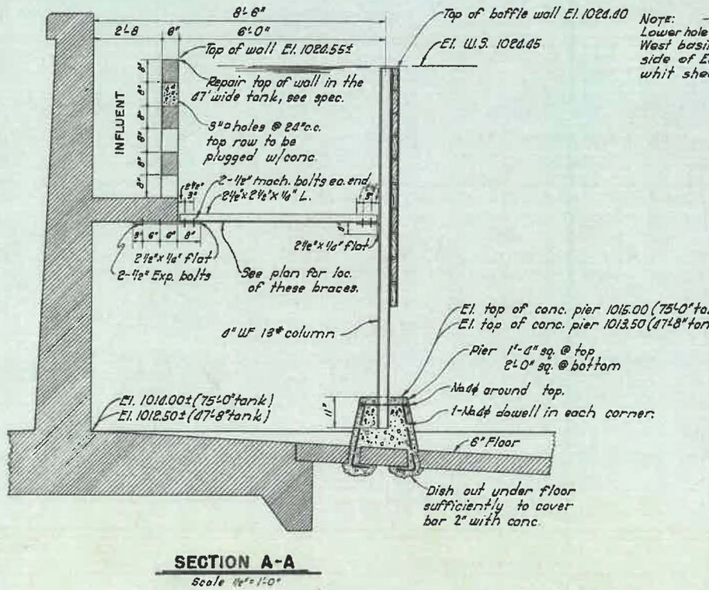
Scale ½"=1'-0"





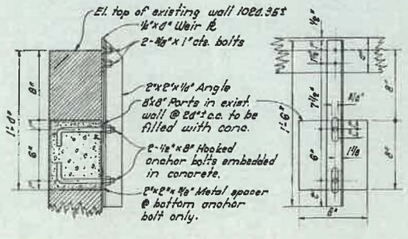
PLAN OF COAGULATION BASINS

Scale 1/16"=1'-0"



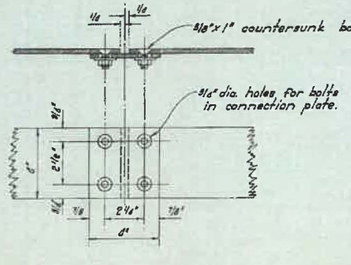
SECTION A-A

Scale ½"=1'-0"



DETAIL OF WEIR PLATE SUPPORT

Scale 1½"=1'-0"



WEIR PLATE CONNECTION

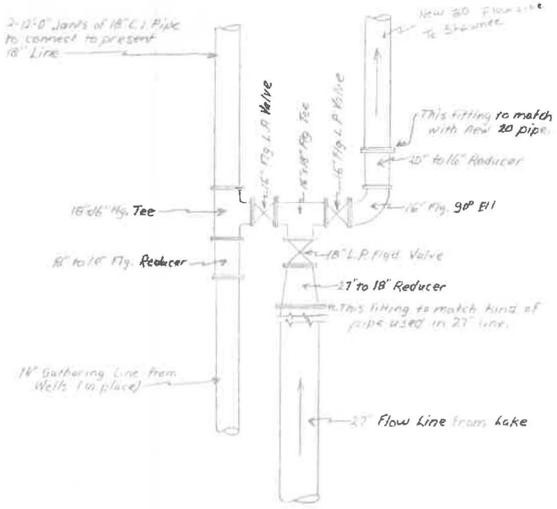
Scale 3"=1'-0

REVISED FOR RECORD DRAWING 10-11-54

DATE 12-15-52	**WATER TREATMENT PLANT**
SCALE AS SHOWN	WATERWORKS IMPROVEMENTS
DRAWN BY V. K.	**SHAWNEE, OKLA.**
TRACED BY J. R.	BENHAM ENGINEERING CO. CONSULTING ENGINEERS
CHECKED BY K H.S	AMERICAN NATIONAL BLDG.
APPROVED	OKLAHOMA CITY, OKLA.
SHEET 32 OF 38	

137

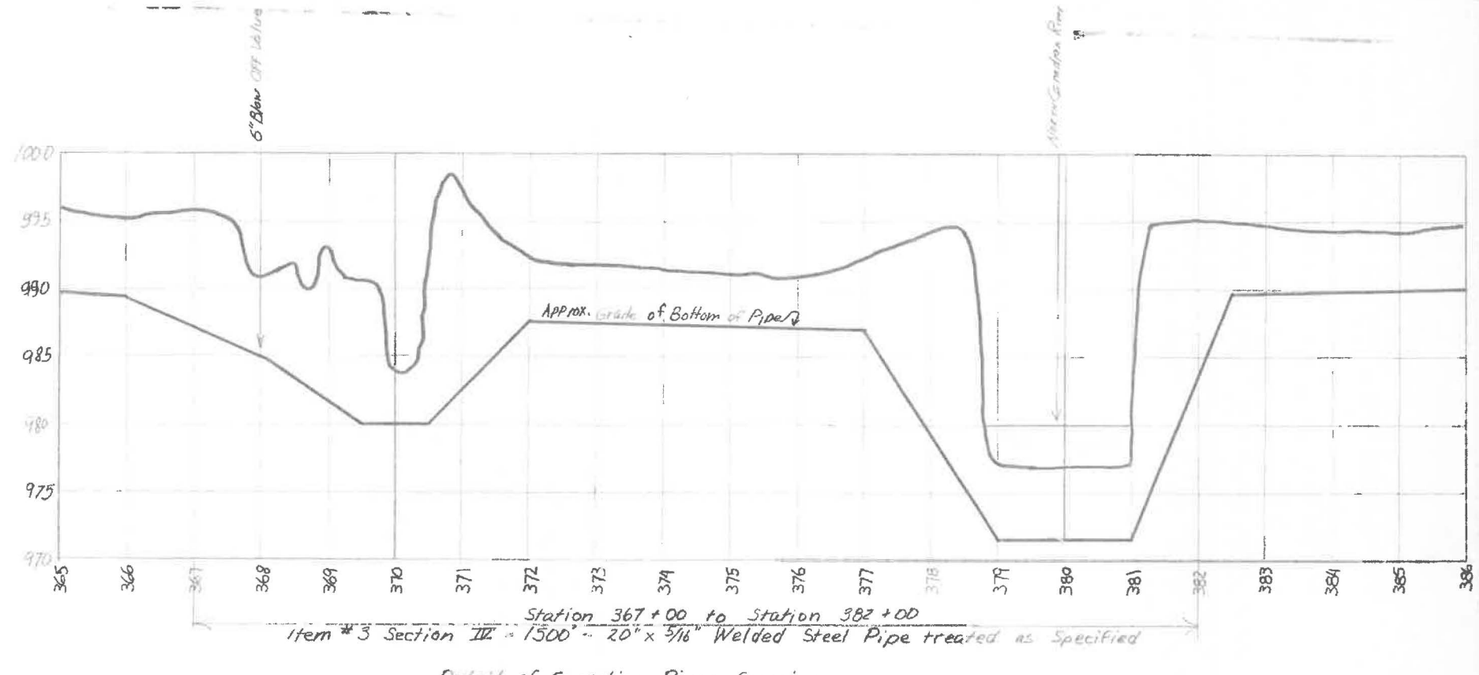
10823



Plan of Pipe Line Connections at Highland Pump Sta.

1/8" = 1'-0"

ITEM 4 - SEC. II

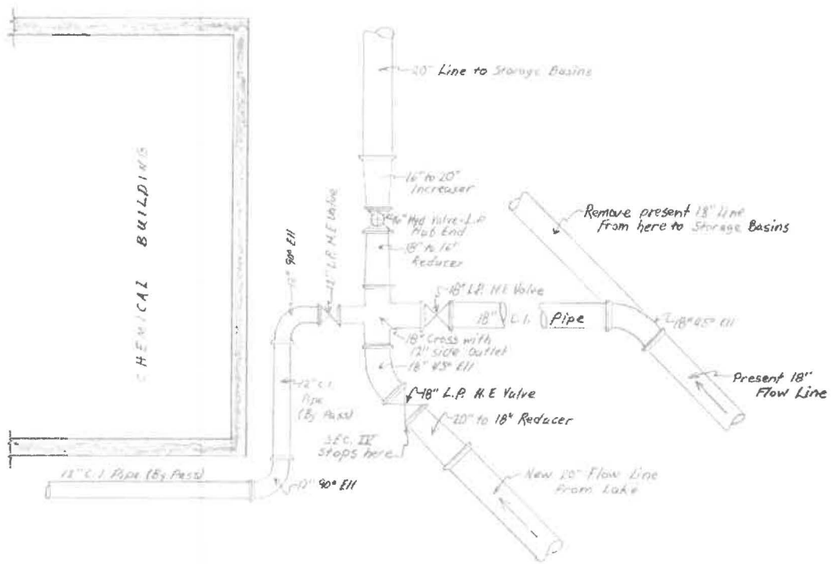


Station 367+00 to Station 382+00

Item # 3 Section III - 1500' - 20" x 5/16" Welded Steel Pipe treated as Specified

Detail of Canadian River Crossing

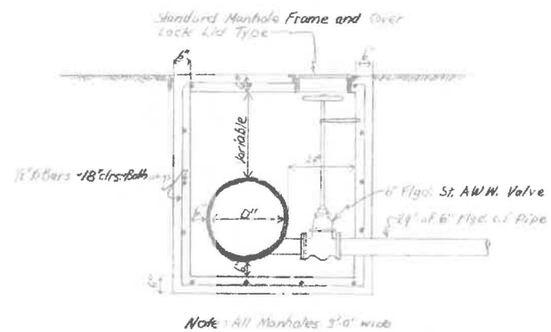
Horiz. 1" = 100' - Vert 1" = 5'



Plan of Pipe Line Connections at Plant

1/4" = 1'-0"

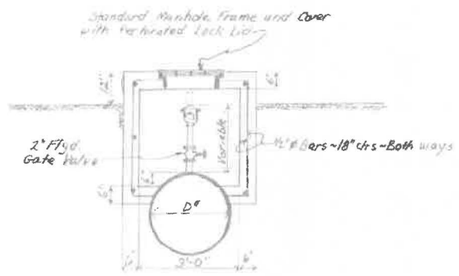
ITEM 15 - SEC II



Note: All Manholes 3'-0" Wide

Detail of 6" Blow-off Connections

1/2" = 1'-0"



2" Air and Vacuum Valve

1/2" = 1'-0"

DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

PIPE LINE DETAILS

Scales AS NOTED | SHEET NO. 19 OF 28 SHEETS

EAGLE FILE CORP., IRVINE, CA
1063 BLES
DEER CREEK PIP

To South Line of Lot 4

Elev. 12'

100,000 Gal Wash Tank
To be removed from
Highland Pump Station - Item 8

New 16" C.I. Pipe - Lead Joints

Existing Sewer

45° Bend
For Connection

New 14" C.I. Main

To River

45° Bends

95° Bend

Present 14" Main
to be removed after new
14" Main is Built

4'6" Brick M.H.

10" Sluice
Gate

Top of Wall
Elev. 1037.27

Depth of Basin
13' ±

EXISTING STORAGE BASINS

3,000,000 GAL. CAPACITY

Depth Basin
13' ±

18" Inlet Pipe
Fl. 1029.72

Connect 20" C.I. Main
to Existing Line

New 20" C.I. Pipe Line

Old 16" C.I. Line
to be removed

Old 16" C.I. Plugged
16" C.I. Sewer

Old
Pipe to
be used

NEW COAGULATION BASIN

New 12" Sewer

Existing Manhole

New Manhole

Existing 16" C.I. Supply Line
8" C.I. Line
To be removed

EXISTING COAGULATION BASIN

18" C.I. Line to be removed
after new line in use

Existing 20" C.I. Line to be Removed

Existing Filter Wash Sewer

Old Concrete
Clear Well

New 8" Sewer

NEW FILTERS

NEW PUMP STATION

New Sanitary Sewer Manhole

Existing Sewer From Basins

12" Venturi Meter - Item 11

Present 125 H.P. Motor

Present 14" Main

OLD RIVER PUMP STATION

175.47'

NORTH CANADIAN RIVER

Elev. 1015.49'

30° Bend

12" C.V. Bypass - From pipe removed

12" Valve

New 20"x12" B.&S. Cross

Existing 20" Line

30" Sluice Gate

EXISTING CHEMICAL BLDG

16" Control Valve
Item 12

12" C.I. By-Pass

30° Bend

New 14" Main

12" Valves

18" Valves

Connect

14" Main - Old pipe reloid

See Sheet #14 for detail
of this Connection

New 20"
Supply Line

Existing 18"
Supply Line

Approx. Point
Where old pipe is
to be laid

Kickapoo St.

Sec. Line

Sec. Cor

Existing Filter Building

Old Filter No. 1 & 2

12" Suction to Pumps

Present High Service Pumps

Existing Drain to River

Existing Concrete Basin

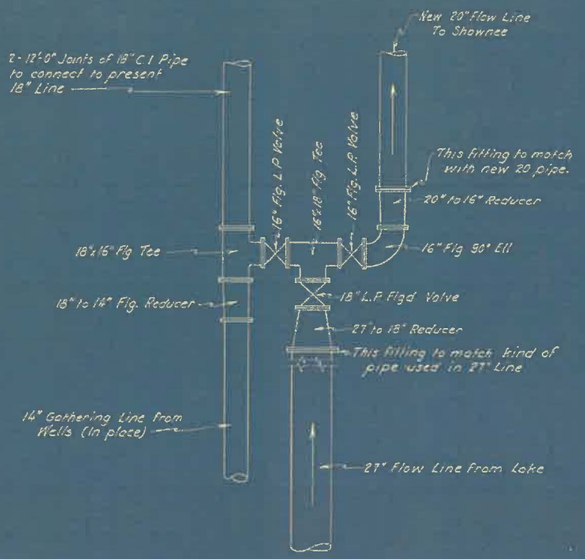
Temporary 10" C.I. Sewer
(To be white old Pipe)

New 14" 90° Ell

DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

FILTER PLANT AND PUMP STATION
GENERAL PLAN

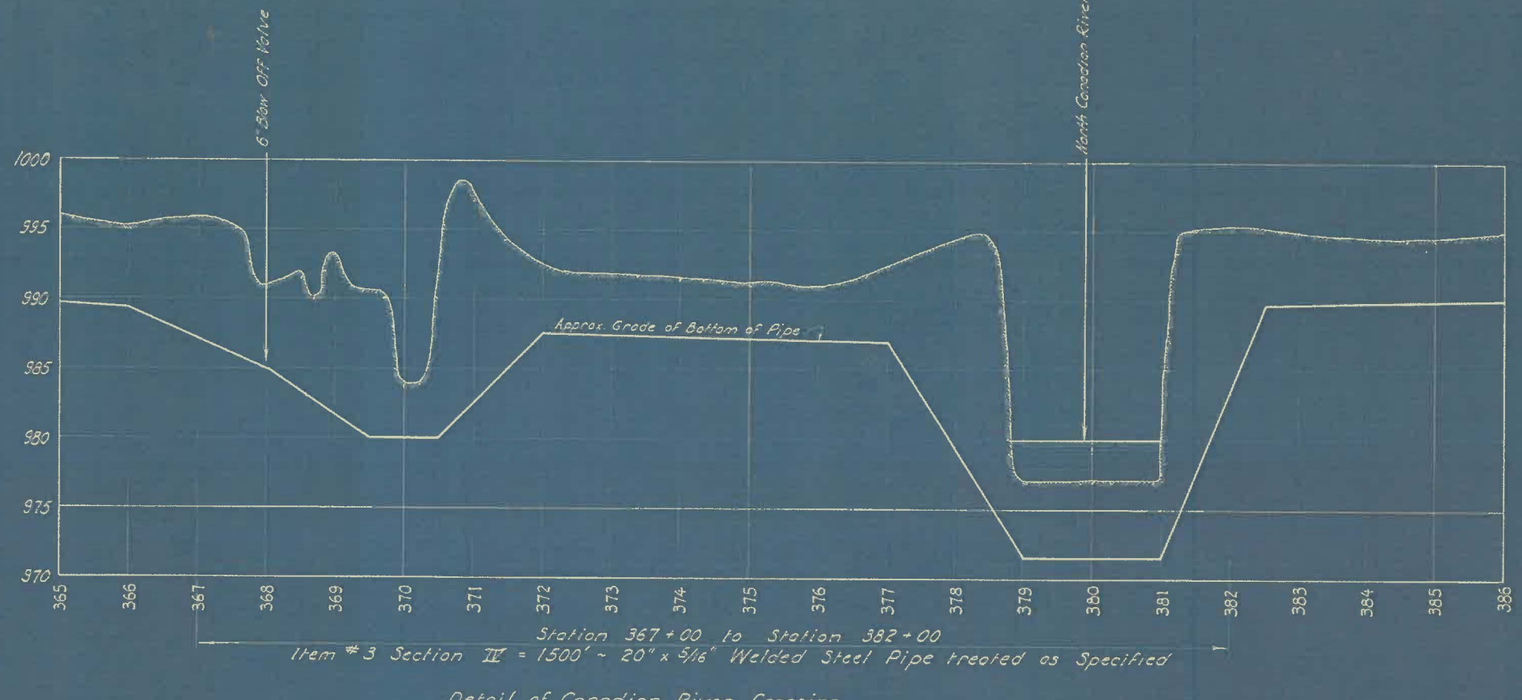
T. E. Thompson, City Mgr.	SCALES: 1" = 20'
E. F. Edge, City Engr.	November, 1934
W. R. Holway, Consulting Engineer	SHEET NO. 15 OF 28 SHEETS



Plan of Pipe Line Connections at Highland Pump Sta.

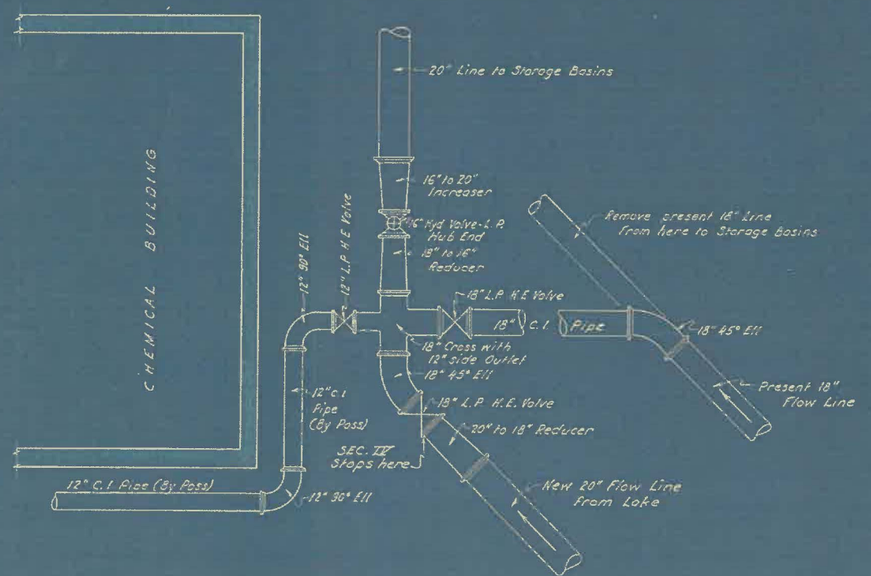
1/4" = 1'-0"

ITEM 4 - SEC. IV



Detail of Canadian River Crossing

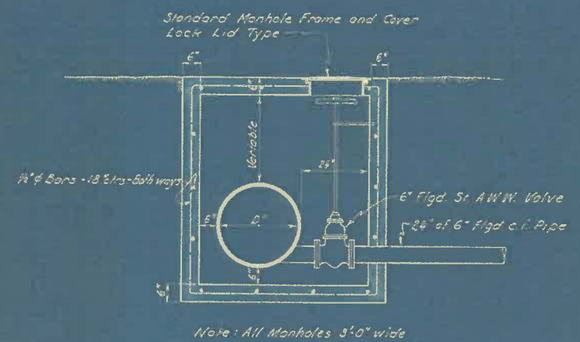
Horiz. 1" = 100' - Vert. 1" = 5'



Plan of Pipe Line Connections at Plant

1/4" = 1'-0"

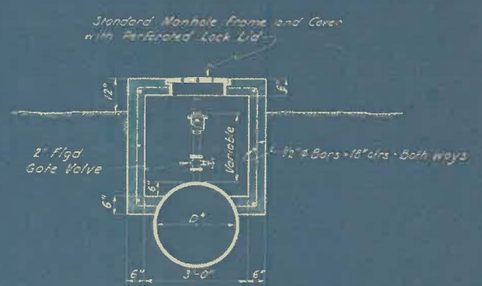
ITEM 15 - SEC. V



Note: All Manholes 3'-0" wide

Detail of 6" Blowoff Connections

1/2" = 1'-0"



2" Air and Vacuum Valve

1/2" = 1'-0"

DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

PIPE LINE DETAILS

T. E. Thompson, City Mgr.	SCALES: As Noted
E. F. Edge, City Engr.	November 1934
W. R Holway, Consulting Engineer	SHEET NO. 14 OF 28 SHEETS

R. 2 E. R. 3 E. R. 4 E.

T. 10 N.

North Branch South Deer Creek

Gravel Road to Mt. Lake

Dam Sec 11

Approach Road Sec 11

PROPOSED LAKE

Graham Siding

Crossan

Geddy

Gravel Road

CHAPMAN WATER WELLS

North Canadian River

CITY WATER WELLS

PRESENT WELL PUMP STA.

Location of Elevated Tank to be moved to Water Sec 1

Craig

CITY WATER WELLS

Canadian River Crossing

Levy Channel

20" PIPE LINE

STAND PIPE

SHAWNEE

Highland Ave.

New 16" Main

SHAWNEE WATER-WORKS

Lost Creek

Squirrel Creek

Hydraulic Grade Line

27" PIPE LINE - SEC III

20" PIPE LINE - SEC IV

Deer Creek

North Deer Creek

Canadian River

WATER-WORKS

Top of Dam Elev 1062.0

Top of Basin Well Elev 1037.0

1075

1050

1025

1000

975

0 5,000 10,000 15,000 20,000 25,000 30,000 35,000 40,000 45,000 50,000 FEET

GENERAL PLAN SHEET NO 15

DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

GENERAL MAP AND CONDENSED PROFILE

T. E. Thompson, City Mgr.
L. P. Edge, City Engr.
W. R. Holway, Consulting Engineer

SCALES: Hor. 1" = 2000' Ver. 1" = 20'
November 1934
SHEET NO 1 OF 28 SHEETS

SPILLWAY

Concrete Retaining Wall

10+62.91 W. end Bridge
12+42.91 W. end Spillway

Concrete Bridge
El. 1064.0

Class D Riprap

Riprap Class "A"

10' Berm - El. 1057.5

Outlet Channel - To be paid for under Items 6 & 8 only

Inlet Channel - To be paid for under Items 6 & 8 only.

DEER CREEK

Section Line

Drilled Hole #4

Borrow Limit

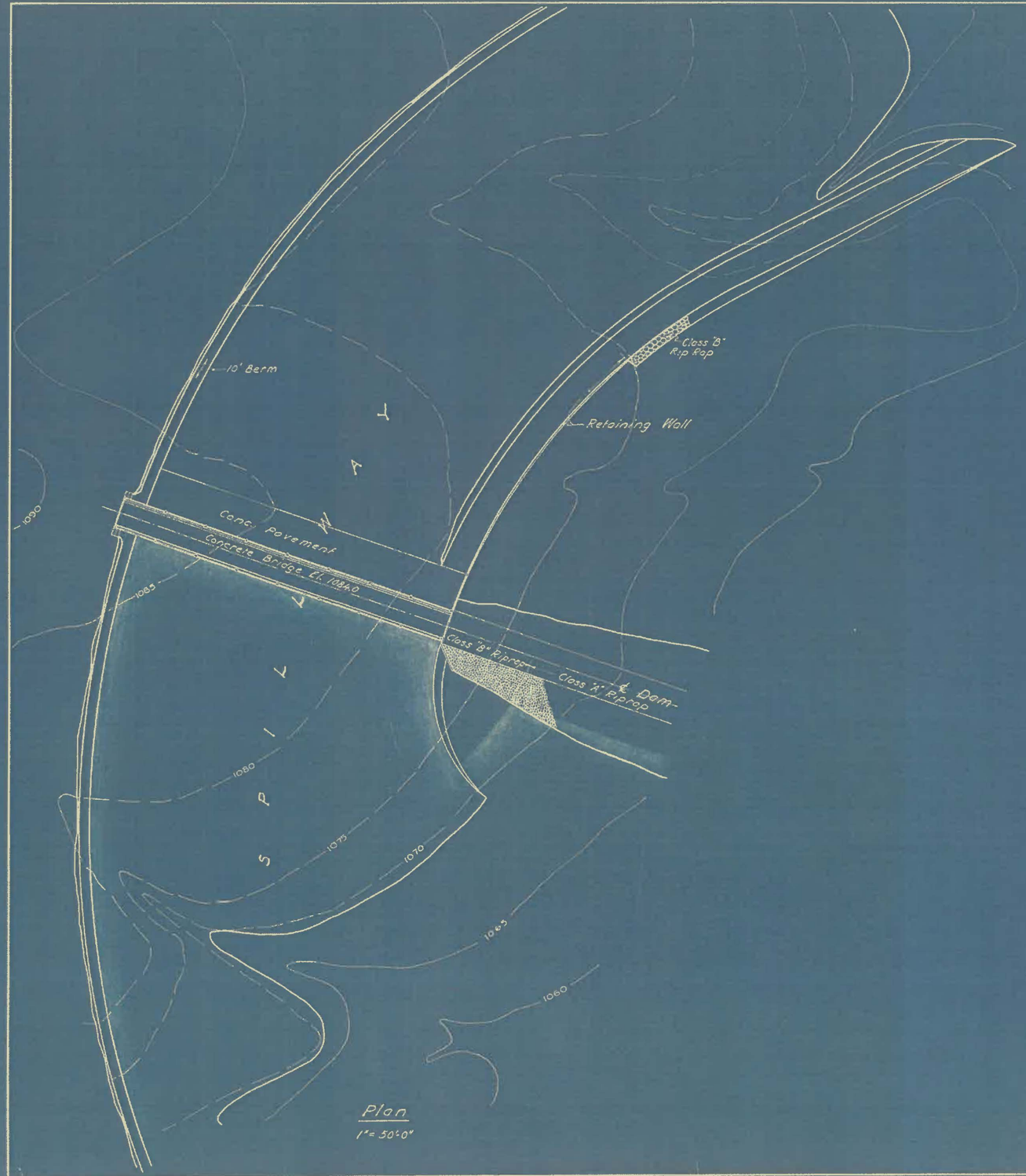
Adjacent Tank

Utility Tower

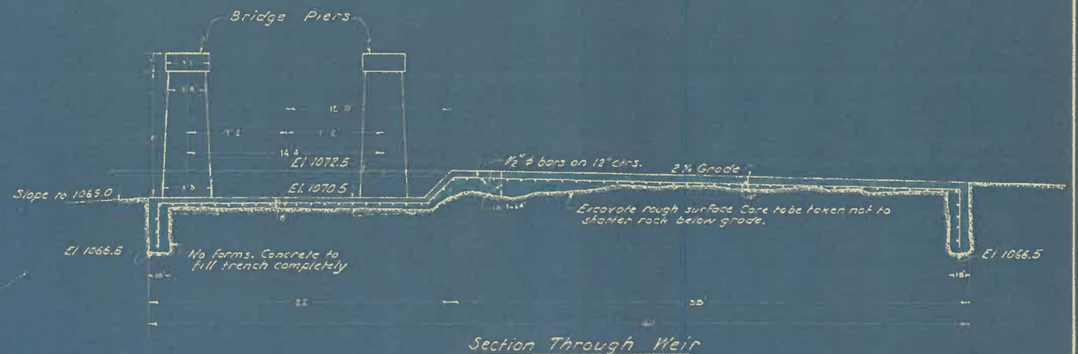
Utility Tower

N

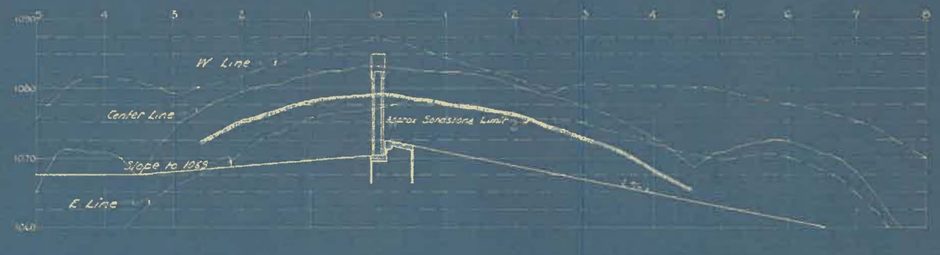
DEER CREEK WATER PROJECT SHAWNEE, OKLAHOMA	
PLAN OF DAM	
T. E. Thompson, City Mgr. E. F. Edge, City Engr. W. R. Holway, Consulting Engineer	SCALES: 1" = 100' November, 1934 SHEET NO. 3 OF 28 SHEETS



Plan
1" = 50'-0"



Section Through Weir
1" = 5'-0"



Profiles of Spillway Channel
Hor. 1" = 100' - Ver. 1" = 10'

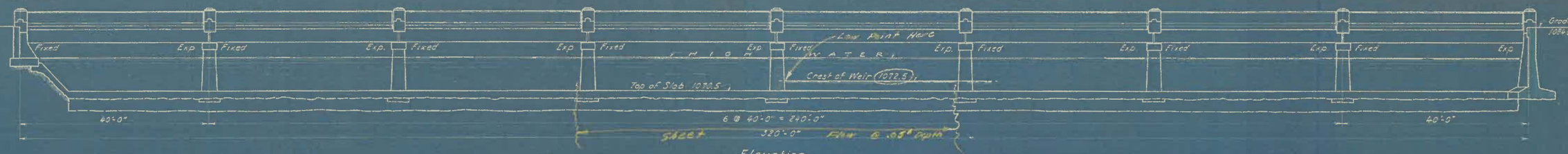


Cross Section of Spillway Sta. 2 +00
Hor. 1" = 30'- Ver. 1" = 10'

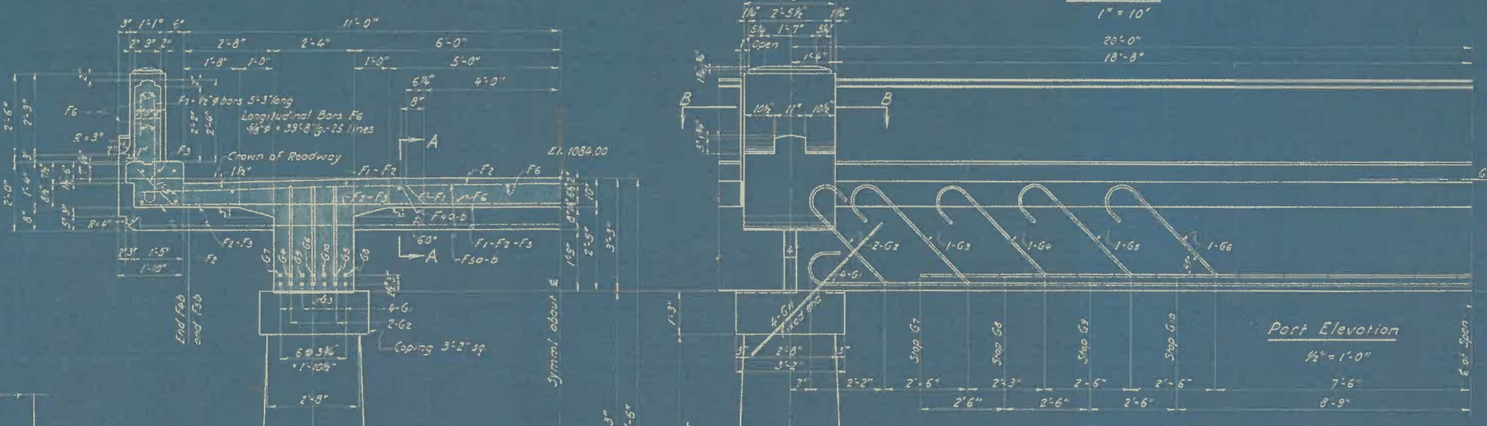
DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

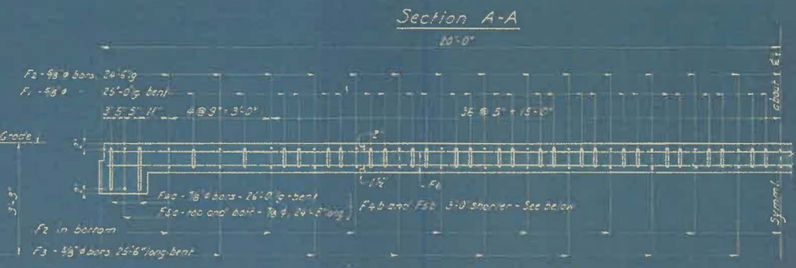
SPILLWAY ~ PLAN AND SECTION

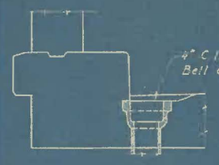
T. E. Thompson, City Mgr.	SCALES: As Noted
E. F. Edge, City Engr.	November, 1936
W. R. Holway, Consulting Engineer	SHEET NO. 5 OF 28 SHEETS



Elevation
1" = 10'

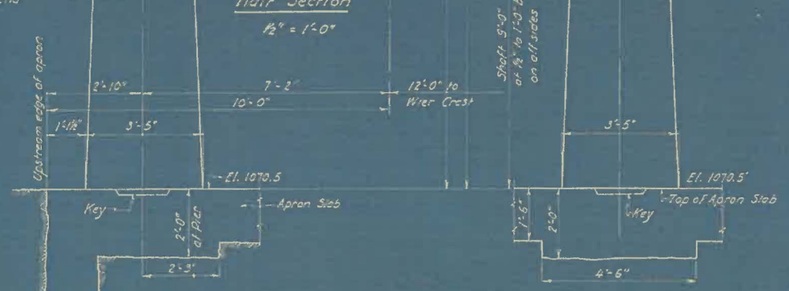


Section A-A




Floor Drains
2 at ℄ of each Span
1" = 1'-0"

Half Section
1½" = 1'-0"



Girder Bars for One Span

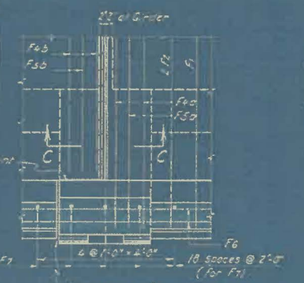
8	G1	1⅛"ø	× 41'-4"	330⅔'
4	G2	"	× 44'-0"	176'
2	G3	"	× 40'-6"	81'
2	G4	"	× 35'-6"	71'
2	G5	"	× 30'-6"	61'
2	G6	"	× 25'-6"	51'
2	G7	"	× 32'-6"	65'
2	G8	"	× 27'-6"	55'
2	G9	"	× 22'-6"	45'
2	G10	"	× 17'-6"	35'
8	G11	⅞"ø	× 5'-6"	44'

Weight 5280#

Floor and Railing Bars for One Span

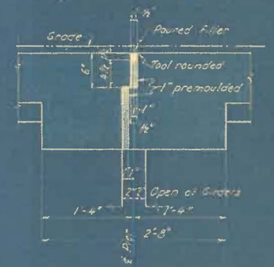
53	F1	⅝"ø	× 25'-0"	1300'
44	F2	"	× 24'-6"	1078'
14	F3	"	× 25'-6"	357'
2	Fab	⅞"ø	× 26'-0"	52'
2	Fbb	"	× 23'-0"	46'
1	Fsb	"	× 24'-8"	24⅔'
1	Fsb	"	× 21'-8"	21⅔'
25	F6	⅝"ø	× 39'-8"	993⅓'
44	F7	½"ø	× 5'-3"	231'

Weight 4406#

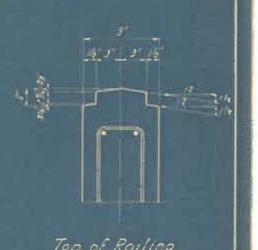


¼" joint open for railing open or filled with premoulded joint material or fascia.

Section B-B
Showing Expansion Joint



Enlarged Section C-C
1" = 1'-0"



Top of Railing
1½" = 1'-0"

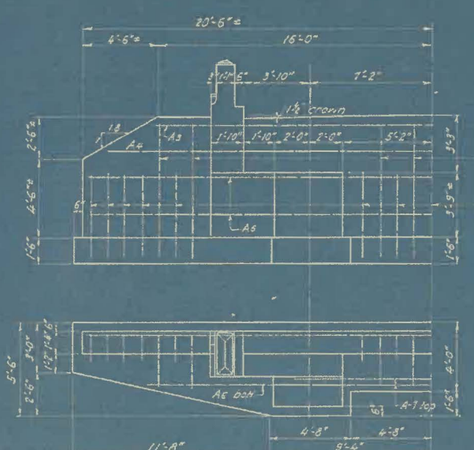


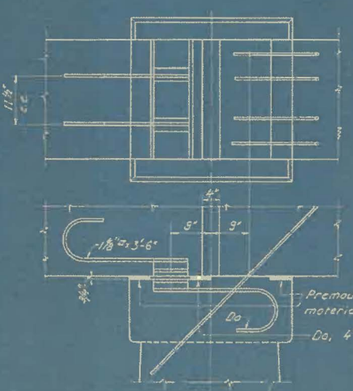
Bars for Abutment

8	A1	½"ø	× 10'-6"
15	A2	"	× 6'-0"
1	A3	"	× 32'-0"
1	A4	"	× 38'-0"
2	A5	"	× 40'-0"
1	A6	"	× 33'-0"
2	A7	¾"ø	× 15'-0"

Wt 291#

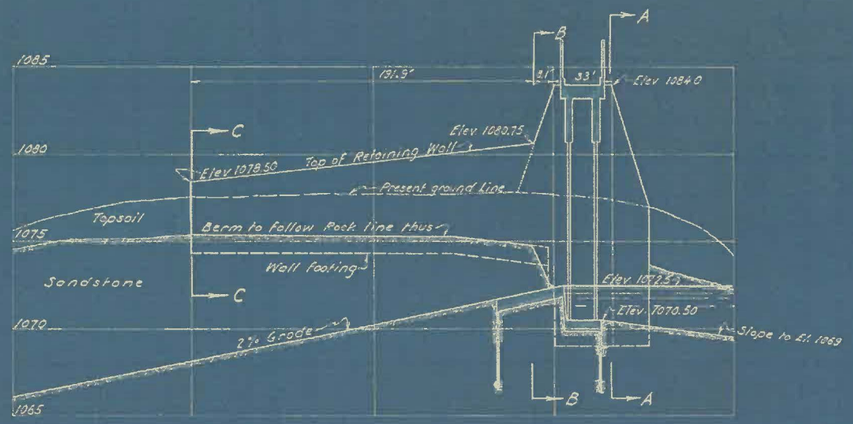
Abutment
1½" = 1'-0"
(One like this)





Details of Girder Bearings
¾" = 1'-0"

DEER CREEK WATER PROJECT SHAWNEE, OKLAHOMA	
SPILLWAY BRIDGE	
T. E. Thompson, City Mgr. E. E. Edge, City Engr. W. R. Holway, Consulting Engineer	SCALES: As Noted November, 1934 SHEET NO. 6 OF 28 SHEETS

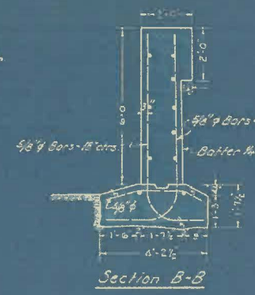


Profile Section Along Spillway Retaining Wall

Scales - Hor. 1" = 40' - Vert. 1" = 4'



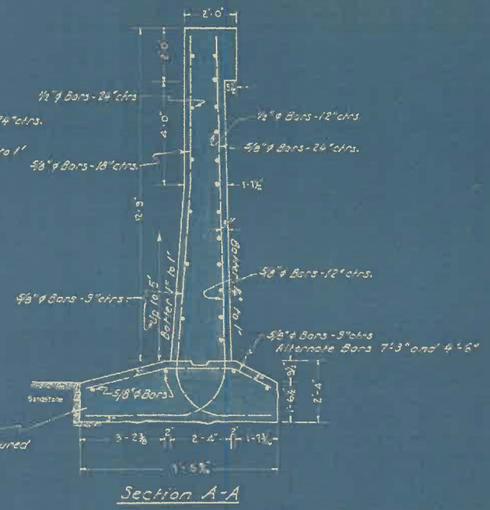
Section C-C



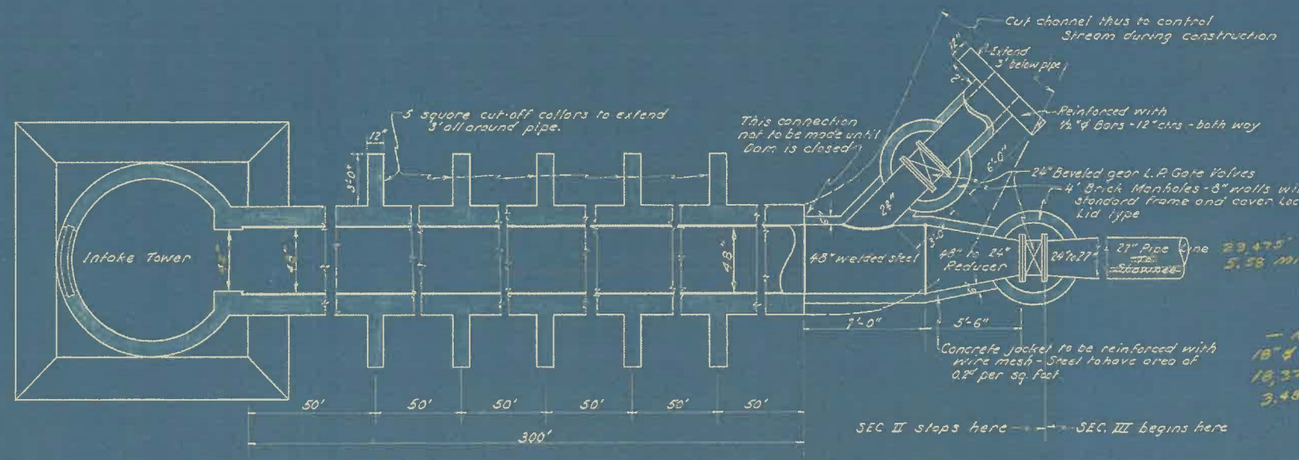
Section B-B

Wing Wall Details

3/8" = 1'-0"

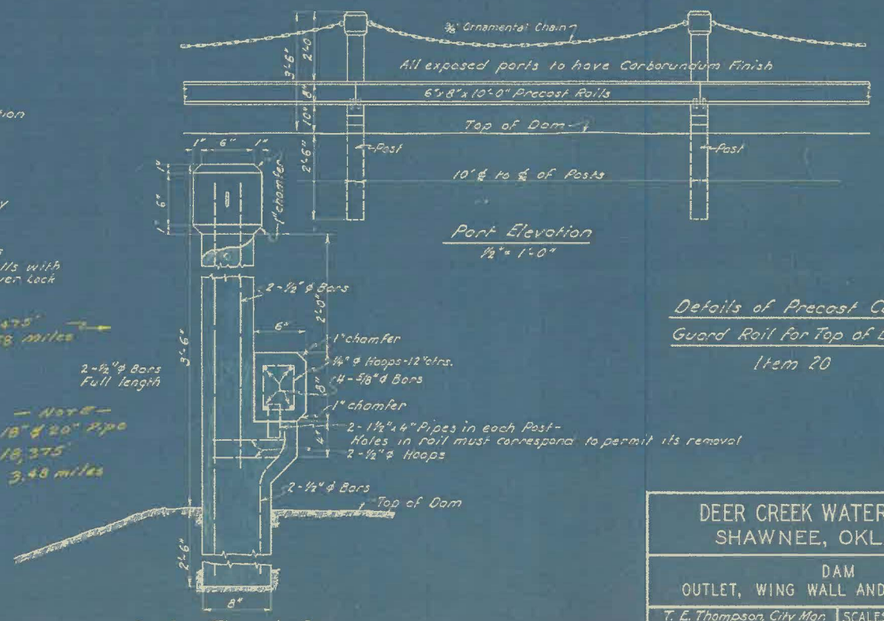


Section A-A



Plan Section Through ℄ of Conduit

1/4" = 1'-0"



Port Elevation

1½" = 1'-0"

Section Through Post

1½" = 1'-0"

Details of Precast Concrete Guard Rail for Top of Dam

Item 20

DEER CREEK WATER PROJECT SHAWNEE, OKLAHOMA	
DAM OUTLET, WING WALL AND GUARD RAIL	
T. E. Thompson, City Mgr. E. F. Edge, City Engr. W. R. Holway, Consulting Engineer	SCALES: As Noted November, 1934 SHEET NO. 8 OF 28 SHEETS

DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

HIGHWAY RELOCATION
ITEM #18

T. E. Thompson, City Mgr.	SCALES: Hor 1"=400' Ver 1"=20'
E. F. Edge, City Engr.	November 1938
W. R. Holway, Consulting Engineer	SHEET NO. 9 OF 28 SHEETS

Sec. 11

Cotton

Cotton

N 53° 15' E

N 53° 15' E

N 53° 15' E

Pasture

Pasture

Pasture

Pasture

Corn

Corn

Alfalfa

Alfalfa

Alfalfa

Alfalfa

Sec. 11

Sec. 12

Sec. 7

SECTION III STARTS HERE.

27" Pipe Line

N 16° 10' E

DAM

Sec. Line

Sta. 0+00 Pipe Line Survey
= 20+00 ℄ Dam

Elev. 1060

Elev. 1050

Elev. 1040

Elev. 1030

Elev. 1020

Elev. 1010

Static Pressure Line

Hydraulic Grade Line (Lake Full) — Slope 0.95/1000.

Hydraulic Grade Line (Lower Inlet to Conc. Basin) — Slope 0.53/1000.

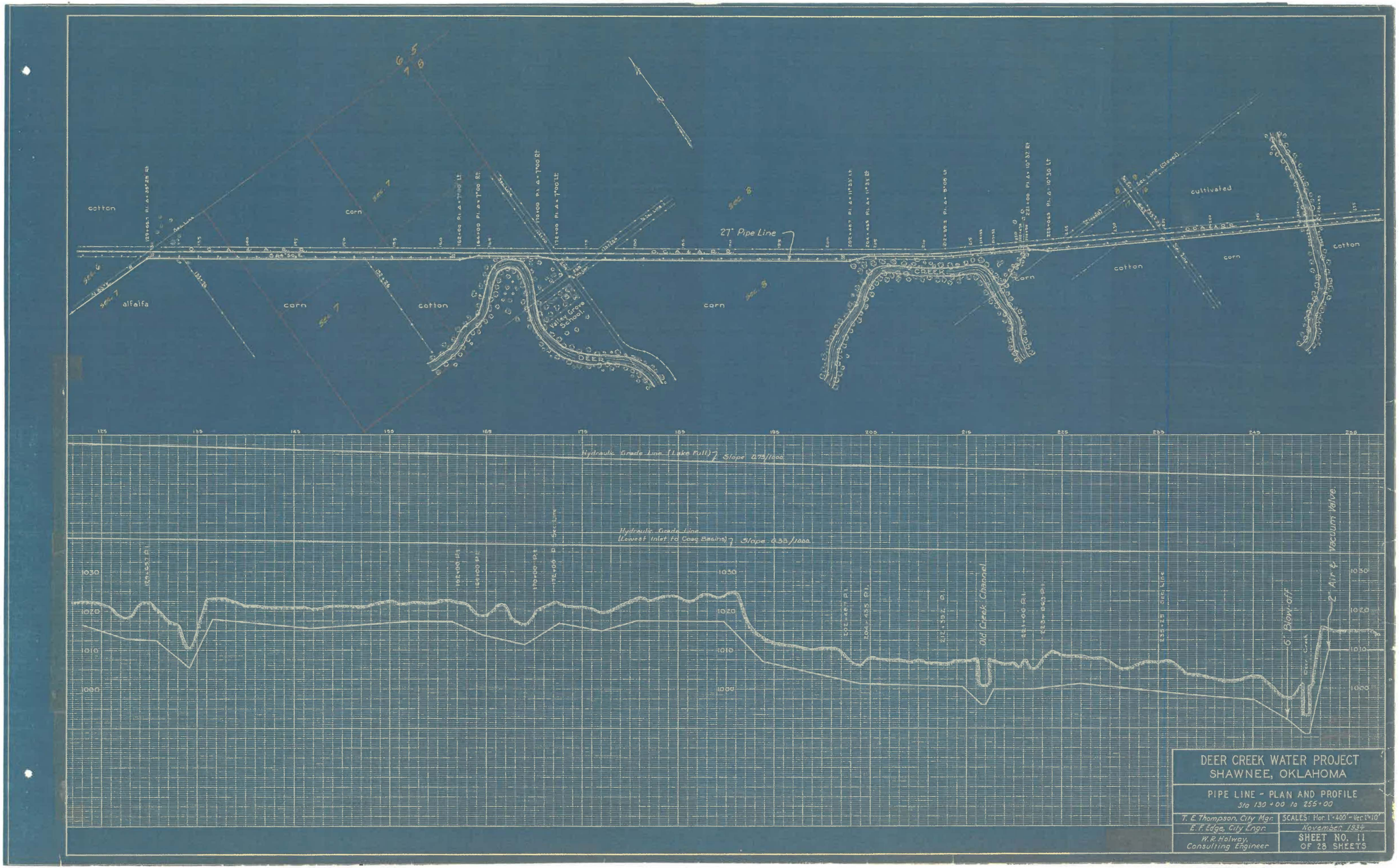
27" Air & Vacuum Valve

Deer Creek Blow-off

DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

PIPE LINE ~ PLAN AND PROFILE
Sta. 0+00 to 130+00

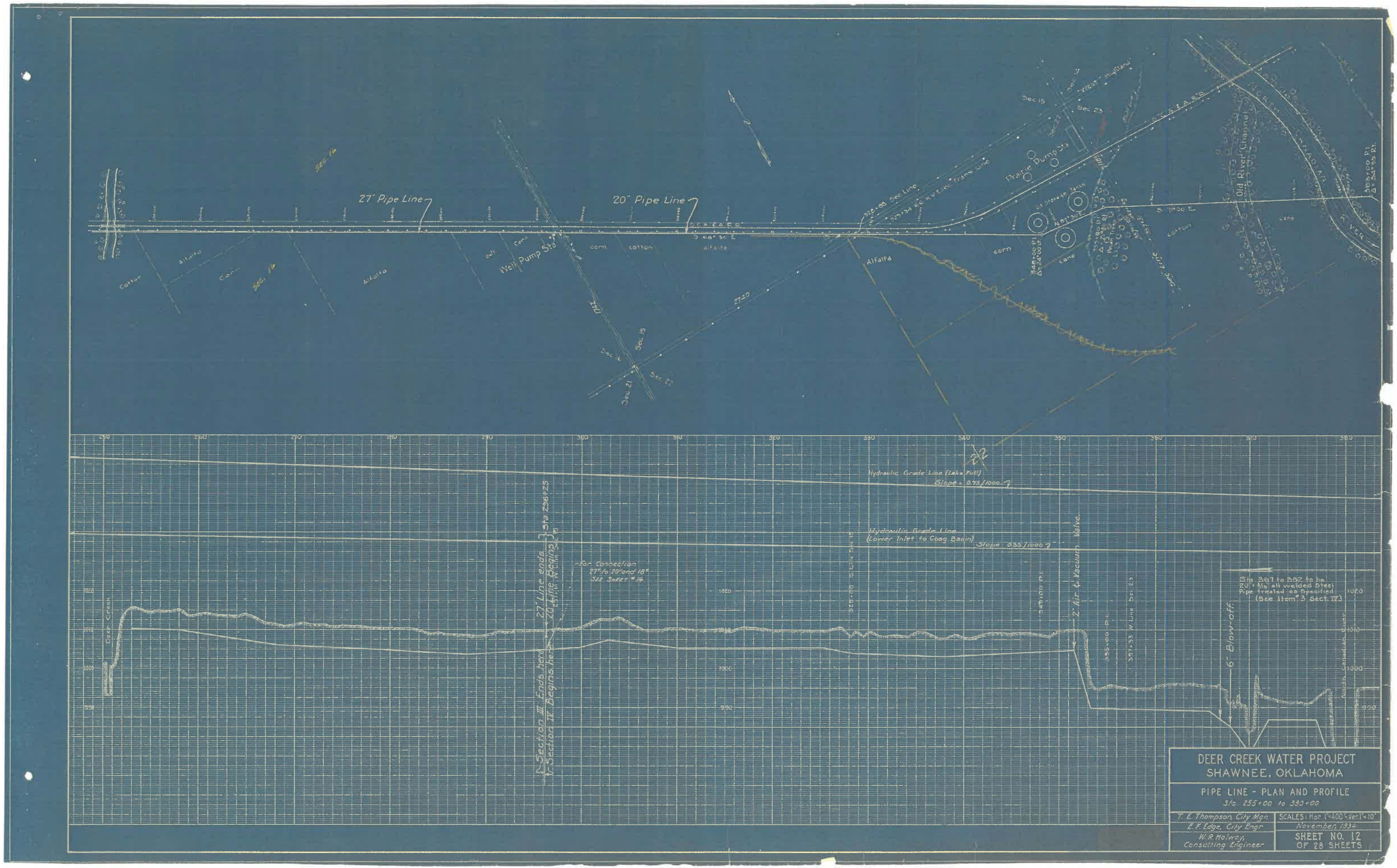
T. E. Thompson, City Mgr.	SCALES: 1" = 400' - Ver. 1" = 10'
E. F. Edge, City Engr.	November, 1934
W. R. Holway, Consulting Engineer	SHEET NO. 10 OF 28 SHEETS



DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

PIPE LINE - PLAN AND PROFILE
Sta 130+00 to 255+00

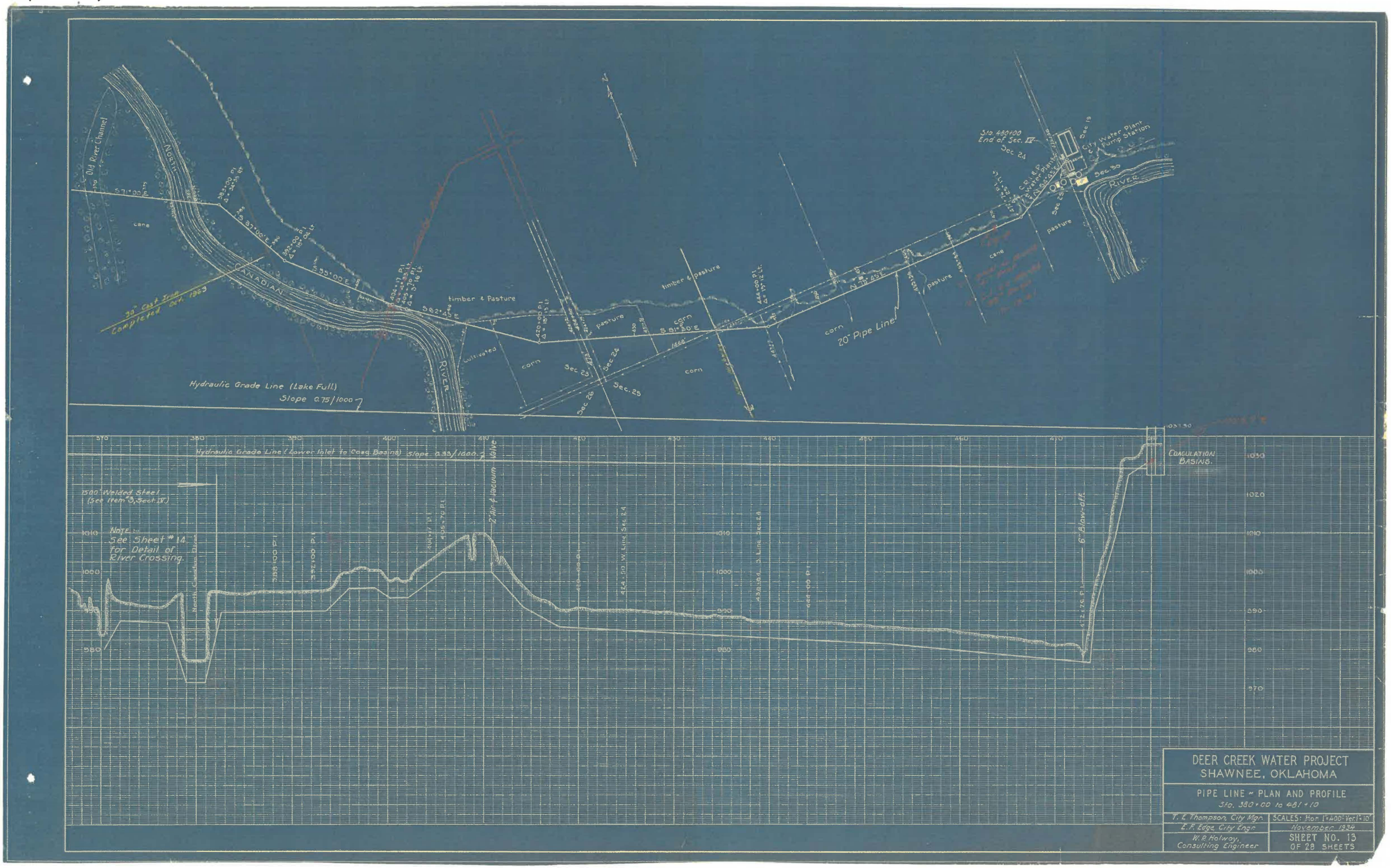
T. E. Thompson, City Mgr.	SCALES: Hor. 1"=400' - Ver. 1"=10'
E. F. Edge, City Engr.	November 1934
W. R. Holway, Consulting Engineer	SHEET NO. 11 OF 28 SHEETS



DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

PIPE LINE - PLAN AND PROFILE
Sta 255+00 to 330+00

T. E. Thompson, City Mgr.	SCALES: Hor 1"=400' Ver 1"=10'
E. F. Edge, City Engr.	November, 1934
W. R. Holway, Consulting Engineer	SHEET NO. 12 OF 28 SHEETS



DEER CREEK WATER PROJECT
SHAWNEE, OKLAHOMA

PIPE LINE ~ PLAN AND PROFILE
Sta. 380+00 to 481+10

T. E. Thompson, City Mgr.	SCALES: Hor. 1"=400' Vert. 10'
L. F. Edge, City Engr.	November 1934
W. R. Holway, Consulting Engineer	SHEET NO. 13 OF 28 SHEETS

Addendum No. 2

Water System Improvements
Water Treatment Plant Expansion
Shawnee Municipal Authority
Shawnee, Oklahoma

April 22, 2021

The plans and specifications on the above referenced project shall be and are hereby amended as follows:

I. PLANS

ITEM NO. 1: Electrical Drawings

Refer to E4, E5a, and E5b. Add NEMA 4X area classification to the pipe gallery area to match that shown on E6a and E6b.

ITEM NO. 2: Plan Sheet No. 33 – Select Backfill

Select Backfill under the slab of the footing and slab for the new process building shall be from off-site.

ITEM NO. 3: Plan Sheet Nos. 6-9 – Demolition Notes

Demolition material (concrete, steel, piping, etc.) may be disposed of below grade in the structures to be demolished as space permits. Excess demolished material shall be disposed of off-site. The top 12" of the backfill to final grade shall be select material from off-site.

Existing spoils in the abandoned storage/settling basin may be moved to the north end of these basins as space is available. Excess spoils (if any) shall be disposed of off-site. The top 12" of backfill to final grade shall be select material from off-site.

ITEM NO. 4: Plan Sheet No. 37 – Backwash Supplemental Supply Vault

A revised Sheet No. 37 is attached.

ITEM NO. 5: Plan Sheet No. 38

The building on Sheet No. 38 shall be an engineered metal building per Section 5.2 of the Specifications.

ITEM NO. 6: Plan Sheet No. 28 - Sump Pumps

Sump pumps on Sheet No. 28 shall have a capacity of 10 gpm at 40 feet of head.

ITEM NO. 7: Plan Sheet No. 6 – Backwash Tank

Delete demolition of abandoned backwash tank. (Backwash tank to remain.)

II. SPECIFICATIONS

ITEM NO. 1: Metal Doors

All metal doors for the process building shall be 3'0" x 7'0". Metal doors and hardware shall comply with the attached specifications. These specifications replace Sections 8.1 and 8.3.

ITEM NO. 2: Handrail

Handrail shall have set screw connections per the plans.

III. BID DOCUMENTS

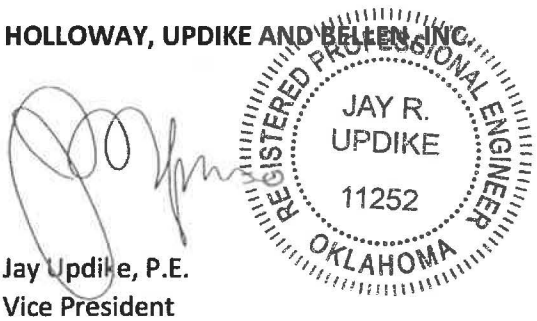
ITEM NO. 1: Bid Form

Bid Item No. 2 "Undercut and Backfill" is for work not shown on the plans and does not apply to select backfill shown on the plans.

A copy of this addendum shall be added to and made a part of each bid.

Sincerely,

HOLLOWAY, UPDIKE AND BELLEN, INC.



Jay Updike, P.E.
Vice President

JU/mm 19SHAWWTP

SECTION 08110 - STANDARD STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes standard hollow-metal steel doors and frames.

1.2 SUBMITTALS

A. Shop Drawings: Provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings.

B. Product test reports.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld Building Products, LLC.
2. Ceco Door Products; an ASSA ABLOY Group Company.
3. CURRIES Company; an ASSA ABLOY Group Company.
4. Kewanee Corporation (The).
5. Republic Builders Products Company.
6. Steelcraft; an Ingersoll-Rand Company.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 zinc-iron-alloy (galvannealed) coating designation.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
2. Frames for Level 3 Steel Doors: 0.067-inch thick steel sheet.

C. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

D. Jamb Anchors: Masonry, stud-wall, compression, or postinstalled expansion type; not less than 0.042 inch thick.

E. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick.

2.5 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch high, unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.6 FABRICATION

A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Standard Steel Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.

C. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Frames: Provide closed tubular members with no visible face seams or joints; fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
4. Plaster Guards: Weld guards to frame at back of hardware mortises in frames installed in concrete or masonry.

5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c.
7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.

D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."

1. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Provide fixed stops and moldings welded on secure side of door or frame.
2. Provide loose stops and moldings on inside of doors and frames.

2.7 FINISHES

A. Steel Finish: Factory priming for field-painted finish.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Remove welded-in shipping spreaders installed at factory.

B. Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

C. Standard Steel Frames: Install standard steel frames for doors and other openings, of size and profile indicated. Comply with SDI 105.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-protection-rated openings, install frames according to NFPA 80.
b. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing antifreezing agents.

2. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 4 Section "Unit Masonry Assemblies."
4. Concrete Walls: Solidly fill space between frames and concrete with grout. Install grout in lifts and take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.

D. Standard Steel Doors: Fit hollow-metal doors accurately in frames. Shim as necessary.

E. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with standard steel door and frame manufacturer's written instructions.

F. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.

G. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

END OF SECTION 08111

SECTION 08331 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of electric-motor operated overhead coiling doors:

1. Insulated service doors.

B. See Division 5 Section "Metal Fabrications" for miscellaneous steel supports.

C. See Division 16 Sections for electrical service and connections for powered operators and accessories.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. acting inward and outward.
2. Impact Test for Flying Debris: Comply with ASTM E 1996, tested according to ASTM E 1886.

a. Level of Protection: Basic Protection.
b. Wind Zone Design 110 mph, pressure test to 1/2 and 1-1/2 x design pressure (positive and negative).

B. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles.

1.3 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

B. Shop Drawings: Include plans, elevations, sections, details, and attachment to other work.

C. Samples: For each exposed finish.

D. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Atlas Door; Div. of Clopay Building Products Company, Inc.
2. Cookson Company.
3. McKeon Rolling Steel Door Company, Inc.
4. Pacific Rolling Doors Co.
5. Raynor.
6. Windsor Door, a MAGNATRAX Corporation.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Interlocking slats in a continuous length for width of door of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door.

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel (SS) sheet; complying with ASTM A 653/A 653M, G90 (Z275) coating designation.
2. Slat type: Flat profile.

3. Insulation: Manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.

B. Endlocks: Malleable-iron casings, secured to curtain slats to comply with wind load.

C. Bottom Bar: 1-1/2 by 1-1/2 by 1/8 inch thick to suit type of curtain slats.

D. Curtain Jamb Guides: Steel angles or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

E. Hood, Interior Style: Form to act as weatherseal and entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods, and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.

1. Steel Door Hoods: Minimum 0.028-inch thick, hot-dip galvanized steel sheet that matches slat steel.
2. Shape: Round or Square.

F. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch- thick, replaceable, continuous sheet secured to inside of hood.

1. Motor-Operated Doors: Combination bottom weatherseal and sensor edge.
2. Jamb Seals: Replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.

G. Slide Bolt: Engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

H. Locking Device Assembly: Lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.

1. Locking Bars: Full-disc cremone type, both jamb sides operable from inside only.
2. Lock cylinder is specified in Division 8 Section "Door Hardware."

I. Power-Operated Doors: Safety interlock switch to disengage power supply when door is locked.

J. Counterbalancing Mechanism: Adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

1. Mounting Brackets: Cast iron or cold-rolled steel plate.

K. Electric Door Operator: Manufacturer's standard type, size, and capacity for door and operation-cycle requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories. Comply with NFPA 70.

1. Disconnect Device: Hand-operated for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount to be accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
2. Door-Operator Type: Wall-, hood-, or bracket-mounted unit with electric motor, belt-reduction or gear-head-reduction drive, and chain and sprocket secondary drive.
3. Through-wall-mounted motor operator.

L. Electric Motors: High-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or service factor. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.

1. Totally enclosed, nonventilated or fan-cooled motor, fitted with plugged drain, and controller with NEMA ICS 6, Type 4 enclosure where indicated.

M. Control Equipment: NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc, with remote, three-button control station.

1. Obstruction Detection Device: External automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
2. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.

2.3 FINISHES

A. Galvanized Steel Finish: Manufacturer's standard finish.

1. Color and Gloss: As selected by Onwer from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports

1. Install fire-rated doors to comply with NFPA 80.

B. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion, and with weathertight fit around entire perimeter.

3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain doors. Refer to Division 1 Section "Closeout Procedures and Demonstration and Training."

END OF SECTION 08331

SECTION 08710 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Commercial door hardware.
2. Cylinders for doors specified in other Sections.

B. See Division 8 door sections for astragals and door silencers.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each exposed finish.

C. Product certificates.

D. Other Action Submittals:

1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams.

a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
b. Content: Include the following information:

1) Identification number, location, hand, fire rating, and material of each door and frame.
2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
3) Complete designations of every item required for each door or opening including name and manufacturer.
4) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

C. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

D. Keying Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

B. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.5 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion, except as follows:
   a. Exit Devices: Two years from date of Substantial Completion.
   b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.

2.2 HINGES, GENERAL

A. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

B. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Stainless steel, with stainless-steel pin.

C. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors.

D. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head; machine screws, drilled and tapped holes, for metal doors. Finish screw heads to match surface of hinges.

2.3 HINGES

A. Butts and Hinges: BHMA A156.1.

B. Template Hinge Dimensions: BHMA A156.7.

C. Available Manufacturers:

1. Baldwin Hardware Corporation (BH).
2. Bommer Industries, Inc. (BI).
3. McKinney Products Company; an ASSA ABLOY Group company (MCK).
4. PBB, Inc. (PBB).
5. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

2.4 LOCKS AND LATCHES, GENERAL

A. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Lock Trim:

1. Levers: Provide as specified ro equal configuration to Yale Augusta - AUR

2. Dummy Trim: Match lever lock trim and escutcheons.

D. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors.

E. Backset: 2-3/4 inches, unless otherwise indicated.

F. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set.

2.5 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:

1. Mortise Locks: BHMA A156.13.

B. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13, Grade 1; Series 1000.

1. Available Manufacturers:

a. Adams Rite Manufacturing Co. (ARM).
b. Best Access Systems; Div. of The Stanley Works (BAS).
c. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
d. Folger Adam Security Inc.; an ASSA ABLOY Group company (FAS).
e. Falcon Lock; an Ingersoll-Rand Company (FAL).
f. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
g. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
h. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).

2.6 EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1.

B. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

D. Outside Trim: Lever or Lever with cylinder material and finish to match locksets, unless otherwise indicated.

1. Match design for locksets and latchsets, unless otherwise indicated.

E. Through Bolts: For exit devices and trim on metal doors.

F. Available Manufacturers:

1. Adams Rite Manufacturing Co. (ARM).
2. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
3. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
4. Precision Hardware, Inc. (PH).
5. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
6. Von Duprin; an Ingersoll-Rand Company (VD).
7. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).

2.7 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5, Grade 1.

B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Five.

C. Permanent Cores: Manufacturer's standard; finish face to match lockset; with removable cores.

D. Construction Keying: Comply with the following:

1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
2. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

a. Furnish permanent cores to Owner for installation.

E. Manufacturer: Same manufacturer as for locks and latches.

F. Available Manufacturers:

1. ABLOY Security, Inc.; an ASSA ABLOY Group company (ABL).
2. Arrow USA; an ASSA ABLOY Group company (ARW).
3. ASSA, Inc.; an ASSA ABLOY Group company (ASA).
4. Best Access Systems; Div. of The Stanley Works (BAS).
5. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
6. Falcon Lock; an Ingersoll-Rand Company (FAL).
7. Medeco Security Locks, Inc.; an ASSA ABLOY Group company (MED).
8. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
9. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
10. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).

2.8 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference into master, grand master and great-grand master key system.

1. Existing System: Master key or grand master key locks to Owner's existing system.
2. Existing System: Re-key Owner's existing master key system into new keying system.

B. Keys: Nickel silver, permanently inscribed with a visual key control number and including the notation "DO NOT DUPLICATE."

1. Quantity: In addition to one extra key blank for each lock, provide three cylinder change keys and five master, grand master and great-grand master keys.

2.9 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5, Grade 2, wall-mounted metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

B. Cross-Index System: Multiple-index system for recording key information. Include three receipt forms for each key-holding hook. Set up by Installer.

2.10 OPERATING TRIM

A. Standard: BHMA A156.6.

B. Materials: Fabricate from stainless steel, unless otherwise indicated.

C. Available Manufacturers:

1. Burns Manufacturing Incorporated (BM).
2. Don-Jo Mfg., Inc. (DJO).
3. Forms + Surfaces (FS).
4. Hager Companies (HAG).
5. Hiawatha, Inc. (HIA).
6. IVES Hardware; an Ingersoll-Rand Company (IVS).
7. Rockwood Manufacturing Company (RM).
8. Trimco (TBM).

2.11 CLOSERS

A. Accessibility Requirements: Comply with the following maximum opening-force requirements:

1. Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.

C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

D. Surface Closers: BHMA A156.4, Grade 1. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

1. Available Manufacturers:

a. LCN Closers; an Ingersoll-Rand Company (LCN).
b. Norton Door Controls; an ASSA ABLOY Group company (NDC).
c. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).

2.12 PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:

1. Material: 0.050-inch thick stainless steel.
2. Available Manufacturers:

a. Baldwin Hardware Corporation (BH).
b. Hager Companies (HAG).
c. IVES Hardware; an Ingersoll-Rand Company (IVS).
d. Rockwood Manufacturing Company (RM).
e. Trimco (TBM).

2.13 STOPS AND HOLDERS

A. Combination Overhead Stops and Holders: BHMA A156.8, Grade 1.

B. Silencers for Door Frames: BHMA A156.16, Grade 1; neoprene or rubber; fabricated for drilled-in application to frame.

C. Available Manufacturers:

1. Architectural Builders Hardware Mfg., Inc. (ABH).
2. Baldwin Hardware Corporation (BH).
3. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
4. HES, Inc.; an ASSA ABLOY Group company (HES).
5. IVES Hardware; an Ingersoll-Rand Company (IVS).
6. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
7. Rockwood Manufacturing Company (RM).
8. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
9. Stanley Commercial Hardware; Div. of The Stanley Works (STH).
10. Trimco (TBM).

2.14 DOOR GASKETING

A. Standard: BHMA A156.22.

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

D. Gasketing Materials: ASTM D 2000 and AAMA 701/702.

E. Available Manufacturers:

1. Hager Companies (HAG).
2. M-D Building Products, Inc. (MD).
3. National Guard Products (NGP).
4. Pemko Manufacturing Co. (PEM).

2.15 THRESHOLDS

A. Standard: BHMA A156.21.

B. Accessibility Requirements: Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high for exterior doors.

C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch high.

D. Available Manufacturers:

1. Pemko Manufacturing Co. (PEM).
2. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).

2.16 FABRICATION

A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

B. Fasteners: Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Comply with NFPA 80 for fasteners of door hardware in fire-rated applications.

C. Finishes: BHMA A156.18, as indicated in door hardware sets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Steel Doors and Frames: Comply with DHI A115 Series. Drill and tap doors and frames for surface-applied door hardware according to ANSI A250.6.

B. Mounting Heights: Mount door hardware units at heights complying with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

3.2 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

3.3 DOOR HARDWARE SETS

Door Hardware Set No. 1: Hollow Metal doors, single leaf, swing type.
(See note #1 below)

No.	Item	Size	Notes
1 ½ PR	Butts		
1	Lockset		
1	Cylinder		
1	Closer		
2	Kickplate	10" x 34"	
1	Overhead Door Stop		Optional Hold-open
1	Exterior Tamper Plate		
1 set	Door Gasketing		
1	Door Top Weatherstrip		
1	Door Bottom Sweep		
1	Door Bottom Weatherstripping		Optional
1	Threshold		ADA Compliant

Door Hardware Set No. 2: Hollow Metal doors, single leaf, swing type.
(See note #1 below)

No.	Item	Size	Notes
1 ½ PR	Butts		
1	Exit Device		See note #2 below
1	Cylinder		
1	Closer		
2	Kickplate	10" x 34"	
1	Overhead Door Stop		Option: Hold-open
1	Exterior Tamper Plate		
1 set	Door Gasketing		
1	Door Top Weatherstrip		
1	Door Bottom Sweep		
1	Door Bottom Weatherstripping		Optional
1	Threshold		ADA Compliant

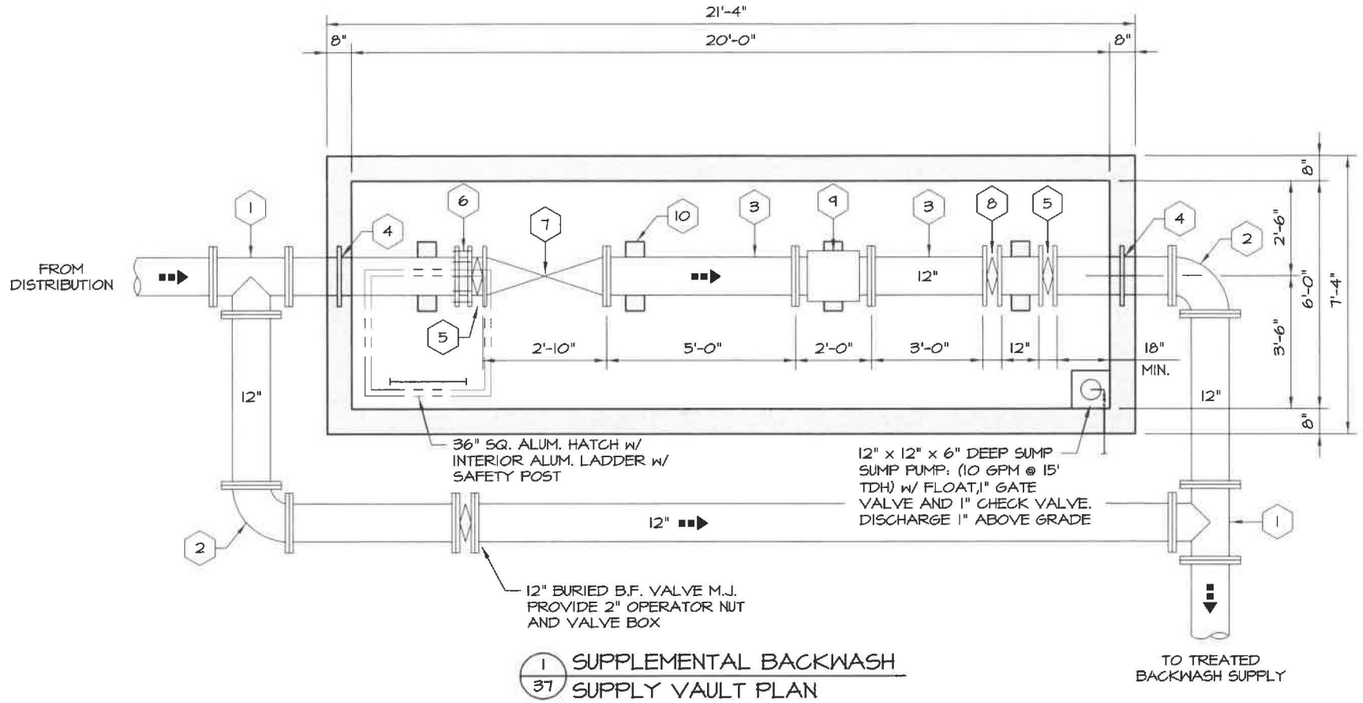
Door Hardware Set No. 3: Coiling Doors.

No.	Item	Size	Notes
1	Lock Cylinder		See note #3 below

Notes

1. Provide Hardware set #1 or #2 for Hollow Metal Doors. (Not Both)
2. Exit device options: Doggable, can be provided with or without exterior handles.
3. Coordinate with Coiling Door Manufacturer.

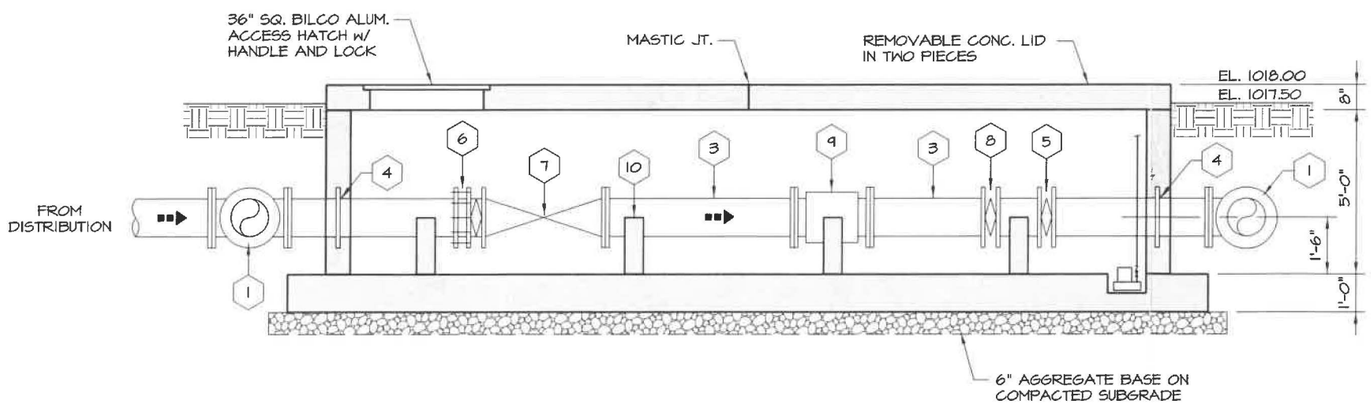
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1/37 SUPPLEMENTAL BACKWASH SUPPLY VAULT PLAN

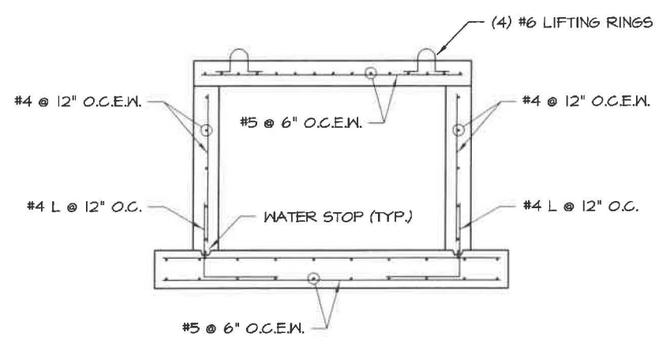
SCALE: 1/2" = 1'-0"

EQUIPMENT SCHEDULE	
MARK	DESCRIPTION
1	12" X 12" TEE MJxMJ
2	12" 90° BEND FLxFL
3	12" SPOOL PC. FLxFL
4	12" WALL PIPE PExPE
5	12" B.F. VALVE w/ HANDWHEEL OPERATOR
6	COUPLING ADAPTER
7	12" PRESSURE REDUCING VALVE FLxFL
8	12" B.F. VALVE w/ ELEC. OPERATOR
9	12" MAGNETIC METER FLxFL
10	CONCRETE PIPE SUPPORT (3 REQ'D.)



2/37 SUPPLEMENTAL BACKWASH SUPPLY VAULT SECTION

SCALE: 1/2" = 1'-0"



3/37 REINFORCING SECTION

SCALE: 1/2" = 1'-0"

BAR IS ONE INCH ON ORIGINAL DRAWING 0 — 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Holloway, Updike and Bellen, Inc.
215 EAST 33rd BOULEVARD MUSKOGEE, OKLAHOMA 918/682-7811

WATER TREATMENT PLANT IMPROVEMENTS
SHAWNEE MUNICIPAL AUTHORITY

Scale: As Shown	Detail: GPM
Date: 2020	Check: JRU

BACKWASH SUPPLEMENTAL SUPPLY VAULT
.

Proj. No. 19SHAWMTP
Sht. No. 37

Addendum No. 3

Water System Improvements
Water Treatment Plant Expansion
Shawnee Municipal Authority
Shawnee, Oklahoma

April 29, 2021

The plans and specifications on the above referenced project shall be and are hereby amended as follows:

I. PLANS

ITEM NO. 1: Use of Spoils

Spoils containing rocks or materials less than 2" in size (as available) may be used for the top 12" of the final grading.

ITEM NO. 2: High Service Pumps

Removed Pump Nos. 2 and 3 shall be delivered to the Owner. The Contractor shall dispose of Pump No. 1.

ITEM NO. 3: Sheet No. 6

1) Add plan sheet note – "Remove all abandoned piping within open excavations necessary for new work to extent possible. Plug open abandoned pipes with concrete into piping (3'-0" min) prior to backfill and show on record drawings locations and size."

2) Revise plan sheet demolition note stating 2'-0" below final grade to 3'-0" below final grade. Processed demolished concrete waste may be utilized as backfill within abandoned structures below 3'-0" of final grade and maximum size of 18". Haul off all metal, rebar and plastic demolished piping and materials.

ITEM NO. 4: Sheet No. 15

Add plan sheet note – "Contractor to coordinate and submit final construction joints wall and elevated slab joint layout with rebar submittal as required for rebar and required rebar laps. All construction joints shall include keyways and PVC waterstop."

ITEM NO. 5: Metal Building

As an option to painting the frame of the process building the Contractor may provide hot dipped galvanized pre-engineered building frame to include, but not limited to beams, purlins, braces and other frame components including, bolts, anchor bolts and fasteners. Galvanizing shall meet G90 galvanized coating on all members according to ASTM A123/A123M.

ITEM NO. 6: Sheet No. 37

Add note: "Update structure interior head height to 7'-0" ID and replace access shown with two 48"x48" Halliday aluminum 300# hatch. Locate one directly above the meter and the other for the ladder access/valves. Provide an aluminum access ladder at the wall for access near the pressure reducing valve and update hatch location for ladder and meter removal/maintenance. Lifting rings shown shall be 4ea per concrete panel with final locations by rebar submittal approval."

ITEM NO. 7: Plan Sheet S1

Add the following Notes to Drawing Sheet S1:

8. Additional corner, intersection and opening reinforcement is required. Refer to Drawing S11 for requirements.

9. All walls of the Clarifier Vacuum Chambers shall be cast monolithically. No walls joints will be permitted in chamber perimeter walls.

10. Contractor shall submit a pour schedule and color-coded drawings showing locations of all wall pours and cold joints for Engineer review prior to forming.

II. SPECIFICATIONS

ITEM NO. 1: Electrical Specifications

Add the attached Specification 13321 Fiber Optic Cabling and Equipment to the Specifications.

III. BID DOCUMENTS

ITEM NO. 1: Prebid Attendance List

A copy of the attendance list is attached.

A copy of this addendum shall be added to and made a part of each bid.

Sincerely,

HOLLOWAY, UPDIKE AND BELLEN, INC.



Jay Updike, P.E.
Vice President

JU/mm 19SHAWWTP

SIGN-IN

Prebid Conference

Water Treatment Plant Expansion

Shawnee Municipal Authority (SMA)

2:00 p.m. April 27, 2021

Name	Representing	Phone No.	Email
Jason Ray	HUB	918 698 1968	JRAY@HUBENGINEERS.COM
Rick Stovall	HUB	918-616-3138	r.stovall@hubengineers.com
Ken Dedmon	BRB Const.	785-290-1634	kenjohns one bdcontractors.com
Delton McCaskill	Downey Contracting	405-478-5277	bids@downeycontracting.com
Rusty Gillispie	Ramsey Ward Elect.	580-220-4218	rusty@ramseyward.com
Nathan Galle	Walters-Morgan Const. Inc.	785-539-7513	ngalle@waltersmorgan.com
KARL CRISWELL	DANE ELECTRIC	(405) 693-2669	KARL@DANEELECTRIC.com
DAVE KIMMEY	ENERCON ENG.	309-339-5005	DKimmey@ENERCON-ENR.com
Ricky Thompson	Wynn Construction	405.753.1120	bid@wynnconstruction.com
~~CHARLIE THOMPSON~~	~~ALL PHASE ELEC. INC~~	405-550-1601	~~APEINC94@SBCGLOBAL.NET~~

SIGN-IN

Prebid Conference

Water Treatment Plant Expansion

Shawnee Municipal Authority (SMA)

2:00 p.m. April 27, 2021

Name	Representing	Phone No.	Email
J. D Stamps	SMA		
Jacob Wickware	SMA	(405)273-0890	Jacob.Wickware@shawnee.ok.org
Mike Girdner	Worth Hydrochem	405-366-7729	mgirdner@worthok.com
Matt Green	Worth Hydrochem	405 866 7729	MGREEN@WORTHOK.COM
Richard Morrison	OIL CAPITAL ELECTRIC	918-625-6638	rmorrison@oce.us.com
Rod Lunkwitz	Archer Western Const.	972 4578500	RLUNKWITZ@WALSHGROUP.COM
Joel Coburn	Archer Western Const.	8175380005	JCOBURN@WALSHGROUP.COM
Adan Paramo	Libra Electric	405. 990-3381	adan2978@outlook.com
John Dawes	Libra Electric	405. 698.8241	johndawes@libraelectric.net

SECTION 13321

FIBER OPTIC CABLING AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Work of this Section includes providing a fiber optic communications infrastructure including, but not limited to, fiber optic cable (FOC), patch panels, terminations, testing, and implementation.

B. The Work includes testing individual fiber cables installed under this Contract, and testing a completed fiber optic communications network.

1.02 QUALITY ASSURANCE

A. The cable manufacturer shall be ISO9001 certified and registered.

B. The fiber optic cabling system materials furnished under this Section shall be provided by Fiber Optic Suppliers who have been providing these types of materials for the past three years. The Fiber Optic Suppliers shall provide personnel capable of providing technical assistance during installation.

C. The installation of fiber optic cabling system materials furnished under this Section shall be performed by an installation Contractor who has been installing these types of materials and systems for the past three years.

D. Supplier must furnish five working installation references.

1.03 DELIVERY, STORAGE, AND HANDLING

A. The cable shall be packaged in cartons and/or wound on spools or reels. Each package shall contain only one continuous length of cable. The packaging shall be constructed so as to prevent damage to the cable during shipping and handling.

B. When the length of an order requires a large wooden reel, the cable will be covered with a three-layer laminated protective material. The outer end of the cable shall be securely fastened to the reel head so as to prevent the cable from becoming loose in transit. The inner end of the cable shall project into a slot in the side of the reel or into housing on the inner slot of the drum, in such a manner and with sufficient length to make it available for testing.

C. Test tails shall be at least two meters long. The inner end shall be fastened so as to prevent the cable from becoming loose during shipping and installation. Reels shall be permanently marked with an identification number that can be used by the manufacturer to trace the manufacturing history of the cable and fiber.

D. Wooden reels shall be plainly marked to indicate the direction in which it should be rolled to prevent loosening of the cable on the reel.

E. All fiber optic cables shall be attenuated tested. The attenuation of each fiber shall be provided with each cable reel by the manufacturer.

F. The attenuation shall be measured at 1310 nm and 1550 nm for single-mode fibers and 850nm and 1300nm for multimode fiber cables after received on site. The manufacturer shall submit the test results prior to installation of the cable.

G. Packaging

1. The completed cable shall be packaged for shipment on non-returnable wooden reels. It is the responsibility of the Contractor to determine all required cable lengths.

2. Top and bottom ends of the cable shall be available for testing.

3. Both ends of the cable shall be sealed to prevent the ingress of moisture.

4. Each reel shall have a weatherproof reel tag attached identifying the reel and cable. The reel tag shall include the following information:

a. Cable Number Gross Weight.

b. Shipped Cable Length in Meters.

c. Product Number.

d. Date Cable was Tested.

e. Cable Length Markings Item Number.

H. Each cable shall be accompanied by a cable data sheet.

PART 2 PRODUCTS

2.01 GENERAL MATERIALS

A. Cabinets: cabinets shall be provided as indicated on the contract Drawings.

B. Provide tight buffered cables that are not gel filled and are suitable for indoor/outdoor applications. These cables shall be flame retardant for indoor applications and water and fungus resistant for outdoor applications.

C. Optical Fiber Characteristics

1. All fibers in the cable must be usable fibers and meet required specifications.

2. Each optical fiber shall consist of a doped silica core surrounded by a concentric silica cladding. The fiber shall be matched clad design.

3. Multi-mode: Provide multimode, optical glass fiber compatible with LED or laser based transmission systems with the following fiber types:

D. Manufacturers

1. Corning Cable Systems Corp.

2. CommScope.

3. Belden Cable.

4. Or equal.

2.02 STANDARD 62.5/125 μM FIBER

A. The multimode fiber shall meet EIA/TIA-492AAAA-A-1997, "Detail Specification for 62.5-□m Core Diameter/125-□m Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers."

Geometry

Core Diameter	(μm)	62.5 ± 3.0
Core Non-Circularity		≤ 5 %
Cladding Diameter	(μm)	125.0 ± 2.0
Cladding Non-Circularity		≤ 1.0 %
Core-to-Cladding Concentricity	(μm)	≤ 1.5
Coating Diameter	(μm)	245 ± 5
Colored Fiber Nominal Diameter	(μm)	253 - 259

Optical

Cabled Fiber Attenuation	(dB/km)	
850 nm		≤ 3.5
1300 nm		≤ 1.0
Point Discontinuity	(dB)	
850 nm		≤ 0.2
1300 nm		≤ 0.2
Cabled Effective Modal Bandwidth[1)]	(MHz•km)	
850 nm		≥ 220
IEEE 802.3 GbE Distance	(m)	
1000BASE-SX Window (850 nm)		up to 300
1000BASE-LX Window (1300 nm)		up to 550
OFL Bandwidth	(MHz•km)	
850 nm		≥ 200
1300 nm		≥ 500
Numerical Aperture		0.275 ± 0.015

1) As predicted by RML BW, per TIA/EIA 455-204 and IEC 60793-1-41, for *intermediate performance laser based systems* (up to 1 Gb/s).

2.03 LOOSE TUBE FIBER OPTIC CABLE (INDOOR/OUTDOOR)

A. Cable shall be flame-retardant, UV stabilized, fully water blocked with dielectric central member for use in indoor/outdoor applications. The buffer tubes shall be gel-free. Each buffer tube shall contain a water-swellable yarn for water-blocking protection. Cable manufacturer shall have a minimum of 20 years in manufacturing optical fiber cable in order to demonstrate reliable field performance. Cable and fiber manufacturer shall be the same company to ensure long-term reliability of the cabled fiber and to ensure the availability of fully integrated technical support. Cable shall be suitable for installation in duct, aerial, and riser environments. Cable shall meet UL OFNR specifications and not require transition splicing upon building entry in order to meet fire codes.

B. Optical fibers shall be placed inside a buffer tube.

C. Each buffer tube shall contain up to 12 fibers.

D. In buffer tubes containing multiple fibers, the colors shall be stable across the specified storage and operating temperature range and not subject to fading or smearing onto each other or into the gel filling material. Colors shall not cause fibers to stick together.

E. Buffer tubes shall be kink-resistant within the specified minimum bend radius.

F. Fillers may be included in the cable core to lend symmetry to the cable cross-section where needed.

G. The central anti-buckling member shall consist of a glass-reinforced plastic rod. The purpose of the central member is to prevent buckling of the cable.

H. The cable core shall contain a water-blocking material. The water-blocking material shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter and shall be readily removable with conventional non-toxic solvents. Cable shall contain water-blocking threads between tubes.

I. The cable shall contain at least one ripcord under the sheath for easy sheath removal.

J. Tensile strength shall be provided by a combination of high tensile strength dielectric yarns.

K. The high tensile strength dielectric yarns shall be helically stranded evenly around the cable core.

L. All dielectric cables (with no armoring) shall be sheathed with medium density polyethylene (MDPE). The minimum normal jacket thickness shall be 1.4 mm. Jacketing material shall be applied directly over the tensile strength members and water-blocking material. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

2.04 CABLE CONSTRUCTION

A. Riser Cables

1. Riser cables up to 24 fibers: In cables with more than one fiber, the fibers shall be stranded around a dielectric member and surrounded by layered aramid yarns. The aramid yarns shall serve as the tensile strength member of the cable. A ripcord may be applied between the aramid yarns and the outer jacket to facilitate jacket removal. The outer jacket shall be extruded over the aramid yarns for physical and environmental protection.

2. Riser cables with more than 24 fibers: The buffered fibers shall be grouped into six fiber subunits. In each subunit, the individual fibers shall be stranded around a dielectric central member and surrounded by layered aramid yarns. A ripcord shall be incorporated in the subunit design to facilitate access to the individual fibers. The subunit jacket shall be extruded over the aramid yarns for additional physical and environmental protection. The subunits shall be stranded around a dielectric central member. A ripcord shall be inserted beneath the outer jacket to facilitate jacket removal. The outer jacket shall be extruded around the units for physical and environmental protection.

B. Plenum Cables

1. Plenum cables up to 24 fibers: The fibers shall be stranded around a dielectric member and surrounded by layered aramid yarns. The aramid yarns shall serve as the tensile strength member of the cable. A ripcord may be applied between the aramid yarns and the outer jacket to facilitate jacket removal. The outer jacket shall be extruded over the aramid yarns for physical and environmental protection.

2. Plenum cables with 24 to 72 fibers: The buffered fibers shall be grouped into six fiber subunits. In each subunit, the individual fibers shall be stranded around a dielectric central member and surrounded by layered aramid yarns. A ripcord shall be incorporated in the subunit design to facilitate access to the individual fibers. The subunit jacket shall be extruded over the aramid yarns for additional physical and environmental protection. The subunits shall be stranded around a dielectric central member. A ripcord shall be inserted beneath the outer jacket to facilitate jacket removal. The outer jacket shall be extruded around the units for physical and environmental protection.

3. Plenum cables with more than 72 fibers: The buffered fibers shall be grouped into twelve fiber subunits. In each subunit, the individual fibers shall be stranded around a dielectric central member and surrounded by layered aramid yarns. A ripcord shall be incorporated in the subunit design to facilitate access to the individual fibers. The subunit jacket shall be extruded over the aramid yarns for additional physical and environmental protection. The subunits shall be stranded around a dielectric central member. A ripcord shall be inserted beneath the outer jacket to facilitate jacket removal. The outer jacket shall be extruded around the units for physical and environmental protection.

4. The strength member shall be a high modulus aramid yarn. The aramid yarns shall be helically stranded around the buffered fibers. Non-toxic, non-irritant talc shall be applied to the yarn to allow the yarns to be easily separated from the fibers and the jacket.

C. Cable Jacket

1. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness; jackets extruded under high pressure are not acceptable. The jacket shall be smooth, as is consistent with the best commercial practice. The jacket shall provide the cable with a tough, flexible, protective coating, able to withstand the stresses expected in normal installation and service.

2. The cable and subunit jacket color shall be orange for cables containing multimode fibers.

3. The cable and subunit jacket color shall be yellow for cables containing single-mode fibers.

4. For cables with more than two fibers, the cable jacket shall be designed for easy removal without damage to the optical fibers by incorporating a ripcord under each cable jacket. Non-toxic, non-irritant talc shall be applied to the aramid yarns to allow the yarns to be easily separated from the fibers and the jacket.

5. The nominal thickness of the cable outer jacket shall be sufficient to provide adequate cable protection while meeting the mechanical, flammability, low smoke, and environmental test requirements of this document over the life of the cable.

D. The cable shall be all-dielectric.

2.05 CABLE IDENTIFICATION

A. The individual fibers shall be color coded for identification. The optical fiber color coding shall be in accordance with EIA/TIA-598, "Color Coding of Fiber Optic Cables." The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color coded buffered fibers shall not adhere to one another. When fibers are grouped into individual units, each unit shall be numbered in the unit jacket for identification. The number shall be repeated at regular intervals.

B. The outer cable jacket shall be marked with the manufacturer's name or UL file number, date of manufacture, fiber type, flame rating, UL symbol, and sequential length markings every two feet. The markings shall be in contrasting color to the cable jacket.

2.06 CABLE TESTING REQUIREMENTS

A. The Contractor shall submit laboratory test reports on representative samples of similar cable design to demonstrate compliance prior to cable installation.

2.07 FIBER CABLE TERMINATIONS, CONNECTORS, AND CABLE ASSEMBLIES

A. Pigtail Splicing

1. For termination of fiber cables at a termination or connector panel (patch panel), with one end of a piece of cable preconnectorized and the other end unterminated for splicing to

the cable that needs to be terminated. Splicing and connectors shall meet the requirements listed in this Section.

2. A splice/termination tray shall house the splices and serve to fully protect excess lengths of loose tube fibers from exposure. Splice tray shall be compatible with the selected patch panel and installed for easy access to the spliced cable sections.

3. Pigtail assemblies shall match fiber cable type and model and shall be as manufactured by Corning Cable Systems or equal.

B. Buffer Tube Fan-Out Kits

1. Individual fibers within a loose tube cable with 250 μm coated fibers shall use a fan-out kit to maintain flexibility and ease of handling fibers within a termination cabinet. Fan-out kits shall be installed in the patch panel enclosures to transition the loose tube fibers to ruggedized tight-buffered fiber pigtail cables. Optical fusion splices shall connect the loose tube fibers to the tight-buffered pigtail cables. The optical splice loss shall comply with the specifications for optical splices. Splice protection sleeves shall be employed on all splices to protect the splices.

2. The tight-buffered pigtails shall be factory-preconnectorized with STTM connectors as specified.

C. Connectors (Cable Assemblies)

1. The fiber optic communications system shall utilize stainless steel ST style connectors for all fiber optic connections. SC style connectors will be acceptable only if ST style connectors are not compatible with the equipment being provided. The connectors shall be designed for use with 50/62.5/125/250 micron cable. Each connector shall cause a maximum signal attenuation of 1.6 dB.

   a. Insertion loss (typical): 0.3 dB

   b. Durability (mating cycles): 500 (minimum)

   c. Repeatability: Less than 0.2 dB

   d. Operating Temperature: 0 to plus 60 degrees C]

2. After termination with connectors, the fiber ends must be visually inspected at a magnification of not less than 100 power for multimode and 200x for single mode to check for cracks or pits in the endface of the fiber.

3. Connectors shall have a maximum allowable connection loss of 0.3 dB per mated pair, as measured per EIA-455-34. No index-matching gel is to be used; dry interfaces only.

4. Each connector shall be of the industry standard ST type compatible; designed for single-mode and multimode tolerances; shall meet or exceed the applicable provisions of EIA-455-5, 455-2A, and 455-34; and shall be capable of 100 repeated ratings with a maximum loss increase of 0.1 dB. Connectors shall incorporate a key-way design and shall have a Zirconia ceramic ferrule. Connector bodies and couplings shall be made of corrosion-

resistant and oxidation-resistant materials such as nickel-plated zinc, designed to operate in humid environments without degradation of surface finishes. Connectors shall be capable of operating in a range of -40 to 80 degrees C.

5. Manufacturers

   a. Corning Cable Systems, Hickory, NC

   b. AMP, Inc., Harrisburg, PA

   c. 3M Telecom Systems Group, Austin, TX or equal.

D. Fiber Optic Patch Cables

1. Fiber optic patch cable shall be two-fiber zipcord 50/62.5/125 core/clad micron multimode riser rated cable.

2. Installation of patch cables shall include all spares and observe the minimum fiber bend radius and strain relief.

2.08 FIBER OPTIC TERMINATION PATCH PANELS

A. General

1. Patch panels shall be suitable for wall mounting, comprised of internal mounting plate, cable holders, slack cable take up/organizer blocks, patch block with connectors, and ground lugs as indicated. Panels shall be NEMA 4X, 316 stainless steel construction for outdoors; and NEMA 12, 316 stainless steel or fiberglass for indoor use. Patch panels shall be suitable for multimode system operation at 800 and 1300 nanometers. Patch panels shall be suitable for ST or LC connectors. The patch panels shall be sized to handle the number of fibers as required. All fibers shall be terminated in the patch panel.

2. Where shown on the plans or in the related specification Sections, the fiber optic cable shall terminate inside a communications cabinet on a termination patch panel. All fiber sub-cables within the exposed buffer tube shall be terminated with fan-out kits with preconnectorized pigtails. The patch panel shall have a fiber capacity equal to the total number of fibers (connected and spare) for all cables to be connected.

3. Unused buffer tubes shall be uncut and looped within the patch panel for continuous routing of the fiber buffer tube within the cable assembly.

4. Patch panels shall be designed for either rack mounting on a standard equipment rack or housed in an enclosure for direct wall mounting. The patch panel shall contain "ST" type bayonet or LC couplings. All unused couplings shall have protective dust covers. All panels shall be furnished with locking doors.

5. Factory-terminated, tight-buffered, aramid-reinforced fiber optic jumper assemblies or interconnect cables, standard 3.0-mm O.D., shall connect the optical cable terminations to the patch panel couplings.

6. The termination patch panel shall be equipped with a suitable means for routing and securing of cables, and shall provide a suitable means of protection for the mounted fiber connectors to prevent damage to fibers and connectors during all regular operation and maintenance functions. All cables shall be provided with strain relief. Bend diameters on cable fibers and jumpers must be greater than four inches at all times to ensure optical and mechanical integrity of the optical fibers.

7. Termination panels shall be equipped with splice trays (where applicable) and holders for pigtail and through fiber splicing.

8. Termination panels shall be provided with all hardware, options, and accessories to provide for a complete installation of the fiber optic system.

9. Panels shall be as manufactured by Corning Cable Systems LANscape or equal.

B. Rack Mount Fiber Distribution Center (FDC) Splice Housing

1. A rack-mountable Fiber Distribution Center splice housing shall be provided for pigtail splicing and through fiber splicing equipment.

2. The splice housing shall be compatible with the FDC for interconnection of the splicing equipment with the fiber cable management, termination, and distribution rack equipment.

3. Splice trays shall be provided for pigtail splicing.

4. The splice housing shall be sized and equipped with sufficient capacity to terminate and feed through all required fiber cable, plus an additional 20 percent.

5. Provide one spare splice tray.

6. Splice housing shall be Corning Cable Systems LANscape CSH series.

C. Rack Mount Fiber Distribution Center (FDC)

1. The Fiber/Network equipment rack shall be supplied with two rack-mountable Fiber Distribution Centers (FDCs) capable of 48 ST fiber termination points each. The connector center shall be 19" rack-mountable and provide for internal fan-out, splicing, and connection of the fiber optic cable to front panel ST connection patch panel.

2. The FDC shall provide backbone and intermediate connects and cable strain relief for a maximum of five fiber cable systems. The front shall be swing open construction with keyed latch mechanism.

3. The FDC shall be compatible for interconnection with the FDC Splice Housing and provide space and support the addition of fiber cable splice trays for future cable connection and termination.

4. The Fiber Connection Center shall be Corning Cable Systems LANscape CCH series.

D. Wall/Panel Mount Fiber Distribution Center (WDC)

1. The field-mounted fiber termination enclosures shall be supplied with a Wall Mount Fiber Distribution Center (WDC) capable of 48 ST fiber termination points. The distribution center shall be panel-mounted and provide for internal fan-out, splicing, and connection of the fiber optic cable to the patch panel assemblies.

2. Splice trays shall be provided for pigtail splicing. The WDC shall be provided with pass-thru splice trays for continuation of the fiber cable system to additional sites.

3. Provide one spare splice tray.

4. The WDC shall provide space and support the addition of future fiber cable splice trays.

5. The Wall Mount Fiber Distribution Center shall be Corning Cable Systems LANscape (WCH) series.

PART 3 EXECUTION

3.01 GENERAL

A. Provide all material, equipment, and labor to test and integrate the fiber optic system as indicated and as specified.

B. Installation shall comply with EIA/TIA Standards 568 and 569.

C. Fiber optic cables shall be continuous from component to component. Intermediate fiber splices shall not be allowed.

D. Provide delivery, storage, and handling of materials and equipment in accordance with Section 01600.

3.02 IDENTIFICATION

A. Label each termination point.

B. Label each cable, buffer tube, and fiber with permanent waterproof typewritten tags.

3.03 PHYSICAL CHECKOUT

A. General Procedures

1. Conduct physical checkout of the fiber optic data highway network.

2. Physical checkout shall be performed prior to functional testing.

B. Check Procedures

1. Verify that fiber optic cable reels have been off-loaded from truck carefully and not damaged.

2. Submit to the Engineer all test data provided by the fiber manufacturer.

3. Verify that the optical fibers of the cable assembly are the type and quantity as specified and as recommended by the Instrumentation System Supplier.

4. Verify that cable construction is the type specified.

5. Verify that fiber optic patch panels have been installed plumb and level at locations indicated.

6. Verify that optical fiber connections or terminations within patch panels and splice closures are in accordance with cable manufacturer's recommendations.

3.04 FIBER OPTIC CABLE TESTING

A. General: The Contractor shall perform pre-installation and post-installation FOC tests. The Construction Manager shall be notified a minimum of 10 days in advance so that these tests are witnessed. All test equipment shall be traceable to NIST standards.

B. Test equipment: The Contractor shall use the following to perform pre-installation and post-installation FOC tests:

1. Optical time domain reflectometer (OTDR). The OTDR shall be laser precision, and be able to test single mode or multimode systems with a visual fault locator. The OTDR shall be as manufactured by Corning, Agilent Technologies, Fluke Networks, or equal.

C. Pre-installation Tests

1. The purpose of these tests is to perform acceptance tests on the cable prior to installation to verify that the cable conforms to the manufacturer's specifications; is free of defects, breaks, and damages by transportation and manufacturing processes; and to provide baseline readings in dB.

2. Prior to removal of each cable from the delivery reel, all optical fibers within the cables shall be tested by the Contractor using an OTDR. The OTDR tests shall consist of end-to-end length and fiber attenuation (dB/km) measurements to ensure proper performance of the fiber optic cable. The tests shall be performed from both ends of each fiber to ensure complete fiber continuity within the cable structure.

3. Pre-installation, "on-reel" test results shall be compared with the manufacturer's test report delivered with the cable. Gross dissimilarities shall be noted and remedied between the Contractor and manufacturer. In all cases, all fibers must meet the optical attenuation specifications prior to cable installation.

4. The Contractor shall perform tests on all reels of cable. The Construction Manager shall be notified a minimum of 15 days prior to any test.

5. The Contractor shall document each test and submit the report to the Construction Manager for review. Documentation shall consist of both hard copy and 3.5 inch electronic disk complete with all application software.

6. Cable shall not be installed until the Construction Manager has reviewed the test report.

7. Maximum allowable attenuation is 0.5 dB/km at 1310 and 1550 nm. The Contractor shall replace any cable in which any fiber does not meet this requirement.

D. Post-installation tests: After FOC has been installed and connectorized, the following tests shall be performed:

1. Visually inspect terminal connectors for out-of-round condition and surface defects such as micro-chips and cracks using a 200X (minimum) inspection microscope.

2. A recording OTDR shall be used to test for end-to-end continuity and attenuation of each optical fiber. The OTDR shall have an X-Y plotter to provide a hard copy record of each trace of each fiber. The OTDR shall be equipped with sufficient internal masking to allow the entire cable section to be tested. This may be achieved by using an optical fiber pigtail of 30 feet or more to display the required cable section.

3. The maximum permissible end-to-end loss shall be 0.5 dB/km. The Contractor shall replace any cable in which any fiber does not meet this requirement.

4. The OTDR shall be calibrated for the correct index of refraction to provide proper length measurement for the known length of reference fiber.

5. A transmission test shall be performed with the use of a 1310 and 1550 nm stabilized light sources and 1310 nm/1550 nm power meters for SMF. This test shall be conducted in both directions on each fiber of each cable.

6. Hard and electronic copies of test documentation shall be submitted to the Construction Manager. The documentation shall include:

a. The trace plot.

b. Index.

c. dB/km loss.

d. Cable length.

e. Date and time of test.

f. Wavelength.

g. Pulse width.

h. The test site.

i. Cable ID.

j. Fiber number and type.

k. Operator's initials.

7. The Contractor shall compare the pre-installation test results to the post-installation results. If a deviation of greater than one dB occurs, the Construction Manager shall be

notified in writing by the Contractor, and the cable shall be removed and replaced at no additional cost to the OWNER.

8. Upon completion of the previous tests, all FOC coils shall be secured with ends capped to prevent intrusion of dirt and water.

E. Certification of completion of pre- and post-fiber installation testing including test results shall be provided to the Engineer, Contractor, and Ozone Control System Supplier. Test results shall be submitted on paper in a binder, including results indicated in tables or a spreadsheet. Test results that exceed specification limits shall be noted. The electronic copy shall be included in the binder.

F. Required OTDR Trace Information

1. All traces shall display the entire length of cable under test, highlighting any localized loss discontinuities (installation-induced losses and/or connector losses). The trace shall display fiber length (in kilofeet), fiber loss (dB), and average fiber attenuation (in dB/km), as measured between two markers placed as near to the opposite ends of the fiber under test as is possible while still allowing an accurate reading. Care shall be taken to ensure that the markers are placed in the linear region of the trace, away from the front-end response and far-end Fresnel reflection spike. Time averaging shall be used to improve the display signal to noise ratio. The pulse width of the OTDR shall be set to a sufficient width to provide adequate injected power to measure the entire length the fiber under test.

2. If connectors exist in the cable under test, then two traces shall be recorded. One trace shall record the fiber loss (dB) and average attenuation (dB/km) of the entire cable segment under test, including connectors. The second trace shall display a magnified view of the connector regions, revealing the connector losses (dB). All connector losses shall be measured using the five-point splice loss measurement technique.

3. The OTDR trace shall also include the following information:

   a. The date and time of the test.

   b. The cable ID number.

   c. The cable segment ID number.

   d. The fiber color or sub-cable number.

   e. Launch point connector number.

   f. The optical wavelength used for the test.

   g. The refractive index setting of the OTDR.

   h. The pulse width setting of the OTDR.

   i. The averaging interval of the test.