

Blackmon, Amanda

From: Blackmon, Amanda
Sent: Monday, November 9, 2020 7:21 AM
To: Blackmon, Amanda
Subject: FW: Flippin - WWTF Improvements
Attachments: Form1-executed.pdf; Form2A-executed.pdf; DesignCalculation-stamped.pdf; FEMA - Firmette.pdf; Topographic map.pdf

From: John Selig [<mailto:jselig@ce-associates.biz>]
Sent: Friday, November 6, 2020 2:46 PM
To: Water Permit Application
Subject: Flippin - WWTF Improvements

Dear Sir/Madam,

Attached are copies of the executed permit application forms for the above-referenced project. Also attached are copies of my design calculations for the oxidation ditch and clarifiers, the FEMA Firmette, and a topographic map depicting the approximate location of the existing WWTF. Because of the size of the files, I am attaching links that can be utilized to access and download the detailed construction drawings and the project manual (including the technical specifications) for the proposed improvements. Please review this information and advise me of any additional information that might be necessary in order to declare this application administratively complete.

The City of Flippin has contacted its laboratory concerning the sampling for the parameters in Table B. As soon as the samples are pulled and the results available, Table B will be completed and submitted.

Thank you for your cooperation in this matter. If you should have any questions or comments, do not hesitate to call me at 870-273-4185, or you can reach me via email.

<https://ceassoc.sharepoint.com/:b:/g/EbC-aUzs8PtPqMQYtikNSTkBYleEbVpp2DxwXW4TJWJrlw?e=gzgjB>

https://ceassoc.sharepoint.com/:b:/g/ESWzFY0MQXRBmWk4Zmc5d0gB4qqK4ulbw6uV2tr2Pog9_Q?e=vml3kw

John S. Selig, P.E.
Civil Engineering Associates, LLC
2114 East Matthews Avenue
Jonesboro, Arkansas 72401
(870) 972-5316

NPDES PERMIT APPLICATION
FORM 1

ARKANSAS DEPARTMENT OF ENERGY AND ENVIRONMENT
DIVISION OF ENVIRONMENTAL QUALITY - OFFICE OF WATER QUALITY
5301 Northshore Drive
North Little Rock, AR 72118-5317
www.adeq.state.ar.us/water

PURPOSE OF THIS APPLICATION

- INITIAL PERMIT APPLICATION FOR NEW FACILITY
- INITIAL PERMIT APPLICATION FOR EXISTING FACILITY
- MODIFICATION OF EXISTING PERMIT
- REISSUANCE (RENEWAL) OF EXISTING PERMIT
- MODIFICATION AND CONSTRUCTION OF EXISTING PERMIT
- CONSTRUCTION PERMIT

SECTION A- GENERAL INFORMATION

1. Legal Applicant Name (The permit will be issued under this name. This is the entity that controls and is responsible for operations and compliance.):

City of Flippin

Note: The legal name of the applicant must be identical to the name listed with the Arkansas Secretary of State.

2. Operator Type: Private Municipality State Federal Partnership Corporation Other
State of Incorporation: _____

3. Facility Name: Flippin Wastewater Treatment Facility

4. Is the legal applicant identified in number 1 above the owner of the facility? Yes No

5. NPDES Permit Number (If Applicable): AR0021717

6. NPDES General Permit Number (If Applicable): ARG

7. NPDES General Storm Water Permit Number (If Applicable): ARR00

8. Permit Numbers and/or names of any permits issued by ADEQ or EPA for an activity located in Arkansas that is presently held by the applicant or its parent or subsidiary corporation which are not listed above:

| <u>Permit Name</u> | <u>Permit Number</u> | <u>Held by</u> |
|--------------------|----------------------|----------------|
| | | |
| | | |

9. Give driving directions to the wastewater treatment plant with respect to known landmarks:

Go one block north of East Main on Eighth Street, then turn East on Industrial Drive. Follow Industrial Drive to dead-end at the treatment facility.

10. Facility Physical Location: (Attach a map with location marked; street, route no. or other specific identifier)

Street: 222 East Industrial Drive

City: Flippin County: Marion State: Arkansas Zip: 72634

11. Facility Mailing Address for permit, DMR, and invoice (Street or Post Office Box):

Name: Flippin Wastewater Treatment Facility Title: _____
Street: _____ P.O. Box P.O. Box 40
City: Flippin State: Arkansas Zip: 72634
E-mail address*: cofmaintenance@hotmail.com Fax: 870-453-5722

* Is emailing all documents (permit, letters, DMRs, invoices, etc.) acceptable to the applicant? Yes No

12. Neighboring States Within 20 Miles of the permitted facility (Check all that apply):

Oklahoma Missouri Tennessee Louisiana Texas Mississippi

13. Indicate applicable Standard Industrial Classification (SIC) Codes and NAICS codes for primary processes (See Item #3 of the instructions for assistance in determining the correct SIC and NAICS Codes):

4952 SIC Facility Activity under this SIC or NAICS:
221320 NAICS _____

14. Design Flow: 0.35 MGD Highest Monthly Average of the last two years Flow: 0.429 MGD

15. Is the outfall equipped with a diffuser? Yes No

16. Responsible Official (as described on the last page of this application):

Name: Jerald Marberry Title: Mayor
Address: P.O. Box 40 Phone Number: 870-453-8300
E-mail Address: jgmmarberry@gmail.com
City: Flippin State: Arkansas Zip: 72634

17. Cognizant Official (Duly Authorized Representative of responsible official as described on the last page of this application):

Name: J.L. Wagoner Title: Public Works Director
Address: P.O. Box 40 Phone Number: 870-453-8300
E-mail Address: cofmaintenance@hotmail.com
City: Flippin State: Arkansas Zip: 72634

18. Name, address and telephone number of active consulting engineer firm (If none, so state):

Contact Name: John S. Selig, P.E.
Company Name: Civil Engineering Associates, LLC
Address: 2114 East Matthews Avenue Phone Number: 870-972-5316
E-mail Address: jselig@ce-associates.biz
City: Jonesboro State: Arkansas Zip: 72401

19. Wastewater Operator Information

Wastewater Operator Name: J.L. Wagoner License number: 010535
Class of municipal wastewater operator: I II III IV
Class of industrial wastewater operator: Basic Advanced

SECTION B: FACILITY AND OUTFALL INFORMATION

1. Facility Location (All information must be based on the **front door (gate)** location of the facility). A topographic map must be submitted. See Item #5 of the instructions for additional details.:

Lat: 36 ° 16 ' 56 " Long: 92 ° 35 ' 03 "

2. Outfall Information (If more than two outfalls, add additional pages)

Outfall 001

End-of-Pipe

Location: Latitude: 36 ° 17 ' 00 " Longitude: 92 ° 35 ' 10 "

Monitoring

Location: Latitude: 36 ° 16 ' 59 " Longitude: 92 ° 35 ' 06 "

Description of outfall location: Pipe into Fallen Ash Creek to the west of the WWTF

Name of Receiving Stream (i.e. an unnamed tributary of Mill Creek, thence into Mill Creek; thence into Arkansas River):

Fallen Ash Creek, thence into the White River in Segment 4I of the White River

Type of Treatment system (Include all components of the treatment system and attach the process flow diagram):

Screening, grit removal, oxidation ditch, final clarifiers, ultra violet disinfection, post aeration. Sludge will be held in a lagoon.

How are effluent samples collected?

Grabbed at the end of the post aeration basin

How is flow measured, i.e., v-notch weir, totalizing meter, Parshall flume, etc.?

V-notch weir with ultra-sonic flow meter (instantaneous flow plus totalizing)

Outfall

End-of-Pipe

Location: Latitude: _____ ° _____ ' _____ " Longitude: _____ ° _____ ' _____ "

Monitoring

Location: Latitude: _____ ° _____ ' _____ " Longitude: _____ ° _____ ' _____ "

Description of outfall location: _____

Name of Receiving Stream (i.e. an unnamed tributary of Mill Creek, thence into Mill Creek; thence into Arkansas River):

Type of Treatment system (Include all components of the treatment system and attach the process flow diagram):

How are effluent samples collected?

How is flow measured, i.e., v-notch weir, totalizing meter, Parshall flume, etc.?

3. Is the proposed or existing facility located above the 100-year flood level? Yes No

NOTE: FEMA Map must be included with this application. Maps can be ordered at www.fema.gov.

If "No", what measures are (or will be) used to protect the facility? _____

4. Population for Municipal and Domestic Sewer Systems: 1,355

5. Backup Power Generation for Treatment Plants

Are there any permanent backup generators? Yes No

If Yes, how many? 1 Total Horsepower (hp)? 300 kW

If no, check one of the following.

- Portable generator is available.
- The WWTP does not require power to operate.
- Operations at the facility will cease if power is not available.
- The WWTP has sufficient capacity to hold influent until power is restored.
- Other, please explain _____

SECTION C – WASTE STORAGE AND DISPOSAL INFORMATION

1. Solids/Sludge Disposal Method (Check as many as are applicable):

Solids are not produced at this facility.

Landfill:

Landfill Site Name _____ ADEQ Solid Waste Permit No. _____

Land Application: ADEQ State Permit No. _____

Septic tank: Arkansas Department of Health Permit No.: _____

Distribution and Marketing: Facility receiving sludge:

Name: _____ Address: _____

City: _____ State: _____ Zip: _____ Phone: _____

Rail: _____ Pipe: _____ Other: _____

Subsurface Disposal (Lagoon for which the sole purpose is storing sludge):

Location of lagoon _____ How old is the lagoon? _____

Surface area of lagoon: _____ Acre Depth: _____ ft Does lagoon have a liner? Yes No

Incineration: Location of incinerator _____

Remains in Treatment Lagoon(s):

How old is the lagoon(s)? _____ Has sludge depth been measured? Yes No

If Yes, Date measured? _____ Sludge Depth? _____ ft If No, When will it be measured? _____

Has sludge ever been removed? Yes No If Yes, When was it removed? _____

Other (Provide complete description): Sludge holding pond

SECTION D - WATER SUPPLY

Water Sources which are downstream of the outfall location, i.e., those which could be affected by the discharge from this facility (check as many as are applicable):

None

Private Well - Distance from Discharge point: Within 5 miles Within 50 miles

Municipal Water Utility (Specify City): Flippin

Distance from Discharge point: Within 5 miles Within 50 miles

Surface Water- Name of Surface Water Source: _____

Distance from Discharge point: Within 5 miles Within 50 miles

Lat: _____ ° _____ ‘ _____ “ Long: _____ ° _____ ‘ _____ “

Other (Specify): _____

Distance from Discharge point: Within 5 miles Within 50 miles

SECTION E: TRUST FUND REQUIREMENTS AND DISCLOSURE STATEMENT

1. Ark. Code Ann. § 8-4-203(b)(1)(A) forbids the Arkansas Department of Energy and Environment – Division of Environmental Quality (DEQ) from issuing, modifying, renewing, or transferring a permit for a nonmunicipal domestic sewage treatment works without the applicant first fulfilling the trust fund requirements set forth in that section. Ark. Code Ann. § 8-4-203(b)(1)(B) defines “nonmunicipal domestic sewage treatment works” as a device or system operated by an entity other than a city, town, or county that treats, in whole or in part, waste or wastewater from humans or household operations and must continually operate to protect human health and the environment despite a permittee’s failure to maintain or operate the device or system. NDSTW’s can include, but are not limited to:

- Sewer Improvement Districts;
- Subdivisions,
- Mobile Home Parks,
- Property Owner’ Associates,
- RV parks, and
- Apartments

Exclusions Excluded from this application’s Section E.1. requirements for trust fund contribution fees are:

- State or federal facilities,
- Schools,
- Universities and colleges,
- Public facilities boards and public water authorities,
- Entities that continuously operate due to a connection with a city, town, or county, and
- Commercial or industrial entity that treats domestic sewage from its operations and does not accept domestic sewage from other entities or residences.

The trust fund form may be obtained from the DEQ web site at:

<http://www.adeg.state.ar.us/water/permits/npdes/individual/pdfs/ndstw-trust-fund-certification-form.pdf>

2. Disclosure Statement:

Ark. Code Ann. 8-1-106 requires that applicants for any type of permit or transfer of any permit, license, certification or operational authority issued by the DEQ file a Disclosure Statement with their application unless exempt for doing so under Ark. Code Ann. §8-1-106(b)(2). The filing of a Disclosure Statement is mandatory. No application can be considered administratively complete without a completed Disclosure Statement unless that facility is exempt. Publicly traded companies may submit the most recent 10k and 10Q filings to the Securities and Exchange Commission in lieu of the Disclosure Statement. The form may be obtained from the ADEQ web site at:

https://www.adeg.state.ar.us/ADEQ_Disclosure_Statement.pdf

NOT APPLICABLE (N/A):

SECTION F – INDUSTRIAL ACTIVITY

1. Does an effluent guideline limitation promulgated by EPA ([Link to a Listing of the 40 CFR Effluent Limit Guidelines](#)) under Section 304 of the Clean Water Act (CWA) apply to your facility?

YES (Answer questions 2 and 3) NO

2. What Part of 40 CFR? _____

3. What Subpart(s)? _____

4. Give a brief description of all operations at this facility including primary products or services (attach additional sheets if necessary):

5. Production: (projected for new facilities)

| Product(s) Manufactured (Brand name) | Last 12 Months | | Highest Production Year of Last 5 Years | |
|---|----------------|-------------------|---|-------------------|
| | lbs/day* | | lbs/day* | |
| | Highest Month | Days of Operation | Monthly Average | Days of Operation |
| | | | | |
| | | | | |
| | | | | |

* These units could be off-lbs, lbs quenched, lbs cleaned/etched/rinsed, lbs poured, lbs extruded, etc.

| No. | Dilution (e.g., Cooling Water) | Average Flow (GPD) | Maximum Flow (GPD) | Type of Discharge (batch, continuous, none) |
|-----|-----------------------------------|-----------------------|-----------------------|--|
| | | | | |
| | | | | |

If batch discharge occurs or will occur, indicate: [New facilities may estimate.]

Number of batch discharges: _____ per day Average discharge per batch: _____ (GPD)

Time of batch discharges _____ at _____
(days of week) (hours of day)

Flow rate: _____ gallons/minute Percent of total discharge: _____

3. Do you have, or plan to have, automatic sampling equipment or continuous wastewater flow metering equipment at this facility?

| | | | | | | | | |
|----------|--------------------|--------------------------|-----|-------------|--------------------------|----|-----|--------------------------|
| Current: | Flow Metering | <input type="checkbox"/> | Yes | Type: _____ | <input type="checkbox"/> | No | N/A | <input type="checkbox"/> |
| | Sampling Equipment | <input type="checkbox"/> | Yes | Type: _____ | <input type="checkbox"/> | No | N/A | <input type="checkbox"/> |
| Planned: | Flow Metering | <input type="checkbox"/> | Yes | Type: _____ | <input type="checkbox"/> | No | N/A | <input type="checkbox"/> |
| | Sampling Equipment | <input type="checkbox"/> | Yes | Type: _____ | <input type="checkbox"/> | No | N/A | <input type="checkbox"/> |

If yes, please indicate the present or future location of this equipment on the sewer schematic and describe the equipment below:

4. Are any process changes or expansions planned during the next three years that could alter wastewater volumes or characteristics?

Yes No (If no, skip Question 5)

5. Briefly describe these changes and their effects on the wastewater volume and characteristics:

SECTION H -TECHNICAL INFORMATION

Technical information to support this application shall be furnished in appropriate detail to understand the project. Information in this Part is required for obtaining a **construction permit** or for **modification** of the treatment system.

1. Describe the proposed construction activity. Include the types of control equipment to be installed along with their methods of operation and control efficiency.

A new influent lift station will be installed, a new headworks system (both screening & grit removal) will be installed, an additional oxidation ditch will be installed adjacent to the existing ditch, two new 28' diameter clarifier will be installed to replace the existing clarifiers, a new sludge hold pond will be installed.

2. One set of construction plans and specifications, approved (signed and stamped) by a **Professional Engineer (PE)** registered in **Arkansas**, must be submitted as follows:
 - a. The plans must show flow rates in addition to pertinent dimensions so that detention times, overflow rates, and loadings per acre, etc. can be calculated.
 - b. Specifications and complete design calculations.
 - c. All treated wastewater discharges should have a flow measuring device such as a weir or Parshall flume installed after the final treatment unit. Where there is a significant difference between the flow rates of the raw and treated wastewater, a flow measuring device should be provided both before and after treatment.
3. If this application includes a construction permit disturbing five or more acres, a storm water construction permit must be obtained by submitting a notice of intent (NOI) to DEQ.


SECTION I: SIGNATORY REQUIREMENTS

Cognizant Official (Duly Authorized Representative)

40 CFR 122.22(b) states that all reports required by the permit, or other information requested by the Director, shall be signed by the applicant (or person authorized by the applicant) or by a duly authorized representative of that person. A person is a duly authorized representative only if:

- (1) the authorization is made in writing by the applicant (or person authorized by the applicant);
- (2) the authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity responsibility, or an individual or position having overall responsibility for environmental matters for the company.

The applicant hereby designates the following person as a Cognizant Official, or duly authorized representative, for signing reports, etc., including Discharge Monitoring Reports (DMR) required by the permit, and other information requested by the Director:

Signature of Cognizant Official:  Date: 11-5-2020
Printed name of Cognizant Official: J.L. Wagoner
Official title of Cognizant Official: Director of Public Works Telephone Number: 870-453-8300

Responsible Official

The information contained in this form must be certified by a **responsible official** as defined in the "signatory requirements for permit applications" (40 CFR 122.22).

Responsible official is defined as follows:

Corporation, a principal officer of at least the level of vice president

Partnership, a general partner

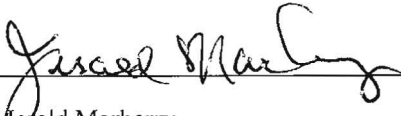
Sole proprietorship: the proprietor

Municipal, state, federal, or other public facility: principal executive officer, or ranking elected official.

"By my signature below, I certify that the cognizant official designated above is qualified to act as a duly authorized representative under the provisions of 40 CFR 122.22(b)." NOTE: If no duly authorized representative is designated in this section, the Division considers the applicant to be the responsible official for the facility and only reports, etc., signed by the applicant will be accepted by the Division.

"By my signature below, I certify that, if this facility is a corporation, it is registered with the Secretary of State in Arkansas. Please provide the full name of the corporation if different than that listed in Section A above."

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations. I further certify under penalty of law that all analyses reported as less than detectable in this application or attachments thereto were performed using the EPA approved test method having the lowest detection limit for the substance tested."

Signature of Responsible Official:  Date: 11/05/2020
Printed name of Responsible Official: Gerald Marberry
Official title of Responsible Official: Mayor Telephone Number: 870-453-8300

| | | |
|---------------------|---|--|
| Form 2A NPDES |  | U.S. Environmental Protection Agency Application for NPDES Permit to Discharge Wastewater NEW AND EXISTING PUBLICLY OWNED TREATMENT WORKS |
|---------------------|---|--|

SECTION 1. BASIC APPLICATION INFORMATION FOR ALL APPLICANTS (40 CFR 122.21(j)(1) and (9))

| | | | | | | |
|---------------------------------------|--|---|----------------------------------|---|--------------------------|-------------------------------------|
| Facility Information | 1.1 | Facility name Flippin Wastewater Treatment Facility | | | | |
| | Mailing address (street or P.O. box) P.O. Box 40 | | | | | |
| | City or town Flippin | | State Arkansas | ZIP code 72634 | | |
| | Contact name (first and last) J.L. Wagoner | Title Public Works Director | Phone number (870) 453-8300 | Email address cofmaintenance@hotmail.com | | |
| | Location address (street, route number, or other specific identifier) <input type="checkbox"/> Same as mailing address 222 East Industrial Drive | | | | | |
| | City or town Flippin | | State Arkansas | ZIP code 72634 | | |
| | 1.2 | Is this application for a facility that has yet to commence discharge? <input type="checkbox"/> Yes → See instructions on data submission requirements for new dischargers. <input checked="" type="checkbox"/> No | | | | |
| Applicant Information | 1.3 | Is applicant different from entity listed under Item 1.1 above? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No → SKIP to Item 1.4. | | | | |
| | Applicant name | | | | | |
| | Applicant address (street or P.O. box) | | | | | |
| | City or town | | State | ZIP code | | |
| | Contact name (first and last) | Title | Phone number | Email address | | |
| | 1.4 | Is the applicant the facility's owner, operator, or both? (Check only one response.) <input type="checkbox"/> Owner <input type="checkbox"/> Operator <input checked="" type="checkbox"/> Both | | | | |
| 1.5 | To which entity should the NPDES permitting authority send correspondence? (Check only one response.) <input type="checkbox"/> Facility <input type="checkbox"/> Applicant <input checked="" type="checkbox"/> Facility and applicant (they are one and the same) | | | | | |
| Existing Environmental Permits | 1.6 | Indicate below any existing environmental permits. (Check all that apply and print or type the corresponding permit number for each.) | | | | |
| | Existing Environmental Permits | | | | | |
| | <input checked="" type="checkbox"/> | NPDES (discharges to surface water) AR0021717 | <input type="checkbox"/> | RCRA (hazardous waste) | <input type="checkbox"/> | UIC (underground injection control) |
| | <input type="checkbox"/> | PSD (air emissions) | <input type="checkbox"/> | Nonattainment program (CAA) | <input type="checkbox"/> | NESHAPs (CAA) |
| <input type="checkbox"/> | Ocean dumping (MPRSA) | <input type="checkbox"/> | Dredge or fill (CWA Section 404) | <input type="checkbox"/> | Other (specify) | |

EPA Identification Number

NPDES Permit Number
AR0021717Facility Name
Flippin WWTFForm Approved 03/05/19
OMB No. 2040-0004

| | | | | | | |
|---|------|--|---|---|--|--|
| Collection System and Population Served | 1.7 | Provide the collection system information requested below for the treatment works. | | | | |
| | | Municipality Served | Population Served | Collection System Type (indicate percentage) | | Ownership Status |
| | | Flippin | 1355 | <u>100</u> % separate sanitary sewer | <input checked="" type="checkbox"/> Own | <input checked="" type="checkbox"/> Maintain |
| | | | | _____ % combined storm and sanitary sewer | <input type="checkbox"/> Own | <input type="checkbox"/> Maintain |
| | | | | <input type="checkbox"/> Unknown | <input type="checkbox"/> Own | <input type="checkbox"/> Maintain |
| | | | | _____ % separate sanitary sewer | <input type="checkbox"/> Own | <input type="checkbox"/> Maintain |
| | | | | _____ % combined storm and sanitary sewer | <input type="checkbox"/> Own | <input type="checkbox"/> Maintain |
| | | | | <input type="checkbox"/> Unknown | <input type="checkbox"/> Own | <input type="checkbox"/> Maintain |
| | | | _____ % separate sanitary sewer | <input type="checkbox"/> Own | <input type="checkbox"/> Maintain | |
| | | | _____ % combined storm and sanitary sewer | <input type="checkbox"/> Own | <input type="checkbox"/> Maintain | |
| | | | <input type="checkbox"/> Unknown | <input type="checkbox"/> Own | <input type="checkbox"/> Maintain | |
| | | | _____ % separate sanitary sewer | <input type="checkbox"/> Own | <input type="checkbox"/> Maintain | |
| | | | _____ % combined storm and sanitary sewer | <input type="checkbox"/> Own | <input type="checkbox"/> Maintain | |
| | | | <input type="checkbox"/> Unknown | <input type="checkbox"/> Own | <input type="checkbox"/> Maintain | |
| | | Total Population Served | 1355 | | | |
| | | | | Separate Sanitary Sewer System | Combined Storm and Sanitary Sewer | |
| | | Total percentage of each type of sewer line (in miles) | | 100 % | % | |
| Indian Country | 1.8 | Is the treatment works located in Indian Country? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | | |
| | 1.9 | Does the facility discharge to a receiving water that flows through Indian Country? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | | |
| Design and Actual Flow Rates | 1.10 | Provide design <i>and</i> actual flow rates in the designated spaces. | | | Design Flow Rate | |
| | | | | | 0.35 mgd | |
| | | Annual Average Flow Rates (Actual) | | | | |
| | | Two Years Ago | | Last Year | | This Year |
| | | 0.20 mgd | | 0.305 mgd | | .286 mgd |
| Discharge Points by Type | 1.11 | Provide the total number of effluent discharge points to waters of the United States by type. | | | | |
| | | Total Number of Effluent Discharge Points by Type | | | | |
| | | Treated Effluent | Untreated Effluent | Combined Sewer Overflows | Bypasses | Constructed Emergency Overflows |
| | | | | | | |
| | | 1 | 0 | 0 | 0 | 0 |

Outfalls Other Than to Waters of the United States

1.12 Does the POTW discharge wastewater to basins, ponds, or other surface impoundments that do not have outlets for discharge to waters of the United States?
 Yes No → SKIP to Item 1.14.

1.13 Provide the location of each surface impoundment and associated discharge information in the table below.

Surface Impoundment Location and Discharge Data

| Location | Average Daily Volume Discharged to Surface Impoundment | Continuous or Intermittent (check one) |
|----------|--|--|
| | gpd | <input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent |
| | gpd | <input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent |
| | gpd | <input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent |

1.14 Is wastewater applied to land?
 Yes No → SKIP to Item 1.16.

1.15 Provide the land application site and discharge data requested below.

Land Application Site and Discharge Data

| Location | Size | Average Daily Volume Applied | Continuous or Intermittent (check one) |
|----------|-------|------------------------------|--|
| | acres | gpd | <input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent |
| | acres | gpd | <input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent |
| | acres | gpd | <input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent |

1.16 Is effluent transported to another facility for treatment prior to discharge?
 Yes No → SKIP to Item 1.21.

1.17 Describe the means by which the effluent is transported (e.g., tank truck, pipe).

1.18 Is the effluent transported by a party other than the applicant?
 Yes No → SKIP to Item 1.20.

1.19 Provide information on the transporter below.

Transporter Data

| | | |
|-------------------------------|--------------------------------------|----------|
| Entity name | Mailing address (street or P.O. box) | |
| City or town | State | ZIP code |
| Contact name (first and last) | Title | |
| Phone number | Email address | |

Outfalls and Other Discharge or Disposal Methods

| | | | | | |
|--|--|---|--------------------------------------|--|--|
| Outfalls and Other Discharge or Disposal Methods Continued | 1.20 | In the table below, indicate the name, address, contact information, NPDES number, and average daily flow rate of the receiving facility. | | | |
| | Receiving Facility Data | | | | |
| | Facility name | | Mailing address (street or P.O. box) | | |
| | City or town | | State | ZIP code | |
| | Contact name (first and last) | | Title | | |
| | Phone number | | Email address | | |
| NPDES number of receiving facility (if any) <input type="checkbox"/> None | | Average daily flow rate | | | mgd |
| 1.21 | Is the wastewater disposed of in a manner other than those already mentioned in Items 1.14 through 1.21 that do not have outlets to waters of the United States (e.g., underground percolation, underground injection)? | | | | |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No → SKIP to Item 1.23. | | | | | |
| 1.22 | Provide information in the table below on these other disposal methods. | | | | |
| Information on Other Disposal Methods | | | | | |
| | Disposal Method Description | Location of Disposal Site | Size of Disposal Site | Annual Average Daily Discharge Volume | Continuous or Intermittent (check one) |
| | | | acres | gpd | <input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent |
| | | | acres | gpd | <input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent |
| | | | acres | gpd | <input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent |
| Variance Requests | 1.23 | Do you intend to request or renew one or more of the variances authorized at 40 CFR 122.21(n)? (Check all that apply. Consult with your NPDES permitting authority to determine what information needs to be submitted and when.) | | | |
| | <input type="checkbox"/> Discharges into marine waters (CWA Section 301(h)) <input type="checkbox"/> Water quality related effluent limitation (CWA Section 302(b)(2)) <input checked="" type="checkbox"/> Not applicable | | | | |
| Contractor Information | 1.24 | Are any operational or maintenance aspects (related to wastewater treatment and effluent quality) of the treatment works the responsibility of a contractor? | | | |
| | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No → SKIP to Section 2. | | | | |
| | 1.25 | Provide location and contact information for each contractor in addition to a description of the contractor's operational and maintenance responsibilities. | | | |
| | Contractor Information | | | | |
| | | | Contractor 1 | Contractor 2 | Contractor 3 |
| | Contractor name (company name) | | | | |
| | Mailing address (street or P.O. box) | | | | |
| | City, state, and ZIP code | | | | |
| | Contact name (first and last) | | | | |
| | Phone number | | | | |
| Email address | | | | | |
| Operational and maintenance responsibilities of contractor | | | | | |

SECTION 2. ADDITIONAL INFORMATION (40 CFR 122.21(j)(1) and (2))

| | | | | | | |
|---|---|--|---|--------------------------------------|-------------------------------------|---|
| Design Flow | Outfalls to Waters of the United States | | | | | |
| | 2.1 | Does the treatment works have a design flow greater than or equal to 0.1 mgd? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No → SKIP to Section 3. | | | | |
| Inflow and Infiltration | 2.2 | Provide the treatment works' current average daily volume of inflow and infiltration. | Average Daily Volume of Inflow and Infiltration 150,000 gpd | | | |
| | Indicate the steps the facility is taking to minimize inflow and infiltration. The City of Flippin has another construction project under development that will rehabilitate the entire wastewater collection system. This rehabilitative work will replace approximately 90% of the collection system and rehabilitate all of the remaining manholes. The I/I should be effectively eliminated once this construction is completed. | | | | | |
| Topographic Map | 2.3 | Have you attached a topographic map to this application that contains all the required information? (See instructions for specific requirements.) <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | | | | |
| Flow Diagram | 2.4 | Have you attached a process flow diagram or schematic to this application that contains all the required information? (See instructions for specific requirements.) <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | | | | |
| Scheduled Improvements and Schedules of Implementation | 2.5 | Are improvements to the facility scheduled? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No → SKIP to Section 3. | | | | |
| | Briefly list and describe the scheduled improvements. | | | | | |
| | 1. An additional oxidation ditch will be constructed next to the existing ditch to double capacity. | | | | | |
| | 2. The existing clarifiers will be replaced with two (2) new 25' diameter clarifiers. | | | | | |
| | 3. A sludge holding pond will be constructed to replace the digester and drying beds. | | | | | |
| | 4. A new headworks system will be installed to include both screening and grit removal. | | | | | |
| | 2.6 | Provide scheduled or actual dates of completion for improvements. | | | | |
| Scheduled or Actual Dates of Completion for Improvements | | | | | | |
| | Scheduled Improvement (from above) | Affected Outfalls (list outfall number) | Begin Construction (MM/DD/YYYY) | End Construction (MM/DD/YYYY) | Begin Discharge (MM/DD/YYYY) | Attainment of Operational Level (MM/DD/YYYY) |
| | 1. | 001 | 05/03/2021 | 03/31/2022 | 04/01/2022 | 06/01/2022 |
| | 2. | 001 | 05/03/2021 | 03/31/2022 | 04/01/2022 | 06/01/2022 |
| | 3. | 001 | 05/03/2021 | 03/31/2022 | 04/01/2022 | 06/01/2022 |
| | 4. | 001 | 05/03/2021 | 03/31/2022 | 04/01/2022 | 06/01/2022 |
| 2.7 | Have appropriate permits/clearances concerning other federal/state requirements been obtained? Briefly explain your response. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> None required or applicable | | | | | |
| Explanation: All environmental clearances and permits have been obtained for the work. | | | | | | |

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SECTION 3. INFORMATION ON EFFLUENT DISCHARGES (40 CFR 122.21(j)(3) to (5))

| | | | | |
|--|--|--|-----------------------------|-----------------------------|
| Description of Outfalls | 3.1 | Provide the following information for each outfall. (Attach additional sheets if you have more than three outfalls.) | | |
| | | Outfall Number <u>001</u> | Outfall Number _____ | Outfall Number _____ |
| | State | Arkansas | | |
| | County | Marion | | |
| | City or town | Flippin | | |
| | Distance from shore | N/A ft. | ft. | ft. |
| | Depth below surface | 3 ft. | ft. | ft. |
| | Average daily flow rate | 0.35 mgd | mgd | mgd |
| | Latitude | 36° 17' 00" N | ° ' " | ° ' " |
| | Longitude | 92° 35' 10" W | ° ' " | ° ' " |
| Seasonal or Periodic Discharge Data | 3.2 | Do any of the outfalls described under Item 3.1 have seasonal or periodic discharges? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No → SKIP to Item 3.4. | | |
| | 3.3 | If so, provide the following information for each applicable outfall. | | |
| | | Outfall Number _____ | Outfall Number _____ | Outfall Number _____ |
| | Number of times per year discharge occurs | | | |
| | Average duration of each discharge (specify units) | | | |
| | Average flow of each discharge | mgd | mgd | mgd |
| Months in which discharge occurs | | | | |
| Diffuser Type | 3.4 | Are any of the outfalls listed under Item 3.1 equipped with a diffuser? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No → SKIP to Item 3.6. | | |
| | 3.5 | Briefly describe the diffuser type at each applicable outfall. | | |
| | | Outfall Number _____ | Outfall Number _____ | Outfall Number _____ |
| Waters of the U.S. | 3.6 | Does the treatment works discharge or plan to discharge wastewater to waters of the United States from one or more discharge points? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No → SKIP to Section 6. | | |

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| | | 3.7 Provide the receiving water and related information (if known) for each outfall. | | |
|-----------------------------|--|---|---|---|
| | | Outfall Number <u>001</u> | Outfall Number _____ | Outfall Number _____ |
| Receiving Water Description | Receiving water name | White River | | |
| | Name of watershed, river, or stream system | Segment 4I | | |
| | U.S. Soil Conservation Service 14-digit watershed code | | | |
| | Name of state management/river basin | | | |
| | U.S. Geological Survey 8-digit hydrologic cataloging unit code | 11010003 | | |
| | Critical low flow (acute) | cfs | cfs | cfs |
| | Critical low flow (chronic) | cfs | cfs | cfs |
| | Total hardness at critical low flow | mg/L of CaCO ₃ | mg/L of CaCO ₃ | mg/L of CaCO ₃ |
| | | | 3.8 Provide the following information describing the treatment provided for discharges from each outfall. | |
| | | Outfall Number <u>001</u> | Outfall Number _____ | Outfall Number _____ |
| Treatment Description | Highest Level of Treatment (check all that apply per outfall) | <input checked="" type="checkbox"/> Primary <input type="checkbox"/> Equivalent to secondary <input checked="" type="checkbox"/> Secondary <input type="checkbox"/> Advanced <input type="checkbox"/> Other (specify) | <input type="checkbox"/> Primary <input type="checkbox"/> Equivalent to secondary <input type="checkbox"/> Secondary <input type="checkbox"/> Advanced <input type="checkbox"/> Other (specify) | <input type="checkbox"/> Primary <input type="checkbox"/> Equivalent to secondary <input type="checkbox"/> Secondary <input type="checkbox"/> Advanced <input type="checkbox"/> Other (specify) |
| | Design Removal Rates by Outfall | 001 | | |
| | BOD ₅ or CBOD ₅ | 95 % | % | % |
| | TSS | 95 % | % | % |
| | Phosphorus | <input checked="" type="checkbox"/> Not applicable % | <input type="checkbox"/> Not applicable % | <input type="checkbox"/> Not applicable % |
| | Nitrogen | <input type="checkbox"/> Not applicable 95 % | <input type="checkbox"/> Not applicable % | <input type="checkbox"/> Not applicable % |
| | Other (specify) | <input checked="" type="checkbox"/> Not applicable % | <input type="checkbox"/> Not applicable % | <input type="checkbox"/> Not applicable % |

| | | | | | | | |
|--|---|---|--|--|-----------------------------|----------------|--|
| Treatment Description Continued | 3.9 | Describe the type of disinfection used for the effluent from each outfall in the table below. If disinfection varies by season, describe below. | | | | | |
| | | | Outfall Number <u>001</u> | Outfall Number _____ | Outfall Number _____ | | |
| | Disinfection type | U.V. | | | | | |
| | Seasons used | All | | | | | |
| Dechlorination used? | <input checked="" type="checkbox"/> Not applicable <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Not applicable <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Not applicable <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Not applicable <input type="checkbox"/> Yes <input type="checkbox"/> No | | | |
| Effluent Testing Data | 3.10 | Have you completed monitoring for all Table A parameters and attached the results to the application package? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | | | | | |
| | 3.11 | Have you conducted any WET tests during the 4.5 years prior to the date of the application on any of the facility's discharges or on any receiving water near the discharge points? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No → SKIP to Item 3.13. | | | | | |
| | 3.12 | Indicate the number of acute and chronic WET tests conducted since the last permit reissuance of the facility's discharges by outfall number or of the receiving water near the discharge points. | | | | | |
| | | | Outfall Number _____ | Outfall Number _____ | Outfall Number _____ | | |
| | | | Acute | Chronic | Acute | Chronic | |
| | Number of tests of discharge water | | | | | | |
| | Number of tests of receiving water | | | | | | |
| | 3.13 | Does the treatment works have a design flow greater than or equal to 0.1 mgd? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No → SKIP to Item 3.16. | | | | | |
| | 3.14 | Does the POTW use chlorine for disinfection, use chlorine elsewhere in the treatment process, or otherwise have reasonable potential to discharge chlorine in its effluent? <input type="checkbox"/> Yes → Complete Table B, including chlorine. <input checked="" type="checkbox"/> No → Complete Table B, omitting chlorine. | | | | | |
| | 3.15 | Have you completed monitoring for all applicable Table B pollutants and attached the results to this application package? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | | | | | |
| 3.16 | Does one or more of the following conditions apply? <ul style="list-style-type: none"> The facility has a design flow greater than or equal to 1 mgd. The POTW has an approved pretreatment program or is required to develop such a program. The NPDES permitting authority has informed the POTW that it must sample for the parameters in Table C, must sample other additional parameters (Table D), or submit the results of WET tests for acute or chronic toxicity for each of its discharge outfalls (Table E). <input type="checkbox"/> Yes → Complete Tables C, D, and E as applicable. <input checked="" type="checkbox"/> No → SKIP to Section 4. | | | | | | |
| 3.17 | Have you completed monitoring for all applicable Table C pollutants and attached the results to this application package? <input type="checkbox"/> Yes <input type="checkbox"/> No | | | | | | |
| 3.18 | Have you completed monitoring for all applicable Table D pollutants required by your NPDES permitting authority and attached the results to this application package? <input type="checkbox"/> Yes <input type="checkbox"/> No additional sampling required by NPDES permitting authority. | | | | | | |

Effluent Testing Data Continued

| 3.19 | Has the POTW conducted either (1) minimum of four quarterly WET tests for one year preceding this permit application or (2) at least four annual WET tests in the past 4.5 years? <input type="checkbox"/> Yes <input type="checkbox"/> No → Complete tests and Table E and SKIP to Item 3.26. | | | | |
|-----------------------------------|---|-----------------------------------|--------------------|--|--|
| 3.20 | Have you previously submitted the results of the above tests to your NPDES permitting authority? <input type="checkbox"/> Yes <input type="checkbox"/> No → Provide results in Table E and SKIP to Item 3.26. | | | | |
| 3.21 | Indicate the dates the data were submitted to your NPDES permitting authority and provide a summary of the results. | | | | |
| | <table border="1"> <thead> <tr> <th>Date(s) Submitted (MM/DD/YYYY)</th> <th>Summary of Results</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> </tr> </tbody> </table> | Date(s) Submitted (MM/DD/YYYY) | Summary of Results | | |
| Date(s) Submitted (MM/DD/YYYY) | Summary of Results | | | | |
| | | | | | |
| 3.22 | Regardless of how you provided your WET testing data to the NPDES permitting authority, did any of the tests result in toxicity? <input type="checkbox"/> Yes <input type="checkbox"/> No → SKIP to Item 3.26. | | | | |
| 3.23 | Describe the cause(s) of the toxicity: | | | | |
| 3.24 | Has the treatment works conducted a toxicity reduction evaluation? <input type="checkbox"/> Yes <input type="checkbox"/> No → SKIP to Item 3.26. | | | | |
| 3.25 | Provide details of any toxicity reduction evaluations conducted. | | | | |
| 3.26 | Have you completed Table E for all applicable outfalls and attached the results to the application package? <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable because previously submitted information to the NPDES permitting authority. | | | | |

SECTION 4. INDUSTRIAL DISCHARGES AND HAZARDOUS WASTES (40 CFR 122.21(j)(6) and (7))

Industrial Discharges and Hazardous Wastes

| 4.1 | Does the POTW receive discharges from SIUs or NSCIUs? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No → SKIP to Item 4.7. | | | | |
|----------------|--|----------------|------------------|--|--|
| 4.2 | Indicate the number of SIUs and NSCIUs that discharge to the POTW. | | | | |
| | <table border="1"> <thead> <tr> <th>Number of SIUs</th> <th>Number of NSCIUs</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> </tr> </tbody> </table> | Number of SIUs | Number of NSCIUs | | |
| Number of SIUs | Number of NSCIUs | | | | |
| | | | | | |
| 4.3 | Does the POTW have an approved pretreatment program? <input type="checkbox"/> Yes <input type="checkbox"/> No | | | | |
| 4.4 | Have you submitted either of the following to the NPDES permitting authority that contains information substantially identical to that required in Table F: (1) a pretreatment program annual report submitted within one year of the application or (2) a pretreatment program? <input type="checkbox"/> Yes <input type="checkbox"/> No → SKIP to Item 4.6. | | | | |
| 4.5 | Identify the title and date of the annual report or pretreatment program referenced in Item 4.4. SKIP to Item 4.7. | | | | |
| 4.6 | Have you completed and attached Table F to this application package? <input type="checkbox"/> Yes <input type="checkbox"/> No | | | | |

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Industrial Discharges and Hazardous Wastes Continued

4.7 Does the POTW receive, or has it been notified that it will receive, by truck, rail, or dedicated pipe, any wastes that are regulated as RCRA hazardous wastes pursuant to 40 CFR 261?
 Yes No → SKIP to Item 4.9.

4.8 If yes, provide the following information:

| Hazardous Waste Number | Waste Transport Method (check all that apply) | | Annual Amount of Waste Received | Units |
|------------------------|---|--|---------------------------------|-------|
| | <input type="checkbox"/> Truck <input type="checkbox"/> Dedicated pipe | <input type="checkbox"/> Rail <input type="checkbox"/> Other (specify) _____ | | |
| | <input type="checkbox"/> Truck <input type="checkbox"/> Dedicated pipe | <input type="checkbox"/> Rail <input type="checkbox"/> Other (specify) _____ | | |
| | <input type="checkbox"/> Truck <input type="checkbox"/> Dedicated pipe | <input type="checkbox"/> Rail <input type="checkbox"/> Other (specify) _____ | | |

4.9 Does the POTW receive, or has it been notified that it will receive, wastewaters that originate from remedial activities, including those undertaken pursuant to CERCLA and Sections 3004(7) or 3008(h) of RCRA?
 Yes No → SKIP to Section 5.

4.10 Does the POTW receive (or expect to receive) less than 15 kilograms per month of non-acute hazardous wastes as specified in 40 CFR 261.30(d) and 261.33(e)?
 Yes → SKIP to Section 5. No

4.11 Have you reported the following information in an attachment to this application: identification and description of the site(s) or facility(ies) at which the wastewater originates; the identities of the wastewater's hazardous constituents; and the extent of treatment, if any, the wastewater receives or will receive before entering the POTW?
 Yes No

SECTION 5. COMBINED SEWER OVERFLOWS (40 CFR 122.21(j)(8))

CSO Map and Diagram

5.1 Does the treatment works have a combined sewer system?
 Yes No → SKIP to Section 6.

5.2 Have you attached a CSO system map to this application? (See instructions for map requirements.)
 Yes No

5.3 Have you attached a CSO system diagram to this application? (See instructions for diagram requirements.)
 Yes No

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| CSO Outfall Description | 5.4 | For each CSO outfall, provide the following information. (Attach additional sheets as necessary.) | | |
|---|---|---|---|--|
| | | CSO Outfall Number ____ | CSO Outfall Number ____ | CSO Outfall Number ____ |
| | City or town | | | |
| | State and ZIP code | | | |
| | County | | | |
| | Latitude | ° ' " | ° ' " | ° ' " |
| | Longitude | ° ' " | ° ' " | ° ' " |
| | Distance from shore | ft. | ft. | ft. |
| Depth below surface | ft. | ft. | ft. | |
| CSO Monitoring | 5.5 | Did the POTW monitor any of the following items in the past year for its CSO outfalls? | | |
| | | CSO Outfall Number ____ | CSO Outfall Number ____ | CSO Outfall Number ____ |
| | Rainfall | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| | CSO flow volume | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| | CSO pollutant concentrations | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| | Receiving water quality | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| | CSO frequency | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Number of storm events | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Yes <input type="checkbox"/> No | |
| CSO Events in Past Year | 5.6 | Provide the following information for each of your CSO outfalls. | | |
| | | CSO Outfall Number ____ | CSO Outfall Number ____ | CSO Outfall Number ____ |
| | Number of CSO events in the past year | events | events | events |
| | Average duration per event | hours <input type="checkbox"/> Actual or <input type="checkbox"/> Estimated | hours <input type="checkbox"/> Actual or <input type="checkbox"/> Estimated | hours <input type="checkbox"/> Actual or <input type="checkbox"/> Estimated |
| | Average volume per event | million gallons <input type="checkbox"/> Actual or <input type="checkbox"/> Estimated | million gallons <input type="checkbox"/> Actual or <input type="checkbox"/> Estimated | million gallons <input type="checkbox"/> Actual or <input type="checkbox"/> Estimated |
| Minimum rainfall causing a CSO event in last year | inches of rainfall <input type="checkbox"/> Actual or <input type="checkbox"/> Estimated | inches of rainfall <input type="checkbox"/> Actual or <input type="checkbox"/> Estimated | inches of rainfall <input type="checkbox"/> Actual or <input type="checkbox"/> Estimated | |

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CSO Receiving Waters

5.7 Provide the information in the table below for each of your CSO outfalls.

| | CSO Outfall Number ____ | CSO Outfall Number ____ | CSO Outfall Number ____ |
|---|----------------------------------|----------------------------------|----------------------------------|
| Receiving water name | | | |
| Name of watershed/ stream system | | | |
| U.S. Soil Conservation Service 14-digit watershed code (if known) | <input type="checkbox"/> Unknown | <input type="checkbox"/> Unknown | <input type="checkbox"/> Unknown |
| Name of state management/river basin | | | |
| U.S. Geological Survey 8-Digit Hydrologic Unit Code (if known) | <input type="checkbox"/> Unknown | <input type="checkbox"/> Unknown | <input type="checkbox"/> Unknown |
| Description of known water quality impacts on receiving stream by CSO (see instructions for examples) | | | |

SECTION 6. CHECKLIST AND CERTIFICATION STATEMENT (40 CFR 122.22(a) and (d))

Checklist and Certification Statement

6.1 In Column 1 below, mark the sections of Form 2A that you have completed and are submitting with your application. For each section, specify in Column 2 any attachments that you are enclosing to alert the permitting authority. Note that not all applicants are required to provide attachments.

| Column 1 | Column 2 | |
|---|---|--|
| <input checked="" type="checkbox"/> Section 1: Basic Application Information for All Applicants | <input type="checkbox"/> w/ variance request(s) | <input type="checkbox"/> w/ additional attachments |
| <input checked="" type="checkbox"/> Section 2: Additional Information | <input checked="" type="checkbox"/> w/ topographic map <input type="checkbox"/> w/ additional attachments | <input checked="" type="checkbox"/> w/ process flow diagram |
| <input checked="" type="checkbox"/> Section 3: Information on Effluent Discharges | <input checked="" type="checkbox"/> w/ Table A <input checked="" type="checkbox"/> w/ Table B <input type="checkbox"/> w/ Table C | <input type="checkbox"/> w/ Table D <input type="checkbox"/> w/ Table E <input type="checkbox"/> w/ additional attachments |
| <input type="checkbox"/> Section 4: Industrial Discharges and Hazardous Wastes | <input type="checkbox"/> w/ SIU and NSCIU attachments <input type="checkbox"/> w/ additional attachments | <input type="checkbox"/> w/ Table F |
| <input type="checkbox"/> Section 5: Combined Sewer Overflows | <input type="checkbox"/> w/ CSO map <input type="checkbox"/> w/ CSO system diagram | <input type="checkbox"/> w/ additional attachments |
| <input checked="" type="checkbox"/> Section 6: Checklist and Certification Statement | <input type="checkbox"/> w/ attachments | |

6.2 **Certification Statement**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

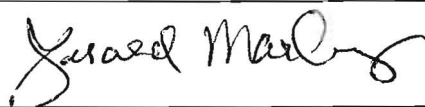
Name (print or type first and last name)

Jerald Marberry

Official title

Mayor

Signature



Date signed

11/05/2020

| | | | |
|---------------------------|----------------------------------|-------------------------------|-----------------------|
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|---------------------------|----------------------------------|-------------------------------|-----------------------|

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| TABLE A. EFFLUENT PARAMETERS FOR ALL POTWS | | | | | | | |
|---|-------------------------|---------|-------------------------|---------|-------------------|--------------------------------|---|
| Pollutant | Maximum Daily Discharge | | Average Daily Discharge | | | Analytical Method ¹ | ML or MDL (include units) |
| | Value | Units | Value | Units | Number of Samples | | |
| Biochemical oxygen demand <input checked="" type="checkbox"/> BOD ₅ or <input type="checkbox"/> CBOD ₅ (report one) | 21.3 | mg/l | 6.24 | mg/l | 39 | | <input type="checkbox"/> ML <input type="checkbox"/> MDL |
| Fecal coliform | 344 | #/100ml | 43 | #/100ml | 39 | | <input type="checkbox"/> ML <input type="checkbox"/> MDL |
| Design flow rate | 0.582 | MGD | 0.240 | MGD | 39 | | |
| pH (minimum) | 6.43 | SU | | | | | |
| pH (maximum) | 7.58 | SU | | | | | |
| Temperature (winter) | N/A | | | | | | |
| Temperature (summer) | N/A | | | | | | |
| Total suspended solids (TSS) | 14 | mg/l | 3.77 | mg/l | 39 | | <input type="checkbox"/> ML <input type="checkbox"/> MDL |

¹ Sampling shall be conducted according to sufficiently sensitive test procedures (i.e., methods) approved under 40 CFR 136 for the analysis of pollutants or pollutant parameters or required under 40 CFR chapter I, subchapter N or O. See instructions and 40 CFR 122.21(e)(3).

| | | | |
|---------------------------|----------------------------------|-------------------------------|----------------|
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|---------------------------|----------------------------------|-------------------------------|----------------|

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TABLE B. EFFLUENT PARAMETERS FOR ALL POTWS WITH A FLOW EQUAL TO OR GREATER THAN 0.1 MGD

| Pollutant | Maximum Daily Discharge | | Average Daily Discharge | | | Analytical Method ¹ | ML or MDL (include units) |
|--|-------------------------|-------|-------------------------|-------|-------------------|--------------------------------|---|
| | Value | Units | Value | Units | Number of Samples | | |
| Ammonia (as N) | | | | | | | <input type="checkbox"/> ML <input type="checkbox"/> MDL |
| Chlorine (total residual, TRC) ² | | | | | | | <input type="checkbox"/> ML <input type="checkbox"/> MDL |
| Dissolved oxygen | | | | | | | <input type="checkbox"/> ML <input type="checkbox"/> MDL |
| Nitrate/nitrite | | | | | | | <input type="checkbox"/> ML <input type="checkbox"/> MDL |
| Kjeldahl nitrogen | | | | | | | <input type="checkbox"/> ML <input type="checkbox"/> MDL |
| Oil and grease | | | | | | | <input type="checkbox"/> ML <input type="checkbox"/> MDL |
| Phosphorus | | | | | | | <input type="checkbox"/> ML <input type="checkbox"/> MDL |
| Total dissolved solids | | | | | | | <input type="checkbox"/> ML <input type="checkbox"/> MDL |

¹ Sampling shall be conducted according to sufficiently sensitive test procedures (i.e., methods) approved under 40 CFR 136 for the analysis of pollutants or pollutant parameters or required under 40 CFR chapter I, subchapter N or O. See instructions and 40 CFR 122.21(e)(3).

² Facilities that do not use chlorine for disinfection, do not use chlorine elsewhere in the treatment process, and have no reasonable potential to discharge chlorine in their effluent are not required to report data for chlorine.



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



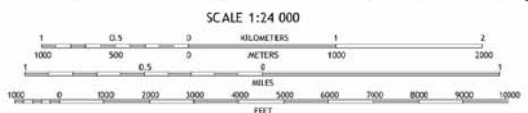
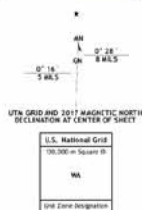
COTTER QUADRANGLE
ARKANSAS
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid: Universal Transverse Mercator, Zone 15S
15 000-foot scale; Arkansas Coordinate System of 1983 (south
zone)

This map is not a legal document. Boundaries may be
generalized for this map scale. Private lands within
boundaries may not be shown. Obtain permission before
entering private lands.

Imagery:NAIP, December 2015
Roads:U.S. Census Bureau, 2015
Names:GNIS, 2016
Hydrography:National Hydrography Dataset, 2015
Contours:National Elevation Dataset, 2000
Boundaries:Multiple sources; see metadata file 1972-2016
Roads:Land Survey System
Wetlands:FWS National Wetlands Inventory 1977 - 2014



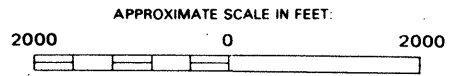
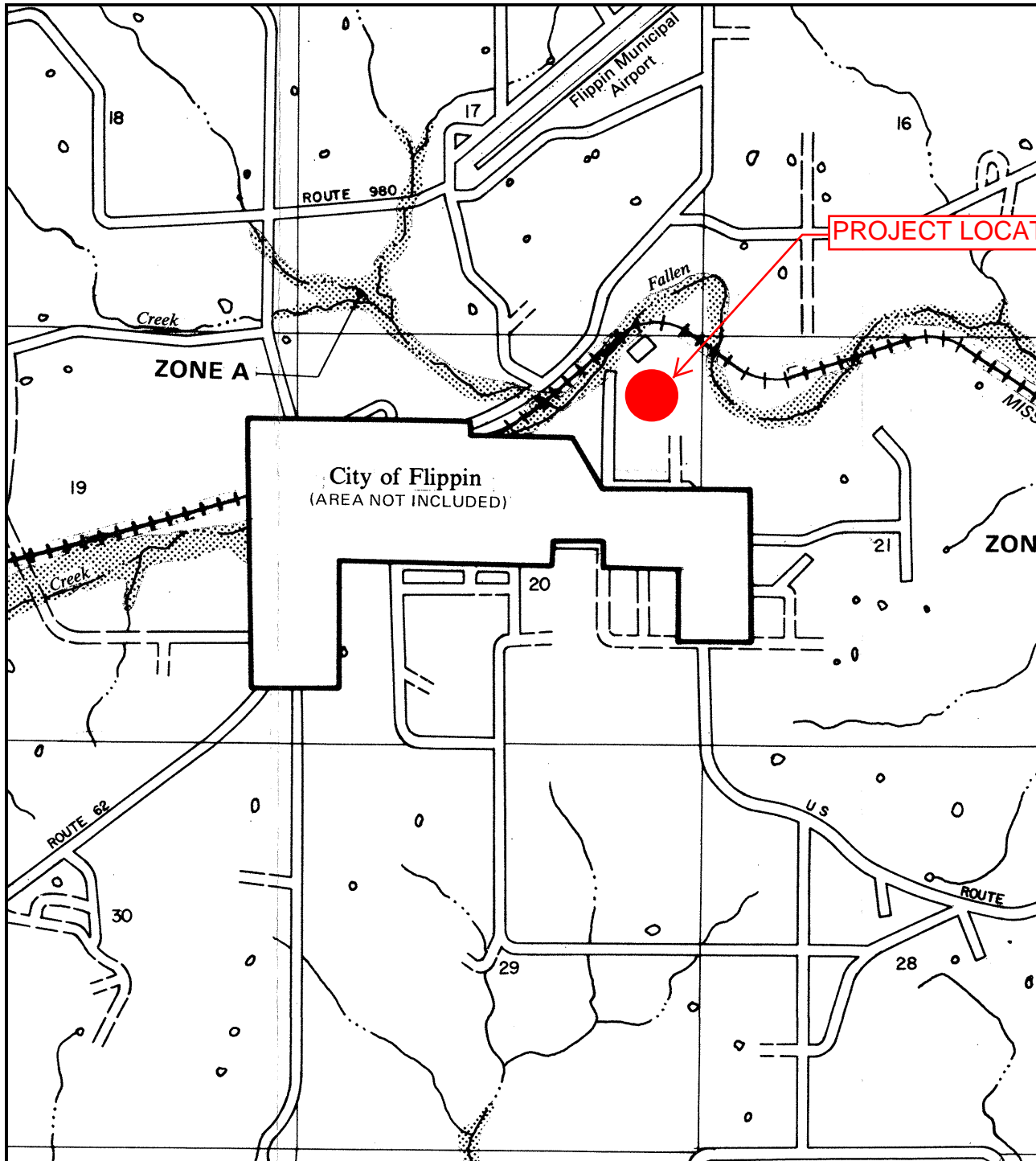
CONTOUR INTERVAL 20 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the
National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 6.0.19

| | | | | | | | |
|-------------|---------------|----------|-------------|----------------------|-------------|--------------|----------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 Cotter NW | 2 Bull Shoals | 3 Midway | 4 Cotter SW | 5 Mountain Home West | 6 Yellville | 7 Rea Valley | 8 Buffalo City |

COTTER, AR
2017





PROJECT LOCATION

FLOOD HAZARD BOUNDARY MAP

**MARION COUNTY,
ARKANSAS**
UNINCORPORATED AREA
PAGE 6 OF 9
(SEE MAP INDEX FOR PAGES NOT PRINTED)

EFFECTIVE DATE:
SEPTEMBER 6, 1977

COMMUNITY - PANEL NO.
050450 0006 A



**U.S. DEPARTMENT OF HOUSING
AND URBAN DEVELOPMENT**

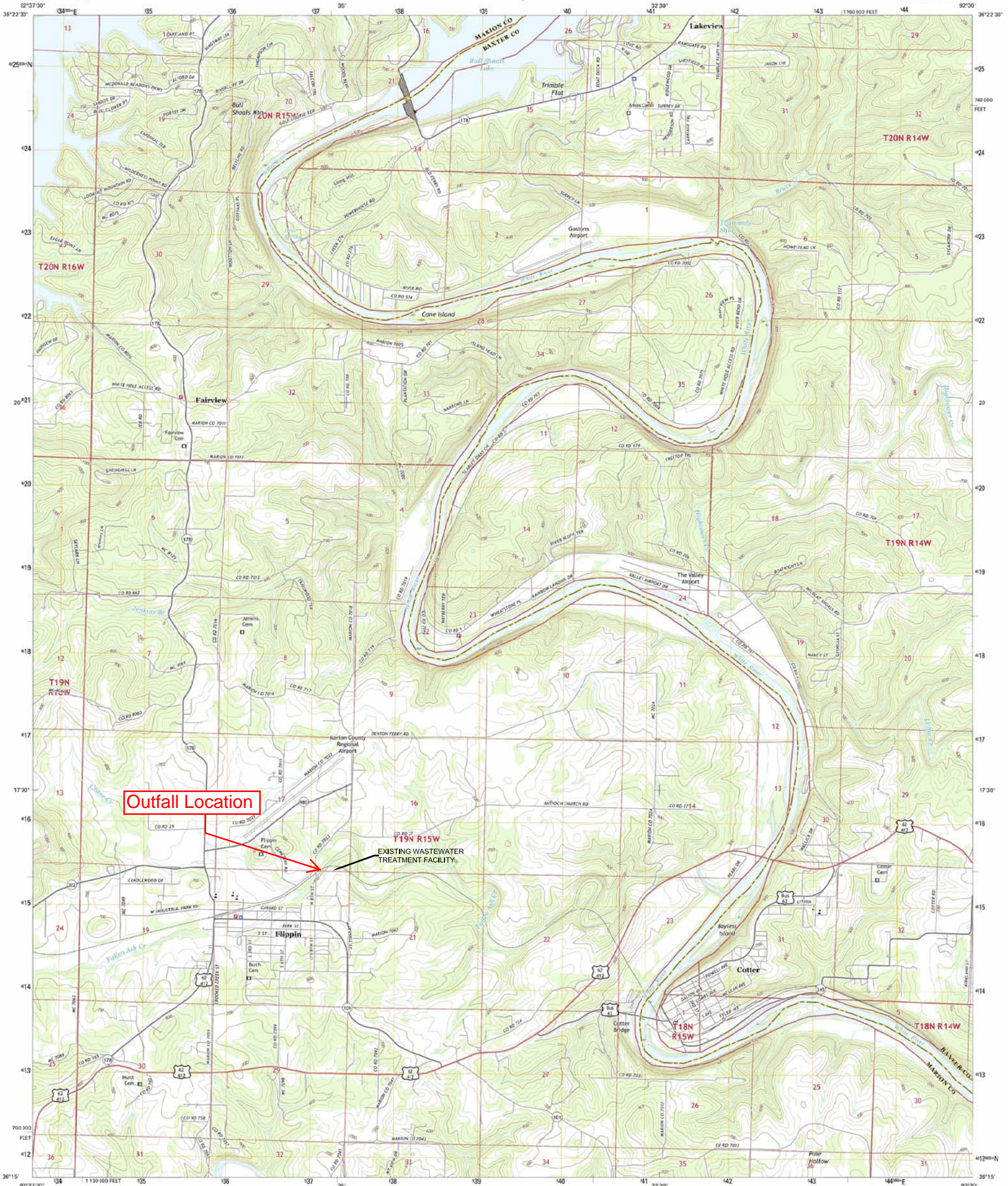
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



COTTER QUADRANGLE
ARKANSAS
7.5-MINUTE SERIES



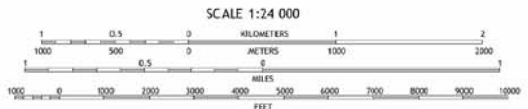
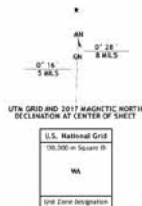
Outfall Location

EXISTING WASTEWATER TREATMENT FACILITY

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid: Universal Transverse Mercator, Zone 15S
15 000-foot scale; Arkansas Coordinate System of 1983 (north
zone)

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Imagery:NAIP, December 2015
Roads:U.S. Census Bureau, 2015
Names:GNIS, 2016
Hydrography:National Hydrography Dataset, 2015
Contours:National Elevation Dataset, 2000
Boundaries:Multiple sources; see metadata file 1972-2016
Roads:Land Survey System, 1972-2016
Wetlands:FWS National Wetlands Inventory 1977 - 2014



| | | | | | | | |
|-------------|---------------|----------|-------------|----------------------|-------------|--------------|----------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 Cotter NW | 2 Bull Shoals | 3 Midway | 4 Cotter SW | 5 Mountain Home West | 6 Yellville | 7 Rea Valley | 8 Buffalo City |

ADJOINING QUADRANGLES

COTTER, AR
2017





CIVIL ENGINEERING ASSOCIATES, LLC

PROJECT: FLIPPEN WWTF IMPROVEMENTS

PROJECT No: _____ Sheet No: 1 Of 1

By: JSS Date: 11/05/2020 Chkd. By: _____ Date: _____

SUBJECT: DESIGN CALCULATIONS

- DESIGN FLOW RATE = 0.35 MGD
- PEAK HOURLY FLOW RATE = 0.72 MGD (BASED ON INFLUENT LEFT STATION CAPACITY OF 500 GPM)
- PEAK HOURLY LOADING RATE = 4.14 LB/CAPITA-DAY

- CLARIFIER

PEAK HOURLY FLOW RATE = 720,000 GPD

CLARIFIER SURFACE AREA = 615.75 ft²

SURFACE OVERFLOW RATE = (720,000 GPD) / (615.75 ft²) = 1,169 gpd/ft²

PEAK HOURLY LOADING RATE = 4.14 LB/CAPITA-DAY

POPULATION = 1,355

PEAK SOLIDS LOADING RATE = (4.14 LB/CAPITA-DAY)(1,355 PEOPLE) / (615.75 ft²) = 9,11 LB/day/ft²

WEIR LENGTH = 40 ft

PEAK HOURLY FLOW RATE = 720,000 GPD

WEIR LOADING RATE = (720,000 GPD) / (40 L.F.) = 18,000 gpd/L.F.

- OXIDATION DITCH

1/2 DESIGN FLOW RATE = 175,000 GPD

BOD₅ = 210 mg/L

BOD_L = $\frac{(175,000 \text{ GPD})(210 \text{ mg/L})(8.34 \text{ lb/gal})}{1,000,000 \text{ L/mg}}$ = 306.50 lb/day

VOLUME OF OXIDATION DITCH
Z(9.5')(11' X 115') = 24,035 ft³

MASS OF BIOMASS FOR BOD REMOVAL = 5,248 lb

ORGANIC LOADING = (306.5 lb/day) / (24) = 12.77 lb BOD/d/1000 ft³

MLSS = (5,248 lb) / (1,000,000) / (9.5 ft) (24,030 ft³) (62.4 lb/mg x 1/ft³) = 3,498 mg/L





CIVIL ENGINEERING ASSOCIATES, LLC

PROJECT: FLOPPIN WWTIP IMPROVEMENTS

PROJECT No: _____ Sheet No: 1 Of 1

By: JSS Date: 12/01/2020 Chkd. By: _____ Date: _____

SUBJECT: SLUDGE HOLDING POND

BOTTOM DIMENSIONS OF POND

17.5 FT. WIDE * 132.2 FT. LONG

WATER DEPTH IN POND WILL BE 10 FT., GIVING 3-FT. OF FREEBOARD

TOTAL VOLUME OF POND = 68,045 FT³ = 508,977 GALL

MASS OF SLUDGE PRODUCED = (350,000)(200)(0.75)(8.34)/1,000,000 = 438 lb/day

VOLUME OF SLUDGE PRODUCED = 438 / (0.0085 * 8.34) = 6,179 GALL/DAY

ASSUMING A 75% RETURN RATE, 1,545 GALL/DAY WOULD BE WASTED TO POND

AT THIS RATE, POND WOULD HAVE 329 DAYS WORTH OF STORAGE WITHOUT ANYTHING BEING DECANTED



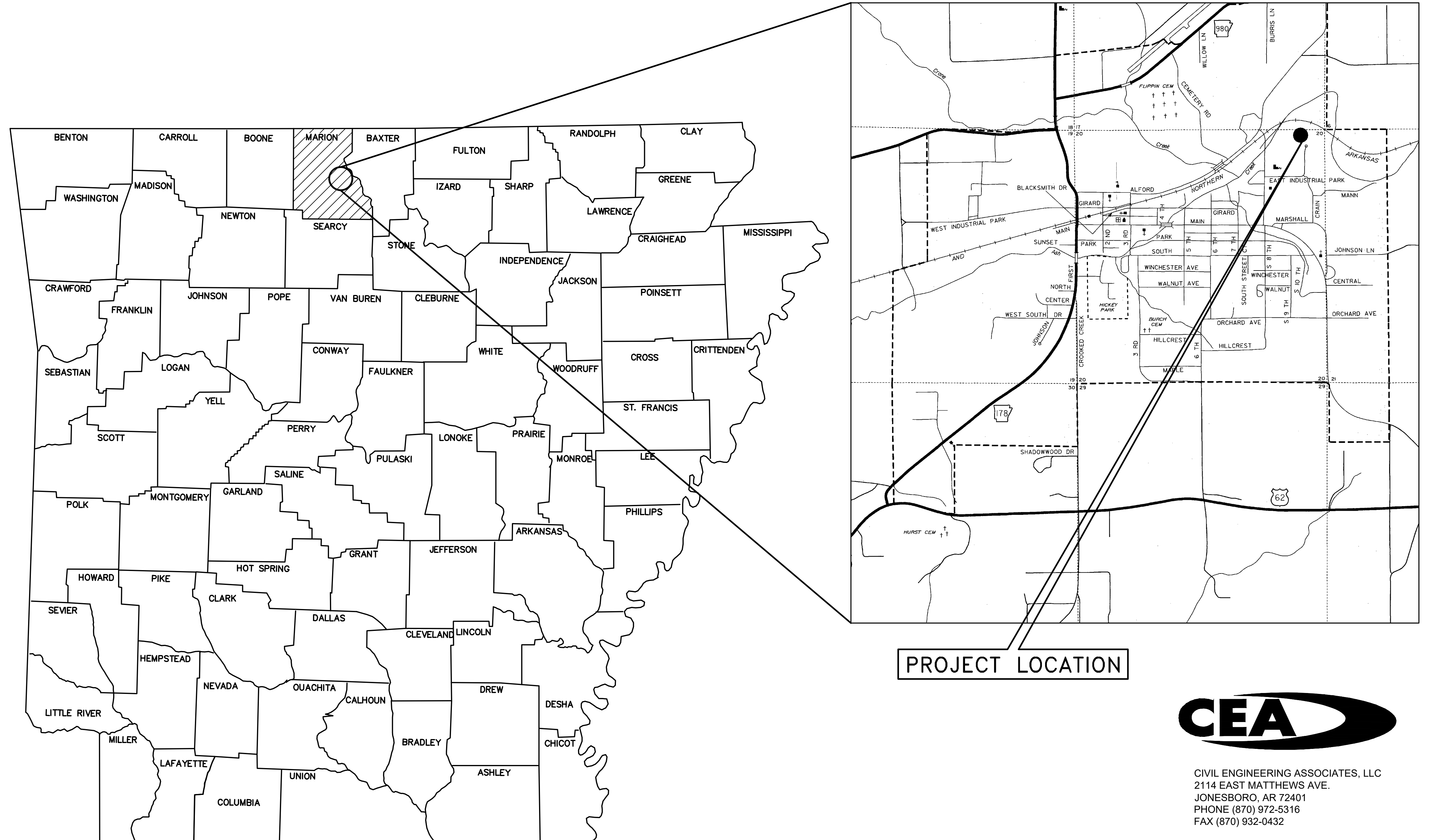
WASTEWATER SYSTEM IMPROVEMENTS

CITY OF FLIPPIN

FLIPPIN, ARKANSAS

INDEX OF SHEETS

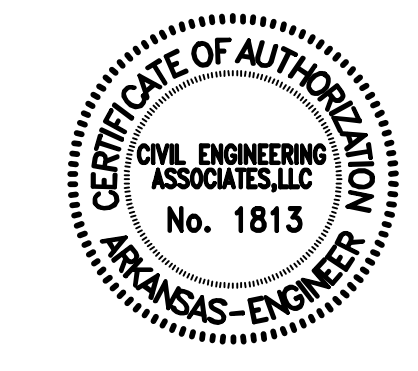
1. COVER SHEET
2. HYDRAULIC PROFILE & FLOW SCHEMATIC
3. EXISTING SITE PLAN
4. PROPOSED SITE PLAN
5. HEAD WORKS DETAILS (STRUCTURAL)
6. OXIDATION DITCH DETAILS (STRUCTURAL)
7. CLARIFIER DETAILS (STRUCTURAL)
8. PUMP BUILDING DETAILS
9. PUMP BUILDING ELEVATION VIEWS
10. LIFT STATION & BUILDING DETAILS
11. STANDARD DETAILS



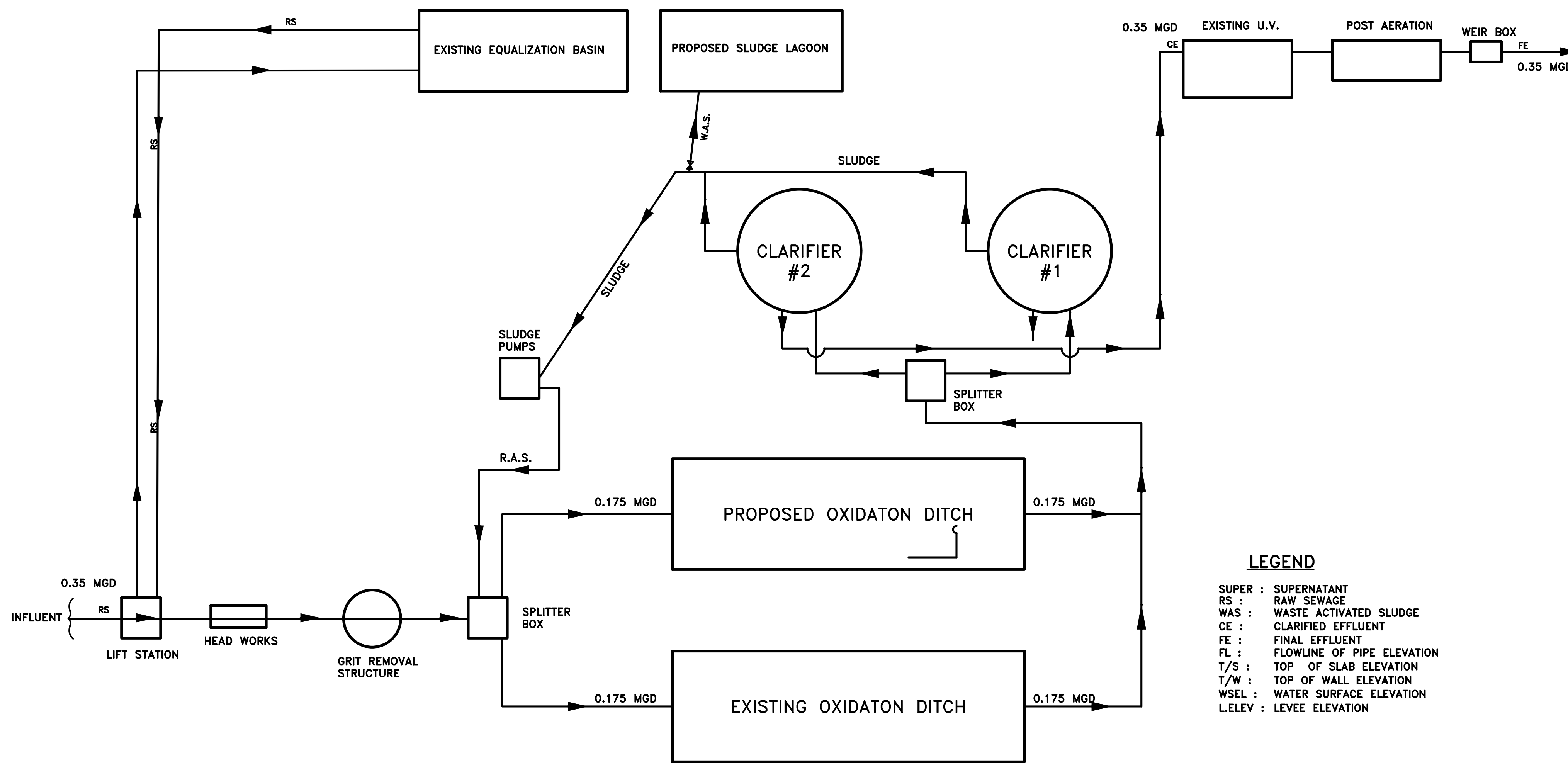
WASTEWATER SYSTEM IMPROVEMENTS
CITY OF FLIPPIN
FLIPPIN, ARKANSAS



CIVIL ENGINEERING ASSOCIATES, LLC
2114 EAST MATTHEWS AVE.
JONESBORO, AR 72401
PHONE (870) 972-5316
FAX (870) 932-0432



NOVEMBER 2020



FLOW SCHEMATIC

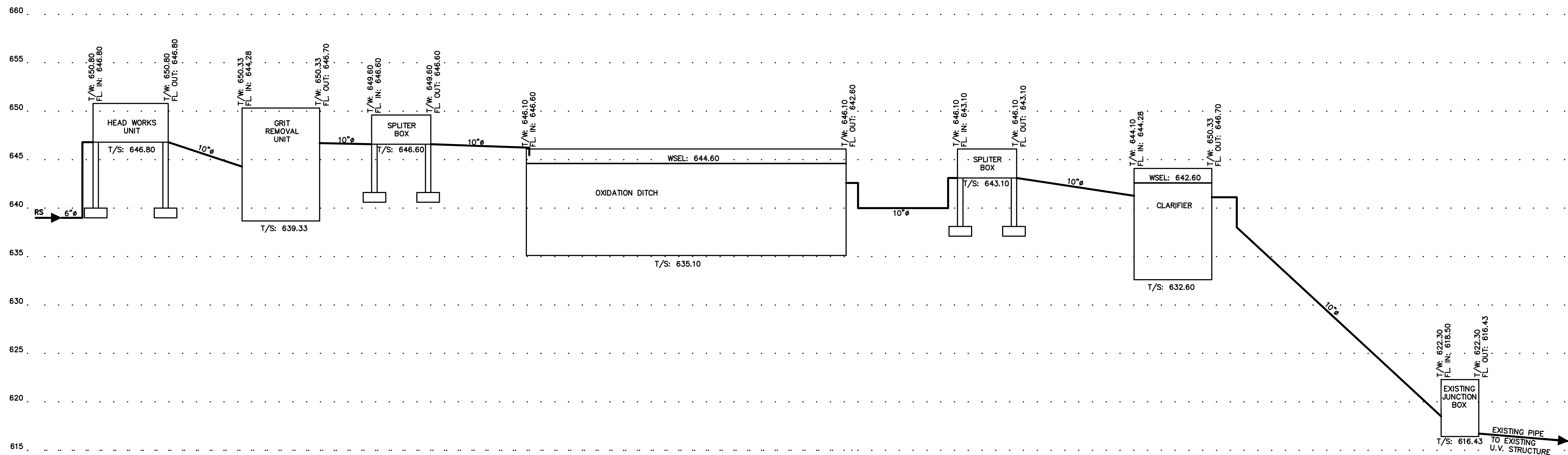
DESIGN DATA

DESIGN FLOW, MGD
Average Dry Weather Flow _____ 0.350

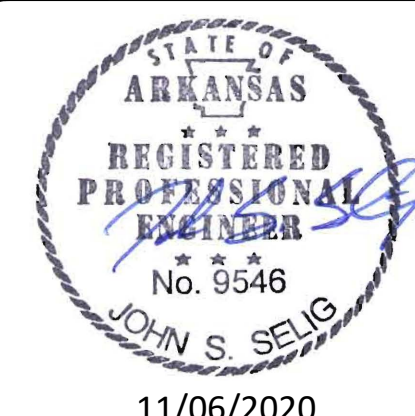
DESIGN PARAMETERS, MG/L
BOD₅ _____ 210
TSS _____ 40
NH₃-N _____ 15

| Effluent Characteristics | Discharge Limitations | | | Monitoring Requirements | |
|---|--|--|--------------------------|-------------------------|---------------|
| | Mass (lbs/day, unless otherwise specified) | Concentration (mg/l, unless otherwise specified) | | Frequency | Sample Type |
| | | Monthly Average | Monthly Avg. | | |
| Flow | N/A | Report, MGD | Report, MGD (Daily Max.) | five/week | Instantaneous |
| Overflow | Monthly Total SSOs (occurrences/month) | | | See Comments | |
| Overflow Volume | Monthly Total Volume of SSOs (gallons/month) | | | See Comments | |
| Carbonaceous Biochemical Oxygen Demand (CBOD ₅) | 15.0 | 10.0 | 15.0 | once/month | grab |
| Total Suspended Solids (TSS) | 22.0 | 15.0 | 22.5 | once/month | grab |
| Ammonia Nitrogen (NH ₃ -N) | | | | | |
| (April) | 5.8 | 4.0 | 4.0 | once/month | grab |
| (May - October) | 3.0 | 2.0 | 3.0 | once/month | grab |
| (November - March) | 13.0 | 9.0 | 10.5 | once/month | grab |
| Dissolved Oxygen (DO) | N/A | 3.0 (Inst. Min.) | | once/month | grab |
| Fecal Coliform Bacteria | | (colonies/100 ml) | | | |
| (May - September) | N/A | 200 | 400 | once/month | grab |
| (October - April) | N/A | 1000 | 2000 | once/month | grab |
| pH | N/A | Minimum 6.0 s.u. | Maximum 9.0 s.u. | once/month | grab |

LEGEND
 SUPER : SUPERNATANT
 RS : RAW SEWAGE
 WAS : WASTE ACTIVATED SLUDGE
 CE : CLARIFIED EFFLUENT
 FE : FINAL EFFLUENT
 FL : FLOWLINE OF PIPE ELEVATION
 T/S : TOP OF SLAB ELEVATION
 T/W : TOP OF WALL ELEVATION
 WSEL : WATER SURFACE ELEVATION
 L.ELEV : LEVEE ELEVATION



HYDRAULIC PROFILE

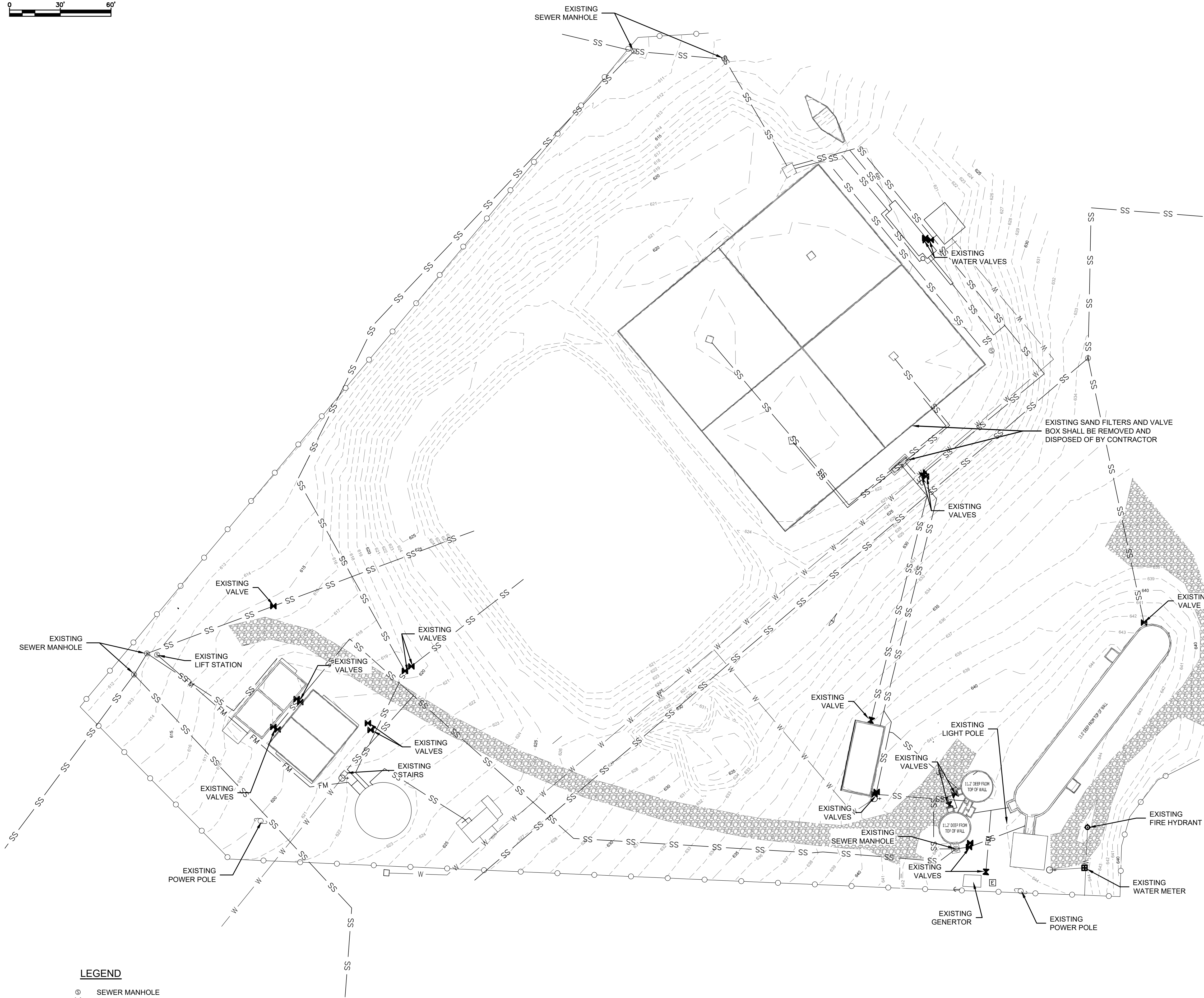
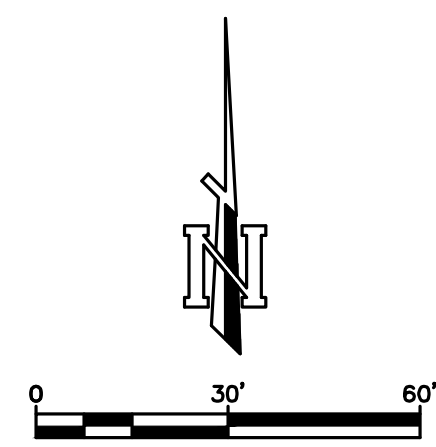


WASTEWATER SYSTEM IMPROVEMENTS
 CITY OF FLIPPIN
 FLIPPIN, ARKANSAS

HYDRAULIC PROFILE
 & FLOW SCHEMATIC

Designed JSS
 Checked JAM
 Drawn ALA
 Approved JSS

SCALE: N.T.S. JOB NO: OGH-16-02
 DATE: AUGUST 2017 SHEET: 2



LEGEND

| | |
|--|----------------------------|
| | SEWER MANHOLE |
| | WATER VALVE |
| | POWER POLE |
| | LIGHT POLE |
| | EXISTING FENCE |
| | EXISTING OVERHEAD ELECTRIC |
| | EXISTING GRAVEL SURFACE |

- GENERAL NOTES:**
- ALL MATERIALS, EQUIPMENT, AND WORKMANSHIP SHALL MEET OR EXCEED THE OWNER'S TECHNICAL SPECIFICATIONS.
 - THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONSTRUCTION STAKEOUT. CONTRACTOR SHALL VERIFY ALL MEASUREMENTS, ELEVATIONS, STATIONS, ETC. BEFORE ORDERING MATERIALS OR PROCEEDING WITH WORK, AND IS RESPONSIBLE FOR SAME. IF ANY DISCREPANCY IN THE PLANS OR SPECIFICATIONS ARISES, THE CONTRACTOR SHALL CONTACT THE ENGINEER BEFORE INITIATING WORK AFFECTED BY THE DISCREPANCY.
 - THE CONTRACTOR IS CAUTIONED AND SHALL BE RESPONSIBLE FOR NOTIFYING THE OWNER'S REPRESENTATIVE OF ANY ERROR OR OMISSION ON THE PLANS WHICH MAY CREATE ADDITIONAL WORK OR EXPENSE BY THE CONTRACTOR, AND SHALL OBTAIN A WRITTEN WORK ORDER FROM THE OWNER'S REPRESENTATIVE PRIOR TO PROCEEDING WITH ANY EXTRA WORK WHICH MAY BE CAUSED FROM SUCH ERROR OR OMISSION ON THE PLANS.
 - THE CONTRACTOR SHALL MAKE APPLICATION FOR, OBTAIN, AND PAY FOR ALL NECESSARY LICENSES AND PERMITS REQUIRED FOR THIS PROJECT. THE CONTRACTOR SHALL INSURE THAT HIS OPERATIONS ARE CARRIED OUT IN CONFORMANCE WITH ALL APPLICABLE STATE, LOCAL, AND FEDERAL CODES, STATUTES, AND REGULATIONS CONCERNING THE PROTECTION OF LIVES AND PROPERTY. ANY CONSTRUCTION OBSERVATION BY THE ENGINEER OR OWNER'S REPRESENTATIVE OF THE CONTRACTOR'S PERFORMANCE SHALL NOT LIMIT THE CONTRACTOR'S RESPONSIBILITY TO ABIDE BY ALL APPLICABLE REQUIREMENTS.
 - CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO AVOID DAMAGE TO EXISTING FACILITIES AND/OR ADJACENT PROPERTIES, AND SHALL BE RESPONSIBLE FOR SAME. CONTRACTOR SHALL CALL ARKANSAS ONE-CALL PRIOR TO ANY EXCAVATION AT THE SITE.
 - ACCESS ALONG ROADWAYS SHALL BE MAINTAINED AT ALL TIMES. CONSTRUCTION IN CITY, COUNTY OR STATE RIGHT-OF-WAY SHALL BE COORDINATED BY CONTRACTOR WITH THE OWNER.
 - CONTRACTOR SHALL KEEP AN ORDERLY WORK SITE AND SHALL DISPOSE OF ALL CONSTRUCTION DEBRIS IN ACCORDANCE WITH ALL LOCAL, STATE, AND/OR FEDERAL REGULATIONS.
 - CONTRACTOR SHALL PROVIDE CONSTRUCTION SCHEDULE TO OWNER'S REPRESENTATIVE PRIOR TO COMMENCING WORK.
 - CONTRACTOR WILL BE PROVIDED WITH AN ELECTRONIC DRAWING FOR STAKE OUT PURPOSES.
 - THIS PROJECT IS REGULATED UNDER THE NPDES STORM WATER PROGRAM AND IS CONSIDERED A SMALL CONSTRUCTION SITE (GREATER THAN 1 ACRES BUT LESS THAN 5 ACRES). A COPY OF THE GENERAL PERMIT IS PROVIDED IN THE PROJECT MANUAL. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLYING WITH ALL APPLICABLE PERMIT REQUIREMENTS AND/OR RESTRICTIONS, INCLUDING BUT NOT LIMITED TO PREPARATION OF A SITE SPECIFIC STORM WATER POLLUTION PREVENTION PLAN (SWPPP) AND THE INSTALLATION, INSPECTION, AND MAINTENANCE OF BEST MANAGEMENT PRACTICES (BMPs).
 - CONTRACTOR SHALL BE RESPONSIBLE FOR ALL QUALITY CONTROL TESTING FOR THE PROJECT INCLUDING BUT NOT LIMITED TO LABORATORY SOIL TESTS, IN PLACE SOIL DENSITY TESTS, AND CONCRETE/ASPHALT TESTING, AS SPECIFIED.
 - CONTRACTOR SHALL ESTABLISH POSITIVE DRAINAGE OVER SITE, AND SHALL REESTABLISH TURF COVER OVER ALL DISTURBED AREAS THAT ARE NOT TO BE PAVED, OR OTHERWISE FINISHED, IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.
 - OWNER SHALL ESTABLISH BOUNDARIES OF PERMANENT CONSTRUCTION EASEMENT PRIOR TO CONSTRUCTION. ANY ADDITIONAL AREA NEEDED BY THE CONTRACTOR FOR STAGING, ETC. SHALL BE ACQUIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
 - CONTRACTOR SHALL COORDINATE TIE IN WORK WITH OWNER TO ENSURE THAT PLANT OPERATION IS MAINTAINED.
 - CONTRACTOR SHALL MAINTAIN SITE ACCESS DURING CONSTRUCTION. THE EXISTING GRAVEL ROAD TO THE SITE WILL NEED TO BE REPAIRED ON AN AS NEEDED BASIS, DURING CONSTRUCTION.



11/06/2020



**WASTEWATER SYSTEM IMPROVEMENTS
CITY OF FLIPPIN
FLIPPIN, ARKANSAS**

**EXISTING
SITE PLAN**

Designed _____ JSS
 Checked _____ RLP
 Drawn _____ ALA
 Approved _____ JSS

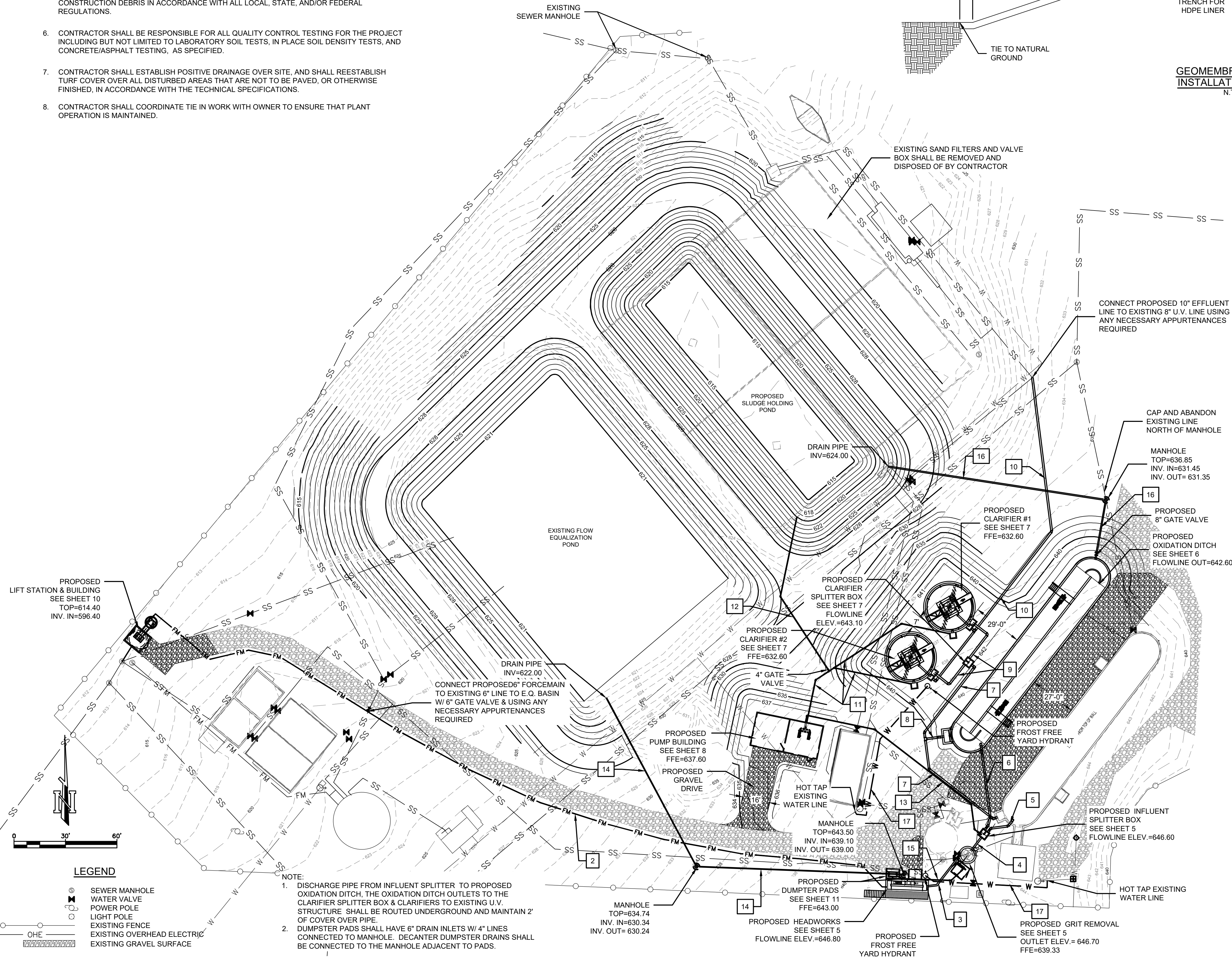
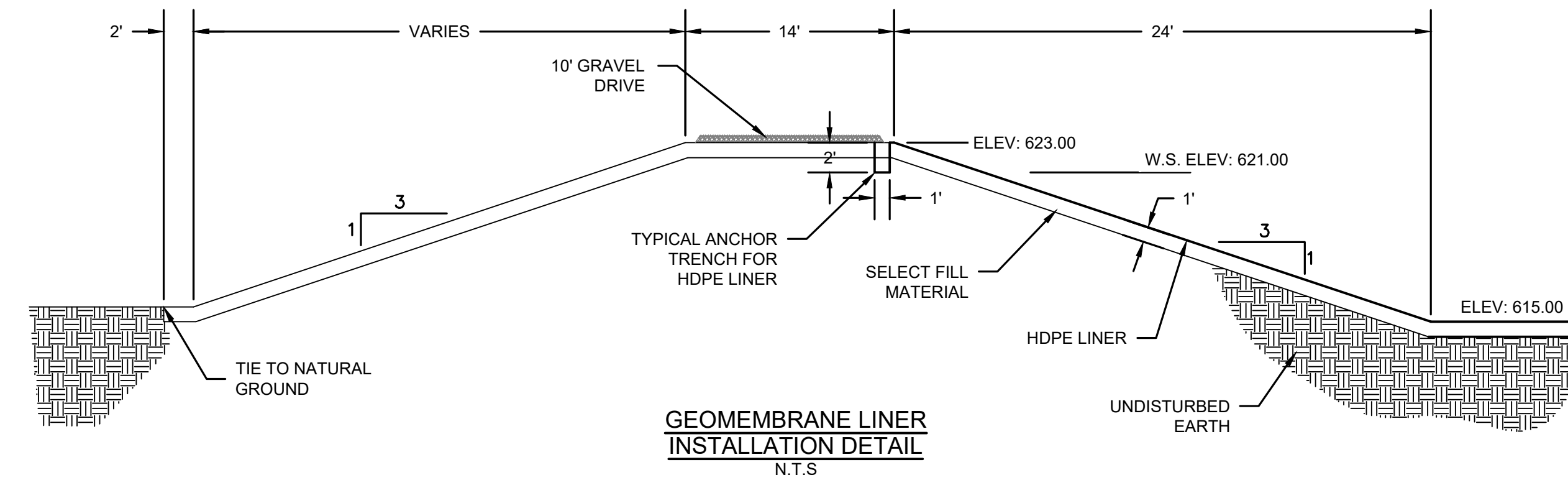
| | |
|------------------------|-------------|
| SCALE: 1" = 30' | JOB NO.: |
| DATE: NOVEMBER 2020 | SHEET: 3 |

NOTES:

1. ALL EXPOSED PIPING SHALL BE PAINTED ACCORDING TO PAINT SPECIFICATION 09900.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONSTRUCTION STAKEOUT. CONTRACTOR SHALL VERIFY ALL MEASUREMENTS, ELEVATIONS, STATIONS, ETC. BEFORE ORDERING MATERIALS OR PROCEEDING WITH WORK, AND IS RESPONSIBLE FOR SAME. IF ANY DISCREPANCY IN THE PLANS OR SPECIFICATIONS ARISES, THE CONTRACTOR SHALL CONTACT THE ENGINEER BEFORE INITIATING WORK AFFECTED BY THE DISCREPANCY.
3. THE CONTRACTOR IS CAUTIONED AND SHALL BE RESPONSIBLE FOR NOTIFYING THE OWNER'S REPRESENTATIVE OF ANY ERROR OR OMISSION ON THE PLANS WHICH MAY CREATE ADDITIONAL WORK OR EXPENSE BY THE CONTRACTOR, AND SHALL OBTAIN A WRITTEN WORK ORDER FROM THE OWNER'S REPRESENTATIVE PRIOR TO PROCEEDING WITH ANY EXTRA WORK WHICH MAY BE CAUSED FROM SUCH ERROR OR OMISSION ON THE PLANS.
4. CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO AVOID DAMAGE TO EXISTING FACILITIES AND/OR ADJACENT PROPERTIES, AND SHALL BE RESPONSIBLE FOR SAME. CONTRACTOR SHALL CALL ARKANSAS ONE-CALL PRIOR TO ANY EXCAVATION AT THE SITE.
5. CONTRACTOR SHALL KEEP AN ORDERLY WORK SITE AND SHALL DISPOSE OF ALL CONSTRUCTION DEBRIS IN ACCORDANCE WITH ALL LOCAL, STATE, AND/OR FEDERAL REGULATIONS.
6. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL QUALITY CONTROL TESTING FOR THE PROJECT INCLUDING BUT NOT LIMITED TO LABORATORY SOIL TESTS, IN PLACE SOIL DENSITY TESTS, AND CONCRETE/ASPHALT TESTING, AS SPECIFIED.
7. CONTRACTOR SHALL ESTABLISH POSITIVE DRAINAGE OVER SITE, AND SHALL REESTABLISH TURF COVER OVER ALL DISTURBED AREAS THAT ARE NOT TO BE PAVED, OR OTHERWISE FINISHED, IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.
8. CONTRACTOR SHALL COORDINATE TIE IN WORK WITH OWNER TO ENSURE THAT PLANT OPERATION IS MAINTAINED.

YARD PIPING NOTES:

1. ALL LENGTHS SHOWN ARE APPROXIMATE LAYING LENGTHS OF PIPE. SEE MECHANICAL SHEETS FOR ADDITIONAL PIPES AND FITTINGS.
2. ALL LENGTHS SHOWN ARE FOR ASSISTING CONTRACTOR IN BIDDING. CONTRACTOR WILL BE RESPONSIBLE FOR ANY ADDITIONAL LENGTH THAT MAY BE REQUIRED AND SHOULD INCLUDE IN THEIR BID PRICING. NO ADDITIONAL MONIES WILL BE ADDED.



ESTIMATED DIRT QUANTITIES

CUT= 2,156 CU. YDS.
FILL= 9,371 CU. YDS.

NOTE: QUANTITIES ARE AN ESTIMATE WITH A 15% COMPACTION FACTOR FIGURED INTO THE FILL QUANTITY.

1. ALL DIRT WORK SHALL FOLLOW THE REQUIREMENTS OF SPECIFICATION 02300.

OUTSIDE PIPING SCHEDULE

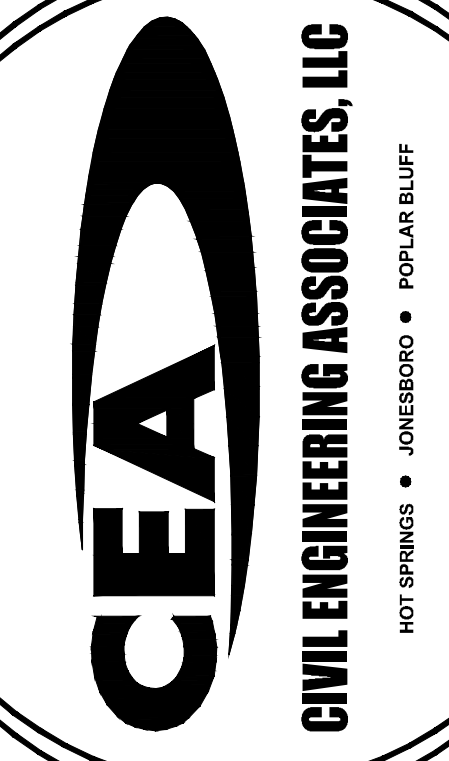
| LINE NO. | LINE SIZE | LINE TYPE | DESCRIPTION | APPROX. QUANTITY |
|----------|-----------|-----------|---|------------------|
| 1 | 6" | PVC | PROPOSED 6" FORCE MAIN TO PROPOSED HEADWORKS | 480 L.F. |
| 2 | 10" | D.I. | PROPOSED DISCHARGE LINE FROM HEADWORKS TO GRIT REMOVAL STRUCTURE | 26 L.F. |
| 3 | 3" | D.I. | PROPOSED DISCHARGE LINE FROM GRIT REMOVAL PUMP TO DECANTER DUMPSTER | 26 L.F. |
| 4 | 10" | D.I. | PROPOSED DISCHARGE LINE FROM GRIT REMOVAL STRUCTURE TO INFLUENT SPLITTER BOX | 10 L.F. |
| 5 | 10" | D.I. | PROPOSED SPLITTER BOX DISCHARGE LINE TO EXISTING OXIDATION DITCH | 18 L.F. |
| 6 | 10" | D.I. | PROPOSED SPLITTER BOX DISCHARGE LINE TO PROPOSED OXIDATION DITCH | 67 L.F. |
| 7 | 10" | DIP | PROPOSED EXISTING OXIDATION DITCH DISCHARGE LINE TO PROPOSED CLARIFIER SPLITTER BOX | 127 L.F. |
| 8 | 10" | DIP | PROPOSED EXISTING OXIDATION DITCH DISCHARGE LINE TO COMBINED OXIDATION DISCHARGE LINE | 14 L.F. |
| 9 | 10" | DIP | PROPOSED DISCHARGE LINES FROM CLARIFIER SPLITTER BOX TO CLARIFIERS INLETS | 55 L.F. |
| 10 | 10" | PVC | PROPOSED DISCHARGE LINES FROM CLARIFIERS TO EXISTING U.V. LINE CONNECTION | 220 L.F. |
| 11 | 4" | PVC | PROPOSED SLUDGE LINES FROM CLARIFIERS TO SLUDGE PUMPS IN PUMP BUILDING | 166 L.F. |
| 12 | 4" | PVC | PROPOSED SLUDGE LINE FROM CLARIFIER SLUDGE LINE TO SLUDGE POND | 100 L.F. |
| 13 | 4" | PVC | PROPOSED R.A.S LINE FROM SLUDGE PUMP TO INFLUENT SPLITTER BOX | 148 L.F. |
| 14 | 6" | PVC | PROPOSED DRAIN LINE FROM DUMPSTER DRAIN MANHOLE TO EXISTING EQUALIZATION POND | 236 L.F. |
| 15 | 3" | PVC | PROPOSED GRIT LINE TO DECANTER DUMPSTER | 45 L.F. |
| 16 | 8" | PVC | PROPOSED OXIDATION DITCH DRAIN LINE TO PROPOSED SLUDGE HOLDING POND | 165 L.F. |
| 17 | 1" | PVC | PROPOSED WATER LINE TO YARD HYDRANTS | 170 L.F. |

LEGEND

- ⊙ SEWER MANHOLE
- ⊕ WATER VALVE
- ⊙ POWER POLE
- ⊙ LIGHT POLE
- EXISTING FENCE
- EXISTING OVERHEAD ELECTRIC
- EXISTING GRAVEL SURFACE

NOTE:

1. DISCHARGE PIPE FROM INFLUENT SPLITTER TO PROPOSED OXIDATION DITCH, THE OXIDATION DITCH OUTLETS TO THE CLARIFIER SPLITTER BOX & CLARIFIERS TO EXISTING U.V. STRUCTURE SHALL BE ROUTED UNDERGROUND AND MAINTAIN 2' OF COVER OVER PIPE.
2. DUMPSTER PADS SHALL HAVE 6" DRAIN INLETS W/ 4" LINES CONNECTED TO MANHOLE. DECANTER DUMPSTER DRAINS SHALL BE CONNECTED TO THE MANHOLE ADJACENT TO PADS.

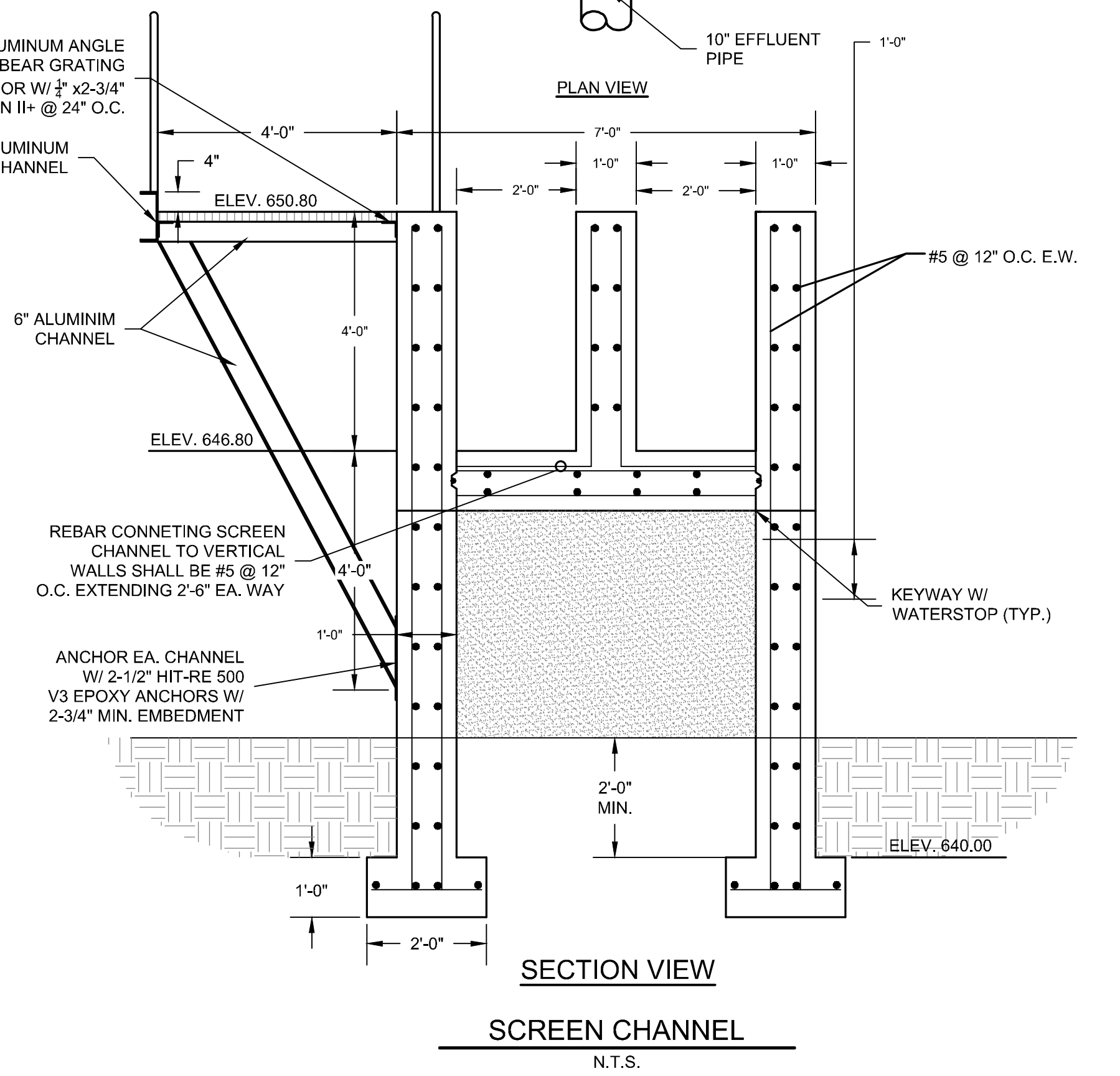
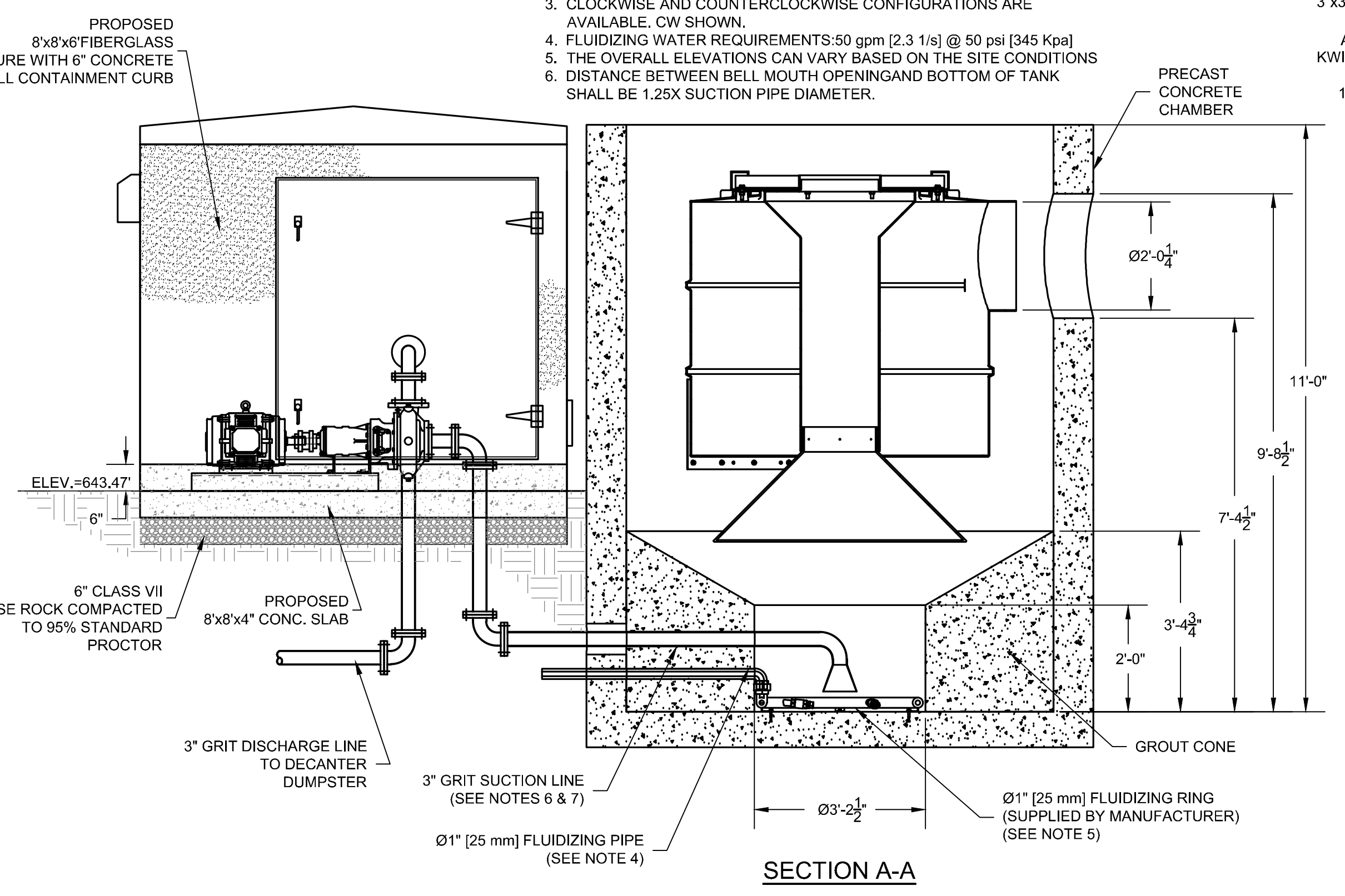
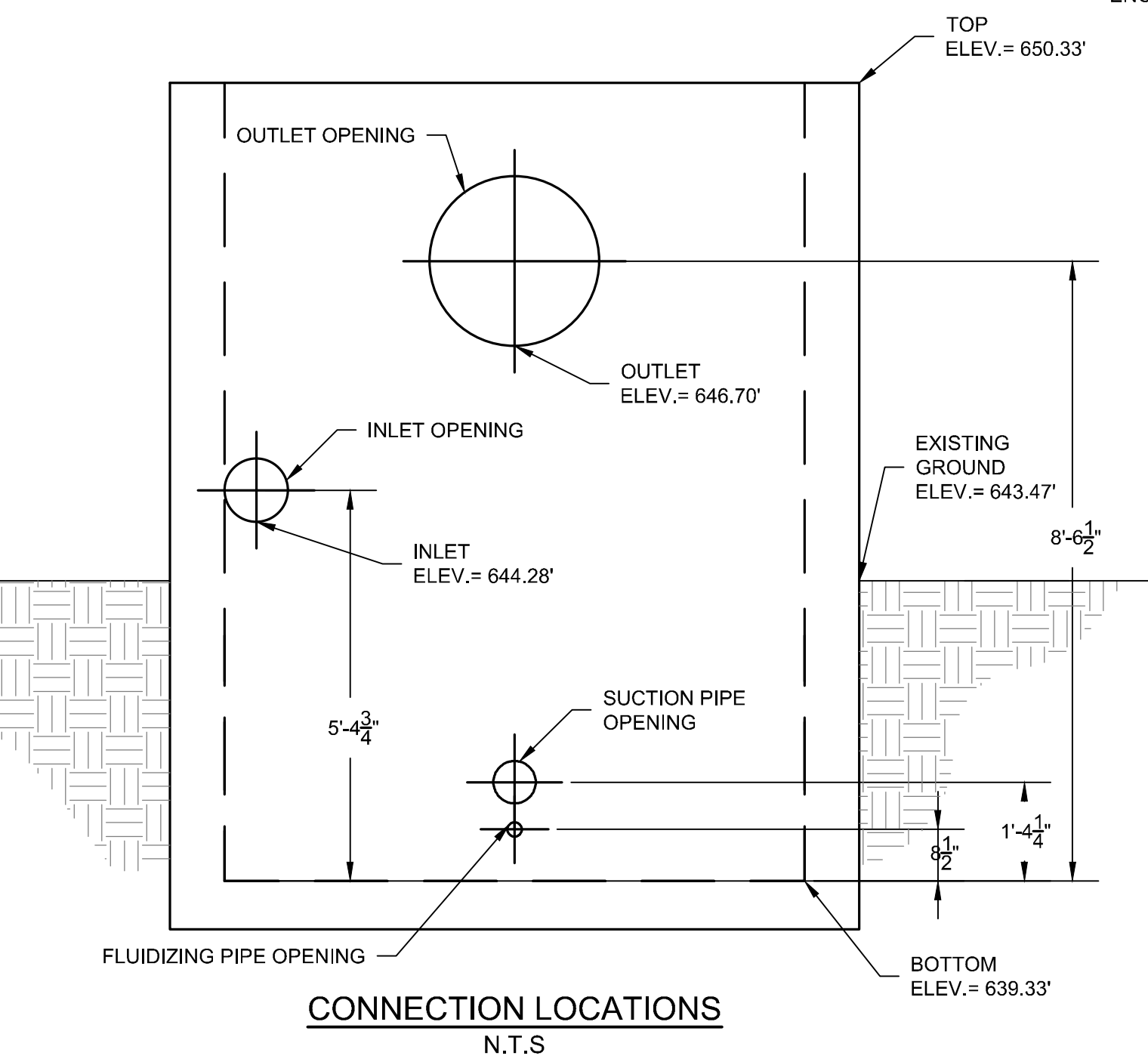
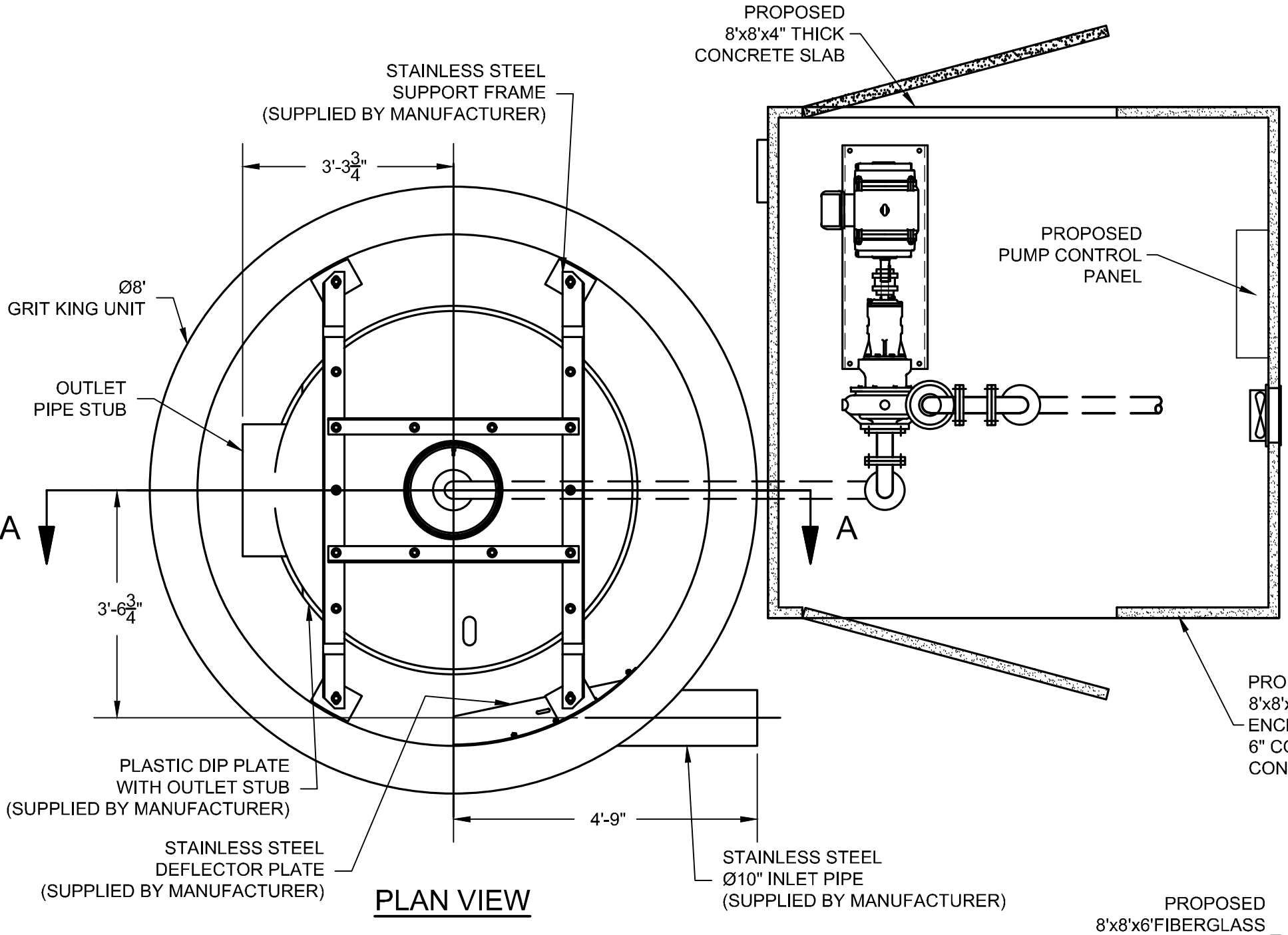
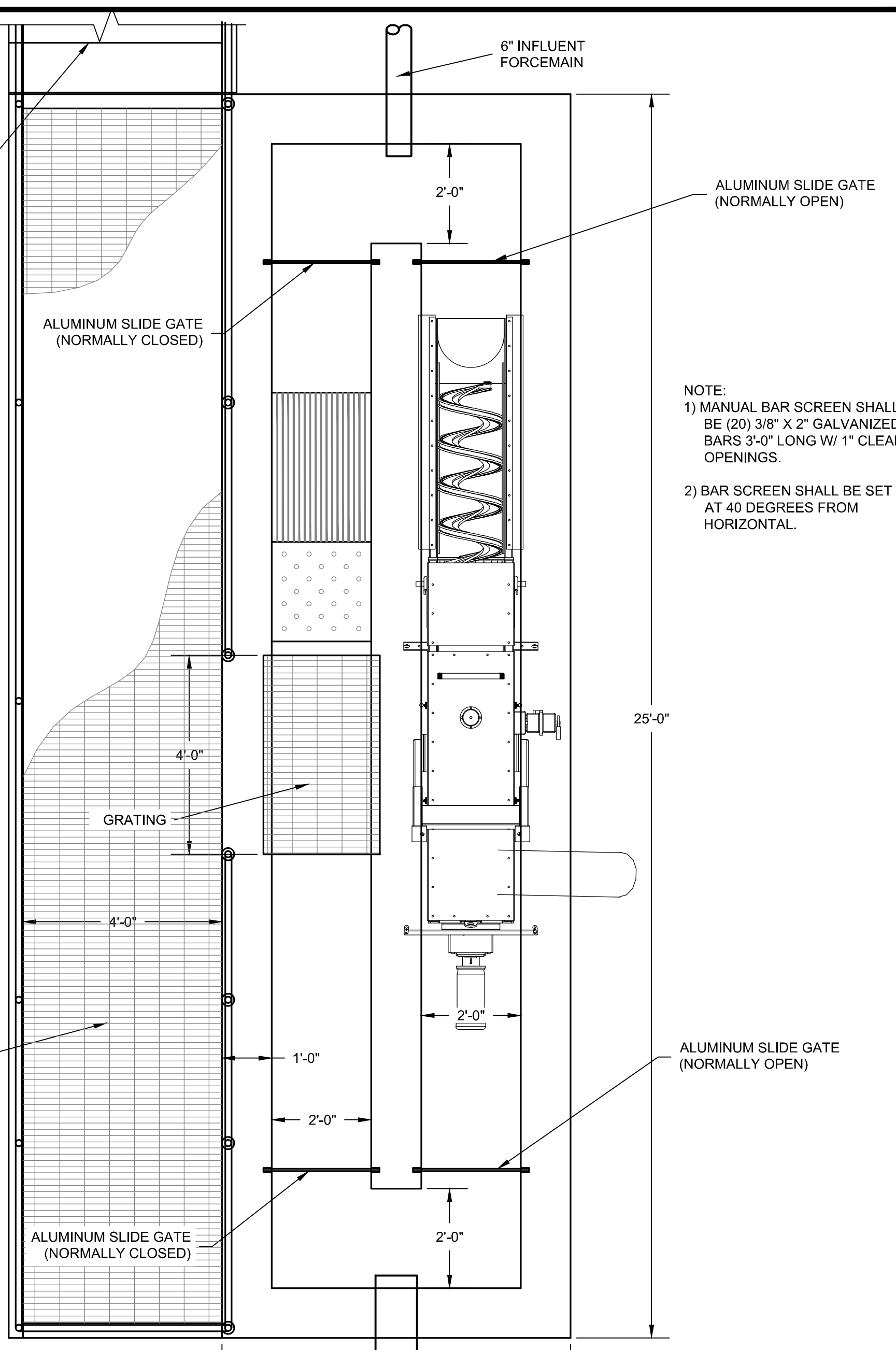
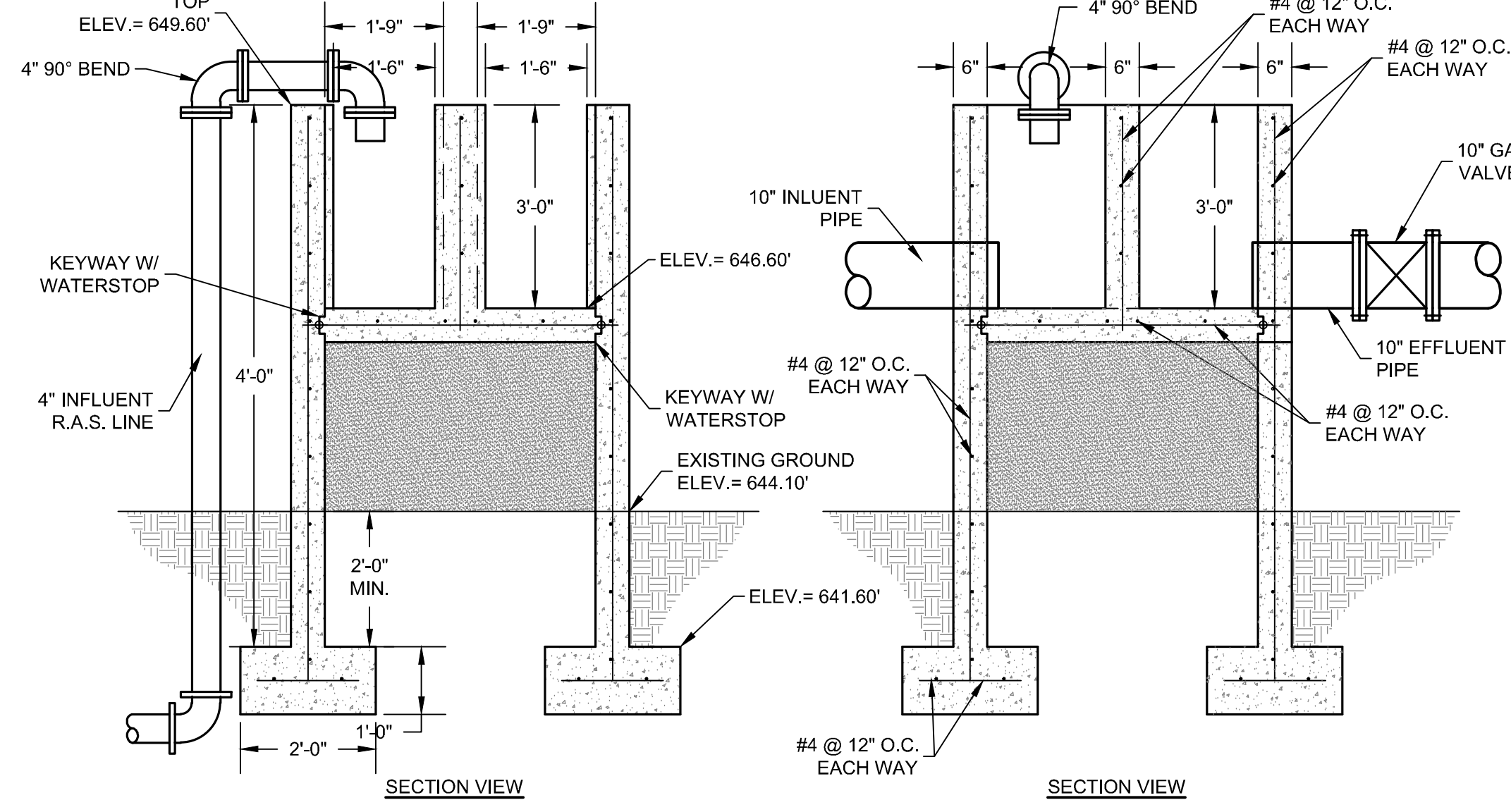
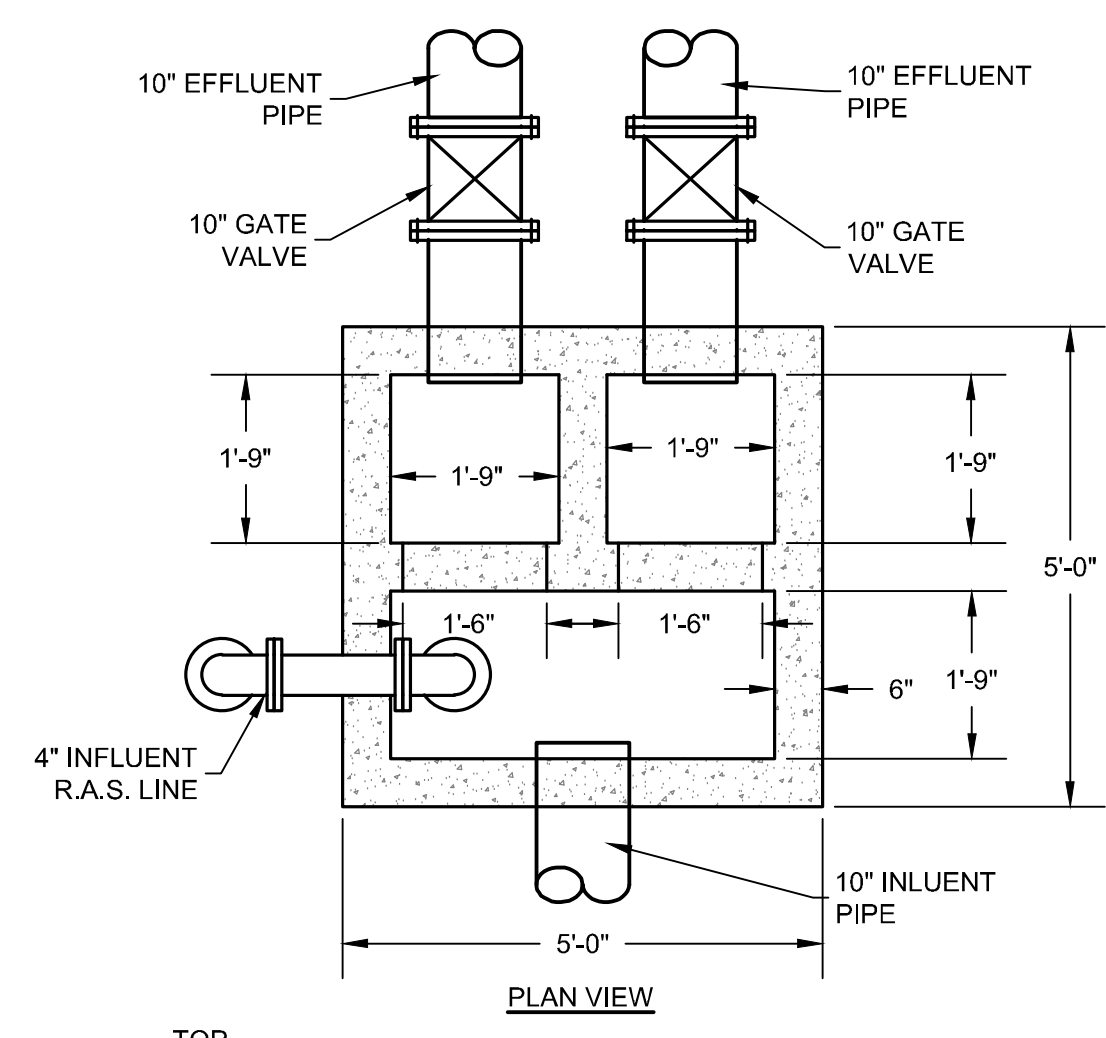
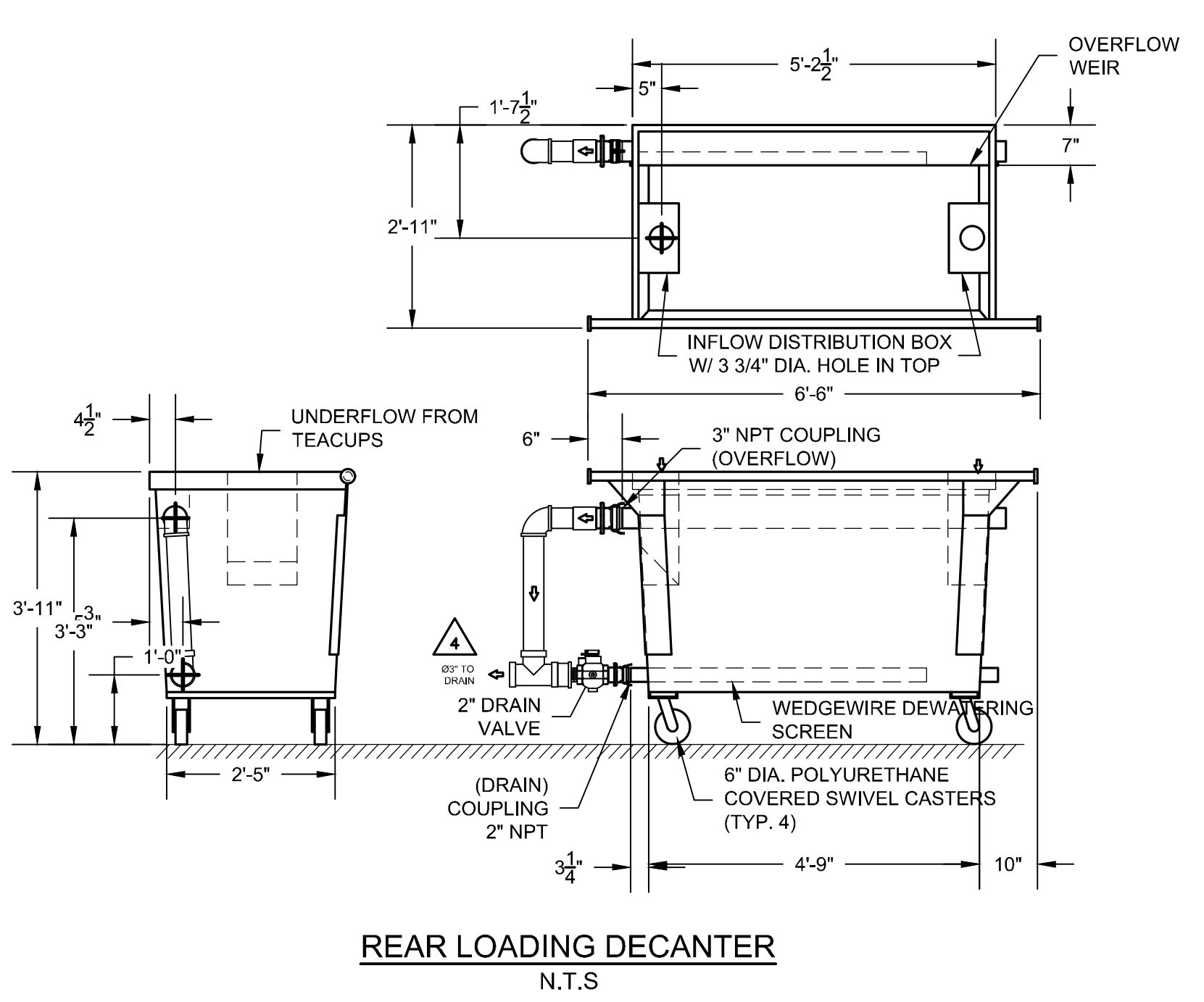


**WASTEWATER SYSTEM IMPROVEMENTS
CITY OF FLIPPIN
FLIPPIN, ARKANSAS**

**PROPOSED
SITE PLAN**

Designed: JSS
Checked: RLP
Drawn: ALA
Approved: JSS

SCALE: 1" = 30'
DATE: NOVEMBER 2020
JOB NO.:
SHEET: 4



- NOTES:**
1. PLANT FLOW BYPASS IS RECOMMENDED TO ALLOW THE GRIT KING TO BE TAKEN OUT OF SERVICE IF MAINTENANCE IS REQUIRED.
 2. THE INLET PIPE AND OUTLET PIPE STUB MAY BE ROTATED 360 DEGREES ABOUT THE UNIT'S CENTRAL AXIS.
 3. CLOCKWISE AND COUNTERCLOCKWISE CONFIGURATIONS ARE AVAILABLE. CW SHOWN.
 4. FLUIDIZING WATER REQUIREMENTS: 50 gpm [2.3 1/s] @ 50 psi [345 Kpa]
 5. THE OVERALL ELEVATIONS CAN VARY BASED ON THE SITE CONDITIONS
 6. DISTANCE BETWEEN BELL MOUTH OPENING AND BOTTOM OF TANK SHALL BE 1.25X SUCTION PIPE DIAMETER.

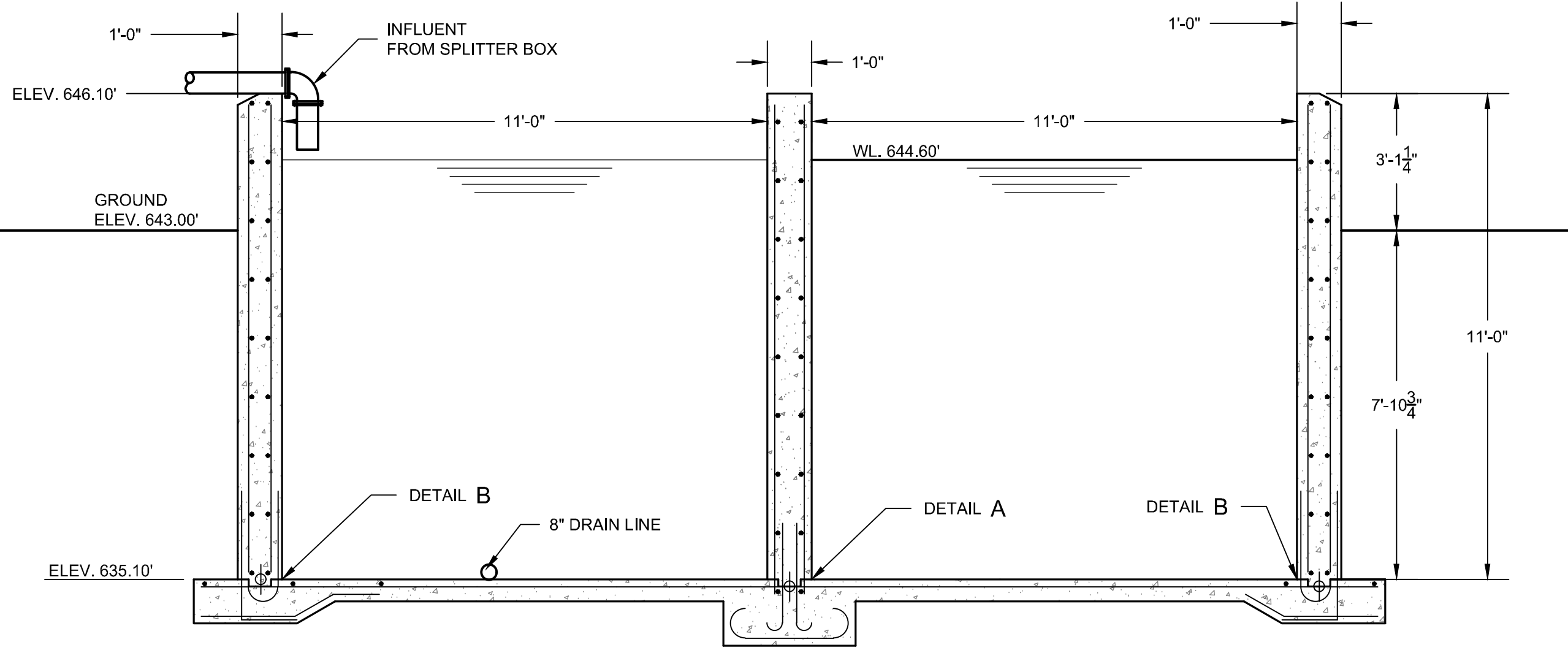
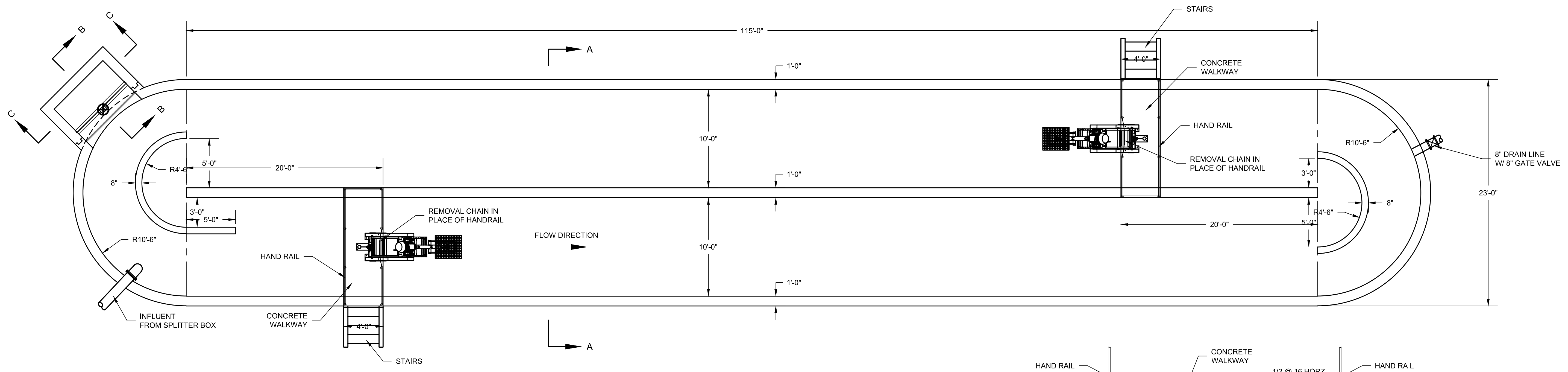
NOTE:
 1) MANUAL BAR SCREEN SHALL BE (20) 3/8" X 2" GALVANIZED BARS 3'-0" LONG W/ 1" CLEAR OPENINGS.
 2) BAR SCREEN SHALL BE SET AT 40 DEGREES FROM HORIZONTAL.

WASTEWATER SYSTEM IMPROVEMENTS
CITY OF FLIPPIN
FLIPPIN, ARKANSAS

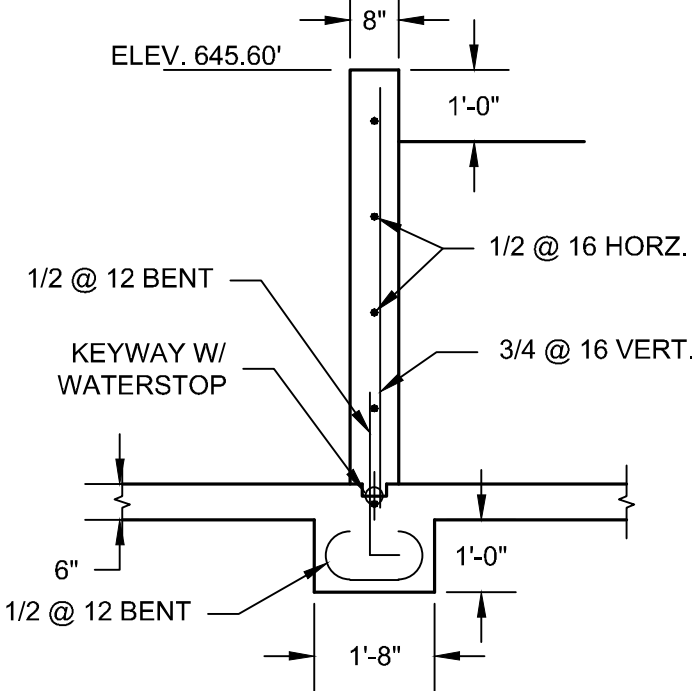
OXIDATION DITCH
DETAILS (STRUCTURAL)

Designed JSS
 Checked RLP
 Drawn ALA
 Approved JSS

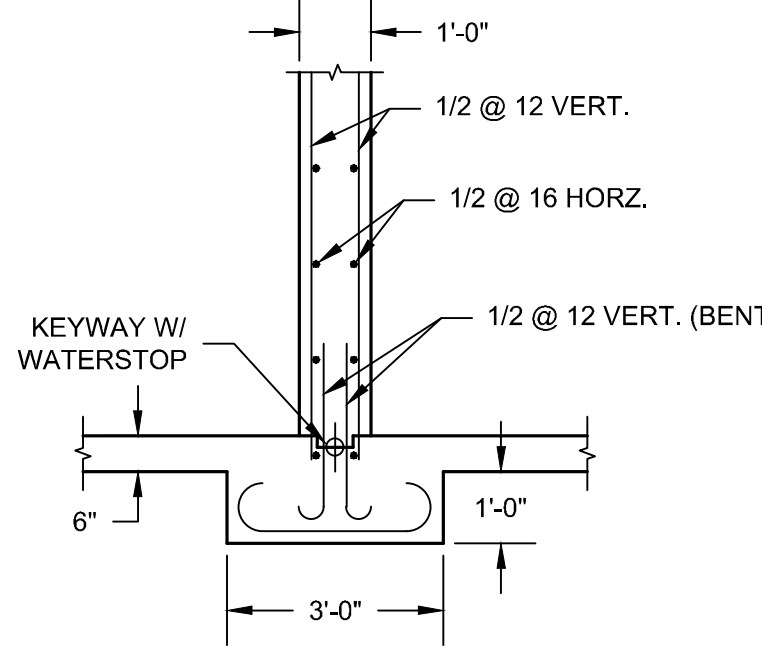
SCALE: 1" = 30'
 DATE: NOVEMBER 2020
 JOB NO: SHEET: 6



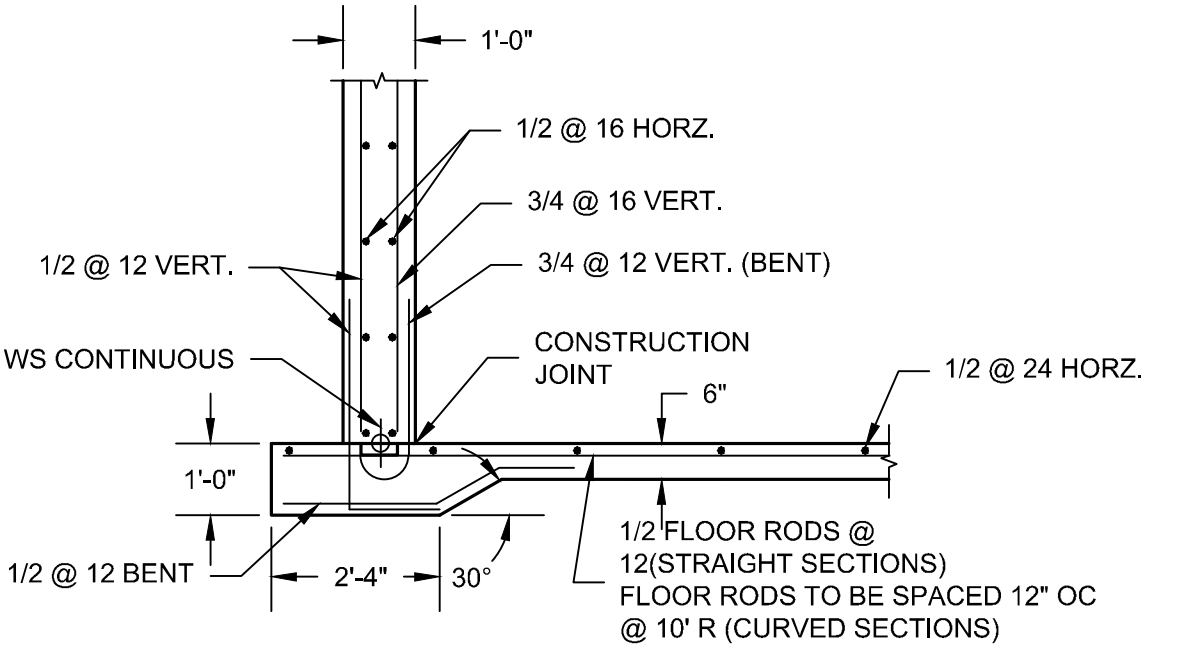
SECTION VIEW A-A
 N.T.S.



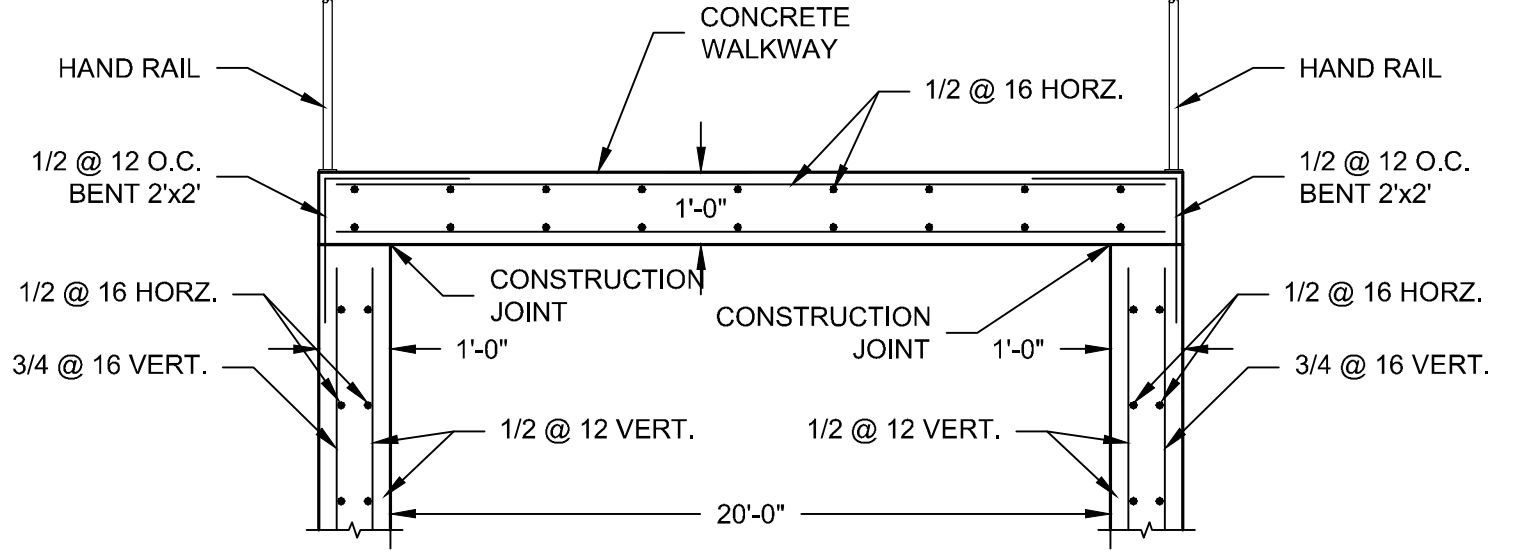
BAFFLE WALL SECTION
 N.T.S.



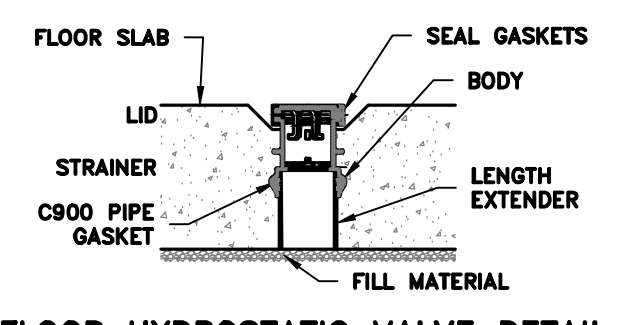
DETAIL A
 N.T.S.



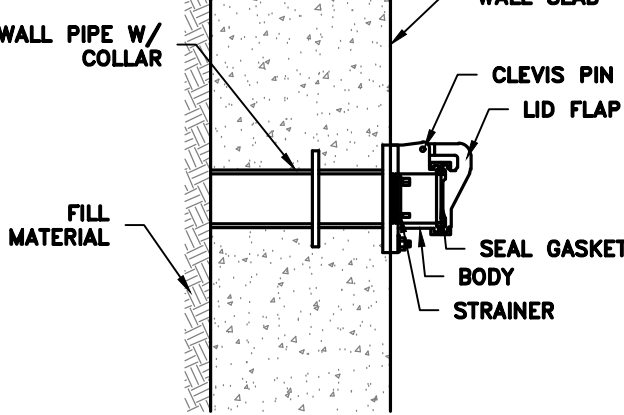
DETAIL B
 N.T.S.



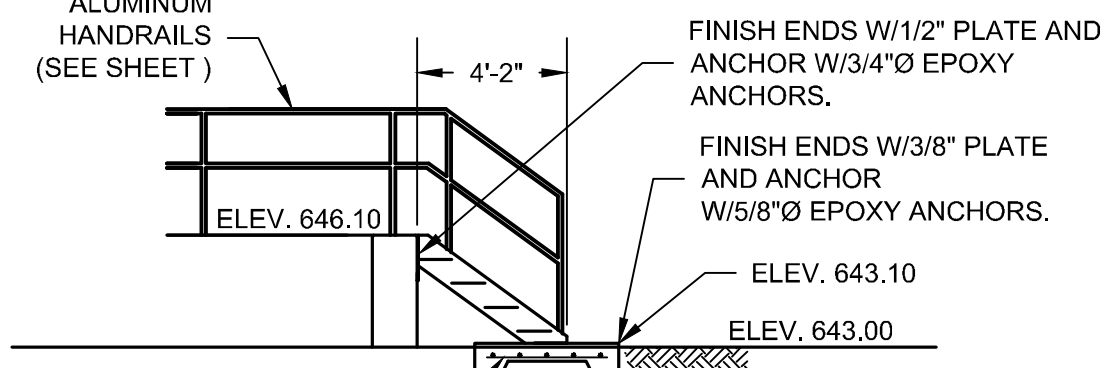
CONCRETE WALKWAY DETAIL
 N.T.S.



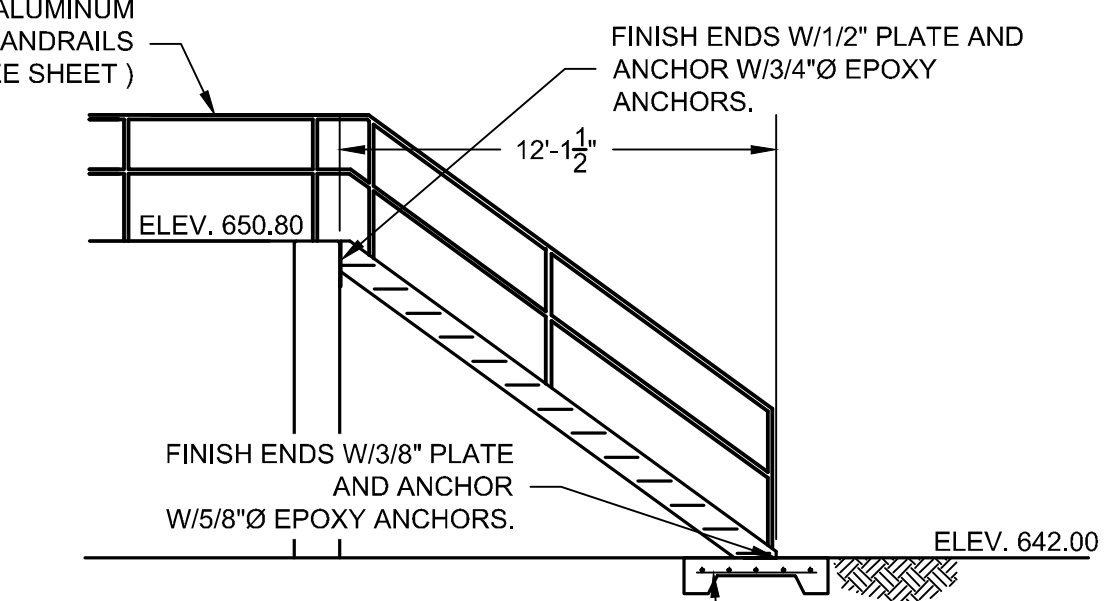
FLOOR HYDROSTATIC VALVE DETAIL
 NO SCALE



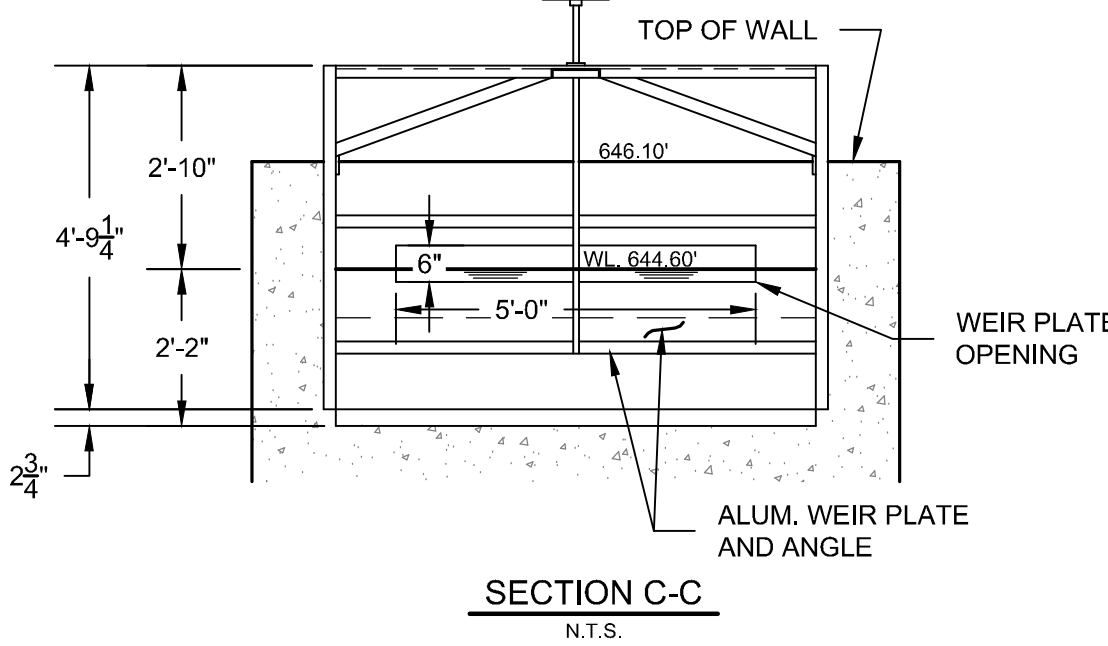
WALL HYDROSTATIC VALVE DETAIL
 NO SCALE



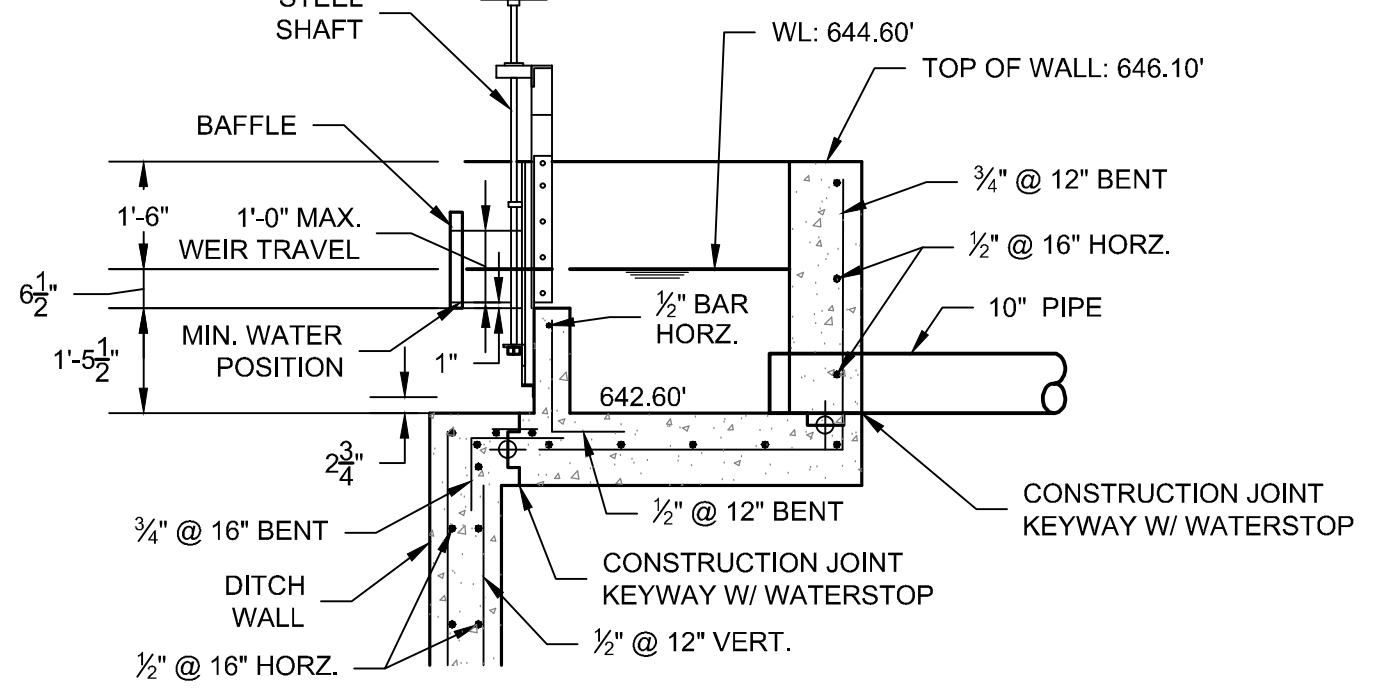
OXIDATION DITCH STAIR SECTION
 N.T.S.



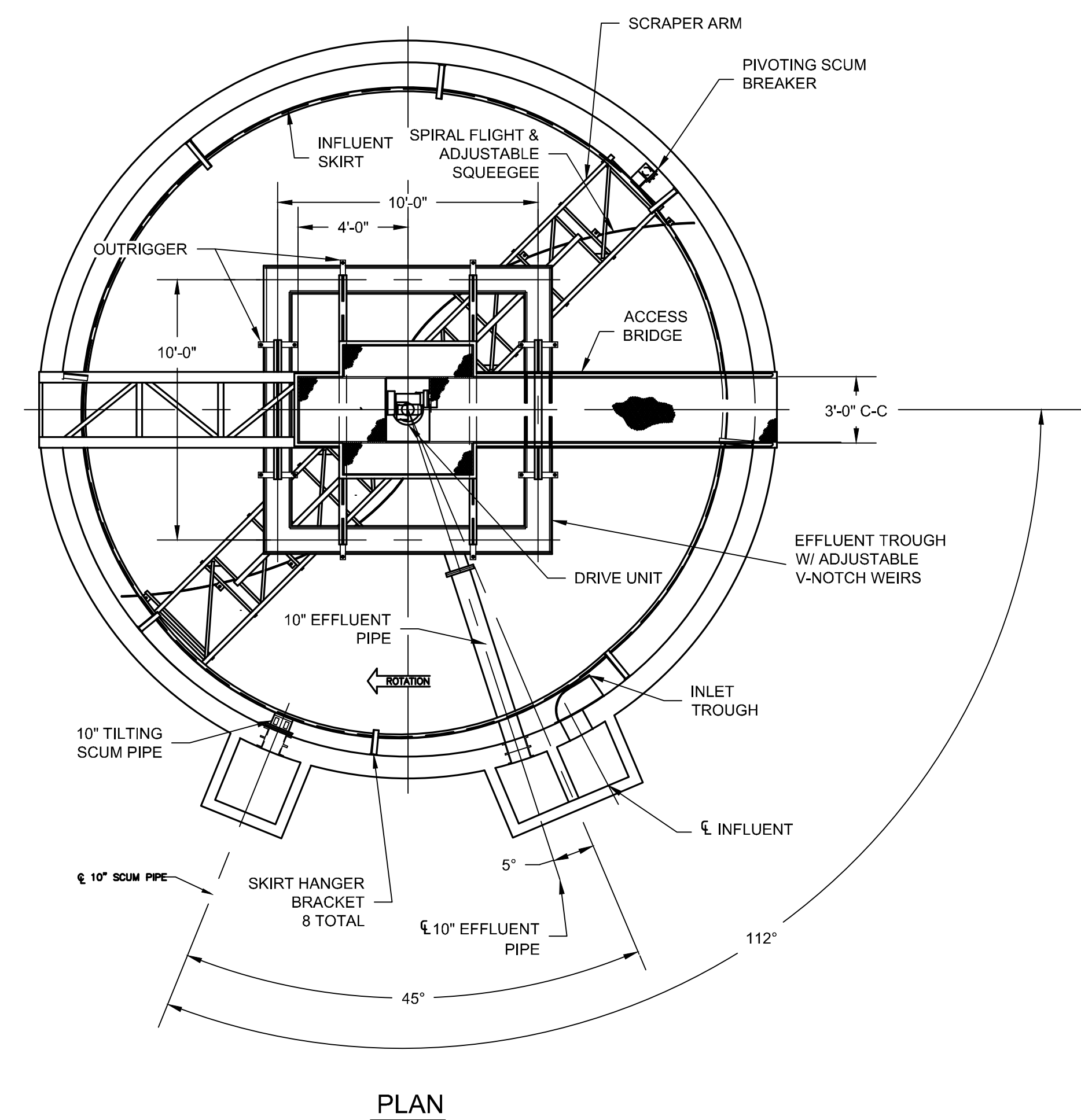
SCREEN CHANNEL STAIR SECTION
 N.T.S.



SECTION C-C
 N.T.S.



SECTION B-B
 N.T.S.

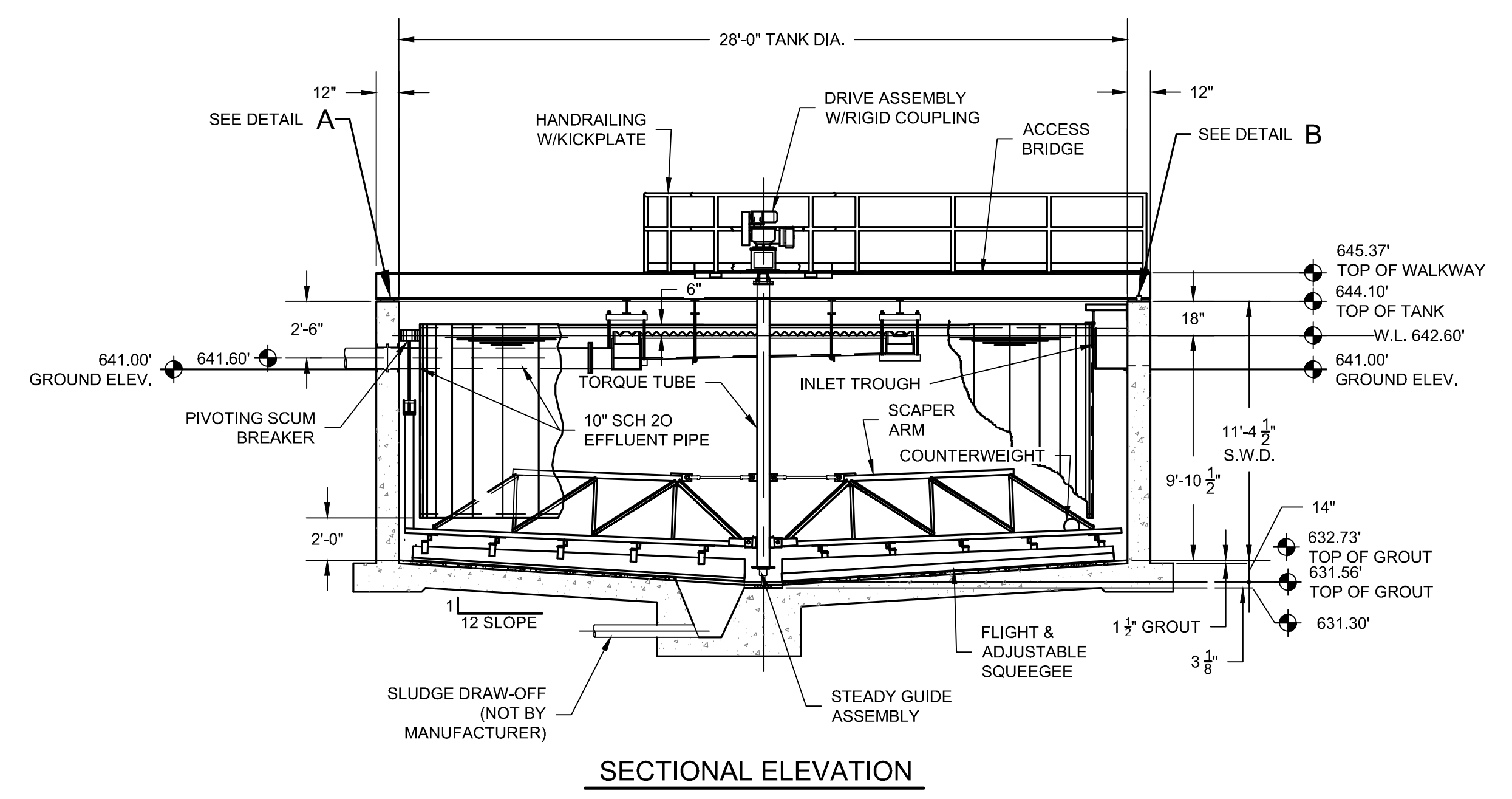


PLAN

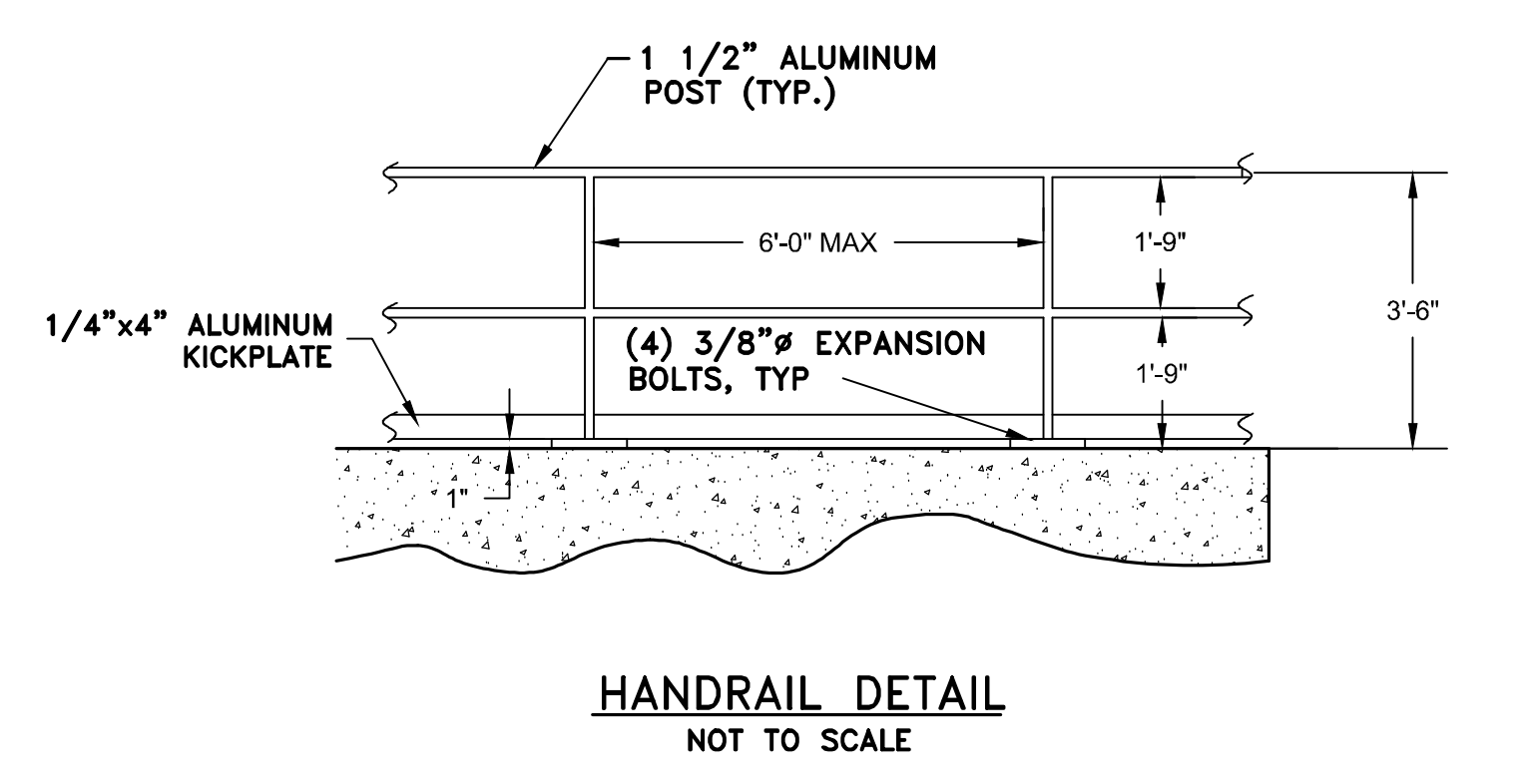


DETAIL A

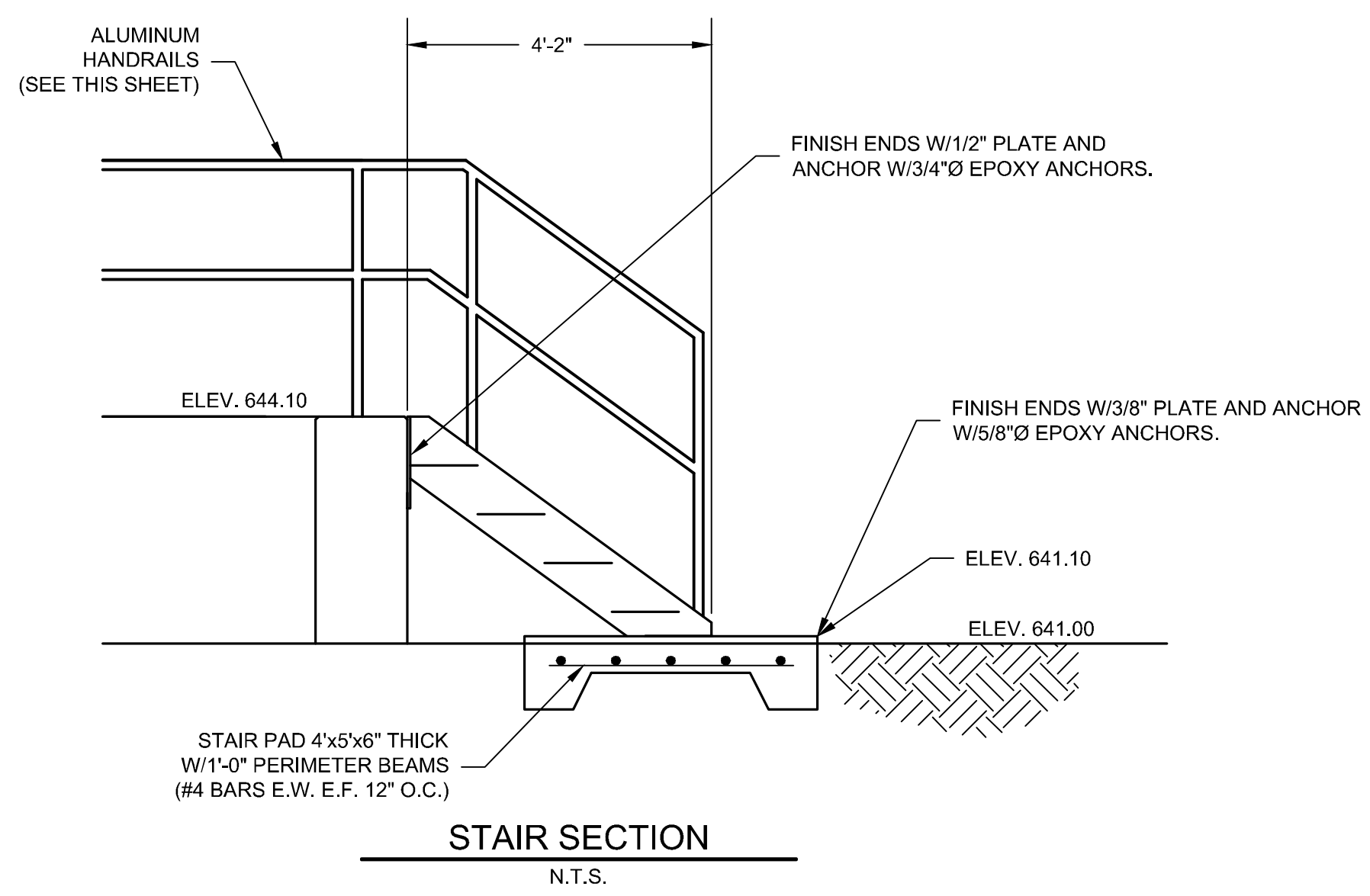
DETAIL B



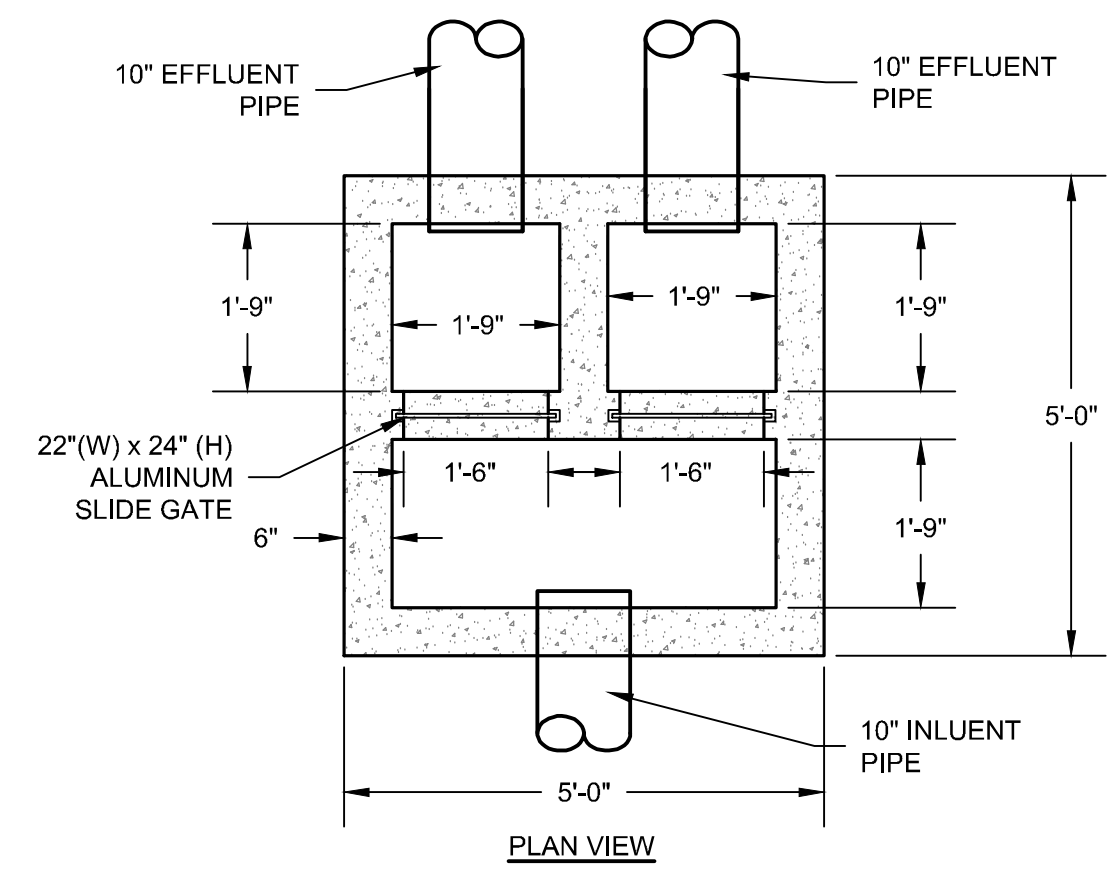
SECTIONAL ELEVATION



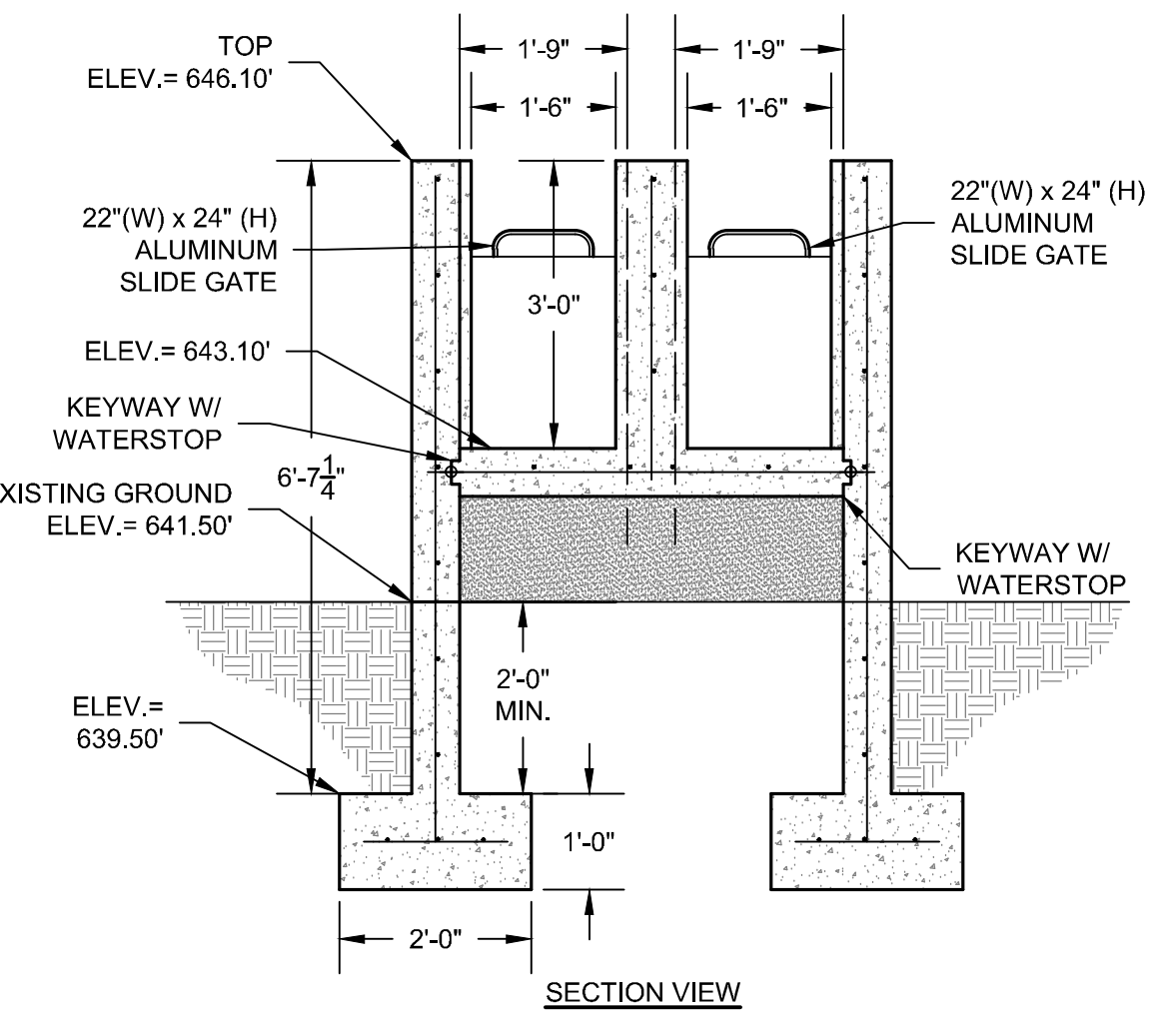
HANDRAIL DETAIL
 NOT TO SCALE



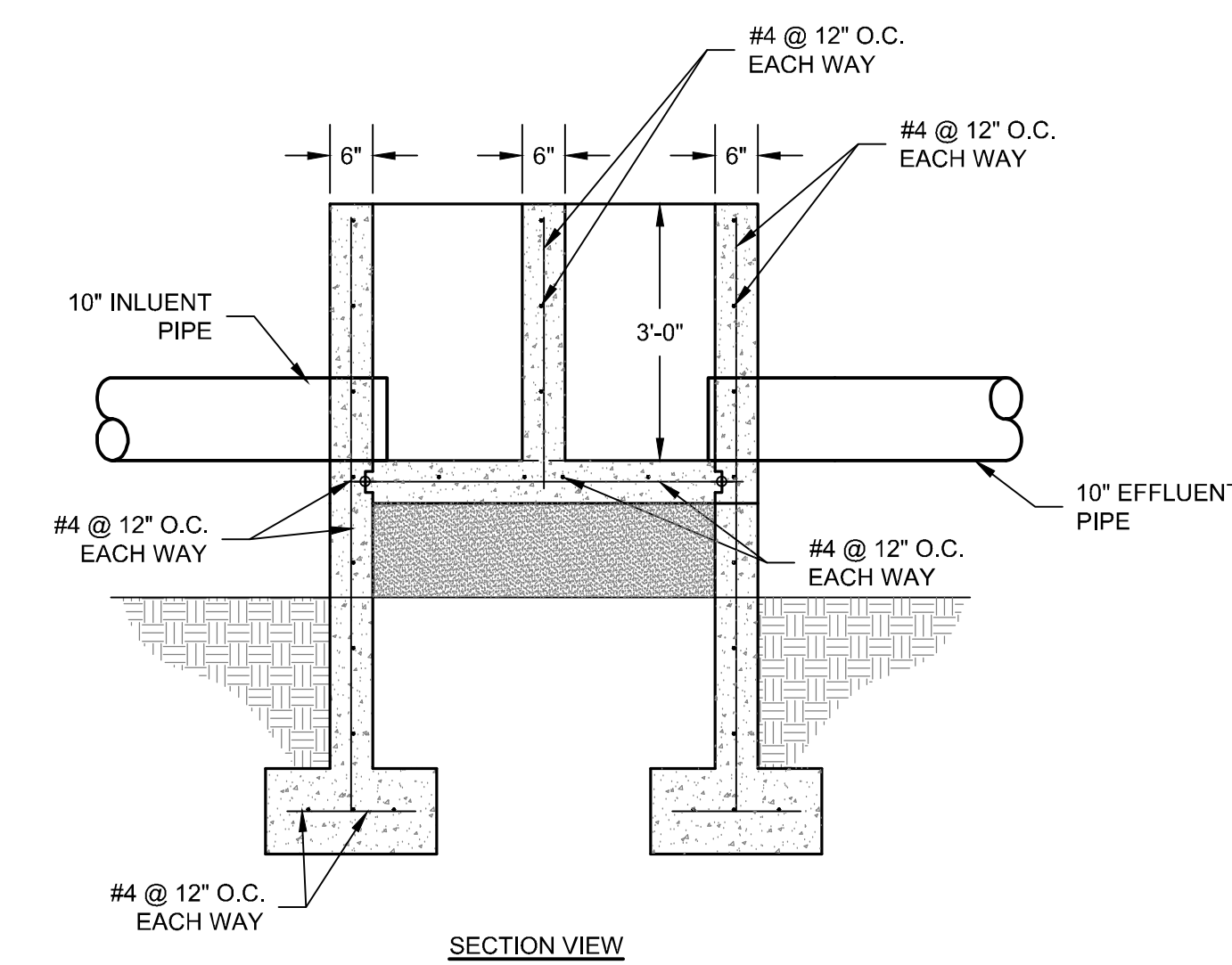
STAIR SECTION
 N.T.S.



PLAN VIEW



SECTION VIEW



SECTION VIEW

CLARIFIER SPLITTER BOX
 N.T.S.

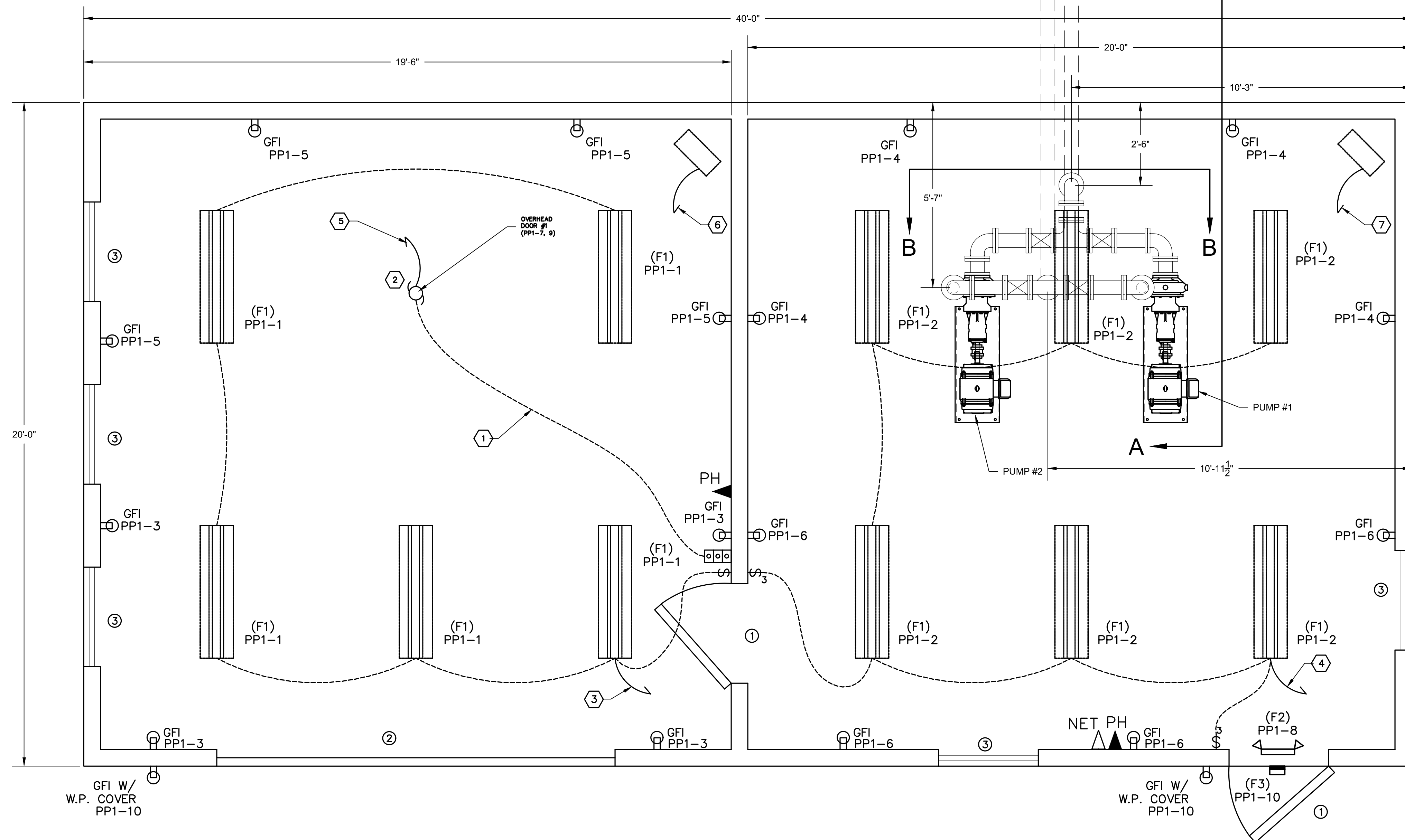
| DOOR AND FRAME SCHEDULE | | | | | | | | | | |
|-------------------------|----------------|------|-----------|---------|-------|-----------|-----------------|---------|---|---------------------|
| MK | SIZE | DOOR | | | FRAME | | | REMARKS | | |
| | | TYPE | MATERIAL | GLAZING | TYPE | MATERIAL | HEAD JAMB THRES | | | |
| ① | 3"x6"x1/2" | A | HOL. MTL. | NONE | A | HOL. MTL. | 1 | 1 | 1 | INSL. DOOR W/ GLASS |
| ② | 12"x12"x1-1/2" | A | HOL. MTL. | NONE | A | HOL. MTL. | 1 | 1 | 1 | INSL. DOOR |

DOOR HARDWARE TO BE COMMERCIAL GRADE AUTOMATIC LEVER. ALL EXTERIOR DOORS TO HAVE AUTOMATIC CLOSING DEVICES. ALL METAL DOORS SHALL BE PAINTED.

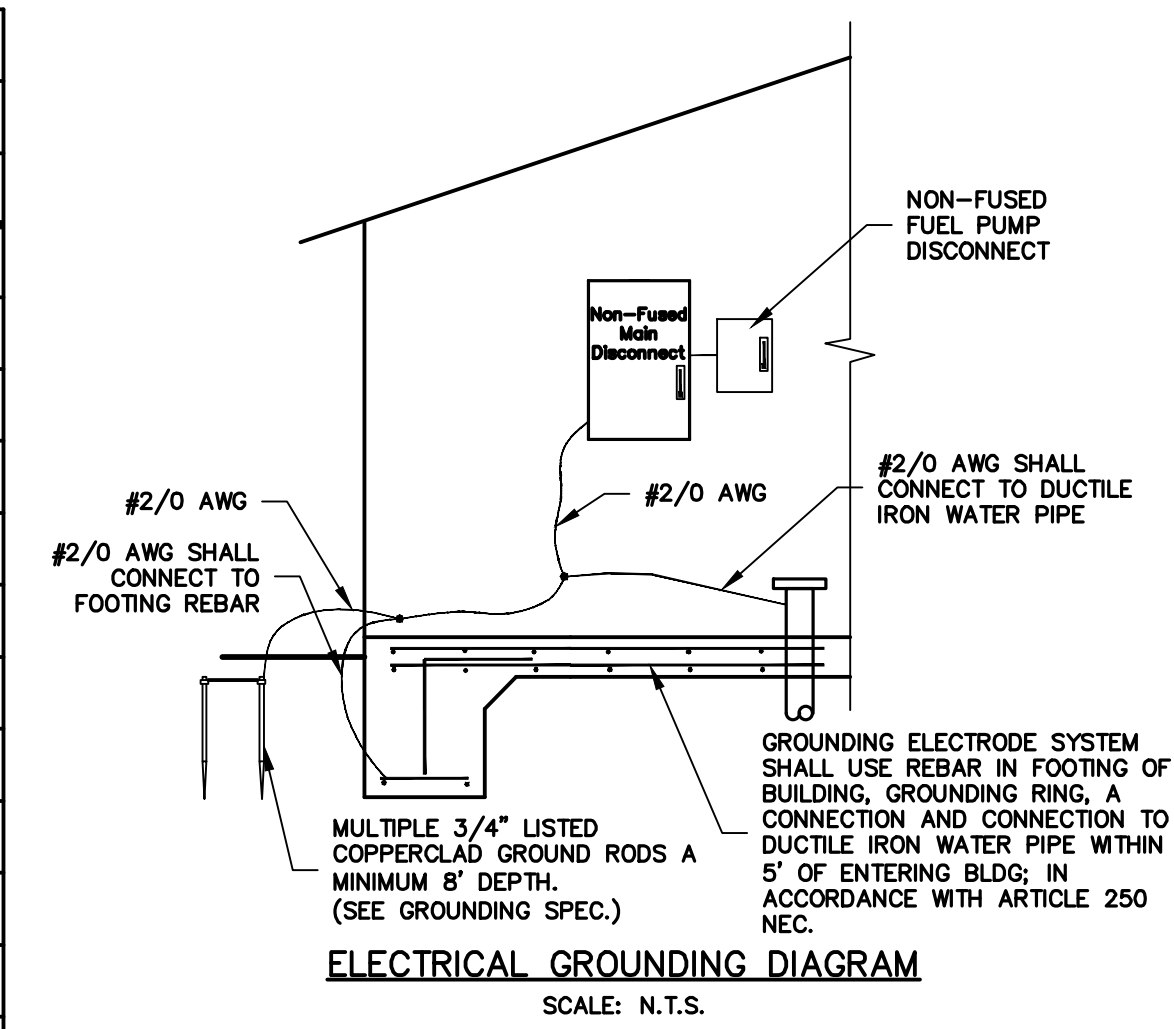
| WINDOW AND FRAME SCHEDULE | | | | |
|---------------------------|-------|----------------|--------------------------------|------------------|
| MK | SIZE | FRAME TYPE | | REMARKS |
| | | | STYLE | |
| ③ | 3"x4" | ALUMINUM FRAME | LOCKABLE DOUBLE-HUNG W/ SCREEN | ENERGY EFFICIENT |

| ELECTRIC PLAN SCHEDULE | | | | | |
|------------------------|-----|---|--------|-----|---|
| SYMBOL | QTY | DESCRIPTION | SYMBOL | QTY | DESCRIPTION |
| (F1) | 11 | FLUORESCENT 32 W T8 4 LAMP SURFACE MOUNT FIXTURE, W/ ALUMINUM WHITE FRAME WITH CLEAR ACRYLIC SHELLING, 120V BALLAST WITH 5,000K LAMP COLOR OR EQUAL, ELECTRONIC BALLAST | (GFI) | 0 | DUPLICATE RECEPTACLE, 20 AMP, 120V, NEMA 5-20R OR EQUAL - 18" ABOVE FINISHED FLOOR |
| (F2) | 1 | COMBINATION EXIT/EMERGENCY LIGHT EXTRACTOR # MCL-U-89-182-1H | (GFI) | 18 | GROUND FAULT CIRCUIT INTERRUPTER DUPLICATE RECEPTACLE, 20 AMP, 120V, NEMA 5-20R OR EQUAL - 18" ABOVE FINISHED FLOOR |
| (F3) | 1 | BATTERY POWERED EMERGENCY LIGHT (120V) LITRONA # RELIG MOUNT 8" ABOVE FINISHED FLOOR | (GFI) | 2 | GROUND FAULT CIRCUIT INTERRUPTER DUPLICATE RECEPTACLE, 20 AMP, 120V, NEMA 5-20R OR EQUAL W/ WEATHERPROOF COVER - 18" ABOVE FINISHED FLOOR |
| (F4) | 1 | POWER PANEL | (GFI) | 1 | NETWORK RECEPTACLE - INCLUDES NETWORK LINES TO NETWORK BOX, INSTALL RECEPTACLE 18" ABOVE FLOOR, STUB 3/4" CONDUIT THROUGH WALL PLATE. |
| (F5) | 1 | SINGLE POLE LIGHT SWITCH - 120V/20A - 48" ABOVE FINISHED FLOOR (UNLESS OTHERWISE NOTED) | (PH) | 2 | TELEPHONE RECEPTACLE - INCLUDES PHONE LINES TO PHONE BOX, INSTALL RECEPTACLE 18" ABOVE FLOOR, STUB 3/4" CONDUIT THROUGH WALL PLATE. |
| (F6) | 2 | 3-WAY LIGHT SWITCH - 120V/20A - 48" ABOVE FINISHED FLOOR (UNLESS OTHERWISE NOTED) | (MDS) | 1 | MANUAL DISCONNECT SWITCH |
| (F7) | 1 | 3/4 HP MOTORIZED GARAGE DOOR MOTOR | | | |
| (F8) | 1 | THREE BUTTON GARAGE DOOR CONTROLLER | | | |

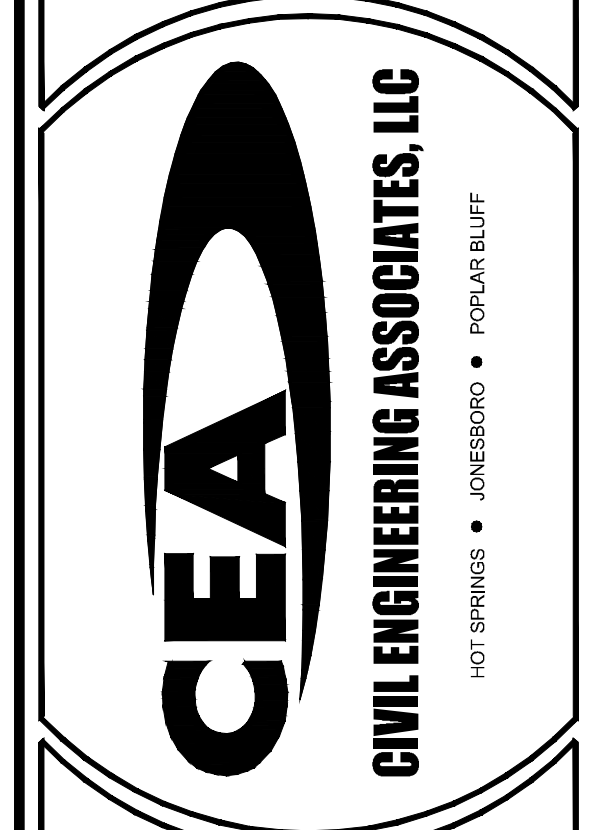
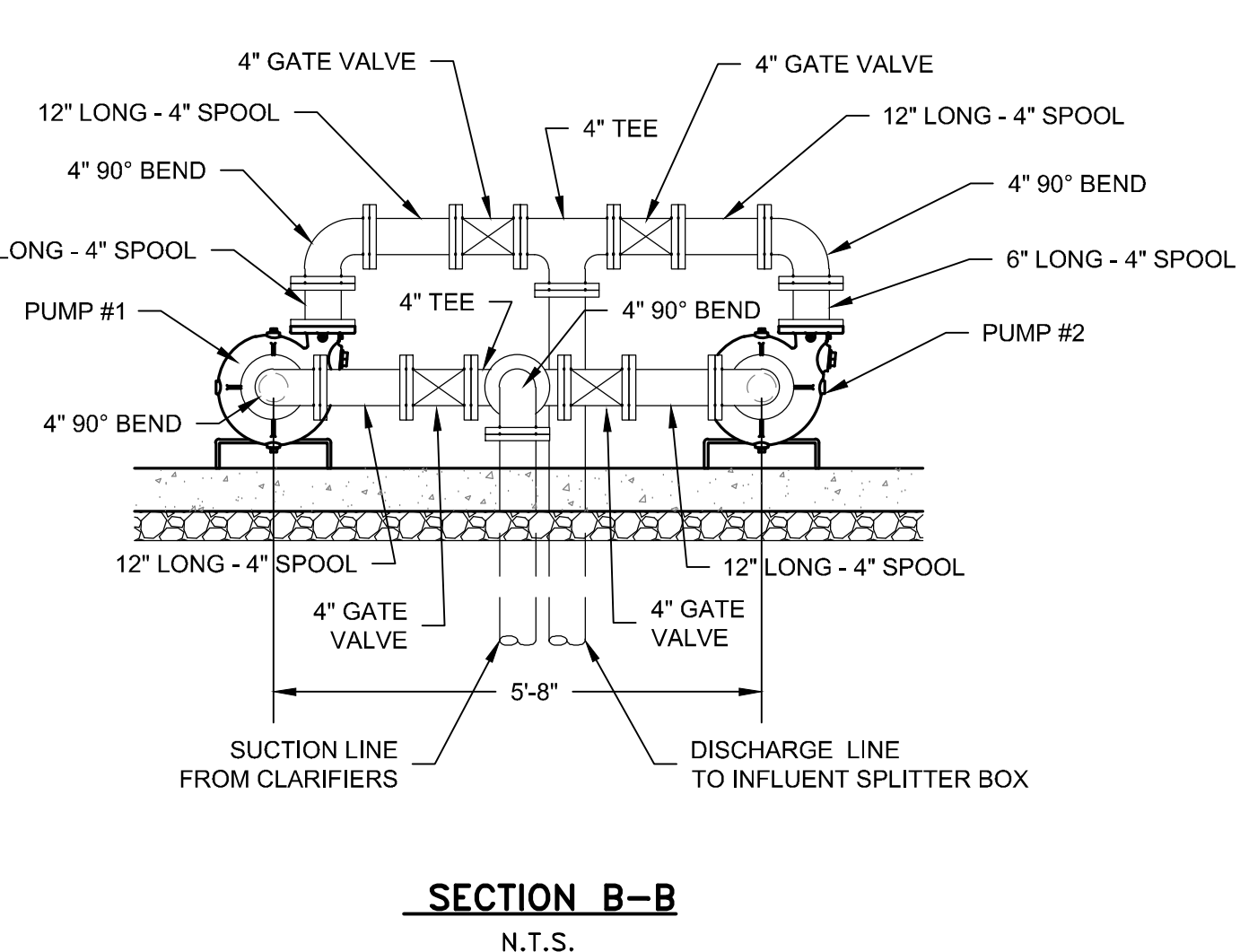
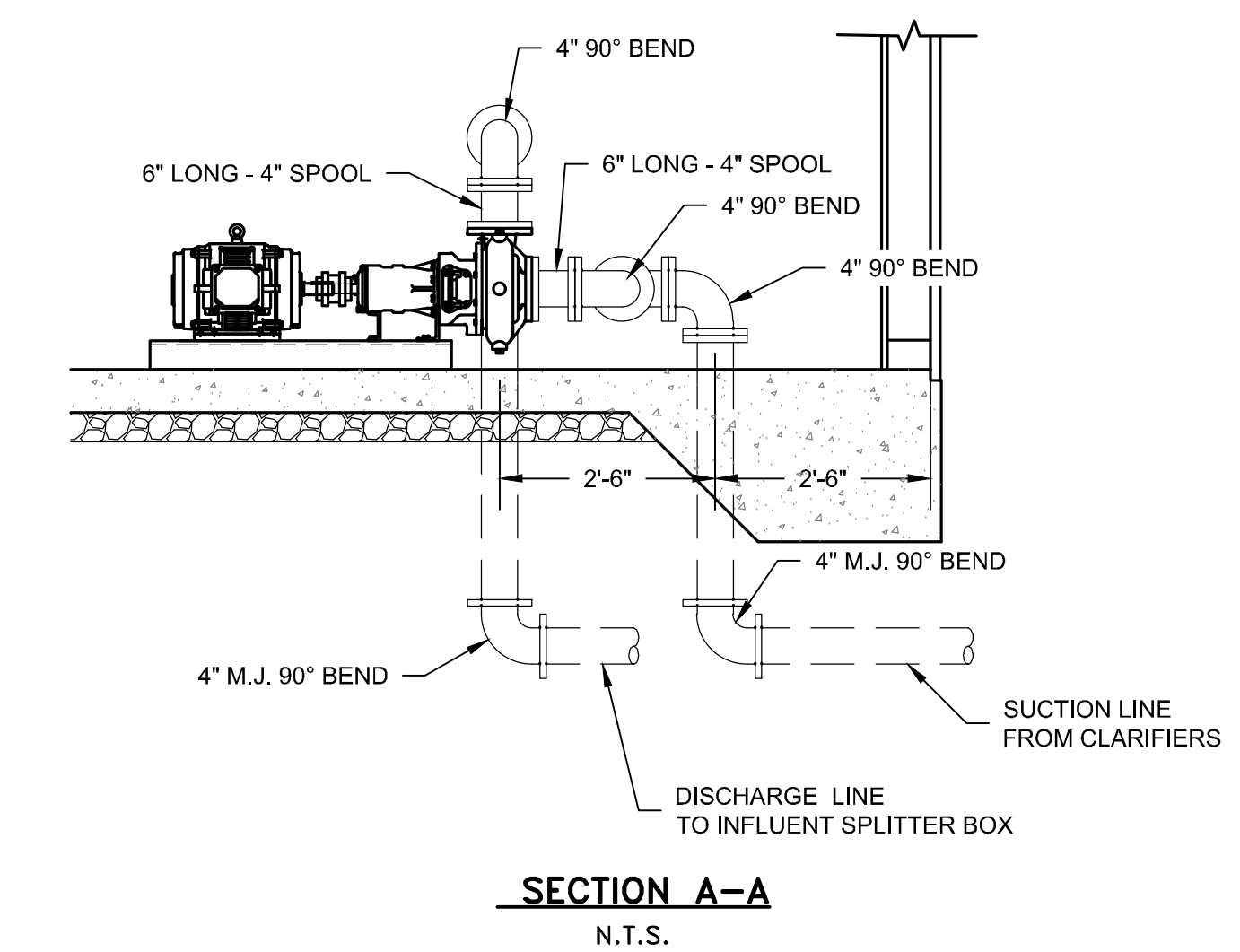
- ① OVERHEAD DOOR CONTROL WIRING IN CONDUIT
- ② 20A/120V/1P DISCONNECT SWITCH, MOUNT BESIDE MOTORIZED EQUIPMENT
- ③ TO POWER PANEL #1 CIRCUIT (PP1-1)
- ④ TO POWER PANEL #1 CIRCUIT (PP1-2)
- ⑤ TO POWER PANEL #1 CIRCUIT (PP1-7 & 9)
- ⑥ TO POWER PANEL #1 CIRCUIT (PP1-11 & 13)
- ⑦ TO POWER PANEL #1 CIRCUIT (PP1-15 & 17)



| POWER PANEL 'PP-1' | | | | | | | | | | |
|--|------------------------|-----------|-----------|----------------|------|-----------|-----------|---------------------------------------|----------|--|
| 120/208V/1P/3W-400A BREAKER, SURFACE MOUNTED NEMA 1 ENCLOSURE, BOLT IN BREAKER PROVIDE COMBINATION NEUTRAL & EDC BUS BONDED TO ENCLOSURE | | | | | | | | | | |
| CIR. NO. | CIRCUIT DESCRIPTION | L1 (AMPS) | L2 (AMPS) | BRK. | BRK. | L2 (AMPS) | L1 (AMPS) | CIRCUIT DESCRIPTION | CIR. NO. | |
| 1 | LIGHTS GARAGE | 8 A | 20A/1P | 20A/1P | 9 A | 20A/1P | 9 A | LIGHTS PUMP ROOM | 2 | |
| 3 | RECEPTACLES GARAGE | 6 A | 20A/1P | 20A/1P | 6 A | 20A/1P | 6 A | RECEPTACLES PUMP ROOM | 4 | |
| 5 | RECEPTACLES GARAGE | 6 A | 20A/1P | 20A/1P | 6 A | 20A/1P | 6 A | RECEPTACLES PUMP ROOM | 6 | |
| 7 | OVERHEAD DOOR #1 | 9 A | 20A/1P | 20A/1P | 1 A | 20A/1P | 1 A | EXIT/EMERGENCY LIGHTS | 8 | |
| 9 | OVERHEAD DOOR #1 | 9 A | 20A/1P | 20A/1P | 4 A | 20A/1P | 4 A | OUTSIDE BUILDING LIGHTS - RECEPTACLES | 10 | |
| 11 | HEATER #1 (5,000 WATT) | 21 A | 30A/1P | 30A/2P | 24 A | 30A/2P | 24 A | CONDENSOR #1 | 12 | |
| 13 | HEATER #1 (5,000 WATT) | 21 A | 30A/1P | 30A/2P | 24 A | 30A/2P | 24 A | CONDENSOR #1 | 14 | |
| 15 | HEATER #2 (5,000 WATT) | 21 A | 30A/1P | 30A/2P | 16 A | 30A/2P | 16 A | AHU #1 | 16 | |
| 17 | HEATER #2 (5,000 WATT) | 21 A | 30A/1P | 30A/2P | | 30A/2P | | SPACE | 18 | |
| 19 | SPACE | | | | | | | SPACE | 20 | |
| 21 | SPACE | | | | | | | SPACE | 22 | |
| 23 | SPACE | | | | | | | SPACE | 24 | |
| SUB-TOTAL | | 85 A | 57 A | | | 47 A | 43 A | SUB-TOTAL | | |
| TOTAL AMPS L1: | | 108 A | | TOTAL AMPS L2: | | 104 A | | | | |

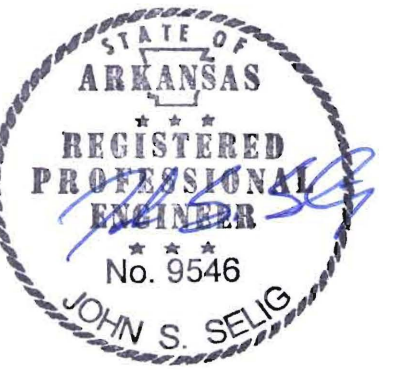


- GENERAL ELECTRICAL NOTES:**
- 1) ALL ELECTRICAL WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE, AND ALL LOCAL CITY CODES AND ORDINANCES.
 - 2) COORDINATE ELECTRIC SERVICE INSTALLATION WITH LOCAL POWER COMPANY, ALL INCIDENTAL COSTS SHALL BE INCLUDED IN CONTRACTORS BID.
 - 3) ALL INTERIOR METAL PIPING, STRUCTURAL METAL, AND METAL HVAC DUCTWORK SHALL BE BONDED TO THE ELECTRICAL SERVICE GROUNDING SYSTEM IN ACCORDANCE WITH ARTICLE 250.104 OF THE NATIONAL ELECTRICAL CODE.
 - 4) ALL MOTOR CONTROL CENTERS, PANELBOARDS, BREAKERS, DISCONNECT SWITCHES, AND FUSES SHALL HAVE MINIMUM SHORT CIRCUIT CURRENT RATING AS REQUIRED BY THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE. THE ELECTRICAL CONTRACTOR SHALL VERIFY BUILDING TRANSFORMER KVA AND IMPEDANCE RATING WITH LOCAL POWER COMPANY, AND INSTALL ALL OVERCURRENT PROTECTIVE DEVICES, MOTOR CONTROL CENTERS, PANELBOARDS, AND DISCONNECT SWITCHES TO MEET MINIMUM SHORT CIRCUIT CURRENT RATING REQUIREMENTS.
 - 5) ALL WIRE SHALL BE #12AWG THWN IN CONDUIT WITH EQUIPMENT GROUND WIRE, UNLESS NOTED OTHERWISE. CONDUCTORS SHALL BE INCREASED IN SIZE WHERE NECESSARY TO ALLOW FOR VOLTAGE DROP.
 - 6) ALL CONDUITS WITHIN INTERIOR OF BUILDING LIGHTING, OUTLETS, AND OTHER BUILDING ELECTRICAL EQUIPMENT SHALL BE EXPOSED ELECTRICAL METALLIC TUBING WITH COMPRESSION FITTINGS OR RIGID GALVANIZED STEEL, UNLESS NOTED OTHERWISE.(CONDUIT, WIRING, AND DEVICE BOXES SHALL BE RECESSED IN WALL FOR LIVING QUARTER AREA.)
 - 7) ALL CONDUITS SERVING OUTSIDE LIGHTS AND OUTLETS SHALL BE ELECTRICAL METALLIC TUBING WITH COMPRESSION FITTINGS CONCEALED IN WALLS OR CEILING, UNLESS NOTED OTHERWISE.
 - 8) ALL CONDUIT IN OR BELOW FLOOR OR BURIED SHALL BE RIGID GALVANIZED STEEL OR PVC SCHEDULE 40.
 - 9) ALL BURIED CONDUIT AND WIRING SHALL HAVE MAGNETIC WARNING RIBBON PLACED 12" ABOVE CONDUIT AND WIRING.
 - 10) CONDUIT EXPOSED TO PHYSICAL DAMAGE AND PENETRATING CONCRETE FLOOR OR SLAB SHALL BE RIGID GALVANIZED STEEL.
 - 11) ALL OUTLET AND JUNCTION BOXES WITHIN HANGAR OF BUILDING MAY BE SURFACE MOUNTED UNLESS NOTED OTHERWISE.
 - 12) ALL OUTLET AND JUNCTION BOXES SERVING OUTSIDE LIGHTS AND OUTLETS SHALL BE RECESSED, UNLESS NOTED OTHERWISE.
 - 13) VERIFY EXACT EQUIPMENT POWER REQUIREMENTS OF MECHANICAL AND SPECIAL EQUIPMENT WITH RESPECTIVE CONTRACTOR/SUPPLIER PRIOR TO INSTALLING REQUIRED BREAKERS, DISCONNECTS, AND CIRCUITS.
 - 14) ALL LIGHTING FIXTURES AND CONDUIT SHALL BE BRACED OR ANCHORED TO RESIST A SEISMIC HORIZONTAL FORCE ACTING IN ANY DIRECTION AS REQUIRED BY APPLICABLE LOCAL BUILDING CODES.
 - 15) CONTRACTOR SHALL FURNISH 5"x3 1/2" (MINIMUM SIZE) ARC FLASH WARNING LABEL ON FACE OF ALL SWITCHBOARDS, PANELBOARDS, DISCONNECT SWITCHES, METER SOCKET ENCLOSURES, AND MOTOR CONTROL CENTERS AS REQUIRED BY NEC.
 - 16) CONTRACTOR SHALL FAMILIARIZE THEMSELVES WITH ALL EQUIPMENT AND SHALL BE RESPONSIBLE FOR ALL POWER, CONTROL, AND AIR LINES NECESSARY FOR THE JOB, WHETHER SHOWN OR NOT. NO ADDITIONAL FEES SHALL BE GIVEN TO THE CONTRACTOR FOR ANY ADDITIONAL CONDUIT OR WIRING NECESSARY.



WASTEWATER SYSTEM IMPROVEMENTS
CITY OF FLIPPIN
FLIPPIN, ARKANSAS

| | |
|-----------------------|----------|
| PUMP BUILDING DETAILS | |
| Designed | JSS |
| Checked | RLP |
| Drawn | ALA |
| Approved | JSS |
| SCALE: 1" = 30' | JOB NO: |
| DATE: NOVEMBER 2020 | SHEET: 8 |



11/06/2020



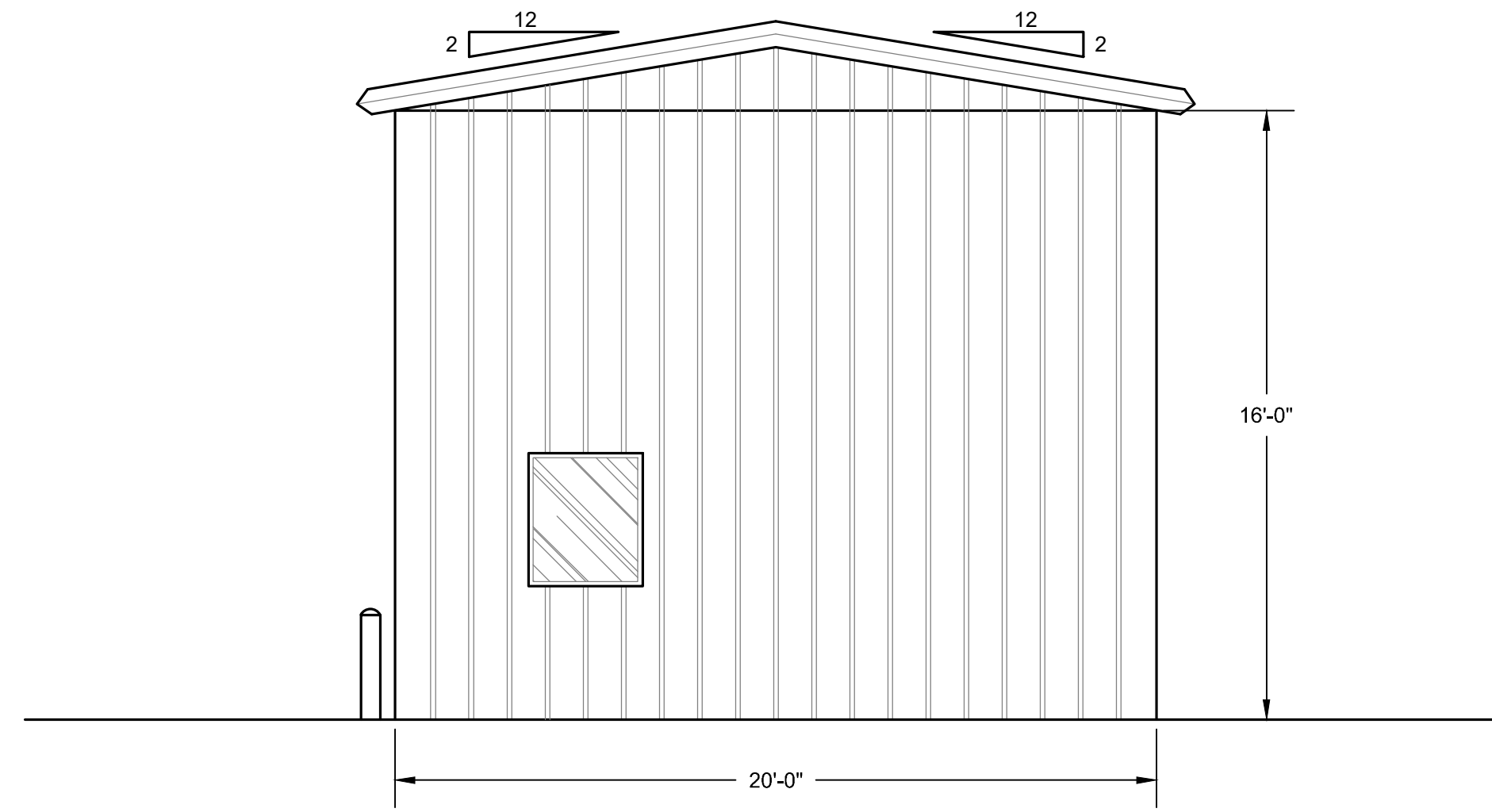
WASTEWATER SYSTEM IMPROVEMENTS

**CITY OF FLIPPIN
FLIPPIN, ARKANSAS**

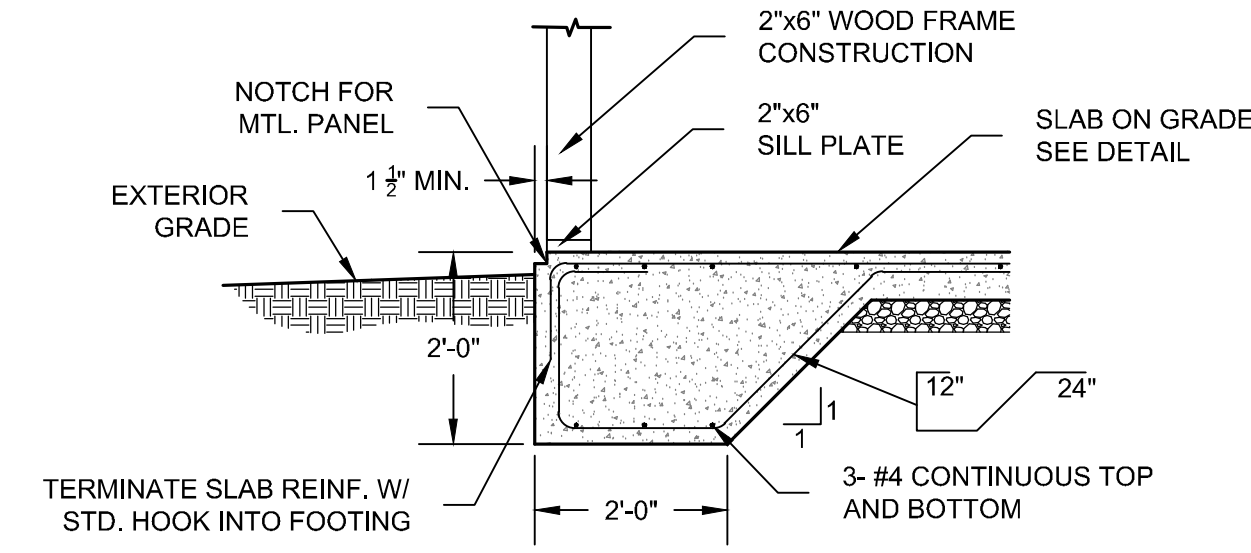
**PUMP BUILDING
ELEVATION VIEWS**

Designed JSS
 Checked RLP
 Drawn ALA
 Approved JSS

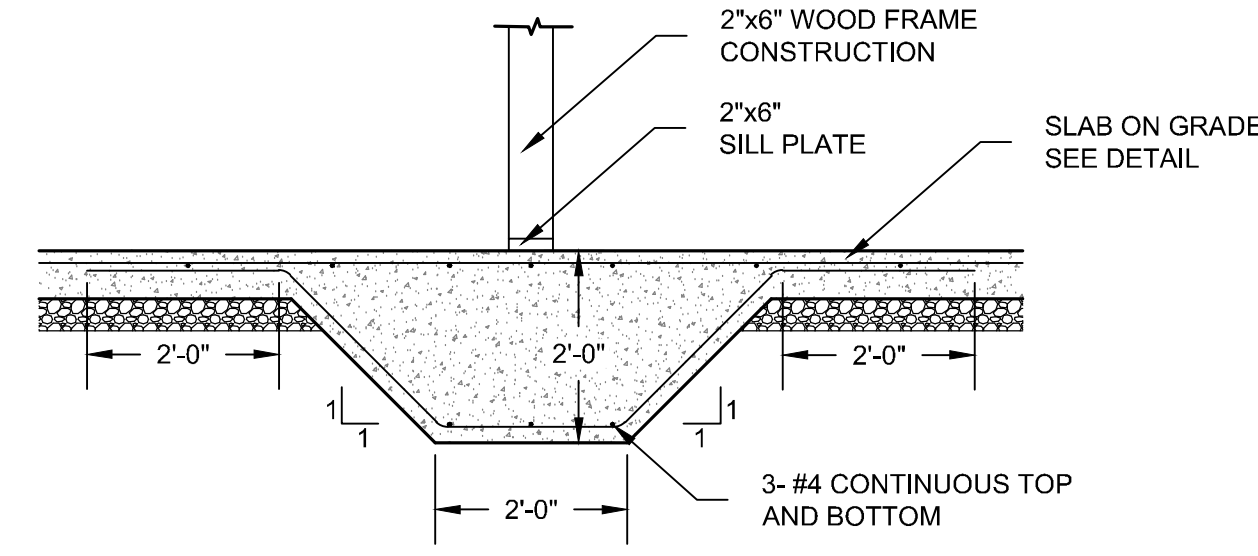
SCALE: 1" = 30'
 DATE: NOVEMBER 2020
 JOB NO:
 SHEET: 9



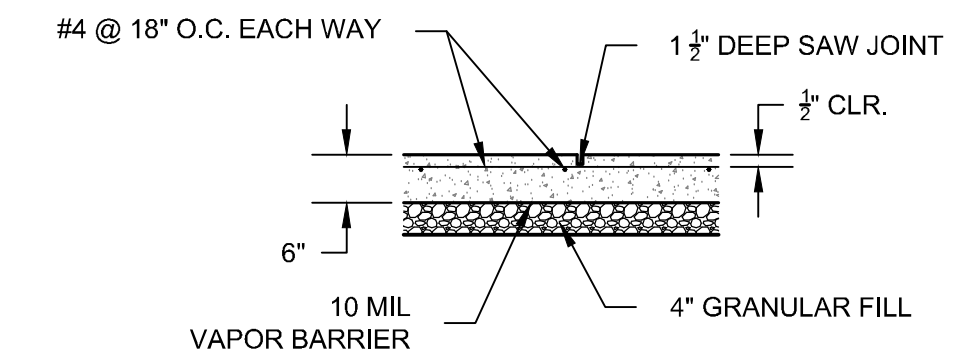
EAST VIEW



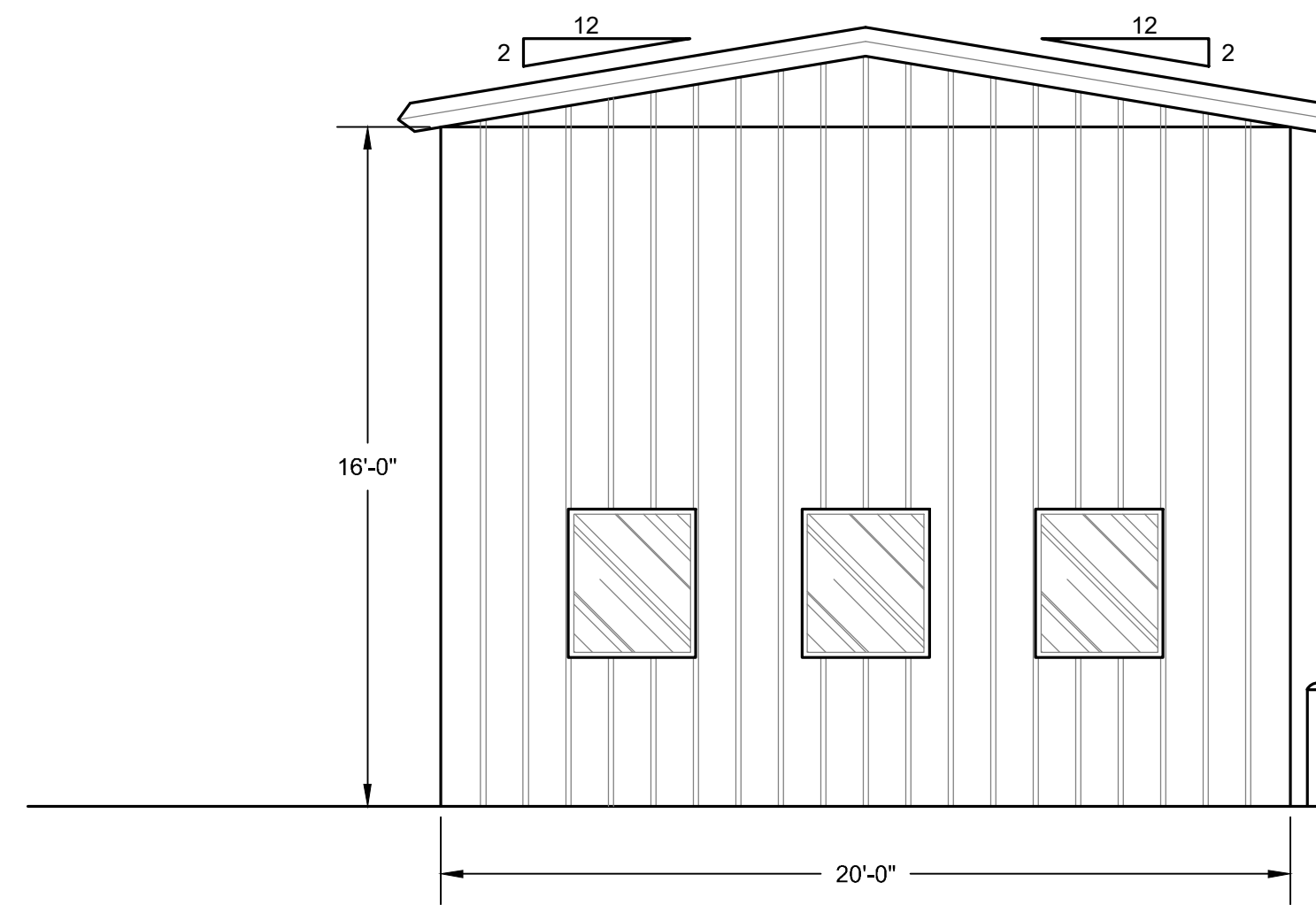
FOOTING SECTION DETAIL
N.T.S.



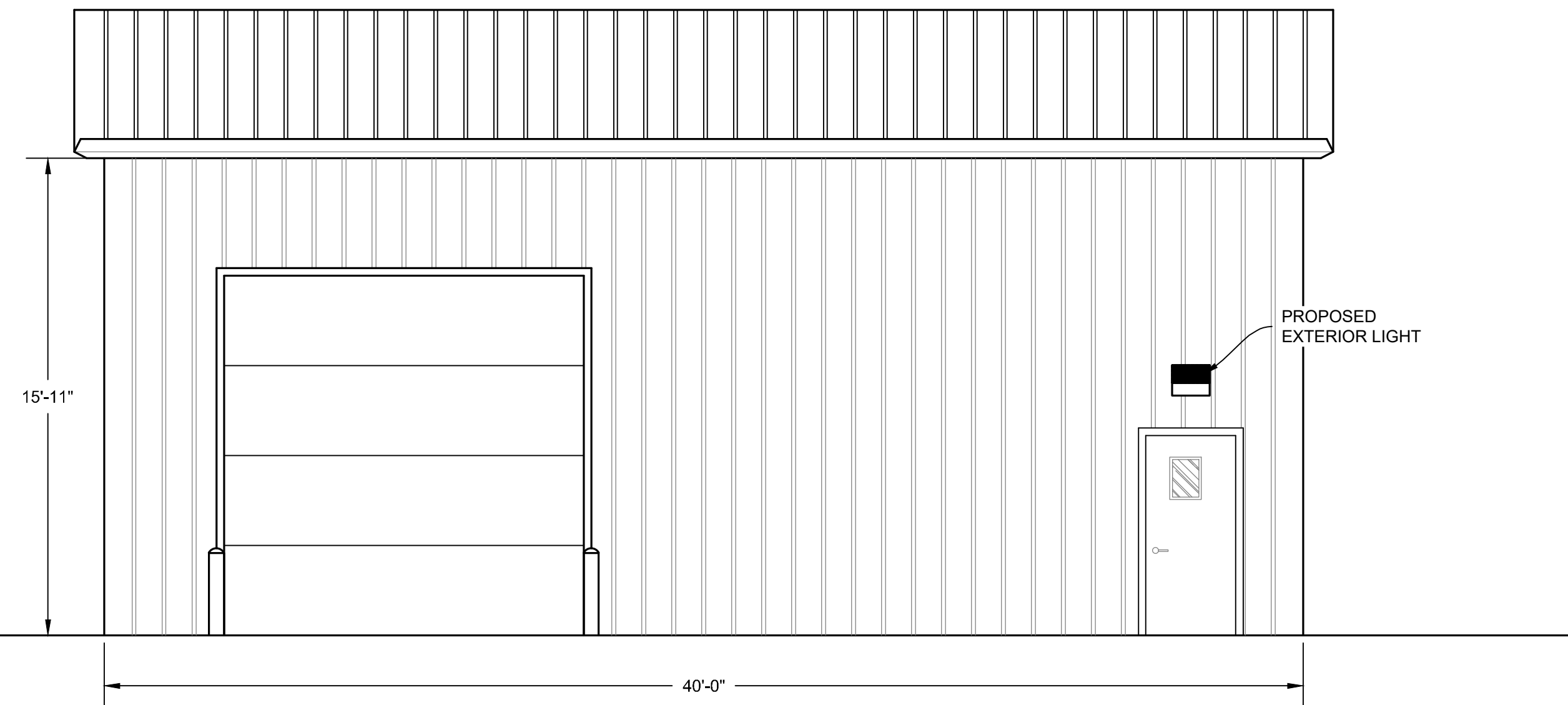
WALL BEAM SECTION DETAIL
N.T.S.



SLAB SECTION DETAIL
N.T.S.



WEST VIEW



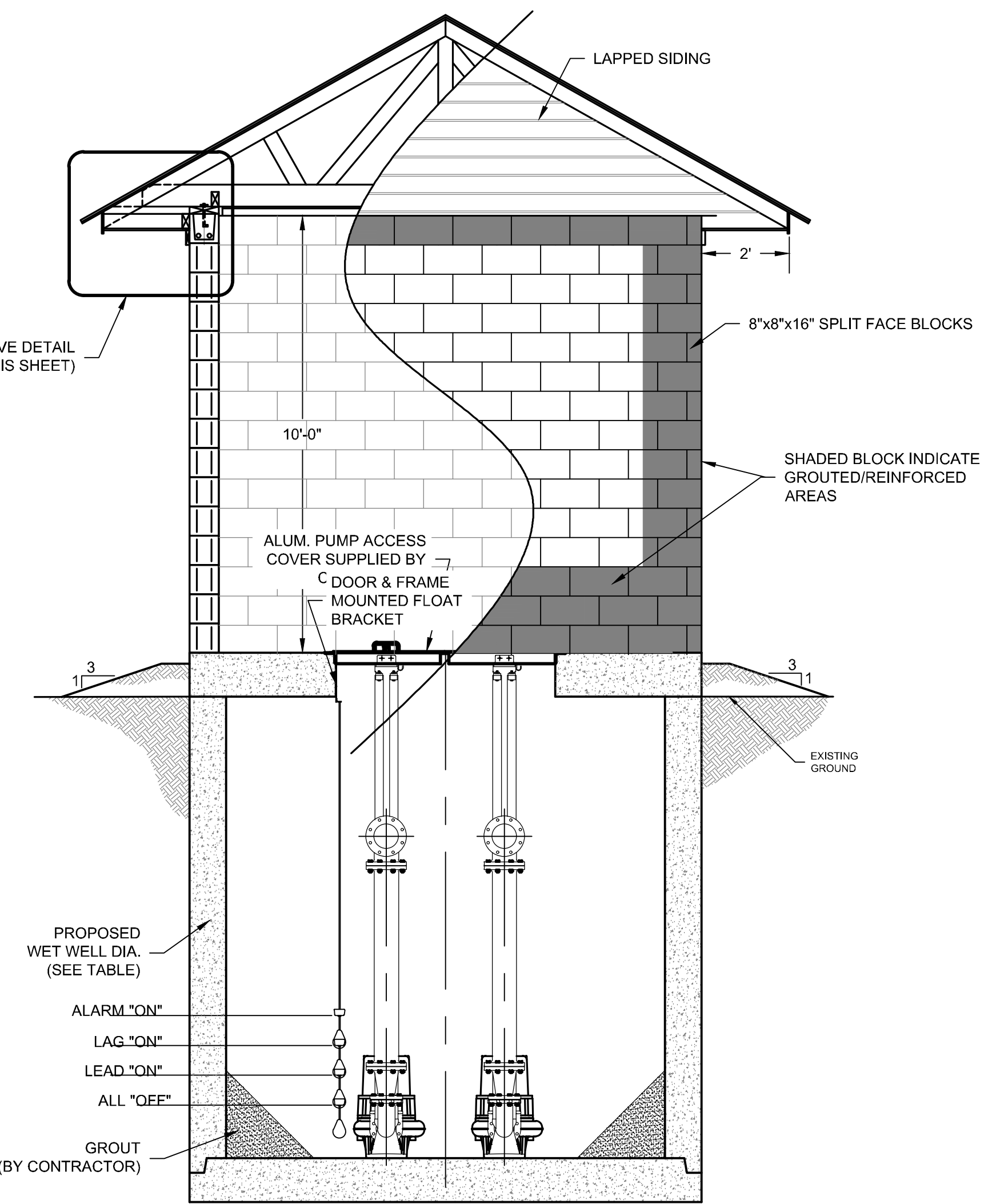
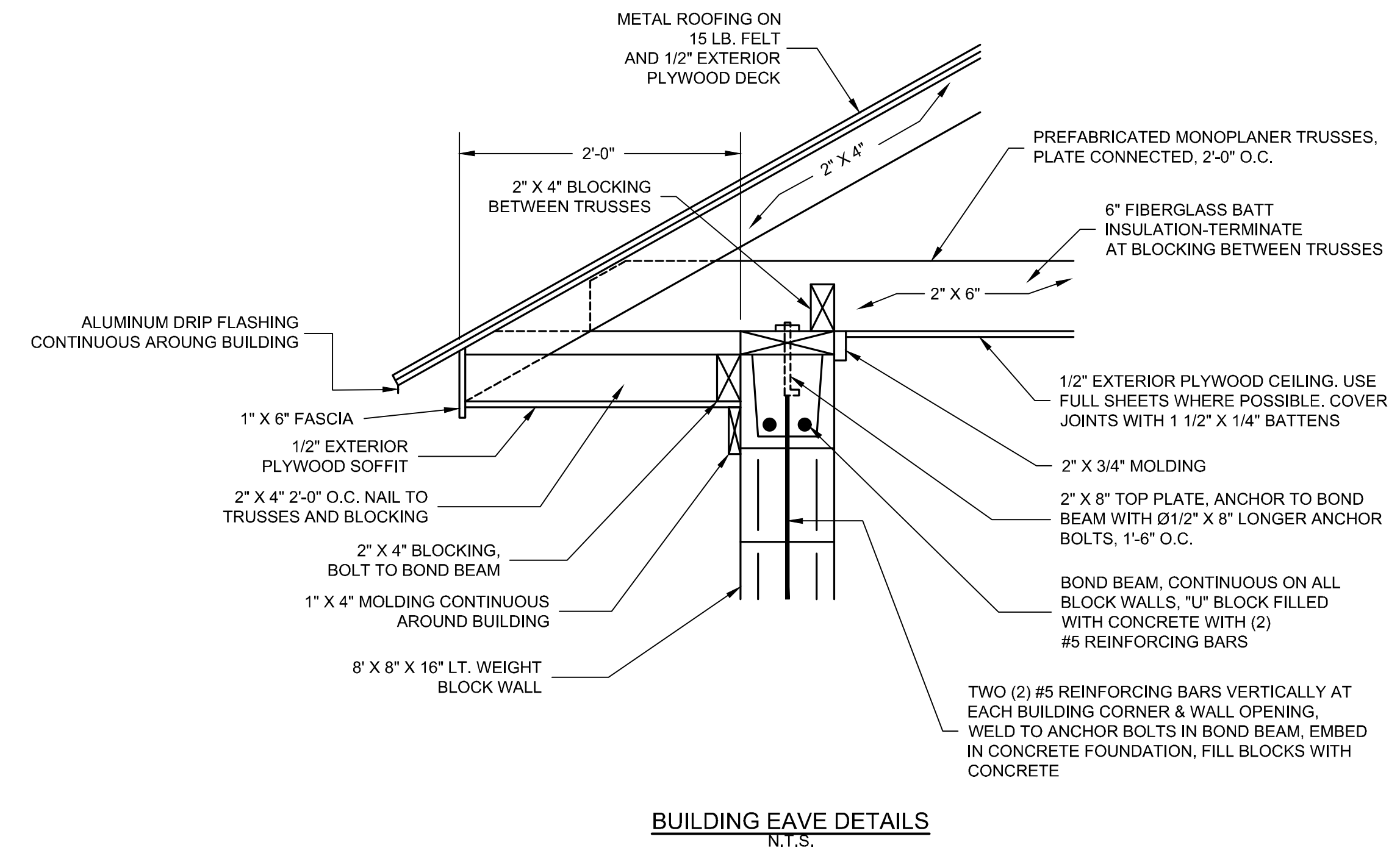
SOUTH VIEW

**WASTEWATER SYSTEM IMPROVEMENTS
CITY OF FLIPPIN
FLIPPIN, ARKANSAS**

**LIFT STATION &
BUILDING DETAILS**

Designed JSS
Checked RLP
Drawn ALA
Approved JSS

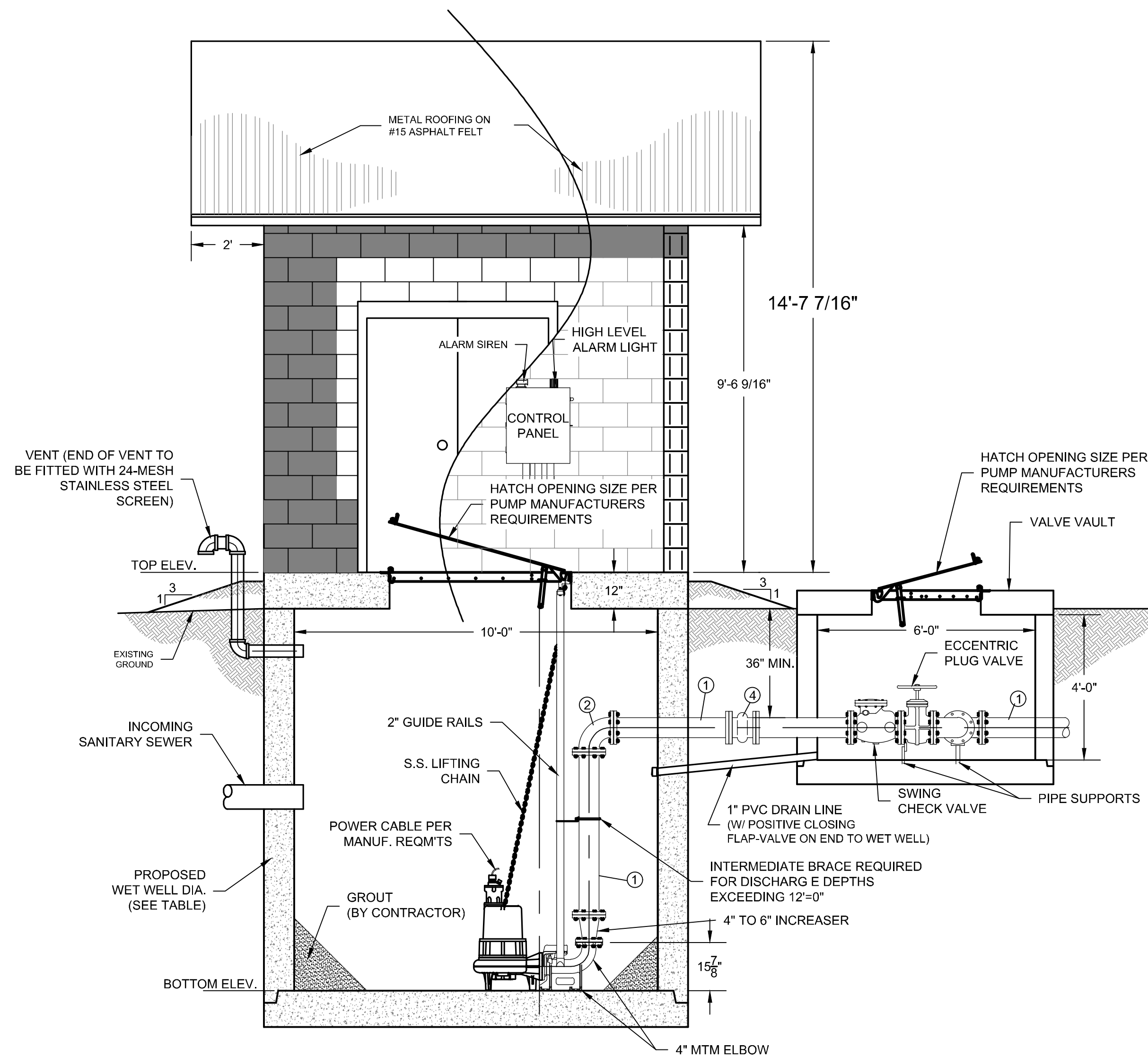
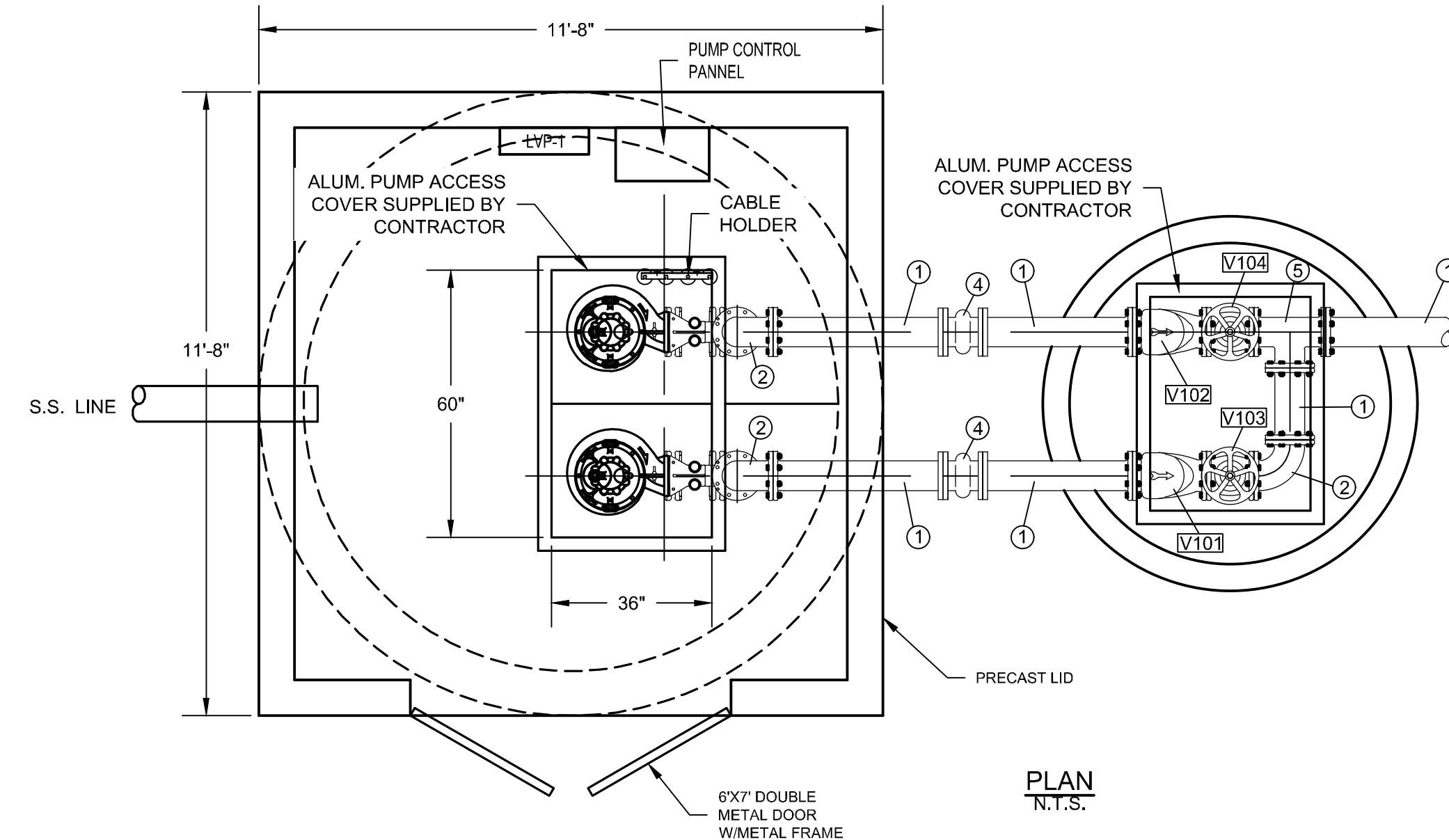
SCALE: N.T.S. JOB NO:
DATE: NOVEMBER 2020 SHEET: 10



| LIFT STATION DATA | | |
|-------------------|---------------------------|-----------|
| | LIFT STATION NO. 1 | |
| 1 | ALARM "ON" ELEVATION | 596.40 |
| 2 | LAG PUMP "ON" ELEVATION | 595.90 |
| 3 | LEAD PUMP "ON" ELEVATION | 595.40 |
| 4 | ALL PUMPS "OFF" ELEVATION | 593.40 |
| 5 | BOTTOM SLAB ELEVATION | 591.40 |
| 6 | PIPE INFLUENT ELEVATION | 67 596.40 |
| 7 | TOP OF WETWELL | 614.40 |
| 8 | EXISTING GROUND | 613.36 |
| 9 | WET WELL (FT) | 10' DIA. |
| 10 | TOTAL DYNAMIC HEAD (FT) | 55.20 |
| 11 | PUMP CAPACITY EACH (GPM) | 500 |
| 12 | MOTOR HP | 20 |
| 13 | PUMP RPM | 1750 |
| 14 | NUMBER OF PUMPS | 2 |
| 15 | DISCHARGE PIPING (IN) | 6 |
| | HYDROMATIC MODEL # | S4K |

| VALVE SCHEDULE | |
|----------------|-------------------------|
| V101-V102 | 6" SWING CHECK VALVE |
| V103-V104 | 6" ECCENTRIC PLUG VALVE |

| PIPING SCHEDULE | |
|-----------------|----------------------|
| 1 | 6" SPOOL |
| 2 | 6" 90° BEND |
| 3 | 6" WALL PIPE |
| 4 | 6" FLEXIBLE COUPLING |
| 5 | 6" X 6" X 6" TEE |



NOTES:

- CONTRACTOR SHALL MAKE TIE-IN TO EXISTING FORCE MAIN AND INSTALL A PERMANENT BY-PASS CONNECTION UTILIZING ALL NECESSARY FITTINGS, 3" GATE VALVE, AND 3" ALUMINUM CAMLOCK FOR PUMP CONNECTION (SEE DETAIL SHEET 8).
- POWER FOR PROPOSED LIFT STATION SHALL BE FROM MAIN POWER SUPPLY FOR WWTF; THEREFORE, LIFT STATION WILL BE SUPPLIED POWER FROM PROPOSED GENERATOR DURING POWER FAILURES.

SITE PREPARATION AND GRADING

- SITE PREPARATION AND FOUNDATION SUBGRADE PREPARATION SHALL BE IN STRICT ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS AND WITH THE RECOMMENDATIONS OF THE GEOTECHNICAL ENGINEER'S REPORT FOR THIS PROJECT.
- IT IS IMPORTANT THAT POSITIVE DRAINAGE BE ESTABLISHED DURING CONSTRUCTION SUCH THAT WATER WILL NOT POND AROUND THE CONSTRUCTION SITE DURING AND FOLLOWING THE CONSTRUCTION PERIOD. ALL GRADES MUST BE ADJUSTED TO PROVIDE POSITIVE DRAINAGE AWAY FROM THE STRUCTURES. WHERE PAVING OR FLAT-WORK ABUTS THE STRUCTURES, CARE SHALL BE TAKEN THAT THE JOINT IS PROPERLY SEALED AND MAINTAINED.

EXCAVATIONS AND SLOPES:

- AFTER OPENING, FOOTINGS SHALL BE INSPECTED AND CONCRETE PLACED AS SOON AS POSSIBLE TO AVOID EXPOSURE OF THE FOOTING BOTTOMS TO WETTING AND DRYING CONDITIONS. IF IT IS REQUIRED THAT FOOTING EXCAVATIONS BE LEFT OPEN FOR MORE THAN ONE DAY, THEY SHALL BE PROTECTED TO REDUCE EVAPORATION OR ENTRY OF SOIL MOISTURE.
- THE CONTRACTOR IS SOLELY RESPONSIBLE FOR DESIGNING AND CONSTRUCTING STABLE TEMPORARY EXCAVATIONS AND SHALL SHORE, SLOPE, OR BENCH THE SIDES OF ALL EXCAVATIONS AS REQUIRED TO MAINTAIN STABILITY OF BOTH THE EXCAVATION SIDES AND BOTTOM. ALL EXCAVATIONS SHALL COMPLY WITH THE APPLICABLE LOCAL, STATE, AND FEDERAL SAFETY REGULATIONS INCLUDING THE CURRENT OSHA EXCAVATION AND TRENCH SAFETY STANDARDS. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR THE MEANS, METHODS, AND SEQUENCING OF CONSTRUCTION OPERATIONS. THIS INFORMATION IS PROVIDED ONLY AS A SERVICE AND UNDER NO CIRCUMSTANCES SHOULD THE INFORMATION PROVIDED BE INTERPRETED TO MEAN THAT THE ENGINEER IS ASSUMING RESPONSIBILITY FOR CONSTRUCTION SITE SAFETY OR THE CONTRACTOR'S ACTIVITIES; SUCH RESPONSIBILITY IS NOT BEING IMPLIED AND SHOULD NOT BE SO INTERPRETED.

FOUNDATION NOTES:

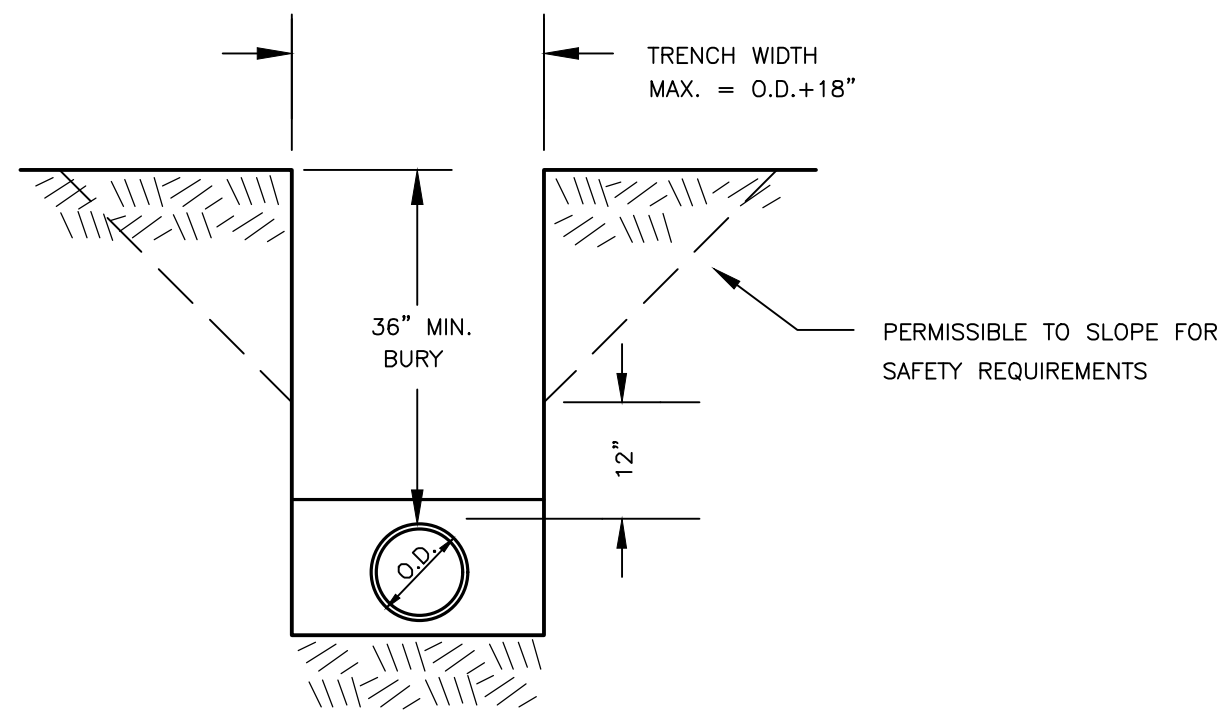
- THE MONOLITHIC FOUNDATION/SLAB WAS DESIGNED IN ACCORDANCE WITH STANDARD ENGINEERING PRACTICES FOR DESIGN AND CONSTRUCTION OF SLABS-ON-GRADE. THE DESIGN ASSUMES THAT THE SITE HAS BEEN PREPARED IN ACCORDANCE WITH THE SITE GRADING AND PREPARATION SPECIFICATIONS CONTAINED ELSEWHERE IN THESE DOCUMENTS, AND HAS RENDERED THE SOILS INTO A STABLE CONDITION (L800 DEFLECTION).
- MOISTURE CONTROL, BEFORE AND AFTER CONSTRUCTION, SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR, AND SHALL INCLUDE SAND OR GRAVEL FILL, VAPOR BARRIER, ETC. ALL WORK SHALL BE IN ACCORDANCE WITH GOVERNING CODES AND LOCAL PRACTICES.
- NEITHER CALCIUM CHLORIDE OR ANY OTHER ADMIXTURE THAT IS CORROSIVE TO FERROUS METALS SHALL BE USED IN THE FOUNDATION SLAB.

CONCRETE NOTES:

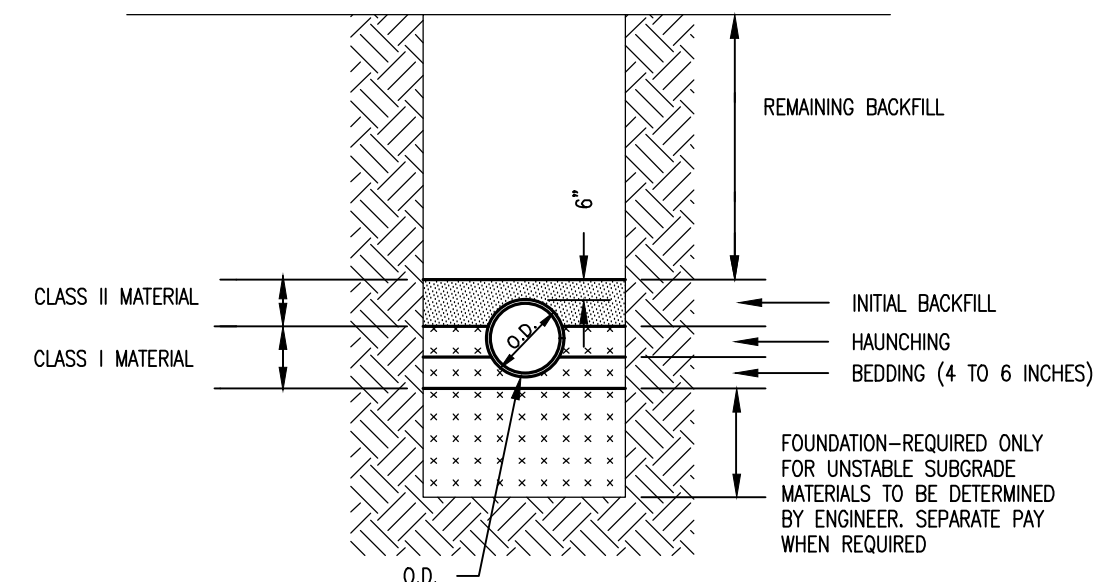
- ALL MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE REQUIREMENTS OF ACI 318-83, "BUILDING CODE FOR REINFORCED CONCRETE," AND THE "MANUAL OF STANDARD PRACTICE FOR DETAILING CONCRETE STRUCTURES, ACI 315."
- CONCRETE SHALL CONFORM TO CHAPTERS 4 AND 5 OF THE ACI 318-83, AND ASTM C-150.
- CONCRETE AGGREGATES SHALL CONFORM TO ASTM C33. THEIR SIZE SHALL NOT EXCEED ONE (1) INCH FOR FOUNDATIONS AND THREE QUARTERS (3/4) INCH FOR OTHER WORK.
- CONCRETE PLACEMENT SLUMP SHALL BE 4-1/2 INCH MINIMUM.
- ALL CONCRETE SHALL PRODUCE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI AT 28 DAYS.
- SHORING, BRACING, AND ALL TEMPORARY SUPPORTS FOR REINFORCED CONCRETE SLABS, COLUMNS, BEAMS, AND ANY OTHER STRUCTURAL MEMBERS IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR.

REINFORCING STEEL NOTES:

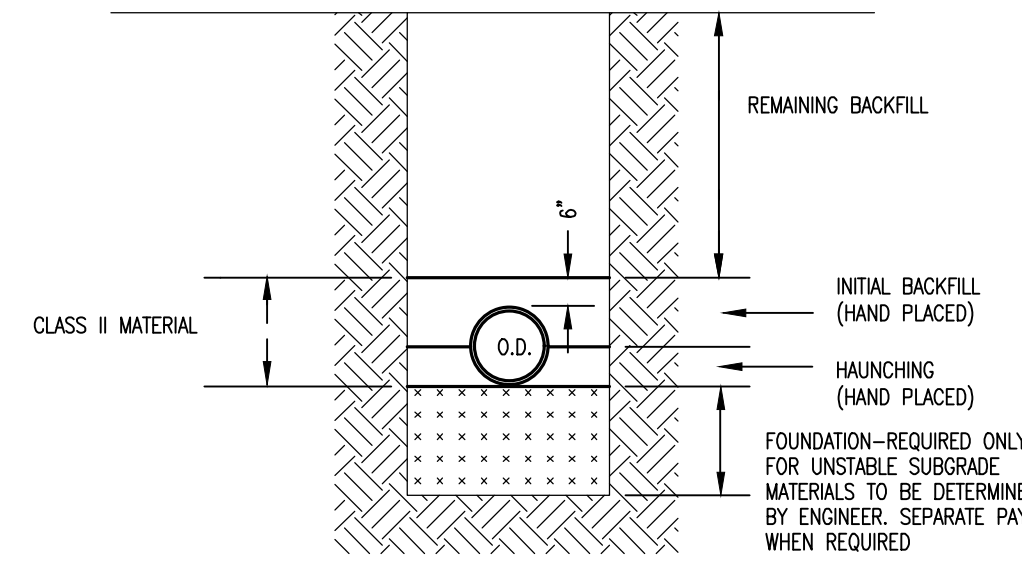
- REINFORCING STEEL SHALL BE ASTM A-615, GRADE 60, EXCEPT STIRRUPS AND COLUMN TIES, WHICH MAY BE GRADE 40.
- REINFORCING STEEL SHALL BE CLEAN, FREE FROM DIRT AND FREE FROM RUST. FITTED OR SCALED REINFORCING STEEL WILL NOT BE ACCEPTABLE.
- DETAILS OF REINFORCEMENTS SHALL COMPLY WITH REQUIREMENTS OF ASTM STANDARDS REFERENCED IN ACI 318, AND WITH THE STRUCTURAL DRAWINGS.
- WIRE MESH REINFORCING IN SLABS SHALL BE 6 X 6 - W1.4 X W1.4 WWM, UNLESS OTHERWISE INDICATED ON THE DRAWINGS.



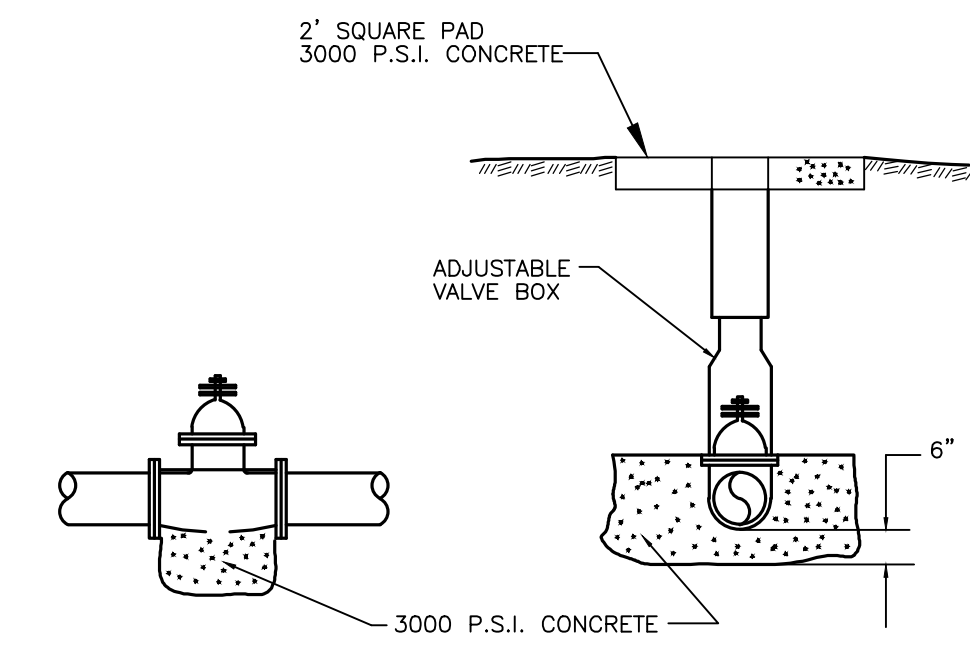
TYPICAL TRENCH SECTION
N.T.S.



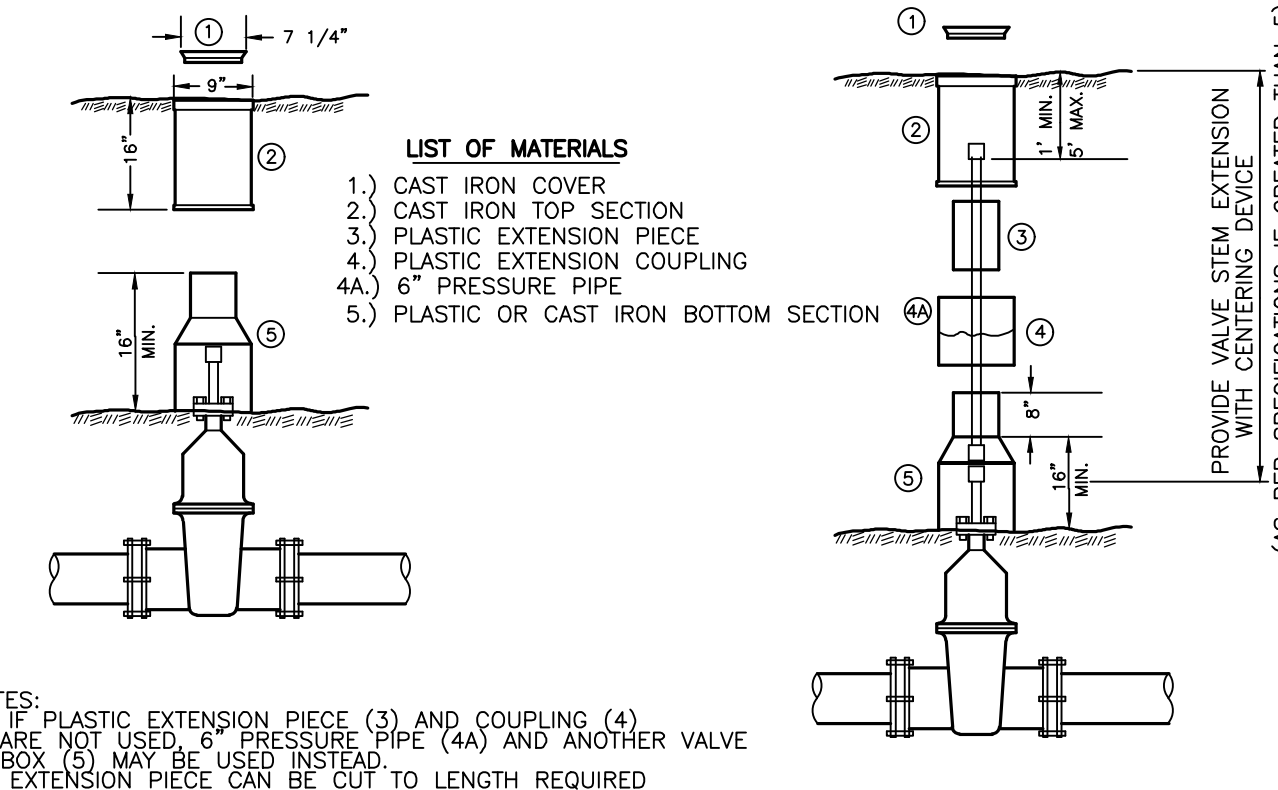
GRAVITY PVC PIPE EMBEDMENT DETAIL
N.T.S.



GRAVITY RIGID PIPE-CLASS-II-EMBEDMENT DETAIL
(TO BE USED FOR RIGID PIPE EXCEPT AS NOTED ON PLANS)
N.T.S.

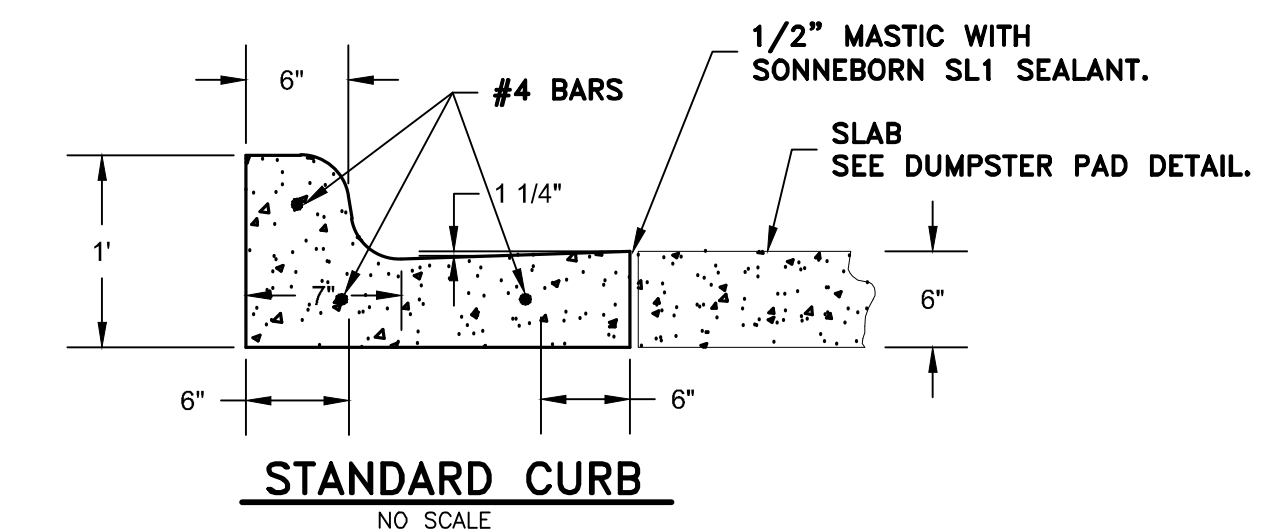


BLOCKING DETAILS FOR VALVES
N.T.S.



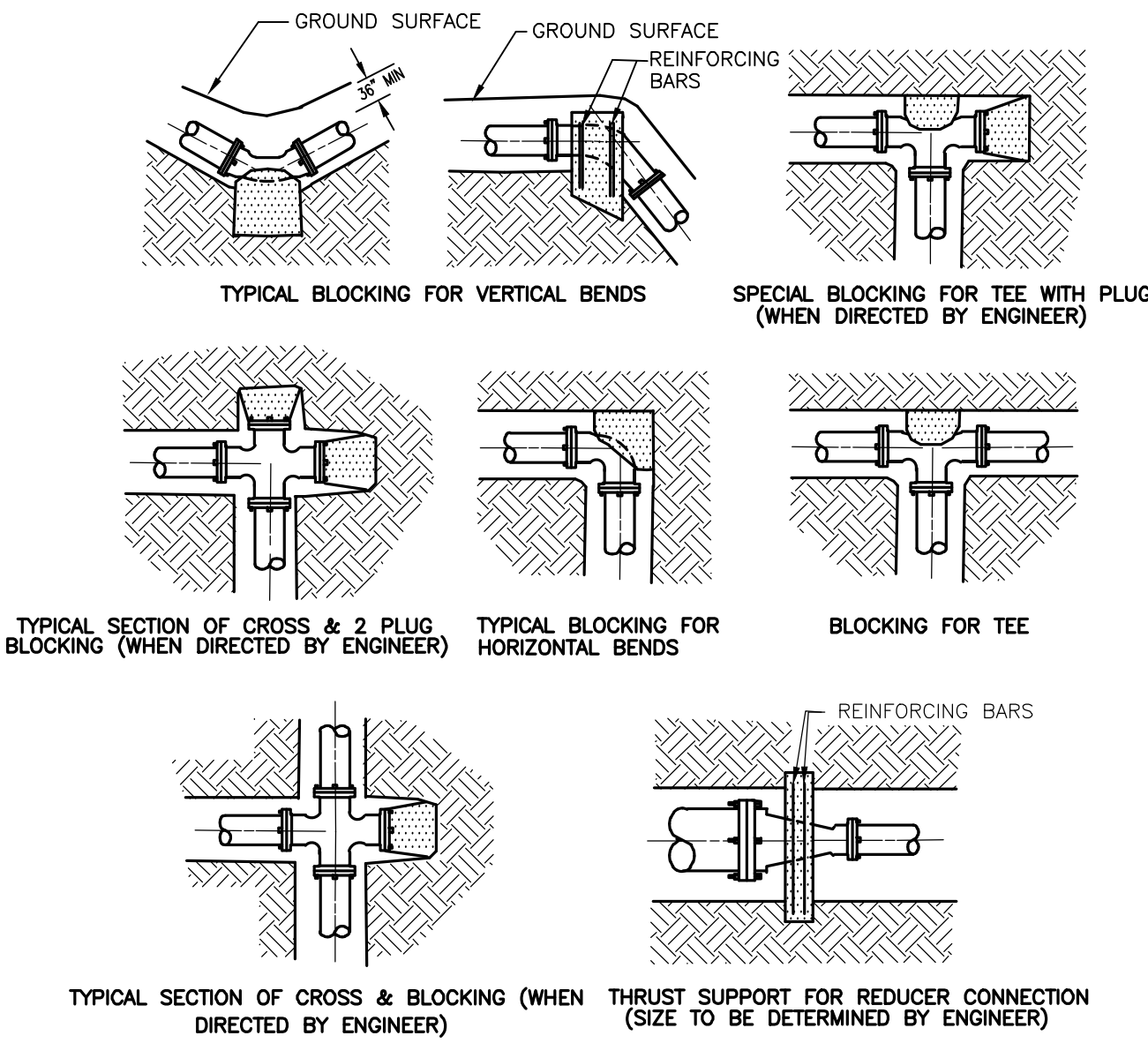
VALVE BOX INSTALLATION
N.T.S.

CONCRETE DUMPSTER PAD DETAIL
N.T.S.



STANDARD CURB
NO SCALE

NOTE: REINFORCE PERIMETER OF GRATING WITH 1/4" BY 2" ALUMINUM PLATE, WELDED IN PLACE CONTINUOUSLY.

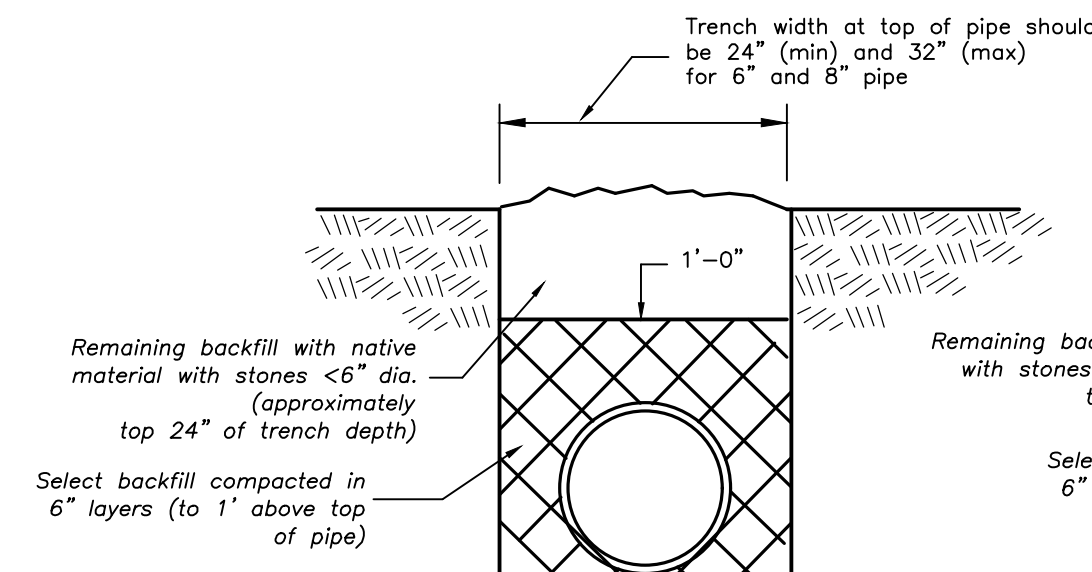


THRUST BLOCKING DETAILS
N.T.S.

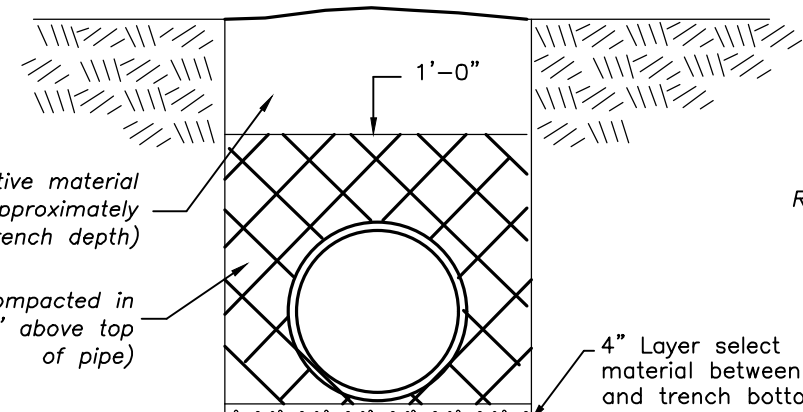
NOTES ON THRUST BLOCKING:

- ALL BLOCKING SHALL BE AGAINST UNDISTURBED HAND DUG SOIL AND SHALL BE CONCRETE HAVING A MINIMUM 28 DAY STRENGTH OF 3000 LBS PER SQUARE INCH.
- THRUST CALCULATIONS TO BE BASED ON THRUST DUE TO WATER PRESSURE AT 100% OF TEST PRESSURE. THRUST = 2.4P SIN 1/2 φ WHERE P = AREA OF PIPE, φ = WATER PRESSURE, φ = DEFLECTION ANGLE.
- VERTICAL UPLIFT BLOCKS SHALL BE DESIGNED ON THE BASIS OF 150 LBS. PER CU. FT. FOR CONCRETE AND SOIL AT 180 LBS. PER CU. FT. OVER THE AREA OF BLOCK.
- VERTICAL DOWN THRUST BLOCKS SHALL BE DESIGNED ON THE BASIS OF 200 LBS. PER SQ. FT. ALLOWABLE SOIL BEARING PRESSURE. DIMENSIONS MAY BE DECREASED WITH APPROVAL OF THE ENGINEER IF MEASURED SOIL CONDITIONS PERMIT. IN POOR SOIL CONDITIONS, BLOCK DIMENSIONS SHALL BE INCREASED IN PROPORTION TO ALLOWABLE BEARING VALUE.
- THRUST BLOCKS ON HORIZONTAL BENDS, TEES, CROSSES, AND REDUCERS SHALL BE SIZED BASED ON 3,000 LBS. PER SQ. FT. OF BLOCKING SURFACE AREA IN CONTACT WITH UNDISTURBED SOIL. BLOCK DIMENSIONS MAY BE DECREASED WITH APPROVAL OF THE ENGINEER IF MEASURED SOIL CONDITIONS PERMIT. IN POOR SOIL CONDITIONS, BLOCK DIMENSIONS SHALL BE INCREASED IN PROPORTION TO THE ALLOWABLE BEARING VALUE.
- ALL BLOCKING SHALL HAVE A MINIMUM SOIL COVER OF 1 FT.
- ADDITIONAL REINFORCING MAY BE REQUIRED FOR HORIZONTAL BLOCKING TO HANDLE UNUSUAL SHEAR LOADING CONDITIONS.

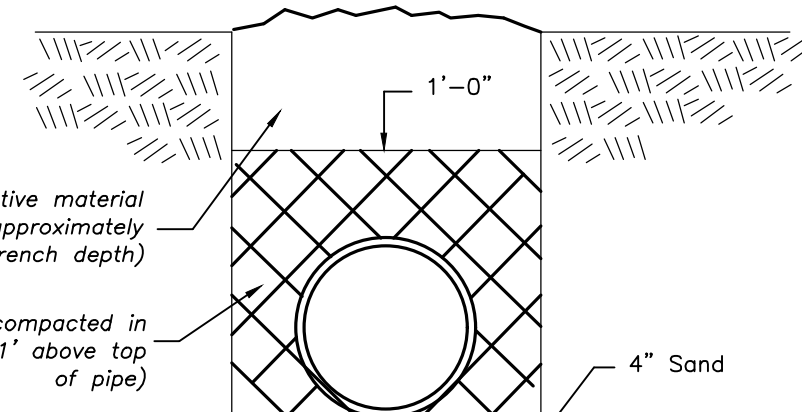
| PIPE SIZE | THRUST IN TONS EXERTED AT PLUGS, TEES AND BENDS FOR EACH 100 LBS. PER SQ. IN. OF TEST PRESSURE | | | | | | BEARING AREA IN SQUARE FEET OF THRUST BLOCK IN CONTACT WITH UNDISTURBED SOIL | | | | | |
|-----------|--|--------|----------|----------|--------------|--------------|--|-------|----------|----------|--------------|--------------|
| | PLUG | TEE | 90° BEND | 45° BEND | 22-1/2° BEND | 11-1/4° BEND | PLUG | TEE | 90° BEND | 45° BEND | 22-1/2° BEND | 11-1/4° BEND |
| 1.5" | 0.09 | 0.09 | 0.13 | 0.07 | 0.03 | 0.02 | 0.059 | 0.059 | 0.083 | 0.045 | 0.023 | 0.012 |
| 2" | 0.16 | 0.16 | 0.22 | 0.12 | 0.06 | 0.03 | 0.11 | 0.11 | 0.15 | 0.080 | 0.041 | 0.021 |
| 3" | 0.35 | 0.35 | 0.50 | 0.27 | 0.14 | 0.07 | 0.24 | 0.24 | 0.33 | 0.18 | 0.092 | 0.046 |
| 4" | 0.63 | 0.63 | 0.89 | 0.48 | 0.25 | 0.12 | 0.42 | 0.42 | 0.59 | 0.32 | 0.16 | 0.082 |
| 6" | 1.41 | 1.41 | 2.00 | 1.08 | 0.55 | 0.28 | 0.94 | 0.94 | 1.33 | 0.72 | 0.37 | 0.19 |
| 8" | 2.51 | 2.51 | 3.55 | 1.92 | 0.98 | 0.49 | 1.68 | 1.68 | 2.37 | 1.28 | 0.65 | 0.33 |
| 10" | 3.93 | 3.93 | 5.55 | 3.01 | 1.53 | 0.77 | 2.62 | 2.62 | 3.70 | 2.00 | 1.02 | 0.51 |
| 12" | 5.65 | 5.65 | 8.00 | 4.33 | 2.21 | 1.11 | 3.77 | 3.77 | 5.33 | 2.89 | 1.47 | 0.74 |
| 14" | 7.70 | 7.70 | 10.89 | 5.89 | 3.00 | 1.51 | 5.13 | 5.13 | 7.26 | 3.93 | 2.00 | 1.01 |
| 16" | 10.05 | 10.05 | 14.22 | 7.69 | 3.92 | 1.97 | 6.70 | 6.70 | 9.48 | 5.13 | 2.62 | 1.31 |
| 18" | 12.72 | 12.72 | 17.99 | 9.74 | 4.96 | 2.49 | 8.48 | 8.48 | 12.00 | 6.49 | 3.31 | 1.66 |
| 20" | 15.71 | 15.71 | 22.21 | 12.02 | 6.13 | 3.08 | 10.47 | 10.47 | 14.81 | 8.02 | 4.09 | 2.05 |
| 22" | 22.62 | 22.62 | 31.99 | 17.31 | 8.83 | 4.43 | 15.08 | 15.08 | 21.33 | 11.54 | 5.88 | 2.96 |
| 24" | 28.63 | 28.63 | 40.49 | 21.91 | 11.17 | 5.61 | 19.09 | 19.09 | 26.99 | 14.61 | 7.45 | 3.74 |
| 30" | 35.35 | 35.35 | 49.98 | 27.05 | 13.79 | 6.93 | 23.56 | 23.56 | 33.32 | 18.03 | 9.19 | 4.62 |
| 36" | 50.90 | 50.90 | 72.98 | 38.95 | 19.86 | 9.98 | 33.93 | 33.93 | 47.98 | 25.97 | 13.24 | 6.65 |
| 42" | 69.27 | 69.27 | 97.97 | 53.02 | 27.03 | 13.58 | 46.18 | 46.18 | 65.31 | 35.25 | 18.02 | 9.05 |
| 48" | 90.48 | 90.48 | 127.96 | 69.25 | 35.30 | 17.74 | 60.32 | 60.32 | 85.30 | 46.17 | 23.54 | 11.83 |
| 54" | 114.51 | 114.51 | 161.94 | 87.64 | 44.68 | 22.45 | 76.34 | 76.34 | 107.96 | 58.43 | 29.79 | 14.97 |



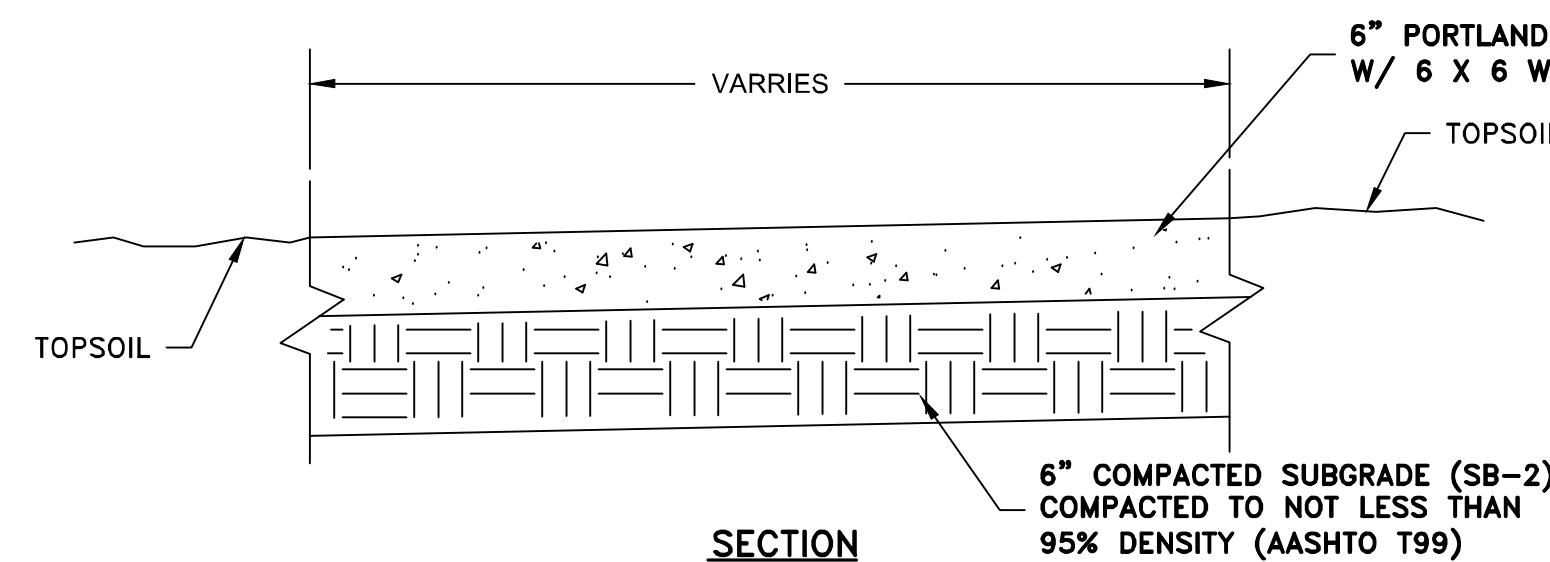
FORCEMAIN TYPE 1 LAYING CONDITION BEDDING
(USE UNDER NORMAL CONDITIONS)



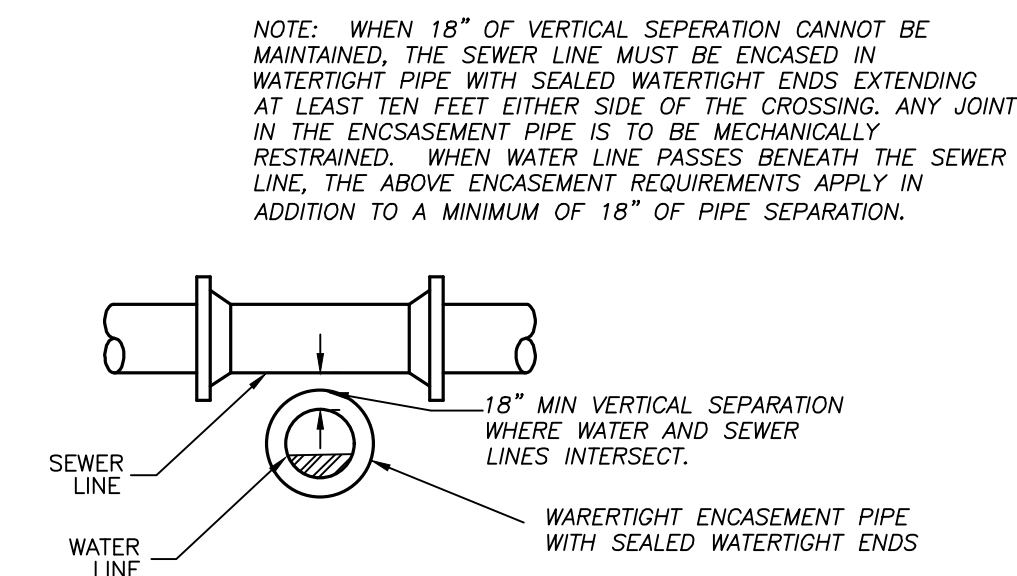
FORCEMAIN TYPE 2 LAYING CONDITION BEDDING
(USE FOR ROCKY OR HARD TRENCH BOTTOM)



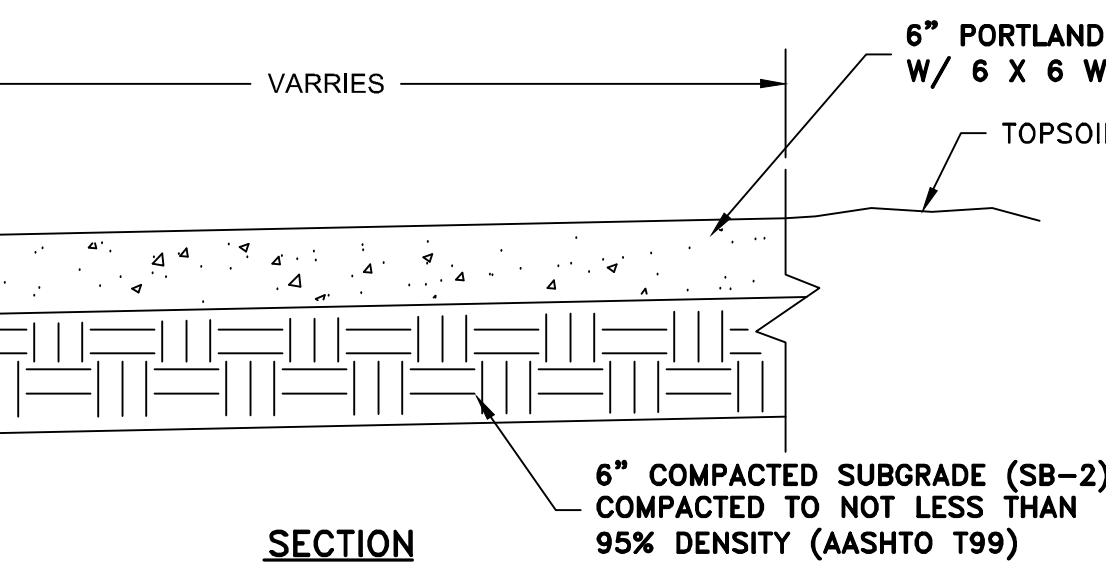
FORCEMAIN TYPE 3 LAYING CONDITION BEDDING
(USE FOR SOFT OR WET TRENCH BOTTOM)



DUMPSTER PAD DETAIL
NO SCALE



TYPICAL SEWER & WATER CROSSINGS
N.T.S.



SECTION



11/06/2020



WASTEWATER SYSTEM IMPROVEMENTS
CITY OF FLIPPIN
FLIPPIN, ARKANSAS

STANDARD
DETAILS

Designed JSS
Checked RLP
Drawn ALA
Approved JSS

SCALE: N.T.S.
DATE: NOVEMBER 2020
JOB NO:
SHEET: 11

PROJECT MANUAL
TECHNICAL SPECIFICATIONS
WASTEWATER TREATMENT FACILITY IMPROVEMENTS
CITY OF FLIPPIN, ARKANSAS
NOVEMBER 2020

Prepared By:



11/06/2020

2114 East Matthews Avenue
Jonesboro, Arkansas 72401

(870) 972-5316
FAX (870) 932-0432

REVOLVING LOAN FUND (RLF)

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- (B) Information for Bidders
- (C) Davis-Bacon Wage Rates
- (D) Bid
- (E) Bid Bond
- (F) Contractor's Act of Assurance
- (G) DBE/MBE/WBE Certification
- (H) Agreement
- (I) Payment Bond
- (J) Performance Bond
- (K) Insurance
- (L) Notice of Award
- (M) Notice to Proceed
- (N) Certificate Of Owner's Attorney
- (O) ANRC Approval of Contract
- (P) General Conditions (if applicable)
- (Q) Supplemental General Conditions

Technical Specifications

ADVERTISEMENT FOR BIDS

City of Flippin
Owner
239 E. Main St.
Address
Flippin, Arkansas 72634

Separate sealed Bids for the construction of the proposed wastewater treatment facility improvements (including a new lift station, headworks system, including a grit removal and screening, a second oxidation ditch parallel to the existing oxidation ditch, aeration equipment, 2-25' diameter clarifiers, the rehabilitation of two intermittent sand filters, a sludge holding pond, an office/lab building, and installation of a stand-by, backup generator unit) will be received by the Honorable Jerald Marberry, Mayor, City of Flippin, at the office of City Hall until [REDACTED], on [REDACTED], 2020 and then at said office publicly opened and read aloud.

The Contract Documents may be examined at the following locations:

Civil Engineering Associates, LLC, 2114 East Matthews Avenue, Jonesboro, Arkansas 72401, Phone: (870) 972-5316, John S. Selig, P.E., and at the Flippin City Hall, 239 East Main Street, Flippin, Arkansas 72634.

Copies of the Contract Documents may be obtained at the office of Civil Engineering Associates, LLC located at 2114 East Matthews Avenue, Jonesboro, Arkansas 72401, upon payment of \$ [REDACTED] for each set.

Any contract or contracts awarded under this invitation for bids will be subject to the requirements of the Arkansas Revolving Loan Fund (RLF) Programs as described in the contract documents.

All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin. Bidders on this work will be required to comply with the President's Executive Order 11246, as amended. The requirements for Bidders and Contractors under this order are explained in the specifications.

Each Bidder must comply with the requirements, terms, and conditions of the Arkansas Natural Resources Commission, the Disadvantaged, Minority and Women Business Enterprise (DBE/MBE/WBE) requirements, the Consolidated Appropriations Act of 2014 (Public Law 113-76) including the "American Iron and Steel (AIS)" requirement, Labor Standards, and Equal Employment Opportunity provisions during the performance of this contract. The Bidder commits itself to the requirements for the participation contained herein and all other requirements, terms, and conditions of these bid conditions by submitting a properly signed Bid. Each requirement listed above for the RLF programs are in the Supplemental Conditions in the Contract Documents.

INFORMATION FOR BIDDERS

Bids will be received by the City of Flippin (herein called the "Owner") at the City Hall until _____, 20 _____ and then at said office publicly opened and read aloud.

Each Bid must be submitted in a sealed envelope, addressed to The Honorable Jerald Marberry, Mayor at City Hall, 239 East Main Street, Flippin, Arkansas 72634.

Each sealed envelope containing a Bid must be plainly marked on the outside as Bid for Wastewater Treatment Facility Improvements and the envelope should bear on the outside the Bidder's name, address, and license number if applicable, and the name of the project for which the Bid is submitted. If forwarded by mail, the sealed envelope containing the Bid must be enclosed in another envelope addressed to the Owner at City Hall, P.O. Box 40, Flippin, Arkansas 72634.

The Bidders attention is called to the requirements of the Supplemental General Conditions for the Revolving Loan Fund (RLF) contained in the contract documents including but not limited to Disadvantaged, Minority and Women's Business (DBE/MBE/WBE) participation and reporting requirements as well as, the "American Iron and Steel" requirement, Labor Standards, and Equal Employment Opportunity. Further, Bidders will be required to submit with their Bids, a Contractor's Act of Assurance Form certifying their understanding of and compliance with the Supplemental General Conditions. In addition, post Bid completion of DBE/MBE/WBE Compliance Evaluation Forms will be required and approved before the Contract can be Awarded.

All Bids must be made on the required Bid form. All blank spaces for Bid prices must be filled in, in ink or typewritten, and the Bid form must be fully completed and executed when submitted. Only one copy of the Bid form is required.

The Owner may waive any informalities or minor defects or reject any and all Bids. Any Bid may be withdrawn prior to the above scheduled time for the opening of Bids or authorized postponement thereof. Any Bid received after the time and date specified shall not be considered. No Bidder may withdraw a Bid within sixty days after the actual date of the opening thereof. Should there be reasons why the contract cannot be Awarded within the specified period, the time may be extended by mutual agreement between the Owner and the Bidder.

Bidders must satisfy themselves of the accuracy of the estimated quantities in the Bid schedule by examination of the site and a review of the drawings and specifications including Addenda. After Bids have been submitted, the Bidder shall not assert that there was a misunderstanding concerning the quantities of Work or of the nature of the Work to be done.

The Owner shall provide to Bidders prior to Bidding, all information that is pertinent to, and delineates and describes, the land owned and rights-of-way acquired or to be acquired.

The Contract Documents contain the provisions required for the construction of the Project. Information obtained from an Officer, Agent, or Employee of the Owner or any other person shall not affect the risks or obligations assumed by the Contractor or relieve the contractor from fulfilling any of the conditions of the Contract.

Each Bid must be accompanied by a Bid Bond payable to the Owner for five percent of the total amount of the Bid. As soon as the Bid prices have been compared, the Owner will return the Bonds of all except the three lowest responsible Bidders. After Bids have been opened and prior to Award, the apparent low Bidder will have fifteen business days to submit their DBE solicitation process and forms. All Bidders, as a condition of bidding, are required to document to the Owner and to the Commission that the "good faith efforts" were taken in the preparation of bids to obtain DBE/MBE/WBE participation. The Commission will give notice when the Contractor and Entity can sign the Agreement. When the Agreement is executed the Bonds of the

two remaining unsuccessful Bidders will be returned. The Bid Bond of the successful Bidder will be retained until the Payment Bond and Performance Bond have been executed and approved, after which it will be returned. A certified check may be used in lieu of a Bid Bond.

A Performance Bond and a Payment Bond each in the amount of 100 percent of the Contract Price, with a corporate surety approved by the Owner, will be required for the faithful performance of the contract.

Attorneys-in-Fact who sign Bid Bonds or Payment Bonds and Performance Bonds must file with each Bond a certified and effective dated copy of their Power of Attorney. Attorneys-in-Fact that sign the Bonds must be licensed to conduct business in the State of Arkansas.

The party to whom the contract is Awarded will be required to execute the Agreement, and obtain the performance Bond and payment Bond within ten calendar days from the date when Notice of Award is delivered to the Bidder. The Notice of Award shall be accompanied by the necessary Agreement and Bond forms. In case of failure of the Bidder to execute the Agreement, the Owner may consider the Bidder in default; in which case the Bid Bond accompanying the proposal shall become the property of the Owner.

Successful Bidder must comply with the requirements of Arkansas Code Ann. §17-25-401-409 (1995) in accordance with the procedures established by the Contractors Licensing Board (Reference Supplemental General Conditions).

Successful Bidder must comply with the requirements of Act 291 of 1993 concerning trenches or other excavations five feet deep or more in accordance with OSHA standards.

The Owner within ten days of receipt of acceptable Performance Bond, Payment Bond and Agreement signed by the party to whom the Agreement was awarded shall sign the Agreement and return to such party an executed duplicate of the Agreement. Should the Owner not execute

the Agreement within such period, the Bidder may by Written Notice withdraw the signed Agreement. Such notice of withdrawal shall be effective upon receipt of the notice by the Owner.

The Notice to Proceed shall be issued within ten days of the execution of the Agreement by the Owner. Should there be reasons why the Notice to Proceed cannot be issued within such period, the time may be extended by mutual agreement between the Owner and Contractor. If the Notice to Proceed has not been issued within the ten day period or within the period mutually agreed upon, the Contractor may terminate the Agreement without further liability on the part of either party.

The Bidder must present satisfactory evidence that he has been regularly engaged in the type of work Bid upon, giving the length of time so engaged, and that he is fully prepared with the necessary capital, material, machinery, and expert workmen to perform the contract.

The attention of prospective Bidders is directed to Act 150 of the 1965 Acts of Arkansas, being an "Act Regulating the Practice of Contracting in the State of Arkansas". When the project presented for Bid is financed in whole or in part with State funds and is estimated to cost \$20,000.00 or more, the prospective Bidder must show evidence of license with the "Contractor's Licensing Board" for the State of Arkansas before a proposal form will be furnished.

The Owner may make such investigations as deemed necessary to determine the ability of the Bidder to perform the Work, and the Bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Agreement and to complete the Work contemplated therein.

A conditional or qualified Bid will not be accepted.

Award will be made to the lowest responsible Bidder.

All applicable laws, ordinances and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the contract throughout.

Each Bidder is responsible for inspecting the site and for reading and being thoroughly familiar with the Contract Documents. The failure or omission of any Bidder to do any of the foregoing shall in no way relieve any Bidder from any obligation in respect to its Bid.

Further, the Bidder agrees to abide by the requirements set forth in the Supplemental Conditions.

The low Bidder shall supply the names and addresses of major material Suppliers and Subcontractors when required to do so by the Owner.

Inspection trips for prospective Bidders may be arranged by calling City Hall (Phone: 870-453-8300) and scheduling a visit.

The ENGINEER is Civil Engineering Associates, LLC.

The ENGINEER'S address is 2114 East Matthews Avenue, Jonesboro, Arkansas 72401.

REVOLVING LOAN FUND (RLF)
Davis Bacon Wage Determination

(Insert Determination package here)

BID

Proposal of _____ (hereinafter called "Bidder"), organized and existing under the laws of the State of _____ doing business as _____. *. To the City of Flippin (hereinafter called "Owner").

In compliance with your Advertisement for Bids, Bidder hereby proposes to perform all Work for the construction of Flippin Wastewater Treatment Facility Improvements in strict accordance with the Contract Documents, within the time set forth therein, and at the prices stated below.

The Contractor's Act of Assurance Form must be included in the bid proposal. The DBE/MBE/WBE Compliance Evaluation Forms must be supplied after the Low Bidder is confirmed.

By submission of this Bid, each Bidder certifies, and in the case of a joint Bid each party thereto certifies as to its own organization, that this Bid has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this Bid with any other Bidder or with any competitor.

Bidder hereby agrees to commence Work under this contract on or before a date to be specified in the Notice to Proceed and to fully complete the Project within two hundred seventy (270) consecutive calendar days thereafter. Bidder further agrees to pay as liquidated damages, the sum of \$600.00 for each consecutive calendar day thereafter as provided in the Supplemental Conditions.

Bidder acknowledges receipt of the following Addendum:

* Insert "a corporation", "a partnership", or "an individual" as applicable.

Bidder agrees to perform all the work described in the Contract Documents for the following unit prices or lump sum:

Bid Schedule

NOTE: BIDS shall include sales tax and all other applicable taxes and fees.

| Item Number | Description | Estimated Quantity | Unit | Unit Price | Total Amount |
|-------------|--|--------------------|------|------------|--------------|
| 1. | Influent Lift Station | 1 | L.S. | | |
| 2. | Headworks System, including grit removal and screening | 1 | L.S. | | |
| 3. | Proposed Oxidation Ditch | 1 | L.S. | | |
| 4. | Aeration Equipment (Existing and Proposed Oxidation Ditch) | 1 | L.S. | | |
| 5. | 28' Diameter Clarifier | 2 | EA. | | |
| 6. | Yard Piping | 1 | L.S. | | |
| 7. | Miscellaneous Splitter Boxes | 1 | L.S. | | |
| 8. | Rehabilitation of Existing EQ Basin | 1 | L.S. | | |
| 9. | Sludge Holding Pond | 1 | L.S. | | |
| 10. | Control/Office Building | 1 | L.S. | | |
| 11. | Generator & Automatic Transfer Switch | 1 | L.S. | | |
| 12. | Ultra-Sonic Effluent Flow Meter | 1 | L.S. | | |
| 13. | Trench/Excavation Safety System | 1 | L.S. | | |

Total Bid Amount\$ _____

Total Bid Amount (in words) _____

Respectfully submitted:

Signature

Address

Title

Date

License Number (if applicable)

SEAL - (if BID is by a Corporation)

BID BOND

Know all men by these presents, that we, the undersigned, _____, as Principal, and _____ as Surety, are hereby held and firmly bound unto the City of Flippin, as Owner in the penal sum of _____ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

Signed, this _____ day of _____, 2020. The Condition of the above obligation is such that whereas the Principal has submitted to the City of Flippin a certain Bid, attached hereto and hereby made a part hereof to enter into a contract in writing, for the Flippin Wastewater Treatment Facility Improvements.

Now, therefore,

- (a) If said Bid shall be rejected, or
- (b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attachment hereto (properly completed in accordance with said Bid) and shall furnish a Bond for faithful performance of said contract, and for the payment of all persons performing labor furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its Bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

In witness whereof, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

Principal

Surety

By: _____

Important - Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized in accordance with Section 16 of the Supplemental General Conditions to transact business in the State of Arkansas.

CONTRACTOR'S ACT OF ASSURANCE FORM

As the authorized agent of the individual, incorporation, or corporation (hereinafter referred to as the Contractor) bidding on or participating in a Revolving Loan Fund (RLF) financed project, I certify that I have read and understand the requirements of the RLF Supplemental General Conditions, and that the principles, agents and employees of the Contractor will comply with these requirements, including all relevant statutes and regulations issued pursuant thereto. As the authorized agent of the Contractor, I further certify that:

DBE / MBE / WBE During the bid process, and throughout the performance of the Contract, whenever subcontracts are to be awarded, I will take the six (6) affirmative steps described in the Supplemental General Conditions to use Disadvantaged, Minority and Women's Business (DBE / MBE / WBE) firms wherever possible. I will document to the borrower and the Arkansas Natural Resources Commission all efforts to secure DBE / MBE / WBE participation, including follow-up efforts, and will report to the Owner the dollar value of all DBE / MBE / WBE contracts and subcontracts awarded.

AMERICAN IRON AND STEEL I will comply with the 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 pursuant to this contract and the RLF Supplemental General Conditions. I understand that 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 I 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 detailed in the RLF Supplemental General Conditions.

EQUAL OPPORTUNITY I will comply with all requirements of 41 CFR Chapter 60 and Executive Orders 11246 and 11375, including inclusion of all required equal opportunity clauses in each subcontract awarded in excess of \$10,000, and will furnish a similar statement from each proposed subcontractor, when appropriate. I will also comply with all Equal Employment Opportunity requirements as defined by Section 504 of the Rehabilitation Act of 1973; the Age Discrimination Act of 1975; and Section 13 of the Federal Water Pollution Control Act Amendments of 1972 regarding sex discrimination.

NONSEGREGATED FACILITIES The Contractor that I represent does not and will not maintain any facilities provided for its employees in a segregated manner, or permit its employees to perform their services at any location under the Contractor's control where segregated facilities are maintained. I will also obtain a similar certification from each subcontractor prior to the award of any subcontract exceeding \$10,000 to said subcontractor, which is not exempt from the equal opportunity clause.

LABOR STANDARDS I will comply with the Labor Standards Provisions contained in Davis-Bacon wage rates specific to this contract and the RLF Supplemental General Conditions. I understand that the aggregate wage rates paid to any employees must equal or exceed the sum total of the base rate plus any listed fringe rate. I will furnish weekly payrolls and certifications as may be required by the Owner to affirm compliance. I will also require that weekly payrolls be submitted to the Owner for all Subcontracts.

OSHA REQUIREMENTS I will comply with the Department of Labor Occupational Safety and Health Administration (OSHA) Regulations promulgated under Section 107 of the Contract Work Hours and Safety Standard Act (40 U.S.C. 327-333) in performance of the contract.

PROCUREMENT PROHIBITIONS In compliance with Executive Order 11738, Section 306 of the Clean Air Act and Section 508 of the Clean Water Act, I certify that I will not procure goods and services from persons who have been convicted of violations of either law, if the facility that gave rise to said violations produces said goods or services.

PRESERVATION OF OPEN COMPETITION In accordance with Executive Order 13202 and its amendments, I certify that I have not discriminated against my employees or any subcontractor based upon labor affiliation or lack thereof.

RESPONSIBILITIES OF PARTICIPANTS REGARDING TRANSACTIONS (A.K.A. DEBARMENT AND SUSPENSION) I certify that I shall fully comply with Subpart C of 40 CFR Part 32, entitled "Responsibilities of Participants Regarding Transactions." I am responsible for ensuring that any lower tier covered transaction, as described in Subpart B of 40 CFR Part 32, entitled "Covered Transactions," includes a term or condition requiring compliance with Subpart C. I am responsible for further requiring the inclusion of a similar term or condition in any subsequent lower tier covered transactions. I acknowledge that failing to disclose the information required under 40 CFR 32.335 may result in the delay or negation of this assistance agreement, or pursuance of legal remedies, including suspension and debarment. I further acknowledge that I may access the Excluded Parties List System at <http://www.epls.gov>. This term and condition supersedes EPA Form 5700-49, "Certification Regarding Debarment, Suspension, and Other Responsibility Matters."

I understand that a false statement on this certification regarding any of the above certifications may subject the Contractor or Subcontractor to civil or criminal prosecution. I further certify that I will obtain a similar certification for each subcontract awarded.

AUTHORIZED AGENT

CONTRACTOR NAME: _____

ARKANSAS LICENSE NO. _____

SIGNATURE: _____

DATE: _____

PRINTED NAME: _____

TITLE: _____

DBE/MBE/WBE COMPLIANCE EVALUATION FORM
SUPPLEMENTAL CONDITIONS OF THE REVOLVING LOAN FUND
(Bid Package Documentation)

Bidders are to complete this form and submit within fifteen days after the bid opening. A condition for remaining in competition for award is the satisfactory completion of this form. The undersigned submits the following data with respect to the firm's efforts to meet the Arkansas Natural Resources Commission's goal for DBE/MBE/WBE participation. If you have any questions please contact Mr. Keith Sanders, Environmental Program Manager at (501) 682-0554 or email keith.sanders@arkansas.gov.

Prime Contractors that are DBE firms are not exempt from conducting the "good faith efforts" as described in 40 CFR Part 33, Subpart C- Good Faith Efforts.

Subcontracting is to be defined as subcontracts for construction, supplies, equipment and services. It is very infrequent that a Prime Contractor can do the job without hiring for construction, equipment, supplies, and services. If Prime Contractor does not sub-contract/procure for any of the categories mentioned above, the Prime Contractor must indicate that on this form.

1. Name of Project: _____ Project No: _____
Flippin Wastewater Treatment Facility Improvements

2. Name of General Contractor: _____

3. DBE/MBE/WBE Firm: _____
(Name) (Complete a separate form for each DBE/MBE/WBE to be used as a subcontractor)

(Address) (City, State, Zip Code)

(Phone Number) (Fax Number)

4. Describe Work to be performed by the DBE/MBE/WBE, provide dollar amount of the subcontract.

DOCUMENTATION OF AFFIRMATIVE STEPS TAKEN TO OBTAIN DBE/MBE/WBE PARTICIPATION

5. Documentation that DBE/MBE/WBE quotes were solicited through direct communication and documentation of responses received (Direct communication includes: faxes, phone calls, letters, e-mails). Newspaper ads/public notice ads alone will not be considered sufficient to meet the good faith effort requirements. The omission of a newspaper advertisement/public notice is not grounds for the bid to be rejected as well.
-
-

6. What sources were used to identify potential DBE/MBE/WBE firms. (Arkansas Highway and Transportation Department; Arkansas Economic Development Commission's Minority Business Development Division; U.S. Small Business Administration; other sources, please specify and provide documentation). ANRC recommends using the sources above.
-
-

7. Describe steps taken to divide work items into small tasks in an effort to maximize DBE/MBE/WBE participation.
-
-

8. List reasons for rejecting a DBE/MBE/WBE that indicated a desire to participate and/or submitted bids.
-
-

The undersigned hereby certified, having provided responses or documentation to the questions in the foregoing affirmative steps taken to obtain DBE/MBE/WBE participation, that they are true and correct to the best of her/her knowledge, information and belief.

Name of General Contractor: _____

Signature: _____

Title/Date: _____

Consulting Engineer will insert
EPA forms 6100-2, 6100-3, and 6100-4 here

AGREEMENT

This Agreement, made this _____ day of _____, 2020, by and between the City of Flippin, hereinafter called "Owner" and _____ doing business as (an individual,) or (a partnership,) or (a corporation) hereinafter called "Contractor".

Witnesseth: That for and in consideration of the payments and agreements herein after mentioned:

1. The Contractor will commence and complete the construction of Flippin Wastewater Treatment Facility Improvements.
2. The Contractor will furnish all of the materials, supplies, tools, equipment, labor and other services necessary for the construction and completion of the Project described herein.
3. The Contractor will commence the work required by the Contract Documents within ten (10) calendar days after the date of the Notice to Proceed and will complete the same within two hundred seventy (270) calendar days unless the period for completion is extended otherwise by the Contract Documents.
4. The Contractor agrees to perform all of the Work described in the Contract Documents and comply with the terms therein for the sum of \$ _____ or as shown in the Bid schedule.
5. The term "Contract Documents" means and includes the following:
 - (A) Advertisement for Bids
 - (B) Information for Bidders
 - (C) Davis-Bacon Wage Determination(s)
 - (D) Bid
 - (E) Bid Bond
 - (F) Agreement
 - (G) General Conditions (if applicable)
 - (H) Revolving Loan Fund (RLF) Supplemental General Conditions
 - (I) Supplemental Conditions

- (J) Payment Bond
- (K) Performance Bond
- (L) Notice of Award
- (M) Notice to Proceed
- (N) Contractor's Act of Assurance
- (O) DBE/MBE/WBE Certification and EPA Forms 6100-2, -3, and -4
- (P) Insurance
- (Q) Certificate of Owner's Attorney
- (R) ANRC Approval of Contract
- (S) Change Order

- (T) Drawings prepared by Civil Engineering Associates, LLC, John S. Selig, P.E. numbered 1 through 11, and dated November 6, 2020.
- (U) Specifications prepared or issued by Civil Engineering Associates, LLC, John S. Selig, P.E., dated November 6, 2020.
- (V) Addenda:
 - No. _____ dated _____, 20 _____
 - No. _____ dated _____, 20 _____
 - No. _____ dated _____, 20 _____
 - No. _____ dated _____, 20 _____
 - No. _____ dated _____, 20 _____
 - No. _____ dated _____, 20 _____

- 6. The Owner will pay to the Contractor in the manner and at such times as set forth in the Supplemental Conditions such amounts as required by the Contract Documents.
- 7. This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns.
- 8. This contract shall not be effective unless and until approved by the Executive Director of the Arkansas Natural Resources Commission.

In witness whereof, the parties hereto have executed or caused to be executed by their duly authorized official, this Agreement in 5 copies each of which shall be deemed an original on the date first above written.

(Seal) **Owner** City of Flippin
Entity

Attest: _____
Witness

By: _____

(Name typed)

Jerald Marberry
(Name typed)

Title

Mayor
Title

(Seal) **Contractor** _____

Attest: _____
Witness

By: _____

(Name typed)

(Name typed)

Title

Address

Employee Identification Number

PAYMENT BOND

Know All Persons By These Presents: that

(Name of Contractor)

(Address of Contractor)

a _____, hereinafter called
(Corporation, Partnership, or Individual)

Principal and _____
(Name of Surety)

hereinafter called Surety, are held and firmly bound unto the City of Flippin, 239 East Main Street, Flippin, Arkansas 72634 hereinafter called Owner and unto all persons, firms and corporations who or which may furnish labor, or who furnish materials to perform as described under the contract and to their successors and assigns in the total aggregate penal sum of _____ Dollars (\$ _____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

The Condition of This Obligation is such that whereas, the Principal entered into a certain contract with the Owner dated the _____ day _____ of 2020, a copy of which is hereto attached and made a part hereof for the construction of:
Wastewater Treatment Facility Improvements

Now, therefore, if the Principal shall promptly make payment to all persons, firms, and corporations furnishing materials for or performing labor in the prosecution of the Work provided for in such contract, and any authorized extensions or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery,

equipment and tools, consumed or used in connection with the construction of such Work, and for all labor cost incurred in such Work including that by a Subcontractor, and to any mechanic or materialman lienholder whether it acquires its lien by operation of State or Federal law; then this obligation shall be void, otherwise to remain in full force and effect.

Provided, that beneficiaries or claimants hereunder shall be limited to the Subcontractors, and persons, firms and corporations having a direct contract with the Principal or its Subcontractors.

Provided, further, that the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the Work to be performed thereunder or the Specifications accompanying the same shall in any way affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of this contract or to the Work or to the Specifications.

Provided, further, that no suit or action shall be commenced hereunder by any claimant: (a) Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two of the following: The Principal, the Owner or the Surety above named within ninety days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal, Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the State in which the aforesaid project is located, save that such service need not be made by a public officer. (b) After the expiration of one (1) year following the date of which Principal ceased work on said Contract, is being understood, however, that if any limitation embodied in the Bond is prohibited by any law

controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

Provided, further, that it is expressly agreed that this Bond shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than twenty percent, so as to bind the Principal and the Surety to the full and faithful performance of the Contract as so amended. The term "Amendment", whenever used in this Bond and whether referring to this Bond, the contract or the loan Documents shall include any alteration, addition, extension or modification of any character whatsoever.

Provided, further, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

Witness whereof, this instrument is executed in five (5) counterparts, each of which shall be deemed an original, this the _____ day of _____ 20 _____.

(Corp. Seal)

Contractor _____
Principal

Attest: _____
Witness as to Principal
(If Corp. then Corp. Sec.)

By: _____
(If Corp then CEO)

Address

Address

Surety _____

Attest: _____
Witness as to Surety

By: _____
Attorney-in-Fact

Address

Address

Note: Date of Bond must not be prior to date of Contract.

If Contractor is partnership, all partners should execute Bond.

Important: Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be in accordance with Section 16 of the RLF Supplemental General Conditions and be authorized to transact business in the State of Arkansas.

PERFORMANCE BOND

Know All Persons By These Presents: that

(Name of Contractor)

(Address of Contractor)

a _____, hereinafter called
(Corporation, partnership, or Individual)

Principal, and _____
(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto the City of Flippin, 239 East Main Street, Flippin, Arkansas 72634 hereinafter called Owner in the total aggregate penal sum of _____ Dollars (\$ _____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

The condition of this obligation is such that whereas, the Principal entered into a certain contract with the Owner dated the _____ day of _____ 2020 , a copy of which is hereto attached and made a part hereof for the construction of:

Wastewater Treatment Facility Improvements

Now, therefore, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the Owner with or without notice to the Surety and during the one year guaranty period and if the Principal shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless

the Owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void, otherwise to remain in full force and effect.

Provided, further, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to Work to be performed thereunder or the Specifications accompanying same shall in any way affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the Work or to the Specifications.

Provided, further, that it is expressly agreed that the Bond shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than twenty percent, so as to bind the Principal and the Surety to the full and faithful performance of the Contract as so amended. The term "Amendment", wherever used in this Bond, and whether referring to this Bond, the Contract or the Loan Documents shall include any alteration, addition, extension, or modification of any character whatsoever.

Provided, further, that no final settlement between the Owner and the Principal shall abridge the right of the other beneficiary hereunder, whose claim may be unsatisfied. The Owner is the only beneficiary hereunder.

In Witness Whereof, this instrument is executed in five (5) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 2020.

(Corp. Seal)

Contractor

Principal

Attest:

Witness as to Principal
(If Corp. then Corp. Sec.)

By:

(If Corp then CEO)

Address

Address

Surety

Attest:

Witness as to Surety

By:

Attorney-in-Fact

Address

Address

Note: Date of Bond must not be prior to date of Contract.

If Contractor is partnership, all partners should execute Bond.

Important: Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be in accordance with Section 16 of the RLF Supplemental General Conditions and be authorized to transact business in the State of Arkansas.

REVOLVING LOAN FUND (RLF)
Insurance

(Insert Insurance package here)

NOTICE OF AWARD

To: _____

Project Description: Wastewater Treatment Facility Improvements.

The Owner considered the Bid submitted by you for the above-described Work in response to its Advertisement for Bids, dated _____, 2020 and Information for Bidders.

You are hereby notified that your Bid has been accepted for items in the amount of \$ _____.

You are required by the Information for Bidders to execute the Agreement and furnish the required Contractor's Performance Bond, Payment Bond and certificates of insurance within ten calendar days from the date of this Notice to you.

If you fail to execute said Agreement and to furnish said Bonds within ten (10) days from the date of this Notice, said Owner will be entitled to consider all your rights arising out of the Owner's acceptance of your Bid as abandoned and as a forfeiture of your Bid Bond. The Owner will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this Notice of Award to the Owner.

Dated this _____ day of _____, 2020.

City of Flippin

Owner

By _____

Title _____

Acceptance of Notice

Receipt of the above Notice of Award is hereby acknowledged by

this the _____ day of _____, 2020

By _____

Title _____

NOTICE TO PROCEED

To: _____ Date: _____
_____ Project: Flippin Wastewater Treatment
Facility Improvements

You are hereby notified to commence Work in accordance with the Agreement dated
_____, 2020, on or before _____, 2020 and you are
to complete the Work within 270 consecutive calendar days thereafter. The date of completion
of all Work is therefore _____, 2020.

City of Flippin
Owner

By _____

Title _____

Acceptance of Notice

Receipt of the above Notice to Proceed
is hereby acknowledged by

this the _____, 2020

By _____

Title _____

Employer Identification
Number _____

**CERTIFICATE
of
OWNER'S ATTORNEY**

I, the undersigned, _____, the duly
authorized and acting legal representative of _____
_____, do hereby certify as follows:

I have examined the attached contract(s), insurance, and performance and payment bond(s), and I
am of the opinion that each of the aforesaid agreements, once validly executed, constitutes a
valid and legally binding obligation upon the parties executing the same in accordance with
terms, conditions, and provisions thereof.

Name: _____

Date: _____

**APPROVAL
of
CONTRACT**

Approved as to form and content and without liability for any payments thereunder, the Arkansas Natural Resources Commission hereby concurs in the Award of this contract to _____ of _____, _____. The Contract will address _____ in _____, _____. Work will include _____.

The base bid amount for construction is \$_____.

ARKANSAS NATURAL RESOURCES COMMISSION

By: _____
Bruce Holland
Executive Director

Date

REVOLVING LOAN FUND (RLF) SUPPLEMENTAL GENERAL CONDITIONS

- | | |
|---|--|
| 1. Project Funding | 30. Archeological, Historical, and Cultural Remains |
| 2. Supersession | 31. Storm Water Permit Requirements |
| 3. Definitions | 32. Engineer's Authority |
| 4. Additional Instructions & Detail Drawings | 33. Owner's Protection from Contractor's Actions |
| 5. Drawings & Specifications | 34. Inspection & Testing |
| 6. Land & Rights-of-Way | 35. Supervision by Contractor |
| 7. Bidding and Contract Award | 36. Payment to Contractor |
| 8. American Iron and Steel (AIS) | 37. Acceptance of Final Payment as Release |
| 9. Disadvantaged, Minority, Women's Business Enterprises | 38. Cleanup and Corrections |
| 10. Equal Employment Opportunity Clause | 39. Taxes |
| 11. Labor Standards | 40. State Tax Exemption |
| 12. Responsibilities of Participants Regarding Transactions (A.K.A. Debarment and Suspension) | 41. Operation and Maintenance Manual |
| 13. Procurement Prohibitions | 42. Changes in the Work |
| 14. Substitutions | 43. Subsurface Conditions |
| 15. Insurance | 44. Correction of Work |
| 16. Contract Security | 45. Surveys, Permits, Regulations |
| 17. Assignments | 46. Time for Completion & Liquidated Damages |
| 18. Indemnification | 47. Suspension of Work, Termination, & Delay |
| 19. Separate Contracts | 48. As-Built Drawings |
| 20. Subcontracting | 49. Guarantee |
| 21. Pre-Construction Conference | 50. Patents |
| 22. Schedules, Reports & Records | 51. Conflicts of Interest |
| 23. Job Bulletin Board | 52. Arbitration by Mutual Agreement |
| 24. Shop Drawings | 53. Gratuities |
| 25. Materials, Services & Facilities | |
| 26. Safety Standards | |
| 27. Protection of Lives and Property | Appendix A Labor Standards Provisions, Attachments 1 & 2 |
| 28. Protection of Work, Property, and Persons | Appendix B Equal Employment Opportunity Provisions, Title 41, Chapter 60 |
| 29. Protection of the Environment | Appendix C 40 CFR Part 33 Subpart C: Good Faith Efforts |
| | Appendix D. Memorandum: Implementation of American Iron and Steel (AIS) |

1. PROJECT FUNDING

These Supplemental General Conditions are based on detailed, specific guidance provided by the United States Environmental Protection Agency (US EPA).

In accordance with Title XV and XVI, the Arkansas Natural Resources Commission (Commission) and the Arkansas Development Finance Authority (ADFA) is not a partner, joint venture or in any way party to the construction contract. The Recipient and its Contractors shall release and hold harmless the officers and employees of the Commission and ADFA from claims arising in connection with the design, construction and operation of the project including any matter due solely to the Contractor or Borrowers negligence.

2. SUPERSESSSION

These Supplemental General Conditions supersede any conflicting provisions of the Contract Documents.

3. DEFINITIONS

Wherever used in the Contract Documents, the following terms shall have the meanings indicated and shall be applicable to both the singular and plural thereof:

- A. **Addenda** - Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the Contract Documents, Drawings and Specifications, by additions, deletions, clarifications, or corrections.
- B. **Bid** - The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
- C. **Bidder** - Any person, firm or corporation submitting a Bid for the Work.
- D. **Bonds** - Bid, Performance, and Payment Bonds and other instruments of surety, furnished by the Contractor and the Contractor's surety in accordance with the Contract Documents.
- E. **Change Order** - A written order to the Contractor authorizing an addition, deletion, or revision in the Work within the general scope of the Contract Documents, or authorizing an adjustment in the Contract Price or Contract Time.
- F. **Commission** - The Arkansas Natural Resources Commission.
- G. **Contract Documents** - The contract, including Advertisement for Bids, Information for Bidders, Bid, Bid Bond, Agreement, Payment Bond, Performance Bond, Notice of Award, Notice to Proceed, Change Order, Drawings, Specifications, General Conditions, Supplemental General Conditions, and Addenda.
- H. **Contract Price** - The total monies payable to the Contractor under the terms and conditions of the Contract Documents.
- I. **Contract Time** - The number of calendar days stated in the Contract Documents for the completion of the Work.
- J. **Contractor** - The person, firm or corporation with whom the Owner has executed the Agreement.

- K. **Drawings** - The parts of the Contract Documents, which show the characteristics, and scope of the Work to be performed and which have been prepared or approved by the Engineer.
- L. **Engineer** - The person, firm, or corporation named as such in the Contract Documents.
- M. **Field Order** - A written order effecting a change in the Work not involving an adjustment in the Contract Price, an extension of the Contract Time, or a change affecting the overall integrity of the design of the project issued by the Engineer, not the Engineer's Resident Inspector, to the Contractor during construction.
- N. **Notice of Award** - The written notice of the acceptance of the Bid from the Owner to the successful Bidder.
- O. **Notice to Proceed** - Written communication issued by the Owner to the Contractor authorizing him/her to proceed with the Work and establishing the date for commencement of the Work.
- P. **Owner** - A public or quasi-public body or authority, corporation, association, partnership, or an individual for whom the Work is to be performed.
- Q. **Project** - The undertaking to be performed as provided in the Contract Documents.
- R. **Resident Project Representative** - The authorized representative of the Owner who is assigned to the Project site or any part thereof.
- S. **Shop Drawings** - All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a Subcontractor, manufacturer, Supplier or distributor, which illustrates how specific portions of the Work shall be fabricated or installed.
- T. **Specifications** - A part of the Contract Documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.
- U. **Subcontractor** - An individual, firm or corporation having a direct contract with the Contractor or with any other Subcontractor for the performance of a part of the Work at the site.
- V. **Substantial Completion** - That date certified by the Engineer when the construction of the Project or a specified part thereof is sufficiently completed, in accordance with the Contract Documents, so that the Project or specified part can be utilized for the purposes for which it is intended.
- W. **Additional Supplemental General Conditions** - Modifications to Supplemental General Conditions required by a State agency for participation in the Project and approved by the agency in writing prior to inclusion in the Contract Documents, or such requirements that may be imposed by applicable state laws.
- X. **Supplier** - Any person or organization who supplies materials or equipment for the Work, including that fabricated to a special design, but who does not perform labor at the site.
- Y. **Work** - All labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in the Project.

Z. **Written Notice** - Any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at their last given address, or delivered in person to said party or their authorized representative on the Work.

4. ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

- A. The Contractor may be furnished additional instructions and detail drawings, by the Engineer, as necessary to carry out the Work required by the Contract Documents.
- B. The additional drawings and instructions thus supplied will become a part of the Contract Documents. The Contractor shall carry out the Work in accordance with the additional detailed drawings and instructions.

5. DRAWINGS AND SPECIFICATIONS

- A. The intent of the Drawings and Specifications is that the Contractor shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the Work in accordance with the Contract Documents and all incidental work necessary to complete the Project in an acceptable manner, ready for use, occupancy or operation by the Owner.
- B. In case of conflict between the Drawings and Specifications, the Specifications shall govern. Figure dimensions on Drawings shall govern over general Drawings.
- C. Any discrepancies found between the Drawings and Specifications and site conditions or any inconsistencies or ambiguities in the Drawings or Specifications shall be immediately reported to the Engineer, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. Work done by the Contractor after discovery of such discrepancies, inconsistencies or ambiguities shall be done at the Contractor's risk.
- D. In the case of defective Specifications for which the Owner is responsible, the equitable adjustment shall include any increased cost the Contractor reasonably incurred in attempting to comply with those defective Specifications.

6. LAND AND RIGHTS-OF-WAY

- A. Prior to issuance of Notice to Proceed, the Owner shall obtain all land and rights-of-way necessary for carrying out and for the completion of the Work to be performed pursuant to the Contract Documents, unless otherwise mutually agreed.
- B. The Owner shall provide to the Contractor information which delineates and describes the lands owned and rights-of-way acquired.

- C. The Contractor shall provide at its own expense and without liability to the Owner any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

7. BIDDING AND CONTRACT AWARD

- A. Prospective Bidders are advised that other sections of these Supplemental General Conditions describe requirements pertaining to bidding and the performance of the RLF funded contract. The Supplemental General Conditions should be thoroughly reviewed by prospective Bidders prior to the preparation and submission of bids.
- B. Awards shall be made only to the lowest responsive, responsible Contractors possessing the ability to perform successfully under the terms and conditions of the proposed procurement. Bidders are required to comply with the requirements of these Supplemental General Conditions in the preparation and submission of bids. Failure by the bidder to comply with the requirements outlined herein may result in the rejection of the bid as non-responsive.
- C. Bidders shall submit with the bid proposal an executed Contractor's Act of Assurance form as provided in these contract documents. Through execution of this form, the Bidder warrants its understanding of and compliance with these Supplemental General Conditions and all relevant requirements pertaining to the RLF funded work. In addition, each prime Contractor is required to submit an executed Contractor's Act of Assurance form to the Owner for each subcontract awarded above \$2,000.00.
- D. The information described below shall be submitted to the Commission by the Owner for review and approval within thirty days of bid opening. Construction contracts will not be Awarded without Commission concurrence.
 - i. Proposal of the lowest responsive responsible Bidder.
 - ii. Bid tabulation showing all bids and bid opening date.
 - iii. Recommendation of Award of contract by Engineer.
 - iv. Clear Site Certificate without exceptions.
 - v. Certified copies of the advertisements for bids.
 - vi. Bid bond for and name of Surety Company that will underwrite the Payment and Performance Bonds for the lowest responsive responsible Bidder.
 - vii. Itemized bid breakdown of lump sum bid from lowest responsive responsible Bidder (if applicable).
 - viii. Resume(s) of the proposed resident inspector(s).
 - ix. Contractors Act of Assurance Form
 - x. DBE/MBE/WBE documentation from lowest responsive responsible Bidder within fifteen days of bid opening.

Items (vi.), (vii.), (viii), (ix.), and (x.) shall be submitted by the lowest responsive responsible Bidder to the Owner within fifteen days of bid opening for transmittal to the Commission.

- E. If the Owner has not already enacted a written protest procedure to handle and resolve disputes relating to the award of contracts, the Owner will follow the process below upon receipt of a bid protest:
- i. Bid protests may be filed by an “interested party.” Prior to a bid submittal deadline, these persons include any party who declares an interest in the solicitation. Following the bid submittal deadline, interested parties include only bidders who submitted a bid or response to the solicitation.
 - ii. The written protest shall specify the reasons and facts upon which the protest is based; specific portions of the documents or statutes that form the basis of the protest; and the name, address, and telephone number of the party representing the Bidder.
 - iii. The protest must be filed in writing with the Owner at the address below:

Attn: _____

_____, AR _____

- iv. The protest must be filed with the Owner before 5 p.m. and no later than five business days after the date of the Bid opening.
- v. Owner must disclose all bid protests to the Commission immediately.
- vi. Owner will investigate the basis for the bid protest and analyze the facts. Owner will notify Bidder whose bid is the subject of the bid protest of evidence presented in the bid protest and evidence found as a result of the investigation, and, if deemed appropriate, afford Bidder an opportunity to rebut such evidence, and permit Bidder to present evidence that it should be allowed to perform the work. If deemed appropriate by Owner, an informal hearing will be held.
- vii. Owner will issue a written decision within 15 days following receipt of the bid protest, unless factors beyond Owner's reasonable control prevent such a resolution, in which event such decision will be issued as expeditiously as circumstances reasonably permit. The decision will state the reasons for the action taken by Owner. A copy of the decision will be furnished to the protestor, the Commission, the Bidder whose bid is the subject of the bid protest, and all Bidders affected by the decision. A Bidder is affected by the decision on a bid protest if a decision on the protest could have resulted in the Bidder not being the lowest responsible and responsive Bidder for the contract.

8. AMERICAN IRON AND STEEL (AIS)

The Contractor acknowledges to and for the benefit of the Owner and the Commission 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 including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and the Commission 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 Commission. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner or Commission to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Owner or Commission resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Commission or any damages owed to the Commission by the Owner). While the Contractor has no direct contractual privity with the Commission, as a lender to the Owner for the funding of its project, the Owner and the Contractor agree that the Commission 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 Commission. A copy of the EPA Memorandum implementing the American Iron and Steel requirement and its procedures is attached as Appendix D to these Supplemental General Conditions.

9. DISADVANTAGED, MINORITY, AND WOMEN'S BUSINESS ENTERPRISES

Whenever subcontracts are solicited, the Contractor is required to take affirmative steps (known as "good faith efforts") to assure that disadvantaged business enterprises (DBE), which includes small and minority and women's business enterprises (MBE/WBE) as well, are used when possible as sources of materials, supplies, equipment, construction activities and professional services. DBE utilization is authorized by 40 CFR Parts 30, 31, 33, 35, and 40, OMB Circular A-102, and Executive Orders 11625, 12432 and 12138.

The Contractor and Loan Recipient shall at a minimum, take the following affirmative actions, known as "good faith efforts" in the procurement of subcontracts for construction, equipment, services, and supplies:

- i. Ensure DBE firms are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities and include small, minority and women's businesses on solicitation lists;
- ii. Assure that small, minority and women's businesses are solicited whenever they are potential sources;
- iii. Divide total requirements, when economically feasible, into small tasks or quantities to permit maximum participation by small, minority and women's businesses;
- iv. Establish delivery schedules, when the requirements of the work permit, which will encourage participation by small, minority and women's businesses;

- v. Use the services of the Small Business Administration and the Office of Minority Business Enterprise of the U.S. Department of Commerce, AHTD and AEDC as appropriate.
- vi. Continue the above steps, including follow-up contact as necessary, throughout the performance of the contract.

Prime Contractors must also follow the steps indicated below in the paragraph entitled “DBE/MBE/WBE Requirements Prior to Award” and all other instructions of this document.

DBE/MBE/WBE Requirements Prior to Award: All Bidders, as a condition of bidding, are required to document to the Owner and to the Commission that the “good faith efforts” were taken in the preparation of bids to obtain DBE/MBE/WBE participation. Contractors, including DBE Prime Contractors, must conduct the “six good faith efforts” as well. Steps for Compliance are as follows:

- i. Solicit DBE/MBE/WBE quotes through direct solicitation communication, document that this was done, and submit within fifteen days of the bid opening. Examples of direct solicitation communication that must be conducted by the low bidder are: faxes, letters, phone calls, and emails. Indicate the source of the DBE/MBE/WBE list(s) used. Sources of DBE Certified Lists are listed below. Newspaper Advertisements/Public Notices alone will not meet the required DBE solicitation efforts.
- ii. Document efforts and responses received.
- iii. Document contracts awarded, or intent to award, and indicate whether the contract is with a DBE/MBE or WBE certified firm.
- iv. Document the basis on which the subcontractor/supplier was selected and/or rejected for all contracts awarded.

Note: Subcontracts include: supplies, services, equipment, and construction activity.

If the Primary Contractor states that they can complete the entire project using only in-house services and supplies, then the Contractor must indicate they will not use a subcontractor or procure supplies, services, and equipment on the DBE Compliance Evaluation Form and shall write a letter to that effect to Keith Sanders, DBE Coordinator. Note, this occurs very infrequently.

If more information is needed please feel free to contact the Division’s DBE Coordinator Keith Sanders at (501) 682-0554.

Required Form: These forms are to be submitted within fifteen days of the bid opening.

- DBE Compliance Evaluation Form Supplemental Conditions of the Revolving Loan Fund. (This form is numbered RLF-96 for CWRLF projects.) This form is to be completed and submitted within fifteen days of the bid opening.
- EPA Forms: 6100-2; 6100-3; and 6100-4

Lists of DBE/MBE/WBE firms are available from:

- Arkansas Highway and Transportation Department, Programs and Contracts Division; 10324 I-30; Post Office Box 2261; Little Rock, Arkansas 72203, Phone: (501) 569-2259 www.ahtd.state.ar.us/contract/program/letting
- Arkansas Economic Development Commission, Small and Minority Business Team; One Capitol Mall; Little Rock, Arkansas 72201; Phone: (501) 682-6105 <http://www.arkansasedc.com>.
- Arkansas Small Business Administration, Business Opportunity Section; 2120 Riverfront Drive, Suite 100; Little Rock, Arkansas 72202-1747; Phone: (501) 324-7379; <http://pro-net.sba.gov/> or <http://www.ccr.gov>.

A copy of 40 CFR Part 33, Subpart C- Good Faith Efforts is attached to these Supplemental General Conditions.

DBE/MBE/WBE Reporting Requirements: In addition to the reporting and documentation requirements during bidding, the Contractor is required to report to the Owner within fifteen days of the end of each calendar quarter, or to the Division as requested, all contracts awarded to DBE/MBE/WBE firms throughout the life of the contract, including the one year Project Performance Period. The Owner is required to report to the Division within thirty days of the end of each calendar quarter, all contracts awarded by the Owner and subcontracts awarded by the Owner's Contractors to DBE/MBE/WBE firms. In accordance with 40 CFR 35, Subpart K, the Division must report to the Environmental Protection Agency all DBE/MBE/WBE participation in the RLF program.

10. EQUAL EMPLOYMENT OPPORTUNITY CLAUSE

- A. The Contractor will not discriminate against any employee or applicant for employment because of race, color, creed, sex, age, marital status, or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, creed, sex, age, marital status, 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 furnish and post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this equal employment opportunity clause.
- B. The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, creed, sex, age, marital status, or national origin.
- C. In the event of the Contractor's noncompliance with the equal employment opportunity clause of this contract or with any rules, regulations, or orders, this contract may be cancelled, terminated, or suspended in whole or in part.

- D. The Contractor shall include the provisions of subparagraph's (A) through (C) in every subcontract or purchase order involved with this contract.
- E. The Contractor or any Subcontractor shall have an affirmative action plan which declares that it does not discriminate on the basis of race, color, creed, national origin, sex, marital status, or age and which specifies goals and target dates to assure the implementation of that plan. The Owner shall establish procedures to assure compliance with this requirement by the Contractor and to assure that suspected or reported violations are promptly investigated.
- F. The Contractor and Subcontractors supplying materials, equipment and/or labor must comply with the Civil Rights Act of 1964 as amended (42 U.S.C. 2000d et seq.), Section 504 of the Rehabilitation Act of 1973 as amended (29 U.S.C. 794), Section 13 of the Federal Water Pollution Control Act Amendments of 1972 regarding sex discrimination (Public Law 92-500), and the Age Discrimination Act of 1973.

The Contractor and all Subcontractors shall provide equal employment opportunity for all qualified applicants and all contractor solicitations for employees must contain the Equal Employment Opportunity statement. The Prime Contractor must assure Subcontractor compliance with the Civil Rights Act for each subcontract by including the Act of Assurance form and these Supplemental General Conditions in each Subcontract in excess of \$10,000. Applicable Equal Employment Opportunity regulations and Nondiscrimination provisions are described in the Appendix to these Supplemental General Conditions.

11. LABOR STANDARDS

The Contractor and all Subcontractors awarded subcontracts shall pay all laborers and mechanics employed on the project not less than the prevailing wage rates, as determined by the United States Secretary of Labor, in accordance with the Davis-Bacon Act as provided for in the Supplemental General Condition's Appendix A.

The wage decision identifies job classifications and minimum wages to be paid to all workers. Payrolls must be submitted weekly by the Contractor and all non-exempt Subcontractors to the Owner showing each worker's name, address, job classification, hourly rate of pay, daily regular and overtime hours, gross and net pay, and any fringe benefits where applicable. All workers are required to receive overtime pay in any week in which the hours worked exceed 40 hours per work week. Overtime is paid at a rate not less than 1 and 1/2 times the worker's base rate of pay.

The Owner is responsible for monitoring contractor compliance with Davis-Bacon Act requirements of Appendix A. The Owner's responsibilities will include, but not be limited to, payroll review for compliance, maintain payroll files, and conduct on-site interviews with the Contractor's employees to verify payroll accuracy. The Owner will provide the Commission a letter with each pay request certifying wages, through payroll

review and employee interviews, met the Davis-Bacon Requirements of this contract. Copies of completed interviews will be forwarded to the Commission.

**12. RESPONSIBILITIES OF PARTICIPANTS REGARDING TRANSACTIONS
(A.K.A. DEBARMENT AND SUSPENSION)**

Individuals or organizations that have been debarred or excluded from participating in Federal Assistance programs under 40 CFR Part 32 are prohibited from participating in the RLF program. This prohibition applies for every contract and subcontract for materials, supplies, equipment, and services. Contractors and Subcontractors shall execute the Contractors Act of Assurance Form as provided in the Contract Documents certifying compliance with 40 CFR Part 32.

13. PROCUREMENT PROHIBITIONS

As required by Executive Order 11738, Section 306 of the Clean Air Act and Section 508 of the Clean Water Act, RLF loan recipients, Prime Contractors and Subcontractors are prohibited from procuring goods and services from persons who have been convicted of violations of either law if the goods or services are to be produced by the facility that gave rise to the violation.

14. SUBSTITUTIONS (of “or Equal”)

All RLF procurement transactions shall be conducted in a manner that promotes maximum free and open competition. Whenever a material, article, or piece of equipment is identified on the Drawings or Specifications by reference to brand name or catalogue numbers, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality and function shall be considered for substitution. The Contractor may recommend the substitution of a material, article, or piece of equipment of equal substance and function for those referred to in the Contract Documents by reference to brand name or catalogue number, and if, in the opinion of the Engineer, such material, article or piece of equipment is of equal substance and function to that specified, the Engineer may approve its substitution and use by the Contractor. Any cost differential shall be deductible from the Contract Price and the Contract Documents shall be appropriately modified by Change Order. The Contractor warrants that if substitutes are approved, no major changes in the function or general design of the Project will result. Incidental changes or extra component parts required to accommodate the substitute will be made by the Contractor without a change in the Contract Price or Contract Time.

15. INSURANCE

- A. The Contractor shall purchase and maintain such insurance as will protect it from claims set forth below which may arise out of, or result from, the Contractor’s execution of the Work, whether such execution be by the Contractor, any Subcontractor, or by anyone

directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- i. Claims under worker's compensation, disability benefit and other similar employee benefit acts;
- ii. Claims for damages because of bodily injury, occupational sickness or disease, or death of employees;
- iii. Claims for damages because of bodily injury, sickness or disease, or death of any person other than employees;
- iv. Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the Contractor, or (2) by any other person; and
- v. Claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom.

B. Certificates of Insurance acceptable to the Owner and the Commission shall be filed with the Owner and the Commission prior to commencement of the Work. Each insurance policy shall contain a clause providing that it shall not be canceled by the insurance company without written notice to the Owner and the Commission of intention to cancel that is in accordance with Arkansas Code Annotated §23-66-206. These Certificates shall contain a provision that coverages afforded under the policies will not be cancelled unless at least fifteen days prior written notice has been given to the Owner and the Commission. The Insurance shall be made by an agent licensed by the Insurance Commissioner of the State of Arkansas to represent the surety company executing the bonds. Furthermore, the Commission will be a "Certificate Holder" and the words "will endeavor" must be removed from the insurance form.

C. The Contractor shall procure and maintain, at the Contractor's own expense, during the Contract Time, liability insurance as hereinafter specified:

Contractor's General Public Liability and Property Damage Insurance including vehicle coverage issued to the Contractor and protecting the Contractor from all claims for personal injury, including death, and all claims for destruction of or damage to property, arising out of or in connection with any operations under the Contract Documents, whether such operations be by the Contractor or by any Subcontractor employed by the Contractor or anyone directly or indirectly employed by the Contractor or by a Subcontractor employed by the Contractor. Insurance shall be written with a limit of liability of not less than \$1,000,000 for all damages arising out of bodily injury, including death, at any time resulting therefrom sustained by any one person in any one accident; and a limit of liability of not less than \$2,000,000 aggregate for any such damage sustained by two or more persons in any one accident. Insurance shall be written with a limit of liability of not less than \$1,000,000 for all property damage sustained by any one person in any one accident; and a limit of liability of not less than \$1,000,000 aggregate for any such damage sustained by two or more persons in any one accident.

D. The Contractor shall furnish umbrella liability coverage, and keep it in effect during the term of the contract which provides excess limits over the primary coverages. The

minimal amount of coverage will be determined by the Risk Management Division of the Arkansas Insurance Department.

- E. The Contractor shall procure and maintain, at the Contractor's own expense, during the Contract Time, in accordance with the provisions of the laws of the State in which the Work is performed, Worker's Compensation Insurance, including occupational disease provisions, for all of the Contractor's employees at the site of the Project and in case any Work is sublet, the Contractor shall require such Subcontractor similarly to provide Worker's Compensation Insurance, including occupational disease provisions for all of the latter's employees unless such employees are covered by the protection afforded by the Contractor. In case any class of employees engaged in hazardous work under this contract at the site of the Project is not protected under Worker's Compensation statute, the Contractor shall provide, and shall cause each Subcontractor to provide, adequate and suitable insurance for the protection of its employees not otherwise protected.
- F. The Contractor shall secure, if applicable, "All Risk" type Builder's Risk Insurance for Work to be performed. Unless specifically authorized by the Owner, the amount of such insurance shall not be less than the Contract Price totaled in the Bid. The policy shall cover not less than the losses due to fire, explosion, hail, lightening, vandalism, malicious mischief, wind, collapse, riot, aircraft, and smoke during the Contract Time, and until the Work is accepted by the Owner. The policy shall name as the insured the Contractor, and the Owner.

16. **CONTRACT SECURITY**

- A. The Contractor shall within ten days after the receipt of the Notice of Award furnish the Owner and the Commission with a Performance Bond and a Payment Bond in penal sums equal to the amount of the Contract Price, conditioned upon the performance by the Contractor of all undertakings, covenants, terms, conditions and agreements of the Contract Documents, and upon the prompt payment by the Contractor to all persons supplying labor and materials in the prosecution of the Work provided by the Contract Documents. Such Bonds shall be executed by the Contractor and a corporate bonding company licensed to transact such business in the State in which the Work is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570, provided that the contract amount shall not exceed the underwriting limitation listed for the surety in Circular 570. For contracts in excess of \$100,000.00, the Bonds shall be issued by a Bonding Company by the A.M. BEST Rating Book as follows:
 - i. contracts in excess of \$100,000.00, but less than \$1,000,000.00 - "B+" rating or higher and contract amount may not exceed 2.0% of the policyholder's surplus.
 - ii. contracts in excess of \$1,000,000.00 - "A" rating or higher and contracts may not exceed 2.0% of the policyholder's surplus.
- B. In addition, the Bonds shall be executed by an Agent licensed by the Insurance Commissioner of the State of Arkansas to represent the surety company executing the bonds. The mere countersigning of a bond will not be sufficient. The Agent shall file with

the bonds its Power of Attorney. The expense of these Bonds shall be borne by the Contractor. If at any time a surety on any such Bond is declared bankrupt or loses its right to do business in the State of Arkansas or is removed from the above list of Surety Companies, the Contractor shall notify the Owner, Engineer, and the Commission and substitute an acceptable Bond (or Bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner and Commission. The Contractor shall pay the premiums on such Bond. No further payment shall be deemed due nor shall be made until the new surety or sureties shall have furnished an acceptable Bond to the Owner and the Commission.

17. ASSIGNMENTS

The Contractor shall not sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or of any right, title or interest therein, or any obligations thereunder, without written consent of the Owner.

18. INDEMNIFICATION

- A. The Contractor will indemnify and hold harmless the Owner and the Engineer and their agents and employees from and against all claims; damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the Work, provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting therefrom; and is caused in whole or in part by any negligent or willful act or omission of the Contractor, and Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.
- B. In any and all claims against the Owner or the Engineer, or any of their agents or employees, by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under worker's compensation acts, disability benefits acts or other employee benefits acts.
- C. The obligation of the Contractor under this paragraph shall not extend to the liability of the Engineer, its agents or employees arising out of the preparation or approval of maps, Drawings, opinions, reports, surveys, Change Orders, designs or Specifications.

19. SEPARATE CONTRACTS

- A. The Owner reserves the right to let other contracts in connection with this Project. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and the execution of their Work, and shall properly connect and coordinate the Work with theirs. If the proper execution or results of any part of the Contractor's Work depends upon the Work of any other Contractor, the Contractor shall

inspect and promptly report to the Engineer any defects in such Work that render it unsuitable for such proper execution and results.

- B. The Owner may perform additional Work related to the Project or the Owner may let other contracts containing provisions similar to these. The Contractor will afford the other Contractors who are parties to such contracts (or the Owner, if the Owner is performing the additional Work) reasonable opportunity for the introduction and storage of materials and equipment and the execution of Work, and shall properly connect and coordinate the Work with theirs.
- C. If the performance of additional Work by other Contractors or the Owner is not noted in the Contract Documents prior to the execution of the Contract, written notice thereof shall be given to the Contractor prior to starting any such additional Work. If the Contractor believes that the performance of such additional Work by the Owner or others involves it in additional expense or entitles it to an extension of the Contract Time, the Contractor may make a claim thereof as provided in Sections 15 and 16.

20. SUBCONTRACTING

- A. The Contractor may utilize the services of specialty Subcontracts on those parts of the Work which, under normal contracting practices, are performed by specialty Subcontractors.
- B. The Contractor shall not award Work to Subcontractor(s), in excess of fifty percent of the Contract Price, without prior written approval of the Owner.
- C. The Contractor shall be fully responsible to the Owner for the acts and omissions of its Subcontractors, and of persons either directly or indirectly employed by them, as the Contractor is for the acts and omissions of persons directly employed by the Contractor.
- D. The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the Work to bind Subcontractors to the Contractor by the terms of the Contract Documents insofar as applicable to the Work of Subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents.
- E. Nothing contained in this Contract shall create any contractual relationship between any Subcontractor and the Owner.

21. PRE-CONSTRUCTION CONFERENCE

A Pre-Construction Conference (PCC) will be held following the RLF loan closing, the review of bid documents by the Commission, and the Award of the construction contract(s). Work orders will not be issued until after the PCC is held and the Contractor has furnished an acceptable completion schedule as described by these Supplemental General Conditions. The PCC shall be attended by the Owner, Engineer, Contractor(s),

and representatives of the Commission. The purpose of the conference will be to define the roles and responsibilities of the Owner, the Commission, the Engineer and all Contractors during the performance of the Contract.

22. SCHEDULES, REPORTS AND RECORDS

- A. The Contractor shall submit to the Owner and the Engineer such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data where applicable as are required by the Contract Documents for the Work to be performed. One copy of the up-to-date schedule shall be maintained at the job site.
- B. Prior to the first partial payment estimate, the Contractor shall submit construction progress schedules showing the order in which the Contractor proposes to carry on the Work, including dates at which the various parts of the Work will be started, estimated date of completion of each part and, as applicable:
 - i. The dates at which special detailed drawings will be required; and
 - ii. Respective dates for submission of Shop Drawings, the beginning of manufacture, the testing and the installation of materials, supplies and equipment.
- C. The Contractor shall also submit a schedule of payments that the Contractor anticipates will be earned during the course of the Work that must be updated each month.

23. JOB BULLETIN BOARD

The Contractor shall maintain a weather-tight job bulletin board in an area frequented by the Contractor's employees for the duration of construction. The job bulletin board shall display at a minimum a copy of the Davis-Bacon Wage Decision, a Davis-Bacon poster, a notice to employees concerning minimum wage requirements, Equal Employment Opportunity (Labor Standards) information, and a notice to labor unions as applicable. A copy of the construction schedule (i.e. critical path chart) is to be placed on the job bulletin board and updated monthly, showing project progress.

24. SHOP DRAWINGS

- A. The Contractor shall provide Shop Drawings as may be necessary for the prosecution of the Work as required by the Contract Documents. The Engineer shall promptly review all Shop Drawings. The Engineer's approval of any Shop Drawings shall not release the Contractor from responsibility for deviations from the Contract Documents. The approval of any Shop Drawings, which substantially deviates from the requirement of the Contract Documents, shall be evidenced by a Change Order.
- B. When submitted for the Engineer's review, Shop Drawings shall bear the Contractor's certification that he has reviewed, checked and approved the Shop Drawings and that they are in conformance with the requirements of the Contract Documents.

- C. Portions of the Work requiring Shop Drawings or submission of samples shall not begin until the Shop Drawings or submissions have been approved by the Engineer. A copy of each approved Shop Drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer.

25. MATERIALS, SERVICES AND FACILITIES

- A. It is understood that, except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, lights, power, transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete and deliver the Work within the specified time.
- B. Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the Work. Stored materials and equipment to be incorporated in the Work shall be located so as to facilitate prompt inspection. Materials not located in or near the project site will not be eligible for re-imburement.
- C. Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the Manufacturer.
- D. Materials, supplies, and equipment shall be in accordance with samples submitted by the Contractor and approved by the Engineer.
- E. Materials, supplies or equipment to be incorporated into the Work shall not be purchased by the Contractor or the Subcontractor subject to a chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the Seller.

26. SAFETY STANDARDS

- A. The Contractor is responsible for complying with the Department of Labor Safety and Health Regulations promulgated under Section 107 of the Contract Work Hours and Safety Standard Act (40 U.S.C. 327-333). The Contractor shall not require any laborer or mechanic employed in the performance of the contract to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health or safety, as determined under construction safety and health standards promulgated by regulations of the Secretary of Labor.

Job site situations which pose an immediate and serious threat to life or safety will be referred to the Occupational Safety and Health Administration (OSHA).

- B. Act 291 of the 1993 Arkansas General Assembly applies to all public improvement construction projects that involve any trench or excavation which equals or exceeds five feet in depth. Beginning March 1, 1993, Act 291 requires that:

- i. The current edition of Occupational Safety and Health Administration Standard for Excavation and Trenches Safety System, 29 CFR 1926, Subpart P, be specifically incorporated into the specifications for the project; and
- ii. The contract bid form include a separate pay item for trench and excavation safety systems and be included in the base bid.

In the event that a Contractor fails to complete a separate pay item in accordance with the Act, the Owner shall declare that the bid fails to comply fully with the specifications and the bid will be considered invalid as a non-responsive bid.

The Owner shall notify the Safety Commission of the State Department of Labor of the award of a contract covered by this Act.

27. PROTECTION OF LIVES AND PROPERTY

- A. In order to protect the lives and health of its employees under the contract, the Contractor shall comply with all pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., and shall maintain an accurate record of all cases of death, occupational disease, and injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment or work under the contract.
- B. The Contractor alone shall be responsible for the safety, efficiency, and adequacy of its plant, appliances and methods and for any damage which may result from his failure or his improper construction, maintenance or operation.

28. PROTECTION OF WORK, PROPERTY, AND PERSONS

- A. The Contractor will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. The Contractor will take all necessary precautions for the safety of, will provide the necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the Work and other persons who may be affected thereby, all the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.
- B. The Contractor will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. The Contractor will erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection. The Contractor will notify owners of adjacent utilities when prosecution of the Work may affect them. The Contractor will remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or part, by the Contractor, any Subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them be liable, except damage or loss attributable to the fault of the

Contract Documents or to the acts or omissions of the Owner, of the Engineer or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the Contractor.

- C. In emergencies affecting the safety of persons or the Work or property at the site or adjacent thereto, the Contractor, without special instructions or authorization from the Engineer or Owner, shall act to prevent threatened damage, injury or loss. The Contractor will give the Engineer prompt Written Notice of any significant changes in the Work or deviations from the Contract Documents caused thereby, and a Change Order shall thereupon be issued covering the changes and deviations involved.

29. PROTECTION OF THE ENVIRONMENT

The Contractor will provide for protection of the environment as required by the Contract Documents, Local Ordinance, State and Federal Law and these Supplemental General Conditions. The Contractor shall:

- i. Limit the area of construction disturbance to areas within temporary and permanent easements and the land areas designated for the Contractors use in performing the work.
- ii. Provide for the protection of trees, shrubs and grass wherever possible.
- iii. Provide for the prevention of air pollution through burning permits as required. The Contractor shall provide dust control on haul roads as site conditions dictate.
- iv. Control noise pollution by providing efficient mufflers on all machinery and limiting work hours if required by the Contract Documents.
- v. Control excessive erosion and sedimentation at the job site through prompt seeding of disturbed areas and the construction of temporary control measures as required in the contract documents and by Storm Water Permits.
- vi. Perform the work in coordination with the Owner and in a manner that will provide for the continuous transport and treatment of wastewater during construction.
- vii. Cease all work in areas where species classified as threatened or endangered under the Endangered Species Act (Public Law 93-205 as amended) are discovered and promptly notify the Engineer.

30. ARCHAEOLOGICAL, HISTORICAL, AND CULTURAL REMAINS

The Contractor shall immediately stop all work in any area where artifacts of archaeological, historical or cultural significance are found and notify the Engineer. The Owner shall notify the Commission, the State Advisory Council on Historic Preservation and the Arkansas Natural Heritage Commission of the discovery.

31. STORM WATER PERMIT REQUIREMENTS

- A. The Contractor is advised that if this construction activity involves clearing, grading or excavation activities that result in the disturbance of one or more acres of total land area including areas which are part of the total RLF project, this activity is subject to Storm Water Permit Requirements of the Arkansas Department of Environmental Quality. The Owner will obtain an NPDES General Stormwater Permit for construction activities (ARR150000). The Contractor is responsible for compliance with all terms and conditions of the General Permit. Most RLF projects are eligible for inclusion under the General Permit.
- B. The General Permit requires the control of the entrance of pollutants into the surface and ground waters of the State. Temporary and permanent sediment and erosion control measures must be included in the Work during the course of construction. These measures may include temporary and permanent seeding, construction of catch basins, the use of mulch, straw bales and silt fences to control sediments, the use of riprap at erosion-prone areas, and other measures.
- C. The General Permit also requires maintenance and “good housekeeping practices” that include items such as proper waste disposal, proper storage for hazardous materials and designating safe places for equipment maintenance and wash-down.
- D. The Contractor is required to maintain on-site a Stormwater Pollution Prevention Plan describing the storm water pollution prevention measures that will be taken at the construction site. The Plan must include a site description, a description of the nature of the activity, the intended sequence of the work, estimates of the total area involved in the activity, an estimate of the possible volume of runoff from the area, site maps showing drainage patterns, pollution prevention measures that will be taken, and other items.
- E. The Contractor is responsible for implementation of Best Management Practices described within the Stormwater Pollution Prevention Plan.
- F. The Contractor shall be responsible for implementing all applicable requirements of the Owner’s ADEQ General Stormwater Permit for Construction Activity, 401 Water Quality Certification, the COE Section 404 Permit, the ADEQ Short-Term Activity Authorization, the SPCCP, the USFWS recommendations for cave protection, local Municipal Separate Storm Sewer requirements, and all other environmental regulatory requirements that are associated with the construction activities that the Contractor is to perform.
- G. Additional information and application materials may be obtained by writing to the Arkansas Department of Environmental Quality’s Storm Water Permits Section.

32. ENGINEER'S AUTHORITY

- A. The Engineer shall act as the Owner's representative during the construction period, shall decide questions which may arise as to quality and acceptability of materials furnished and Work performed, and shall interpret the intent of the Contract Documents in a fair and unbiased manner. The Engineer will make visits to the site and determine if the Work is proceeding in accordance with the Contract Documents.
- B. The Contractor will be held strictly to the intent of the Contract Documents in regard to the quality of materials, workmanship, and execution of the Work. Inspections may be made at the factory or fabrication plant of the source of material supply.
- C. The Engineer will not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety.
- D. The Engineer shall promptly make decisions relative to interpretation of the Contract Documents.

33. OWNER'S PROTECTION FROM CONTRACTOR'S ACTIONS

The Engineer may withhold or, on account of subsequently discovered evidence, nullify the whole or part of any approved partial payment estimate to such extent as may be necessary to protect the owner from loss on account of:

- i. Defective work not remedied.
- ii. Claims filed or reasonable evidence indicating probable filing of claims.
- iii. Failure of Contractor to make payments properly to Subcontractors or for material or labor.
- iv. A reasonable doubt that the work can be completed for the balance then unpaid.
- v. Damage to another Contractor.
- vi. Performance of work in violation of the terms of the contract documents.

34. INSPECTION AND TESTING

- A. All materials and equipment used in the construction of the Project shall be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the Contract Documents.
- B. The Owner shall provide for full time inspection of the work by the Engineer to assure the work is being performed in accordance with the approved plans, specifications and change orders; and in accordance with sound engineering principles and building practices.

The Resident Inspector(s) of the Owner will perform required inspections and tests and maintain on-site records as assurance that the work conforms to the contract requirements. The Resident Inspector shall make available to the Owner and Commission

representatives adequate records of such inspections and tests. Failed tests with passing retests will be clearly marked in the project records.

- C. The Contractor will maintain an adequate inspection and supervision system and perform required inspections and tests to assure that the work conforms to the contract requirements. The Contractor will make available to the Owner and the Commission adequate records of such inspections and tests. Failed tests with passing re-tests will be clearly marked in the project records.
- D. If laws, ordinances, or regulations of any public body having jurisdiction require any Work (or part thereof) to specifically be inspected, tested, or approved by an employee or other representative of such public body, the Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish the Engineer the required certificates of inspection or approval.
- E. Inspections, tests, or approvals by the Engineer or others shall not relieve the Contractor from the obligations to perform the Work in accordance with the requirements of the Contract Documents and Specifications.
- F. The Engineer and the Engineer's representatives will at all times have access to the Work. In addition, authorized representatives and agents of any participating State agency shall be permitted to inspect all work, materials, payrolls, records or personnel, invoices of materials, and other relevant data and records. The Contractor will provide proper facilities for such access and observation of the Work and also for any inspection or testing thereof.
- G. The Commission will make periodic engineering and administrative inspections of the project to examine project records, monitor progress and inspect the work for conformance with contract requirements. The Commission shall notify the Owner and the Engineer of any observed deficiencies in the completed construction, procedures or materials used in construction, resident inspection, engineering supervision, financial management or any violation of loan program requirements. The Commission will require the Owner to take such action as may be necessary to correct any such observed deficiency.
- H. If any Work is covered contrary to the written instructions of the Engineer it must, if requested by the Engineer, be uncovered for the Engineer's observation and replaced at the Contractor's expense.
- I. If the Engineer considers it necessary or advisable that covered Work be inspected or tested by others, the Contractor, at the Engineer's request, will uncover, expose or otherwise make available for observation, inspection or testing as the Engineer may require, that portion of the Work in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such Work is defective, the Contractor will bear all the expenses of such uncovering, exposure, observation, inspection and testing and of

satisfactory reconstruction, if however, such Work is not found to be defective, the Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate Change Order shall be issued.

- J. The Contractor shall maintain books, records, documents and other evidence directly pertinent to performance on RLF funded work under this agreement in accordance with the provisions of these Contract Documents. The Contractor shall also maintain the financial information and data used in the preparation or support of the cost submission required for a change order and a copy of the cost summary submitted to the Owner. The Owner and the Commission or any of their authorized representatives shall have access to all such books, records, documents and other evidence for the purpose of inspection, audit and copying during normal business hours. The Contractor will provide proper facilities for such access and inspection.
- K. Upon completion of all project construction, the Commission will schedule a final inspection within thirty days of receipt of a written certification by the Owner that construction is ready for a final inspection. Prior to approval of the final construction payment, the Commission will verify that all construction is complete in accordance with plans, specifications and approved change orders, all equipment has been purchased and installed, the final contract amounts have been agreed to by Change Order, as-built drawings are complete, and the Owner has prepared an operation and maintenance manual that includes contractor supplied data as required by these Supplemental General Conditions.

Following an acceptable Final Inspection by the Commission, the Commission will provide written acceptance to the Owner of the project and the final construction payment can be requested. The Commission will not approve the final construction payment until the Owner and the Contractor has complied with the requirement for the release of final payment as outlined in these Supplemental General Conditions.

35. SUPERVISION BY CONTRACTOR

The Contractor will supervise and direct the Work. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The Contractor will employ and maintain on the Work a qualified supervisor or superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the site. The Supervisor shall have full authority to act on behalf of the Contractor and all communications given to the supervisor shall be as binding as if given to the Contractor. The Supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the Work.

36. PAYMENT TO CONTRACTOR

- A. Disbursements from the State Revolving Loan Fund (RLF) Programs shall be made monthly based upon actual work performed and materials stored on site less retainage. Funds will not be disbursed from the RLF without approval by the Commission. The Commission will approve disbursements provided the Owner (loan recipient) and the Contractor are in compliance with the provisions of these contract documents and RLF regulations. Contract cost overruns approved by the Commission but in excess of the loan amount must be funded by the Owner or through an additional loan. Contract cost overruns not approved by the Commission must be funded by the Owner.
- B. Each month, at least ten days before each progress payment falls due (but not more often than once a month), the Contractor shall prepare and submit to the Engineer a progress estimate acceptable in form and content to the Engineer and the Commission supported by such data as the Engineer may reasonably require. The estimate shall show a detailed breakdown of the amount of work completed previously, amount of work completed this period, amount of work completed to date, the amount of retainage, and the quantity and value of materials and equipment currently stored on site that have not been incorporated into the work. Partial payment requests will be placed on the form provided by the Commission and must include a reduced scale copy of the updated construction schedule. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to the Owner as will establish Owner's title to the material and equipment and protect the Owner's interest therein, including applicable insurance.

The progress payment request shall also include a certification by the Contractor that it has complied with all labor standards. The Certification may be placed in the content of the progress payment request or Commission form "Certification by Contractor of Labor Standards Compliance" may be attached to the payment request. No disbursement request will be approved by the Commission without this certification. Furthermore, the Owner will provide the Commission a letter with each pay request certifying wages, through payroll review and employee interviews, met the Davis-Bacon Requirements of this contract. Copies of completed interviews will be forwarded to the Commission.

The Engineer will, within ten days after receipt of each partial payment estimate, either indicate in writing approval of payment, and present the partial payment estimate to the Owner or return the partial payment estimate to the Contractor indicating in writing the reasons for refusing to approve payment. In the latter case, the Contractor may make the necessary corrections and resubmit the partial payment estimate. The Owner will, within ten days of presentation of an approved partial payment estimate, pay the Contractor a progress payment on the basis of the approved partial payment estimate less the retainage.

Retainage will be in accordance with state law (Arkansas Code of 1987 as amended, Annotated 22-9-604) and as described herein. The retainage shall be an amount equal to five percent of said estimate (excluding Section C. below). Upon final completion of the work, any amount retained may be paid to the Contractor. When the Work has been completed except for Work which cannot be completed because of weather conditions, lack of materials or other reasons which in the judgement of the Owner are valid reasons for non-completion, the Owner may make additional payments, retaining at all times an amount sufficient to cover the estimated cost of the Work still to be completed.

- C. In compliance with Arkansas Code Ann. §17-25-404 (1995), ten percent may be withheld from the Engineer's estimate until a proper statement or certificate is received from the Contractors Licensing Board stating that the required bond has been filed and that the Contractor is otherwise in compliance with Arkansas Code Ann. §17-25-404 (1995).
 - i. That no compensating tax is due the State under the contract.
 - ii. That the tax due under the contract has been paid.
 - iii. That a suitable surety bond has been provided by the Contractor and approved by the Contractors Licensing Board as prescribed in the Act.
- D. The Owner shall request payment on Disbursement Request Form supplied during the Pre-Construction Conference. The requested amount shall not exceed the current amounts approved for construction, engineering and other project costs on individual line items. Only those individuals authorized to represent the Owner and the Engineer shall sign the Disbursement Request Form. Documentation for costs incurred since the last disbursement request must accompany each pay request including the Contractor's monthly pay estimate with attachments as described in these Supplemental General Conditions and invoices for engineering, administrative, and legal services as well as approved equipment costs.
- E. The Owner is required to submit one copy of the completed Disbursement Request Form and all supporting documentation to the Commission for processing; the deadlines for all disbursements from the City to the Commission will be discussed at the Preconstruction Conference. Disbursement requests not received at the Commission prior to the deadlines established in the Preconstruction Conference will not be processed and paid until the following month.

For the Owner to realize this deadline, Contractor estimates should be received by the Engineer on or before the 10th day of each month. The actual due date for Contractor estimates shall be as established by the Contract Documents or by the Engineer.

- F. Disbursements from the RLF are generally received by the Owner (loan recipient) from the Arkansas Development Finance Authority (ADFA) within the first ten working days of the month. The Owner shall promptly pay all bills due as disbursements are made from the RLF.

- G. Prior to Substantial Completion, the Owner with the approval of the Engineer and with the concurrence of the Contractor, may use any completed or substantially completed portions of the Work. Such use shall not constitute an acceptance of such portions of the Work.
- H. The Owner shall have the right to enter the premises for the purpose of doing work not covered by the Contract Documents. This provision shall not be construed as relieving the Contractor of the sole responsibility for the care and protection of the Work, or the restoration of any damaged Work except such as may be caused by agents or employees of the Owner.
- I. Upon completion and acceptance of the Work, the Engineer shall issue a certificate attached to the final payment request that the Work has been accepted under the conditions of the Contract Documents. The entire balance found to be due the Contractor, including the retained percentages, but except such sums as may be lawfully retained by the Owner shall be paid to the Contractor within thirty days of completion and acceptance of the Work.
- J. The Contractor will indemnify and save the Owner or the Owner's agents harmless from all claims growing out of the lawful demand of Subcontractors, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, tools and all supplies, incurred in the furtherance of the performance of the Work. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived. If the Contractor fails to do so the Owner may, after having notified the Contractor, either pay unpaid bills or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed in accordance with the terms of the Contract Documents, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to either the Contractor, the Contractor's Surety, or any third party. In paying any unpaid bills of the Contractor, any payment so made by the Owner shall be considered as a payment made under the Contract Documents by the Owner to the Contractor and the Owner shall not be liable to the Contractor for any such payments made in good faith.
- K. If the Owner fails to make payment thirty days after approval by the Engineer, in addition to other remedies available to the Contractor, there shall be added to each such payment interest at the maximum legal rate commencing on the first day after said payment is due and continuing until the payment is received by the Contractor.

- L. In addition to the Contract Time specified in these Contract Documents, the Bond Purchase Agreement between the Owner and the Commission contains an estimated completion date beyond which no further loan disbursements will be made without specific written waiver by ADFA and the Commission. ADFA and the Commission will grant waivers only where there is sufficient documented evidence that project completion was delayed through no fault of the Contractor and the Owner.

Regardless of the existence of circumstances where a delay in completion is beyond the control of the Contractor and the Owner, a waiver to the estimated completion date will not be granted should the granting of such waiver harm any commitments made to the purchasers of Revolving Loan Fund Bonds issued by ADFA. Should a waiver be denied, the Owner must complete the project with its own funds or apply for an additional loan from the RLF program.

37. ACCEPTANCE OF FINAL PAYMENT AS RELEASE

The acceptance of the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and all liability to the Contractor other than claims in stated amounts as may be specifically excepted by the Contractor for all things done or furnished in connection with this Work and for every act and neglect of the Owner and others relating to or arising out of this Work. Any payment, however, final or otherwise, shall not release the Contractor or its sureties from any obligations under the Contract Documents or the Performance and Payment Bonds.

38. CLEANUP AND CORRECTIONS

Where work on unit price items are substantially complete but lack clean-up and/or corrections ordered by the Engineer, amounts shall be deducted from unit prices in partial payment estimates to amply cover such clean-up and corrections.

39. TAXES

The Contractor will pay all sales, consumer, use and other similar taxes required by the laws of the place where the Work is performed.

40. STATE TAX EXEMPTION

This section only applies with projects receiving Clean Water Revolving Loan Funds; Drinking Water Revolving Loan Funds can not receive this benefit. Except where applicable below, the Contractor will pay all sales, consumer, use and other similar taxes required by the laws of the place where the Work is performed. Machinery and equipment purchased by the Contractor for installation under this contract may be exempt from Arkansas Sales Tax. Arkansas Department of Finance and Administration Regulation GR-66 states that the gross proceeds derived from the sale of pollution control machinery and equipment are exempt from the tax if:

- i. The machinery and equipment is utilized, either directly or indirectly, by manufacturing or processing plants or facilities, or cities or towns in Arkansas to prevent or reduce air or water pollution or contamination which might otherwise result from the operation of the plant or facility; and,
- ii. The machinery and equipment is required by Arkansas or federal law or regulations to be installed and utilized to control pollution or contamination as evidenced by written documentation from the Arkansas Natural Resources Commission or the Environmental Protection Agency.
- iii. Supplies and chemicals used by pollution control machinery and equipment are taxable.

Should the contract involve the installation of pollution control machinery and equipment at a treatment facility, the Arkansas Department of Environmental Quality will furnish a written general certification to document that the machinery and equipment is required by Arkansas or federal law. A request for written documentation should be sent to the Arkansas Department of Environmental Quality's NPDES Permit Branch, Water Division.

To claim the exemption, the Contractor must provide the vendor with a copy of the documentation. The invoice must show that the purchase is for pollution control machinery and equipment under Arkansas Code Annotated 26-53-114. Most ancillary items necessary to install the equipment do not qualify for tax exemption. Any questions involving the definition of machinery and equipment should be directed to the Arkansas Department of Finance and Administration's Sales and Use Tax Section.

41. OPERATION AND MAINTENANCE MANUAL

- A. The Contractor shall furnish four copies of all operation, maintenance, repair and replacement manuals, and product data for all equipment supplied by the Contractor to the Engineer. The Engineer shall not certify payments requesting more than eighty percent of the Contract amount until such time as all operation, maintenance, repair and replacement manuals, and product data has been furnished by the Contractor to the Engineer.
- B. The Engineer is required to obtain approval from the Commission of the project operation and maintenance manual prior to the release of the final construction payment.

42. CHANGES IN THE WORK

- A. The Owner may at any time, as the need arises, order changes within the scope of the Work without invalidating the Agreement. If such changes increase or decrease the amount due under the Contract Documents, or in the time required for performance of the Work, an equitable adjustment shall be authorized by Change Order.
- B. All changes should be recorded and approved on a contract Change Order so that they may be included in partial payment estimates. The Commission must approve all contract

Change Orders prior to commencing with the associated Work. When drafting Change Orders, the Engineer will use the RLF form provided by the Commission.

- C. All changes, which affect the cost of the construction of the Project, must be authorized by means of a contract Change Order. The contract Change Order will include extra work, work for which quantities have been altered from those shown in the bidding schedule, as well as decreases or increases in the quantities of installed units which are different than those shown in the bidding schedule because of final measurements.

In the case of defective specifications for which the Owner is responsible, the equitable adjustment shall include any increased cost the Contractor reasonably incurred in attempting to comply with those defective specifications.

Where justified, adjustments to the Contract Time specified in the Contract Documents shall be made in conjunction with changes in the work and with equitable adjustments in the contract price as described in these Supplemental General Conditions. Where delays in project completion are not due to changes in the work or acts of the Owner, extensions to the contract time will be made only where there is sufficient documented evidence that delays in project completion were caused by events beyond the contractor's control.

The Owner shall promptly investigate the conditions and if found that conditions materially differ, the Owner will cause an increase or decrease in the Contractor's cost or the time required to perform any part of the work under this agreement as applicable.

The Contractor shall promptly, and before such conditions are disturbed, notify the Owner in when differing site conditions occur. Notification will come in the writing with:

- i. Subsurface or latent physical conditions at the site differing materially from those indicated in this agreement, or
- ii. Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this agreement.

No claim of the Contractor for increased cost or time due to differing site conditions shall be allowed unless the Contractor has given a written notice of the differing site conditions within thirty days of the discovery of such conditions.

- D. The Contractor shall document the necessity of all claims for additional cost and time in writing and shall provide detailed cost and time estimates to the Engineer for all proposed contract changes. The Engineer shall review the supporting documents and estimates provided by the Contractor for reasonableness and shall as necessary develop independent cost estimates of the proposed contract changes to assure that the cost of the proposed change is fair and reasonable.
- E. The Owner shall provide sufficient information such as a description and justification for the change, drawings, the Contractor's proposal and other supporting documentation to the Commission for review. The Owner shall promptly notify the Commission in writing

of events or proposed changes which may substantially alter the design and scope of the Project, alter the type of treatment provided or the location, size, capacity, or quality of any major item of equipment or treatment unit, or exceed the amount of funds available to complete the project.

- F. The Contract Price may be changed only by a Change Order. The value of any Work covered by a Change Order or of any claim for increase or decrease in the Contract Price shall be determined by one or more of the following methods in the order of precedence listed below:
 - i. Unit prices previously approved.
 - ii. An agreed lump sum.
- G. Should project changes increase the amount of funds necessary to complete the Project beyond the initial loan amount, the Owner must fund the project changes or apply to the Commission for monies to cover the cost overruns.
- H. The Engineer, also, may at any time, by issuing a Field Order, make changes in the details of the Work. The Contractor shall proceed with the performance of any changes in the Work so ordered by the Engineer unless the Contractor believes that such Field Order entitles the Contractor to change in Contract Price or Time, or both, in which event the Contractor shall give the Engineer written notice thereof within seven days after the receipt of the ordered change. Thereafter the Contractor shall document the basis for the change in Contract Price or Time within thirty days. The Contractor shall not execute such changes pending the receipt of an executed Change Order or further instruction from the Owner.

43. SUBSURFACE CONDITIONS

- A. The Contractor shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the Owner by Written Notice of:
 - i. Subsurface or latent physical conditions at the site differing materially from those indicated in the Contract Documents; or
 - ii. Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in Work of the character provided for in the Contract Documents.
- B. The Owner shall promptly investigate the conditions, and if it is found that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the Work, an equitable adjustment shall be made and the Contract Documents shall be modified by a Change Order. Any claim of the Contractor for adjustment hereunder shall not be allowed unless the required Written Notice has been given; provided that the Owner may, if the Owner determines the facts so justify, consider and adjust any such claims asserted before the date of final payment.

44. CORRECTION OF WORK

- A. The Contractor shall promptly remove from the premises all Work rejected by the Engineer for failure to comply with the Contract Documents, whether incorporated in the construction or not, and the Contractor shall promptly replace and re-execute the Work in accordance with the Contract Documents and without expense to the Owner and shall bear the expense of making good all Work of other Contractors destroyed or damaged by such removal or replacement.
- B. All removal and replacement Work shall be done at the Contractor's expense. If the Contractor does not take action to remove such rejected Work within ten days after receipt of Written Notice, the Owner may remove such Work and store the materials at the expense of the Contractor.

45. SURVEYS, PERMITS, REGULATIONS

- A. The Owner, through the Engineer, shall furnish all boundary surveys and establish all base lines for locating the principal component parts of the Work together with a suitable number of bench marks adjacent to the Work as shown in the Contract Documents. From the information provided by the Engineer unless otherwise specified in the Contract Documents, the Contractor shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pipe locations and other working points, lines, elevations and cut sheets.
- B. The Contractor shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, shall be charged with the resulting expense and shall be responsible for any mistake that may be caused by their unnecessary loss or disturbance.
- C. Permits and licenses of a temporary nature necessary for the prosecution of the Work shall be secured and paid for by the Contractor unless otherwise stated in the Supplemental General Conditions. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the Owner, unless otherwise specified. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn and specified. If the Contractor observes that the Contract Documents are at variance therewith, the Contractor shall promptly notify the Engineer in writing, and any necessary changes shall be adjusted as provided in Section 42, CHANGES IN THE WORK.

46. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

- A. The date of beginning and the time for completion of the Work are essential conditions of the Contract Documents and the Work embraced shall be commenced on a date specified in the Notice to Proceed.
- B. The Contractor will proceed with the Work at such rate of progress to insure full completion within the Contract Time. It is expressly understood and agreed, by and

between the Contractor and the Owner that the Contract Time for the completion of the Work described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the Work.

- C. If the Contractor shall fail to complete the Work within the Contract Time, or extension of time granted by the Owner, then the Contractor will pay to the Owner the amount for liquidated damages as specified in the Bid for each calendar day that the Contractor shall be in default after the time stipulated in the Contract Documents.
- D. The Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the Work is due to the following and the Contractor has promptly given Written Notice of such delay to the Owner or Engineer.
 - i. To any preference, priority or allocation order duly issued by the Owner.
 - ii. To unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather; and
 - iii. To any delays of Subcontractors occasioned by any of the causes specified in paragraphs (i.) and (ii) of this article.
- E. Where justified, adjustments to the Contract Time specified in the Contract Documents shall be made in conjunction with changes in the work and with equitable adjustments in the contract price as described in these Supplemental General Conditions. Where delays in project completion are not due to changes in the work or acts of the Owner, extensions to the contract time will be made only where there is sufficient documented evidence that delays in project completion were caused by events beyond the Contractor's control. Requests for time extensions by the Contractor must be submitted with the pay estimate for the month that the lost days are being sought.
- F. Notification procedures.
 - i. At eighty percent completion of project construction time the Engineer will contact in writing the Surety Company, the Contractor, the Owner, and the Funding Agencies. The letter will contain contract specific language concerning time left in the contract and work needed to be completed. If the Engineer deems the project to be on time for completion then they may contact the Owner and the Funding Agency via email requesting a relief from this clause.
 - ii. When contract time has been completed and the project is not substantially complete, the Engineer will notify in writing the Surety Company, the Contractor, the Owner, and the Funding Agencies. The letter will notify all parties that Liquidated Damages will be assessed from this point forward until the project has been completed.
 - iii. If paragraph ii. above is enacted, the Engineer will contact all parties in writing when the project is complete.

47. SUSPENSION OF WORK, TERMINATION, AND DELAY

- A. The Owner may suspend the Work or any portion thereof for a period of not more than ninety days or such further time as agreed upon by the Contractor, by Written Notice to the Contractor and the Engineer, which shall fix the date on which Work shall be resumed. The Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension.
- B. If the Contractor is adjudged to be bankrupt or insolvent, or makes a general assignment for the benefit of his creditors, or if a trustee or receiver is appointed for the Contractor or for any of its property, or if the Contractor files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or applicable laws, or repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, or repeatedly fails to make prompt payments to Subcontractors or for labor, materials, or equipment or disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction of the Work or disregards the authority of the Engineer, or otherwise violates any provision of the Contract Documents, then the Owner may, without prejudice to any other right or remedy and after giving the Contractor and its surety a minimum of ten days from delivery of a Written Notice, terminate the services of the Contractor and take possession of the Project and of all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor, and finish the Work by whatever method the Owner may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct and indirect costs of completing the Project, including compensation for additional professional services, such excess shall be paid to the Contractor. If such costs exceed such unpaid balance, the Contractor will pay the difference to the Owner. Such costs incurred by the Owner will be determined by the Engineer and incorporated in a Change Order.
- C. Where the Contractor's services have been so terminated by the Owner, said termination shall not affect any right of the Owner against the Contractor then existing or which may thereafter accrue. Any retention or payment of monies by the Owner due the Contractor will not release the Contractor from compliance with the Contract Documents. Upon receipt of a termination action the Contractor shall promptly discontinue all affected work (unless the notice directs otherwise), and deliver or otherwise make available to the Owner all data, drawings, specifications, reports, estimates, summaries and such other information and materials as may have been accumulated by the Contractor in performing this agreement, whether completed or in process.
- D. After ten days from delivery of a Written Notice to the Contractor and the Engineer, the Owner may, without cause and with prejudice to any other right or remedy, elect to abandon the Project and terminate the Contract. In such case the Contractor shall be paid for all Work executed and any expense sustained plus reasonable profit.
- E. If, through no act or fault of the Contractor, the Work is suspended for a period of more than ninety days by the Owner or under an order of the court or other public authority, or the Engineer fails to act on any request for payment within thirty days after it is

submitted, or the Owner fails to pay the Contractor substantially the sum approved by the Engineer or awarded by arbitrators within thirty days of its approval and presentation, then the Contractor may, after ten days from delivery of a Written Notice to the Owner and the Engineer terminate the Contract and recover from the Owner payment for all Work executed and all expenses sustained. In addition and in lieu of terminating the Contract, if the Engineer has failed to act on a request for payment or if the Owner has failed to make any payment as aforesaid, the Contractor may upon ten days written notice to the Owner and the Engineer stop the Work until paid all amounts then due, in which event and upon resumption of the Work Change Orders shall be issued for adjusting the Contract Price or extending the Contract Time or both to compensate for the costs and delays attributable to the stoppage of the Work.

- F. If the performance of all or any portion of the Work is suspended, delayed, or interrupted as a result of a failure of the Owner or Engineer to act within the time specified in the Contract Documents, or if no time is specified, within a reasonable time, an adjustment in the Contract Price or an extension of the Contract Time, or both, shall be made by Change Order to compensate the Contractor for the costs and delays necessarily caused by the failure of the Owner or Engineer.

48. AS-BUILT DRAWINGS

To assure quality control, the Contractor and the Owner's Inspector shall each maintain a complete set of Plans and Specifications and approved shop drawings at the construction site. In addition, one set of Plans shall be maintained at the site solely for the purpose of marking authorized changes in the plans as the work progresses. These marked up drawings shall be used in the preparation of as-built drawings following project completion and shall be maintained in current condition at all times.

49. GUARANTEE

The Contractor shall guarantee all materials and equipment furnished and Work performed for a period of one year from the date of Substantial Completion. The Contractor warrants and guarantees for a period of one year from the date of Substantial Completion of the system that the completed system is free from all defects due to faulty materials or workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the system resulting from such defects. The Owner will give notice of observed defects with reasonable promptness. In the event that the Contractor should fail to make such repairs, adjustments, or other Work that may be made necessary by such defects, the Owner may do so and charge the Contractor the cost thereby incurred. The Performance Bond shall remain in full force and effect through the guarantee period.

50. PATENTS

The Contractor shall pay all applicable royalties and license fees, and shall defend all suits or claims for infringement of any patent rights and save the Owner harmless from

loss on account thereof, except that the Owner shall be responsible for any such loss when a particular process, design, or product of a particular manufacturer or manufacturers is specified, however, if the Contractor has reason to believe that the design, process or product specified is an infringement of a patent, the Contractor shall be responsible for such loss unless the Contractor promptly gives such information to the Engineer.

51. CONFLICTS OF INTEREST

No official of the Owner who is authorized in such capacity and on behalf of the "Owner" to negotiate, make, accept or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part thereof. No officer, employee, architect, attorney, engineer or inspector of or for the "Owner" who is authorized in such capacity and on behalf of the "Owner" who is in any legislative, executive, supervisory, or other similar functions in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

52. ARBITRATION BY MUTUAL AGREEMENT

- A. All claims, disputes, and other matters in question arising out of, or relating to, the Contract Documents or the breach thereof, except for claims which have been waived by making an acceptance of final payment as provided by Section 36 and 37, may be decided by arbitration if the parties mutually agree. Any agreement to arbitrate shall be specifically enforceable under the prevailing arbitration law. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in any court having jurisdiction thereof.
- B. Notice of the request for arbitration shall be filed in writing with the other party to the Contract Documents and a copy shall be filed with the Engineer. Request for arbitration shall in no event be made on any claim, dispute, or other matter in question which would be barred by the applicable statute of limitations.
- C. The Contractor shall diligently pursue the completion of the work during any arbitration or court proceeding unless the work is suspended by the Owner or the contract terminated under the provisions of the Contract Documents.

53. GRATUITIES

If the Owner finds after a notice and hearing that the Contractor or any of the Contractor's agents or representatives offered or gave gratuities (in the form of entertainment, gifts or otherwise) to any official, employee or agent of the Owner, or the State, in an attempt to secure an agreement or favorable treatment in awarding, amending

or making any determinations related to the performance of this agreement, the Owner may, by written notice to the Contractor, terminate this agreement. The Owner may also pursue other rights and remedies that the law or this agreement provides. However, the existence of the facts on which the Owner bases such findings shall be at issue and may be reviewed in proceedings under the Disputes and Remedies section of these Supplemental General Conditions.

Appendix A.

United States Environmental Protection Agency
Washington, DC 20460

Labor Standards Provisions for
Federally Assisted Contracts

Davis-Bacon and Related Acts

ATTACHMENT 1

CWSRF: The recipient agrees to include in all agreements to provide assistance for the construction of treatment works carried out in whole or in part with such assistance 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 with such assistance made available under section 205(m) of that Act (33 U.S.C. 1285(m)), or both, a term and condition requiring compliance with the requirements of section 513 of that Act (33 U.S.C. 1372) in all procurement contracts and sub-grants, and require that loan recipients, procurement contractors and sub-grantees include such a term and condition in subcontracts and other lower tiered transactions. All contracts and subcontracts for the construction of treatment works carried out in whole or in part with assistance made available as stated herein shall insert in full in any contract in excess of \$2,000 the contract clauses as attached hereto entitled "Wage Rate Requirements Under The Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6)." This term and condition applies to all agreements to provide assistance under the authorities referenced herein, whether in the form of a loan, bond purchase, grant, or any other vehicle to provide financing for a project, where such agreements are executed on or after October 30, 2009.

DWSRF: The recipient agrees to include in all agreements to provide assistance for any construction project carried out in whole or in part with such assistance made available by a drinking water revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12), a term and condition requiring compliance with the requirements of section 1450(e) of the Safe Drinking Water Act (42 U.S.C.300j-9(e)) in all procurement contracts and sub-grants, and require that loan recipients, procurement contractors and sub-grantees include such a term and condition in subcontracts and other lower tiered transactions All contracts and subcontracts for any construction project carried out in whole or in part with assistance made available as stated herein shall insert in full in any contract in excess of \$2,000 the contract clauses as attached hereto entitled "Wage Rate Requirements Under The Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6)." This term and condition applies to all agreements to provide assistance under the authorities referenced herein, whether in the form of a loan, bond purchase, grant, or any other vehicle to provide financing for a project, where such agreements are executed on or after October 30, 2009.

ATTACHMENT 2

Wage Rate Requirements

Under The Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6)

With respect to the Clean Water and Safe Drinking Water State Revolving Funds, EPA provides capitalization grants to each State which in turn provides subgrants or loans to eligible entities within the State. Typically, the subrecipients are municipal or other local governmental entities that manage the funds. For these types of recipients, the provisions set forth under Roman Numeral I, below, shall apply. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in Section 3(ii)(A), below and for compliance as described in Section I-5.

Occasionally, the subrecipient may be a private for profit or not for profit entity. For these types of recipients, the provisions set forth in Roman Numeral II, below, shall apply. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in Section II-3(ii)(A), below and for compliance as described in Section II-5.

I. Requirements Under The Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6) for Subrecipients That Are Governmental Entities:

The following terms and conditions specify how recipients will assist EPA in meeting its Davis-Bacon (DB) responsibilities when DB applies to EPA awards of financial assistance under the FY 2013 Continuing Resolution with respect to State recipients and subrecipients that are governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient. If a State recipient needs guidance, the recipient may contact Lorraine Fleury at fleury.lorraine@epa.gov or at 215-814-2341 of EPA, Region III Grants and Audit Management Branch for guidance. The recipient or subrecipient may also obtain additional guidance from DOL's web site at <http://www.dol.gov/whd/>

1. Applicability of the Davis-Bacon (DB) prevailing wage requirements.
Under the FY 2013 Continuing Resolution, 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 water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a 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 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 DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL 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 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 DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL 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 DOL 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 DOL 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 DOL'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 wages resulting from the use of DOL's revised wage determination.
3. Contract and Subcontract provisions.
 - (a) The Recipient shall insure that the subrecipient(s) shall insert in full in 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 treatment work under the CWSRF or 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 Continuing Resolution, the following clauses:

(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(s), 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 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(s) 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 (s) to the State award official. The State award official 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 or will notify the State award official 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 subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, 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 or will notify the contracting officer 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(s), 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 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 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/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(s) for transmission to the State or EPA if requested by EPA, the State, 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, 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 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.

- (iv) 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 be appropriate, 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 (b)(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 (write the name of agency) 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 documentation 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. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicated that there is a risk that the contractor or subcontractor is not complying with DB.

Subrecipients shall immediately conduct 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 or 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 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 or subcontractor is not complying with DB. In addition, during the

examinations the subrecipient shall verify evidence of fringe benefit plans and payments there under by contractors and subcontractors who claim credit for fringe benefit contributions.

- (d) The subrecipient shall periodically review contractors and subcontractors 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 that 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 listed at <http://www.dol.gov/contacts/whd/america2.htm>.

II. Requirements Under The Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6) for Subrecipients That Are Not Governmental Entities:

The following terms and conditions specify how recipients will assist EPA in meeting its DB responsibilities when DB applies to EPA awards of financial assistance under the FY2013 Continuing Resolution with respect to subrecipients that are not governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient for guidance. If a State recipient needs guidance, the recipient may contact Julie Milazzo at Milazzo.julie@epa.gov or at 415-972-3687, EPA Grants Management Office for guidance. The recipient or subrecipient may also obtain additional guidance from DOL's web site at <http://www.dol.gov/whd/>

Under these terms and conditions, the subrecipient must submit its proposed DB wage determinations to the State recipient for approval prior to including the wage determination in any solicitation, contract task orders, work assignments, or similar instruments to existing contractors.

1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.
Under the FY 2013 Continuing Resolution, 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 water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a 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 before authorizing work on that site.
2. Obtaining Wage Determinations.
 - (a) Subrecipients must obtain proposed wage determinations for specific localities at www.wdol.gov. After the Subrecipient obtains its proposed wage determination, it must

submit the wage determination to the Arkansas Natural Resources Commission's Water Resource Development Division for approval prior to inserting the wage determination into a solicitation, contract or issuing task orders, work assignments or similar instruments to existing contractors (ordering instruments unless subsequently directed otherwise by the State recipient Award Official.

- (b) 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 on a weekly basis to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL 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 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 DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL 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.
- (c) 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 DOL wage determination from www.wdol.gov into the ordering instrument.
- (d) 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.
- (e) 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 DOL 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 DOL'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 wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in 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 treatment work under the CWSRF or 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 Continuing Resolution, the following clauses:

(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(s), 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 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(s) 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(s) to the State award official. The State award official will transmit the report, 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 or will notify the State award official 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 and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request, and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA 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 or will notify the contracting officer 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(s) 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 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 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/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(s) for transmission to the State or EPA if requested by EPA, the State, 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, 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 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.

- (iv) 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 be appropriate, 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 (b)(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 (b)(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 (b)(1) of this section.
- (3) Withholding for unpaid wages and liquidated damages. The subrecipient shall upon the request of the EPA Award Official or an authorized representative of the Department of Labor, 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 (b)(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 (b)(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 (write the name of agency) 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 documentation 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. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicated that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct 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 or 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 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 or subcontractor is not complying with DB. In addition, during the

examinations the subrecipient shall verify evidence of fringe benefit plans and payments there under by contractors and subcontractors who claim credit for fringe benefit contributions.

- (d) The subrecipient shall periodically review contractors and subcontractors 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 that 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 listed at <http://www.dol.gov/whd/america2.htm>.

Appendix B.

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

Final Rule

Part 60-1 Obligations of Contractors and Sub-Contractors

§60-1.4 Equal Opportunity Clause

(a) **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:

- (2) 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 form 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.
- (3) 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.
- (4) 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.

- (5) 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.
- (6) 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, 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.
- (7) In the event of the contractor's non-compliance 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.
- (8) 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 interest 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 compliances.

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.

(b) **SUBCONTRACTS.** Each nonexempt prime contractor or subcontractor shall include the equal opportunity clause in each of its nonexempt subcontracts.

(c) **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 director may designate.

(d) **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.

(e) **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.

Part 60-4 - Construction Contractors - Affirmative Action Requirements
§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 give (SIC) 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 designed by the Director pursuant to §60-4.5 of this part (see 4) 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 work force in each trade on all construction work in the covered area, are as follows:

| | | |
|-------------|---|--|
| Time Tables | Goals for minority participation for each trade Insert goals for each year. | Goals for female participation in each trade Insert goals for each year. |
|-------------|---|--|

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 specification 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 the 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.

- (3) 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 sub-contract 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; estimated dollar amount of the subcontract ; estimated starting and completion dates of the subcontract; and the geographical area in which the contract 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).

§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 non-construction 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 Contracts 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 a 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 a 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 7a 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 the goals in each craft during the period specified.
- (5) Neither the provisions of any collective bargaining agreement, or 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 non-working 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. The 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 what-ever 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 meets 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 complied under 7b above.
- f. Disseminate the Contractor's EEO policy by providing notice of the 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 new media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with who 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 obligation under these specifications are being carried out.
 - n. 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.
 - o. 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.
 - p. 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 contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participating may be asserted as fulfilling any one or more to 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 work force 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 to 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 enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

- (12) 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.
- (13) 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 Contract fails to comply with the requirements to the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.
- (14) 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 of 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.
- (15) 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.

Appendix C.

40 CFR PART 33

PARTICIPATION BY DISADVANTAGED BUSINESS ENTERPRISES
IN UNITED STATES ENVIRONMENTAL PROTECTION AGENCY PROGRAMS

Subpart C—Good Faith Efforts

§ 33.301 What does this subpart require?

A recipient, including one exempted from applying the fair share objective requirements by § 33.411, is required to make the following good faith efforts whenever procuring construction, equipment, services and supplies under an EPA financial assistance agreement, even if it has achieved its fair share objectives under subpart D of this part:

- (a) Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian Tribal, State and Local and Government recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.
- (b) Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.
- (c) Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. For Indian Tribal, State and local Government recipients, this will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.
- (d) Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
- (e) Use the services and assistance of the SBA and the Minority Business Development Agency of the Department of Commerce.
- (f) If the prime contractor awards subcontracts, require the prime contractor to take the steps in paragraphs (a) through (e) of this section.

§ 33.302 Are there any additional contract administration requirements?

- (a) A recipient 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 recipient.
- (b) A recipient must be notified in writing by its prime contractor prior to any termination of a DBE subcontractor for convenience by the prime contractor.
- (c) If a DBE subcontractor fails to complete work under the subcontract for any reason, the recipient must require the prime contractor to employ the six good faith efforts described in § 33.301 if soliciting a replacement subcontractor.
- (d) A recipient must require its prime contractor to employ the six good faith efforts described in § 33.301 even if the prime contractor has achieved its fair share objectives under subpart D of this part.

§ 33.303 Are there special rules for loans under EPA financial assistance agreements?

A recipient of an EPA financial assistance agreement to capitalize a revolving loan fund, such as a State under the CWRLF or DWSRF or an eligible entity under the Brownfields Cleanup Revolving Loan Fund program, must require that borrowers receiving identified loans comply with the good faith efforts described in § 33.301 and the contract administration requirements of § 33.302. This provision does not require that such private and nonprofit borrowers expend identified loan funds in compliance with any other procurement procedures contained in 40 CFR part 30, part 31, or part 35, subpart O, as applicable.

§ 33.304 Must a Native American (either as an individual, organization, Tribe or Tribal Government) recipient or prime contractor follow the six good faith efforts?

- (a) A Native American (either as an individual, organization, corporation, Tribe or Tribal Government) recipient or prime contractor must follow the six good faith efforts only if doing so would not conflict with existing Tribal or Federal law, including but not limited to the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450e), which establishes, among other things, that any federal contract, subcontract, grant, or subgrant awarded to Indian organizations or for the benefit of Indians, shall require preference in the award of subcontracts and subgrants to Indian organizations and to Indian-owned economic enterprises.
- (b) Tribal organizations awarded an EPA financial assistance agreement have the ability to solicit and recruit Indian organizations and Indian-owned economic enterprises and give them preference in the award process prior to undertaking the six good faith efforts. Tribal governments with promulgated tribal laws and regulations concerning the solicitation and recruitment of Native-owned and other minority business enterprises, including women-owned business enterprises, have the discretion to utilize these tribal laws and regulations in lieu of the six good faith efforts. If the effort to recruit Indian organizations and Indian-owned economic enterprises is not successful, then the recipient must follow the six good faith efforts. All tribal recipients still must retain records documenting compliance in accordance with § 33.501 and must report to EPA on their accomplishments in accordance with § 33.502.
- (c) Any recipient, whether or not Native American, of an EPA financial assistance agreement for the benefit of Native Americans, is required to solicit and recruit Indian organizations and Indian-owned economic enterprises and give them preference in the award process prior to undertaking the six good faith efforts. If the efforts to solicit and recruit Indian organizations and Indian-owned economic enterprises is not successful, then the recipient must follow the six good faith efforts.
- (d) Native Americans are defined in § 33.103 to include American Indians, Eskimos, Aleuts and Native Hawaiians.

Appendix D.

MEMORANDUM

SUBJECT: Implementation of American Iron and Steel provisions of P.L. 113-76, Consolidated Appropriations Act, 2014

FROM: Andrew Sawyers, Director
Office of Wastewater Management (4201M)

Peter Grevatt, Director
Office of Ground Water and Drinking Water (4601M)

TO: Water Management Division Directors
Regions I - X

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an “American Iron and Steel (AIS)” requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use iron and steel products that are produced in the United States for projects for the construction, alteration, maintenance, or repair of a public water system or treatment works if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Fiscal Year 2014.

Section 436 also sets forth certain circumstances under which EPA may waive the AIS requirement. Furthermore, the Act specifically exempts projects where engineering specifications and plans were approved by a State agency prior to January 17, 2014.

The approach described below explains how EPA will implement the AIS requirement. The first section is in the form of questions and answers that address the types of projects that must comply with the AIS requirement, the types of products covered by the AIS requirement, and compliance. The second section is a step-by-step process for requesting waivers and the circumstances under which waivers may be granted.

Implementation

The Act states:

Sec. 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.

(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.

The following questions and answers provide guidance for implementing and complying with the AIS requirements:

Project Coverage

What classes of projects are covered by the AIS requirement?

All treatment works projects funded by a CWSRF assistance agreement, and all public water system projects funded by a DWSRF assistance agreement, from the date of enactment through the end of Fiscal Year 2014. The AIS requirements apply to the entirety of the project, no matter when construction begins or ends. Additionally, the AIS requirements apply to all parts of the project, no matter the source of funding.

Covered Iron and Steel Products

What is an iron or steel product?

For purposes of the CWSRF and DWSRF projects that must comply with the AIS requirement, an iron or steel product is one of the following made primarily of iron or steel that is permanently incorporated into the public water system or treatment works:

- Lined or unlined pipes or fittings;
- Manhole Covers;
- Municipal Castings (defined in more detail below);
- Hydrants;
- Tanks;
- Flanges;
- Pipe clamps and restraints;
- Valves;
- Structural steel (defined in more detail below);
- Reinforced precast concrete; and
- Construction materials (defined in more detail below).

What does the term ‘primarily iron or steel’ mean?

‘Primarily iron or steel’ places constraints on the list of products above. For one of the listed products to be considered subject to the AIS requirements, it must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

Can you provide an example of how to perform a cost determination?

For example, the iron portion of a fire hydrant would likely be the bonnet, body and shoe, and the cost then would include the pouring and casting to create those components. The other material costs would include non-iron and steel internal workings of the fire hydrant (i.e., stem, coupling, valve, seals, etc.). However, the assembly of the internal workings into the hydrant body would not be included in this cost calculation. If one of the listed products is not made primarily of iron or steel, United States (US) provenance is not required. An exception to this definition is reinforced precast concrete, which is addressed in a later question.

If a product is composed of more than 50% iron or steel, but is not listed in the above list of items, must the item be produced in the US? Alternatively, must the iron or steel in such a product be produced in the US?

The answer to both question is no. Only items on the above list must be produced in the US. Additionally, the iron or steel in a non-listed item can be sourced from outside the US.

What is the definition of steel?

Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel and other specialty steels.

What does ‘produced in the United States’ mean?

Production in the United States of the iron or steel products used in the project requires that all manufacturing processes, including application of coatings, must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives. All manufacturing processes includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating and coating. Further, if a domestic iron and steel product is taken out of the US for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin.

Are the raw materials used in the production of iron or steel required to come from US sources?

No, raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-US sources.

If an above listed item is primarily made of iron or steel, but is only at the construction site temporarily, must such an item be produced in the US?

No. Only the above listed products made primarily of iron or steel, permanently incorporated into the project must be produced in the US. For example trench boxes or scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

What is the definition of ‘municipal castings’?

Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

- Access Hatches;
- Ballast Screen;
- Benches (Iron or Steel);
- Bollards;
- Cast Bases;
- Cast Iron Hinged Hatches, Square and Rectangular;
- Cast Iron Riser Rings;
- Catch Basin Inlet;
- Cleanout/Monument Boxes;
- Construction Covers and Frames;
- Curb and Corner Guards;
- Curb Openings;
- Detectable Warning Plates;
- Downspout Shoes (Boot, Inlet);
- Drainage Grates, Frames and Curb Inlets;
- Inlets;
- Junction Boxes;
- Lampposts;
- Manhole Covers, Rings and Frames, Risers;
- Meter Boxes;
- Steel Hinged Hatches, Square and Rectangular;
- Steel Riser Rings;
- Trash receptacles;
- Tree Grates;
- Tree Guards;
- Trench Grates; and
- Valve Boxes, Covers and Risers.

What is ‘structural steel’?

Structural steel is rolled flanged shapes, having at least one dimension of their cross-section 3 inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zees. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

What is a ‘construction material’ for purposes of the AIS requirement?

Construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered “structural steel”. This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels, dome structures, roofing, ductwork, surface drains, cable hanging systems, manhole steps, fencing and fence tubing, guardrails, doors, gates, and screens.

What is not considered a ‘construction material’ for purposes of the AIS requirement?

Mechanical and electrical components, equipment and systems are not considered construction materials. Mechanical equipment is typically that which has motorized parts and/or is powered by a motor. Electrical equipment is typically any machine powered by electricity and includes components that are part of the electrical distribution system.

The following examples (including their appurtenances necessary for their intended use and operation) are NOT considered construction materials: pumps, motors, gear reducers, drives (including variable frequency drives (VFDs)), electrical/pneumatic/manual accessories used to operate valves (such as electric valve actuators), mixers, gates, motorized screens (such as traveling screens), blowers/aeration equipment, compressors, meters, sensors, controls and switches, supervisory control and data acquisition (SCADA), membrane bioreactor systems, membrane filtration systems, filters, clarifiers and clarifier mechanisms, rakes, grinders, disinfection systems, presses (including belt presses), conveyors, cranes, HVAC (excluding ductwork), water heaters, heat exchangers, generators, cabinetry and housings (such as electrical boxes/enclosures), lighting fixtures, electrical conduit, emergency life systems, metal office furniture, shelving, laboratory equipment, and analytical instrumentation, and dewatering equipment.

If the iron or steel is produced in the US, may other steps in the manufacturing process take place outside of the US, such as assembly?

No. Production in the US of the iron or steel used in a listed product requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

What processes must occur in the US to be compliant with the AIS requirement for reinforced precast concrete?

While reinforced precast concrete may not be at least 50% iron or steel, in this particular case, the reinforcing rebar must be produced in the US and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the US. The cement and other raw materials used in concrete production are not required to be of domestic origin.

If the reinforced concrete is cast at the construction site, the reinforcing rebar is considered to be a construction material and must be produced in the US.

Compliance

How should an assistance recipient document compliance with the AIS requirement?

In order to ensure compliance with the AIS requirement, specific AIS contract language must be included in each contract, starting with the assistance agreement, all the way down to the purchase agreements.

EPA recommends the use of a step certification process, similar to one used by the Federal Highway Administration. The step certification process is a method to ensure that producers adhere to AIS requirements and assistance recipients can verify that products comply with the AIS requirement. The process also establishes accountability and better enables States to take enforcement actions against violators.

Step certification creates a paper trail which documents the location of the manufacturing process involved with the production of steel and iron materials. A step certification is a process under which each handler (supplier, fabricator, manufacturer, processor, etc.) of the iron and steel products certifies that their step in the process was domestically performed. Each time a step in the manufacturing process takes place, the manufacturer delivers its work along with a certification of its origin. A certification can be quite simple. Typically, it includes the name of the manufacturer, the location of the manufacturing facility where the product or process took place (not its headquarters), a description of the product or item being delivered, and a signature by a manufacturer's responsible party. Attached, as Attachment 3, is a sample certification. These certifications should be collected and maintained by the assistance recipients.

Alternatively, the final manufacturer that delivers the iron or steel product to either the worksite, vendor, or contractor, may provide a certification asserting that all manufacturing processes occurred in the US. While this type of certification may be acceptable, it may not provide the same degree of assurance. Additional documentation may be needed if the certification is lacking important information. Step certification is the best practice.

How should a State ensure assistance recipients are complying with the AIS requirement?

States should, as a best practice, conduct site visits of projects during construction and review documentation demonstrating proof of compliance which the assistance recipient has gathered.

What happens if a State or EPA finds a non-compliant iron and/or steel product permanently incorporated in the project?

If a potentially noncompliant product is identified, the State should notify the assistance recipient of the apparent unauthorized use of a non-domestic component, including a proposed corrective action, and should be given the opportunity to reply. If unauthorized use is confirmed, the State can take one or more of the following actions: request a waiver where appropriate; require the removal of the non-domestic item; or withhold payment for all or part of the project. Only EPA can issue waivers to authorize the use of a non-domestic item. EPA may use remedies available to it under the Clean Water Act, the Safe Drinking Water Act, and 40 CFR part 31 grant regulations in the event of a violation of a grant term and condition.

It is recommended that the State work collaboratively with EPA to determine the appropriate corrective action, especially in cases where the State is the one who identifies the item in noncompliance or there is a disagreement with the assistance recipient.

If fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1 (888) 546-8740 or OIG_Hotline@epa.gov. More information can be found at this website: <http://www.epa.gov/oig/hotline.htm>.

How do international trade agreements affect the implementation of the AIS requirements?

The AIS provision applies in a manner consistent with United States obligations under international agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to such agreements. In general, SRF assistance recipients are not signatories to such agreements, so these agreements have no impact on this AIS provision. In the few instances where such an agreement applies to a municipality, that municipality is under the obligation to determine its applicability and requirements and document the actions taken to comply for the State.

Waiver Process

The statute permits EPA to issue waivers for a case or category of cases where EPA finds (1) that applying these requirements would be inconsistent with the public interest; (2) iron and steel products are not produced in the US in sufficient and reasonably available quantities and of a satisfactory quality; or (3) inclusion of iron and steel products produced in the US will increase the cost of the overall project by more than 25 percent.

In order to implement the AIS requirements, EPA has developed an approach to allow for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow States to apply for waivers of the AIS requirement directly to EPA Headquarters. Pursuant to the Act, EPA has the responsibility to make findings as to the issuance of waivers to the AIS requirements.

Definitions

The following terms are critical to the interpretation and implementation of the AIS requirements and apply to the process described in this memorandum:

Reasonably Available Quantity: The quantity of iron or steel products is available or will be available at the time needed and place needed, and in the proper form or specification as specified in the project plans and design.

Satisfactory Quality: The quality of iron or steel products, as specified in the project plans and designs.

Assistance Recipient: A borrower or grantee that receives funding from a State CWSRF or DWSRF program.

Step-By-Step Waiver Process

Application by Assistance Recipient

Each local entity that receives SRF water infrastructure financial assistance is required by section 436 of the Act to use American made iron and steel products in the construction of its project. However, the recipient may request a waiver. Until a waiver is granted by EPA, the AIS requirement stands, except as noted above with respect to municipalities covered by international agreements.

The waiver process begins with the SRF assistance recipient. In order to fulfill the AIS requirement, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American made iron and steel products. It is essential that the assistance recipient include the AIS terms in any request for proposals or solicitations for bids, and in all contracts. The assistance recipient may seek a waiver at any point before, during, or after the bid process, but before installation of the product, if one or more of the following three conditions is met:

1. Applying the American Iron and Steel requirements of the Act 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.

Proper and sufficient documentation must be provided by the assistance recipient. A checklist detailing the types of information required for a waiver to be processed is attached as Attachment 1.

Additionally, it is strongly encouraged that assistance recipients hold pre-bid conferences with potential bidders. A pre-bid conference can help to identify iron and steel products needed to complete the project as described in the plans and specifications that may not be available from domestic sources. It may also identify the need to seek a waiver prior to bid, and can help inform the recipient on compliance options.

In order to apply for a project waiver, the assistance recipient should email the request in the form of a Word document (.doc) to the State SRF Engineer. The State SRF designee will review the application for the waiver and determine whether the necessary information has been included. Once the waiver application is complete, the State designee will forward the application to either of two email addresses. For CWSRF waiver requests, please send the application to: cwsrfwaiver@epa.gov. For DWSRF waiver requests, please send the application to: dwsrfwaiver@epa.gov.

Evaluation by EPA

After receiving an application for waiver of the AIS requirements, EPA Headquarters will publish the request on its website for 15 days and receive informal comment. EPA Headquarters will then use the checklist in Attachment 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the State designee that a waiver request has been approved or denied as soon as such a decision has been made. Granting such a waiver is a 3-step process:

1. Posting – After receiving a complete application for a waiver, EPA is required to publish the application and all material submitted with the application on EPA’s website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at: http://water.epa.grants_funding/aisrequirement.cfm
2. Evaluation – After receiving an application for waiver of the AIS requirements, EPA Headquarters will use the checklist in Attachment 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.
3. Signature of waiver approval by the Administrator or another agency official with delegated authority – as soon as the waiver is signed and dated, EPA will notify the State SRF program, and post the signed waiver on our website. The assistance recipient should keep a copy of the signed waiver in its project files.

Public Interest Waivers

EPA has the authority to issue public interest waivers. Evaluation of a public interest waiver request may be more complicated than that of other waiver requests so they may take additional time for a decision to be made. An example of a public interest waiver that might be issued could be for a community that has standardized on a particular type or manufacturer of a valve because of its performance to meet their specifications. Switching to an alternative valve may require staff to be trained on the new equipment and additional spare parts would need to be purchased and stocked, existing valves may need to be unnecessarily replaced, and portions of the system may need to be redesigned. Therefore, requiring the community to install an alternative valve would be inconsistent with public interest.

EPA also has the authority to issue a public interest waiver that covers categories of products that might apply to all projects.

EPA reserves the right to issue national waivers that may apply to particular classes of assistance recipients, particular classes of projects, or particular categories of iron or steel products. EPA may develop national or (U.S. geographic) regional categorical waivers through the identification of similar circumstances in the detailed justifications presented to EPA in a waiver request or requests. EPA may issue a national waiver based on policy decisions regarding the public's interest or a determination that a particular item is not produced domestically in reasonably available quantities or of a sufficient quality. In such cases, EPA may determine it is necessary to issue a national waiver.

If you have any questions concerning the contents of this memorandum, you may contact us, or have your staff contact Jordan Dorfman, Attorney-Advisor, State Revolving Fund Branch, Municipal Support Division, at dorfman.jordan@epa.gov or (202) 564-0614 or Kiri Anderer, Environmental Engineer, Infrastructure Branch, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

Attachment 1: Information Checklist for Waiver Request

The purpose of this checklist is to help ensure that all appropriate and necessary information is submitted to EPA. EPA recommends that waiver applicants review this checklist carefully and provide all appropriate information to EPA. This checklist is for informational purposes only and does not need to be included as part of a waiver application.

| Items | ✓ | Notes |
|--|---|-------|
| <p>General</p> <ul style="list-style-type: none"> • Waiver request includes the following information: <ul style="list-style-type: none"> — Description of the foreign and domestic construction materials — Unit of measure — Quantity — Price — Time of delivery or availability — Location of the construction project — Name and address of the proposed supplier — A detailed justification for the use of foreign construction materials • Waiver request was submitted according to the instructions in the memorandum • Assistance recipient made a good faith effort to solicit bids for domestic iron and steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime contractor | | |
| <p>Cost</p> <ul style="list-style-type: none"> • Waiver request includes the following information: <ul style="list-style-type: none"> — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — Supporting documentation indicating that the contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers | | |
| <p>Availability</p> <ul style="list-style-type: none"> • Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested: <ul style="list-style-type: none"> — Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials — Documentation of the assistance recipient’s efforts to find available domestic sources, such as a description of the process for identifying suppliers and a list of contacted suppliers. — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of construction materials • Waiver request includes a statement from the prime contractor confirming the non-availability of the domestic construction materials for which the waiver is sought • Has the State received other waiver requests for the materials described in this waiver request, for comparable projects? | | |

Attachment 2: EPA HQ Review Checklist for Waiver Request

Instructions: To be completed by EPA. Review all waiver requests using the questions in the checklist, and mark the appropriate box as Yes, No or N/A. Marks that fall inside the shaded boxes may be grounds for denying the waiver. If none of your review markings fall into a shaded box, the waiver is eligible for approval if it indicates that one or more of the following conditions applies to the domestic product for which the waiver is sought:

1. The iron and/or steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.
2. The inclusion of iron and/or steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

| Review Items | Yes | No | N/A | Comments |
|--|-----|----|-----|----------|
| Cost | | | | |
| <ul style="list-style-type: none"> • Does the waiver request include the following information? <ul style="list-style-type: none"> — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — A sufficient number of bid documents or pricing information from domestic sources to constitute a reasonable survey of the market • Does the Total Domestic Project exceed the Total Foreign Project Cost by more than 25%? | | | | |
| Availability | | | | |
| <ul style="list-style-type: none"> • Does the waiver request include supporting documentation sufficient to show the availability, quantity, and/or quality of the iron and/or steel product for which the waiver is requested? <ul style="list-style-type: none"> — Supplier information or other documentation indicating availability/delivery date for materials — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of materials • Does supporting documentation provide sufficient evidence that the contractors made a reasonable effort to locate domestic suppliers of materials, such as a description of the process for identifying suppliers and a list of contacted suppliers? • Based on the materials delivery/availability date indicated in the supporting documentation, will the materials be unavailable when they are needed according to the project schedule? (By item, list schedule date and domestic delivery quote date or other relevant information) • Is EPA aware of any other evidence indicating the non-availability of the materials for which the waiver is requested? Examples include: <ul style="list-style-type: none"> — Multiple waiver requests for the materials described in this waiver request, for comparable projects in the same State — Multiple waiver requests for the materials described in this waiver request, for comparable projects in other States — Correspondence with construction trade associations indicating the non-availability of the materials • Are the available domestic materials indicated in the bid documents of inadequate quality compared those required by the project plans, specifications, and/or permits? | | | | |

Attachment 3: Sample Certification for Step Certification Process

The following information is provided as a sample letter of step certification for Buy America compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address
City, State Zip

Subject: Buy America Step Certification for Project (XXXXXX-XXXXXXA)

I, (company representative), certify that the (melting, bending, coating, galvanizing, cutting, etc.) process for (manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. XXXX
2. XXXX
3. XXXX

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

The following information is provided as a sample letter of certification for Buy America compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address
City, State Zip

Subject: Buy America Certification for Project (XXXXXX-XXXXXXA)

I, (company representative), certify that the following products and/or materials shipped/provided to the subject project are in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. XXXX
2. XXXX
3. XXXX

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

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| | OSHA 1926 Subpart P – Excavations | 38 |
| 02315 | Trench Excavation, Backfill, and Compacting | 7 |
| 02510 | General Piping Requirements | 19 |
| 02511 | Separation Distances | 1 |
| 02512 | Sterilization of Water Mains | 1 |
| 02513 | Pipe Testing and Cleanup | 4 |
| 02514 | Tracer wire | 2 |
| 02515 | Ductile Iron | 3 |
| 02516 | Polyvinyl Chloride (PVC) Pipe and Fittings | 3 |
| 02517 | Pipe Laying | 4 |
| 02530 | Sewage Collection System | 3 |
| 02532 | Polyvinyl Chloride (PVC) Pipe-Sewer | 2 |
| 02534 | Sewage Force Main | 4 |
| 02536 | Manhole Construction | 3 |
| 02730 | Gravel Surfacing | 2 |
| 02950 | Site Restoration and Rehabilitation | 3 |
| DIVISION 3 | | |
| CONCRETE | | |
| 03100 | Concrete Forms and Accessories | 5 |
| 03210 | Reinforcing Steel | 4 |
| 03251 | Construction Joints and Waterstops | 4 |
| 03300 | Cast-in-Place Concrete | 18 |
| 03305 | Concrete Sidewalks | 2 |
| 03602 | Nonmetallic Grout | 2 |
| DIVISION 4 | | |
| MASONRY | | |
| 04220 | Reinforced Concrete Masonry Units | 10 |
| DIVISION 5 | | |
| METAL | | |
| 05120 | Structural Steel | 6 |
| 05500 | Fabricated Metalwork and Castings | 7 |
| DIVISION 6 | | |
| WOOD | | |
| 06100 | Rough Carpentry | 5 |
| 06200 | Finish Carpentry | 4 |
| DIVISION 7 | | |
| THERMAL AND MOISTURE PROTECTION | | |
| 07194 | Underslab Vapor Barrier | 2 |
| 07900 | Sealants | 4 |

| | | |
|--------------------|--|----|
| DIVISION 8 | DOORS AND WINDOWS | |
| 08100 | Doors and Frames | 6 |
| 08710 | Door Hardware | 5 |
| 08800 | Termite Control | 2 |
| DIVISION 9 | FINISHES AND COATINGS | |
| 09900 | Painting | 9 |
| DIVISION 10 | (NOT USED) | |
| DIVISION 11 | EQUIPMENT | |
| 11000 | General Requirements | 6 |
| 11226 | Bridge Supported Peripheral Feed Clarifier | 5 |
| 11303 | Aeration and Mixing System | 7 |
| 11312 | Submersible Non-Clog Sewage Pump Station | 6 |
| 11330 | Headworks System | 12 |
| DIVISION 12 | (NOT USED) | |
| DIVISION 13 | (NOT USED) | |
| DIVISION 14 | (NOT USED) | |
| DIVISION 15 | MECHANICAL | |
| 15110 | Manually Operated Valves | 5 |
| DIVISION 16 | ELECTRICAL | |
| 16010 | Basic Electrical Requirements | 7 |
| 16050 | Basic Materials and Methods | 7 |
| 16060 | Grounding | 2 |
| 16120 | Conductors | 3 |
| 16130 | Raceways | 5 |
| 16221 | Generator Set | 9 |
| 16400 | Automatic Transfer Switch | 10 |

SECTION 01100

SUMMARY OF WORK

PART 1. GENERAL

1.01 SCOPE

- A. The work to be performed under the provisions of these contract documents consists of furnishing all materials, equipment, labor, installation, finishing, and start-up service needed to construct and place in complete operation the proposed wastewater treatment facility improvements as shown on the Drawings and specified herein.

1.02 SCOPE, NATURE, AND INTENT OF SPECIFICATIONS AND PLANS

- A. The specifications and plans are intended to supplement, but not necessarily duplicate each other. Any work exhibited in the one, and not in the other, shall be executed as if it had been set forth in both.

Should anything necessary for a clear understanding of the work be omitted from the specifications and plans, or should the requirements appear to be in conflict, the Contractor shall secure written instructions from the Engineer before proceeding with the construction affected thereby.

Dimensions and elevations shown on the plans shall be accurately followed even though they differ from scaled measurements. No work shown on the plans, the dimensions of which are not indicated, shall be executed until necessary dimensions have been obtained from the Engineer.

The Contractor shall check all dimensions, elevations, and quantities shown on the plans and schedules given to him by the Engineer, and shall notify the Engineer of any discrepancy between the plans and the conditions on the ground, or any error or omission in the plans, or in the layout or instructions, which he may discover in the course of the work. The Contractor will not be allowed to knowingly and intentionally take advantage of any error or omission in the plans or contract documents that he could have reasonably provided notice to the Engineer about. Full instruction will be furnished by the Engineer should such error or omission be discovered, and the Contractor shall carry out such instructions as if originally specified.

It is expected that prospective bidding contractors will completely review the Plans and Specifications prior to bidding and notify the Engineer prior to bid date of any perceived conflicts, errors, omissions, or clarifications anticipated.

These will be addressed by written Addendum to all Bidders. Prospective bidding Contractors are encouraged to visit the project location to assure their complete understanding of the project requirements.

1.03 MATERIALS

- A. These specifications are intended to be so written that only materials of the best quality and grade will be furnished. The fact that the specifications may fail to be sufficiently complete in some detail will not relieve the Contractor of full responsibility for providing materials of high quality and protecting them adequately until incorporation in the structure. The specifications for materials set out the minimum standard of quality which the Engineer believes is necessary to procure a satisfactory project. No substitutions will be permitted until the Contractor has received written permission of the Engineer to make a substitution for materials which have been specified.

1.04 WORKMANSHIP

- A. The specifications contain detailed instructions and descriptions covering the major items of construction and workmanship necessary for building and completing the various units or elements of the project. The specifications are intended to be so written that only first class workmanship and finish of the best grade and quality will result. The fact that these specifications may fail to be so complete as to cover all details will not relieve the Contractor of full responsibility for providing a completed project of high quality, first class finish and appearance, and satisfactory for operation.

1.05 LAND FOR CONSTRUCTION PURPOSES

- A. The Contractor will be permitted to use available space belonging to the Owner, on or near the site of work, for construction purposes and for the storage of materials and equipment. The location and extent of the areas so used shall be as designated and approved by the Owner.

The Contractor shall be solely responsible for obtaining and shall pay all costs in connection with any additional storage or work area sites which may be required for proper completion of the work.

1.06 PROTECTING EXISTING STRUCTURES AND UTILITIES

- A. Where excavation or demolition endangers adjacent structures and utilities, the Contractor shall at his own expense carefully support and protect all such structures and/or utilities so that there will be no failure or settlement. Where it is necessary to move services, poles, guy wires, pipelines, or other obstructions, the Contractor shall notify and cooperate with the utility owner. In case damage to an existing structure or utility

occurs, whether failure or settlement, the Contractor shall restore the structure or utility to its original conditions and position without compensation from the Owner.

Contractor shall repair or replace all damaged street surfaces, driveways, sidewalks, curb and gutter, fences, drainage structures, or other structures, to the satisfaction of the Engineer and the Owner. Structures shall be restored to a condition equal to or better than the original condition and of a similar material and design. The costs of such repair or replacement shall be borne by the Contractor and shall be included in the Proposal.

The Contractor shall verify the type, size, and location of all existing piping and valves in the construction area. All piping, valves, electrical conduit, etc., in the construction area shall be removed or relocated as necessary in a manner acceptable to the Engineer.

- B. Contractor shall maintain access to existing operating units affected by his construction activities and coordinate with the Utility regarding times of limited access. Contractor shall coordinate with Utility regarding time and extent of any plant shut downs. Contractor is advised that shut down periods may be limited to four (4) hours and 12:00 A.M. to 6:00 A.M. time frames.

1.07 HANDLING MATERIALS NOT APPROVED

- A. The Contractor shall remove from the site any materials found to be damaged, or not meeting the specifications. These materials shall be removed promptly, unless the Engineer will accept the materials after repairing. Inspection before installation shall not relieve the Contractor from any responsibility to furnish good quality materials. Review of shop drawings and submittals is for the Contractor's benefit. Any equipment that has been installed without approval by the Engineer prior to installation and found not to be in accordance with the specifications shall be removed and replaced with approved items at the Contractor's sole expense.

1.08 PUMPING AND DEWATERING OPERATIONS

- A. Work to be performed may require draining, pumping and dewatering, and certain cleaning operations necessary to complete the work as specified and as indicated on the drawings. It is the intent of these specifications that such draining, pumping and dewatering, and cleaning operations shall be the obligation of the Contractor.

1.09 SANITATION FACILITIES

- A. The Contractor shall provide portable toilet facilities in sufficient number for the Contractor's use throughout the course of the project and in accordance with OSHA requirements.

1.10 UNFAVORABLE CONSTRUCTION CONDITIONS

- A. During unfavorable weather, wet ground, or other unsuitable construction conditions, the Contractor shall confine his operations to work which will not be adversely affected. No portion of the work shall be constructed under conditions which would adversely affect the quality, unless special means or precautions are taken by the Contractor to perform the work in a proper and satisfactory manner.

1.11 FINAL TESTING AND OPERATION

- A. Prior to presentation for final acceptance of the work under this contract, the Contractor shall have started and operated all units of the project for a sufficient duration of time to permit the Engineer to observe overall performance of the respective units and equipment. Such operation shall be properly coordinated with the Owner's operating personnel.

1.12 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly conditions.
- B. Where work is performed in residential and commercial areas, cleanup sufficient to permit normal access and use by property owners shall be performed daily. Final cleanup shall be performed once the extension has been installed. Failure to perform clean-up work as described above may result in retainage of an additional ten (10%) percent of the cost of the work completed until the cleanup work has been completed or non-processing of additional pay requests.

END OF SECTION

SECTION 01310

GENERAL CONSTRUCTION REQUIREMENTS

PART 1. GENERAL

1.01 RELATIONSHIP WITH EXISTING FACILITIES

- A. The Contractor shall notify, in writing, the Engineer 14-days in advance of the time that is necessary to take out of service an existing facility.
- B. The Contractor shall repair or replace, without delay, any and all damage to existing structures, surfaces, equipment, controls, or systems resulting from his operations that are required to put the facility back in operation upon completion of the project.

1.02 BYPASSING

- A. Whenever existing facilities have to be temporarily dammed and dewatered, the work will be done by the Contractor in a manner acceptable to the Engineer. The Contractor shall notify the Engineer and the Owner prior to any such activities.
- B. The General Contractor shall also be responsible for removal of all temporary earthen, steel, or concrete structures required to accomplish this work and returning the sites of these structures to the same or an improved condition as when this project was initiated by the Contractor.
- C. The Contractor shall be responsible for all bypass pumping required to maintain flow during construction.

1.03 TEMPORARY FLOW STOPPAGE

- A. In cases where the construction requires connections to live conduits, or the plugging of pipelines, provisions for temporarily halting flow as required will be planned and coordinated with the Owner and conducted by the Contractor.

1.04 CLEAN UP

- A. The Contractor shall not allow the site of the work to become littered with trash and waste material, but shall maintain the site of the work in a neat and orderly condition throughout the construction period. On or before the completion of the work, the Contractor shall carefully clean out all pits, drain lines and drains, chambers or conduits and shall remove all temporary structure built by him and rubbish of all kinds from any of the grounds which he has occupied and leave them in first-class condition to the satisfaction of the Engineer.

1.05 AS-BUILT DRAWINGS

- A. Concurrent with performance of contract work, each Contractor shall prepare and maintain one neat and legible set of full-size contract drawings indicating "as-built", including but not limited to changes in type, location, length, or size for any item of work. "As-built" drawing mark-ups shall be prepared at the time the applicable item of work is constructed or installed. The preparation of "as-built" drawings shall be as required by the Engineer. Prior to the final acceptance of contract work, the Contractor shall submit to the Engineer one complete set of drawings showing all "as-built" work modifications.

1.06 TESTS AND INSPECTIONS

- A. All materials, equipment, installation, and workmanship included in this contract, if so required by the Engineer, shall be tested and inspected to prove compliance with the contract requirements.
- B. No tests specified herein shall be applied until the item to be tested has been inspected and approval given for the application of such test by an authorized representative of the manufacturer of the equipment.
- C. Acceptance Tests and Inspection
 1. The acceptance tests shall be at the Contractor's expense for any materials or equipment specified herein. This is to include test of items during the process of manufacture and on completion of manufacture, comprising material tests, hydraulic pressure tests, electric tests, performance and operating tests and inspections in accordance with the relevant standards of the industry, and more particularly as detailed in individual clauses of these specifications, or as may be required by the Engineer to satisfy himself that the items tested and inspected comply with the requirements of this contract.
 2. All items delivered at the site shall be inspected in order that the Engineer may be satisfied that such items are of the specified quality and workmanship and are in good order and condition at the time of delivery.
- D. Installed Tests and Inspection
 1. If under test, any portion of the work shall fail to fulfill the contract requirements and is altered, renewed, or replaced, tests on that portion when so altered, removed, or replaced, together with all other portions of the work as are affected thereby, shall if so required by the Engineer, be repeated within reasonable time and in accordance with the specified conditions, and the Contractor shall refund to the Owner all reasonable expenses incurred by the Owner as a result of the carrying out of such tests.
 2. Where, in the case of an otherwise satisfactory installed test, any doubt, dispute, or difference should arise between the Engineer and the Contractor regarding the test results or the methods or

equipment used in the carrying out by the Contractor such a test, then the Engineer may order the test to be repeated. If the repeat test using such modified methods or equipment as the Engineer may require substantially confirms the previous test, then all costs in connection with the repeat test will be paid by the Owner, otherwise the costs shall be borne by the Contractor. Where the results of any installed test fail to comply with the contract requirements for such test, then such repeat tests as may be necessary to achieve the contract requirements shall be made by the Contractor at his own expense.

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SECTION 01330

SUBMITTAL REQUIREMENTS

PART 1. GENERAL

1.01 SUBMITTALS

A. Shop Drawings

The Contractor shall submit to the Engineer six (6) copies of all shop drawings, erection drawings, schedules, certified dimension prints, schematic or system diagrams, data sheets, catalog cuts, bulletins, and other descriptive material as is customary or as may be specifically required by the Engineer prior to purchase, fabrication, or shipment to the Project Site.

B. Format

The drawings and data shall have been reviewed and approved by the Contractor prior to submittal and each bound submittal submitted shall bear the Contractor's approval stamp and signature. Submittal data shall be in such form and so presented that the Engineer may readily review the data. This means that submittals must be bound in an 8½" by 11" format. Engineering drawings are to be reduced to an 11" by 17" format, folded and bound with the submittal. No 24" by 36" drawings will be accepted. Bound submittals shall be for individual specification sections and shall be complete by section.

C. Qualifications

The Contractor is directed to specific specification sections where specific requirements for submittals may be described in more detail. The drawings, or other required descriptive material, will be examined and approved, corrected, or rejected by the Engineer with reasonable promptness. All rejected material shall be revised and resubmitted until approval is obtained. Each submittal shall be accompanied by a letter of qualification stating that the proposed equipment meets the specifications; or, clearly itemizes and explains any proposed exceptions. Delays caused by such rejections will not be considered cause for extension of the contract time. Approval by Engineer indicates general compliance or acceptability; however, it does not relieve the Contractor of final responsibility for proper dimensions, character, quantity, quality, strength, or sufficiency of the items involved. Waivers, or exceptions, to the Plans and Specifications may be validated only in writing by the Engineer. Written validation will specifically identify the feature in question and no such waiver or exception shall be assumed as a result of omissions or oversights in examining and approving the above drawings or other materials.

Any equipment installed by the Contractor, not formally approved by the Engineer, shall be at the Contractor's risk if it is found that the installed equipment does not conform to the specifications.

1.02 OPERATIONS AND MAINTENANCE MANUALS

A. Operation and Maintenance Manuals

The Contractor shall provide six (6) copies of all required operation and maintenance instructions and manuals for individual equipment items. This information shall be completely up-to-date and reflect actual field installed equipment.

B. Format

The O&M information shall be furnished in bound sets as described for the Submittals.

C. Minimum Requirements

1. Name, address, and phone number of nearest competent service organization who can supply parts and service. If this is not the manufacturer's own service department, then furnish letters confirming that the named organization has been factory authorized to represent the manufacturer of the equipment furnished.
2. Complete descriptive literature and drawings of all material furnished. This is to include "as-built" wiring diagrams of all electrical equipment, "as-built" erection drawings providing up-to-date information on the actual construction of the equipment furnished and any field modifications made during installation, start-up, and testing.
3. Installation, operation, and maintenance brochures from the original manufacturers of all mechanical components such as gear reducers, drive couplings, etc., shall be incorporated into the completed installation.
4. Complete Electrical Motor information (name plate date).
5. Recommended spare parts list.
6. Guide to "troubleshooting".
7. All required assembly, installation, alignment, adjustment, and checking instructions.
8. All required operating instructions.
9. All required maintenance instructions including schedules of all required routine maintenance and lubrication checks.

D. Payment

The Owner and Engineer reserve the right to withhold final payment until acceptable O&M information is received for all equipment specified.

1.03 TESTS AND INSPECTIONS

- A. All materials, equipment, installation, and workmanship included in this contract, if so required by the Engineer, shall be tested and inspected to prove compliance with the contract requirements.
- B. No tests specified herein shall be applied until the item to be tested has been inspected and approval given for the application of such test by an authorized representative of the manufacturer of the equipment.
- C. General Requirements: Tests and inspection shall include:
 - 1. The delivery acceptance tests and inspections.
 - 2. The installed tests and inspections of items as installed.

Tests and inspections, unless otherwise specified or accepted, shall be in accordance with the recognized standards of the industry.

The form of evidence of satisfactory fulfillment of delivery acceptance test and of installed test and inspection requirements shall be, at the discretion of the Engineer, either by tests and inspections carried out in his presence or by certificates or reports of tests and inspections carried out by approved persons or organizations.

- D. Delivery Acceptance Tests and Inspections: The delivery acceptance tests and inspections shall be at the Contractor's expense for any materials or equipment specified herein and shall include the following:
 - 1. Test of items during the process of manufacture and/or on completion of manufacture, comprising material tests, hydraulic pressure tests, electric tests, performance and operating tests, and inspections in accordance with the relevant standards of the industry and more particularly as detailed in individual clauses of the specifications, or as may be required by the Engineer to satisfy himself that the items tested and inspected comply with the requirements of this contract.
 - 2. Inspection of all items delivered at the site in order that the Engineer may be satisfied that such items are of the specified quality and workmanship and are in good order and condition at the time of delivery.

END OF SECTION

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SECTION 01720

PROJECT RECORD DOCUMENT

PART 1. GENERAL

1.01 SCOPE

A. General

Prepare and maintain record documents for the project to accurately reflect the construction as built. Documents must be submitted upon completion as a condition of final acceptance.

1.02 MAINTENANCE OF RECORD DOCUMENTS

A. Maintain at the job site during construction activities, one copy of:

1. Contract drawings. As-built drawings.
2. Specifications.
3. Addenda.
4. Reviewed Shop drawings.
5. Change Orders and Field Orders.
6. Other contract modifications.
7. Field test records.
8. Manufacturers' Certifications.
9. Correspondence.

B. Storage

Store record documents in an approved location apart from documents used for construction. Do not use record documents for construction purposes. Provide files and racks for orderly storage. Maintain documents in clean, dry, legible condition. Make documents and samples available at all times for inspection by the Engineer.

1.03 RECORDING

A. Drawing Requirements

Legibly mark contract drawings to record actual construction:

1. Depths of various elements of foundation in relation to the baseline and project benchmark.
2. Horizontal and vertical location of underground and under-slab utilities and appurtenances referenced to permanent surface improvements.
3. Location of internal utilities and appurtenances referenced to permanent surface improvements.

4. Field changes of dimension and detail.
5. Changes made by change order or field order.
6. Details not on original contract drawings.

B. Specifications

Legibly mark specifications and addenda to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2. Changes made by change order or field order.
3. Other matters not originally specified.

1.04 SUBMITTAL

- A. At project completion, deliver record documents to the Engineer. Place all letter-sized material in a 3-ring binder, neatly indexed. Bind contract drawings and shop drawings in rolls of convenient size for ease of handling.
- B. Accompany the submittal with a transmittal letter containing:
 1. Date.
 2. Project title and number.
 3. Contractor's name and address.
 4. Title and number of each record document.
 5. Certification that each document as submitted is complete and accurate.
 6. Signature of Contractor.
- C. Sufficient retainage will be withheld from final payment until acceptable Project Record Documents are submitted to the Engineer.

END OF SECTION

SECTION 01890

PROJECT CLOSE-OUT

PART 1. GENERAL

1.01 SCOPE

- A. Provide all labor, material, equipment, services, papers, documents, and incidentals necessary to effectively close-out the project.

PART 2. DETAIL REQUIREMENTS

2.01 DETAIL

- A. Cleaning-up – As the project draws to a close, a program of total clean-up will be initiated by the Contractor. All trades will effectively take care of their areas of responsibilities to insure a clean and ready to occupy work environment both inside and out. This will take place prior to the issuance of the Letter of Substantial Completion.
- B. Guarantees, Bonds, and Affidavits – Prior to project close-out, the Contractor shall submit to the Engineer, three (3) copies of all guarantees, bonds, affidavits, testing reports, color selections, etc., as appropriate to material, service or equipment installation affecting the project. List General Contractor and all major subs and suppliers as well as Project Engineer. List addresses and telephone numbers for each. Bind into three (3) loose-leaf binders and organize by Section.
- C. Project Record Drawings – The Contractor shall maintain and then furnish the Engineer with "as-built" reproducible Mylar drawings upon completion of project, showing actual location, in line and elevations, of all exterior utility lines and of any relocation of piping or conduit within the limits of the site from that shown on the drawings. Any changes to the details, plans or elevations should also be recorded on these drawings. All copies of drawings and specifications, except the Contractor's executed contract sets, remain the property of the Engineer and shall be returned to him at the completion of the project.

If required, the drawings may be returned to the Contractor where more information is necessary prior to acceptance of the drawings.

- D. Final Inspection – At Final Inspection, prior to the issuance of the final Certificate for Payment and in compliance with the General Conditions, all previous punch-list items will be verified by the Contractor in writing that he has corrected said items to conform to the plans and specifications. Also, at this time, individual affidavits from ALL subcontractors stating that they have been paid in full for their services by the General Contractor shall be presented to the Engineer.

The Final Inspection will be made in company with a representative of the Owner, the Engineer, and the Contractor.

END OF SECTION

SECTION 02260

CONTRACTOR'S TRENCH EXCAVATION SYSTEM AND SHORING SAFETY PLAN

PART 1. GENERAL

1.01 SCOPE

- A. This section shall cover the Contractor furnishing a Trench Safety System Plan and all labor and materials for installation and maintenance of the Trench Safety System.

1.02 APPLICATION

- A. For any trench excavation at a depth of five (5') feet or greater or where shown on the plans, provide trench safety system. Trench safety system shall be in accordance with details shown on Contractor's Trench Excavation and Shoring Safety Plan.

1.03 QUALITY ASSURANCE

- A. Trench safety system to meet appropriate requirements established in the Occupational Safety and Health Administration (OSHA) Safety & Health Regulations, 29 CFR 1926, Subpart P – Excavations, Trenching and Shoring, as may be amended, and OSHA's proposed standards on trenching excavation published in Volume 54, No. 209 of the Federal Register, October 31, 1989; Pages 45959-45991. Those standards are incorporated into these specifications by reference. Should the applicable OSHA standards be modified or amended, the more stringent standards shall apply.

1.04 SUBMITTALS

- A. The Contractor shall provide Trench Safety System Plan for Project prior to Award of the Contract. The Plan shall incorporate the detailed plans and specifications for a Trench Safety System conforming to OSHA standards. The Plan shall account for project site conditions, Contractor's trench construction means, methods, techniques or procedures, the relationship of spoil to the edge of the trench, and Contractor's equipment to be used in the construction of the project facilities requiring Trench Safety System(s). Contractor shall submit a certificate signed and sealed by a Registered Professional Engineer licensed in the State of Arkansas stating that Contractor's Trench Safety System Plan has been designed in conformance with appropriate OSHA standards and applicable specifications as required by this item. Contractor's Trench Safety System Plan shall demonstrate the type(s) of Trench Safety System to be used on the project.

1.05 MATERIALS

- A. The materials used in the Trench Safety System shall be furnished by the Contractor, as approved by the Owner, to comply with the requirements of the work of the Contractor as specified herein.
- B. Timber – Trench sheeting materials to be full size, a minimum of two (2") inches in thickness, solid and sound, free from weakening defects such as loose knots and splits.
- C. Steel Sheet Piling – Steel sheet piling shall at a minimum conform to one of the following specifications:
 - 1. ASTM A328.
 - 2. ASTM A572, Grade 50.
 - 3. ASTM A690.

Steel for stringers (wales) and cross braces shall conform to ASTM A588.

- D. Steel Trench Boxes – Portable steel trench box shall at a minimum be constructed of steel conforming to ASTM Specification A-36. Connecting bolts used shall conform to Specifications ASTM A-307. Welds to conform to requirements of AWS Specification D1.1.
- E. Other Materials – Other materials to be utilized shall at a minimum conform to applicable ASTM standards.

1.06 INSTALLATION

- A. Trench safety system shall be constructed, installed, and maintained in accordance with the Trench Safety System Plan prepared by the Contractor's Registered Professional Engineer.
- B. Timber Sheeting – Timber sheeting and size of uprights, stringers (wales), and cross bracing to be installed in accordance with Contractor's plan. In no case shall the sizes of the timber sheeting members be less than, or the spacing greater than, those given in Table P-2 in OSHA Part 1926, Sub-part P – Excavation, Trenching, and Backfilling. Place cross braces in true horizontal position, spaced vertically, and secured to prevent sliding, falling, or kickouts. Cross-braces to be placed at each end of the stringers (wales), in addition to other locations required. Cross braces and stringers (wales) to be placed at splices of uprights, in addition to other locations required.
- C. Steel Sheet Piling – Steel sheet piling of equal or greater strength may be used in lieu of timber shoring shown in the OSHA tables (proposed standards). Drive steel sheet piling to at least minimum depth below trench bottom as recommended by Contractor's Registered Professional Engineer providing design. Place cross braces in true horizontal position, spaced vertically, and secured to prevent sliding, falling, or kickouts. Cross braces to be placed at each end of stringers (wales), in addition to other locations required.
- D. Trench Boxes – Portable trench box may be used in lieu of timber trench shoring shown in the OSHA tables (proposed standards) and shall be

designed to provide equal or greater protection than timber trench shoring shown in the OSHA tables. In cases where top of portable trench box will be below top of trench, the trench must be sloped to the maximum allowable slope for the soil conditions existing on the Project. In areas where a sloped trench will affect the integrity of existing structures, Contractor to protect structures prior to sloping trench.

- E. Trench Jacks – When trench jacks are used for cross bracing and/or stringers (wales), the trench jacks shall provide protection greater than or equal to the timber cross bracing shown in the OSHA tables (proposed standards). Trench jacks to be placed at each end of stringers (wales) in addition to other locations required.

1.07 SUPERVISION

- A. Contractor must provide competent supervisory personnel at each trench while work is in progress to ensure Contractor's methods, procedures, equipment, and materials pertaining to the safety systems in this Item are sufficient to meet requirements of Arkansas Law and OSHA Standards.

1.08 MAINTENANCE OF SAFETY SYSTEM

- A. The safety system shall be maintained in the condition as shown on the Trench Excavation and Shoring Safety Plan as designed by the Contractor's Registered Professional Engineer. The Contractor shall take all necessary precautions to ensure the safety systems are not damaged during their use. If at any time during its use a safety system is damaged, personnel shall be immediately removed from the trench excavation area and the safety system repaired. The Contractor shall take all necessary precautions to ensure no loads, except those provided for in the plan, are imposed upon the trench safety system.

1.09 INSPECTION

- A. Contractor shall make daily inspection of trench safety system to ensure that the system meets OSHA requirements. Daily inspection to be made by competent personnel. If evidence of possible cave-ins or slides is apparent, all work in the trench shall cease until necessary precautions have been taken to safeguard personnel entering the trench. Contractor shall maintain permanent record of daily inspection.

1.10 REMOVAL

- A. Bed and backfill pipe to a point at least one (1') foot above top of pipe or other embedded items prior to removal of any portion of trench safety system. Bedding and backfill to be in accordance to other applicable specifications items. Backfilling and removal of trench supports shall be in accordance with Contractor's Trench Excavation and Shoring Safety Plan. Removal of trench safety system to be accomplished in such a manner to

cause no damage to pipe or other embedded items. Remove no braces or trench supports until all personnel have evacuated the trench. Backfill trench to within five (5') feet of natural ground prior to removal of entire trench safety system.

END OF SECTION

If it is necessary to stand at the outboard or inboard edge of the deckload where less than 24 inches of bulwark, rail, coaming, or other protection exists, all employees shall be provided with a suitable means of protection against falling from the deckload.

(d) *First-aid and lifesaving equipment.*

(1) Provisions for rendering first aid and medical assistance shall be in accordance with subpart D of this part.

(2) The employer shall ensure that there is in the vicinity of each barge in use at least one U.S. Coast Guard-approved 30-inch lifering with not less than 90 feet of line attached, and at least one portable or permanent ladder which will reach the top of the apron to the surface of the water. If the above equipment is not available at the pier, the employer shall furnish it during the time that he is working the barge.

(3) Employees walking or working on the unguarded decks of barges shall be protected with U.S. Coast Guard-approved work vests or buoyant vests.

(e) *Commercial diving operations.* Commercial diving operations shall be subject to subpart T of part 1910, §§ 1910.401-1910.441, of this chapter.

[39 FR 22801, June 24, 1974, as amended at 42 FR 37674, July 22, 1977]

§ 1926.606 Definitions applicable to this subpart.

(a) *Apron*—The area along the waterfront edge of the pier or wharf.

(b) *Bulwark*—The side of a ship above the upper deck.

(c) *Coaming*—The raised frame, as around a hatchway in the deck, to keep out water.

(d) *Jacob's ladder*—A marine ladder of rope or chain with wooden or metal rungs.

(e) *Rail*, for the purpose of § 1926.605, means a light structure serving as a guard at the outer edge of a ship's deck.

Subpart P—Excavations

AUTHORITY: Sec. 107, Contract Worker Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR

25059), or 9-83 (48 FR 35736), as applicable, and 29 CFR part 1911.

SOURCE: 54 FR 45959, Oct. 31, 1989, unless otherwise noted.

§ 1926.650 Scope, application, and definitions applicable to this subpart.

(a) *Scope and application.* This subpart applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

(b) *Definitions applicable to this subpart.*

Accepted engineering practices means those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such system is designed, specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system) means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross braces mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or sides means the vertical or inclined earth surfaces formed as a result of excavation work.

Failure means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous atmosphere means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickout means the accidental release or failure of a cross brace.

Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

Sheeting means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system) means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in

accordance with §1926.652 (c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring (Shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sides. See "Faces."

Sloping (Sloping system) means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable rock means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Structural ramp means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

Support system means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated data means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Trench (Trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less

(measured at the bottom of the excavation), the excavation is also considered to be a trench.

Trench box. See "Shield."

Trench shield. See "Shield."

Uprights means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

Wales means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

§ 1926.651 Specific excavation requirements.

(a) *Surface encumbrances.* All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

(b) *Underground installations.* (1) The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

(2) Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used.

(3) When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means.

(4) While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

(c) *Access and egress*—(1) *Structural ramps.* (i) Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

(ii) Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement.

(iii) Structural members used for ramps and runways shall be of uniform thickness.

(iv) Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.

(v) Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

(2) *Means of egress from trench excavations.* A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

(d) *Exposure to vehicular traffic.* Employees exposed to public vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

(e) *Exposure to falling loads.* No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with §1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.

(f) *Warning system for mobile equipment.* When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

(g) *Hazardous atmospheres—(1) Testing and controls.* In addition to the requirements set forth in subparts D and E of this part (29 CFR 1926.50-1926.107) to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements shall apply:

(i) Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.

(ii) Adequate precautions shall be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation in accordance with subparts D and E of this part respectively.

(iii) Adequate precaution shall be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.

(iv) When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

(2) *Emergency rescue equipment.* (i) Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous at-

mospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

(ii) Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, shall wear a harness with a life-line securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.

(h) *Protection from hazards associated with water accumulation.* (1) Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

(2) If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

(3) If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person and compliance with paragraphs (h)(1) and (h)(2) of this section.

(i) *Stability of adjacent structures.* (1) Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

(2) Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably

expected to pose a hazard to employees shall not be permitted except when:

(i) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or

(ii) The excavation is in stable rock; or

(iii) A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or

(iv) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

(3) Sidewalks, pavements, and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

(j) *Protection of employees from loose rock or soil.* (1) Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

(2) Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

(k) *Inspections.* (1) Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout

the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

(2) Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

(1) Walkways shall be provided where employees or equipment are required or permitted to cross over excavations. Guardrails which comply with §1926.502(b) shall be provided where walkways are 6 feet (1.8 m) or more above lower levels.

[54 FR 45959, Oct. 31, 1989, as amended by 59 FR 40730, Aug. 9, 1994]

§ 1926.652 Requirements for protective systems.

(a) *Protection of employees in excavations.* (1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when:

(i) Excavations are made entirely in stable rock; or

(ii) Excavations are less than 5 feet (1.52m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

(b) *Design of sloping and benching systems.* The slopes and configurations of sloping and benching systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (b)(1); or, in the alternative, paragraph (b)(2); or, in the alternative, paragraph (b)(3), or, in the alternative, paragraph (b)(4), as follows:

(1) *Option (1)—Allowable configurations and slopes.* (i) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical

(34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

(ii) Slopes specified in paragraph (b)(1)(i) of this section, shall be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this subpart.

(2) *Option (2)—Determination of slopes and configurations using Appendices A and B.* Maximum allowable slopes, and allowable configurations for sloping and benching systems, shall be determined in accordance with the conditions and requirements set forth in appendices A and B to this subpart.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of sloping or benching systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and shall include all of the following:

(A) Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;

(B) Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under paragraph (b) of this section shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include at least the following:

(A) The magnitude of the slopes that were determined to be safe for the particular project;

(B) The configurations that were determined to be safe for the particular project; and

(C) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available to the Secretary upon request.

(c) *Design of support systems, shield systems, and other protective systems.* Designs of support systems shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (c)(1); or, in the alternative, paragraph (c)(2); or, in the alternative, paragraph (c)(3); or, in the alternative, paragraph (c)(4) as follows:

(1) *Option (1)—Designs using appendices A, C and D.* Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in appendices A and C to this subpart. Designs for aluminum hydraulic shoring shall be in accordance with paragraph (c)(2) of this section, but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with appendix D.

(2) *Option (2)—Designs Using Manufacturer's Tabulated Data.* (i) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(ii) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(iii) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall

be made available to the Secretary upon request.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of support systems, shield systems, or other protective systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and include all of the following:

(A) Identification of the parameters that affect the selection of a protective system drawn from such data;

(B) Identification of the limits of use of the data;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2 or Option 3, above, shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include the following:

(A) A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and

(B) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design shall be made available to the Secretary upon request.

(d) *Materials and equipment.* (1) Materials and equipment used for protective systems shall be free from damage or defects that might impair their proper function.

(2) Manufactured materials and equipment used for protective systems shall be used and maintained in a man-

ner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

(3) When material or equipment that is used for protective systems is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.

(e) *Installation and removal of support—(1) General.* (i) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(ii) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(iii) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(iv) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(v) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(vi) Backfilling shall progress together with the removal of support systems from excavations.

(2) *Additional requirements for support systems for trench excavations.* (i) Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and

there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(ii) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) *Sloping and benching systems.* Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) *Shield systems*—(1) *General.* (i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(2) *Additional requirement for shield systems used in trench excavations.* Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

APPENDIX A TO SUBPART P OF PART 1926—SOIL CLASSIFICATION

(a) *Scope and application*—(1) *Scope.* This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(2) *Application.* This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in §1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C

to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in §1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) *Definitions.* The definitions and examples given below are based on, in whole or in part, the following: American Society for Testing Materials (ASTM) Standards D653-85 and D2488; The Unified Soils Classification System, The U.S. Department of Agriculture (USDA) Textural Classification Scheme; and The National Bureau of Standards Report BSS-121.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt, (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or shear vane.

Soil classification system means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil means soil which is underwater or is free seeping.

Type A means cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

- (i) The soil is fissured; or
- (ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
- (iii) The soil has been previously disturbed; or
- (iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or
- (v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means:

- (i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or
- (ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.
- (iii) Previously disturbed soils except those which would otherwise be classed as Type C soil.
- (iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or
- (v) Dry rock that is not stable; or
- (vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C means:

- (i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or
- (ii) Granular soils including gravel, sand, and loamy sand; or
- (iii) Submerged soil or soil from which water is freely seeping; or
- (iv) Submerged rock that is not stable, or

(v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) *Requirements*—(1) *Classification of soil and rock deposits.* Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(2) *Basis of classification.* The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the American Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(3) *Visual and manual analyses.* The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(4) *Layered systems.* In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(5) *Reclassification.* If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) *Acceptable visual and manual tests.*—(1) *Visual tests.* Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained

material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(iii) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(v) Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(2) *Manual tests.* Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as 1/8-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of 1/8-inch thread can be held on one end without tearing, the soil is cohesive.

(ii) *Dry strength.* If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(iii) *Thumb penetration.* The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard

designation D2488—"Standard Recommended Practice for Description of Soils (Visual—Manual Procedure).") Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(iv) *Other strength tests.* Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(v) *Drying test.* The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(A) If the sample develops cracks as it dries, significant fissures are indicated.

(B) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as a unfissured cohesive material and the unconfined compressive strength should be determined.

(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

APPENDIX B TO SUBPART P OF PART 1926—SLOPING AND BENCHING

(a) *Scope and application.* This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in § 1926.652(b)(2).

(b) *Definitions.*

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely

to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and raveling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) *Requirements*—(1) *Soil classification*. Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(2) *Maximum allowable slope*. The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.

(3) *Actual slope*. (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least ½ horizontal to one vertical (½H:1V) less steep than the maximum allowable slope.

(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with § 1926.651(i).

(4) *Configurations*. Configurations of sloping and benching systems shall be in accordance with Figure B-1.

TABLE B-1
MAXIMUM ALLOWABLE SLOPES

| SOIL OR ROCK TYPE | MAXIMUM ALLOWABLE SLOPES (H:V) ^[1] FOR EXCAVATIONS LESS THAN 20 FEET DEEP. [3] |
|---|---|
| STABLE ROCK TYPE A [2] TYPE B TYPE C | VERTICAL (90°) 3/4 : 1 (53°) 1:1 (45°) 1½ : 1 (39°) |

NOTES:

- Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
- A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
- Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

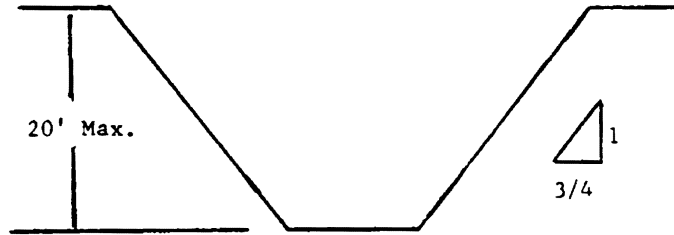
Figure B-1

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

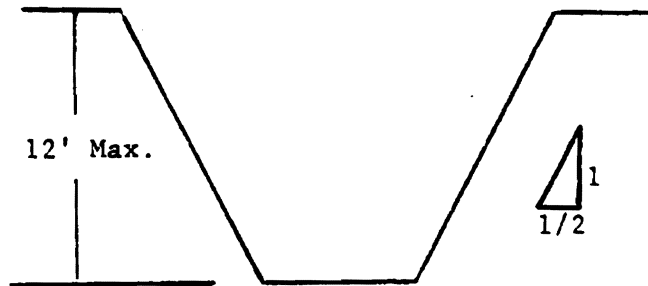
B-1.1 Excavations made in Type A soil.

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of $\frac{3}{4}$:1.



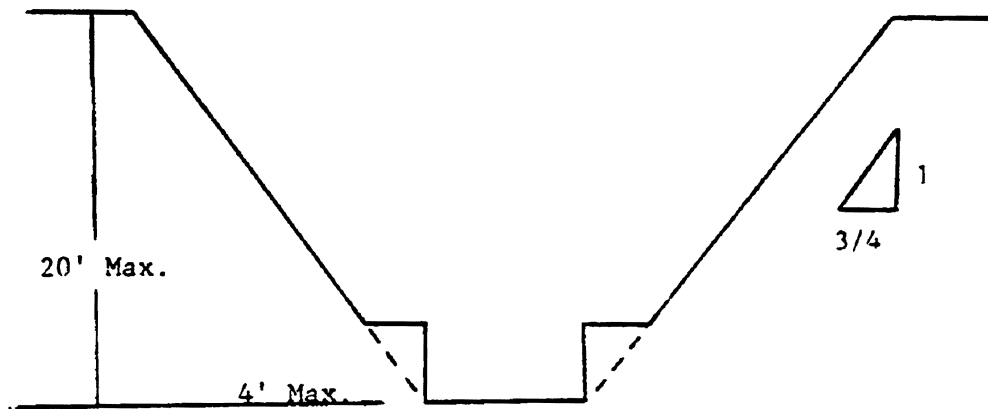
SIMPLE SLOPE—GENERAL

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of $\frac{1}{2}$:1.

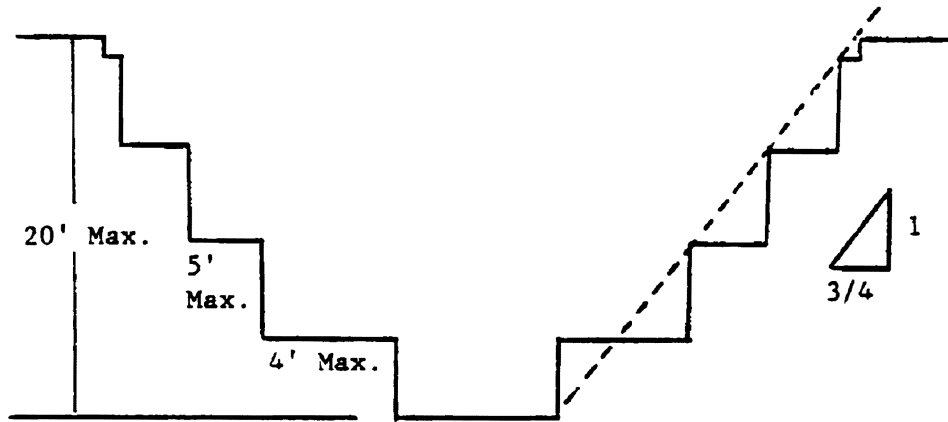


SIMPLE SLOPE—SHORT TERM

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of $\frac{3}{4}$ to 1 and maximum bench dimensions as follows:

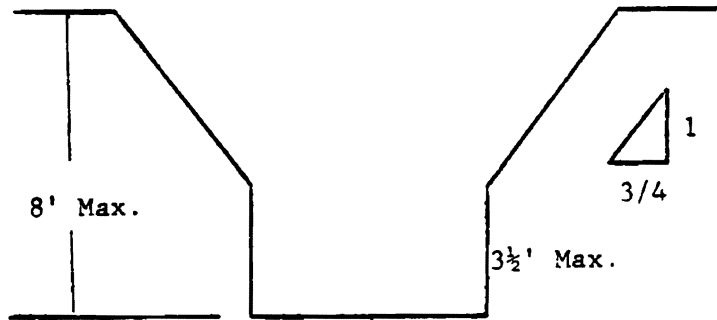


SIMPLE BENCH



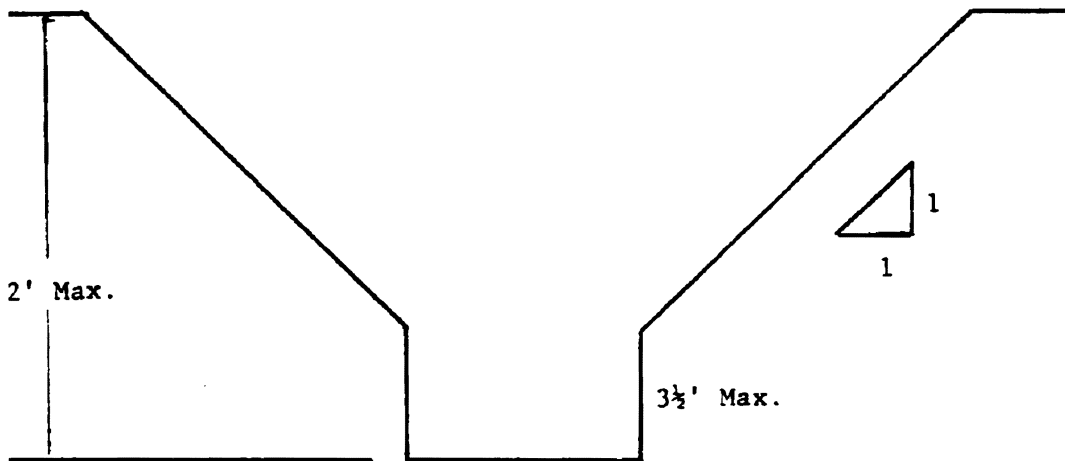
MULTIPLE BENCH

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3½ feet.



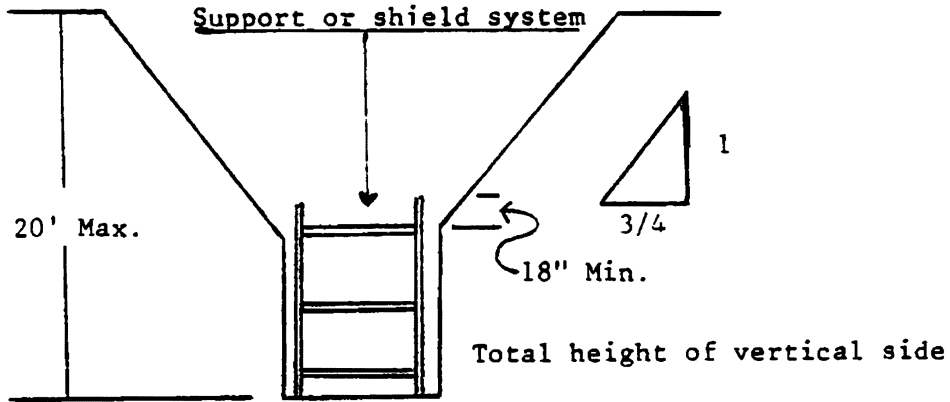
UNSUPPORTED VERTICALLY SIDED LOWER PORTION—MAXIMUM 8 FEET IN DEPTH

All excavations more than 8 feet but not more than 12 feet in depth which unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3½ feet.



UNSUPPORTED VERTICALLY SIDED LOWER PORTION—MAXIMUM 12 FEET IN DEPTH

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of 3/4:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

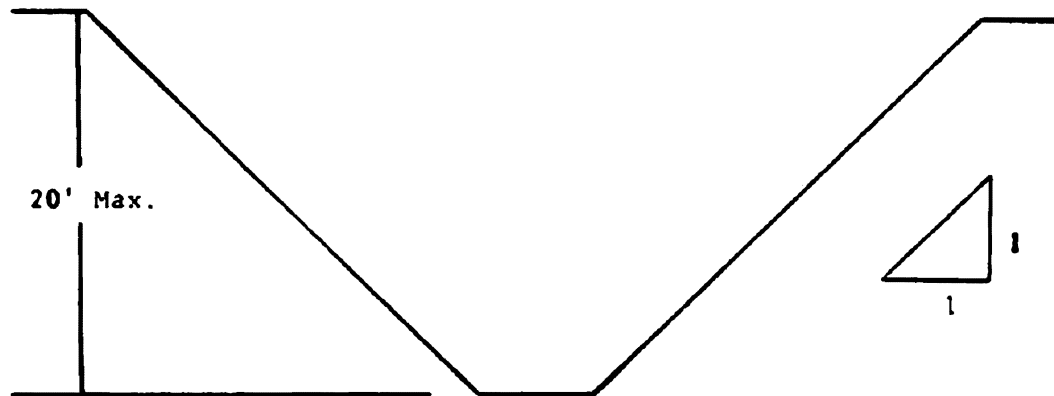


SUPPORTED OR SHIELDED VERTICALLY SIDED LOWER PORTION

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under §1926.652(b).

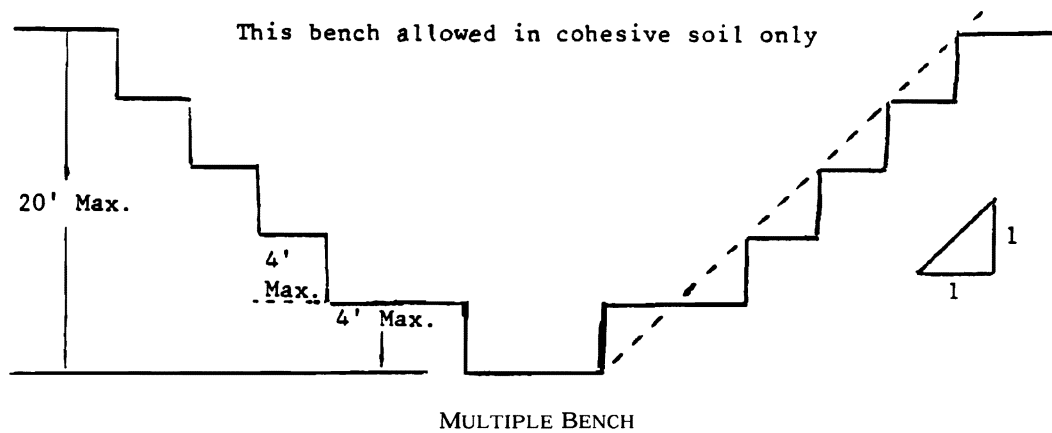
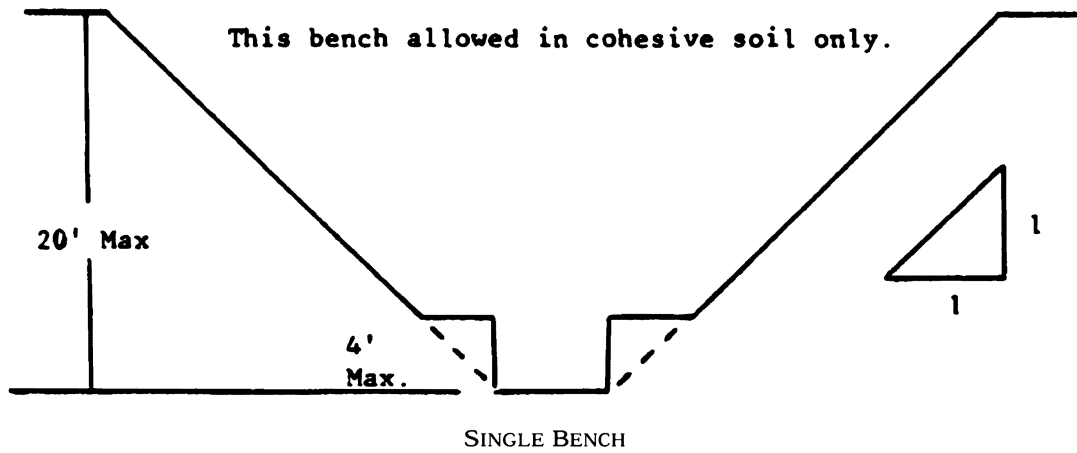
B-1.2 Excavations Made in Type B Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

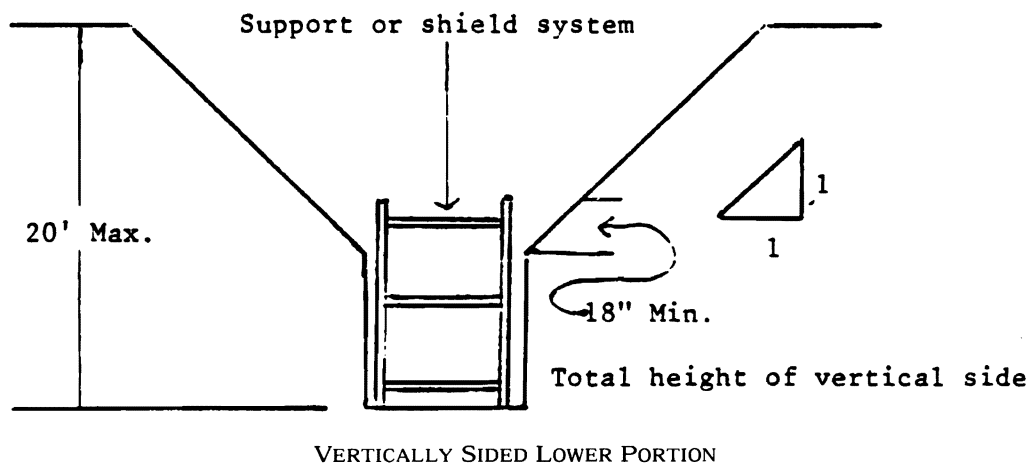


SIMPLE SLOPE

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:



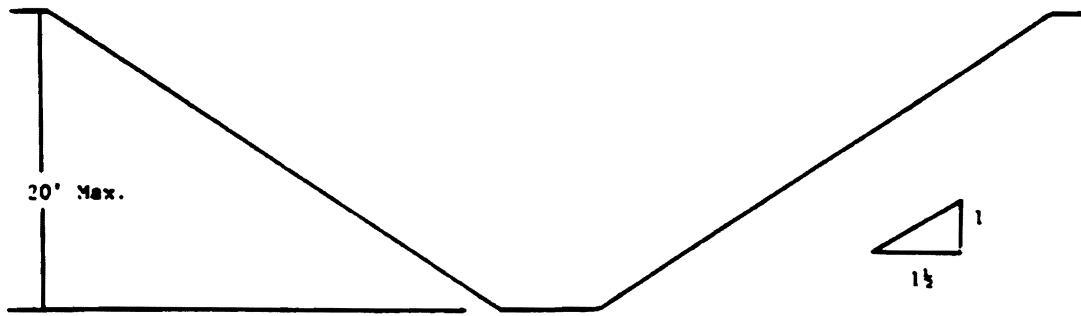
3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.



4. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

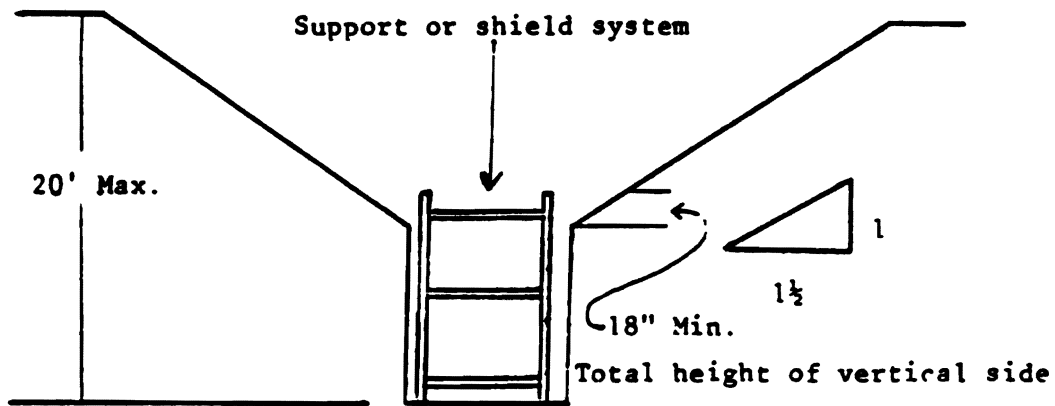
B-1.3 Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.



SIMPLE SLOPE

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of $1\frac{1}{2}:1$.

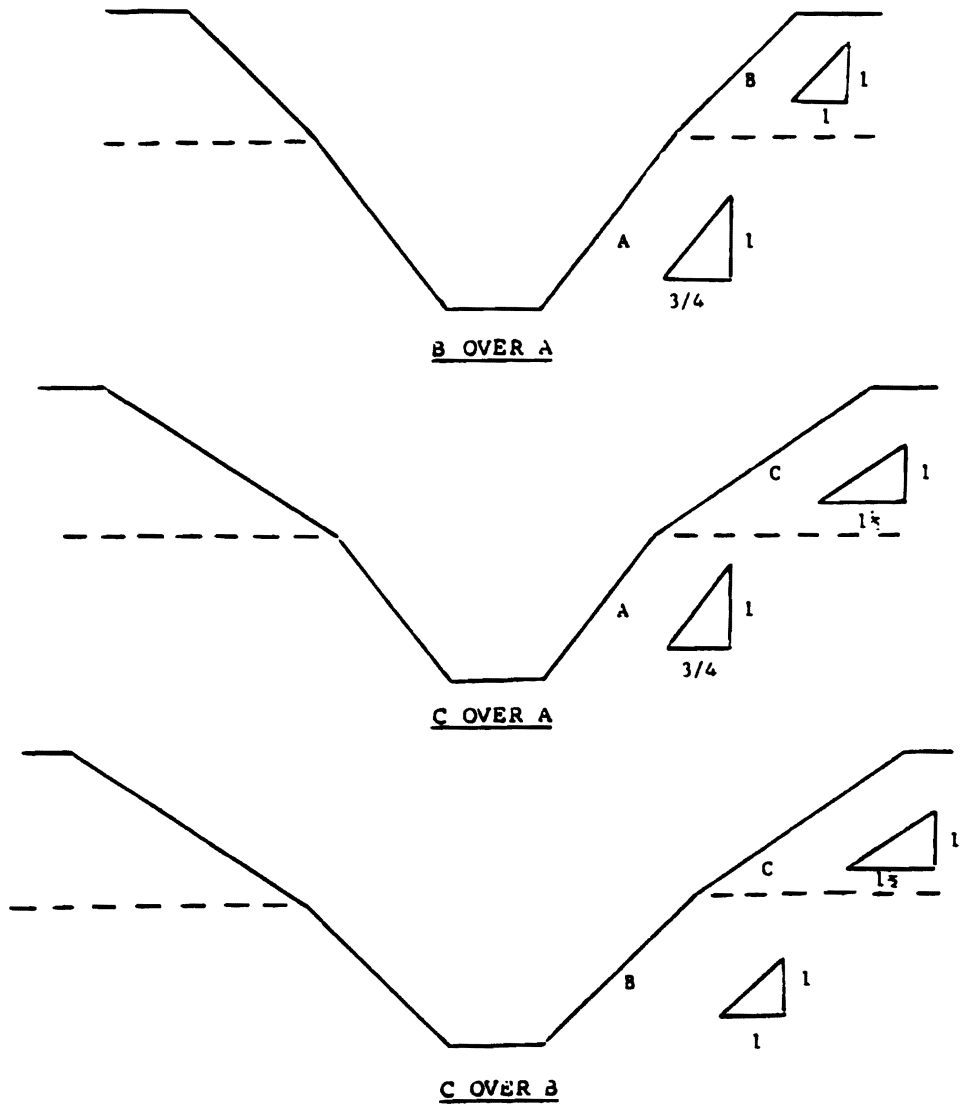


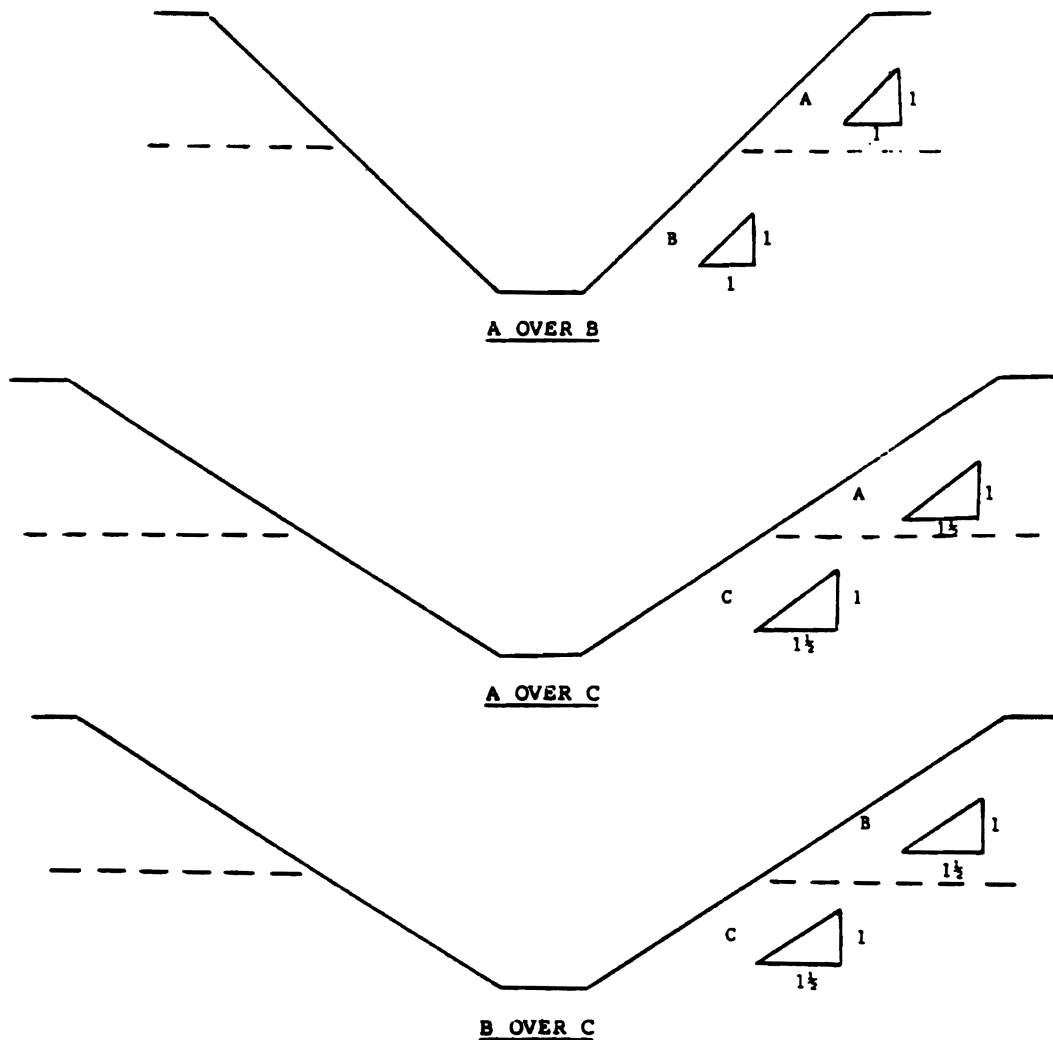
VERTICAL SIDED LOWER PORTION

3. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

B-1.4 Excavations Made in Layered Soils

1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.





2. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

APPENDIX C TO SUBPART P OF PART 1926—TIMBER SHORING FOR TRENCHES

(a) *Scope.* This appendix contains information that can be used when timber shoring is provided as a method of protection from cave-ins in trenches that do not exceed 20 feet (6.1 m) in depth. This appendix must be used when design of timber shoring protective systems is to be performed in accordance with § 1926.652(c)(1). Other timber shoring configurations; other systems of support such as hydraulic and pneumatic systems; and other protective systems such as sloping, benching, shielding, and freezing systems must be designed in accordance with the requirements set forth in § 1926.652(b) and § 1926.652(c).

(b) *Soil Classification.* In order to use the data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of this part.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables C-1.1, C-1.2, and C-1.3, and Tables C-2.1, C-2.2 and C-2.3 following paragraph (g) of the appendix. Each table presents the minimum sizes of timber members to use in a shoring system, and each table contains data only for the particular soil type in which the excavation or portion of

the excavation is made. The data are arranged to allow the user the flexibility to select from among several acceptable configurations of members based on varying the horizontal spacing of the crossbraces. Stable rock is exempt from shoring requirements and therefore, no data are presented for this condition.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix, and on the tables themselves.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations regarding Tables C-1.1 through C-1.3 and Tables C-2.1 through C-2.3 are presented in paragraph (g) of this Appendix.

(d) *Basis and limitations of the data.*—(1) *Dimensions of timber members.* (i) The sizes of the timber members listed in Tables C-1.1 through C-1.3 are taken from the National Bureau of Standards (NBS) report, "Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations." In addition, where NBS did not recommend specific sizes of members, member sizes are based on an analysis of the sizes required for use by existing codes and on empirical practice.

(ii) The required dimensions of the members listed in Tables C-1.1 through C-1.3 refer to actual dimensions and not nominal dimensions of the timber. Employers wanting to use nominal size shoring are directed to Tables C-2.1 through C-2.3, or have this choice under § 1926.652(c)(3), and are referred to The Corps of Engineers, The Bureau of Reclamation or data from other acceptable sources.

(2) *Limitation of application.* (i) It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be designed as specified in § 1926.652(c).

(ii) When any of the following conditions are present, the members specified in the tables are not considered adequate. Either an alternate timber shoring system must be designed or another type of protective system designed in accordance with § 1926.652.

(A) When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two-foot soil surcharge. The term "adjacent" as used here means the area within a horizontal distance from the edge of the trench equal to the depth of the trench.

(B) When vertical loads imposed on cross braces exceed a 240-pound gravity load distributed on a one-foot section of the center of the crossbrace.

(C) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(D) When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables.* The members of the shoring system that are to be selected using this information are the cross braces, the uprights, and the wales, where wales are required. Minimum sizes of members are specified for use in different types of soil. There are six tables of information, two for each soil type. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is then made. The selection is based on the depth and width of the trench where the members are to be installed and, in most instances, the selection is also based on the horizontal spacing of the crossbraces. Instances where a choice of horizontal spacing of crossbracing is available, the horizontal spacing of the crossbraces must be chosen by the user before the size of any member can be determined. When the soil type, the width and depth of the trench, and the horizontal spacing of the crossbraces are known, the size and vertical spacing of the crossbraces, the size and vertical spacing of the wales, and the size and horizontal spacing of the uprights can be read from the appropriate table.

(f) *Examples to Illustrate the Use of Tables C-1.1 through C-1.3.*

(1) *Example 1.*

A trench dug in Type A soil is 13 feet deep and five feet wide.

From *Table C-1.1*, for acceptable arrangements of timber can be used.

Arrangement #B1

Space 4×4 crossbraces at six feet horizontally and four feet vertically.

Wales are not required.

Space 3×8 uprights at six feet horizontally. This arrangement is commonly called "skip shoring."

Arrangement #B2

Space 4×6 crossbraces at eight feet horizontally and four feet vertically.

Space 8×8 wales at four feet vertically.

Space 2x6 uprights at four feet horizontally.

Arrangement #B3

Space 6x6 crossbraces at 10 feet horizontally and four feet vertically.

Space 8x10 wales at four feet vertically.

Space 2x6 uprights at five feet horizontally.

Arrangement #B4

Space 6x6 crossbraces at 12 feet horizontally and four feet vertically.

Space 10x10 wales at four feet vertically.

Spaces 3x8 uprights at six feet horizontally.

(2) Example 2.

A trench dug in Type B soil in 13 feet deep and five feet wide. From Table C-1.2 three acceptable arrangements of members are listed.

Arrangement #B1

Space 6x6 crossbraces at six feet horizontally and five feet vertically.

Space 8x8 wales at five feet vertically.

Space 2x6 uprights at two feet horizontally.

Arrangement #B2

Space 6x8 crossbraces at eight feet horizontally and five feet vertically.

Space 10x10 wales at five feet vertically.

Space 2x6 uprights at two feet horizontally.

Arrangement #B3

Space 8x8 crossbraces at 10 feet horizontally and five feet vertically.

Space 10x12 wales at five feet vertically.

Space 2x6 uprights at two feet vertically.

(3) Example 3.

A trench dug in Type C soil is 13 feet deep and five feet wide.

From Table C-1.3 two acceptable arrangements of members can be used.

Arrangement #B1

Space 8x8 crossbraces at six feet horizontally and five feet vertically.

Space 10x12 wales at five feet vertically.

Position 2x6 uprights as closely together as possible.

If water must be retained use special tongue and groove uprights to form tight sheeting.

Arrangement #B2

Space 8x10 crossbraces at eight feet horizontally and five feet vertically.

Space 12x12 wales at five feet vertically.

Position 2x6 uprights in a close sheeting configuration unless water pressure must be resisted. Tight sheeting must be used where water must be retained.

(4) Example 4.

A trench dug in Type C soil is 20 feet deep and 11 feet wide. The size and spacing of members for the section of trench that is over 15 feet in depth is determined using Table C-1.3. Only one arrangement of members is provided.

Space 8x10 crossbraces at six feet horizontally and five feet vertically.

Space 12x12 wales at five feet vertically.

Use 3x6 tight sheeting.

Use of Tables C-2.1 through C-2.3 would follow the same procedures.

(g) Notes for all Tables.

1. Member sizes at spacings other than indicated are to be determined as specified in §1926.652(c), "Design of Protective Systems."

2. When conditions are saturated or submerged use Tight Sheeting. Tight Sheeting refers to the use of specially-edged timber planks (e.g., tongue and groove) at least three inches thick, steel sheet piling, or similar construction that when driven or placed in position provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. Close Sheeting refers to the placement of planks side-by-side allowing as little space as possible between them.

3. All spacing indicated is measured center to center.

4. Wales to be installed with greater dimension horizontal.

5. If the vertical distance from the center of the lowest crossbrace to the bottom of the trench exceeds two and one-half feet, uprights shall be firmly embedded or a mudsill shall be used. Where uprights are embedded, the vertical distance from the center of the lowest crossbrace to the bottom of the trench shall not exceed 36 inches. When mudsills are used, the vertical distance shall not exceed 42 inches. Mudsills are wales that are installed at the toe of the trench side.

6. Trench jacks may be used in lieu of or in combination with timber crossbraces.

7. Placement of crossbraces. When the vertical spacing of crossbraces is four feet, place the top crossbrace no more than two feet below the top of the trench. When the vertical spacing of crossbraces is five feet, place the top crossbrace no more than 2.5 feet below the top of the trench.

TABLE C-1.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A $P_a = 25 \times H + 72 \text{ psf}$ (2 ft Surcharge)

| DEPTH OF TRENCH (FEET) | SIZE (ACTUAL) AND SPACING OF MEMBERS ** | | | | | | | | | | | | | |
|------------------------|---|------------------------|---------|---------|----------|----------|----------------------|-----------|----------------------|---|-----|-----|-----|-----|
| | HORIZ. SPACING (FEET) | CROSS BRACES | | | | | VERT. SPACING (FEET) | WALES | | UPRIGHTS | | | | |
| | | WIDTH OF TRENCH (FEET) | | | | | | SIZE (IN) | VERT. SPACING (FEET) | MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) | | | | |
| | | UP TO 4 | UP TO 6 | UP TO 9 | UP TO 12 | UP TO 15 | | | | CLOSE | 4 | 5 | 6 | 8 |
| 5 TO 10 | UP TO 6 | 4X4 | 4X4 | 4X6 | 6X6 | 6X6 | 4 | Not Req'd | --- | | | | 2X6 | |
| | UP TO 8 | 4X4 | 4X4 | 4X6 | 6X6 | 6X6 | 4 | Not Req'd | --- | | | | | 2X8 |
| | UP TO 10 | 4X6 | 4X6 | 4X6 | 6X6 | 6X6 | 4 | 8X8 | 4 | | | 2X6 | | |
| | UP TO 12 | 4X6 | 4X6 | 6X6 | 6X6 | 6X6 | 4 | 8X8 | 4 | | | | 2X6 | |
| 10 TO 15 | UP TO 6 | 4X4 | 4X4 | 4X6 | 6X6 | 6X6 | 4 | Not Req'd | --- | | | | 3X8 | |
| | UP TO 8 | 4X6 | 4X6 | 6X6 | 6X6 | 6X6 | 4 | 8X8 | 4 | | 2X6 | | | |
| | UP TO 10 | 6X6 | 6X5 | 6X6 | 6X8 | 6X8 | 4 | 8X10 | 4 | | | 2X6 | | |
| | UP TO 12 | 6X6 | 6X6 | 6X6 | 6X8 | 6X8 | 4 | 10X10 | 4 | | | | 3X8 | |
| 15 TO 20 | UP TO 6 | 6X6 | 6X6 | 6X6 | 6X8 | 6X8 | 4 | 6X8 | 4 | 3X6 | | | | |
| | UP TO 8 | 6X6 | 6X6 | 6X6 | 6X8 | 6X8 | 4 | 8X8 | 4 | 3X6 | | | | |
| | UP TO 10 | 8X8 | 8X8 | 8X8 | 8X8 | 8X10 | 4 | 8X10 | 4 | 3X6 | | | | |
| | UP TO 12 | 8X8 | 8X8 | 8X8 | 8X8 | 8X10 | 4 | 10X10 | 4 | 3X6 | | | | |
| OVER 20 | SEE NOTE 1 | | | | | | | | | | | | | |

* Mixed oak or equivalent with a bending strength not less than 850 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-1.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B $P_a = 45 X H + 72$ psf (2 ft. Surcharge)

| DEPTH OF TRENCH (FEET) | SIZE (ACTUAL) AND SPACING OF MEMBERS** | | | | | | | | | | | | | |
|------------------------|--|------------------------|---------|---------|----------|----------|----------------------|-----------|----------------------|---|-----|-----|--|--|
| | HORIZ. SPACING (FEET) | CROSS BRACES | | | | | VERT. SPACING (FEET) | WALES | | UPRIGHTS | | | | |
| | | WIDTH OF TRENCH (FEET) | | | | | | SIZE (IN) | VERT. SPACING (FEET) | MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) | | | | |
| | | UP TO 4 | UP TO 6 | UP TO 9 | UP TO 12 | UP TO 15 | | | | CLOSE | 2 | 3 | | |
| 5 TO 10 | UP TO 6 | 4X6 | 4X6 | 6X6 | 6X6 | 6X6 | 5 | 6X8 | 5 | | | 2X6 | | |
| | UP TO 8 | 6X6 | 6X6 | 6X6 | 6X8 | 6X8 | 5 | 8X10 | 5 | | | 2X6 | | |
| | UP TO 10 | 6X6 | 6X6 | 6X6 | 6X8 | 6X8 | 5 | 10X10 | 5 | | | 2X6 | | |
| | See Note 1 | | | | | | | | | | | | | |
| 10 TO 15 | UP TO 6 | 6X6 | 6X6 | 6X6 | 6X8 | 6X8 | 5 | 8X8 | 5 | | 2X6 | | | |
| | UP TO 8 | 6X8 | 6X8 | 6X8 | 8X8 | 8X8 | 5 | 10X10 | 5 | | 2X6 | | | |
| | UP TO 10 | 8X8 | 8X8 | 8X8 | 8X8 | 8X10 | 5 | 10X12 | 5 | | 2X6 | | | |
| | See Note 1 | | | | | | | | | | | | | |
| 15 TO 20 | UP TO 6 | 6X8 | 6X8 | 6X8 | 8X8 | 8X8 | 5 | 8X10 | 5 | 3X6 | | | | |
| | UP TO 8 | 8X8 | 8X8 | 8X8 | 8X8 | 8X10 | 5 | 10X12 | 5 | 3X6 | | | | |
| | UP TO 10 | 8X10 | 8X10 | 8X10 | 8X10 | 10X10 | 5 | 12X12 | 5 | 3X6 | | | | |
| | See Note 1 | | | | | | | | | | | | | |
| OVER 20 | SEE NOTE 1 | | | | | | | | | | | | | |

* Mixed oak or equivalent with a bending strength not less than 850 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-1.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C P_a = 80 X H + 72 psf (2 ft. Surcharge)

| DEPTH OF TRENCH (FEET) | SIZE (ACTUAL) AND SPACING OF MEMBERS** | | | | | | | | | | | | | |
|------------------------|--|------------------------|---------|---------|----------|----------|----------------------|-----------|----------------------|--|--|--|--|--|
| | HORIZ. SPACING (FEET) | CROSS BRACES | | | | | VERT. SPACING (FEET) | SIZE (IN) | VERT. SPACING (FEET) | UPRIGHTS | | | | |
| | | WIDTH OF TRENCH (FEET) | | | | | | | | MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) (See Note 2) | | | | |
| | | UP TO 4 | UP TO 6 | UP TO 9 | UP TO 12 | UP TO 15 | | | | CLOSE | | | | |
| 5 TO 10 | UP TO 6 | 6X8 | 6X8 | 6X8 | 8X8 | 8X8 | 5 | 8X10 | 5 | 2X6 | | | | |
| | UP TO 8 | 8X8 | 8X8 | 8X8 | 8X8 | 8X10 | 5 | 10X12 | 5 | 2X6 | | | | |
| | UP TO 10 | 8X10 | 8X10 | 8X10 | 8X10 | 10X10 | 5 | 12X12 | 5 | 2X6 | | | | |
| | See Note 1 | | | | | | | | | | | | | |
| 10 TO 15 | UP TO 6 | 8X8 | 8X8 | 8X8 | 8X8 | 8X10 | 5 | 10X12 | 5 | 2X6 | | | | |
| | UP TO 8 | 8X10 | 8X10 | 8X10 | 8X10 | 10X10 | 5 | 12X12 | 5 | 2X6 | | | | |
| | See Note 1 | | | | | | | | | | | | | |
| 15 TO 20 | See Note 1 | | | | | | | | | | | | | |
| | UP TO 6 | 8X10 | 8X10 | 8X10 | 8X10 | 10X10 | 5 | 12X12 | 5 | 3X6 | | | | |
| | See Note 1 | | | | | | | | | | | | | |
| | See Note 1 | | | | | | | | | | | | | |
| OVER 20 | SEE NOTE 1 | | | | | | | | | | | | | |

* Mixed Oak or equivalent with a bending strength not less than 850 psi.
 ** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *
 SOIL TYPE A P_a = 25 X H ± 72 psf (2 ft. Surcharge)

| DEPTH OF TRENCH (FEET) | SIZE (S4S) AND SPACING OF MEMBERS ** | | | | | | | | | | | | | |
|------------------------|--------------------------------------|------------------------|---------|---------|----------|----------|----------------------|-----------|----------------------|---|------|-----|------|-----|
| | HORIZ. SPACING (FEET) | CROSS BRACES | | | | | VERT. SPACING (FEET) | WALES | | UPRIGHTS | | | | |
| | | WIDTH OF TRENCH (FEET) | | | | | | SIZE (IN) | VERT. SPACING (FEET) | MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) | | | | |
| | | UP TO 4 | UP TO 6 | UP TO 9 | UP TO 12 | UP TO 15 | | | | CLOSE | 4 | 5 | 6 | 8 |
| 5 TO 10 | UP TO 6 | 4X4 | 4X4 | 4X4 | 4X4 | 4X6 | 4 | Not Req'd | Not Req'd | | | | 4X6 | |
| | UP TO 8 | 4X4 | 4X4 | 4X4 | 4X6 | 4X6 | 4 | Not Req'd | Not Req'd | | | | | 4X8 |
| | UP TO 10 | 4X6 | 4X6 | 4X6 | 6X6 | 6X6 | 4 | 8X8 | 4 | | | 4X6 | | |
| | UP TO 12 | 4X6 | 4X6 | 4X6 | 6X6 | 6X6 | 4 | 8X8 | 4 | | | | 4X6 | |
| 10 TO 15 | UP TO 6 | 4X4 | 4X4 | 4X4 | 6X6 | 6X6 | 4 | Not Req'd | Not Req'd | | | | 4X10 | |
| | UP TO 8 | 4X6 | 4X6 | 4X6 | 6X6 | 6X6 | 4 | 6X8 | 4 | | 4X6 | | | |
| | UP TO 10 | 6X6 | 6X6 | 6X6 | 6X6 | 6X6 | 4 | 8X8 | 4 | | | 4X8 | | |
| | UP TO 12 | 6X6 | 6X6 | 6X6 | 6X6 | 6X6 | 4 | 8X10 | 4 | | 4X6 | | 4X10 | |
| 15 TO 20 | UP TO 6 | 6X6 | 6X6 | 6X6 | 6X6 | 6X6 | 4 | 6X8 | 4 | 3X6 | | | | |
| | UP TO 8 | 6X6 | 6X6 | 6X6 | 6X6 | 6X6 | 4 | 8X8 | 4 | 3X6 | 4X12 | | | |
| | UP TO 10 | 6X6 | 6X6 | 6X6 | 6X6 | 6X8 | 4 | 8X10 | 4 | 3X6 | | | | |
| | UP TO 12 | 6X6 | 6X6 | 6X6 | 6X8 | 6X8 | 4 | 8X12 | 4 | 3X6 | 4X12 | | | |
| OVER 20 | SEE NOTE 1 | | | | | | | | | | | | | |

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
 ** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *
 SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

| DEPTH OF TRENCH (FEET) | SIZE (S4S) AND SPACING OF MEMBERS ** | | | | | | | | | | | | | |
|------------------------|--------------------------------------|------------------------|---------|---------|----------|----------|----------------------|-----------|----------------------|---|------|-------------|-----|------|
| | HORIZ. SPACING (FEET) | CROSS BRACES | | | | | VERT. SPACING (FEET) | WALES | | UPRIGHTS | | | | |
| | | WIDTH OF TRENCH (FEET) | | | | | | SIZE (IN) | VERT. SPACING (FEET) | MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) | | | | |
| | | UP TO 4 | UP TO 6 | UP TO 9 | UP TO 12 | UP TO 15 | | | | CLOSE | 2 | 3 | 4 | 6 |
| 5 TO 10 | UP TO 6 | 4X6 | 4X6 | 4X6 | 6X6 | 6X6 | 5 | 6X8 | 5 | | | 3X12 4X8 | | 4X12 |
| | UP TO 8 | 4X6 | 4X6 | 6X6 | 6X6 | 6X6 | 5 | 8X8 | 5 | | 3X8 | | 4X8 | |
| | UP TO 10 | 4X6 | 4X6 | 6X6 | 6X6 | 6X8 | 5 | 8X10 | 5 | | | 4X8 | | |
| | See Note 1 | | | | | | | | | | | | | |
| 10 TO 15 | UP TO 6 | 6X6 | 6X6 | 6X6 | 6X8 | 6X8 | 5 | 8X8 | 5 | 3X6 | 4X10 | | | |
| | UP TO 8 | 6X8 | 6X8 | 6X8 | 8X8 | 8X8 | 5 | 10X10 | 5 | 3X6 | 4X10 | | | |
| | UP TO 10 | 6X8 | 6X8 | 8X8 | 8X8 | 8X8 | 5 | 10X12 | 5 | 3X6 | 4X10 | | | |
| | See Note 1 | | | | | | | | | | | | | |
| 15 TO 20 | UP TO 6 | 6X8 | 6X8 | 6X8 | 6X8 | 8X8 | 5 | 8X10 | 5 | 4X6 | | | | |
| | UP TO 8 | 6X8 | 6X8 | 6X8 | 8X8 | 8X8 | 5 | 10X12 | 5 | 4X6 | | | | |
| | UP TO 10 | 8X8 | 8X8 | 8X8 | 8X8 | 8X8 | 5 | 12X12 | 5 | 4X6 | | | | |
| | See Note 1 | | | | | | | | | | | | | |
| OVER 20 | SEE NOTE 1 | | | | | | | | | | | | | |

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
 ** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C $P_a = 80 \times H + 72$ psf (2 ft. Surcharge)

| DEPTH OF TRENCH (FEET) | SIZE (S4S) AND SPACING OF MEMBERS ** | | | | | | | | | | | | | |
|------------------------|--------------------------------------|------------------------|---------|----------|----------|------|----------------------|-----------|----------------------|---|-------|--|--|--|
| | HORIZ. SPACING (FEET) | CROSS BRACES | | | | | VERT. SPACING (FEET) | WALES | | UPRIGHTS | | | | |
| | | WIDTH OF TRENCH (FEET) | | | | | | SIZE (IN) | VERT. SPACING (FEET) | MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) | | | | |
| | UP TO 4 | UP TO 6 | UP TO 9 | UP TO 12 | UP TO 15 | | | | | | CLOSE | | | |
| 5 TO 10 | UP TO 6 | 6X6 | 6X6 | 6X6 | 6X6 | 8X8 | 5 | 8X8 | 5 | 3X6 | | | | |
| | UP TO 8 | 6X6 | 6X6 | 6X6 | 8X8 | 8X8 | 5 | 10X10 | 5 | 3X6 | | | | |
| | UP TO 10 | 6X6 | 6X6 | 8X8 | 8X8 | 8X8 | 5 | 10X12 | 5 | 3X6 | | | | |
| | See Note 1 | | | | | | | | | | | | | |
| 10 TO 15 | UP TO 6 | 6X8 | 6X8 | 6X8 | 8X8 | 8X8 | 5 | 10X10 | 5 | 4X6 | | | | |
| | UP TO 8 | 8X8 | 8X8 | 8X8 | 8X8 | 8X8 | 5 | 12X12 | 5 | 4X6 | | | | |
| | See Note 1 | | | | | | | | | | | | | |
| | See Note 1 | | | | | | | | | | | | | |
| 15 TO 20 | UP TO 6 | 8X8 | 8X8 | 8X8 | 8X10 | 8X10 | 5 | 10X12 | 5 | 4X6 | | | | |
| | See Note 1 | | | | | | | | | | | | | |
| | See Note 1 | | | | | | | | | | | | | |
| | See Note 1 | | | | | | | | | | | | | |
| OVER 20 | SEE NOTE 1 | | | | | | | | | | | | | |

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
 ** Manufactured members of equivalent strength may be substituted for wood.

APPENDIX D TO SUBPART P OF PART 1926—ALUMINUM HYDRAULIC SHORING FOR TRENCHES

(a) Scope. This appendix contains information that can be used when aluminum hydraulic shoring is provided as a method of protection against cave-ins in trenches that

do not exceed 20 feet (6.1m) in depth. This appendix must be used when design of the aluminum hydraulic protective system cannot be performed in accordance with §1926.652(c)(2).

(b) Soil Classification. In order to use data presented in this appendix, the soil type or types in which the excavation is made must

first be determined using the soil classification method set forth in appendix A of subpart P of part 1926.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables D-1.1, D-1.2, D-1.3 and E-1.4. Each table presents the maximum vertical and horizontal spacings that may be used with various aluminum member sizes and various hydraulic cylinder sizes. Each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. Tables D-1.1 and D-1.2 are for vertical shores in Types A and B soil. Tables D-1.3 and D-1.4 are for horizontal waler systems in Types B and C soil.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations (footnotes) regarding Table D-1.1 through D-1.4 are presented in paragraph (g) of this appendix.

(6) Figures, illustrating typical installations of hydraulic shoring, are included just prior to the Tables. The illustrations page is entitled "Aluminum Hydraulic Shoring; Typical Installations."

(d) *Basis and limitations of the data.*

(1) Vertical shore rails and horizontal wales are those that meet the Section Modulus requirements in the D-1 Tables. Aluminum material is 6061-T6 or material of equivalent strength and properties.

(2) Hydraulic cylinders specifications. (i) 2-inch cylinders shall be a minimum 2-inch inside diameter with a minimum safe working capacity of no less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe working capacity of not less than 30,000 pounds axial compressive load at extensions as recommended by product manufacturer.

(3) *Limitation of application.*

(i) It is not intended that the aluminum hydraulic specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be otherwise designed as specified in §1926.652(c).

(ii) When any of the following conditions are present, the members specified in the Ta-

bles are not considered adequate. In this case, an alternative aluminum hydraulic shoring system or other type of protective system must be designed in accordance with §1926.652.

(A) When vertical loads imposed on cross braces exceed a 100 Pound gravity load distributed on a one foot section of the center of the hydraulic cylinder.

(B) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(C) When only the lower portion or a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables D-1.1, D-1.2, D-1.3 and D-1.4.* The members of the shoring system that are to be selected using this information are the hydraulic cylinders, and either the vertical shores or the horizontal wales. When a waler system is used the vertical timber sheeting to be used is also selected from these tables. The Tables D-1.1 and D-1.2 for vertical shores are used in Type A and B soils that do not require sheeting. Type B soils that may require sheeting, and Type C soils that always require sheeting are found in the horizontal wale Tables D-1.3 and D-1.4. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is made. The selection is based on the depth and width of the trench where the members are to be installed. In these tables the vertical spacing is held constant at four feet on center. The tables show the maximum horizontal spacing of cylinders allowed for each size of wale in the waler system tables, and in the vertical shore tables, the hydraulic cylinder horizontal spacing is the same as the vertical shore spacing.

(f) *Example to Illustrate the Use of the Tables:*

(1) *Example 1:*

A trench dug in Type A soil is 6 feet deep and 3 feet wide. From Table D-1.1: Find vertical shores and 2 inch diameter cylinders spaced 8 feet on center (o.c.) horizontally and 4 feet on center (o.c.) vertically. (See Figures 1 & 3 for typical installations.)

(2) *Example 2:*

A trench is dug in Type B soil that does not require sheeting, 13 feet deep and 5 feet wide. From Table D-1.2: Find vertical shores and 2 inch diameter cylinders spaced 6.5 feet o.c. horizontally and 4 feet o.c. vertically. (See Figures 1 & 3 for typical installations.)

(3) A trench is dug in Type B soil that does not require sheeting, but does experience some minor raveling of the trench face. The

trench is 16 feet deep and 9 feet wide. From Table D-1.2: Find vertical shores and 2 inch diameter cylinder (with special oversleeves as designated by footnote #B2) spaced 5.5 feet o.c. horizontally and 4 feet o.c. vertically, plywood (per footnote (g)(7) to the D-1 Table) should be used behind the shores. (See Figures 2 & 3 for typical installations.)

(4) Example 4: A trench is dug in previously disturbed Type B soil, with characteristics of a Type C soil, and will require sheeting. The trench is 18 feet deep and 12 feet wide. 8 foot horizontal spacing between cylinders is desired for working space. From Table D-1.3: Find horizontal wale with a section modulus of 14.0 spaced at 4 feet o.c. vertically and 3 inch diameter cylinder spaced at 9 feet maximum o.c. horizontally. 3x12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(5) Example 5: A trench is dug in Type C soil, 9 feet deep and 4 feet wide. Horizontal cylinder spacing in excess of 6 feet is desired for working space. From Table D-1.4: Find horizontal wale with a section modulus of 7.0 and 2 inch diameter cylinders spaced at 6.5 feet o.c. horizontally. Or, find horizontal wale with a 14.0 section modulus and 3 inch diameter cylinder spaced at 10 feet o.c. horizontally. Both wales are spaced 4 feet o.c. vertically. 3x12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(g) *Footnotes, and general notes, for Tables D-1.1, D-1.2, D-1.3, and D-1.4.*

(1) For applications other than those listed in the tables, refer to §1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to §1926.652(c)(2) and §1926.652(c)(3).

(2) 2 inch diameter cylinders, at this width, shall have structural steel tube (3.5x3.5x0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

(3) Hydraulic cylinders capacities. (i) 2 inch cylinders shall be a minimum 2-inch inside diameter with a safe working capacity of not less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe work capacity of not less than 30,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(4) All spacing indicated is measured center to center.

(5) Vertical shoring rails shall have a minimum section modulus of 0.40 inch.

(6) When vertical shores are used, there must be a minimum of three shores spaced equally, horizontally, in a group.

(7) Plywood shall be 1.125 in. thick softwood or 0.75 inch. thick, 14 ply, arctic white birch (Finland form). Please note that plywood is not intended as a structural member, but only for prevention of local raveling (sloughing of the trench face) between shores.

(8) See appendix C for timber specifications.

(9) Wales are calculated for simple span conditions.

(10) See appendix D, item (d), for basis and limitations of the data.

ALUMINUM HYDRAULIC SHORING TYPICAL INSTALLATIONS

FIGURE NO. 1
VERTICAL ALUMINUM
HYDRAULIC SHORING
(SPOT BRACING)

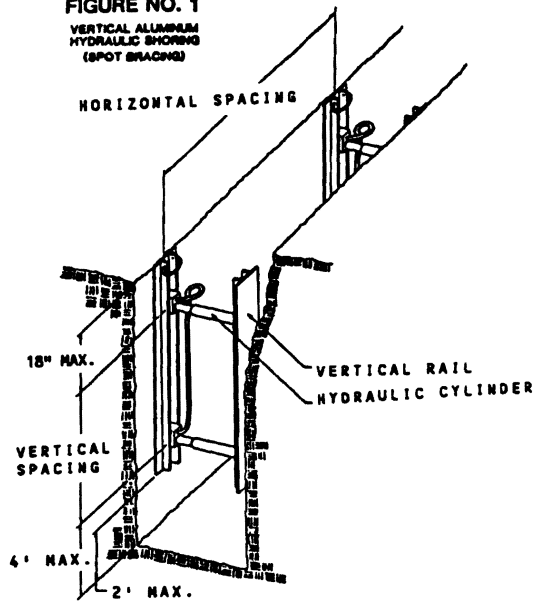


FIGURE NO. 2
VERTICAL ALUMINUM
HYDRAULIC SHORING
(WITH PLYWOOD)

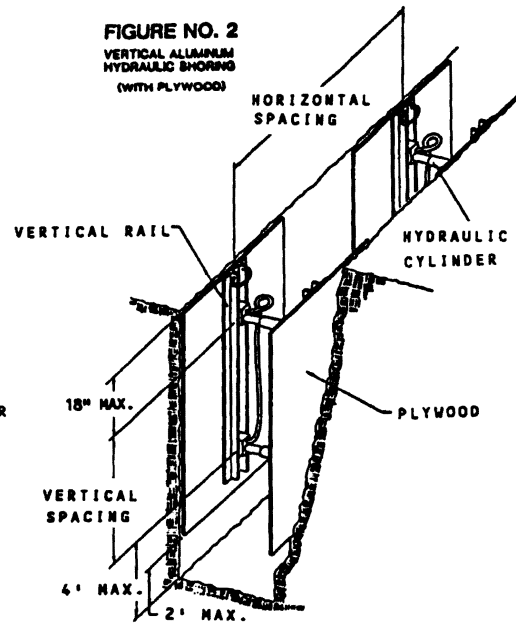


FIGURE NO. 3
VERTICAL ALUMINUM
HYDRAULIC SHORING
(STACKED)

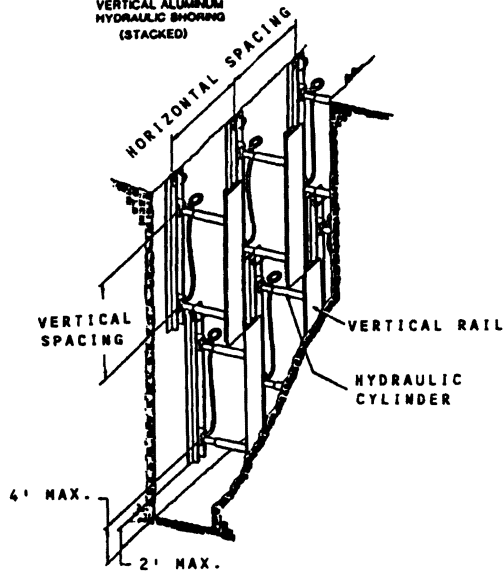
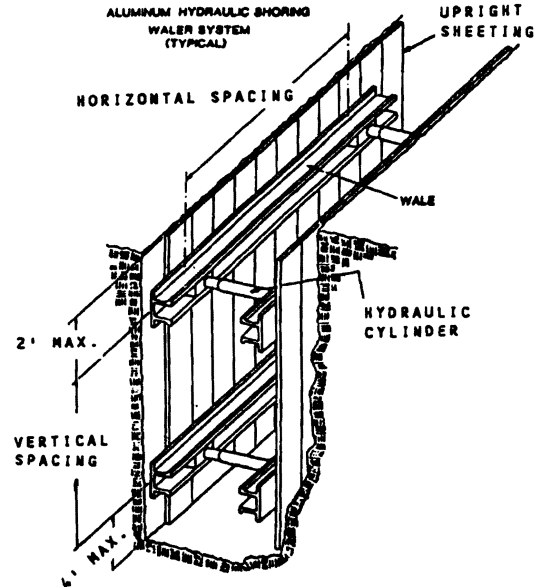


FIGURE NO. 4

ALUMINUM HYDRAULIC SHORING
WALER SYSTEM
(TYPICAL)



**TABLE D - 1.1
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE A**

| DEPTH OF TRENCH (FEET) | HYDRAULIC CYLINDERS | | | | |
|------------------------|-----------------------------------|---------------------------------|------------------------|-----------------------------|------------------|
| | MAXIMUM HORIZONTAL SPACING (FEET) | MAXIMUM VERTICAL SPACING (FEET) | WIDTH OF TRENCH (FEET) | | |
| | | | UP TO 8 | OVER 8 UP TO 12 | OVER 12 UP TO 15 |
| OVER 5 UP TO 10 | 8 | 4 | 2 INCH DIAMETER | 2 INCH DIAMETER NOTE (2) | 3 INCH DIAMETER |
| OVER 10 UP TO 15 | 8 | | | | |
| OVER 15 UP TO 20 | 7 | | | | |
| OVER 20 | NOTE (1) | | | | |

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)

Note (1): See Appendix D, Item (g) (1)

Note (2): See Appendix D, Item (g) (2)

**TABLE D - 1.2
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE B**

| DEPTH OF TRENCH (FEET) | HYDRAULIC CYLINDERS | | | | |
|------------------------|-----------------------------------|---------------------------------|------------------------|-----------------------------|------------------|
| | MAXIMUM HORIZONTAL SPACING (FEET) | MAXIMUM VERTICAL SPACING (FEET) | WIDTH OF TRENCH (FEET) | | |
| | | | UP TO 8 | OVER 8 UP TO 12 | OVER 12 UP TO 15 |
| OVER 5 UP TO 10 | 8 | 4 | 2 INCH DIAMETER | 2 INCH DIAMETER NOTE (2) | 3 INCH DIAMETER |
| OVER 10 UP TO 15 | 6.5 | | | | |
| OVER 15 UP TO 20 | 5.5 | | | | |
| OVER 20 | NOTE (1) | | | | |

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)

Note (1): See Appendix D, Item (g) (1)

Note (2): See Appendix D, Item (g) (2)

**TABLE D - 1.3
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE B**

| DEPTH OF TRENCH (FEET) | WALES | | HYDRAULIC CYLINDERS | | | | | | TIMBER UPRIGHTS | | |
|------------------------|-------------------------|--------------------------------------|------------------------|-------------------|-----------------|-------------------|------------------|-------------------|-------------------------------|-------|-------|
| | VERTICAL SPACING (FEET) | SECTION MODULUS * (IN ³) | WIDTH OF TRENCH (FEET) | | | | | | MAX.HORIZ.SPACING (ON CENTER) | | |
| | | | UP TO 8 | | OVER 8 UP TO 12 | | OVER 12 UP TO 15 | | SOLID SHEET | 2 FT. | 3 FT. |
| | | | HORIZ. SPACING | CYLINDER DIAMETER | HORIZ. SPACING | CYLINDER DIAMETER | HORIZ. SPACING | CYLINDER DIAMETER | | | |
| OVER 5 UP TO 10 | 4 | 3.5 | 8.0 | 2 IN | 8.0 | 2 IN NOTE(2) | 8.0 | 3 IN | — | — | 3x12 |
| | | 7.0 | 9.0 | 2 IN | 9.0 | 2 IN NOTE(2) | 9.0 | 3 IN | | | |
| | | 14.0 | 12.0 | 3 IN | 12.0 | 3 IN | 12.0 | 3 IN | | | |
| OVER 10 UP TO 15 | 4 | 3.5 | 6.0 | 2 IN | 6.0 | 2 IN NOTE(2) | 6.0 | 3 IN | — | 3x12 | — |
| | | 7.0 | 8.0 | 3 IN | 8.0 | 3 IN | 8.0 | 3 IN | | | |
| | | 14.0 | 10.0 | 3 IN | 10.0 | 3 IN | 10.0 | 3 IN | | | |
| OVER 15 UP TO 20 | 4 | 3.5 | 5.5 | 2 IN | 5.5 | 2 IN NOTE(2) | 5.5 | 3 IN | 3x12 | — | — |
| | | 7.0 | 6.0 | 3 IN | 6.0 | 3 IN | 6.0 | 3 IN | | | |
| | | 14.0 | 9.0 | 3 IN | 9.0 | 3 IN | 9.0 | 3 IN | | | |
| OVER 20 | NOTE (1) | | | | | | | | | | |

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)

Notes (1): See Appendix D, item (g) (1)

Notes (2): See Appendix D, Item (g) (2)

* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

**TABLE D - 1.4
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE C**

| DEPTH OF TRENCH (FEET) | WALES | | HYDRAULIC CYLINDERS | | | | | | TIMBER UPRIGHTS | | |
|------------------------|-------------------------|------------------------------------|------------------------|-------------------|-----------------|-------------------|------------------|-------------------|--------------------------------|-------|-------|
| | VERTICAL SPACING (FEET) | SECTION MODULUS (IN ³) | WIDTH OF TRENCH (FEET) | | | | | | MAX. HORIZ SPACING (ON CENTER) | | |
| | | | UP TO 8 | | OVER 8 UP TO 12 | | OVER 12 UP TO 15 | | SOLID SHEET | 2 FT. | 3 FT. |
| | | | HORIZ. SPACING | CYLINDER DIAMETER | HORIZ. SPACING | CYLINDER DIAMETER | HORIZ. SPACING | CYLINDER DIAMETER | | | |
| OVER 5 UP TO 10 | 4 | 3.5 | 6.0 | 2 IN | 6.0 | 2 IN NOTE(2) | 6.0 | 3 IN | 3x12 | — | — |
| | | 7.0 | 6.5 | 2 IN | 6.5 | 2 IN NOTE(2) | 6.5 | 3 IN | | | |
| | | 14.0 | 10.0 | 3 IN | 10.0 | 3 IN | 10.0 | 3 IN | | | |
| OVER 10 UP TO 15 | 4 | 3.5 | 4.0 | 2 IN | 4.0 | 2 IN NOTE(2) | 4.0 | 3 IN | 3x12 | — | — |
| | | 7.0 | 5.5 | 3 IN | 5.5 | 3 IN | 5.5 | 3 IN | | | |
| | | 14.0 | 8.0 | 3 IN | 8.0 | 3 IN | 8.0 | 3 IN | | | |
| OVER 15 UP TO 20 | 4 | 3.5 | 3.5 | 2 IN | 3.5 | 2 IN NOTE(2) | 3.5 | 3 IN | 3x12 | — | — |
| | | 7.0 | 5.0 | 3 IN | 5.0 | 3 IN | 5.0 | 3 IN | | | |
| | | 14.0 | 6.0 | 3 IN | 6.0 | 3 IN | 6.0 | 3 IN | | | |
| OVER 20 | NOTE (1) | | | | | | | | | | |

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)

Notes (1): See Appendix D, item (g) (1)

Notes (2): See Appendix D, Item (g) (2)

* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

APPENDIX E TO SUBPART P OF PART 1926—ALTERNATIVES TO TIMBER SHORING

Figure 1. Aluminum Hydraulic Shoring

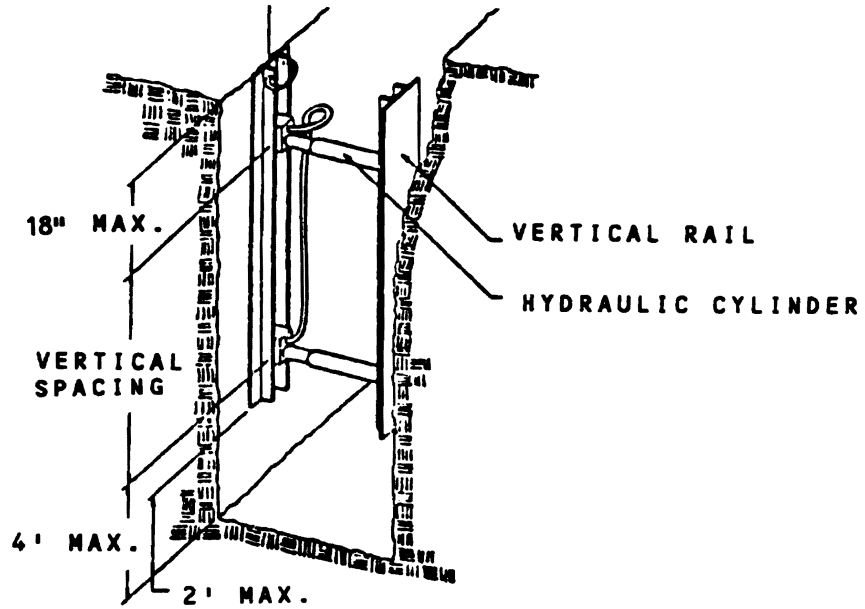


Figure 2. Pneumatic/hydraulic Shoring

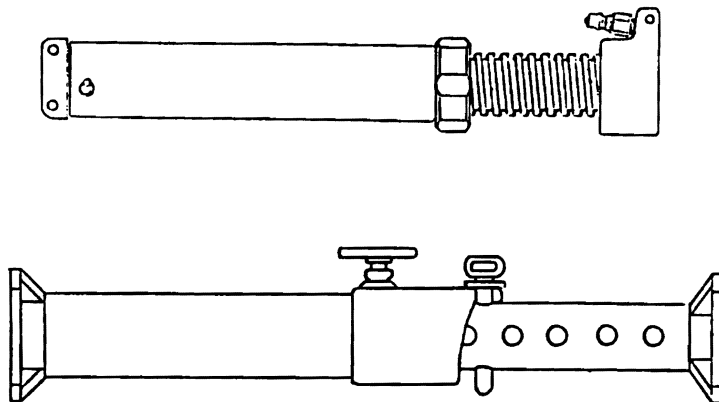


Figure 3. Trench Jacks (Screw Jacks)

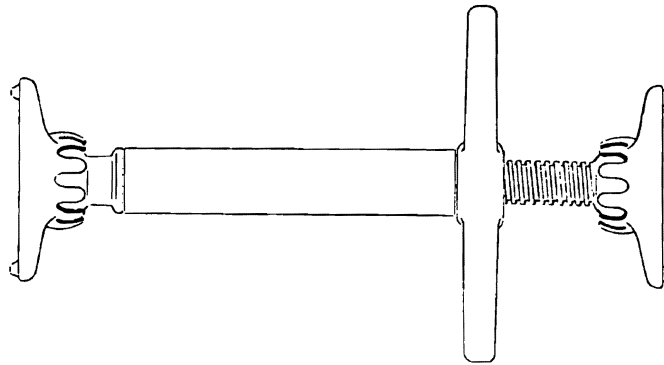
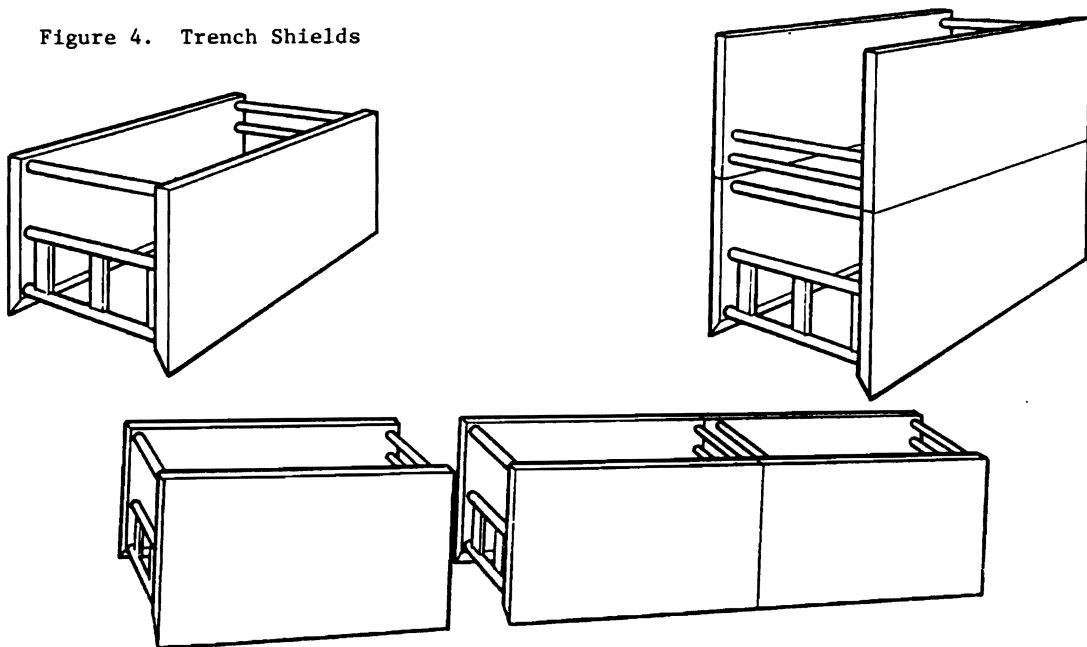


Figure 4. Trench Shields



APPENDIX F TO SUBPART P OF PART 1926—SELECTION OF PROTECTIVE SYSTEMS

The following figures are a graphic summary of the requirements contained in sub-

part P for excavations 20 feet or less in depth. Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional engineer in accordance with §1926.652 (b) and (c).

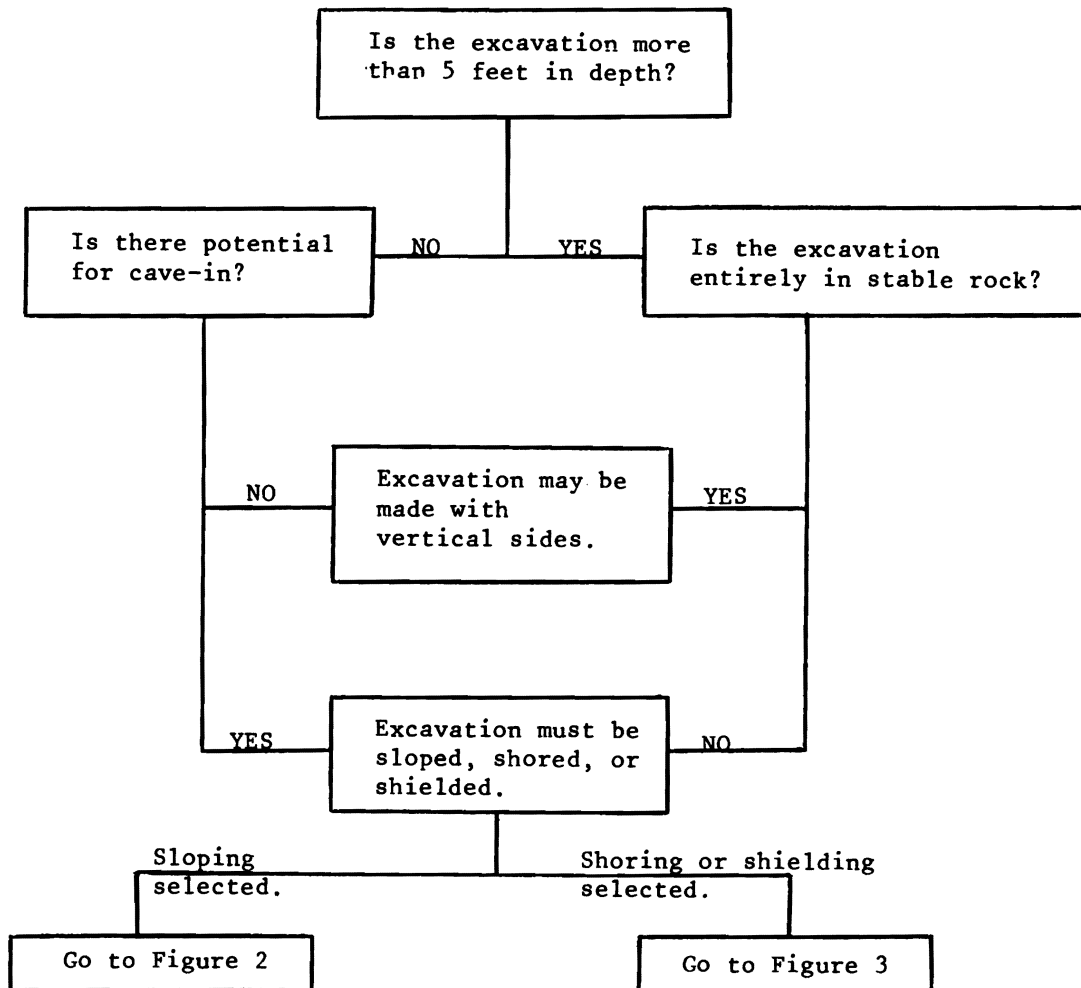


FIGURE 1 - PRELIMINARY DECISIONS

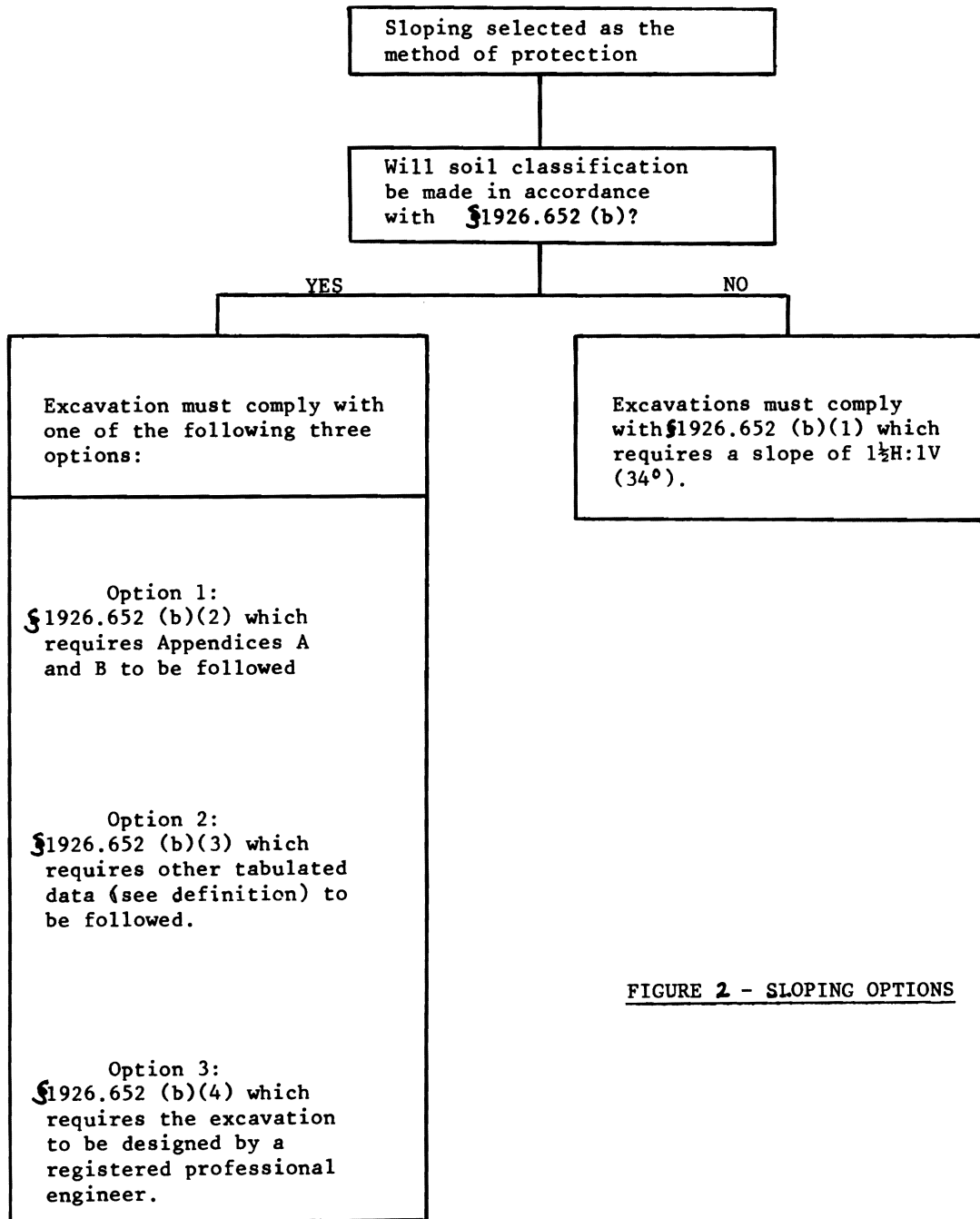


FIGURE 2 - SLOPING OPTIONS

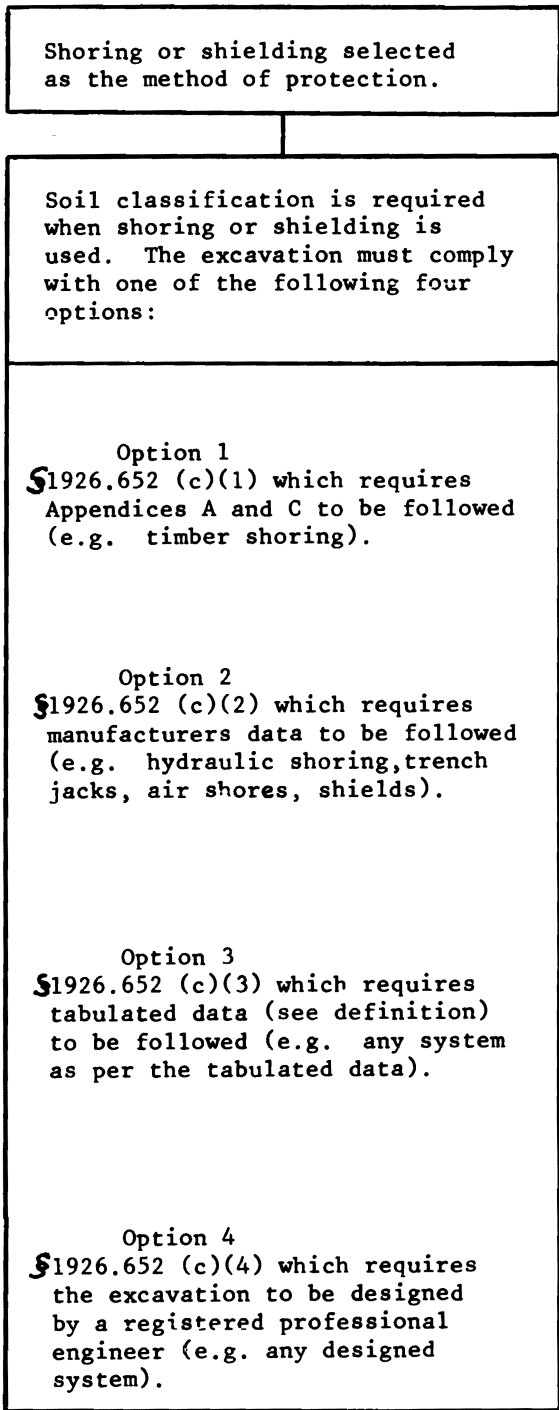


FIGURE 3 - SHORING AND SHIELDING OPTIONS

SECTION 02315

TRENCH EXCAVATION, BACKFILL, AND COMPACTING

PART 1. GENERAL

1.01 SUMMARY

- A. Work of this Section also includes:
 - 1. Replacing topsoil that contains regenerative material.
 - 2. Disposal of trees, stumps, brush, roots, limbs, and other waste materials from clearing operations.
 - 3. Imported topsoil.
 - 4. Crush rock backfill required by over-excavation.
 - 5. Imported pipe zone material.
 - 6. Trench settlement repair, including replacing roadway surfacing, sidewalk, or other structures.
 - 7. Replacing damaged culverts.
- B. Trench excavation is classified as common excavation and includes removal of material of whatever types encountered to depths shown or as directed by Engineer.
- C. Pipe zone includes full width of excavated trench from 4" below bottom of pipe to a point 6" above top outside surface of pipe barrel.
- D. Conform to federal, state, and local codes governing safe loading of trenches with excavated material.
- E. The right is reserved to modify the use, location, and quantities of the various types of backfill during construction as Engineer considers to be in the best interest of Owner.
- F. There shall be no additional payment for rock excavation.

1.02 RELATED SECTIONS

- A. Section 02532 – Polyvinyl Chloride (PVC) Sewer Pipe.

1.03 REFERENCES

- A. Arkansas Highway and Transportation Department, P.O. Box 2261, Little Rock, Arkansas 72203
 - 1. AHTD 303 – Aggregate Base Course.
- B. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
 - 1. ASTM D448 – Classifications for Standard Sizes of Aggregate and Bridge Construction.

2. ASTM D698 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, using 5.5-lb. (2.49-kg.) Rammer and 12" (304.8-mm) Drop.
 3. ASTM D1557 – Test Methods for Moisture –Density Relations of Soils and Soil-Aggregate Mixtures, Using 10-lb. (4.54-kg.) Rammer and 18" (457-mm) Drop.
 4. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- C. Occupational Safety and Health Administration (OSHA) Standard for Excavation and Trenches Safety System, 29 CFR 1926, Subpart P = Excavations.
 - D. The Contractor shall be solely responsible for trench and excavation safety systems in accordance with Act 291 of 1993.

PART 2. PRODUCTS

2.01 FOUNDATION STABILIZATION

- A. Crushed gravel or crushed rock, free from dirt, clay balls, or organic material, well graded from coarse to fine, containing sufficient finer material for proper compactions, and meeting ASTM D448 Size No. 67 (Concrete Aggregate).

2.02 PIPE ZONE MATERIAL

- A. Select native material shall consist of fine loose earth or sand free from clods or rocks larger than $\frac{3}{4}$ " in dimension and of proper moisture content for maximum consolidation.
- B. Crushed granular material conforming to ASTM D448, Size No. 67.
- C. Washed stone bedding size $\frac{1}{4}$ " to $\frac{3}{4}$ ".

2.03 COMMON FILL MATERIALS

- A. Material shall not contain pieces larger than 3", and shall be free of roots, debris, or organic matter.

2.04 BEDDING MATERIAL

- A. Pea gravel, sand, or other locally available bedding material, as approved.
- B. Bedding material shall be a maximum of $\frac{3}{4}$ " angular rock and $1\frac{1}{2}$ " rounded rock.

2.05 TRENCH BACKFILL

- A. Granular Backfill:
 1. Natural or artificial mixture of gravel and soil mortar uniformly well graded from coarse to fine.
 2. AHTD Section 303 Class 3, Class 4, or Class 7 as specified in this Section.

2.06 PVC GRAVITY PIPE TRENCH

- A. Refer to Drawings for trench details.

2.07 COMPACTION EQUIPMENT

- A. Suitable type and adequate to obtain the amount of compaction specified.
- B. Operate in strict accordance with manufacturer's instructions and recommendations and maintain conditions so that it delivers manufacturer's rated compactive effort.

2.08 IMPORTED TOPSOIL

- A. Suitable sandy loam from an approved source.
- B. Possess friability and a high degree of fertility.
- C. Free of clods, roots, gravel, and other inert material.
- D. Free of quackgrass, horsetail, and other noxious vegetation and seed.

PART 3. EXECUTION

3.01 PREPARATION

- A. Where clearing or partial clearing of right-of-way is necessary, complete prior to start of trenching.
- B. Cut trees and brush as near to surface of ground as practicable, remove stumps, and pile for disposal.
- C. Do not permit excavated materials to cover brush or trees prior to disposal.

3.02 DISPOSAL OF CLEARED MATERIAL

- A. Dispose of cleared materials in a manner that meets or exceeds requirements of state, county, and local regulations regarding health, safety, and public welfare.
- B. Dispose of nonflammable and flammable material off the construction site in an approved location.
- C. Do not leave material on the Project site, shove onto abutting private properties, or bury in embankments or trenches.

3.03 REMOVAL OF OBSTRUCTIONS

- A. Remove obstructions within trench area or adjacent to trench area, such as tree roots, stumps, abandoned piling, logs, and debris.
- B. Engineer may, if requested, make changes in the trench alignment to avoid major obstructions, if such alignment changes can be made within the easement or right-of-way without adversely affecting the intended function of the facility.
- C. Dispose of obstructions in accordance with this Section.

3.04 REMOVAL AND REPLACEMENT OF TOPSOIL

- A. Where trenches cross lawns, garden areas, pasturelands, cultivated fields, or other areas on which reasonable topsoil conditions exist, remove topsoil for a depth of 6" for full width of trench to be excavated.
- B. Use equipment capable of removing a uniform depth of material, such as a scraper or motor grader; a backhoe shall not be considered suitable.
- C. Stockpile removed topsoil at regular intervals, and do not mix with other excavated material.
- D. Locate stockpiles so that material of one ownership is not transported and stockpiled on property of another ownership.
- E. Minimum Finished Depth of Topsoil over Trenches: 5".
- F. Imported topsoil may be substituted for stockpiling and replacing topsoil.
- G. Maintain finished grade of topsoil level with area adjacent to trench until final acceptance by Engineer.
- H. Repair damage to adjacent topsoil caused by work operations.
 - 1. Remove rock, gravel, clay, and other foreign materials from the surface.
 - 2. Regrade.
 - 3. Add topsoil as required.

3.05 TRENCH WIDTH

- A. Minimum width of unsheeted trenches where pipe is to be laid shall be 18" greater than the outside diameter of the pipe or as approved.
- B. Maximum width at top of trench shall not be limited, except where excess width of excavation would cause damage to adjacent structures or property or cause undue stresses on the pipe.
- C. Confine trench widths to dedicated rights-of-way or construction easements, unless special written agreements have been made with affected property owners.

3.06 EXCAVATION

- A. Material excavated is defined as unclassified excavation regardless of the material encountered.
- B. Excavate trench to lines and grades shown or as established by Engineer with proper allowance for pipe thickness and for pipe base or special bedding when required.
- C. If trench is excavated below required grade, correct with foundation stabilization material.
- D. Place material over full width of trench in compacted layers not exceeding 6" deep to established grade with allowance for pipe base or special bedding.

3.07 PREPARATION OF TRENCH – LINE AND GRADE

- A. Do not deviate more than 1/2" from line or 1/2" from grade. Measure for grade at the pipe invert, not at the top of the pipe, because of permissible variation in pipe wall thickness.
- B. Grade the bottom of the trench by hand to the line and grade where the pipe is to be laid, with proper allowance for pipe thickness and for pipe base when specified or indicated.
- C. Remove hard spots that would prevent a uniform thickness of bedding.
- D. Check the grade with a straightedge and correct irregularities found.
- E. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of lifting tackle.

3.08 SHORING, SHEETING, AND BRACING OF TRENCHES

- A. Sheet and brace trench when necessary to prevent caving during excavation in unstable material or to protect adjacent structures, property, workers, and the public.
- B. Increase trench widths accordingly by the thickness of the sheeting.
- C. Maintain sheeting in place until pipe has been placed and backfilled at pipe zone.
- D. Remove shoring and sheeting as backfilling is done in a manner that will not damage pipe or permit voids in backfill.
- E. Conform to safety requirements of federal, state, or local public agency having jurisdiction for sheeting, shoring, and bracing of trenches; the most stringent of these requirements shall apply.

3.09 LOCATION OF EXCAVATED MATERIALS

- A. Place excavated material only within construction easement, right-of-way, or approved working area.
- B. Do not obstruct private or public traveled roadways or streets.

3.10 REMOVAL OF WATER

- A. Provide and maintain ample means and devices to promptly remove and dispose of water entering trench during time trench is being prepared for pipe laying, during laying of pipe, and until backfill at pipe zone is completed.
 - 1. These provisions apply during the noon hour as well as overnight.
 - 2. Provide necessary means and devices, as approved, to positively prevent water from entering the construction area of another contractor.
- B. Dispose of water in a manner to prevent damage to adjacent property.
- C. Drainage of trench water through the pipeline under construction is prohibited.

3.11 FOUNDATION STABILIZATION

- A. When existing material in bottom of trench is unsuitable for supporting pipe, excavate unsuitable material.
- B. Backfill trench to subgrade of pipe base with foundation stabilization material specified.
- C. Place foundation stabilization material over the full width of trench and compact in layers not exceeding 6" deep to required grade by making passes with a vibratory compactor (or equivalent).
- D. Material shall be considered unsuitable when it contains more than 5% organic material by volumetric sampling or when it will not support a reading of 1.5 on a hand penetrometer.

3.12 ROCK IN PIPE TRENCH

- A. Where rock is encountered in bottom of trench, support pipe on bedding material.
- B. Minimum Bedding Thickness: 4" or one-eighth of the outside diameter of pipe, minimum.
- C. Extend bedding up pipe sides one-sixth of outside diameter of the pipe, minimum.
- D. Backfill over pipe according to pipe zone type.

3.13 PIPE ZONE BACKFILL

- A. Depth of the pipe zone above pipe barrel varies with pipe material.
- B. Particular attention shall be given to area of pipe zone from flow line to centerline of pipe to ensure firm support is obtained to prevent lateral movement of pipe during final backfilling of pipe zone.
- C. Backfill area of pipe zone from bottom of pipe to horizontal centerline of pipe by hand-placing material around pipe in 4" layers.
- D. Achieve continuous support beneath pipe haunches by "walking in" and slicing with shovel.
- E. Backfill area of pipe zone from horizontal centerline to top of pipe zone with pipe zone material as shown in trench details on Drawings.

3.14 TRENCH BACKFILL ABOVE PIPE ZONE

- A. When backfill is placed mechanically, push backfill material onto slope of backfill previously placed and allow to slide down into trench.
- B. Do not push backfill into trench in a way to permit free fall of material until at least 2' of cover is provided over top of pipe.
- C. Under no circumstances allow sharp, heavy pieces of material to drop directly onto pipe or tamped material around pipe.
- D. Do not use backfill material of consolidated masses larger than 1/2 cubic foot.
- E. Backfill under improved surfaces (i.e. – concrete, asphalt, or gravel surfaces) shall be full depth gravel, Class 7.

3.15 EXCESS EXCAVATED MATERIAL

- A. Dispose of excess excavated material off project site in an approved area.

3.16 DRAINAGE CULVERTS

- A. Replace drainage culverts that are removed on near right angles to pipe centerline.
- B. If pipe cannot be reused or is damaged during removal, dispose of it and provide new pipe.
- C. Protect culverts from damage or restore to equivalent condition.
- D. Replace culverts to existing lines and grades.
- E. Do not replace culverts until proposed pipeline is installed and backfill of trench has been completed to subgrade of culvert.

3.17 PIPE COVER

- A. Place select material from excavation over pipe to provide minimum coverage, as shown on Drawings or as directed by Engineer.

3.18 DRAINAGE DITCH RESTORATION

- A. Undercrossings of minor drainage ditches not covered in another Specification Section shall be backfilled so that upper 1' of material in ditch between ditch banks is clay.
- B. Compact material for full ditch width by six (6) passes of vibratory compactor (or equivalent).
- C. Where indicated on Drawings, provide concrete arch, or rip rap on ditch banks.

3.19 SETTLEMENT

- A. Correct settlement noted in backfill, fill, or in structures built over backfill or fill within warranty period.

3.20 IMPORTED TOPSOIL

- A. Should regenerative material be present in soil, remove both surface and root that appears within 1-year following acceptance of Project in a manner satisfactory to Owner.

END OF SECTION

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SECTION 02510

GENERAL PIPING REQUIREMENTS

PART 1. GENERAL

1.01 WORK INCLUDED

- A. This section provides requirements for furnishing and installing piping for facilities. Refer to related work specified in other sections to coordinate the complete installation.
- B. All piping is identified on the drawings by its size and service. Unless noted otherwise, pipe, fittings, and general purpose valves shall conform to those specified in the piping system specification sheet for that service. The piping system specification sheets are in alphabetical order at the end of this section. All special valves and other appurtenances shall be as specified herein.

1.02 RELATED WORK

- A. Division 1 - General
- B. Division 2 - Site Work
- C. Division 3 - Concrete
- D. Division 15 - Mechanical

1.03 PROJECT RECORD DOCUMENTS

- A. Upon completion of all work, furnish prints and tracings showing locations and principal details and modifications of piping systems as built.
- B. Furnish all information on buried piping and utilities encountered during construction.

1.04 SUBMITTALS

- A. Submit product data and shop drawings on each type of pipe, valves, fittings, fabricated piping, miscellaneous appurtenances, and accessories in accordance with Section 01330.

1.05 WELDERS CERTIFICATION

- A. Employ welders qualified by current certification in the positions required, to perform welding operations per American Welding Society requirements. Contractor shall submit documentation for all welders on the job.

PART 2. PRODUCTS

2.01 PIPING

All newly installed pipes and related products must conform to ANSI/NSI Standard 61 and must be certified by an organization associated with ANSI. All piping shall be manufactured

in the United States. No foreign made pipe or fittings shall be allowed on this project.

A. Ductile Iron Pipe

1. Ductile iron pipe shall conform to the requirements of AWWA C-150 and AWWA C-151. Pipe installed above ground or within underground structures will be thickness Class 53 (minimum) for flanged or grooved end pipe. Pipe installed underground will be thickness Class 51 (minimum) for slip-joint pipe with "polywrap" coating applied per the manufacturer's guidelines.

B. Steel Pipe

1. Black steel pipe for pressure less than 150-psi ambient temperatures shall be ASTM A 53 (ANSI B 125.1) or ASTM A 135 (ANSI B125.3), grade B seamless (smaller than 24") or electric-resistance welded (for 24" and larger) black steel or hot dipped galvanized standard weight unless otherwise noted.
2. Stainless steel pipe shall be ASTM A 312 (ANSI B135), Grade TP 304L seamless and welded stainless pipe.

C. Polyvinyl Chloride Pipe (PVC)

1. PVC pipe shall be Type 1, grade 1, manufactured in accordance with ASTM D 1785 (ANSI B72.7) and ASTM D 1784. Underground pressure piping shall meet ASTM D2241-SDR 21 rated at 200-psi or AWWA C900 Class 100 DR-25 or AWWA C900 Class 150 DR-18 or UNI-BELL B-11-DR-25 or better. Gravity sewer lines shall meet ASTM D3034-SDR 35 or ASTM F789-PS46 or ASTM F679-PS46. For water treatment plant sites: all sewer lines shall be AWWA C900 Class 150 DR-18.

Perforated PVC pipe shall meet ASTM F758-PS46.

2. All PVC pipe shall be manufactured from virgin plastic.

D. Reinforced Concrete Culvert Pipe

1. All reinforced concrete pipe to be used for culverts shall comply with ASTM C76, Class III.

E. Fiberglass Reinforced Polyester Pipe

1. All fiberglass reinforced polyester pipe to be used for culverts shall comply with ASTM D3262 and be a minimum stiffness class (SN) of 36.
2. All fiberglass reinforced polyester pipe to be used for pressured systems or force mains shall comply with AWWA C950 or ASTM D3754 and be a minimum stiffness class (SN) of 36.

F. Copper tubing

1. All copper tubing for water service lines shall be type "K" and shall conform to ASTM Standard "Seamless Copper Water Tube" B1785, latest revision.

2.02 UNIONS

A. Malleable Iron Unions

1. Use 150-pound standard (300-pound WOG) malleable iron, ground joint unions with bronze seat. Provide flanged union joints on piping 2½" and larger. Use service galvanized unions for galvanized pipe. Use insulating unions where indicated or required where joining dissimilar metals.

B. Polyvinyl Chloride (PVC) Unions

1. Use Schedule 80 threaded PVC unions.

2.03 COUPLINGS, GASKETS, AND FITTINGS

A. Flanges, Gaskets and Bolts

Cast iron flanges shall conform to ANSI B16.1. Flange gaskets shall be full-face type, suitable for the intended service. Substitution of other gasket materials shall be only with the express written consent of the Engineer. Thickness shall be 1/16" for pipe 10" and less and 1/8" for larger pipe. Flange assembly bolts shall be standard square head carbon steel machine bolts with heavy, hot pressed, hexagon nuts, ANSI B18.2. Threads shall conform to ANSI B1.1, coarse thread series, Class 2 fit. Bolt length shall be such that after joints are made up the bolt shall protrude through the nut, but not more than 1/2". Bolts for use in submerged service shall be galvanized. All screwed flanges on cast iron pipe shall be refaced, as required, after fabrication to ensure that pipe ends are flush with face of flange.

Forged steel flanges shall conform to ANSI B16.5, R.F. Flange gaskets shall match raised faces. On 3½" flanges and smaller, gaskets shall be 1/16" thick. On 4" flanges and larger, gaskets shall be 1/8" thick. Flange assembly bolts shall be standard square head carbon steel machine bolts with heavy, hot pressed hexagon nuts, ANSI B18.2. 150-psi steel flanges may be bolted to cast iron valves, fittings or other parts, having either integral Class 125 cast iron flanges or screwed Class 125 companion flanges. When such construction is used, the raised face on the steel flange shall be removed.

B. Pipe Threads

Unless noted otherwise, all pipe threads shall conform in dimensions and limits of size to ANSI B2.1, taper joint thread.

C. Flange Coupling Adapters

Flanged coupling adapters shall be Smith Blair 912-913 or approved equal. Coupling gaskets shall be as recommended by the coupling manufacturer for the service intended.

D. Mechanical Pipe Couplings

Mechanical pipe couplings shall be Smith Blair #441 or approved equal. Coupling gaskets shall be as recommended by the coupling manufacturer for the service intended. Mechanical pipe couplings for buried cast or ductile iron shall be ductile iron couplings.

E. Compression Fittings

Compression fittings for copper pipe shall be Dresser Style 88, McDonald, or approved equal.

F. Joints

Joints of mechanical installations inside structures, and of yard piping shall be as detailed on the Plans. Where not detailed on the Plans, such joints shall be mechanical type or push-on type, except that the first joint outside of buildings shall be mechanical type, and pipelines installed under structures shall be a mechanical joint pipe.

All other joints shall be mechanical type or push-on type. Lubricant for push-on type shall be that recommended by the manufacturer of the pipe.

G. Provide gaskets of neoprene, unless otherwise noted.

H. Provide full face gaskets or flat faced and ring gaskets for raised face flanges. Use 1/16" thick gaskets for pipe smaller than 6" and 1/8" thick gaskets for pipe 6" and larger. Gasket dimension shall conform to ANSI B16.21.

I. Provide insulating flange gasket kit where indicated or required where joining dissimilar metals or pipe materials.

2.04 VALVES

A. General

Valves shall be as specified in Section 15110, Manually Operated Valves, or as specified herein. A union or flanged connection shall be provided within 2' of each threaded end valve unless the valve can be otherwise easily removed from the piping. Unless otherwise indicated, the direction of rotation of the valve operating wheel, wrench nut, or lever shall be to the left (counterclockwise) to open the valve.

All valves, except those which are equipped with power operators shall be provided with manual operators. Unless otherwise specified, each manual operator shall be equipped with an operating wheel.

Chain wheels and operating chains shall be provided on all valves 4" and larger with centerline more than 7'6" above the floor except where other operator types are specifically required. Each chain wheel operated valve shall be equipped with a chain guide which will permit rapid handling of the operating chain without "gagging" of the wheel and will also permit reasonable side pull on the chain. Operating chains shall be heavily plated with zinc or cadmium and shall be looped to extend to within 4' of the floor below the valve. Where recommended by the manufacturer, the operator shall be provided with a hammer blow wheel.

Wrench nuts shall be provided on all buried valves, on all valves which are to be operated through floor boxes, and where shown. All wrench nuts shall comply with Section 20 of AWWA C-500. Not less than two operating keys shall be provided for operation of the wrench nut operated valves.

For all valves buried at a depth of greater than 3', an extension stem shall be provided to bring the operating nut within 3' of the finished elevation.

B. Gate Valves

The bearing, moving, or wearing parts of all gate valves shall be either of solid bronze or faced with bronze. Bronze facings shall be securely fastened to the iron castings. On valves 12" and smaller, all wedging surfaces may be Grade I, II, or III bronze to iron, but not iron to iron. All material shall be of the best quality and especially adapted for the service required, and workmanship shall be first class in all respects.

Gate valves shall conform to the current specifications of the American Water Works Association and shall be designed for a minimum water working pressure of 150-psi, unless otherwise specified on the Plans. Gate valves shall have a clear water way equal to the full nominal diameter of the valve and shall be opened by turning to the left. Each valve shall have the maker's initials, pressure rating, and year in which the manufacturer cast the body. Each valve shall have a non-rising stem, unless otherwise shown on the Plans.

All valves shall be equipped with "O" ring stem seals. Valves located inside structures shall be wheel operated, unless otherwise shown on the Plans. Valves in the ground shall be nut-operated. Gate valves located outside of structures shall be mechanical joint, or special rubber gasket joint, unless otherwise specified.

Except as may be otherwise approved by the Engineer, all gate valves required for this Contract shall be from one manufacturer, and similar types and sizes shall be identical and the parts interchangeable.

C. Ball Valves

Ball valves may be used in piping systems 2" in diameter and smaller. Valves shall be plastic or steel for line pressure up to 100-psi and steel for line pressures over 100-psi. Plastic ball valves shall be constructed from thermoplastic polyvinyl chloride. Valves shall be of the cartridge type, with locked-in seal carriers, ethylene propylene rubber

"O" ring seals, and Teflon seats. Valves shall be double entry, true-union threaded and coupled. Where shown on the Plans, furnish flanged valves with 125-psi flanges. Plastic ball valves shall be as manufactured by Balon Corporation, Oklahoma City, OK, or approved equal.

Steel ball valves shall be of 2-piece construction with internally seated stem. Provide precision machined mating surfaces, stem stop integral with body, and multi-seal seats. Ball shall be plated and polished. Provide each valve with lever operator. Steel ball valves designed for general service applications up to 1000-lbs. working pressure shall be as manufactured by Balon Corporation, or equal.

D. Valve Marking

All exposed valves shall be tagged with identifying numbers as shown on the Drawings. Tags shall be 2" diameter brass, Style No. 300-BL as manufactured by Seton Name Plate Corporation, or approved equal. Tags shall be fastened with brass chain and "S" hooks.

E. Backflow Preventers

Backflow preventers shall be of the reduced pressure principal type conforming to the applicable requirements of AWWA C-506, and shall be as manufactured by Watts or FEBCO.

F. Valve Boxes

Cast iron valve boxes extending to the finished or established ground or paved surfaces shall be provided for all buried valves. They shall have suitable base castings to fit properly over the bonnets of their respective valves and heavy top sections with stay-put covers. Boxes shall be of the screw or sliding type having 5¼" shaft diameter or greater. Covers shall be marked with the class of service. A concrete pad 1'6" x 1'6" x 4" thick shall be poured around the valve boxes.

2.05 FREEZE PROTECTION

All exposed piping, valves, or equipment shall be provided with freeze protection. The freeze protection shall consist of copper sheath, resistance type heating cable and 1" of insulation. The heating cable shall be designed to keep the contained fluid 50°F above ambient temperature. The heating cable shall be suitable for 110 V, single phase operation and ON-OFF switches for the tape shall be provided at each area of piping or equipment. The insulation shall be as specified except that preformed insulation must be oversized to allow for the heating cable.

PART 3. COATINGS AND LININGS

3.01 GENERAL

- A. Coatings and linings are specified on the piping system specification sheets and shall conform to this section.

3.02 CEMENT MORTAR LINING

- A. Cement mortar lining shall be for cast or ductile iron pipe and fittings and shall be standard thickness lining conforming to AWWA C104 (ANSI A241.4).

3.03 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement for all buried cast or ductile iron pipe, fittings, and valve shall conform to AWWA C105 (ANSI A21.5).

3.04 EXTRUDED PLASTIC COATING

- A. Extruded plastic coating for steel pipe shall be a high density polyethylene, or polypropylene copolymer, extruded to cover an adhesive first coat, to form a combined adhesive-extruded thermoplastic resin coating conforming to Federal Specification L-C 530B, Type 1. The first coat shall consist of rubber, asphalt, fluxing oil, and high molecular weight resin. Extruded plastic coatings shall have a minimum combined thickness of adhesive and thermoplastic of 33-mils for pipe up to and including 2" nominal diameter, 37-mils up to 3", 42-mils up to 5", and 46-mils for all pipe larger than 5" nominal diameter. Joints, for pipe and fittings having extruded plastic coating, shall be covered by plastic sleeves fabricated from radiation cross-linked, semi-rigid polyethylene, coated on the inside with a specifically formulated thixotropic adhesive, which when heated, shall shrink to encapsulate the joint with a strong impervious seal.

3.05 GALVANIZING

- A. Galvanizing shall be in accordance with ASTM A153.

3.06 PIPE SUPPORTS

- A. All exposed piping shall be supported in conformance with the pipe support and structural attachment details per the plans.

3.07 PIPE INSULATION

- A. All above-ground outdoor piping shall be insulated with 2" J-M650 Micro-lok fiberglass pipe insulation material or equal. This material shall be covered with ASJ and stapled into place with outward clinching staples 2" O.C. Fittings and valves shall be covered with the same material and sealed with Childers CP-11 weather proofing. All insulation shall be weatherproofed with a jacket of 0.016" smooth aluminum held in place with stainless steel screws 6" O.C. Fittings shall be weatherproofed with premolded PABCD fitting covers or equal.

3.08 JOINT RESTRAINT

- A. Joint restraint shall be provided at ALL buried fittings. The joint restraint systems shall be as manufactured by EBAA Iron for 3" and larger and MIDCO for 2" or approved equal. All elbows, reducers, and laterals of all tees shall have EBAA Megalug or MIDCO restraint. Laterals with swivel glands will be excluded. Size and number shall be as shown or the minimum recommended by the manufacturer for the pipe size and service.

3.09 PROTECTION OF BURIED STEEL PIPE, VALVES, AND APPERTENANCES

- A. All steel pipe installed underground shall be protected as specified. All buried valves, flanges, mechanical joints and mechanical pipe couplings shall be protected with a built-up asphalt mastic coating covered with a protective tape wrap. Surfaces shall be cleaned by wire brushing immediately prior to application of the mastic. The mastic shall be molded firmly to encase all bolts, nuts and flanges, and built up to a uniform surface over entire fitting. The build-up surface shall be covered with a protective tape wrap. Materials shall be applied in full accordance with manufacturer's recommendations. Coating shall be Type M-1 (LT) Denso Plast with Denso (LT) tape, Protectowrap tap, or approved equal.

PART 4. EXCAVATION

4.01 PIPE EMBEDMENT FOR PVC PIPE

- A. Pipe embedment shall consist of bedding, haunching, and initial backfill materials as shown on the standard detail sheets of the Plans. The class of material to be used below and above the pipe and placement and compaction of embedment materials shall conform to the requirements shown on the Plans and to the following specifications:
- B. Embedment Materials: The following are descriptions of the classifications of embedment materials which may be used for pipe embedment as shown on the standard detail sheets of the Plans:
 - 1. Class I: Angular graded stone ($\frac{3}{4}$ " maximum), including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
 - 2. Class II: Fine sand and clayey gravels, including fine sands, sand/clay mixtures, and gravel/clay mixtures.

Where approved by the Engineer, good sound earth may be classified as Class II embedment. Good sound earth is defined as gravel, sand, sandy loam, or loam free from excessive clay and silt.

- C. Bedding Placement and Composition: Prior to pipe installation, carefully bring the bedding material to grade along the entire length of the pipe to be installed. To ensure that adequate and uniform support is provided under the pipe and to avoid

differential settlement of the pipe, certain procedures should be adhered to and precautions taken as outlined herein. Blocking shall not be used to bring the pipe to grade.

1. Class I Bedding: When Class I material is used for bedding, little or no compaction is necessary due to the nature of the angular particles. A depth of 6" of Class I material is sufficient to provide uniform bedding. If Class I material is used for bedding, it must also be utilized for haunching at least up to the spring line of the pipe to avoid loss of side support through migration of Class II hunching material into the bedding.
2. Class II Bedding: Care must be taken with Class II material to provide a uniformly compacted bedding. Place the bedding material to a point above the pipe bottom such that resulting compaction will bring the material to grade. Use hand or mechanical tamping to compact the bedding material to a minimum 90% Standard Proctor Density. Slightly damp material will generally result in maximum compaction with a minimum of effort. If water is added to improve compaction or if water exists in the trench, take care to avoid saturation of Class II material, which could result in additional stability problems of the bedding. Carefully bring the surface of the bedding to grade after compacting it.

D. Haunching and Initial Backfill Placement and Compaction:

1. Class I Material:

Wet Conditions: In any area where the pipe will be installed below existing or future ground water levels or where the trench could be subject to inundation, Class I material when used, shall be placed to the top of the pipe.

A minimum of effort is needed to compact the material. However, in the initial stage of placing this type of material, take care to ensure that sufficient Class I material has been worked under the haunch of the pipe to provide adequate side support. Take precautions to prevent movement of the pipe during placing of the material under the pipe haunch. Except for the protection of the pipe from large particles of backfill material, little care need be taken and no compaction is necessary in placing initial backfill to a distance of 6" above the top of the pipe.

Dry Conditions: In any area where ground water will not be experienced at any time above the level of the foundation material or where the trench will not be subject to inundation, place Class I material to the spring line of the pipe. Follow the procedure described above for placing Class I material in wet conditions. If Class II material is used for initial backfill above the spring line, achieve compaction consistent with SECTION 4.01.D.(2) below.

2. Class II Material: Place Class II material with care under the lower haunch area of the pipe, compact, and then place additional material to the spring line of the pipe. If care has been taken to shape the bedding material to the curvature of the pipe, only one stage of placement will be required to bring the haunching material to the spring line of the pipe. In either event, thoroughly compact the

haunching material to a minimum of 90% Standard Proctor Density. Take precautions to prevent movement of the pipe during placing of material under the pipe haunch. Place initial backfill material in two stages; one to the top of the pipe and the other to a point at least 6" over the top of the pipe. Compact each stage of haunching and initial backfill by hand or mechanical tamping to a minimum of 90% Standard Proctor Density.

4.02 PIPE EMBEDMENT FOR RIGID PIPE

- A. All pipe other than PVC shall conform to the following embedment specifications.
- B. Pipe embedment shall consist of bedding, haunching, and initial backfill materials as shown on the standard detail sheets of the plans. The class of material to be used below and above the pipe and placement and compaction of embedment materials shall conform to the requirements shown on the plans and to the following specifications:
- C. Embedment Materials: The following are descriptions of the classifications of embedment materials which may be used for pipe embedment as shown on the standard detail sheets of the plans:
 - 1. Class I: Shall be described in SECTION 4.02.D.(1).
 - 2. Class II: Suitable native material including fine sands, sandy clay mixtures, and gravel/clay mixtures.
- D. Bedding Placement and Composition: Prior to pipe installation, carefully bring the bedding material to grade along the entire length of the pipe to be installed. To ensure that adequate and uniform support is provided under the pipe and to avoid differential settlement of the pipe, certain procedures should be adhered to and precautions taken as outlined herein. Blocking shall not be used to bring the pipe to grade.
 - 1. Class I Bedding: The bedding shall have a minimum thickness beneath the pipe of 4" or $\frac{1}{8}$ of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe to spring line of the pipe. Backfill from pipe spring line to 6" above the top of the pipe shall be of the bedding material or carefully placed earth. Hand placed backfill shall be finely divided materials free from debris, organic material, and stones.
 - 2. Class II Bedding: The pipe shall be bedded in suitable native material on an unshaped trench bottom providing uniform and continuous support of pipe barrel between bell or coupling holes. After each pipe has been placed to grade, aligned, and placed in final position, deposit sufficient bedding material under the pipe haunches and one each side of the pipe to hold the pipe in proper position during subsequent pipe jointing, bedding, and backfill operation. Deposit bedding material uniformly and simultaneously on each side of the pipe to prevent lateral displacement. Bedding material shall be hand or mechanically tamped to a minimum of 90% Standard Proctor (Density) to a point 6" above top of the pipe.

Trench backfill from a point 6" above the top of the pipe shall be as described in SECTION 4.03.

4.03 TRENCH BACKFILL

- A. Backfilling from a point 6" above the pipe to the top of the trench shall be done with good earth and shall be free of large rocks. No material of a perishable, spongy or otherwise unsuitable nature shall be used in backfilling.

Where trenches are not under paved areas or proposed structures, backfill need not be mechanically tamped. Before reaching the top of the trench, the trench shall be flooded with water to achieve some degree of consolidation. Consolidation with heavy equipment shall not be allowed.

Where trenches are under paved (or otherwise improved) areas or proposed structures, the entire trench shall be backfilled with a Class 7 material and compacted to a density of 95% ASTM D-698 or better.

The backfill of materials to be placed under paved areas or proposed structures shall be compacted with mechanical devices manufactured for that purpose from the top of the pipe to the top of the existing or proposed subgrade.

4.04 TESTING

In Place moisture-density test may be ordered by the Engineer to insure that all trench backfill complies with the requirements of the specification. Tests will be performed by a recognized testing laboratory, and all costs will be paid for by the Contractor. Copies of all test results will be furnished to the Owner.

4.05 SPECIAL PROBLEMS

- A. When the pipe being installed is provided with elastomeric seal joints, bell holes shall be excavated in the bedding material to allow for unobstructed assembly of the joint. Care should be taken that the bell hole is no larger than necessary to accomplish proper joint assembly. When the joint has been made, the bell hole should be carefully filled with bedding or haunching material to provide for adequate support of the pipe throughout its entire length.
- B. Before the trench is wheel-loaded, provide cover in accordance with pipe manufacturer's recommendation. Where pipelines are less than 36" deep, avoid the use of heavy equipment across these lines.
- C. Take care to avoid contact between the pipe and compaction equipment. Compaction of haunching, initial backfill, and backfill material should generally be done in such a way so that compaction equipment is not used directly above the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe.
- D. If sheeting or other trench protection is removed, take care so as not to disturb previously constructed foundation bedding, haunching, and initial backfill. If it has been necessary to place or drive sheeting or other trench protection below the top of the pipe, consideration should be given to leaving in place this portion of the sheeting or trench protection, since its removal could jeopardize the side support

necessary for the pipe.

4.06 GENERAL

This section covers the laying of piping.

A. Gravity Sewer Lines and Drains

1. Each joint of pipe shall be inspected carefully before being placed in the trench. Any joint found to be cracked, or otherwise so damaged as to impair its usefulness, shall be plainly marked in such a manner that the marking will not rub or wash off. Damaged joints shall be removed from the site as soon as feasible.
2. All pipe shall be laid with the bell up-stream. Each pipe shall be laid to plan line and grade, or to line and grade directed by the Engineer, using batter boards and top line, or laser beam grade light. Where batter board and top line is used, each pipe shall be plumbed for line with plumb bob, and graded for elevation with a grade stick. Care shall be taken that each spigot is centered properly in the bell of the preceding pipe and properly seated, and that each pipe is solidly bedded. As the work progresses, the pipes shall be cleaned of all dirt and other foreign matter. They shall be maintained clean until accepted or put in service.
3. At the end of each day's work, and when for any reason the laying of pipe will be discontinued for an appreciable period, the open ends of the pipe line shall be closed temporarily.
4. The cutting of pipe for any reason shall be done in a neat and workmanlike manner without damage to pipe or pipe lining.
5. Pipe shall be lowered carefully into the trench in such manner that spigot and bell will not become contaminated. Spigot and bell shall be checked for cleanliness immediately before insertion of spigot into bell.
6. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid in water and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Full responsibility for the diversion of drainage and for dewatering of trenches during construction shall be borne by the Contractor.
7. Spigot and bells shall be cleaned thoroughly before the application of lubricant and attachment of the preformed joint gasket. Application of lubricant and attachment of the gasket shall be in strict accord with the joint.
8. Pipe shall not be placed in the trench without excavating for bells so that the entire barrel of the pipe is uniformly supported on the pipe bedding.
9. Pipe shall be supported to proper line and grade, and secured against upheaval or floating during the placement of concrete bedding or encasement.

B. Pressure Mains

1. All pipe and fittings shall be installed to the line and grade as detailed on the plans. Subject to the approval of the Engineer, other fittings may be added to or substituted for those shown on the plans, should the need therefore arise during construction. This permissive stipulation in no way shall relieve the Contractor of the responsibility for furnishing and installing all fittings required for a complete

and proper installation of main as detailed on the plans.

2. All dirt and other foreign matter shall be removed from the inside of pipe and fittings before they are lowered into the trench. They shall be kept clean during and after laying, care shall be taken to keep dirt out of the jointing space. At the end of each days work, and when pipe laying is discontinued for an appreciable period, open ends of pipe shall be closed with a cast plug or cap firmly secured in place.
3. All pipe and fittings shall be lowered carefully into the trench in such manner as to prevent damage to pipe, fittings, or linings. Neither pipe nor fittings shall be dropped or dumped into the trench.
4. Cutting of pipe, where needed, shall be done in a neat and workmanlike manner without damage to pipe or pipe lining.
5. Unless otherwise directed by the Engineer, pipe shall be laid with bell ends facing in the direction of laying. For lines on an appreciable slope, bells shall, at the direction of the Engineer, face upgrade. Wherever necessary to deflect pipe from a straight line in either the horizontal or vertical plane, to avoid obstructions, or for other allowable reasons, the degree of deflection at any joint shall not exceed the maximum recommended by the pipe manufacturer.

C. Connections to Existing Sewers and Drains

1. Connections to existing sewers and drains shall not be made until all of the proposed piping and manholes have been constructed, cleaned and approval granted by the Engineer for making connection. No connection to existing sewers and drains shall be made until new lines have passed specified leakage tests.
2. All work shall be completed in a workmanlike manner using materials specified or as approved by the Engineer. Watertight connections shall meet with the requirements concerning tests of these specifications.

D. Installation of Slip-Type Joints

1. Prior to jointing, the bell and spigot ends of the pipes, and bells of fittings, shall be cleaned thoroughly with soapy water and cloth, and by whatever additional means as are necessary to remove all foreign matter and attain the required cleanliness. A wire brush shall be used as necessary. Particular care shall be exercised to clean the gasket seat. The gland also shall be cleaned in like manner.
2. Joints shall be made in strict accord with the recommendations of the pipe manufacturer. The rubber gasket shall be cleaned with soapy water and cloth, and inserted in the gasket seat within the bell. The spigot end of the pipe shall be inserted in the bell of the pipe to which connection is being made, and forced to a firm contact with the shoulder of the bell. When this initial insertion is made, the alignment of the added pipe shall deviate from true alignment not more than the amount recommended by the pipe manufacturer.
3. Following the initial insertion, the bell end of the added pipe shall be moved sideways or up a distance of approximately 8" to move the spigot end slightly away from the shoulder of the connecting bell, thus providing for expansion and flexibility in the completed line. The added pipe then shall be placed in true

alignment at intended grade.

E. Installation of Mechanical Joints

1. The spigot end of pipe and the bell of fitting, and the rubber gasket, shall be cleaned thoroughly as specified for pipe joints in Paragraph D above. The gland also shall be cleaned in like manner.
2. After the gland and gasket are placed on the spigot end of the pipe a sufficient distance from the end to avoid fouling the bell, the spigot end shall be inserted in the bell to firm contact with the bell shoulder. The rubber gasket then shall be advanced into the bell and seated in the gasket seat. Care shall be exercised to center the spigot within the bell.
3. The gland shall be brought into contact with the gasket, all bolts entered and all nuts made hand tight. Continued care shall be exercised to keep spigot centered in bell. The joint shall be made tight by turning the nuts with a wrench; first partially tightening a nut, then partially tightening the nut 180° therefrom, and working thus around the pipe, with uniformly applied tension until the required torque is applied to all nuts. Required torque ranges and indicated wrench lengths for standard bolts are as follows:

| <u>Diameter, Inches</u> | <u>Range of Torque Foot-Pounds</u> | <u>Length of Wrench, Inches</u> |
|-----------------------------|--|-------------------------------------|
| 5/8 | 40 - 60 | 8 |
| 3/4 | 60 - 90 | 10 |
| 1 | 70 - 100 | 12 |
| 1 1/4 | 90 - 120 | 14 |

4.07 TRENCH SAFETY SYSTEMS

- A. Refer to Section 02260 of these Technical Specifications.

4.08 PLASTIC PIPE

- A. Installation shall be in accordance with applicable ASTM Standards D 2774, D 2855 and F 402. The CONTRACTOR shall make certain before jointing polyvinyl chloride pipe that the ring groove in the bell of the pipe is clean, with no dirt or foreign material that could interfere with proper seating of the ring. Make sure pipe end is clean. Wipe with a clean dry cloth around the entire circumference from the end to one inch beyond the reference mark. Lubricate the spigot end of the pipe, using only the lubricant supplied by the manufacturer. Be sure the entire circumference is covered. The coating should be the equivalent of a brush coat of enamel paint. It can be applied by hand, cloth, pad, sponge or glove. Do not lubricate the ring groove in the bell because such lubrication could cause ring displacement. The bevel end is then inserted into the bell so that it is in contact with the ring. Brace the bell, while the bevel end is pushed in under the ring, so that previously completed joints in the line will not be closed up. The spigot end is pushed until the reference mark on the spigot end is flush with the end of the bell. If undue resistance to inserting of the

bevel end is encountered or the reference mark does not reach the flush position, disassemble the joint and check the position of the ring. If it is twisted or pushed out of its seat, clean the ring, bell and bevel end and repeat the assembly steps.

4.09 PIPE JOINT INSTALLATION

A. Dissimilar Materials

1. For piping systems which carry water or which are installed underground, wherever pipes of dissimilar metals are connected, an insulating section of rubber or plastic pipe shall be installed. The insulating section shall have a minimum length of 12 pipe diameters. Dielectric unions of an acceptable type may be used in lieu of the specified insulating sections. Wherever copper pipe is supported from hangers, it shall be insulated from the hangers with PVC tape.

B. Screwed Joints

1. Make up all threaded joints using a suitable joint lubricating compound applied to male threads only. Thoroughly ream all field cuts and carefully make all connections so that thread engagement will be secured.

C. Welded Joints

1. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping. Machine beveling in shop is preferred. Field beveling may be done by flame cutting to acceptable standards.
2. Align piping and equipment so that no part is offset more than 1/15". Set all fittings and joint square and true to preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.
3. Do 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 procedure as the completed weld. Otherwise, remove tack welds during welding operation.
4. Do not split, bend, flatten or otherwise damage piping before, during or after installation.
5. Remove dirt, scale and other foreign matter from inside piping before tying in sections, fittings, valves or equipment.

D. Flanged Joints

1. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe and equipment. Align bolt holes to straddle the vertical, horizontal, or north-south center line.
2. Install proper gaskets, suitable for intended service and factory cut to proper dimensions. Secure with a suitable gasket cement.
3. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
4. Take special care when attaching suction and discharge piping to jumping equipment to ensure that no stresses are transmitted or imposed on pump

suction and discharge flanges by the connected piping. Install and permanently support all such piping to accurately match bolt holes and to provide uniform contact over entire installation of bolts in flanges. In addition, pump connection piping shall be free to move parallel to its longitudinal center line while bolts in pump connection flanges are tightened.

4.10 WET CONNECTIONS

Schedules of existing fittings and proposed new fittings needed to make wet connections to existing waterlines as shown on the plans are estimates only. It is to be recognized that after existing lines and fittings are uncovered, that some discrepancies may occur. Where discrepancies occur, the CONTRACTOR shall request a decision by the OWNER as to how the connection in question shall be made. CONTRACTOR shall plan his work concerning wet connections in such a way that a minimum of inconvenience shall occur to existing water customers due to water service interruptions. Before water service interruptions are made to any customer, CONTRACTOR shall notify designated official and cooperate with operating personnel in every way to minimize service interruptions due to wet conditions. In certain locations, other utility lines or conduits will be obstructing the normal path of proposed waterlines. In such instances, gravity lines of all kinds hold priority as to grade over water pressure lines, gas lines, electric conduits, or other obstruction conduits or combinations of conduits which may be encountered. CONTRACTOR is to analyze conditions carefully and then use best judgment in determining proper method of proceeding through obstructed area with waterline construction, and shall notify the utility owner forty-eight (48) hours in advance of making such connection after obtaining approval from the Engineer.

4.11 OFFSET AND FITTINGS INSTALLATION

- A. Because of the small scale of drawings, the indication of all offsets and fittings is not possible. Carefully investigate the structural and finish conditions affecting the work and take such steps as may be required to meet such conditions.
- B. Provide proper space for covering and removal of pipe, and special clearances for offsets and fittings.
- C. All iron fittings shall be wrapped in a plastic protector in conformance with AWWA Standard C-105 and ANSI A21.5 "Polyethylene Encasement for Gray and Ductile Cast-Iron piping for Water and Other Liquids". Fitting wrapping shall be installed in such a manner as to curtail or prevent corrosion of the metallic fittings.

4.12 SECURING AND SUPPORTING

- A. General
 - 1. Support piping as required to maintain line and grade, with due provisions for expansion and contraction. Use approved hot-dipped galvanized hangers, rollers, anchors and guides properly connected to structural members. Do not support piping from other piping. Use non-metallic and stainless steel hangers where indicated on the plans.
- B. Hangers and Straps

1. Place hangers not more than 6 feet apart on $\frac{1}{2}$ " and $\frac{3}{4}$ " pipes or 10' apart on larger pipes. Place hangers not more than 6' apart for all sizes of PVC pipe.
2. Support vertical risers with hot-dipped galvanized steel strap pipe clamps properly supported at every floor unless otherwise shown on drawings.
3. Perforated bar hangers, straps, wires or chains are not permitted.

C. Unistrut Pipe Supports

1. Provide standard Unistrap metal framing members and appurtenances for pipe support when applicable. Mult-A-Frame and Power-Strut pipe support systems also are acceptable. Hot-dip galvanize all such members and appurtenances.

D. Anchors

1. Provide anchors as indicated or required. Unless otherwise detailed on drawings, use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results.
2. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe.

E. Pipe Guides

1. For plant piping, provide pipe alignment guides as required by pipe manufacturer.
2. Guide expansion joints with two guides on the side opposite the anchor.

F. Substitution

1. In lieu of restrained joint pipe and fittings, Contractor may substitute mechanical or push-on joints with reaction anchorages and blocking as specified here and approved by Engineer. Provide all unlugged tees, Y-branches and bends deflecting $22\frac{1}{2}^{\circ}$ or more which are installed in piping subjected to internal hydrostatic heads in excess of 15' in exposed or 30' in buried piping with suitable reaction blocking, struts, anchors, clamps, joint harness or other adequate means to prevent movement of pipe caused by unbalanced internal liquid pressure or as indicated on drawings.
2. Trench Installation

Where in trench, provide fittings with concrete thrust blocking between fitting and solid undisturbed ground in each case except where solid ground blocking support is not available. At tops of slopes, anchor vertical angle bends by means of a mass of concrete of sufficient weight to resist hydraulic thrust at maximum pressures to which pipe will be subjected. Install concrete blocking and anchors so that all joints between pipe and fittings are accessible for repair. Bearing area of concrete reaction blocking against ground or trench bank shall be as shown on

drawings or as directed by Engineer in each case. In event that adequate support against undisturbed ground cannot be obtained, install metal harness anchorages consisting of steel rods or bolts across joint and securely anchor to pipe and fitting or other adequate anchorage facilities approved by Engineer to provide necessary support. Should lack of a solid vertical excavation face be due to careless or otherwise improper trench excavation, entire cost of furnishing and installing metal harness anchorage in excess of contract value of concrete blocking replaced by such anchorages shall be borne by Contractor.

3. Locations other than trenches

Provide blocking, struts, anchorages or other supports for fittings installed in fills or other unstable reaction ground above grade or exposed within structures as required by drawings or as directed by Engineer.

4. Protection of Metal Surfaces

Adequately protect all steel clamps, rods, bolts and other metal accessories used in reaction anchorages, or joint harness subject to submergence or contact with earth or fill material and not encased in concrete from corrosion with not less than two coats of either Koppers "Bitumastic No.50", or equal, heavy coal-tar coating material applied to clean, dry metal surfaces. First coat shall be dry and hard before second coat is applied.

4.13 PIPE SLEEVES

A. Sleeves

1. Wall pipes are required where shown on the plans and at all pipes penetrating water holding structures.
2. Fit with sleeves all pipes passing through masonry and concrete construction. Fabricate sleeves of hot dipped galvanized steel pipe unless otherwise indicated. Size sleeve for minimum clearance between pipe or insulation and sleeve.
3. Extend each sleeve through the floor or wall. Cut the sleeve flush with each surface, except that in exposed locations, extend floor sleeves 2" above finished floor line.
4. Caulk all sleeves watertight and airtight. Seal annular space between pipes and sleeves with a Thunderline Link-Seal or approved equal.

4.14 CLEANING OF PIPING SYSTEMS

A. General

1. Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the systems in service. Use whatever temporary connections are required for cleaning, purging and circulating.

B. Strainer

1. For each system when specified in that system, install temporary strainers in front of pumps, tanks, water still, solenoid valves, control valves and other equipment where permanent strainers are not indicated. Keep these strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a blow-off valve.

4.15 LEAK TESTS

- A. See Section 02513 – Pipe Testing & Clean Up.

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SECTION 02511

SEPARATION DISTANCES

PART 1. GENERAL

1.01 SCOPE OF WORK

This section covers the requirements with respect to separation distances for water lines and sanitary sewers.

1.02 ADH RULES AND REGULATIONS

The ADH Rules and Regulations read as follows:

A. Sanitary and Safety Hazards

The operating routine shall include necessary protective measures to detect and remove or destroy any contaminant of concern or regulation that might enter the distribution system. Every precaution must be taken against the possibility of sewage contamination of the water in the distribution system. Water mains and sanitary sewers shall be constructed as far apart as practicable, and shall be separated by undisturbed and compacted earth. **A minimum horizontal distance of ten feet should be maintained between water lines and sewer lines or other sources of contamination.** Water lines and sewers shall not be laid in the same trench except on the written approval of the Arkansas Department of Health. Water mains necessarily in close proximity to sewers must be placed so that the bottom of the water line will be at least 18 inches above the top of the sewer line at its highest point. If this distance must unavoidably be reduced, the water line or the sewer line must be encased in watertight pipe with sealed watertight ends extending at least ten feet either side of the crossing. Any joint in the encasement pipe is to be mechanically restrained. The encasement pipe may be vented to the surface if carrying water or sewer under pressure. Where a water line must unavoidably pass beneath the sewer line, at least 18 inches of separation must be maintained between the outside of the two pipes in addition to the preceding encasement requirement. Exceptions to this must be approved in writing by the Arkansas Department of Health.

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SECTION 02512

STERILIZATION OF WATER MAINS

PART 1. GENERAL

1.01 DESCRIPTION OF WORK

- A. The work to be performed under this section of the Specifications shall consist of furnishing all labor, materials, and equipment necessary to sterilize water lines.
- B. Disinfection of the water lines shall be performed in accordance with AWWA-C651 – “Standard for Disinfection Water Mains” (Latest Edition).

1.02 STERILIZATION

- A. Prior to sterilizing, each valved section of the new pipeline shall be pressure tested and flushed with clean water from the existing system to remove all apparent evidence of dust, soil and fine debris which may have entered the line during construction and testing.
- B. Chlorine shall be used to sterilize the pipeline by the following method: The amount of chlorine applied shall be such as to provide a dosage of not less than fifty (50) parts per million. The chlorinating material shall be introduced to the water lines and distribution system in a manner approved by the Engineer. After a contact time of not less than twenty-four (24) hours, the system shall be flushed with clean water until the residual chlorine content is not greater than 0.2 parts per million. All valves in the lines being sterilized shall be opened and closed several times during the contact period.
- C. A minimum of two (2) samples shall be collected on consecutive days and submitted for analysis to the State Board of Health for each segment of water line installed. No water main shall be placed into service until satisfactory test reports have been received.
- D. Unless otherwise provided for in the Bid Schedule and Proposal, the cost of furnishing the chlorine, labor, tools, equipment, and test of chlorine content and bacteriological tests shall be at the expense of the Contractor.

END OF SECTION

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SECTION 02513

PIPE TESTING AND CLEAN UP

PART 1. GENERAL

1.01 DESCRIPTION

- A. This section covers the testing of pipe materials, joints, or other materials incorporated into plant piping and leakage tests to determine watertightness.
- B. All pipelines and sewers shall be tested. Test pressure, duration, and media shall be as specified by the Engineer. Care should be exercised to isolate equipment not rated for the specified test pressure to avoid damage to the equipment.

PART 2. LEAKAGE TESTS

2.01 LEAKAGE TESTS OF GRAVITY LINES

The leakage test must be performed in the presence of a representative of the Engineer. The Contractor shall provide 24-hours minimum notice before beginning testing procedures. Leakage tests for watertightness of gravity sewer lines shall be completed in accordance with the following procedure:

- A. Air Testing: Prior to air testing the pipe shall be visually inspected to determine collapsed or crushed pipe. After visual inspection the section to be tested shall be cleaned and flushed. After flushing, all pipe outlets in the test section shall be plugged and each plug shall be suitably and securely braced.
 - 1. Air testing shall be performed per Uni-Bell PVC Pipe Association's, "Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe". The Contractor is to use the table at the end of the Section as a reference guide.
- B. Safety Provisions: Plugs used to close the sewer pipe for the air test must be securely braced to prevent the unintentional release of a plug which can become a high velocity projectile. Gauges, air piping manifolds, and valves shall be located at the top to enter a manhole where a plugged pipe is under pressure. Four pounds (gauge) air pressure develops a force against the plug in a 12" diameter pipe of approximately 450-pounds.

2.02 PRESSURE CONDUIT LEAKAGE TESTS

- A. Leakage tests for all piping specified to be "Water Tested" shall be made by filling the main with water and increasing the pressure to the testing pressure specified by the Engineer.

All pressure lines for this project shall be tested at 1.5 times the working pressure of the line. The duration of the leakage test shall be a minimum of 2-hours and shall be conducted in the presence of the Engineer or his project representative.

- B. All waterline shall be tested in accordance with AWWA C-600 or AWWA C-605 as applicable.
- C. Leakage of all exposed piping shall be zero throughout the duration of the test.
- D. The main shall not be accepted until the actual leakage is equal to or less than the allowable. In addition, all obvious leaks shall be repaired.
- E. The maximum leakage per hour for ductile iron, PVC, and concrete pipe shall be as calculated from the following formula:

Rubber gasket or O-ring joints (iron, PVC, and concrete)

$$L = \frac{ND\sqrt{P}}{7400}$$

L = Allowable leakage (gallons per hour)
N = Number of joints in pipeline tested
D = Nominal diameter (inches)
P = Test pressure (psi)

2.03 LEAKS ENCOUNTERED IN FINAL INSPECTION

- A. In addition to passing the above described leakage tests, all obvious running leaks which may be observed in the final inspection shall be satisfactorily repaired.

2.04 CLEANING UP

- A. As the construction work progresses, the Contractor shall backfill the trenches, remove excess excavated materials and other debris and do sufficient cleanup and blading of the trench surfaces to make the streets and alleys suitable for safe use of traffic.

After the construction work is completed and before final acceptance by the Owner, the Contractor shall remove all rubbish, excess materials, excess materials from excavations and other debris from the site of the work and all trench surfaces shall be bladed as heretofore specified. Adjacent road ditches and slopes which have been disturbed by this construction shall be restored to original shape density and condition. The cost of clean-up shall be included in the bid prices for the various units of work. After the cleanup has been completed, but before final acceptance by the Owner, the entire line must be tested to see that there are no obstructions in the line. Water for this testing shall be the responsibility of the Contractor. A rubber or plastic beach ball of same diameter as the pipe will be flushed through the line for this test.

2.05 LINE CLEANING

- A. All piping must be flushed to remove all mud and debris following construction. Materials flushed from the line shall not be allowed to enter the existing collection system.

2.06 DISINFECTION

- A. Following satisfactory completion of the acceptance test, all potable water lines shall be disinfected in accordance with Section 02512 of these Technical Specifications and AWWA C651.

END OF SECTION

**AIR TESTING (TIME PRESSURE DROP METHOD)
MINIMUM TIME IN SECONDS FOR 1 PSIG DROP (3.5 PSIG TO 2.5 PSIG)**

| Length of Test Section in | | Pipe Diameter in Inches | | | | | | | | | | | |
|---------------------------|------------|-------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|
| Feet | <u>4</u> | <u>6</u> | <u>8</u> | <u>10</u> | <u>12</u> | <u>15</u> | <u>18</u> | <u>21</u> | <u>24</u> | <u>27</u> | <u>30</u> | <u>33</u> | <u>36</u> |
| 25 | 4 | 10 | 18 | 28 | 40 | 62 | 89 | 121 | 158 | 200 | 248 | 299 | 356 |
| 50 | 9 | 20 | 35 | 55 | 79 | 124 | 178 | 243 | 317 | 401 | 495 | 599 | 713 |
| 75 | 13 | 30 | 53 | 83 | 119 | 186 | 267 | 364 | 475 | 601 | 743 | 898 | 1020 |
| 100 | 18 | 40 | 71 | 110 | 158 | 248 | 356 | 485 | 639 | 765 | 851 | 935 | |
| 125 | 22 | 50 | 88 | 138 | 198 | 309 | 446 | 595 | 680 | | | | |
| 150 | 26 | 59 | 106 | 165 | 238 | 371 | 510 | | | | | | |
| 175 | 31 | 69 | 123 | 193 | 277 | 425 | | | | | | | |
| 200 | 35 | 79 | 141 | 220 | 317 | | | | | | | | |
| 225 | 40 | 89 | 158 | 248 | 340 | | | | | | | | |
| 250 | 44 | 99 | 176 | 275 | | | | | | | | | |
| 275 | 48 | 109 | 194 | 283 | | | | | | | | | |
| 300 | 53 | 119 | 211 | | | | | | | | | | |
| 350 | 62 | 139 | 227 | | | | | | | | | | |
| 400 | 70 | 158 | | | | | | | | | | | |
| 450 | 79 | 170 | | | | | | | | | | | |
| 500 | 88 | | | | | | | | | | | | |
| 550 | 97 | | | | | | | | | | | | |
| 600 | 106 | | | | | | | | | | | | |
| <u>650</u> | <u>113</u> | <u>170</u> | <u>227</u> | <u>283</u> | <u>340</u> | <u>425</u> | <u>510</u> | <u>595</u> | <u>680</u> | <u>765</u> | <u>851</u> | <u>935</u> | <u>1020</u> |

SECTION 02514

TRACER WIRE

PART 1. GENERAL

1.01 SCOPE OF WORK

- A. This section provides for the installation of tracer wire with all non-metallic pressure pipes.

PART 2. MATERIALS

2.01 TRACER WIRE

- A. Copper: 14-gauge, stranded or solid, watertight insulation for direct bury.
- B. UL-Listed 30V or greater.
- C. Roll Length: 1,000 L.F. minimum.
- D. Uniform APWA Color Coded for Installation: Potable Water-Blue, Reclaimed Water-Purple, Sewer-Green.

2.02 CONNECTORS

- A. Solderless, 3M Direct Bury splice kit, or approved equivalent.

2.03 UTILITY MARKERS

- A. Fiberglass reinforced composite marker with decal identifying type of installation and contact information, Carsonite or approved equivalent.
- B. Uniform APWA Color Coded for Installation: Potable Water-Blue, Reclaimed Water-Purple, Sewer-Green.

2.04 TEST STATION

- A. Carson-Scepter Utility Test Station or approved equal with identifying decals and insulated terminal block.
- B. Uniform APWA Color Coded for Installation: Potable Water-Blue, Reclaimed Water-Purple, Sewer-Green.

PART 3. INSTALLATION

3.01 GENERAL

- A. Tracer wire shall be taped to the top centerline of the pipe every five (5') feet with an adhesive tape or plastic tie strap such that the wire remains in place during pipe embedment and trench backfill.

- B. Tracer wire shall not be run continuously without a point of access for longer than 1,500 feet.
- C. Connectors are to be used at intermediate locations as necessary.
- D. Points of access shall include valve boxes, air release vaults, flushing hydrants, test stations, or other points approved by the Owner.
- E. Tracer wire is to be brought up inside boxes and vaults in a manner that is acceptable to the Owner.
- F. Tracer wire is to be connected to test stations in accordance with manufacturer's recommendations.
- G. Utility markers are to be installed at all points of access to the tracer wire with the exception of where test stations have been installed.

PART 4. TESTING

4.01 GENERAL

- A. The Contractor shall test all tracer wire to demonstrate that the wire is capable of locating the pipe. All tests shall be witnessed by the Owner's Representative prior to final acceptance of the work.
- B. If a wire will not pass current, the Contractor shall, at no expense to the Owner, locate the break, repair the break, and retest the wire until it works in accordance with its intended use.

END OF SECTION

SECTION 02515

DUCTILE IRON PIPE

PART 1. GENERAL

1.01 SCOPE

- A. This section covers ductile iron pipe and fittings where indicated on the drawings or where required by the specifications.

PART 2. PRODUCTS

2.01 MATERIALS

- A. All ductile iron pipe shall meet the requirements of ANSI A21.51. All fittings for ductile iron pipe shall meet the requirements of ANSI A21.10. Fittings for 12" diameter and smaller pipe shall be grey iron castings. Fittings for pipe larger than 12" in diameter shall be ductile iron castings.
- B. All ductile iron pipe and fittings shall have a cement mortar interior lining, as manufactured by American Cast Iron Pipe Company, meeting the requirements of AWWA C104 (ANSI A241.4).
- C. Except where otherwise required, ductile iron pipe shall be provided with a bituminous exterior coating approximately 1-mil thick conforming to the manufacturer's standard. Where ductile iron pipe is to be painted, the pipe may be shipped with no outside coating as it will be blasted to near white prior to painting.

Ductile iron pipe located inside wet wells or manholes will receive an approximately 80-mil thick exterior coating of POLIBRID 705 or equivalent 100% solids content elastomeric polyurethane coating applied to pipe and fittings after installation by approved methods, personnel and guidelines of the manufacturer of the coating.

- D. Except where otherwise required, 4" in diameter and smaller pipe shall be thickness Class 51 and 6" in diameter and larger pipe shall be thickness Class 50.

2.02 JOINTS

- A. Joints for ductile iron pipe and fittings shall be as indicated on the drawings or as specified herein. Where not indicated on the drawings, buried ductile iron pipe and buried fittings shall have mechanical joints. Where not indicated on the drawings, otherwise, exposed ductile iron pipe and fittings shall have flanged joints.
- B. Ductile iron pipe with threaded flanges shall be at least thickness Class 53. Pipe with threaded flanges conforming to the dimensions of ANSI B16.1, 125-pound flanges shall be fabricated to meet the requirements of ANSI A21.15.
- C. Rubber gaskets for ductile iron pipe and fittings shall be of synthetic rubber.
- D. All joints shall be assembled in accordance with the manufacturer's recommendations. All bolted joints and connections shall be tightened uniformly around the pipe. All joints shall be completely water tight.

- E. All buried joints, including joints inside manholes or similar structures, shall be coated as described in Section 09900 - Painting.

PART 3. EXECUTION

3.01 GENERAL

- A. After the pipe has been placed and backfilled, each section of newly laid pipe shall be subjected to a hydrostatic pressure test. For any section being tested, the pressure applied shall be such that at the lowest point in the section, the pressure shall be equal to the design pressure of the pipe, or as indicated on the plans.
- B. Methods
 1. Each section of pipe shall be slowly filled with water and the specified test pressure measured to the point of lowest elevation, shall be supplied by means of a pump or fire hydrant connected to the pipe in a satisfactory manner. All necessary apparatus including gauges and meters shall be furnished by the Contractor.
 2. The Contractor may test the pipeline in sections when all the pipe in the section has been placed and all concrete blocking is at least 28-days old. The test shall be made against valves when available, or by placing temporary plugs or bulkheads in the pipe, and filling the line slowly with water. Care shall be used to see that all air vents are open during the filling. After the line, or section thereof, has been completely filled, it shall be allowed to stand under a slight pressure at least 48-hours to allow the lining to absorb what water it will and to allow the escape of air from any air pockets. During this period, the bulkheads, valves, manholes, and connections, shall be examined for leaks. If any are found, these shall be stopped or, in the case of valves, in the main line or bulkheads, provision shall be made for measuring the leakage during the test. The water necessary to maintain the test pressure shall be measured through a meter, or by the other means satisfactory to the Engineer. The Contractor shall furnish all necessary equipment and make tests at his expense.
 3. Before applying the specified test pressure, all air shall be expelled from the pipe. In the event it is necessary to expel air from high points other than where taps are provided, the Contractor may tap the line for this purpose and afterward tightly plug the tap. No extra compensation will be made for these taps. Duration of test shall be two hours.
 4. During the test, the entire route of the pipeline shall be inspected to locate any leaks or breaks. Any defective joints, cracked or defective pipe, fittings, or valves discovered in consequence of this pressure test shall be removed and replaced with sound material in the manner provided and the test shall be repeated until satisfactory results are obtained.
 5. Any and all noticeable leaks shall be repaired regardless of whether the actual leakage is within allowable amounts.

C. Permissible Leakage - See Section 02513.

1. Should any test of pipe disclose leakage greater than that specified, the Contractor shall, at his own expense, locate and repair the defective joints, until the leakage is within the specified allowance.

END OF SECTION

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SECTION 02516

POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PART 1. GENERAL

1.01 SUMMARY

- A. Provide polyvinyl chloride (PVC) pipe and fittings.

1.02 RELATED SECTIONS

- A. Section 02315 - Trench Excavation, Backfill, and Compacting.
- B. Section 02513 - Pipe Testing and Cleanup.

1.03 REFERENCES

- A. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
 - 1. ASTM D1784 – Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - 2. ASTM D2241 – Specifications for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 - 3. ASTM D3139 – Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 4. ASTM F477 – Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- B. American Water Works Association, 6666 West Quincy Avenue, Denver, Colorado 80235.
 - 1. AWWA C110/A21.10 – American National Standard for Ductile-Iron and Gray-Iron Fittings, 3" Through 48" For Water and Other Liquids.

PART 2. PRODUCTS

2.01 PIPE

- A. PVC pressure pipe, Class 200, SDR-21 in compliance with ASTM D1784 and manufactured from virgin PVC compound with a cell classification of 12454-B with gasket joints and integral bell for buried water piping.
- B. PVCO pressure pipe, Class 200 in compliance with ASTM F1483 and manufactured from virgin PVC compound with a cell classification of 12454-B with gasket joints and integral bell for buried water piping.
- C. Pipe and fittings shall be manufactured in the United States. Foreign made products shall be unacceptable.
- D. Pipe shall be permanently marked at 5' intervals with the following information:
 - 1. Nominal Size.
 - 2. Material code designation.

3. Manufacturer's name or trademark and production record code.
4. ASTM or AWWA certification.
5. SDR designation.

E. Warranty:

1. Manufacturer of the pipe shall warrant product for a period of not less than one (1) year.
2. Forward copies of warranty to the Owner.
3. Replace defective materials at no extra cost to the Owner.

2.02 JOINTS

- A. Buried Pipe: Gasketed slip joint.
- B. Comply with ASTM D3139.

2.03 FITTINGS

- A. Fittings 4" and Larger: Gray or ductile iron, 250-psi pressure class, cement-lined and seal-coated. Where taps are shown on fittings, tapping bosses shall be provided.
 1. Flanges Joint – ANSI/AWWA C153 and ANSI B16.1, faced and drilled 125-pound ANSI standard.
 2. Mechanical Joint: ANSI/AWWA C153 and ANSI/AWWA C111.
 3. Flexible Joint: American Flex-Lox pipe or equal.
- B. Cement Linings: In accordance with ANSI A21.4.
- C. Fittings shall receive an exterior coating of 1-mil thick bituminous material in accordance with ANSI A21.4.
- D. Fittings shall have distinctly cast on them the manufacturer's identification, pressure rating, nominal diameter of openings, and the number of degrees or fraction of the circle on bends.
- E. Fittings Smaller than 4": PVC.

2.04 GASKETS

- A. As recommended by pipe manufacturer to conform to pipe.
- B. Comply with ASTM F477.

PART 3. EXECUTION

3.01 GENERAL

- A. Rigid PVC pipe shall be cut, made up, and installed in accordance with the pipe manufacturer's recommendations.
- B. Offset shall be as recommended by the manufacturer for the maximum temperature variation between time of installation and final use.

3.02 TRACER WIRE

- A. Furnish and install a 14-gage insulated copper trace wire with PVC pressure pipe.
- B. Rolls of wire shall have a minimum length of 1,000 L.F.
- C. Connections of ends of wire shall be made using direct-bury splice that affords effective moisture seal, as manufactured by 3M Industries or approved equal.
- D. Run wire continuous from valve box to valve box, meter box, air release vault, cleanout, or other access points.
- E. Bring wire up inside boxes and vaults in an accessible method.
- F. Bring wire around or tape wire to each pipe section.
- G. Pipe testing shall include following trace wire.
- H. Wire breaks shall be repaired at no additional expense to the Owner.

3.03 THRUST BLOCKS

- A. Install 2,500-psi concrete thrust blocks at bends, wyes, or other thrust points on pressure piping.
- B. Block to bear against undisturbed soil and shall be of size and with bearing area as shown on Drawings.

3.04 TESTING

- A. Pressure lines shall be hydrostatically tested at the pressures listed in Section 02513.
- B. Use pipe-locating equipment to test continuity of tracer wire.
- C. Engineer shall observe and document pressure and tracer wire tests.

END OF SECTION

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SECTION 02517

PIPE LAYING

PART 1. GENERAL

1.01 WORK INCLUDED

- A. This section covers the laying of plant piping. All material shall be in accordance with SECTION 02510 of these specifications.

PART 2. LINES AND DRAINS

2.01 GRAVITY SEWER LINES AND DRAINS

- A. Each joint of pipe shall be inspected carefully before being placed in the trench. Any joint found to be cracked, or otherwise so damaged as to impair its usefulness, shall be plainly marked in such a manner that the marking will not rub or wash off. Damaged joints shall be removed from the site as soon as feasible.
- B. All sewer pipe shall be laid with the bell up-stream. Each pipe shall be laid to plan line and grade, or to line and grade directed by the Engineer, using batter boards and top line, or laser beam grade light. Where batter board and top line is used, each pipe shall be plumbed for line with a plumb bob, and graded for elevation with a grade stick. Care shall be taken that each spigot is centered properly in the bell of the preceding pipe and properly seated, and that each pipe is solidly bedded. As the work progresses, the pipes shall be cleaned of all dirt and other foreign matter. They shall be maintained clean until accepted or put in service.
- C. At the end of each day's work, and when for any reason the laying of pipe will be disconnected for an appreciable period, the open ends of pipe line shall be closed temporarily.
- D. The cutting of pipe for any reason shall be done in a neat and workmanlike manner without damage to pipe or pipe lining.
- E. Pipe shall be lowered carefully into the trench in such manner that spigot and bell will not become contaminated. Spigot and bell shall be checked for cleanliness immediately before insertion of spigot into bell.
- F. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid in water and no pipe shall be laid when trench conditions or whether are unsuitable for such work. Full responsibility for the diversion of drainage and for dewatering of trenches during construction shall be borne by the Contractor.
- G. Spigot and bells shall be cleaned thoroughly before the application of lubricant and attachment of the preformed joint gasket. Application of lubricant and attachment of the gasket shall be in strict accordance with the joint.
- H. Pipe shall not be placed in the trench without excavating for bells so that the entire barrel of the pipe is uniformly supported on the pipe bedding.
- I. Pipe shall be supported to proper line and grade, and secured against upheaval

of floating during the placement of concrete bedding or encasement.

2.02 FORCE MAINS AND RECIRCULATION MAINS

- A. All pipe and fittings shall be installed to the line and grade as detailed on the plans. Subject to the approval of the Engineer, other fittings may be added to or substituted for those shown on the plans, should the need therefor arise during construction. This permissive stipulation in no way shall relieve the Contractor of the responsibility for furnishing and installing all fittings required for a complete and proper installation of main as detailed on the plans.
- B. All dirt and other foreign matter shall be removed from the inside of pipe and fittings before they are lowered into the trench. They shall be kept clean during and after laying, care shall be taken to deep dirt out of the jointing space. At the end of each days work, and when pipe laying is discontinued for an appreciable period, open ends of pipe shall be closed with a cast plug or cap firmly secured in place by tamped jute or hemp.
- C. All pipe and fittings shall be lowered carefully into the trench in such a manner as to prevent damage to pipe, fittings or linings. Neither pipe nor fittings shall be dropped or dumped into the trench.
- D. Cutting of pipe, where needed, shall be done in a neat and workmanlike manner without damage to pipe or pipe lining.
- E. Unless otherwise directed by the Engineer, pipe shall be laid with bell ends facing in the direction of laying. For lines on an appreciable slope, bells shall, at the direction of the Engineer, face upgrade. Wherever necessary to deflect pipe from a straight line in either the horizontal or vertical plane, to avoid obstructions, or for other allowable reasons, the degree of deflection at any joint shall not exceed the maximum recommended by the pipe manufacturer.

2.03 STEEP GRADES

A. Concrete Pipe Anchors

Where pipe is constructed on grades of 15% or greater, concrete anchors shall be provided as shown on the plans.

B. Type of Pipe

Ductile iron pipe, meeting the requirements of SECTION 13620 AND 13630, shall be used on all piping when the grade is 15% or greater.

2.04 CONNECTIONS TO EXISTING SEWERS

- A. Connections to existing sewers shall not be made until all of the proposed piping and manhole have been constructed, cleaned and approval granted by the Engineer for making connection. No connection to existing sewers shall be made until new sewers have passed specified leakage tests.
- B. All work shall be completed in a workmanlike manner using materials specified or as approved by the Engineer. Watertight connections shall meet with the

requirements concerning tests of these specifications.

2.05 INSTALLATION OF SLIP TYPE JOINTS

- A. Prior to jointing, the bell and spigot ends of the pipes, and bells of fittings, shall be cleaned thoroughly with soapy water and cloth, and by whatever additional means as are necessary to remove all foreign matter and attain the required cleanliness. A wire brush shall be used as necessary. Particular care shall be exercised to clean the gasket seat. The gland also shall be cleaned in like manner.
- B. Joints shall be made in strict accord with the recommendations of the pipe manufacturer. The rubber gasket shall be cleaned with soapy water and cloth, and inserted in the gasket seat within the bell. The spigot end of the pipe shall be inserted in the bell of the pipe to which connection is being made, and forced to a firm contact with the shoulder of the bell. When this initial insertion is made, the alignment of the added pipe shall deviate from true alignment not more than the amount recommended by the pipe manufacturer.
- C. Following the initial insertion, the bell end of the added pipe shall be moved sideways or up a distance of approximately 8" to move the spigot end slightly away from the shoulder of the connecting bell, thus providing for expansion and flexibility in the completed line. The added pipe then shall be placed in true alignment at intended grade.

2.06 INSTALLATION OF MECHANICAL JOINTS

- A. The spigot end of pipe and the bell of fittings, and the rubber gasket, shall be cleaned thoroughly as specified for pipe joints in Paragraph 2.05 above. The gland also shall be cleaned in like manner.
- B. After the gland and gasket are placed on the spigot end of the pipe a sufficient distance from the end to avoid fouling the bell, the spigot end shall be inserted in the bell to firm contact with the bell shoulder. The rubber gasket then shall be advanced into the bell and seated in the gasket seat. Care shall be exercised to center the spigot within the bell. The gland shall be brought into contact with the gasket, all bolts entered and all nuts made hand tight. Continued care shall be exercised to keep spigot centered in bell. The joint shall be made tight by turning the nuts with a wrench; first partially tightening a nut, then partially tightening the nut 180° therefrom, and working thus around the pipe, with uniformly applied tension until the required torque is applied to all nuts. Required torque ranges and indicated wrench lengths for standard bolts are as follows:

| Diameter Inches | Range of Torque Wrench Inches | Length of Inches |
|----------------------------|--|-----------------------------|
| 5/8 | 40 - 60 | 8 |
| 3/4 | 60 - 90 | 10 |
| 1 | 70 - 100 | 12 |
| 1-1/4 | 90 - 120 | 14 |

2.08 PAINTING

- A. All non-buried pipe and fittings shall be painted as specified in DIVISION 9 - FINISHES, of these Specifications. Ductile iron pipe to be painted shall be supplied without an asphaltic exterior coating.

END OF SECTION

SECTION 02530

SEWAGE COLLECTION SYSTEM

PART 1. GENERAL

1.01 SUMMARY

- A. Provide sewage collection system.
- B. Perform pressure and leakage testing of piping.

1.02 RELATED SECTIONS

- A. Section 02315 – Excavation and Backfill.
- B. Section 02532 – Polyvinyl Chloride (PVC) Pipe – Sewer.
- C. Section 02536 – Manhole Construction.

PART 2. PRODUCTS

2.01 GENERAL

- A. Unless otherwise specified or shown on Drawings, pipe used for wastewater conveyance shall be SDR-35 PVC.
- B. Like items of material provided shall be the end products of one manufacturer.

PART 3. EXECUTION

3.01 PIPE PREPARATION AND HANDLING

- A. Clean ends of pipe thoroughly.
- B. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.
- C. Use proper implements, tools, and facilities for the safe and proper protection of the pipe.
- D. Avoid any physical damage to the pipe.
- E. Do not drop or dump pipe into trenches.

3.02 PREPARATION OF TRENCH – LINE AND GRADE

- A. Do not deviate more than 1/2" from line or 1/2" from grade. Measure for grade at the pipe invert, not at the top of the pipe, because of permissible variation in pipe wall thickness.
- B. Grade the bottom of the trench by hand to the line and grade to which the pipe is to be laid, with proper allowance for pipe thickness and for pipe base when specified or indicated.
- C. Remove hard spots that prevent a uniform thickness of bedding.
- D. Before laying each section of the pipe, check the grade with a straightedge and correct irregularities found.

- E. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, grade may only be disturbed for the removal of lifting tackle.

3.03 BELL (JOINT) HOLES

- A. At the location of each joint, dig bell (joint) holes of ample dimensions in the bottom of the trench and at the sides where necessary to permit easy visual inspection of the entire joint.

3.04 REMOVAL OF WATER

- A. Remove and dispose of water entering the trench during the process of pipe laying.
- B. Keep trench dry until pipe laying and jointing are completed.
- C. Removal of water shall be in conformance with specifications in Section 02315.

3.05 PREVENT TRENCH WATER AND ANIMALS FROM ENTERING PIPE

- A. When pipe laying is not in progress, including noon hours, open ends of pipe shall be closed; and no trench water, animals, or foreign material shall be permitted to enter the pipe.

3.06 LAYING BURIED PIPE

- A. Buried pipe shall be prepared as specified and laid on the prepared base and bedded to ensure uniform bearing.
- B. No pipe shall be laid in water or when trench conditions are unsuitable.
- C. Prevent uplift and floating of the pipe prior to backfilling.

3.07 TESTING – GENERAL

- A. Conduct leakage test on newly installed pipelines in accordance with Section 02513.
- B. Provide necessary equipment and material to perform testing.
- C. The Owner will monitor the tests.

3.08 GRAVITY SEWERS – ALIGNMENT

- A. Prior to final acceptance of the Work, the Owner will test lines for alignment.
- B. Provide assistance to Owner and lanterns for testing.
- C. Should any line deviate more than 1/2" from a straight line between manholes, the line may be rejected by Owner.
- D. Remove and replace lines rejected by Owner at no additional cost to Owner.

3.09 GRAVITY SEWERS LEAK TEST

- A. Sewers shall pass leakage tests as specified in Section 02513.

- B. Leakage test shall be performed in the presence of Owner's representative.

3.10 MANDREL TEST

- A. Perform deflection (reduction in vertical inside diameter) tests between successive manholes on PVC gravity sewer pipe at least 60-days after installation.
- B. Perform tests utilizing a sharp edge Mandrel.
- C. Deflection shall not exceed 5%.
- D. Mandrel dimensions based on 5% deflection shall be as follows:
 - 1. 6" diameter pipe: 5.62" Mandrel OD.
 - 2. 8" diameter pipe: 7.52" Mandrel OD.
 - 3. 10" diameter pipe: 9.41" Mandrel OD.
 - 4. 12" diameter pipe: 11.19" Mandrel OD.
 - 5. 15" diameter pipe: 13.70" Mandrel OD.
 - 6. 18" diameter pipe: 16.82" Mandrel OD.

3.11 TEST RECORDS

- A. Records shall be made of each piping system installation during the test. These records shall include:
 - 1. Date of test.
 - 2. Description and identification of piping tested.
 - 3. Test fluid.
 - 4. Test Pressure.
 - 5. Remarks, to include such items as:
 - a. Leaks (type, location).
 - b. Repairs made on leaks.
 - 6. Certification by Contractor and written approval by Owner.

END OF SECTION

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SECTION 02532

POLYVINYL CHLORIDE (PVC) PIPE – SEWER

PART 1. GENERAL

1.01 SUMMARY

- A. Provide polyvinyl chloride (PVC) pipe and fittings for sewer lines.

1.02 RELATED SECTIONS

- A. Section 02315 – Trench Excavation, Backfill, and Compacting.
- B. Section 02530 – Sewage Collection System.

1.03 REFERENCES

- A. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
 - 1. ASTM D1784 – Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - 2. ASTM F477 – Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

PART 2. PRODUCTS

2.01 PIPE

- A. PVC gravity sewer pipe, SDR-35 in compliance with ASTM D1784 and manufactured from virgin PVC compound with a cell classification of 12454-B with gasket joints and integral bell.
- B. Pipe shall be manufactured in the United States. Foreign made products shall be unacceptable.
- C. Pipe shall be permanently marked at 5' intervals with the following information:
 - 1. Nominal Size.
 - 2. Material code designation.
 - 3. Manufacturer's name or trademark and production record code.
 - 4. ASTM or AWWA certification.
 - 5. SDR designation.
- D. Warranty:
 - 1. Manufacturer of the pipe shall warrant product for a period of not less than one (1) year.
 - 2. Forward copies of warranty to the Owner.
 - 3. Replace defective materials at no extra cost to the Owner.

2.02 JOINTS

- A. Buried Pipe: Gasketed slip joint.
- B. Comply with ASTM D3139.

2.03 GASKETS

- A. As recommended by pipe manufacturer to conform to pipe.
- B. Comply with ASTM F477.

PART 3. EXECUTION

3.01 GENERAL

- A. Rigid PVC pipe shall be cut, made up, and installed in accordance with the pipe manufacturer's recommendations.
- B. Offset shall be as recommended by the manufacturer for the maximum temperature variation between time of installation and final use.

3.02 TESTING

- A. Gravity sewer line shall be tested in accordance with Section 02513.
- B. Engineer shall observe tests.

END OF SECTION

SECTION 02534

SEWAGE FORCE MAIN

PART 1. GENERAL

1.01 SUMMARY

- A. Furnish and install pressure pipe and fittings for sewage force main.

1.02 RELATED SECTIONS

- A. Section 02315 – Trench Excavation, Backfill, and Compacting.

1.03 REFERENCES

- A. American Society for Testing and Materials, 1961 Race Street, Philadelphia, Pennsylvania 19103.
 - 1. ASTM D1784 – Specification for Rigid Poly(Vinyl Chloride)(PVC) Compounds and Chlorinated Poly(Vinyl Chloride)(CPVC) Compounds.
 - 2. ASTM D2241 – Specification for Rigid Poly(Vinyl Chloride)(PVC) Pressure Rated Pipe (SDR-Series).
 - 3. ASTM D3139 – Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 4. ASTM F477 – Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.04 SUBMITTALS

- A. Make submittals in accordance with Section 01330.
- B. Product Data:
 - 1. Pipe materials and manufacturers.
 - 2. Manufacturer's standard installation instructions.
- C. Certificate of Compliance: Submit attesting that materials provided are in compliance with referenced standards.
- D. Test Records:
 - 1. Date of Test.
 - 2. Description and identification of piping tested.
 - 3. Test Fluid.
 - 4. Test Pressure.
 - 5. Remarks to include such items as:
 - a. Leaks (type, location).
 - b. Repairs made on leaks.

6. Certification by Contractor and written approval by Engineer.

1.05 QUALITY CONTROL

A. Polyvinyl Chloride (PVC)

1. PVC pipe manufactured from Type I, Grade 1 PVC, conforming to ASTM D1784.
2. Pipe shall be tested in accordance with ASTM D2241 and product standard PS 22-70.

PART 2. MATERIALS

2.01 PVC PIPE, FITTINGS, AND JOINTS

A. Pipe: Conform to the following requirements:

1. ASTM D1784 Class 200, Type I, Grade 1.

B. Permanently mark at 5' intervals with the following information:

1. Nominal size.
2. Material code designation.
3. Manufacturer's name or trademark and production record code.
4. ASTM or AWWA certification.
5. SDR designation.

C. Joints:

1. Buried Pipe: Gasketed slip joint with integral bell for buried water piping.
2. Comply with ASTM D3139.

D. Fittings:

1. Fittings 4" and larger: Cast iron or ductile iron mechanical joint.
2. Fittings Smaller than 4": PVC.

E. Gaskets:

1. As recommended by pipe manufacturer for outside diameter of pipe.
2. Comply with ASTM F477.

F. Tracer Wire:

1. Furnish and install 14-gage, insulated copper wire with PVC force main.
2. Rolls of wire shall have a minimum length of 1,500 L.F.

3. Connections of ends of wire shall be made using direct-bury splice that affords effective moisture seal, as manufactured by 3M Industries or approved equal.
4. Run wire continuous from valve box to valve box, air release vault, cleanout, or other access point.
5. Pipe testing shall include following tracer wire.
6. Wire breaks shall be repaired at no additional expense to the Owner.

G. Tee Fittings:

1. Furnish caps or plugs with each tee outlet or stub.
2. Band or otherwise secure plug or cap to withstand test pressures involved without leakage.
3. Furnish tee outlets with gasketed type joint or approved adapter to join service connection pipe used.

2.02 CONCRETE FOR THRUST BLOCKING AND ENCASEMENT.

- A. Install 2,500-psi concrete thrust blocks at bends, wyes, or other thrust points on pressure piping.
- B. Block to bear against undisturbed soil and shall be of size and with bearing area as shown on the Drawings.

PART 3. EXECUTION

3.01 PREPARATION OF TRENCH

A. Bell Holes:

1. Excavate bell holes at each joint to permit proper assembly and inspection of entire joint.
2. Bell holes shall be of sufficient depth to preclude direct bearing of bell on bottom of trench.

3.02 RELATION TO WATER LINE

- A. See Section 02511 – Separation Distances.

3.03 THRUST BLOCKING

- A. Do not over excavate in areas where thrust blocks are to be poured.
- B. Construct suitable forms to obtain shapes that will provide full bearing surfaces against undisturbed earth, as indicated.
- C. Pour thrust blocking against undisturbed earth.
- D. Cure thrust blocks a minimum of 5-days before conducting hydrostatic and air tests.

3.04 LAYING AND JOINTING PIPE AND FITTINGS

- A. Install in accordance with manufacturer's written instructions.

3.05 HYDROSTATIC AND LEAK TESTING OF PRESSURE LINES

- A. See Section 02513 – Pipe Testing and Cleanup.

3.06 EXTERIOR PROTECTION FOR BURIED OR SUBMERGED PIPING ACCESSORIES

- A. Wrap mechanical joints and valves with 8-mil polywrap.

END OF SECTION

SECTION 02536

MANHOLE CONSTRUCTION

PART 1. GENERAL

1.01 SUMMARY

- A. Construct manholes.
- B. Manhole details are shown on Drawings.

1.02 RELATED SECTIONS

- A. Section 02315 – Trench Excavation, Backfill, and Compacting.
- B. Section 03300 – Cast-in-Place Concrete.

1.03 REFERENCES

- A. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
 - 1. ASTM A615 – Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 2. ASTM C94 – Specification for Ready-Mix Concrete.

PART 2. MATERIALS

2.01 BASE ROCK

- A. Clean gravel or crushed rock conforming to requirements for granular fill for foundation stabilization as specified in Section 02315.

2.02 CONCRETE

- A. Ready-mixed, conforming to ASTM C94.
- B. Compressive field strength for manhole bases: Not less than 3,000 psi at 28-days.
- C. Maximum size of aggregate: 1½".
- D. Slump: Between 2" and 4".

2.03 FORMS

- A. Exterior exposed surfaces shall be plywood, steel, or fiberglass.
- B. Others shall be matched boards, plywood, or other approved material.
- C. Form vertical surfaces.
- D. Trench walls, large rock, or earth shall not be approved form material.

2.04 REINFORCING STEEL

- A. Conform to ASTM A615, Grade 60, deformed bars.

2.05 CAST-IN-PLACE MANHOLES

- A. Cast-in-place type manholes shall be in accordance with details of construction approved by Engineer and Section 03300.
- B. Precast Manholes: Are acceptable.

2.06 MANHOLE STEPS

- A. Cast iron or steel encased in PVC and conform to OSHA requirements.
- B. Rungs: Neenah Catalog No. R-1982-J or equal, as shown on Drawings.
- C. Space rungs vertically as shown on Drawings.
- D. Maximum spacing of rungs: 16".
- E. Install steps to provide a continuous ladder with steps equally spaced vertically in assembled manhole.
- F. Steps shall be capable of withstanding a force of 350-pounds, applied at any place on the step and in any direction which projects from the point of application through a diameter of the step cross-section at that point, with no permanent deformation resulting.
- G. Steps shall be cast into manhole wall.

2.07 MANHOLE FRAMES AND COVERS

- A. Manufacturer: Neenah, Model R-1772; East Jordan Iron Works, Series 1348; or approved equal.
- B. Lettering on Lid: "Sanitary Sewer".

PART 3. EXECUTION

3.01 EXCAVATION AND BACKFILL

- A. Conform to applicable portions of Section 02315.
- B. Backfill around manholes shall be of same quality as trench backfill immediately adjacent, see Section 02315.

3.02 ROCK BASE

- A. Remove water from the excavation.
- B. Place a minimum of 6" of granular foundation stabilization as specified in Section 02315.
- C. Thoroughly compact with mechanical vibrating or power tamper.

3.03 MANHOLE INVERT

- A. Grout invert to allow for a smooth transition from one pipe to another.

3.04 MANHOLE FRAMES AND COVERS

- A. Install frames and covers on top of manholes to prevent infiltration of surface or groundwater into manholes.
- B. Set frames in bed of mortar with mortar carried over flange of ring as shown on Drawings.
- C. Set frames so tops of covers are 6" above surface of adjoining ground surface, unless otherwise shown or directed.

3.05 VACUUM TESTING

- A. All manholes shall be tested for water tightness by means of a vacuum test.
- B. The manhole vacuum test shall be performed with suitable apparatus made for such purpose and shall adhere to ASTM C 1244-93 or most current.

END OF SECTION

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SECTION 02730

GRAVEL SURFACING

PART 1. GENERAL

1.01 SECTION INCLUDES

- A. Gravel paving course, compacted.

1.02 RELATED SECTIONS

- A. Section 02200 – Site Preparation.
- B. Section 02315 – Trench Excavation, Backfill, and Compacting.

1.03 REFERENCES

- A. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
 - 1. ASTM C136 – Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. Arkansas Department of Transportation, P.O. Box 2262, Little Rock, Arkansas 72203.
 - 1. ARDOT 303 – Aggregate Base Course.

1.04 TESTS

- A. Graduation of stone materials will be performed in accordance with ASTM C136.

PART 2. PRODUCTS

2.01 MATERIALS

- A. Natural and artificial mixture of gravel and soil mortar.
- B. Gravel:
 - 1. Crushed or uncrushed stone.
 - 2. Free from objectionable, deleterious, or other injurious matter.
 - 3. Graded to AHTD designations Class 3 or Class 4.
 - 4. Class 7 may be used for non-levee roads.

PART 3. EXECUTION

3.01 INSPECTION

- A. Verify compacted subgrade is dry and ready to receive Work of this Section.

- B. Verify gradients and elevations of subgrade are correct.
- C. Beginning of installation means acceptance of existing conditions.

3.02 PLACING GRAVEL PAVING

- A. Spread gravel material over prepared base to a total compacted thickness of 6", minimum.
- B. Level surfaces to elevations and gradients indicated.
- C. Compact placed gravel materials to achieve 95% Modified Proctor density in accordance with ASTM D1557 and Section 02315.
- D. Moisture Content:
 - 1. Add water, if necessary, to assist compaction.
 - 2. With an excess water condition, rework topping and aerate to reduce moisture content.
- E. Perform hand tamping in areas inaccessible to compaction equipment.

END OF SECTION

SECTION 02950

SITE RESTORATION AND REHABILITATION

PART 1. GENERAL

1.01 SUMMARY

- A. Provide finish grading and grass establishment.
- B. The intention of this Specification is that the Contractor establishes turf on pipelines and areas damaged as a result of construction.

PART 2. MATERIALS

2.01 TOPSOIL

- A. Existing topsoil shall be reused where practical.
- B. Imported Topsoil:
 - 1. Furnish at sole expense of Contractor.
 - 2. Friable loam free from subsoil, roots, grass, excessive amounts of weeds, stone, and foreign matter; acidity range (pH) of 5.5 to 7.5; and containing a minimum of 4% and a maximum of 50% organic matter.

2.02 SEED

- A. Certified, blue tag, clean, delivered in original, unopened packages and bearing an analysis of the contents, guaranteed 95% pure and to have a minimum germination rate of 85%, within 1-year of test.

2.03 SEED MIX

- A. Mix for areas: Common Bermuda grass. Follow the recommendations of the local Agricultural Extension Agent for requirements on coverage, fertilization, and seasons.

PART 3. EXECUTION

3.01 SITE GRADING

- A. Shape, trim, and finish slopes to conform with lines, grades, and cross sections shown.
- B. Make slopes free of loose exposed roots and stones exceeding 3" diameter.
- C. Ensure that site drains properly and there are no areas where water may pond.
- D. Finished site grading will be reviewed by Engineer.

3.02 GRADING OF TOPSOIL

- A. Shape the topsoil over the area to the desired shape and contour.
- B. Apply commercial fertilizer at the Agricultural Extension Agent's recommended rate, distributing it uniformly with a mechanical spreader.

3.03 FINISH GRADING

- A. Thoroughly mix the topsoil and fertilizer.
- B. Rake the area to a uniform grade so that areas drain in the same manner as at the start of the Project.
- C. Lightly compact before planting grass.
- D. Remove trash and stones exceeding 2" in diameter from area to a depth of 2" prior to preparation and planting grass.

3.04 TIME OF SEEDING

- A. Conduct seeding under favorable weather conditions during seasons, which are normal for work, as determined by accepted practice in locality of Project.

3.05 MECHANICAL SEEDING

- A. Sow grassed areas evenly with a mechanical spreader at rate of 100 pounds per acre, minimum, or as otherwise recommended by the Agricultural Extension Agent. Roll with cultipacker to cover seed, and water with fine spray. Method of seeding may be varied at discretion of Contractor on his own responsibility to establish a smooth, uniformly grassed area.

3.06 HYDROSEEDING

- A. Seed may be applied by hydroseeding method. Seeding shall be done within 10 days following soil preparation. Hydroseed areas at rate of 100 pounds seed and 500 pounds ammonium phosphate per acre, minimum, or as otherwise recommended by the Agricultural Extension Agent.
- B. Proceed with seeding operation on moist soil, but only after free surface water has drained away.
- C. Exercise care to prevent drift and displacement of mixture into other areas.

3.07 WINTER PROTECTIVE SEEDING

- A. Winter barley or annual rye grass applied at a rate of 120 pounds/acre shall be used after September 15 or as recommended by the Agricultural Extension Agent.
- B. Areas receiving temporary winter protective seeding shall be re-seeded when weather conditions become favorable.

3.08 MAINTENANCE

- A. Begin maintenance immediately after each portion of grass is planted and continue until a reasonable stand of grass has been obtained. Water to keep surface soil moist. Repair washed out areas by filling with topsoil, fertilizing, and seeding.

3.09 GUARANTEE

- A. If, at the end of a 180-day period, a satisfactory stand of grass has not been produced, the Contractor shall renovate and reseed the grass or unsatisfactory portions thereof immediately, or, if after the usual planting season, during the next planting season. If a satisfactory stand of grass develops by July 1 of the following year, it will be accepted. If it is not accepted, a complete replanting will be required during the planting season.
- B. A satisfactory stand is defined as grass or section of grass that has:
 - 1. No bare spots larger than 1 square foot.
 - 2. Not more than 10% of total area with bare spots larger than 1 square foot.
 - 3. Not more than 15% of total area with bare spots larger than 6" square.

END OF SECTION

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SECTION 03100

CONCRETE FORMS AND ACCESSORIES

PART 1. GENERAL

1.01 DESCRIPTION

A. Scope

This section describes the design, construction, erection, and handling of concrete forms for cast-in-place concrete.

1.02 QUALITY ASSURANCE

A. Design Criteria

1. The design of concrete formwork is solely the responsibility of the Contractor.
2. Conform to ACI 347, "Recommended Practice for Concrete Formwork", regarding the design loads, lateral pressures, wind loads, and design stresses.

B. Allowable Tolerances

1. The maximum deflection of formwork for surfaces exposed to view is 1/240 of the span between supports. Camber formwork where necessary to compensate for anticipated deflections in formwork due to loads imposed by fresh concrete and construction loads.
2. The maximum allowable deviation from a true plane is 1/8" in 6' for all exposed surfaces.
3. The maximum deviation from a true circle for circular structures is $\pm 1/4$ " when measured at the edge of each form.
4. The maximum allowable deviation from any Plan dimensions is $\pm 1/4$ ".

C. Reference Standards

1. "Recommended Practice for Concrete Formwork", ACI 347.
2. "Building Code Requirements for Reinforced Concrete Structures", ACI 318.
3. "Specifications for Structural Concrete Building", ACI 301.

1.03 SUBMITTALS

- A. Submit a description of the forming system to be used, including form type and description of form ties, to the Engineer for review.
- B. Submit detailed plans of the forming layout for any structure if directed by the Engineer. If such plans appear inadequate, the Engineer will recommend to the Contractor such changes as he deems necessary. The

Engineer's concurrence shall in no way relieve the Contractor of his responsibility for obtaining satisfactory results or his responsibility for damages or injury resulting from the use of such forming plans.

1.04 HANDLING AND STORAGE

- A. Handle all forming materials with care while erecting, removing, and storing.
- B. When forms are not in use, stack neatly to prevent damage from moisture or other environmental conditions.

PART 2. PRODUCTS

2.01 MATERIALS

- A. Prefabricated Forms – Steel framed plywood, steel framed fiberboard, or steel.
- B. Plywood – Product Standard PS-1, waterproof, resin bonded, exterior fir; Grade B or better for face adjacent to concrete.
- C. Fiberboard – Fed. Spec. LLL-B-810 Type IX, tempered waterproof, concrete form hardboard.
- D. Lumber – Straight, uniform, free from holes, dents, or other surface defects.
- E. Chamfer Strips – Commercially manufactured chamfer strips of molded plastic or PVC. Use one style throughout the project. Surface against concrete planed smooth; 45° chamfer strip with minimum cross section dimension of $\frac{3}{4}$ ".
- F. Form Ties – Steel, removable end, permanently embedded type. Furnish spreader cones such that no metal from the tie remains closer than 1½" from the formed surface after the forms are removed.
- G. Rustication and Score Line Strips – PVC.

2.02 FABRICATION AND MANUFACTURE

- A. All forms shall be fabricated or manufactured to be sufficiently tight to prevent leakage of mortar and to be easily aligned to prevent offsets. Warped or bent forms or frames will not be acceptable.
- B. Construct forms so they may be easily removed without damaging concrete surfaces.
- C. Provide positive means of adjustment of shores and struts by use of wedges or jacks.
- D. Forms shall be sufficiently rigid to prevent displacement or sagging during concrete placement.

PART 3. EXECUTION

3.01 INSPECTION

- A. Inspect all forms for warps, bent frames, damaged plywood or fiberboard and remove damaged forms from the jobsite.
- B. Examine surfaces to which forms may be connected or may abut before beginning erection of forms. Correct any defects and deviations in these surfaces before erecting forms.

3.02 PREPARATION

- A. Field Measurements

Lay out all necessary dimensions required to establish proper placement of forms. Use string lines, chalk lines, or other suitable aids to establish lines and grades for form-setters. Check all dimensions of erected formwork before placing concrete.

- B. Clean forms before beginning erection.
- C. Lubricate with approved commercially prepared form lubricant, all portions of the form which will be in direct contact with concrete.

3.03 ERECTION

- A. Erect all forms in such a manner as to be true to line, dimension, and elevations shown on the Plans, to be rigidly braced and unyielding, and to be completely mortar tight.
- B. Install walers, studs, internal ties, and other form supports, adequately spaced so proper working stresses are not exceeded.
- C. Provide temporary openings in wall and column forms to facilitate cleaning, inspection, and placing of concrete.
- D. Forms for concrete normally exposed to view

1. Lay forms out in a regular and uniform pattern with the long dimension of the panels vertical with all joints aligned. Flat segmental forms may be used for forming curved surfaces 25' in diameter or larger.
2. Do not use any forms which have offsets, ridges, concave, or convex surfaces.
3. Use new, or like new, forms for all surfaces normally exposed to view and to a point one foot below finish grade.

Steel forms shall be square and true and have no dents or deviations from a true plane exceeding $\frac{1}{8}$ ".

4. Wherever the top of a wall is to be exposed to view, bring the top of at least one side of the forms to proper line and grade so the top of the wall can be finished with a screed or template.

- E. Install chamfer strips for all exposed corners.

3.04 FALSEWORK

- A. General Requirements

All falsework shall be designed and constructed so that no excessive settlement or deformation will occur, and so that the necessary rigidity will be provided.

- B. Design Loads

For calculating the loads on falsework, a weight of 150-lbs. per cubic foot shall be assumed for concrete plus a live load of 50-lbs. per square foot of horizontal surface for the forms.

- C. Materials

All timber used in falsework shall be sound, in good condition, and free from defects which will impair its strength. Steel members shall be of adequate strength and of such shape as to be suitable for the purpose intended.

- D. Workmanship

Sills or timber grillages used to support falsework columns, (unless founded on solid rock, shale, or other hard materials) shall be placed in excavated pits and backfilled to prevent softening of the supporting material by drip from the forms or by rains that may occur during construction process. Footings or grillages shall be of ample size to support superimposed loads without settlement. Falsework which cannot be founded on a satisfactory spread footing shall be supported on piling driven to a bearing capacity sufficient to support the superimposed load without settlement. In general, each falsework bent shall be capped transversely at the proper elevation by a cap of adequate size. If desired by the Contractor, a short cap section forming a T-head may be substituted at the top of each pile or column and shall be set at the proper elevation to produce, in conjunction with the use of approved hardwood wedges or jacks, permanent camber indicated on the Plans or specified, plus a construction camber covering allowance for deformation of the forms and falsework. The use of wedges to compensate for incorrectly cut bearing surfaces will not be permitted. Wedges shall be used in pairs and shall be so arranged as to ensure uniform bearing. Each falsework bent shall be of ample size to provide the stiffness required. The bracing shall be securely spiked or bolted to each pile or column it may cross.

3.05 FIELD QUALITY CONTROL

- A. Before placing concrete, check all shores, struts, jacks, connections, and ties for tightness and rigidity.
- B. Check all forms for alignment and for conformance to Plan dimensions.

3.06 REMOVAL OF FORMS

- A. Formwork for beam soffits, structural slabs, and other parts that support the weight of concrete may be removed only after compression tests of field cylinders indicate the concrete has obtained 85% of the specified 28-day strength.
- B. In general, form or shores for supported slabs shall not be removed until the concrete, so supported, has acquired 70% of its design strength; except where the 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 time specified below or sooner, if required by the Engineer, where concrete is to receive a rubbed finish.
- C. Forms shall not be removed before the minimum times given below, or longer if job control test 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 | 3 days |
| Columns | 5 days |
| Walls greater than 12" thick | 7 days |

END OF SECTION

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SECTION 03210

REINFORCING STEEL

PART 1. GENERAL

1.01 SUMMARY

- A. Provide reinforcing steel and welded wire fabric.
- B. Conform to "Placing Reinforcing Bars", Recommended Practices, Joint Effort of CRSI-WCRSI, prepared under the direction of the CRSI Committee on Engineering Practice.
- C. Notify Engineer when reinforcing is ready for inspection and allow sufficient time for this inspection prior to casting concrete.

1.02 RELATED SECTIONS

- A. Section 01330 – Submittal Requirements.
- B. Section 03300 – Cast-in-place Concrete.

1.03 REFERENCES

- A. American Concrete Institute, 22400 West Seven Mile Road, Detroit, Michigan 48219.
 - 1. ACI-318-83 – Building Code Requirements for Reinforcing Concrete.
- B. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
 - 1. ASTM A185 – Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.
 - 2. ASTM A497 – Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
 - 3. ASTM A615 – Specification for Deformed and Plain Billet-Steel for Concrete Reinforcement.
- C. American Welding Society, 550 North West LeJeune Road, Miami, Florida 33126.
 - 1. AWS S1.4-79 – Structural Welding Code; Reinforcing Steel.
- D. Concrete Reinforcing Steel Institute, 933 North Plum Grove Road, Schamburg, Illinois 60195.
 - 1. CRSI-MSP-1-86 – Manual of Standard Practice.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330:

1. Bending lists.
2. Placing drawings.
3. Shop drawings.

B. Shop Drawings:

1. Bars for footings, including dowels, may be fabricated and shipped without prior review of Shop Drawings by the Engineer, provided that Drawings are followed without deviation.
2. Otherwise, Shop and Placing Drawings shall include reinforcing placing plans and details indicating size, location, arrangement, placing sequence, etc., and shall conform to ACI 315.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Steel:

1. Deliver with suitable hauling and handling equipment.
2. Tag for easy identification.
3. Store to prevent contact with the ground.

B. Unloading, storing, and handling of bars shall conform to CRSI publication "Placing Reinforcing Bars".

PART 2. PRODUCTS

2.01 DEFORMED REINFORCING BARS

A. Deformed billet-steel bars conforming to ASTM A615, Grade 60.

2.02 WELDED WIRE FABRIC

A. Conform to ASTM A185 or A497.

2.03 ACCESSORIES:

- A. Tie wire: 16-gage, black, soft-annealed wire.
- B. Bar supports: proper type for intended use.
- C. Bar supports in beams, columns, walls, and slabs exposed to view after stripping: Small rectangular concrete blocks of same color and strength of concrete that is being placed around them.
- D. Concrete supports: for reinforcing concrete placed on grade.
- E. Conform to requirements of "Placing Reinforcing Bars" published by CRSI.

PART 3. EXECUTION

3.01 REINFORCING STEEL

- A. Clean metal reinforcement of loose mill scale, oil, earth and other contaminants.
- B. Straightening and rebending reinforcing steel:
 - 1. Do not straighten or rebend metal reinforcement.
 - 2. Where construction access through reinforcing is a problem, use bundle or space bars instead of bending.
 - 3. Submit details and obtain Engineer's review prior to placing.
- C. Protection, spacing, and positioning of reinforcing steel: Conform to the current edition of the ACI Standard Building Code Requirements for Reinforced Concrete (ACI 318), reviewed placing drawings and design drawings.
- D. Location Tolerance: Conform to the current edition of "Placing Reinforcing Bars" published by Concrete Reinforcing Steel Institute and to the Details and Notes on the Drawings.
- E. Splicing:
 - 1. Conform to Drawings and current edition of ACI Code 318.
 - 2. Stagger splices in adjacent bars.
- F. Tying deformed reinforcing bars: Conform to current edition of "Placing Reinforcing Bars" published by Concrete Reinforcing Steel Institute and to details and notes on Drawings.
- G. Field Bending:
 - 1. Field bending of reinforcing steel bars is not permitted when rebending will later be required to straighten bars.
 - 2. Consult with Engineer prior to pouring if there is a need to work out a solution to prevent field bending.

3.02 REINFORCEMENT AROUND OPENINGS

- A. Place an equivalent area of steel around pipe or opening and extend on each side sufficiently to develop bond in each bar.
- B. See Drawings for bar extension length each side of opening.
- C. Where welded wire fabric is used, provide extra reinforcement using fabric or deformed bars.

3.03 WELDING REINFORCEMENT

- A. Welding shall not be permitted unless Contractor submits detailed Shop Drawings, qualifications, and radiographic nondestructive testing procedures for review by Engineer.
 - 1. Obtain results of this review prior to proceeding.

2. Basis for submittals: Structural Welding Code, Reinforcing Steel, AWS D1.4-79, published by American Welding Society, and applicable portions of ACI 318, current edition.
3. Test 10% of welds using radiographic, nondestructive testing procedures referenced codes.

3.04 PLACING WELDED WIRE FABRIC

- A. Conform to ACI 318-77 and to current Manual of Standard Practice, Welded Wire Fabric, by Wire Reinforcement Institute regarding placement, bends, laps, and other requirements.
- B. Placing:
 1. Extend fabric to within 2" of edges of slab.
 2. Lap splices at least 1½ courses of fabric and a minimum of 6".
 3. Tie laps and splices securely at ends and at least every 24" with 16-gage black annealed steel wire.
 4. Place welded wire fabric at the proper distance above bottom of slab.

END OF SECTION

SECTION 03251

CONSTRUCTION JOINTS AND WATERSTOPS

PART 1. GENERAL

1.01 SCOPE

A. General

This section covers construction joints, expansion joints, and placement of waterstops.

B. Placement

Waterstops shall be installed in all construction joints with water or liquid on at least on one side of joint and at other locations required by the plans. All waterstops shall be continuous throughout their length.

1.02 SUBMITTALS

- A. Submit a catalogue brochure of the waterstop to be used showing dimension and configuration in accordance with Section 01330.

PART 2. PRODUCTS

2.01 WATERSTOPS

A. PVC Waterstop

1. All waterstops shall be of "Rib Type" with a center bulb, capable of resisting a maximum pressure load of 65' of water.
2. Approved Manufacturers
 - a. Serviced Products Division, W.R. Grace and Company.
 - b. B.F. Goodrich.
 - c. Vinyltex Corporation.
 - d. Saf-T-Grip Specialties Corporation.
 - e. Vinyl-stops by Sonneborn-Contech.
3. All waterstops shall be 3/16" nominal thickness and 6" wide with 1" center bulb.

B. Adhesive Waterstops

1. Meet or exceed all requirements of Federal Specifications SS-S-00210, "Sealing Compound, Preformed Plastic for Expansion Joints," Type I or Type II. Plastic waterstop shall be equal to Synko-Flex as manufactured by Synko-Flex Products Company, Houston, Texas.
2. The plastic waterstop shall be produced from blends of refined hydrocarbon

resins and plasticizing compounds reinforced with inert material 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.

2.02 EXPANSION JOINTS

A. General

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.

B. 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.

1. The sheet filler shall conform to the requirements of AASHTO Specification M-59 with the following additional provisions.
2. 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.

C. Hot Poured Rubberized Tar Joint Sealer

Hot poured rubberized mastic 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.

2.03 CONSTRUCTION JOINTS

A. General

Location of all construction joints shall be approved by the Engineer.

1. Maximum length of wall pours shall be 40' provided with construction joints or as shown on the plans.
2. Bottom slabs and wall footings for concrete structures that will hold water shall be poured monolithically without cold joints or other discontinuities or weakened areas.
3. Radial control joints consisting of 1/2" to 3/4" wide troweled grooves shall be

required at 60° increments in circular slabs. Such joints shall be caulked with epoxy joint sealer after the concrete is cured and prior to placement of grout topping if used.

4. All cracks greater than 0.05" wide not located in control joints shall be sealed by cutting a bevel groove on the water side of the crack 1/2" to 3/4" wide and caulking with epoxy sealant. Crack widths shall be measured at the concrete surface.

PART 3. EXECUTION

3.01 INSTALLATION OF WATERSTOPS

- A. Install waterstops such that one-half of the width will be embedded on one side of the joint and one-half in the other. Secure the waterstop in position using a method insuring the waterstop will be held securely and in straight alignment; do not allow the waterstop to come in contact with reinforcing steel.
- B. Join all waterstops to form a continuous barrier to the passage of water, both in the same plane and at the intersection of different planes. Use splices designed for the specific purpose of joining PVC waterstops.
 1. Joints in PVC waterstops shall be made by heating the two surfaces to be joined until the material has softened to the point where it is just short of being fluid, bring the two softened surfaces together with a slight rubbing motion followed by firm pressing so that a solid and tight bond is made.
 2. The joints in strips of waterstop made in the above manner shall be such that the entire cross section of the joint is dense, homogeneous, and free of porosity. All finished joints shall have a tensile strength of not less than 75% of the base strip as extruded.
 3. Heating of the surfaces to be joined shall be done by means of an electric splicing iron designed for this purpose and controlled by means of a voltage regulator.
 4. Heat shall be regulated to prevent too rapid melting and charring of the waterstop material.
 5. The Contractor shall provide jigs needed to make the joints in proper and workmanlike manner and in hold the strips so that alignment of joined strips is correct and angles are those required.
 6. Inspect all joints prior to embedment, replace any defective joints.
- C. Protect exposed waterstops from damage between concrete pours.

3.02 INSTALLATION OF ADHESIVE WATERSTOPS

- A. As soon as the form lumber is removed from the joint, brush the joint clean to remove all dust and foreign particles. Immediately apply one brush coat of prime recommended by the waterstop manufacturer.
- B. Remove one face of the protective paper and position in the center of the keyway, lapping strips one inch end to end to form a continuous homogeneous waterstop for the entire length of the section.
- C. Immediately before pouring concrete at the joint, completely clean the joint using

brushes and compressed air to remove all debris. Only just before the concrete pour is made, remove the protective paper covering from the waterstop.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1. GENERAL

1.01 WORK INCLUDED

- A. Cast-in-place concrete, including formwork.

1.02 RELATED WORK

- A. Section 01330–Submittal Requirements.
- B. Section 03210–Reinforcing Steel.

1.03 REFERENCES

- A. American Concrete Institute, Box 19150, Redford Station, Detroit, Michigan 48219 (latest revision).
 - 1. ACI 211.1: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
 - 2. ACI 211.2: Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
 - 3. ACI 211.3 Standard Practice for Selecting Proportions for No-Slump Concrete.
 - 4. ACI 304R: Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 - 5. ACI 304.2R: Placing Concrete by Pumping Method.
 - 6. ACI 304.3R: High Density Concrete: Measuring, Mixing, Transporting, and Placing.
 - 7. ACI 304.4R: Placing Concrete with Belt Conveyors.
 - 8. ACI 305 R: Hot Weather Concreting.
 - 9. ACI 306 R: Cold Weather Concreting.
 - 10. ACI 309: Standard Practice for Consolidating of Concrete.
 - 11. ACI 309.1R: Behavior of Fresh Concrete During Vibration.
 - 12. ACI 309.2R: Identification and Control of Consolidation-Related Surface Defects in Formed Concrete.
 - 13. ACI 347: Recommended Practice for Concrete Formwork.
- B. American Society of Testing for Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103 (latest revision).
 - 1. ASTM C33: Specification for Concrete Aggregates.
 - 2. ASTM C150: Specification for Portland Cement.
 - 3. ASTM C260: Specification for Air-Entraining Admixtures for Concrete.
 - 4. ASTM C309: Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 5. ASTM C494: Specification for Chemical Admixtures for Concrete.

6. ASTM E329: Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

1.04 SUBMITTALS

- A. Provide the following in accordance with Section 01330.
 1. Admixture certification; chloride ion content must be included.
 2. Concrete mix design.
 3. Certification for aggregate quality.
 4. Mill tests for cement.
 5. Method of adding admixtures.
 6. Materials and methods for curing.
 7. Testing agency to perform services required in ACI 301, Section 167.
 8. Laboratory test on concrete.

1.05 QUALITY ASSURANCE

- A. Inspection: Engineer shall have access and rights to inspect batch plants, cement mills, and facilities of suppliers, manufacturers, and subcontractors providing products specified.
- B. Batch Plant:
 1. Certification: Current certification that weighing scales have been tested and are within tolerances as set forth in National Bureau of Standards Handbook No. 44.
 2. Equipment: Semi-automatic or fully automatic.
- C. Perform work in accordance with ACI 301.
- D. Obtain materials from same source throughout the work.

PART 2. PRODUCTS

2.01 CEMENT

- A. Portland cements Type I and Type II conforming to ASTM C150.

2.02 WATER

- A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances.
- B. Potable.

2.03 CONCRETE AGGREGATES

A. General:

1. Natural aggregates, well graded, free from deleterious coatings and organic materials conforming to ASTM C33 (latest revision).
2. Import non-reactive aggregates if local aggregates are reactive (Appendix XI-ASTM C33).
3. Wash aggregates uniformly before use.
4. Other aggregate gradations can be approved by Engineer.

B. Fine Aggregates:

1. Clean, sharp, natural sand conforming to ASTM C33.
2. Less than 2% passing the No. 200 sieve.

C. Coarse Aggregates:

1. Natural gravel, crushed gravel, crushed stone, or combination of these materials.
2. Less than 15% float or elongated particles (long dimension > 5 times short dimension).
3. Less than 0.5% passing the No. 200 sieve.

D. Grading Requirements for Course Aggregates:

| <u>Sieve Size Or Size In Inches</u> | <u>1- 1/2" Aggregate</u> | <u>1" Aggregate</u> | <u>3/4" Aggregate</u> |
|---|--------------------------|---------------------|-----------------------|
| 1- 1/2" | 95-100 | ----- | ----- |
| 1" | ----- | 90-100 | ----- |
| 3/4" | 35-70 | 40-85 | 90-100 |
| 1/2" | ----- | 10-40 | 20-55 |
| 3/8" | 10-30 | 0-15 | 0-15 |
| No. 4 | 0-5 | 0-5 | 0-5 |

E. Grading Requirements for Fine Aggregates:

| <u>Sieve Size</u> | <u>Minimum</u> | <u>Maximum</u> |
|-------------------|----------------|----------------|
| 3/8" | 100 | ----- |
| No. 4 | 95 | 100 |
| No. 8 | 80 | 100 |
| No. 16 | 50 | 85 |
| No. 30 | 25 | 60 |
| No. 50 | 10 | 30 |
| No. 100 | 2 | 10 |

2.04 CONCRETE AIR-ENTRAINING ADMIXTURES

- A. Manufacturer:
 - 1. Air-Mix or Perma-Air by the Euclid Chemical Co.
 - 2. Sealtight Air Entraining Admixture by W.R. Meadows of Texas.
- B. ASTM C260; nontoxic after 30 days.
- C. Use only the specified non-corrosive, non-chloride accelerator. Calcium chloride, thiocyanates or admixtures containing more than 0.05% ions are not permitted.
- D. Provide for concrete exposed to freezing and thawing or required being watertight. Air Content: 5% to 6%.

2.05 ADMIXTURES

- A. Water-Reducing Admixture: Conforming to ASTM C494, Type A and not containing more than 0.05% chloride ions than are present in municipal drinking water.
 - 1. Eucom WR-75 by the Euclid Chemical Company.
 - 2. Pozzolith 200 N by Master Builder.
 - 3. Plastocrete 160 by Sika Chemical Corporation.
- B. Water-Reducing Retarding Admixture: Conforming to ASTM C494, Type D and not containing more chloride ions than are present in municipal drinking water.
 - 1. Eucom Retarder-75 by the Euclid Chemical Company.
 - 2. Pozzolith 100 XR by Master Builder.
 - 3. Plastiment by Sika Chemical Company.
- C. High-Range Water-Reducing Admixture (Superplasticizer): Conforming to ASTM C494, Type F or G, and not containing more chloride ions than are present in municipal drinking water.
 - 1. Eucom 37 by Euclid Chemical Company.
 - 2. Rheobuild 1000 by Master Builders.
 - 3. Sikament by Sika Chemical Company.
- D. Non-Corrosive Non-Chloride Accelerator Admixture: Conforming to ASTM C494 Type C or E, and not containing more chloride ions than are present in municipal drinking water.
 - 1. Accelguard 80 by Euclid Chemical Company.
 - 2. Or approved equal.
 - 3. Manufacturer must have long term non-corrosive test data from an independent testing laboratory (of at least 1 year's duration) using an acceptable accelerated corrosion test method using electrical potential measures.

- E. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions.
- F. Certification: Submit written conformance to the requirements and chloride ion content of the admixture to Engineer prior to mix design review.

2.06 FORMS

- A. Materials: Plywood, hard plastic finished plywood, overlaid waterproof particleboard, or steel.
- B. Surfaces: New and undamaged condition.
- C. Joints: Use tape, gaskets, plugs, or approved caulking to keep joints water tight and to allow them to withstand placing pressures without bulging outward or creating surface patterns.

2.07 FORM TIES

- A. Factory-made and constructed so that tie remains embedded in wall, except for removable portion at each end.
- B. Inserts:
 - 1. Conical or spherical.
 - 2. Fixed to remain in contact with forming material.
 - 3. Constructed so no metal is within 1½" of concrete surface when forms, inserts, and tie ends are removed.
- C. Flat bar ties for panel forms: Plastic or rubber inserts with a minimum depth of 1" and sufficient dimensions to permit proper patching of tie hole.

2.08 BONDING AGENT

- A. Manufacturer: Sonnebond by Sonneborn; or approved equal.
- B. Submit product specifications and manufacturer's specific instructions for application on this Project for Engineer's approval.
- C. Product must meet Project requirements with regard to surface, pot life, set time, vertical or horizontal application, forming restrictions, or other stated requirements.

2.09 BOND BREAKER

- A. Manufacturers:
 - 1. Williams Tilt-Up Compound, Williams Distributors Inc., Seattle, Washington.
 - 2. Silco seal 77, Superior concrete Accessories, Franklin Park, Illinois.
 - 3. Or Equal.
- B. Non-staining type.
- C. Provide positive bond prevention.

- D. Submit for review copies of manufacturer's data, recommendations, and instructions for specific use on this Project.

2.10 CURING COMPOUND

A. Curing and Sealing Compound.

1. Clear styrene acrylate type, minimum 30% solids content.
2. Test data from an independent testing laboratory indicating a maximum moisture loss of 0.030 grams per sq. cm when applied at a coverage rate of 300 sq. ft. per gallon.
3. Submit manufacturer's certification.
4. Sodium silicate compounds are not permitted.
5. Manufacturer:
 - a. Super Rez Seal or Super Pliocure by the Euclid Chemical Co.
 - b. Masterkure 30 by Master Builders.

B. Exposed Concrete Surfaces:

1. Manufacturer:
 - a. Kurez DR by Euclid Chemical Company.
 - b. Or approved equal.
2. Dissipating resin type compound.
3. ASTM C309.
4. Film must chemically break down in 6 to 8 week period.

2.11 BONDING AND REPAIR MATERIALS

A. Rewettable Bonding Compounds:

1. Polyvinyl acetate type.
2. Manufacturer:
 - a. Euco Weld by the Euclid Chemical Company.
 - b. Weldcrete by the Larson Co.
3. Use only in areas not subject to moisture.

B. Non-Rewettable Bonding Compounds:

1. Polymer modified type.
2. Manufacturer:
 - a. Euco-Bond by the Euclid Chemical Company.
 - b. Or approved equal.

- C. Bonding Admixture:
1. Latex, non-rewettable type.
 2. Manufacturer:
 - a. SBR Latex or Flex-Con by the Euclid Chemical Co.
 - b. Daraweld C by W.R. Grace.
- D. Epoxy adhesives:
1. Two component, 100% solids, 100% reactive compound.
 2. Suitable for use on dry or damp surfaces.
 3. Manufacturer:
 - a. Euco Epoxy No. 452MV or No. 620 by the Euclid Chemical Co.
 - b. Sikadure Hi-Mod by the Sika Chemical Corp.
- E. Patching Mortar:
1. Free flowing or gel consistency.
 2. Polymer modified cementitious mortar.
 3. Manufacturer:
 - a. Euco Thin Coat or Concrete Coat by the Euclid Chemical Co. for horizontal repairs.
 - b. Verticoat by the Euclid Chemical Company for vertical or overhead repairs.
 - c. Sikatop 121 or 122 by the Sika Chemical Co. for horizontal repairs.
 - d. Sikatop 123 by the Sika Chemical Co. for vertical or overhead repairs.
- F. Underlayment Compound:
1. Flo-Top by the Euclid Chemical Co.
 2. Manufacturer:
 - a. Flo-Top by the Euclid Chemical Co.
 - b. Or approved Equal.
- G. Repair Topping:
1. Self-leveling, polymer modified high strength topping.
 2. Manufacturer: Thin Top SL by the Euclid Chemical Company.

PART 3. EXECUTION

3.01 DESIGN OF CONCRETE MIX

- A. Submit mix design on each class of concrete for review, include standard deviation analysis or trial mixture test data.
- B. Proportion mix design in accordance with ACI 318-89, Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures".
- C. If trial batches are used:
 - 1. Prepare mix design by independent testing laboratory.
 - 2. Achieve an average compressive strength 1200-psi higher than the specified strength, or 1400-psi for specified concrete strengths over 5000-psi.
 - 3. Certified copies of laboratory trial mix reports and cylinder tests shall be submitted to Engineer by the testing laboratory for approval.
- D. Do not place concrete prior to receipt of Engineer's written approval of mixes and cylinder test results.
- E. Design mix and perform tests to meet the requirements as specified.

| <u>Location</u> | <u>Minimum 28-Day Compressive Strength (psi)</u> | <u>Maximum Water- Cement Ratio</u> | <u>Air Content</u> | <u>Slump Range (in.)</u> |
|---|--|--|------------------------|----------------------------------|
| Footings, Piers, Grade-beams, And other grade Foundations. | 3500 | ----- | Optional | 2-4 |

- F. Minimum Cement Content (based on aggregate size):

| <u>Minimum Cement Content</u> | <u>Maximum Aggregate Size</u> |
|-------------------------------|-------------------------------|
| 517 lb/cy | 1" |
| 540 lb/cy | 1" |
| 564 lb/cy | 3/4" |

- G. Combined Aggregate Gradings:
 - 1. Aggregates for concrete shall be combined in proportions that will provide a mixture within the grading limits in accordance with this Section, unless otherwise approved in writing by Engineer.
 - 2. Maximum aggregate size depends on rebar clearances.
 - 3. Recommended Admixture Usage:

| Location or Condition | Recommended Admixture | Additional Requirements |
|---|---|--|
| Air entrained concrete | Air-entraining admixture | Non-toxic; non-corrosive |
| Pumped concrete admixture | High-range, water-reducing (Superplasticizer) | Initial slump: 2-3' slump with Superplasticizer: 8' max. |
| Concrete with a water-cement ratio below 0.50 | High-range, water-reducing admixture (Superplasticizer) | Initial slump: 2-3' slump with Superplasticizer: 8' max. |

H. Admixtures:

1. Concrete shall contain the specified water-reducing admixture or the specified high-range water-reducing admixture (superplasticizer).
2. Concrete required to be air entrained shall contain an approved air entraining admixture.
3. Pumped concrete, concrete for industrial slabs, architectural concrete, concrete required to be watertight, or concrete with a water/cement ratio below 0.50 shall contain the specified high-range water-reducing admixture (superplasticizer).

3.02 MEASUREMENT OF MATERIALS AND MIXING

- A. Conform to ACI 304 current edition; specified requirements for mix design, testing, and quality control; and to other requirements of these Specifications.

3.03 RETEMPERING

- A. Retempering of concrete or mortar in which the cement has partially hydrated will not be permitted. Redosage with the specified high-range water-reducing admixture (superplasticizer) may be done with the prior approval of the Engineer regarding dosage and time periods.

3.04 FORMS—MAXIMUM SIZE OF CONCRETE PLACEMENTS

- A. Coordinate with other trades whose work may be located within or below concrete.
- B. Notify Engineer 1 full working day prior to erection of forms for inspection.
- C. Thoroughly clean forms and adjacent surfaces to receive concrete; remove chips, wood, sawdust, dirt or other debris before concrete is placed.
- D. Design:
 1. Design, erect, support, brace, and maintain formwork in accordance with:

- a. Building Codes Requirements for Reinforced Concrete (ACI 318).
 - b. Recommended Practice for Concrete Formwork (ACI 347).
 - c. Construction Industry Standards (OSHA 2207).
2. Design formwork to be readily removable without impact, shock, or damage to concrete surfaces and adjacent materials.
- E. Reuse of Forms: Do not reuse forms unless they are in new and undamaged condition.
- F. Beveled Edges (Chamfer):
- 1. Form $\frac{3}{4}$ " bevels at concrete edges.
 - 2. Where beveled edges on existing adjacent structures are diverse more than $\frac{3}{4}$ ", obtain Engineer's approval of size prior to placement of bevel form strip.
- G. Form Tolerances: Construct forms to sizes, shapes, lines, and dimensions shown, work in finished structures.

| Tolerances | Concrete Canal Lining (in) | Drainage Structure (in) |
|---------------------------------------|----------------------------|-------------------------|
| Alignment–Tangents | 1 | |
| -- Curves | | |
| Grades | 1 | |
| Plumb: In any 10-foot of length | ----- | $\frac{1}{2}$ |
| Footings: | | |
| a. Variation in dimensions in drawing | ----- | - $\frac{1}{2}$ + 2 |
| b. Misplacement or eccentricity | ----- | 2% |
| c. Reduction in thickness | ----- | 5% |

- H. Removal of Forms:
- 1. Do not disturb forms until concrete is sufficiently strong to withstand possible injury.
 - 2. Do not remove shoring until member has acquired sufficient strength to support its weight and the load upon it.

3.05 FORM TIES

- A. Place in uniform patterns on exposed surfaces.
- B. Number and placement sufficient to withstand pressures and limit deflection of forms to acceptable limits.

3.06 PLACING CONCRETE - GENERAL

- A. Do not place concrete without Engineer being present.
- B. Allow other trades reasonable time to complete portions of work which must be completed before concrete is placed.
- C. Notify Engineer at least 1 full working day in advance before starting to place concrete to permit inspection of forms, reinforcing, sleeves, conduits, boxes, inserts, or other work required to be installed in concrete.
- D. Review curing methods with Engineer and verify curing materials and equipment are at Project site.
- E. Placement shall conform to requirements and recommendations of ACI 304 and ACI 318, except as modified in these Specifications.
- F. Place concrete as soon as possible after leaving mixer in layers not over 1½' deep:
 - 1. Without segregation or loss of ingredients.
 - 2. Without splashing forms or steel above.
- G. Vertical Free Fall Drop to Final Placement:
 - 1. Concrete shall not be dropped freely where reinforcing will cause segregation.
 - 2. Not to exceed 10' for concrete containing high-range water-reducing admixture (superplasticizer).
 - 3. Not to exceed 5' for other concrete.
- H. Do not use concrete truck chutes, pipes, finishing tools, etc., constructed of aluminum.
- I. Before depositing concrete:
 - 1. Remove debris from space to be occupied by concrete.
 - 2. Dampen:
 - a. Gravel fill beneath slabs on ground.
 - b. Sand where vapor barrier is specified.
 - c. Wood forms.
 - 3. Verify reinforcement is secured in position.

3.07 ADDITION OF WATER AT PROJECT SITE

- A. Do not add water to concrete at Project site if slump is within specified range.
- B. With the Engineer's approval, add water to concrete arriving at Project site with a slump less than the specified range, provided it can be demonstrated that the specified water-cement ration will not be exceeded.
- C. Water/Cement Ratio:

1. Concrete subject to freezing and thawing: Maximum water/cement ratio of 0.50, 4000-psi at 28 days or more.
 2. Concrete subject to deicers or required to be watertight: Maximum cement/water ratio of 0.45, 4500-psi at 28 days or more.
 3. Reinforced concrete subjected to brackish water, salt spray, or deicers; Maximum water/cement ratio or 0.40, 5000-psi at 28 days or more.
- D. The following tests will be required from each truck to which water has been added at Project site: 3 cylinders, 1 slump, and 1 air test. Costs for these tests shall be the full responsibility of the Contractor and shall be withheld from the monthly payment estimate.

3.08 CONVEYING

- A. Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials.
- B. Conveying equipment shall be capable of providing a supply of concrete at the site of placement without interruptions sufficient to permit loss of plasticity between successive increments.

3.09 CONSOLIDATION AND VISUAL OBSERVATION

- A. Concrete shall be consolidated with internal vibrators having a frequency of at least 800-vpm, with amplitude required to consolidate concrete in the section being placed.
- B. At least one standby vibrator in operable condition shall be at the placement site prior to and during placing concrete.
- C. Consolidation equipment and methods shall conform to ACI 309 "Recommended Practice for Consolidation of Concrete".
- D. The forms shall contain sufficient windows or be limited in height to allow visual observation of the concrete.
- E. Vibrator operator is required to see the concrete being consolidated to ensure good quality workmanship; or Contractor shall have a person actually observe the vibration of the concrete and will advise the vibrator operator of changes needed to assure complete consolidation.
- F. Do not use vibrators to transport concrete in forms.

3.10 PLACING CONCRETE IN HOT WEATHER

- A. Follow the recommendations in Hot Weather Concreting, ACI 305.
- B. Do not place concrete at times when temperature is forecast to exceed 100°F within 12-hours after the concrete is placed.
- C. Verify preparations are complete before ordering concrete so that concrete may be placed upon arrival.
- D. Fog spray forms, reinforcing steel, and subgrade just before placing concrete.
- E. Minimize size of concrete placements and thickness of layers of concrete.
- F. Make every effort to maintain concrete temperature:

1. Below 90°F at time of placement, cool the ingredients before mixing by use of chilled water.
2. Uniform:
 - a. Minimize the time of placement.
 - b. Begin each operation in concrete finishing promptly when the concrete is ready for it.

- G. Place concrete promptly upon arrival at Project and vibrate immediately after placement.
- H. Do not add water to retemper.
- I. Consider placing concrete in late afternoon as opposed to early morning.
- J. Provide windbreaks, shading, and fog spraying on days when temperature is forecast to exceed 90°F.
- K. Saw-Cut Joints:
 1. Maximum Joint Spacing: 36 times slab thickness, unless otherwise noted on Drawings.
 2. Soff-Cut Saw: Cut to a depth of 1¼" immediately after final finishing.
 3. Conventional saw shall be used as soon as possible without dislodging aggregate to a depth of ¼ slab thickness.

- L. Protect and cure exposed surfaces by one of the following:
 1. Continuous water curing.
 2. Moisture–cover curing.

3.11 PLACING CONCRETE IN COLD WEATHER (ACI 306R-78)

- A. Preparation:
 1. Follow recommendations in Cold Weather Concreting, ACI 306.
 2. Additives for the sole purpose of providing freeze protection shall not be used.
 3. Arrangements for covering, insulating, housing, or steam heating newly-placed concrete shall be made in advance of placement and shall be adequate to maintain temperature and moisture conditions recommended.
 4. Temperatures of concrete mix shall be as shown as follows for various stages of mixing and placing of concrete mix.

| Concrete Thickness: | 12" | 36" | 72" | 72" |
|---------------------|---|------|------|------|
| Air Temperature: | Minimum concrete temperature as mixed for indicated weather: | | | |
| Above 30°F | 60°F | 55°F | 50°F | 45°F |
| 0°F to 30°F | 65°F | 60°F | 55°F | 50°F |
| Below 0°F | 70°F | 65°F | 60°F | 55°F |
| | Maximum allowable gradual temperature drop in first 24 hours after end of protection: | | | |
| | 50°F | 40°F | 30°F | 20°F |

B. Placement:

1. Surfaces to be in contact with concrete shall be free of snow, ice, and frost and shall be above 40°F.
2. Do not place concrete on frozen subgrade.
3. Placement of insulating material, tarpaulins, or other moveable coverings shall follow closely the placing of concrete so that only a few feet of concrete are exposed to outside air at anytime.

C. Curing and Protection:

1. Keep concrete continuously moist and maintain concrete temperature at a minimum of 50°F for 7-days; temperature shall be uniform throughout concrete. If high early strength concrete is used, this temperature requirement may be reduced to 3-days.
2. It is recommended to leave forms in place for the entire period of protection; use insulated blankets or other approved method on slab surfaces.
3. Limit rapid temperature changes at end of protection period to avoid thermal cracking.

3.12 BONDING TO CONCRETE SURFACES

A. New Concrete Surfaces:

1. New concrete is defined as less than 60-days old.
2. Roughen surface to hardened concrete.
3. Thoroughly clean and saturate with water.
4. Immediately place concrete.
5. Horizontal surfaces:
 - a. Cover surface with 2' of grout.
 - b. Limit first lift on top of grout to 12'.
 - c. Thoroughly vibrate to mix and consolidate grout and concrete.

B. Old Concrete Surfaces:

1. Use bonding agent.
2. Prepare surface in strict accordance with manufacturers printed instructions and recommendations for specific application for this Project.
3. Follow manufacturer's recommendations.

3.13 EVALUATION AND ACCEPTANCE OF CONCRETE

A. Conform to ACI Standard Building Code requirements for reinforced concrete (ACI 318-83), Section 4.7, "Evaluation and Acceptance of Concrete", and to the following specifications:

B. Testing Responsibilities:

1. Contractor:
 - a. Collect, label, and handle test specimens at Project site.
 - b. Provide adequate facilities for safe storage, curing, and protection for first 24-hours and for additional time as may be required before transporting to test lab.
 - c. Deliver test specimens to laboratory.
 - d. Pay for initial testing.
 - e. Pay for failed tests and additional testing resulting from failed tests or Contractor preference.

C. Number of test cylinders.

1. Set of cylinders: Three (3).
2. Sample frequency:
 - a. 1 set/class of concrete/50 cubic yards.
 - b. 1 set/class of concrete/3000 square feet of wall or slab surface.
 - c. 1 set/class of concrete/day.
 - d. Whichever is greater.

- D. Laboratory shall test 3 cylinders for the 28-day strength test. The test results should be the average strength of the 3 cylinders, except that if 1 cylinder shows obvious evidence of improper sampling, molding or testing, it should be discarded and the strengths of the other 2 cylinders averaged. If more than 1 cylinder shows defects, the test should be abandoned.

3.14 PATCHING - GENERAL

- A. Prior to starting patching work, except as specified, obtain Engineer's approval of proposed patching techniques and mixes.

3.15 REPAIR OF DEFECTIVE AREAS

- A. Definition: Concrete in place that does not conform to specified design strength, shapes, alignments, and elevations as shown on Drawings and contains surface defects.
- B. Evaluation and acceptance of concrete shall conform to ACI 318.
- C. With prior approval of Engineer, as to method and procedure, repair defective areas in conformance with ACI 301, Chapter 9, except that the specified bonding compound shall be used.
- D. The specified patching mortar may be used in lieu of the above-mentioned method when color match of adjacent concrete is not required. Prior approval of Engineer is required.
- E. Surface Repairs:
 - 1. Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner.
 - 2. Honey-combed areas and rock pockets:
 - a. Repair immediately after removal of forms.
 - b. Prepare no-slump concrete mortar and test so that, when dry, patching mortar will match surrounding color and strength.
 - c. Cut out to solid concrete or minimum of 1" depth.
 - d. Make edges for cuts perpendicular to the concrete surface.
 - e. Thoroughly clean and dampen with water.
 - f. Apply bonding compound.
 - g. Compact no-slump concrete into patch, and finish to blend with adjacent finished concrete.
 - h. Cure in same manner as adjacent concrete.
 - 3. High Areas: Grind after concrete has cured at least 14-days.
 - 4. Low Areas:
 - a. Repair during or immediately after completion of surface finishing operations.
 - b. Cut out low areas and replace with fresh concrete of same type and class as original concrete.

c. Finish repaired areas to blend into adjacent concrete.

5. Defective Areas:

- a. Cut out and replace with fresh concrete of same type and class as original concrete.
- b. Finish repaired areas to blend into adjacent concrete.

6. Make structural repairs with prior approval of Engineer, as to method and procedure, using the specified epoxy adhesive or epoxy mortar. Where epoxy injection procedures must be used, use an approved low viscosity epoxy made by the manufacturers previously specified.
7. Level floors for subsequent finishes by use of specified underlayment material.
8. Where required, level exposed floors by use of the specified self-leveling repair topping.
9. Repair methods not specified above may be used, subject to approval of Engineer.

3.16 BLOCKOUTS AT PIPES OR OTHER PENETRATIONS

- A. Submit proposed blockouts for review in accordance with Section 01330

3.17 CURING OF CONCRETE

- A. Follow recommendations in Standard Practice for Curing Concrete (ACI 308).
- B. Begin curing as soon as free water has disappeared from concrete surface after placing and finishing.
- C. Continue curing for at least 7-days without interruption.
- D. Curing Methods:

1. Water Curing:

- a. Cover surface with burlap or sand (1" deep) as soon as possible without marring surface.
- b. Keep continuously wet for 7-days; do not allow surface to become alternately wet and dry.
- c. Use water not more than 2°F cooler than concrete.
- d. Allow surface to dry slowly before removing sod.

2. Moisture-Cover Curing:

- a. Cover surface with plastic film (4-mil minimum) as soon as possible without marring the surface. Cover entire surface without wrinkles or holes.
- b. Cover plastic film with 1" of sand and weight edges.
- c. Keep covered for a minimum of 7-days.

3. Curing Compounds:

- a. Verify compatibility with required finishes such as hardeners, paint, stain, tile, or other specified work.
- b. Exposed concrete receiving mastic applied adhesive, or metallic or mineral aggregate hardeners shall be cured with the specified curing and sealing compounds.

E. Cold-Weather Curing:

1. Use moisture-cover curing or liquid membrane-forming compound as approved.
2. Protect concrete from temperature changes in accordance with ACI 306.

F. Hot-Weather Curing: Use water curing or moisture-cover curing as approved.

END OF SECTION

SECTION 03305

CONCRETE SIDEWALKS

PART 1. GENERAL

1.01 WORK INCLUDED

- A. Construction of concrete sidewalks.

1.02 RELATED WORK

- A. Section 01300 – Submittal Requirements
- B. Section 03210 – Reinforcing Steel
- C. Section 03300 – Cast-in-Place Concrete.

1.03 REFERENCES

- A. Section 633 – Concrete Walks and Steps, Standard Specification for Highway Construction, Arkansas Department of Transportation.

PART 2. PRODUCTS

2.01 CONCRETE

- A. Comply with requirements of Section 03300.
- B. Four (4") inch maximum allowable slump.
- C. Do not exceed maximum water/cement ratio.

2.02 FORMS

- A. Constructed of metal or wood, free from warp, and of sufficient strength to resist springing during placement of concrete.

2.03 EXPANSION JOINTS

- A. Joint filler to comply with AASHTO M213.

PART 3. EXECUTION

3.01 SUBGRADE

- A. Excavate or fill, as required, to required grade.
- B. Remove soft and yielding material and replace with suitable material.
- C. Compact entire subgrade with approved mechanical equipment.

3.02 FORMS

- A. Clean and oil prior to placement of concrete.
- B. Securely stake, brace, and set to hold firmly to the required line and grade.

3.03 EXPANSION JOINTS

- A. Leave minimum 1/2" wide space between sidewalk and adjacent structures.
- B. Leave no space between sides of walk and adjacent curbs.

3.04 PLACING AND FINISHING

- A. Deposit concrete in the form upon wetted subgrade to such depth that when it is compacted and finished, the top shall be at the required elevation.
- B. Thoroughly consolidate concrete and spade edges to prevent honeycombing.
- C. Strike off top with a straightedge and tamp or vibrate to flush mortar to the surface. Provide broom finish.
- D. Round edges with a 1/4" radius, including edges at joints.
- E. Cut transverse joints in walk with a 1/4" jointer at intervals not greater than the width of the walk.
- F. Do not use curing compounds.

3.05 BACKFILLING

- A. After removal of forms, backfill spaces on each side of walk with suitable material.
- B. Firmly compact with approved mechanical equipment.
- C. Neatly grade backfill.

END OF SECTION

SECTION 03602

NONMETALLIC GROUT

PART 1. GENERAL

1.01 SCOPE

- A. This section covers grouting of pump, motor, and equipment base plates; column base plates, and pipe supports; other miscellaneous base plates; and, other uses of grout as indicated on the Drawings. Except for grout to be applied as a topping on the floor of structures, and unless otherwise specified, all grouting shall be done with non-shrinking non-metallic grout. Standard grout may be used as a topping for floors, setting beds, and clarifier tanks except where otherwise indicated.

PART 2. PRODUCTS

2.01 MATERIALS

- A. Non-shrinking Non-metallic Grout

- 1. Master Builders "Special LL-713 Grout".
- 2. Gifford-Hill "Supreme".
- 3. U.S. Grout "Five Star Grout".

- B. Composition

No metallic particles, aluminum powder, iron filings, or expansive cement.

- C. Non-shrinking grout shall be furnished prepackaged so that only water is added at jobsite. Mix grout in a mechanical mixer. Use no more water than is necessary to produce a workable grout. Follow manufacturer's instructions which shall be printed on the outside of each bag.

- 1. No shrinkage (0.0%) and a maximum 4.0% expansion when tested in accordance with ASTM C-827. No shrinkage (0.0%) and a maximum of 0.2% expansion in the hardened state when tested in accordance with ASTM-C 621.
- 2. Minimum 28-day compressive strength of 5,000 psi when tested in accordance with ASTM C-109.
- 3. Minimum initial set time of 60 minutes when tested in accordance with ASTM C-191.

PART 3. EXECUTION

3.01 PREPARATION

- A. Wet the concrete foundation to receive non-shrinking grout with water prior to grouting.

3.02 APPLICATION

A. Placement

Place grout in strict accordance with the directions of the manufacturer so that all spaces and cavities below the top of the base plates are completely filled without voids. Use forms where structural components of base plates or bed plates will not confine the grout.

B. Edge Finishing

In all locations where the edge of the grout will be exposed to view, finish smooth after initial set. Except where indicated to be finished on a slope, trim the edges of the grout flush at the base plate, bed plate, or piece of equipment.

END OF SECTION

SECTION 04220

REINFORCED CONCRETE MASONRY UNITS

PART 1. GENERAL

1.01 SUMMARY

- A. Provide hollow concrete masonry units.

1.02 SUBMITTALS

- A. Submit the following in accordance with Section 01330 – Submittal Requirements:
 - 1. Manufacturers' Literature: Submit information illustrating the horizontal joint reinforcement and preformed control joint materials proposed for use.
 - 2. Manufacturers' Certificate: Provide manufacturer's certificate(s) for the masonry units specified herein.

1.03 RELATED WORK

- A. Section 03210 – Reinforcing Steel.
- B. Section 05500 – Fabricated Metalwork and Castings.
- C. Section 07900 – Sealants.
- D. Section 09900 – Painting.

1.04 REFERENCES

- A. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
 - 1. ASTM C90 – Specification for Hollow Load-Bearing Concrete Masonry Units.
 - 2. ASTM C140 – Method of Sampling and Testing Concrete Masonry Units.
 - 3. ASTM C144 – Specification for Aggregate for Masonry Mortar.
 - 4. ASTM C150 – Specification for Portland Cement.
 - 5. ASTM C207 – Specification for Hydrated Lime for Masonry Purposes.
 - 6. ASTM C270 – Specification for Mortar for Unit Masonry.
 - 7. ASTM C331 – Specification for Lightweight Aggregates for Masonry Units.
 - 8. ASTM C404 – Specifications for Aggregates for Masonry Grout.
 - 9. ASTM C476 – Specification for Grout for Reinforced and Nonreinforced Masonry.
 - 10. ASTM D746 – Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
 - 11. ASTM D2240 – Test Method for Rubber Property-Durometer Hardness.
 - 12. ASTM D2287 – Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.

1.05 ACCEPTANCE AT SITE

- A. Masonry units will be sampled for testing in accordance with ASTM C140 after delivery to jobsite.
- B. Masonry construction shall not proceed until test results are known and masonry units are certified by an approved testing agency as complying with these Specifications.
- C. Grout and mortar samples for strength testing shall be taken in accordance with ASTM C476 and C270, as applicable, at beginning of masonry work and thereafter at the discretion of Engineer.

PART 2. PRODUCTS

2.01 CONCRETE MASONRY UNITS (CMU)

- A. General Requirements:
 - 1. Size as shown.
 - 2. Sound, dry, clean, and free of cracks.
 - 3. Units shall have reached specified moisture content and compressive strength prior to placing.
 - 4. Color: Gray for all interior surfaces, earth-tone shades selected by Owner for exterior wall.
 - 5. Surface texture:
 - a. Smooth on exposed surfaces of interior walls and interior face of exterior walls: Arkhola No. C-2760 and C2763 or equal.
 - b. Six-flute split face on exterior surfaces of exterior walls (rough stone texture): Arkhola or equal.
 - 6. Special Units:
 - a. Provide or cut special shapes for corners, jambs, lintels, and other areas shown or required.
 - b. Match color and texture of standard units.
- B. Hollow concrete masonry units: Grade N, Type I in accordance with ASTM C90.
- C. Manufacturer shall certify that masonry units meet requirements of ASTM C90, including moisture content and linear shrinkage requirements for intermediate conditions.

2.02 CEMENT

- A. Type II, ASTM C150, portland cement.

2.03 LIME

- A. Keep dry.

- B. Lime putty: Type S hydrated lime, conforming to ASTM C207.

2.04 AGGREGATES

- A. Aggregate for Hollow Concrete Units:

1. Lightweight and conform to ASTM C90 and ASTM C331.
2. Masonry units: not to exceed 105 pounds per cubic foot, dry density of concrete.

- B. Aggregate for Mortar: ASTM C144.

- C. Aggregate for Grout: ASTM C404.

2.05 WATER

- A. Fresh, clean, and free of deleterious amounts of acids, alkalies, chlorides, and organic materials.

2.06 MORTAR

- A. Freshly prepared and uniformly mixed in the ratio of 1 part Portland cement, $\frac{1}{4}$ part minimum to $\frac{1}{2}$ part maximum lime putty or hydrated lime, damp loose sand not less than $2\frac{1}{4}$ and not more than 3 times the sum of the volumes of the cement and lime used.

- B. ASTM C270, Type S.

- C. Color: Where colored masonry units are used, mortar shall match.

2.07 WATER REPELLANT MORTAR ADMIXTURE

- A. Manufacturer:

1. Hydracide Powder, by Sonneborn
2. Hydratite Liquid, by W.R. Grace and Company.
3. Sika Red Label, by Sika Chemical Corporation.
4. Or equal.

- B. Prepare in accordance with manufacturer's recommendations.

2.08 GROUT

- A. Conform with ASTM C476, except as specified in this Section.

- B. Mix grout with sufficient water to give a fluid pouring consistency without segregation of materials.

- C. Grout for pouring: Coarse grout may be used in grout spaces measuring 4" or more in both horizontal dimensions.

- D. Grout for pumping: Not less than 7 sacks of cement in each cubic yard of grout; Engineer must approve mix design.

2.09 GROUT ADMIXTURE

A. Manufacturer:

1. Sika Grout Aid, Type II, by Sika Chemical Corporation.
2. Grout Aid GA-II, by Concrete Emulsions.
3. Grout Fluidifer LL-612, by Master Builders Co.
4. Or equal.

B. Amount and method of introducing admixture shall be in accordance with manufacturer's recommendations.

2.10 COMPRESSIVE STRENGTH

A. Average 28-day compressive strength of grout samples for each grout pour tested shall not be less than 2,000-psi.

2.11 JOINT REINFORCEMENT AND TIES

A. General: Reinforcement shall be clean and free from loose rust, scale, and any coatings that reduce bond.

B. Reinforcement for 8" or 12" masonry.

1. 2 parallel No. 9 wires, uncoated, welded to No. 9 diagonal crosswires forming a truss design.
2. Use special manufactured corner and wall intersection pieces at these locations.
3. Manufacturer: Blok-Trus AA600 by AA Wire Products Company, Chicago, IL; or equal.

2.12 PERFORMED CONTROL JOINT

A. Manufacturer:

1. No. 12 D/A 2007 Rapid Poly-Joint by Dur-O-Wall National Company, Cedar Rapids, Iowa.
2. Or equal.

B. Material:

1. PVC conforming to ASTM D2287 type PVC 654-4 with a Durometer hardness of 85 ± 5 when tested in accordance with ASTM D2240; cold crack brittleness of -10°C when tested according to ASTM D746.
2. Cut as required along pre-grooved cut points for proper sealant depth.

PART 3. EXECUTION

3.01 WEATHER CONDITIONS

- A. Do not lay masonry when the ambient temperature is below 32° on a rising temperature or below 40°F on a falling temperature, or when there is a possibility of such conditions occurring within 48-hours, unless express approval of Engineer is obtained.
 - 1. In such case, make special provisions for heating materials and protecting finished work.
 - 2. Protect masonry against freezing for a minimum of 48-hours after being laid.
 - 3. Protect tops of walls at all times.
 - 4. Cover tops of walls with waterproof paper when rain or snow is imminent and work is discontinued.
- B. Protect masonry construction from direct exposure to wind and sun when erected in an ambient air temperature of 99°F (37°C) in the shade with relative humidity less than 50%.

3.02 BONDING WALL UNITS - FOUNDATION

- A. Prepare foundation for initial mortar placement by one of the following methods:
 - 1. Sandblast foundation and reinforcing dowels after concrete has fully cured to remove laitance and spillage and to expose sound aggregate.
 - 2. Water blast foundation and reinforcing dowels after concrete has partially cured to remove laitance and spillage and to expose sound aggregate.
 - 3. Green cut fresh concrete with high pressure water and had tools to remove laitance and spillage from foundation and reinforcing dowels and to expose sound aggregate.
- B. Clean foundation of loose material prior to initial mortar placement.

3.03 CORNERS

- A. Standard masonry bond for overlapping units; grouted solid.
- B. Reinforcement: As shown.

3.04 INTERSECTIONS

- A. Bond with reinforcement as shown.
- B. Abutting wall shall not have masonry bond with straight wall.

3.05 LAYING REINFORCED MASONRY UNITS

- A. Conform to Standard Building code and as supplemented by these Specifications.

- B. Do not start laying masonry units if foundation horizontal or vertical alignment does not satisfy tolerance specification Section 03300.
- C. Maximum permissible variation from plumb of wall or of a line of joints in the wall shall be 1/16" per foot of height, and ¼" in the total height of wall.
- D. Maximum permissible variation from a horizontal line along base of wall or for lines of horizontal joints shall be 1/16" per block, ¼" per 50' of wall with proportionately greater tolerance for longer walls up to ½" in total length of wall.
- E. Maintain interior surfaces in the plane described above, and dimension tolerances of units shall be taken up on exterior surfaces.
- F. Units with chipped edges or corners within permissible ASTM limits shall be placed in wall such that chipped area is not exposed to view.

3.06 WALL UNITS

- A. If it is necessary to move a unit after it has been set in place, remove unit from wall, clean, and set in fresh mortar.
- B. Tothing of masonry units will not be permitted unless approval is given by Engineer.
- C. Protect masonry work from damage until final acceptance of work.
- D. Damaged units will not be accepted.

3.07 RUNNING BOND

- A. Unless otherwise shown, walls shall be laid up in straight, uniform courses using a running bond pattern.

3.08 SPECIAL SHAPES

- A. Provide and place such special units as corner block, door jamb block, lintel block fillers, and similar blocks as may be required.
- B. Use required shapes and sizes to work to corners and openings maintaining a proper bond throughout the wall.

3.09 BUILT-IN ITEMS

- A. Door frames, windows, vents, and other items required to be built in wall shall be in position and the wall constructed around them.
- B. Use standard masonry anchors to secure items to wall.
- C. Fill spaces around items with mortar or grout.

3.10 EMBEDDED CONDUITS

- A. Do not place electrical, instrumentation, or water conduits in a cell containing reinforcement unless approved by Engineer.

3.11 MORTAR PREPARATION

- A. Place ½ the water and aggregate in the operating mixer.

- B. Add cement.
- C. Add remaining aggregate and water and mix for at least 2-minutes.
- D. Add lime and continue mixing as long as needed to secure a uniform mass, but no less than 3-minutes after the addition of lime.
- E. The addition of the admixture shall be timed in strict accordance with the manufacturer's instructions and the procedure used for adding it to the mix shall provide good dispersion.
- F. Machine mix in approved mixers.
 - 1. Keep mixer drums clean and free of debris and dried mortar.
 - 2. Place mortar before initial setting of cement.
 - 3. Retempering of mortar in which cement has started to set will not be permitted.

3.12 MORTAR JOINTS - GENERAL

- A. Straight and clean with a uniform thickness of $\frac{3}{8}$ ".
- B. Horizontal and Vertical Joints: Full mortar coverage on face shells.
- C. Vertical Head Joints:
 - 1. Butter well on each unit for a width equal to face shell of unit.
 - 2. Shove joints tightly so that mortar bonds well to both units.
 - 3. Solidly fill joints from face of block to at least the depth of the face shell.
- D. Remove excess mortar from grout space of cells to be filled as the units are being laid.

3.13 EXPOSED JOINTS

- A. Tool exposed joints that will be exposed to view after final construction unless otherwise noted or shown.
- B. Cut joints flush and, as mortar takes its initial set, tool to provide a concave joint.
- C. Tooling:
 - 1. Perform tooling when mortar is partially set but still sufficiently plastic to bond.
 - 2. Use a tool that compacts the mortar, pressing excess mortar out rather than dragging it out.
 - 3. Joints that are not tight at time of tooling shall be raked out, pointed, and then tooled.

3.14 CONCEALED JOINTS

- A. Joints that are not exposed shall be struck flush with no further treatment required.

3.15 PREFORMED CONTROL JOINTS

- A. Omit mortar from vertical joints.
- B. Place control joint material as wall is built.
- C. After wall is grouted, cured, and cleaned, install backing rod (or backup material) and sealant.
- D. Place and tool sealant as specified in Section 07900.

3.16 REINFORCING - GENERAL

- A. Lap reinforcing bars 30 bar-diameter minimum where spliced and wire-tie together.
- B. Bars shall have a minimum clearance of 1 bar-diameter from masonry and from additional parallel bars in same grout space.

3.17 FOUNDATION DOWELS

- A. Size, number, and location of foundation dowels shall match vertical wall reinforcing unless otherwise noted.
- B. When foundation dowel does not line up as intended with vertical core, it shall not be sloped more than 1 horizontal to 6 vertical to bring it into alignment.

3.18 VERTICAL REINFORCING

- A. Hold vertical reinforcing steel in position near ends of bars by wire ties to dowels and/or by reinforcing positioners.
- B. Bars shall be held in position at intervals not exceeding 160 bar-diameter by reinforcing positioners.

3.19 HORIZONTAL REINFORCING

- A. Hold horizontal reinforcing bars in position by wire ties to vertical reinforcing bars or by reinforcing positioners.
- B. Position steel near ends and at intervals not exceeding 160 bar-diameter.
- C. Lay horizontal bars on webs of bond beam units, and place as wall is built.

3.20 HORIZONTAL MORTAR JOINT REINFORCEMENT

- A. Locate as shown on Drawings.
- B. Continuous except for discontinuity at expansion or control joints.
- C. Maximum vertical spacing shall be 24".
- D. Provide in addition to typical wall reinforcing steel.
- E. Provide additional reinforcement for special coursing where indicated on Drawings.
- F. Lap ends of joint reinforcement 6" minimum, except at control joints.

3.21 GROUTING

- A. On-site Mixing: Mix as specified for mortar preparation.
- B. Transit-Mixed:
 - 1. Meet requirements of ASTM C476.
 - 2. Add grout admixture at site in accordance with manufacturer's recommendations.
 - 3. Do not exceed quantity of admixture recommended by manufacturer.
- C. Do not mix, convey, or place grout with equipment constructed of aluminum.
- D. Vertical and horizontal reinforcement, ties, bolts, anchors, and other required embedments shall be secured in place, inspected, and approved before grouting starts.
- E. Grout beams over openings in one continuous operation.
- F. Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear, unobstructed, continuous vertical cell measuring not less than 2" by 3".
- G. Pour grout as soon as possible after mortar has cured to reduce shrinkage cracking of vertical joints.
- H. Wash off scum and stains from masonry immediately after grouting is complete using clean water and fiber brushes.
 - 1. Do not allow grout and mortar stains to dry on face of exposed masonry.
- I. Vertical reinforcement may be placed initially and the wall built up around it, provided reinforcing steel is first wire tied to foundation dowels.
- J. Reinforcing positioners and/or approved cross bracing must be provided to secure top of steel in place.
- K. Vertical steel will not be permitted to be dropped in after block is laid unless reinforcing positioners are provided in the course above the previously grouted course.

3.22 PARTIAL GROUTING REQUIREMENTS

- A. Walls that do not require solid grouting shall have cells containing reinforcing steel and others as shown filled with grout.
- B. Construct cells to be filled to confine grout within cell.
- C. Cover tops of unfilled vertical cells under a bond beam with metal lath to confine grout fill to bond beam section.
- D. Limit height of grout pours to mid-depth of course above horizontal bond beam, except at top course.

3.23 LOW-LIFT GROUTING REQUIREMENTS

- A. Unless otherwise approved by Engineer prior to start of masonry work, grouting shall be low-lift grouting.
- B. When grouting is stopped for 1-hour or longer:

1. Form horizontal construction joints by stopping pour of grout 1/2" below top of uppermost unit.
 2. Fully embed horizontal steel grout in an uninterrupted pour.
- C. Limit grout pour to maximum height of 4'.
 - D. Wall shall not be constructed more than one course above top of grout pour prior to placing grout.
 - E. Grout shall be thoroughly consolidated with an internal "pencil" type vibrator.
 - F. After waiting sufficient time to permit grout to become plastic, but before it has taken any set, grout shall be reconsolidated.
 - G. The waiting period will vary depending upon weather conditions and block absorption rates, but under normal weather conditions within average masonry units, the waiting period should be between 30 and 60 minutes.

3.24 CLEANING

- A. Clean surfaces of excess mortar, grout spillage, dirt, and other foreign substances.
- B. Clean walls not requiring painting or sealing such that there are not visible stains.
- C. Prepare surfaces requiring painting or sealing in accordance with Section 09900.

3.25 PROTECTION

- A. At the end of each day's work, cover tops of walls with building paper or by other means to protect walls from becoming excessively wet.

3.26 TEMPORARY BRACING

- A. Adequately brace walls until walls and roof are completed.
- B. Bracing shall be sufficient to protect roof and walls against damage from elements, including wind and snow.

END OF SECTION

SECTION 05120

STRUCTURAL STEEL

PART 1. GENERAL

1.01 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.02 FEDERAL SPECIFICATIONS (Fed. Spec.):

TT-C-490B - Cleaning Method and Pretreatment of Ferrous Surfaces for Organic Coatings
TT-P-645A - Primer, Paint, Zinc Chromate, Alkyd Type

A. Military Specifications (Mil. Spec.):

DOD-P-15328D - Primer (Wash), Pretreatment & Am 1 (Formula No. 117 for Metal)
Metric
DOD-P-21035A - Paint, High Zinc Dust Content, Galvanizing Repairs (Metric)

B. U.S. Army Corps of Engineers (COE) Waterways Experiment Station Publication:

CRD-C-621-83 - Handbook for Concrete and Cement, Specifications for Nonshrink
Grout, Volume II (1949 Ed.)

C. American Association of State Highway and Transportation Officials (AASHTO)
Publication:

1983 Standard Specifications for Highway Bridges (Thirteenth Edition)

D. American National Standards Institute (ANSI) Publications:

B18.22.1-65 Plain Washers (R81)
B46.1-78 Surface Texture, Surface Roughness, Waviness and Lay

E. American Institute of Steel Construction (AISC) Publications:

1989 Manual of Steel Construction (Ninth Edition) (Includes "Specification
for the Design, Fabrication and Erection of Structural Steel for
Buildings," "Code of Standard Practice for Steel Buildings and
Bridges," and "Structural Joints Using ASTM A325 or A490 Bolts")
1983 Detailing for Steel Construction
1984 Engineering for Steel Construction

F. American Society for Testing and Materials (ASTM) Publications:

| | |
|---------|--|
| A36-84a | Structural Steel |
| A123-78 | Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates Bars and Strip |
| A153-82 | Zinc Coating (Hot Dipped) on Iron and Steel Hardware |
| A307-84 | Carbon Steel Externally Threaded Standard Fasteners |
| A325-84 | High-Strength Bolts for Structural Steel Joints |
| A500-84 | Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| A563-84 | Carbon and Alloy Steel Nuts |
| C827-84 | Early Volume Change of Cementitious Mixtures |

G. American Welded Society, Inc. (AWS) Publication:

| | |
|---------|---------------------------------|
| D1.1-88 | Structural Welding Code - Steel |
|---------|---------------------------------|

H. Steel Structures Painting Council (SSPC) Publications:

| | |
|-----------|--|
| PS8.01-82 | One-Coat Rust Preventive Painting System with Thick-Film Compounds |
| SP-3-82 | Power Tool Cleaning SP-6-82 Commercial Blast Cleaning |

1.03 DESCRIPTION OF WORK

The work includes the fabrication, erection, and shop painting of structural steel. Provide in accordance with AISC "Manual of Steel Construction" except as specified herein. In the AISC "Manual of Steel Construction" referred to herein, the "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings," the "Code of Standard Practice for Steel Buildings and Bridges," and Structural Joints Using ASTM A325 or A490 Bolts" shall be considered a part thereto.

1.04 SUBMITTALS

- A. Shop Drawings: Submit for approval by the Engineer prior to fabrication. Prepare in accordance with the AISC "Detailing for Steel Construction" and AISC "Engineering for Steel Construction." Shop drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS standard welding symbols.

- B. Manufacturer's Certificates of Compliance

- 1.3.2.1 Steel-Mill Test Reports
- 1.3.2.2 Bolts, nuts and washers
- 1.3.2.3 Shop painting materials

- 1.3.2.4 Welding electrodes and rods
- 1.3.2.5 Nonshrink grout
- 1.3.2.6 Galvanizing

C. Welder, Welding Operation and Tacker

Qualification: Prior to welding, submit certification for each stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests.

D. Certified Field Test Reports:

- 1.3.4.1 Field Bolting
- 1.3.4.2 Field Welding and Full Penetration Welds

1.05 DELIVERY AND STORAGE

Handle, store, and protect materials in accordance with the manufacturer's recommendations. Replace damaged items with new items, or repair as approved by the Contracting Officer.

1.06 QUALIFICATIONS

Fabricator and/or erector shall be a company specializing in the fabrication and/or erection of structural steel with a minimum of 10 years of documented experience.

PART 2. PRODUCTS

2.01 MATERIAL

- A. All materials shall comply with AIS.

2.02 STEEL

- A. Structural Steel: ASTM A36
 - 1. Structural Steel Tubing: ASTM A500, Grade B.
- B. Cold Rolled Steel: ASTM A108
- C. Mild Steel Plates: ASTM A283

2.03 BOLTS, NUTS, AND WASHERS

- A. Provide the following unless indicated otherwise.
 - 1. Structural Steel:
 - a. High Strength Bolts: ASTM A307, Grade A; ASTM A325, Type 1 or 2.

- b. Nuts: ASTM A563, Grade A, heavy hex style, except nuts under 1½" may be provided in hex style.
- c. Washers: ANSI B18.22.1, Type B.
- d. Stainless Steel Bolts: ASTM A-320-65-B8 (AISI 304).

2.04 SHOP PAINTING:

- A. Pretreatment: Mil. Spec. DOD-P-15328 or Fed. Spec. TT-C-490, Type I, II, or IV.
- B. Primer: Sherwin-Williams Alkyd Red Oxide or equal.
- C. Rust Preventive: SSPC PS-8.01, suitable for temporary protection.

2.05 GALVANIZING

- A. ASTM A123 or A153, as applicable, unless specified otherwise.
 - 1. Galvanizing Repair Paint: Z.R.C. Cold Galvanizing Compound or equal.

2.06 Structural Steel Accessories:

- A. Welding Electrodes and Rods: AWS D1.1.
- B. Nonshrink Grout: COE CRD-C-621, with no ASTM C827 shrinkage. Grout shall be nonmetallic.

PART 3. EXECUTION

3.01 FABRICATION

- A. Marking: Prior to erection, members shall be provided with a painted erection mark. In addition, connecting parts assembled in the shop for reaming holes in field connections shall be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations.
- B. Shop Painting: Shop paint structural steel, except as modified herein. Do not paint steel surfaces embedded in concrete, galvanized surfaces, bearing surfaces, or surfaces within ½" of the toe of the welds prior to welding (except surfaces on which metal decking or shear studs are to be welded). Prior to assembly, paint surfaces which will be concealed or inaccessible after assembly. Do not apply paint in foggy or rainy weather; when the ambient temperature is below 45°F or over 95°F; or when paint may be exposed to temperatures below 40°F within 48 hours after application, unless approved otherwise.
 - 1. Cleaning: SSPC SP 6, except as modified herein. SSPC SP 3 or SP 6 for steel surfaces exposed in spaces above ceilings, attic spaces, crawl spaces, furred spaces, and chases. In addition, maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

2. Pretreatment: Immediately after cleaning, provide the metal surfaces with one coat of Mil. Spec. DOD-P-15328 pretreatment to a dry film thickness of 0.3 to 0.5 mil. Fed. Spec. TT-C-490.
 3. Priming: Immediately after the pretreatment coating has dried, apply primer to a minimum dry film thickness of 2.0 mil. Repair damaged primed surfaces with an additional coat of primer.
- C. Galvanizing: Provide as indicated or specified. Galvanize after fabrication where possible.
1. Galvanizing Repair: ASTM A780, using galvanizing repair paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied.
- D. Bearing Surfaces and Friction Type Joints: In the shop, coat with a temporary rust preventative. Remove coating, as recommended by the coating manufacturer, immediately prior to field erection.

3.02 ERECTION

- A. Calibration wrenches shall be calibrated every two working days on a minimum of three typical bolts of each diameter. Provide for drainage in structural steel.
- B. Base Plates and Bearing Plates: After final positioning of steel members, provide full bearing under plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions.

3.03 CONNECTIONS

- A. Connections not detailed shall be selected and detailed in accordance with AISC "Manual of Steel Construction." Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Punch, subpunch and ream, or drill bolt holes.

3.04 WELDING

- A. AWS D1.1 Grind exposed welds smooth. Provide AWS D1.1 qualified welders, welding operators, and tackers.

3.05 TESTS AND INSPECTIONS

- A. Perform field tests, and provide labor, equipment, and incidentals required for testing, except that electric power for field tests will be furnished as set forth in Division 1.
- B. Welds:
 1. Visual and Nondestructive Inspection: AWS D1.1. Provide AWS certified welding inspectors for fabrication/erection inspection and testing and verification inspections. Welding inspectors shall visually inspect and mark welds, including

fillet weld end returns. Welding inspectors shall perform radiographic or ultrasonic inspections on all welds required to be full penetration welds.

END OF SECTION

SECTION 05500

FABRICATED METALWORK AND CASTINGS

PART 1. GENERAL

1.01 SUMMARY

- A. Provide fabricated metalwork and castings.
- B. All materials shall be AIS compliant.
- C. Miscellaneous metalwork required to secure the various parts together and provide a complete installation, shall be included under this section.
- D. Insofar as is practical, products provided shall be factory assembled.

1.02 RELATED SECTIONS

- A. Section 09900 – Painting.

1.03 REFERENCES

- A. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
 - 1. ASTM A36 – Specification for Structural Steel.
 - 2. ASTM A48 – Specification for Gray Iron Castings.
 - 3. ASTM A153 – Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 4. ASTM A167 – Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 5. ASTM A193 – Specification for Alloy-Steel and Stainless Steel Bolting Material for High-Temperature Services.
 - 6. ASTM A307 – Specification for Carbon Steel Externally Treated Standard Fasteners.
 - 7. ASTM A325 – Specification for High-Strength Bolts for Structural Steel Joints.
 - 8. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. American Welding Society, 550 North West LeJeune Road, Miami, Florida 33126.
 - 1. D1.1 – Structural Welding Code.
- C. Steel Joist Institute, 1205 48th Avenue N., Suite A, Myrtle Beach, SC 29577.
 - 1. SJI Standard Specification for Open Web Steel Joists, K-Series.

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01330 – Submittal Requirements:
1. Shop Drawings, including calculations where required.
 2. Test pieces and samples.
 3. Certificates, test reports, etc.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Parts and assemblies that are of necessity shipped unassembled, shall be packaged and clearly tagged in a manner that will protect the materials from damage, and facilitate the identification and final assembly in the field.

PART 2. MATERIALS

2.01 GENERAL

- A. Unless otherwise indicated, materials shall conform to latest issue of the following ASTM Specifications:
1. Steel Shapes and Plates: A 36.
 2. Stainless Steel:
 - a. Exterior and Submerged: A 167, Type 316.
 - b. Industrial Uses: A 167, Type 316.
 - c. Interior and Architectural: A 167, Type 304.
 - d. Bolts: A 193, Type 316.
 3. Aluminum, Structural Shapes and Plates: Alloy 6061-T6; conform to referenced specifications and ASTM sections found in the Aluminum Association current Construction Manual Series.
 4. Connection Bolts for Steel Members: A 325 – F.
 5. Galvanized Bolts: A 307, A 153.
 6. Connection Bolts for Wood Members: A 307.
 7. Connection Bolts for Aluminum: A 2024-T4; or use appropriate stainless steel.
 8. Cast Iron: A 48, Class 30.

2.02 OPEN WEB STEEL JOISTS

- A. Open web, parallel chord, load-carrying member suitable for the direct support of the building roof deck.
- B. Provide open web steel joists, K-series.
- C. Designed, handled, and erected in accordance with the SJI Standard Specification.
- D. Joist Designation: 24K8.

- E. Finish: Shop painted.
- F. Manufacturer:
 - 1. Nucor Corporation, Vulcraft Division, Tex-Ark Joist Company.
 - 2. Or equal.

2.03 STEEL ROOF DECK

- A. Manufacturer:
 - 1. United Steel Deck, Inc.
 - 2. Or equal.
- B. Type F profile.
- C. Conforming to ASTM A653, Grade A, B, C, D, E, or F having a minimum yield strength of 33,000-psi. Maximum working stress not to exceed 20,000-psi.
- D. Gage: 18.
- E. Finish: Galvanized conforming to ASTM A653, field painted.

2.04 HANDRAILS

- A. Double rails as shown on Drawings.
- B. Top rail to be 42" above surface (walkway or wall).
- C. Schedule 40 1½" aluminum pipe (1.90" O.D.), ASTM B241, seamless.
- D. Connections: Mechanical, splice sleeves, etc., 6063 or 6061 alloy.

2.05 ANCHORING SYSTEMS FOR CONCRETE

- A. Wedge Anchors:
 - 1. Manufacturer:
 - a. ITT Phillips Drill Division, Michigan City, IN.
 - b. Hilti Kwik-Bolt, stud type, manufactured by Hilti, inc., Stamford, CT.
 - c. Wej-It, stainless steel bolts, completely assembled, manufactured by Wej-It Corporation, Broomfield, CO.
 - d. Or equal.
 - 2. For use 1'-6" above peak water surface in water holding structure.
 - 3. Stainless steel.
 - 4. Sizes shown on Drawings.
 - 5. Provide ICBO (International Conference of Building Officials) or other similar building code organization recommendations regarding safe allowable design loads.

- B. Expansion Anchors:
 - 1. Expansion anchors shall not be used except in dry areas where future corrosion is not a problem.
 - 2. In wet or damp areas, use wedge anchors or adhesive anchors in submerged conditions.
- C. Self-Drilling Anchors:
 - 1. Snap-off type or flush type.
 - 2. For use with hot-dipped galvanized bolts.
- D. Nondrilling Anchors:
 - 1. Manufacturer:
 - a. ITT Phillips Drill Division, Michigan City, IN.
 - b. Hilti HDI Drop-In anchors, Hilti, Inc., Stamford, CT.
 - c. Or equal.
 - 2. Flush Type.
 - 3. For use with bolt or stud type with projecting threaded stud.
 - 4. Provide ICBO or other similar code organizations' recommendations regarding safe allowable design loads.
- E. Adhesive Anchors:
 - 1. Use for anchoring metal components at or below a point 1'-6" above the peak (maximum) water surface elevations in water holding structures.
 - 2. Parabond capsule anchors with 316 stainless steel stud, nuts, and washers, as manufactured by Molly Division, 504 Mt. Laurel Avenue, Temple, PA 19560.
 - 3. Heavy-Duty adhesive anchor with HBP adhesive cartridge with 316 stainless steel anchor rod assembly as manufactured by Hilti, Inc. P.O. Box 45400, Tulsa, Oklahoma 74145, or equal.

2.06 STRUCTURAL STEEL SUPPORTS

- A. Provide structural steel supports of sizes and weights shown.
- B. Weld connections unless otherwise shown.

2.07 MACHINE BOLTS, INSERTS, AND FASTENERS

- A. Machine bolts, inserts, and fasteners not permanently embedded in concrete, but located outdoors in wet well floors, walls, and ceilings; chemical handling areas; equipment rooms subject to drainage, leakage, and washdown; and in galleries and trenches, shall be Type 316 stainless steel.

- B. Machine bolts, inserts, and fasteners not permanently embedded in concrete, but located indoors where washdown, leakage, and drainage are not likely to occur (e.g., in personnel buildings excluding laboratories, on motor floors, in electrical equipment rooms, and in control rooms), may be galvanized steel, ASTM A153.

2.08 LOOSE LINTELS AND ANGLE FRAMING

- A. Provide steel lintels and framing required for support of masonry and other construction that is not attached to structural steel framing.
- B. Galvanize after fabrication.

2.09 LIFTING LUGS

- A. Provide equipment and/or each field-disassembleable part over 100-lb. in weight proper lifting lugs for easy handling.

PART 3. EXECUTION

3.01 GENERAL

- A. Workmanship and finish of metalwork shall be highest grade and equal to the best practice of modern shops for respective work.
- B. Exposed surfaces shall have smooth finish and sharp, well-defined lines.
- C. Provide necessary rabbets, lugs, and brackets so that work can be assembled in a neat, substantial manner.
- D. Conceal fastenings where practical.
- E. Drill metalwork and countersink holes as required for attaching hardware or other materials.
- F. Fabricate materials as specified.
- G. Weld connections, except where bolting is required.
- H. Items requiring special fabrication methods are specified.
- I. Fabrication of other items shall be of equal quality.
- J. Methods of fabrication not otherwise specified or shown shall be adequate for the stresses.
- K. Grind exposed edges of welds smooth on walkways, guardrails, handrails, stairways, channel door frames, steel column bases, and where indicated on Drawings.
- L. Sharp edges shall be rounded to be $\frac{1}{8}$ " minimum radius; all burrs, jagged edges, and surface defects shall be ground smooth.
- M. Prepare welds and adjacent areas such that there is:
 - 1. No undercutting or reverse ridges on weld bead.
 - 2. No weld spatter on or adjacent to weld or any other area to be painted.
 - 3. No sharp peaks or ridges along weld bead.
- N. Grind flush embedded pieces of electrode or wire with adjacent surface of weld bead.

3.02 OPEN WEB STEEL JOISTS

- A. Erect in accordance with SJI Standard Specifications for open web steel joist and manufacturer's recommendations.

3.03 STEEL ROOF DECK

- A. Erect in accordance with manufacturer's specifications and erection layout.

3.04 ALUMINUM

- A. Fabricate aluminum as shown, and in accordance with Aluminum Association Standards and manufacturer's recommendations as approved.
- B. Do not remove mill markings from concealed surfaces.
- C. Exposed surfaces not otherwise coated shall have the inked or painted identification marks removed after material has been inspected and approved by Engineer.
- D. Grind smooth sheared edges exposed in the finished work.
- E. Weld aluminum Gas Metal Arc (MIG) or Gas Tungsten Arc (TIG) processes in accordance with manufacturer's recommendations as approved, and in accordance with recommendations of American Welding Society contained in the Welding Handbook, as last revised.
- F. Grind smooth exposed aluminum welds.

3.05 WELDING

- A. The technique of welding employed, appearance, quality of welds made, and methods of correcting defective work shall conform to codes for Arc and Gas Welding in Building Construction of AWS and AISC.
- B. Surfaces to be welded shall be free from loose scale, rust, grease, paint, and other foreign material, except that mill scale, which will withstand vigorous wire brushing may remain.
- C. A light film of linseed oil may likewise be disregarded.
- D. No welding shall be done when the temperature of the base metal is lower than 0°F.
- E. Finished members shall be true to line and free from twists.
- F. Welding operators shall be qualified in accordance with requirements of current AWS Standard Qualification Procedure D1.1, Chapter 5 and welders of structural and reinforcing steel shall be certified for all positions of welding in accordance with such procedure.
 - 1. Qualification tests shall be run by a recognized testing laboratory at Contractor's expense.
- G. Welding operators shall be subject to examination for requalification using equipment, materials, and electrodes employed in execution of Contract work.

1. Such requalification, if ordered by Engineer, shall be done at expense of Contractor.

3.06 INSTALLATION OF FABRICATED METALWORK

- A. Install in accordance with the shop drawings, Contract Drawings, and these Specifications.
- B. Perform erection work by skilled workmen.
- C. Completed installations shall, in a all cases, be rigid, substantial, and neat in appearance.
- D. Install commercially manufactured products in accordance with manufacturer's recommendations as approved.

3.07 ANCHOR BOLTS

- A. Accurately locate anchor bolts and hold in place with templates at time concrete is poured.

3.08 EXPANSION ANCHORS OR WEDGE ANCHORS

- A. Installation shall not begin until concrete or masonry receiving anchors has attained its design strength.
- B. Anchor shall not be installed closer than 6 times its diameter to either an edge of concrete or masonry, or to another anchor, unless specifically detailed otherwise on Drawings.

3.09 ELECTROLYTIC PROTECTION

- A. Where aluminum is in contact with dissimilar metals, or to be embedded in masonry or concrete, protect surfaces in accordance with System No. 27 of Section 09900.
- B. Allow paint to dry before installation of material.
- C. Protect painted surfaces during installation; should coating become marred, prepare and touch up surface per paint manufacturer's instructions.
- D. Where titanium equipment is in contact with concrete or dissimilar metals, provide full-face neoprene insulation gasket, 3/32" minimum thickness and 70 durometer hardness.

3.10 PAINTING

- A. Thoroughly clean ferrous metal items not galvanized and give shop coat of metal primer.
- B. Preparation of surfaces and application of primer shall be in accordance with Section 09900, utilizing appropriate painting system.

END OF SECTION

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SECTION 06100

ROUGH CARPENTRY

PART 1. GENERAL

1.01 SUMMARY

- A. Provide rough carpentry.

1.02 RELATED SECTIONS

- A. Section 03300 – Cast-In-Place Concrete.

1.03 REFERENCES

- A. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
 - 1. ASTM A307 – Specification for Carbon Steel Externally Treated Standard Fasteners.
 - 2. ASTM A446 – Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
 - 3. ASTM A525 – Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- B. American National Standards Institute, 1430 Broadway, New York, New York 10018.
 - 1. ANSI A199.1
- C. American Wood Preservers Association, P.O. Box 849, Stevensville, Maryland 21666.
- D. American Wood Preservers Bureau, P.O. Box 6085, Arlington, Virginia 22206.

PART 2. PRODUCTS

2.01 QUALITY ASSURANCE

- A. Lumber grading rules and wood species shall be in conformance with U.S. Product Standard PS 20 and the National Forest Products Association. The wood members shall conform to the requirements above and provide design values equal to those published in the "Design Values for Wood Construction", a supplement to the 1977 edition of National Design Specification for Wood Construction, published by the National Forests Products Association.
- B. Plywood grading rules shall be in conformance with latest edition of U.S. Product Standard PS 1/ANSI A199.1 or American Plywood Association Standards.

- C. Joints and connections of wood trusses shall conform to the Uniform Building Code Standard 25-17.

2.02 GRADE MARKS

- A. Each piece of lumber shall be stamped or branded with the grade as determined by an approved grading association indicating conformance with U.S. Product Standard PS 20.
- B. Each panel of plywood shall be identified with the appropriate grade trademark of the American Plywood Association.
- C. Moisture content shall not exceed 19%, unless otherwise specified.
- D. Preservative and pressure treated material shall conform to American Wood Preservers Association Standards (AWPA) and bear the American Wood Preservers Bureau (AWPB) quality mark designation.

2.03 DELIVERY, STORING, AND HANDLING

- A. Immediately upon delivery to jobsite, place materials in area protected from weather.
- B. While unloading, protect surfaces and corners of sheet material.
- C. Store materials a minimum of 6" (150-mm) above ground on framework or blocking and cover with protective waterproof covering; provide for adequate air circulation or ventilation.
- D. Do not store seasoned materials in wet or damp portions of building.

2.04 LUMBER

- A. Dimensions given are nominal. Surface four sides (S4S), unless specified otherwise.
- B. Unless otherwise noted, lumber shall be as follows:

| <u>Use</u> | <u>Minimum Grade</u> |
|---|---|
| General framing, plates, blocking, Braces, studs, furring, and nailers | Standard and Better or Stud Grade |
| Structural light framing, 2"-4" thick, 2"-4" wide | Douglas Fir Larch No. 2 or Southern Pine No. 2 |
| Structural joists and planks, 2"-4" thick, 5" and wider, and headers. | Douglas Fir Larch No. 2 or Southern Pine No. 2 |
| Beams, stringers, posts, timbers | Douglas Fir Larch No. 1 |

- C. Roof Trusses:
 - 1. Supplied by a manufacturer whose design standards meet or exceed the requirements of the National Design Specification for Wood Construction and the Design Specification for Metal Plate Connected Wood Trusses published by the NFPA and Truss Plate Institute, respectively.
 - 2. Common Howe type of the pitch and span shown on Drawings.
 - 3. Rated for a 55-psf load with 15% duration factor.
 - 4. Chord sizes no less than 2" by 4" (nominal).
 - 5. Connectors:
 - a. Meet or exceed all code requirements for ASTM A446 Grade A Structural Steel.
 - b. Minimum thickness of 0.036".
 - c. Hot-dipped galvanized.
- D. Exterior Gable panels and soffits under eaves:
 - 1. $\frac{3}{8}$ " thick rough-textured western red cedar plywood.
 - 2. Appearance grade on one side.
- E. Roof Decking: $\frac{1}{2}$ " thick C-D plywood, exterior grade.

2.05 ROUGH CARPENTRY HARDWARE

- A. Nails: Steel common nails in accordance with the Fastening Schedule of the Standard Building Code. Use hot-dipped zinc-coated nails wherever exposed.
- B. Bolts and Screws: Conforming to ASTM A307, sizes as indicated on Drawings, galvanized where exposed.
- C. Framing Anchors: Simpson, Teco, or Bowman galvanized 8-gauge steel, complete with nails.
- D. Ply Clips: Extruded 6063-T6 aluminum alloy.
- E. Bar or Strap Anchors: ASTM A525, Zinc-coated steel, 18-gauge minimum.

PART 3. EXECUTION

3.01 GENERAL

- A. Use only skilled workers and the highest standards of the craft. Plan work in advance and perform in proper sequence to facilitate prompt and continuous progress of the work.
- B. Lay out, cut, fit, and install all rough carpentry items. Anchor sufficiently to ensure rigidity and permanence and as noted on Drawings.
- C. Install items accurate to dimension, true, to line, level, and square unless indicated otherwise on Drawings. Provide for installation and support of other work.
- D. Verify that surfaces to receive rough carpentry materials are prepared to exact grades and dimensions.

3.02 SILLS AND PLATES

- A. Set level and flush with outside face of foundation or as shown on Drawings. Anchor as noted on Drawings.

3.03 TRUSSES

- A. Install trusses at spacing as shown on Drawings.
- B. Support ends of bottom chord with a minimum of 4" of bearing on the bearing wall.
- C. Fasten to wall with approved framing anchor in manufacturer's recommended manner.
- D. Bridge between bottom chords of trusses with 2" by 4" (minimum) dimensional lumber at intervals not greater than 8'.
- E. Lap bridging pieces over 2 trusses as a minimum.

3.04 RAFTER FRAMING

- A. Install with crown edge up.
- B. Support ends of each member minimum 1½" of bearing on wood or metal.
- C. Lap members framing from opposite sides of beams, girders, or partitions, minimum 4", or tie opposing members together by toenailing or metal connectors.

3.05 NOTCHES

- A. Do not notch in middle third of rafters. Notches in top or bottom of rafters, maximum of 1/6 depth of member. Notched ends, maximum of 1/3 depth of member.

3.06 BORED HOLES

- A. Maximum 1/3 depth of member, 2" minimum distance to top or bottom of joists.

3.07 BRIDGING

- A. Nominal depth-to-thickness ratio of joists exceeding 4, install bridging at 8' intervals.

3.08 METAL CROSS BRIDGING

- A. Install nailable type with two 8d nails in each ends, leaving a space between members minimum of 1/8".

3.9 PRESERVATIVE TREATED WOOD PRODUCTS

- A. Provide preservative treated wood (CCA) for all framing, blocking, furring, nailing strips built into exterior masonry walls and wood in contact with concrete as indicated on Drawings.
- B. Redry and clean lumber, after treatment, to maximum moisture content of 19%, stamped DRY.
- C. Apply two brush coats of same preservative used in original treatment to all sawed or cut surfaces of treated lumber.

END OF SECTION

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SECTION 06200

FINISH CARPENTRY

PART 1. GENERAL

1.01 SECTION INCLUDES

- A. Provide wood trim and finish, wood casework, finish hardware, and other finish carpentry items as specified.

1.02 RELATED SECTIONS

- A. Section 06100 – Rough Carpentry.

1.03 SHOW DRAWINGS

- A. Submit shop drawings of cabinet and casework for review by Engineer prior to start of fabrication.
- B. Indicate size, species, assembly details, applied finish, surfacing, built-up hardware, and necessary connections or other work.

1.04 QUALITY ASSURANCE

- A. Qualifications of Workmen:
 - 1. Cutting and Fitting of Trim and Finish Material: Utilize journeyman finish carpenters.
 - a. Thoroughly trained and experienced in skills required.
 - b. Completely familiar with specified materials and manufacturer's recommended methods of installation.
 - c. Familiar with requirements of this work.
- B. Material Grading:
 - 1. Hardboard, Particleboard, Lumber, and Plywood: Bear trademark, stamp, or other identifying marks indicating grades of material and rules or standards under which produced.
 - a. Identifying Marks on Material: In accordance with rule or standard under which material produced.
 - b. Inspection Agency for Lumber: Certified by Board of Review, American Lumber Standards Committee for species used.
 - 2. Moldings and Millwork: Association trademark shall be applied to each bundle in bundled stock.

3. Precut Lumber: In Lieu of piece grademarking, furnish certificate of inspection from an agency certified by the Board of Review, American Lumber Standards Committee.

C. Custom Grade:

1. Quality Standards, Architectural Woodwork Institute, apply and by reference are made a part of this Specification.
2. References to Custom Grade: As defined in latest edition of AWI Quality Standards.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protection:

1. Materials: Protect before, during, and after installation.
2. Installed Work: Protect from other work.

B. Replacements:

1. If work is damaged, immediately make necessary repairs and replacements to the approval of Engineer at no additional cost to Owner.

PART 2. PRODUCTS

2.01 LUMBER NOT SHOWN

- A. Lumber for Trim and Millwork: Kiln dried to 8 to 12% moisture content.
- B. Lumber for Finish Carpentry: Paint grade Birch kiln dried to 12% maximum moisture content.
- C. Lumber for Structural Carpentry: Specified in Section 06100.

2.02 PLYWOOD NOT SHOWN

- A. Plywood Core Material to Receive Laminated Plastic Surfacing:
 1. Hardwood surface veneer.
 2. High density particle board may be used.
- B. Paint grade Birch with A grade faces for visible sides, equal to INT-APA quality.
- C. Plywood for Structural Carpentry: Specified in Section 06100.

2.03 LAMINATED PLASTIC

- A. Designer Series:
 1. Consoweld.
 2. Formica.

- 3. Nevamar.
 - 4. Wilson Art.
 - 5. Textolite.
- B. Thickness: 1/16"; general purpose Grade 10.
 - C. Backing Sheets:
 - 1. Grade 91, 0.020" thick.
 - 2. Install on backs and edges of doors receiving laminated plastic fronts.

2.04 CABINETS

- A. Manufacturer: American Woodmark or equal.
- B. Submit catalogs to Owner for selection of color and style.

2.05 COUNTERTOPS

- A. Postform tops.
- B. Submit catalogs to Owner for selection of color and style.

PART 3. EXECUTION

3.01 TRIM AND FINISH

- A. Conform to Custom Grade of AWI Quality Standards.
- B. Set true, level, and plumb with tight joints and securely fasten in place.
- C. Protect from dampness until painted or varnished.
- D. Apply finish so that completed results will show as little of the joints as possible and no tool or machine marks, nail holes, or nails.
- E. Lengths of Lumber:
 - 1. Without joints on straight run where possible.
 - 2. Where Joints Necessary: Make accurately and neatly on 45° angle against light.
- F. Moldings: True to details, cleanly cut and sharp.
- G. Exposed Surfaces: Sand to even, smooth surface, ready for finish.
- H. Mill Assemblies: Join with concealed nails or screws, mortise and tenons, dowels, or glued blocks.
- I. Intersection Molds: Neatly coped.
- J. Flat Members of Wood Trim: Back out or saw kerf to prevent warping.

3.02 BACKPRIMING MILLWORK AND TRIM

- A. Allow ample time permit application and drying of required paint prior to installation of millwork and trim.

3.03 CASEWORK

- A. Provide counters, cabinets, shelving, and other casework in accordance with Custom Grade of AWI Quality Standards and with details on Drawings, using materials indicated.
- B. Manufacture in cabinet shop specializing in and experienced in manufacture of casework shown.

3.04 HARDWARE

- A. Rough Hardware (Nails, Screws, Anchor Bolts, Wall Plugs, etc.):
 - 1. Install in types, sizes, and quantities indicated on Drawings or as required for secure anchorage of carpentry work.

END OF SECTION

SECTION 07194

UNDERSLAB VAPOR BARRIER

PART 1. GENERAL

1.01 SUMMARY

- A. Provide underslab vapor barrier.

1.02 RELATED SECTIONS

- A. Section 01330 – Submittal Requirements.
- B. Section 03300 – Cast-in-Place Concrete.

1.03 SUBMITTALS

- A. Manufacturer's Literature: Submit manufacturer's literature on vapor barrier proposed for use in accordance with Section 01330.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to job site in original packages with manufacturer's labels intact.

PART 2. PRODUCTS

2.01 MATERIALS

- A. Vapor barrier shall be a 6-mil sheet polyvinyl or polyethylene.

PART 3. EXECUTION

3.01 COORDINATION

- A. Coordinate the work of all trades so that all items to be placed under the slab are in place prior to the laying of any vapor barrier.

3.02 INSTALLATION OF UNDERSLAB VAPOR BARRIER

- A. Install vapor barrier under concrete slab of all buildings. After base for the slab has been leveled and tamped, apply the vapor barrier with the roll width parallel to the direction of the pour. All joints shall be lapped 6", minimum and sealed with tape or adhesive. Apply the vapor barrier in accordance with manufacturer's instructions.
- B. Caution shall be maintained to provide a puncture-free vapor barrier. Any minor tears or holes shall be repaired with tape. Any tears or holes, which require more

than a 6" length of tape to repair, shall be repaired by removing defective sheet and replacing with a new sheet.

3.03 CLEANUP

- A. Upon completion of the vapor barrier installation and prior to the placing of concrete slab, clean up all waste materials and debris resulting from this operation and dispose of such waste materials off the site.

END OF SECTION

SECTION 07900

SEALANTS

PART 1. GENERAL

1.01 SUMMARY

- A. Provide sealants for repairs to or construction of buildings and structures.

1.02 ENVIRONMENTAL CONDITIONS

- A. The ambient temperature shall be between 40°F and 90°F (4°C and 32°C) when sealant is applied.
- B. Concrete floor temperature shall be between 50°F and 100°F when sealant is applied.

1.03 RELATED SECTIONS

- A. Section 03152 – Construction Joints and Waterstops.

1.04 REFERENCES

- A. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
 - 1. ASTM D1751 – Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Type).
- B. Federal Specifications,
 - 1. TT-S000230
 - 2. TT-S01543

1.05 PRODUCT HANDLING

- A. Deliver all sealants to the jobsite in sealed containers, each bearing manufacturer's name and product designation.

PART 2. PRODUCTS

2.01 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 only. Products of other manufacturers will be considered in accordance with the General Conditions.

- B. Sealants shall be self-leveling (S/L) for horizontal and sloping joints with a maximum slope of 1%. Nonsag sealants (N/S) shall be used for steeper sloped joints, vertical joints, and overhead joints.
- 2.02 SEALANTS – VERTICAL JOINTS IN CAST-IN-PLACE CONCRETE, SUBMERGED AND NONSUBMERGED, AND CONCRETE MASONRY
- A. One-part polyurethane sealant conforming to Federal Specification TT-S000230, Type II, Class A, N/S; Mameco Vulkem 116; Sika Sikaflex IA; or equal. Color shall be manufacturer’s standard limestone gray.
 - B. Dow Corning 888 Silicon Rubber Joint Sealer.
- 2.03 HORIZONTAL JOINTS IN CAST-IN-PLACE CONCRETE, SUBMERGED AND NONSUBMERGED
- A. One-part polyurethane sealant conforming to Federal Specification TT-S000230, Type I, Class A, S/L; Mameco Vulkem 45; or equal. Color shall be manufacturer’s standard limestone gray.
- 2.04 SPECIAL APPLICATIONS
- A. One-part polyurethane sealant conforming to Federal Specification TT-S000230, Type II, Class A, N/S; Mameco Vulkem 116; Sika Sikaflex IA; or equal. Color shall be manufacturer’s standard limestone gray. Typical locations: sealant bed for aluminum thresholds.
- 2.05 METAL DOOR FRAMES, WINDOWS, AND LOUVER FRAMES
- A. One-part acrylic polymeric sealant conforming to Federal Specification TT-S000230, N/S; Pecora 60 Plus Unicrylic; Tremco Mono; or equal. Color for both sides of framing shall be bronze for exterior applications; interior metal door frames, both sides, shall be white or match the color of doorframe.
- 2.06 HIGH TEMPERATURE PIPING (250° F Maximum)
- A. One-part silicone sealant conforming to Federal Specification TT-S01543, Class A, N/S; Pecora 864; Dow Corning 790; or equal. Color shall be bronze.
- 2.07 MILLWORK APPLICATIONS
- A. One-part acrylic latex polymer, paintable, N/S; as manufactured by Pecora; Tremco; or equal. Color shall be white.
- 2.08 CONCRETE MASONRY UNIT SEALANT
- A. Manufacturer: Futura-Seal 935 by Futura Coatings, Inc.

2.09 CONCRETE FLOOR SEALANT

- A. Floor Rock #R0-032 manufactured by Floor Pro, Inc., P.O. Box7083, Louisville, KY. No substitutions will be excepted.

2.10 BACKUP MATERIAL

- A. Use closed-cell polyethylene foam rod conforming to ASTM D1751 and compatible with sealant used. Size as shown or as recommended by manufacturers for all joints greater than 3/16" wide.

2.11 BOND BREAKER

- A. As recommended by sealant manufacturer.

2.12 PRIMER

- A. As recommended by sealant manufacturer.

PART 3. EXECUTION

3.01 PREPARATION

- A. Surfaces to be sealed shall be clean, dry, sound, and free of dust, loose mortar, and other foreign materials.
- B. Mask adjacent surfaces where necessary to maintain neat edge.
- C. Starting of work will be construed as acceptance of all subsurfaces.

3.02 INSTALLATION

- A. Apply materials following manufacturer's recommendation and instructions.
- B. Fill sealant joint completely from back to top, without voids.
- C. Tool sealant joints slightly concave after sealant is installed. When tooling white or light color sealant, a water wet tool shall be used.

3.03 CONCRETE MASONRY UNIT SEALANT

- A. Surface Preparation:
 - 1. Cure masonry for a minimum of 28-days.
 - 2. Surfaces must be clean and dry.
- B. Special Instructions:
 - 1. Apply 2 coats at 125 square foot per gallon, each coat.
- C. Apply in accordance with manufacturer's written instructions.

3.04 CONCRETE FLOOR SEALANT

- A. Floor Preparation:
 - 1. Cure concrete a minimum of 45-days.
 - 2. Remove all curing compounds.
 - 3. Acid etch. Rinse thoroughly. Let dry. Sweep or vacuum.

- B. Special Instructions:
 - 1. Minimum slab temperature: 60°F.
 - 2. Apply 2 coats at 5-mils wet film thickness/2-mils dry film thickness.
 - 3. Minimum dry film thickness: 4 to 5-mils.

- C. Apply sealant in accordance with manufacturer's written instructions.

3.05 CLEANING

- A. The surfaces next to the sealed joints shall be cleaned of smears or other soiling resulting from the sealing application.
- B. At no additional cost to Owner, replace or repair to Owner's satisfaction any damaged surfaces resulting from sealing or cleaning.

END OF SECTION

SECTION 08100

DOORS AND FRAMES

PART 1. GENERAL

1.01 SECTION INCLUDES

- A. Hollow metal doors and frames.
- B. Wood doors and frames.
- C. Rolling service doors.

1.02 RELATED SECTIONS

- A. Section 01330 – Submittals.
- B. Section 08710 – Door Hardware.
- C. Section 09900 – Painting.

1.03 REFERENCE STANDARDS

- A. American National Standard Institution, 1430 Broadway, New York, New York 10018.
- B. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
 - 1. ASTM A1011 – Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy With Improved Formability, and Ultra High Strength.
- C. National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.
 - 1. Pamphlet No. 80.
- D. Steel Door Institute, 712 Lakewood Center North, 14600 Detroit Avenue, Cleveland, Ohio 44107.
 - 1. SDI 100 – Recommended Specifications for Standard Steel Doors and Frames.
 - 2. SDI 105 – Recommended Erection Instructions for Steel Frames.
 - 3. ANSI A250.6 – Hardware on Steel Doors.

1.04 SUBMITTALS

- A. Provide Shop Drawings in accordance with Section 01330.

1. Submit shop drawings covering each type of door and frame, frame conditions, and complete anchorage details, supplemented by suitable schedules covering doors and frames.
 2. Detail connections of door frames to structural steel framing concealed in frames, if any.
 3. For frames too large to ship in one piece, locate and detail field splice joints and indicate complete instructions for making field splices.
 4. Identification of each door shall be noted.
- B. Submit manufacturer's painting specifications in accordance with Section 01330 for factory finished items specified.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle doors and frames in a manner to prevent damage and deterioration.
- B. Provide packaging such as cardboard or other containers, separators, banding, spreaders, and paper wrappings to protect metal items.
- C. Store doors upright, in a protected dry area, at least 1" or more off the ground or floor and at least 1/4" between individual pieces.
- D. Follow special storage and handling requirements of manufacturer.
- E. Protect exposed finish surfaces of prefinished items with masking tape.

PART 2. PRODUCTS

2.01 HOLLOW METAL DOORS AND FRAMES

- A. Manufacturers:
 1. The Ceco Corporation.
 2. Republic Steel Corporation.
 3. Steelcraft Manufacturing Company.
 4. Or equal.
- B. Material:
 1. Sheet steel for frames shall be hot-rolled prime quality carbon steel conforming to ASTM A1011.
 2. Sheet steel for doors shall be cold-rolled stretcher level sheet steel conforming to ASTM A1011.
- C. Provide stainless steel bolts, nuts, and washers as required.
- D. Phosphate treat for paint adhesion, and apply one shop coat of baked-on prime coating compatible with finish coating.
- E. Fabrication:

1. Provide adequate reinforcement and cutouts for hardware, prepared in accordance with ANSI A250.6, also adequate floor and wall anchors.
 2. Door Frames:
 - a. Manufacturer: Same manufacturer as hollow metal door manufacturer.
 - b. 16-gage, knockdown or welded type, and shall conform to SDI 100, except as modified herein.
 - c. Drawings indicate size, shape, and profile of frame members.
 - d. Manufacturer's standard forming methods may be used to achieve the desired finished appearance.
- F. Concealed fasteners or welding are preferred to through-the-face fasteners.

2.02 SOLID WOOD DOORS AND FRAMES

- A. Doors shall be 1 $\frac{3}{4}$ " thick.
- B. Exterior use, birch finish.
- C. Stain all faces.
- D. 2 coats of sealer all faces.
- E. Manufacturer: Weyerhaeuser, Crown, Eggers, or equal.

2.03 ANCILLARY ITEMS

- A. Manufacturer's standard anchors, fasteners, etc.

2.04 DOORS AND TRANSOM PANELS

- A. Hollow metal doors shall be 18-gauge, Grade II, Model 3, seamless, with polyurethane core of dimensions shown.
- B. Doors shall conform to SDI 100, except as modified herein.
- C. Doors shall be constructed and prepared in accordance with ANSI A250.6 and ANSI A115 to receive the hardware specified.

2.05 ROLLING SERVICE DOOR

- A. Manufacturer:
 1. Windsor Door Company, Model SFWI.
 2. Or equal.
- B. Size: As shown on Drawings.
- C. Provide fully insulated weather-stripped sectional service door.
- D. Sectional Overhead Door

1. Insulated steel tongue-and-groove jointed panels with roll-formed internal struts with polypropylene rib caps to provide thermal break; end caps to provide tight seal at jambs; and hardware plates at all fastener points.
 2. Complying with ANSI/DASMA 102 requirements for commercial doors.
 3. Wind Load Performance: Withstanding 15.2-psf external pressure and 12-psf internal pressure when tested in accordance with ASTM E 330.
 4. Insulation: Foamed-in-place high density polyurethane core with flamespread of 10 and smoke density of 210 when measured in accordance with ASTM E 84.
 5. Finish: Baked-on polyester primer and finish coat.
 6. Panel Thickness: 2-inches.
 7. Face Sheet Thickness: 26-gauge.
 8. Panel Design: Flush, embossed ¼" pinstriping, non-repeating random stucco texture.
 9. Thermal Resistance: Calculated "R" value of 16.16.
 10. Zinc Coating: Z275 galvanized, before finishing.
 11. Color: White.
 12. Panel Thickness: 2".
 13. Face Sheet Thickness: 20-gauge, 0.036".
 14. Panel Design: Flush.
 15. Thermal Resistance: Calculated "R" value of 16.16, max.
 16. View Windows: Sealed ½" insulated units, 24" x 6", in high-impact polymer frames.
- E. Tracks: Graduated wedge type weathertight design, with mounting brackets.
1. Material: 16-gage, 0.06", galvanized steel sheet, ASTM A 653/A 653M, Z120 hot-dipped zinc-aluminum coating.
 2. Depth: 3".
- F. Hardware
1. Hinges: Hot-dipped galvanized steel.
 2. Track Rollers: Steel, with case-hardened inner steel races and 10 ball bearings.
 3. Weatherstripping: Rubber head seal, panel joint seals, and compressible U-shaped PVC bottom seal mounted in aluminum retainer.
- G. Counterbalances: Spring torsion type capable of supporting entire door weight, made of ASTM A 229/A 229M oil-tempered steel wire.
1. Performance: Minimum of 100,000 cycles.
 2. Spring Fittings and Drums: Die-cast high strength aluminum.

3. Cables: Prefomed galvanized steel aircraft cables with minimum safety factor of 5 to 1.
- H. Locks: Rim cylinder and locking bar, operable from outside and inside.
- I. Motor Operator
 1. Motor shall be ½-HP, 110 volt continuous-duty rated, open drip-proof, easily removed without disturbing the limit switches.
 2. Controls shall be three button station with momentary contact for open, close, and stop.
 3. Drive reduction shall be bronze forged gears running in an oil bath. Housing shall be of cast iron.
 4. Auxiliary chain hoist shall be supplied with floor level disconnect.
 5. Motor operator shall be Lift-Master, Link H-50-11; or equal.

PART 3. EXECUTION

3.01 INSTALLATION OF FRAMES

- A. Install hollow metal frames in accordance with SDI 105.
- B. Exercise care in setting of frames to maintain scheduled dimensions, hold head level, and maintain jambs plumb and square.
- C. Secure anchorages and connections to adjacent construction.
- D. Wherever possible, leave frame spreader bars intact until frames are set perfectly square and plumb and anchors are securely attached.

3.02 INSTALLATION OF DOORS

- A. Install hollow metal doors in accordance with SDI 100.
- B. Apply hardware in accordance with hardware manufacturer's templates and instructions.
- C. Adjust operable parts for correct function.
- D. Remove hardware, with the exception of prime coated items, tag, box, and reinstall after finish paint work is completed.
- E. Installation of labeled doors shall conform to NFPA Pamphlet No. 80.

3.03 ROLLING SERVICE DOOR

- A. Install according to manufacturer's recommendations.
- B. Install doors plumb, level, and operating smoothly without binding.

3.04 PRIME COAT TOUCHUP

- A. Immediately after erection, areas where prime coat has been damaged shall be sanded smooth and touched up with same primer as applied at shop.
- B. Remove rust before specified touchup is applied; touchup shall not be obvious.

3.05 FINISH

- A. Finish coating shall be as indicated on Drawings and as specified in Section 09900.

3.06 PROTECTION

- A. Protect installed doors and frames against damage from other work.

END OF SECTION

SECTION 08710

DOOR HARDWARE

PART 1. GENERAL

1.01 SUMMARY

- A. Provide door hardware.
- B. Like items of equipment provided hereunder shall be the end products of one manufacturer to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's service.

1.02 RELATED SECTIONS

- A. Section 01330 – Submittal Requirements.
- B. Section 08100 – Doors and Frames.

1.03 REFERENCE STANDARDS

- A. American National Standards Institute, 1430 Broadway, New York, New York 10018.
 - 1. ANSI A156.1 – Butts and Hinges.
 - 2. ANSI A156.2 – Bored and Preassembled Locks and Latches.
- B. Builders Hardware Manufacturers Association, 60 East 42nd Street, Room 511, New York, New York 10165.
 - 1. BHMA 1301 – Materials and Finishes.

1.04 SUBMITTALS

- A. Provide submittals in accordance with Section 01330 – Submittal Requirements.
- B. Schedule:
 - 1. Submit complete schedule of finish hardware required herein, for the Engineer's review.
 - 2. Schedule must be completely detailed, showing all items, numbers, and finishes for all hardware for each separate opening.
 - 3. Any corrections or changes necessary in the schedule to comply with the requirements of the Contract Documents shall be made promptly.
 - 4. Review of the schedule shall not relieve the Contractor of the responsibility for errors or omissions therein.

- C. Manufacturer's Literature:
 - 1. Submit manufacturer's literature for each item of finish hardware required herein, for the Engineer's review.
 - 2. Manufacturers' literature to be plainly marked for each proposed item; indiscriminate submittal of unmarked literature will not be accepted.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall provide a room under lock and key to store all finish hardware until installation is made, and be responsible for loss and pilferage.
- B. Each item of hardware shall be marked as to description and location of installation.
- C. Exposed surfaces of hardware shall be covered and well protected during installation and until building is accepted by Owner to avoid damage to finishes and functions.

PART 2. PRODUCTS

2.01 MANUFACTURERS

- 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 only.
- B. Products of other manufacturers will be considered in accordance with the General Conditions.

2.02 MATERIALS

- A. Provide all finish hardware with suitable fastening for complete work. Items not specifically mentioned by necessary to complete the work shall be furnished, matching in quality and finish the items specified for similar locations.

2.03 FINISHES

- A. Numbers in the 600 series are from BHMA 1301 Product Standard Section M, Materials and Finishes.

2.04 FASTENERS

- A. All fasteners for hardware specified herein shall be stainless steel.

2.05 BUTT HINGES

- A. The Stanley Works; McKinney Manufacturing Company; Lawrence Brothers; or equal, conforming to ANSI A 156.1.

- B. Minimum number of hinges per door leaf: 1½ pairs.
- C. Minimum Height of Hinge:
 1. 4½" for door width up to 3'-0".
 2. 5" for door width 3'-1" to 4'-0".
- D. Width of hinges shall be the minimum, which will provide clearance of trim and permit 180° swing.
- E. Exterior hinges shall have non-removable pin.
- F. Hinge leaves shall be parallel and joint tolerance shall be 0.012" maximum, gauged in closed position.

2.06 FINISH

- A. Finish shall be Satin stainless steel, No. 630.

2.07 HINGE TYPES

- A. Use manufacturer's recommended standard.

2.08 LOCKS AND LATCHSETS

- A. All doors shall be equipped with locks/latchsets. Sargent and Company; Schlage Lock Company; Corbin Division, Emhart Industries, Inc., or equal, conforming to ANSI A156.2.
- B. Design shall be Sargent "GC"; Schalge "Planet"; Corbin "864 Global" knobs and roses. Construction shall be wrought metal.
- C. In all locks provide interchangeable, removable, core cylinders with a minimum of six pins.
- D. Strikes shall have lip dimensions to fit configuration of trim. Provide ¾" throw on all latch bolts used on pair of doors.
- E. Roll up door shall be provided with padlock and hasp at one side of door near bottom.

2.09 BACKSET

- A. 3¾", except as noted.
- B. Finish shall be Satin stainless steel, No. 630.

2.10 LOCK AND LATCH TYPES

- A. Lock by door manufacturer; provide cylinders for keying to other locks as required.

2.11 KEYING

- A. Key all doors alike.
- B. Furnish 2 keys for each door lock.

2.12 BOLTS

- A. Stanley; Lawrence Brothers; or equal.
- B. Bright nickel, No. 645 finish.

2.13 BOLT TYPES

- A. Bottom: 8" foot bolt – 1056, T145 or 4056 or surface bolt 283.

2.14 THRESHOLDS

- A. Pemko Manufacturing Co.; Reese Enterprises, Inc.; or equal.
- B. Thresholds shall be one-piece full width of opening. Extend beyond jamb where indicated.
- C. Provide with stainless steel machine screws in threaded expansion anchors at concrete.
- D. Mill finish, unless indicated otherwise.
- E. Threshold furnished by door manufacturer.

2.15 WEATHERSHIP

- A. Pemko Manufacturing Co.; Reese Enterprises, Inc.; or equal.
- B. Weather-stripping furnished by door manufacturer.

PART 3. EXECUTION

3.01 INSPECTION AND ADJUSTMENT

- A. A representative of the Hardware Supplier shall be available during the construction period, if necessary, to instruct the Contractor on the proper method of installation and adjustment of the Supplier's products.
- B. The representative shall inspect and adjust the hardware items at completion of the work and supply proper maintenance manuals to the Owner.
- C. After installation, adjust hardware for smooth, noise-free operation.
- D. Replace any damaged items.

3.02 INSTALLATION

- A. Follow manufacturer's instructions for installation of finish hardware.
 - 1. Make all work neat and secure, developing full strength of components and providing proper function.
 - 2. Prevent marring, scratching, or otherwise damaging adjacent finishes during the installation of hardware.

- B. Do all fitting, dismantling, and reinstalling of finish hardware required for finish painting work.
 - 1. Use strippable coating, removable tape, and other means to protect and prevent staining of hardware during construction.
 - 2. Protective measures shall be removed and permanent lock cylinders installed prior to final cleaning.
- C. Latch bolts shall be installed to engage in strikes automatically, whether activated by closers or manually. In no case shall additional manual pressure be required to engage latch bolt in strike.

3.03 MOUNTING DIMENSIONS

- A. Use standard door hardware locations recommended and published by the Door and Hardware Institute, except as noted or detailed otherwise.

END OF SECTION

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SECTION 08800

TERMITE CONTROL

PART 1. GENERAL

1.01 SCOPE OF WORK

Work under this section includes providing all material, equipment, and labor necessary to complete termite control work specified herein for all buildings in the project which contain wood or wood products.

1.02 BUILDING SITE PREPRATION

From investigation at the site, determine the soil texture or otherwise obtain this information from the County Agent, Soil Conservation Service or other approved authorities, if not already known.

Remove all work and other cellulose containing materials from the earth sub-grade of the entire area within the walls of the building before the chemical is applied.

Perform foundation and underfloor termite control treatment at buildings to be constructed. The chemical to be used shall be of a type currently known to give insurable protection for the soil and fill at and under the buildings. The chemical shall be applied in sufficient quantity under and around the structure to qualify the building and contents for continuous insurance protection against damage by subterranean termites.

1.03 GUARANTEE

As a part of the termite control work, issue for delivery to the Owner, a termite damage guarantee with performance guaranteed by the applicator and with performance further insured by an insurance company authorized to do business in the State of Arkansas.

The damage guarantee shall provide service and re-service for any subterranean termite infestation without cost to the Owner. In addition, the Damage Guaranty Contract shall cover any and all subterranean termite damage to any of the structure and/or contents in the amount of \$10,000.00. Such damage to be repaired, replaced, or corrected without cost to the Owner.

The damage guarantee shall be effective for a period of 5 years after completion of the initial treatment without payment of any additional fees or premiums by the Owner. Upon expiration of the 5-year period, the Owner shall have the option of extending the damage guarantee contract at any annual fee mutually agreed upon by the Owner and the applicator. The Owner shall reserve the right to cancel as of any anniversary date. The service, re-service, and damage guaranty provisions of the contract shall be non-cancellable by the applicator and the insurance company. The annual fee shall be subject to revisions as of the fifth year anniversary or any later extension date by giving advance written notice to the Owner.

Upon completion of the work, the damage guarantee shall be issued in triplicate, and submitted to the Engineer.

END OF SECTION

SECTION 09900

PAINTING

PART 1. GENERAL

1.01 DESCRIPTION

- A. The work covered by this item of the specifications includes furnishing all paint, labor, and materials and performing all operations in accordance with this section of the Specifications and the applicable portion of the Plans.

The Contractor shall furnish all labor, material, equipment and services for cleaning and painting of surfaces as follows:

1. All metal work, equipment, pumps, valves, fittings, hangers, supports and machinery; except stainless steel, galvanized steel, and aluminum.
2. All exposed piping and hazardous concealed piping, where required, to be color coded.
3. All structural steel not hot-dip galvanized, and miscellaneous steel work.
4. All exposed conduit and electrical work (excluding galvanized steel).
5. All doors and frames as required, except, aluminum or fiberglass frames.
6. All exterior concrete wall surfaces. Exterior concrete roofs shall be sealed with an approved water sealer.
7. All exterior block.

The work to be performed under this section of the Specifications shall consist of furnishing all labor, materials, and equipment necessary for painting pumps, exposed pipe, valves and fittings, hangers, supports, electrical conduits, metal work, structural steel, miscellaneous steel, equipment, doors, miscellaneous wood, concrete block, drywall, etc., as specified herein.

All metal surfaces to be painted shall be sound, clean and free of harmful scales, 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 direction of the Engineer to the extent that he shall determine where and when painting may be done. 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. Ambient air and substrate temperatures must be a minimum of 5°F above dew point.

Painting found defective shall be removed and the surface repainted as directed by the Engineer.

Aluminum and galvanized members shall not be painted.

B. Shop painting

Certain items which will be subjected to immersion in water in the finished work as described and as 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.

1.02 SUBMITTALS

- A. Six (6) sets of submittals are required. Submittals shall include a list of each specific type of paint proposed along with the manufacturer's product data sheet for that product and color charts for color selection. Colors to be selected by Owner or blended to match existing paint.

1.03 DELIVERY AND STORAGE

- A. Deliver all materials to the site in original containers, with labels intact and seals unbroken. With the exception of ready-mixed materials, do all mixing at site.

The Contractor shall use one convenient location at the site for keeping all materials and doing all mixing, etc. Floor of this space shall be properly protected with drop cloths. Oily rags and waste shall be frequently removed and under no circumstances shall they be allowed to accumulate. At the completion of the work, the Contractor

shall clean off all paint spots, oil and stain from all surfaces and leave the entire project in a satisfactory condition.

PART 2. PRODUCTS

2.01 DESCRIPTION

- A. Paint meeting these specifications shall be as manufactured by TNEMEC Company, Sherwin-Williams, or pre-approved before bidding.

The paints and paint products listed below are as manufactured by the TNEMEC Company, Inc. and the Sherwin-Williams Company (SW) and are intended to establish standards of quality. Paint products for this project shall be equal in all respects to the product listed. No request for substitution will be considered which decreases the film thickness designated and/or the number of coats to be applied, the volume of solids, 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, non-volatile content by volume, and list of at least five (5) similar projects where each of the coatings has been used on new construction and has rendered satisfactory service for at least three (3) years. Paint thickness shall be based on dry film thickness.

TNEMEC or Sherwin-Williams (SW)

| | | |
|-----|--|-----------------------|
| 1. | Tnemec 37H-77 Chem-Prime H.S. or SW Kem Kromik Primer B50 | 2.5 - 4.0 mils/coat |
| 2. | Tnemec Series 2H Tneme-Gloss or SW Industrial En. HS | 3.0 - 4.0 mils/coat |
| 3. | Tnemec Series 66 Epoxoline or SW Macropoxy 646 Epoxy | 5.0 - 6.0 mils/coat |
| 4. | Tnemec Series 46H-413 Tneme-Tar or SW Hi-Mil Sher Tar | 16.0 - 18.0 mils/coat |
| 5. | Tnemec Series 1074 Endura-Shield II or SW Hi-Solids Polyurethane | 4.0 - 5.0 mils/coat |
| 6. | Tnemec Series 181 W.B. Tneme-Crete or SW Con Flex Textured | 50 - 60 sq. ft./gal |
| 7. | Tnemec Series 10W Tnemec Primer or SW Prep Rite Wall & Wood Primer | 2.0 - 3.0 mils/coat |
| 8. | Tnemec Series 113 Satin H.B. Tneme Tufcoat or SW Epo-Plex WB Epoxy Low Luster | 4.0 - 6.0 mils/coat |
| 9. | Tnemec Series 54 Masonry Filler or SW Epo-Plex Epoxy Block Filler | 60 - 75 sq. ft./gal. |
| 10. | Tnemec 51 PVA Sealer or SW Prep Rite 200 Latex Primer | 1.5 - 2.0 mils/coat |
| 11. | Tnemec Series 20-1255 Pota-Pox or SW Macropoxy 646 NSF Epoxy | 3.0 - 5.0 mils/coat |
| 12. | Tnemec Series 140-15BL Pota-Pox Plus or SW Tank Clad HS Epoxy NSF | 7.0 - 8.0 mils/coat |

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.

2.02 PAINT SCHEDULE FOR SURFACES

A. Paint surfaces for metal surfaces shall be as shown. The number of coats shall be not less than called for hereunder. Number designation of various coats of paint refer to the same number designation of paints given in the preceding subsection. Surface areas to be painted includes, but is not limited to, the following items:

B. Mechanical Equipment:

1. All indoor pumps, motors, tanks, and base plates on slabs above grade: Shop Coat - one (1) coat of 1; Field Coat - two (2) coats of 3.
2. All indoor pumps, motors, tanks, and base plates on slabs below grade: Shop Coat - one (1) coat of 1; Field Coat - two (2) coats of 3.
3. All outdoor pumps, mixers, motors, and base plates (non-submerged): Shop Coat - one (1) coat of 1; Field Coat - one (1) coat of 3 and one (1) coat of 5.
4. All outdoor pumps, mixers, motors, and base plates (submerged): Shop Coat - one (1) coat of 11; Field Coat - one (1) coat of 12.
5. Exterior submerged process steel to an imaginary plane 9" above high water level: Field blast to SSPC-SP-10; Field Coat - one (1) coat of 11 and one (1) coat of 12.
6. All exterior non-submerged process steel located above an imaginary plane 9" above high water level: Field blast to SSPC-SP-10; Field Coat - one (1) coat of 11 and one (1) coat of 5.
7. All blowers, silencers, and appurtenances: Shop Coat -one (1) coat of 3: Field Coat - two (2) coats of 3.
8. All buried steel: Field Coat - one (1) coat of 4.

C. Piping:

1. All indoor exposed iron or steel pipe, valves, fittings, and appurtenances: Shop Coat - one (1) coat of 1; Field Coat - two (2) coats of 3.
2. All outdoor exposed iron or steel pipe, valves, fittings, and appurtenances: Shop Coat - one (1) coat of 1; Field Coat - one (1) coat of 3 and one (1) coat of 5.
3. All buried iron or stud pipe, valves, fittings, and appurtenances: One (1) coat of 4 and cement-mortar interior lining according to ANSI A21.51 (by pipe manufacturer).
4. All submerged iron or steel pipe, valves, fittings, and appurtenances: Field Sandblast to SSPC-SP-10; Field Coat - one (1) coat of 11 and one (1) coat of 12.
5. All indoor or outdoor exposed polyvinyl chloride pipe, valves, fittings, and appurtenances: Two (2) coats of 3 (prime surface in accordance with paint manufacturer's recommendations).
6. All pipe, valves, fittings, and appurtenances used to convey air under pressure: Shop Coat - one (1) coat of 3; Field Coat - two (2) coats of 3.

D. Miscellaneous Metals:

1. Exposed Structural Steel Members and Bar Joists: Shop Coat - one (1) coat of 1; Field Coat - two (2) coats of 3.

E. Architectural:

1. Hollow Metal Doors, Roll-up Doors, Metal Frames, Steel Windows, and Subframes: Shop Coat - one (1) coat of 1 and one (1) coat of 2.
2. Wood Doors and Frames: Field Coat – one (1) coat of 7 and two (2) coats of 2.
3. Interior Standard and Architectural Concrete Masonry Unit Walls: Field Coat – one (1) coat of 9 and two (2) coats of 3.
4. Exterior Standard Concrete Masonry Unit Walls: Field Coat – two (2) coats of 6.
5. Exterior Architectural Concrete Masonry Unit Walls: One (1) coat of Chemprobe Corp. Prime-A-Pell Plus or equal at 75 sq.ft./gal.
6. Interior Drywall: Field Coat – one (1) coat of 10 and two (2) coats of 8.

Manufacturer's Product Data Sheet, application bulletins, and MSDS must be on hand at the job site at all times and readily available for all workers and Owner's representatives.

- F. Electrical: All electrical items which require painting, such as motor control panel cabinets, exposed metal junction boxes, etc. shall be shop blasted, primed, and finished. The Contractor shall be responsible for repairing any damaged areas by hand tool cleaning, priming, and painting. Repair of damaged areas shall be done in such a way that the completed electrical items are uniform in appearance.

2.03 PAINT SYSTEMS FOR OTHER SURFACES

- A. Exposed surfaces not mentioned above shall receive at least two coats of an appropriate type of paint as recommended by the approved paint manufacturer.

2.04 COLOR CODING OF PROCESS PIPING

All piping shall be color coded or labeled as follows. Where labels are used, they shall be placed along the pipe at no greater than five (5') foot intervals. Where colors are used, they shall follow the color code prescribed below. Color coding must be by solid color or banding. If bands are used, they shall be placed along the pipe at no greater than five (5') foot intervals. The color code is as follows:

| <u>LETTERS</u> | <u>COLOR OF PIPE</u> |
|-------------------|----------------------|
| Potable Water | Dark Blue (11SF) |
| Non-Potable Water | White (11WH) |
| Air | Dark Green (91GN) |
| Sewage | Dark Grey (GR28) |
| Chlorine | Bright Yellow (03SF) |
| Sludge | Antique Brown (84BR) |
| Gas | Red (06SF) |
| Alum | Orange (04SF) |

| | |
|--|---------------------|
| Potassium Permanganate | Violet (14SF) |
| Carbon | Black (35GR) |
| Lime | Light Green (37GN) |
| Ammonia | White (11WH) |
| Settled Water | Aqua (10GN) |
| Filter Effluent | Dark Blue (11SF) |
| Backwash | Light Brown (68BR) |
| Drain | Dark Grey (GR28) |
| Raw Water | Olive Green (110GN) |
| Overhead Traveling Bridge Cranes And Supports | OSHA Orange |

2.05 OTHER COLOR CODING

- A. OSHA Orange - Moving parts of equipment, protected by guards-shafts, couplings, pulleys, and sprockets (the guards themselves to be same color as equipment color).
- B. OSHA Yellow - Caution signs and all physical hazards, outside levers, weight on check valves, lower pulley sprockets and chains on valve operators, inside of openings adjacent to steps on ladder, platforms subject to being struck.
- C. Dark Green - "Safety" and location of first air equipment such as gas masks, first-aid kits, and safety deluxe showers.
- D. Black and White - Areas to remain clear.

PART 3. EXECUTION

3.01 GENERAL

- A. All finish coats are to be field applied. Shop applied primer is acceptable, when applied as specified. It is recognized that some equipment is furnished with a manufacturers finish coating system. The Contractor shall be responsible for re-coating these items with paint systems as specified herein as required by the Engineer.

3.02 SURFACE PREPARATION

- A. General

Surfaces to be painted shall be clean before applying paint or surface treatments. Oil, grease, dirt, rust, loose mill scale, old weathered paint, and other foreign substances shall be removed except as hereinafter specified. All areas of the substrate shall be cleaned of all oil, grease, and other foreign contaminants to meet the requirement of SSPC-SP 1, Solvent Cleaning Standard, before specified surface preparation is performed.

Clean cloths and clean fluids shall be used in solvent cleaning to avoid leaving a thin film of greasy residue. Cleaning and painting shall be so programmed that dust or spray from the cleaning process will not fall on wet, newly painted surfaces. Hardware, electrical fixtures, and similar accessories shall be removed or suitably

masked during preparation and painting operations, or shall be disconnected and moved to permit cleaning and painting of equipment, and following painting shall be replaced and reconnected. Hangers, brackets, and other metallic surfaces which are unaccessible after installation shall be painted, except for final coat, prior to installation. Specific surface preparation requirements are included in paint systems.

B. Metallic Surfaces

Preparation of metallic surfaces shall be conducted in accordance with applicable portions of surface preparation specifications of the Steel Structures Painting Council (SSPC) or as noted.

Minimum surface preparation for new ferrous metal substrates to be painted shall be as follows:

- | | |
|---|-------------------------------|
| 1. Immersion Service | SSPC-SP 10 (Near White Blast) |
| 2. Buried or constant contact with earth | SSPC-SP 10 (Near White Blast) |
| 3. Chemical Storage Area | SSPC-SP 10 (Near White Blast) |
| 4. Exposure to splash and spillage of water, wastewater, or chemicals | SSPC-SP 10 (Near White Blast) |
| 5. Atmospheric Service or interior areas with no chemical exposure | SSPC-SP 6 (Commercial Blast) |
| 6. Substrates operating at elevated temperatures above 250°F | SSPC-SP 10 (Near White Blast) |

Blast profiles shall meet manufacturers' requirements as listed on Product Data Sheet.

C. Preparation of Wood Surfaces

Wood surfaces to be painted shall be clean of dirt, oil, or other foreign substances with mineral spirits, scrapers, sandpaper, or wire brush. Finished surfaces exposed to view shall, if necessary, be made smooth by planing or sandpapering. Millwork shall be sandpapered where necessary, and given a coat of the specified exterior primer on all concealed sides before installation. Small, dry seasoned knots shall be surface scraped, sandpapered, and thoroughly cleaned, and shall be given a thin coat of an acceptable knot sealer before application of the priming coat. All beads or streaks of pitch shall be scraped off, or if the pitch is still soft, it shall be removed with mineral spirits or turpentine and the resinous area shall be thinly coated with knot sealer. After priming, all holes and imperfections shall be filled with putty or plastic wood colored to match the finish coat, allowed to dry, and sandpapered smooth. Painting of exterior wood surfaces shall proceed insofar as practicable only after masonry work has dried.

D. Preparation of Concrete and Masonry Surfaces

All concrete surfaces which require coating shall be prepared for painting per coating manufacturers' requirements, with minimum requirement of concrete shall be dry and shall be prepared by light abrasive blasting per ASTM D4259, except for concrete block substrates. Abrasive blasting shall remove all dirt, dust, efflorescence, oil, and grease stains and other foreign substances and shall provide adequate surface profile for good

adhesion between the concrete and coating or paint. New concrete surfaces which are to receive oil or varnish base coatings shall be allowed to age for at least 60-days except as otherwise specified or directed and, in addition, shall be brush treated with a solution consisting of 2% zinc chloride and 3% phosphoric acid in water, permitted to dry, and the residue removed by light brushing.

Concrete block surfaces shall have all loose mortar and foreign material removed. Fin form marks, all protrusions, or rough edges are to be ground or stoned to provide a continuous surface. No coatings shall be applied unless substrate is clean and dry, and concrete and mortar has cured a minimum of 30-days at 75°F and substrate temperature meets requirement of coating manufacturer.

E. Preparation of Plaster Surfaces

Unless specifically authorized otherwise, paint shall not be applied to plaster surfaces less than 30-days old or containing more than 14% moisture. Before painting, such surfaces shall be dry, clean and free from grit, loose plaster, and surface irregularities. Cracks and holes shall be repaired with acceptable patching materials, properly keyed to existing surfaces, and sandpapered smooth. Surfaces to be coated with oil or varnish base paints shall be tested for the presence of alkali. If present, the alkali shall be neutralized as called for under the preparation of concrete surfaces. Moisture will be tested with a Delmhorst Instrument Company moisture detector.

F. Preparation of Galvanized Surfaces

Generally, galvanized surfaces will not require painting. Galvanized surfaces specified or directed to be painted shall be solvent cleaned in accordance with SSPC-SP-1 and treated with one coat of Oakite 747, Henkel Galvprep, or equal pretreatment.

G. Preparation of Other Surfaces:

Generally, other surfaces such as stainless steel, copper, aluminum, brass, PVC, and other plastics will not require painting. Where surfaces are specified or directed to be painted, they shall be solvent cleaned in accordance with SSPC-SP-1 and treated with one coat of passivator.

3.03 APPLICATION

- A. Painting shall be accomplished by skilled painters in a workmanlike manner. The painting Contractor shall be wholly responsible for the quality of his work and shall not begin any work until the surfaces have been properly prepared. Do not paint any surface which has been damaged, or is in questionable condition, that normal finishing procedures will not conceal. Painter to inspect all surfaces and report any defects to be corrected to the Contractor prior to painting.

Work shall be accomplished under conditions which are suitable for the production of good results. Interior painting shall not begin until all masonry and plaster surfaces are thoroughly cured and dry. Temperatures of spaces in building to be painted shall be maintained above 50°F, and such spaces shall be kept dry. Exterior painting shall

not be done unless temperature, both ambient and substrate, are at least 5°F above dew point, nor in rainy, damp cold, or dusty weather, or until surface is thoroughly dry.

Industrial paint systems shall be applied in strict observation of manufacturer's recommendations for temperature, humidity, curing time, mixing proportions, and surface preparations. All coats shall be applied using procedures and techniques that will assure adhesion to the bare surface and top intermediate coatings. Final finish coat shall be of a color selected by the Engineer or Owner.

3.04 RESPONSIBILITY

- A. The general intent of this specification is to provide direction for placement of protective painting on surfaces which may be corroded or damaged by the weather and to provide a finished project pleasing to the eye.
- B. It shall be the Contractor's responsibility to repair any painting systems which fail either due to the failure of the field applied painting done by the Contractor or his subcontractors, or due to the failure of any shop performed sandblasting and shop applied prime coats.

3.05 TOUCH UP PAINT, PROTECTION AND CLEAN UP

- A. Provide 1-gallon of each color and type of primer and finish paint used for touch-up purposes. Place for storage in area designated by the Engineer. Provide touch up paint at conclusion of project and provide with a minimum of 6-months shelf life.
- B. Protect work against damage by painting and finishing work as required. Leave all work undamaged. Clean, repair or replace, and repaint any damaged areas as directed by Engineer.
- C. Remove any surplus materials, scaffolding and debris and leave area clean.

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SECTION 11000

GENERAL REQUIREMENTS

PART 1. GENERAL

1.01 SCOPE

- A. This section applies to all equipment furnished under Division 11 - EQUIPMENT. These requirements shall supplement every Division 11 Specification except that, in the case of conflicting requirements, the individual equipment specification section shall govern.

1.02 MANUFACTURER'S EXPERIENCE

- A. Unless specifically named in the detailed specifications, a manufacturer shall have furnished equipment of the type and size specified which has been in successful operation for not less than the past 5 years.

1.03 ADAPTATION OF EQUIPMENT

- A. Equipment shall be readily adaptable for installation and operation in the structures as shown on the plans. No responsibility for alteration of a planned structure to accommodate other types of equipment will be assumed by the Owner. Equipment which requires alteration of the structures will be considered only if the Contractor assumes all responsibility for making and coordinating all necessary alterations. All such alterations shall be made at the Contractor's expense and only if approved in writing by the Engineer.

1.04 PATENTED DEVICES

If the manufacturer is required or desires to use any design, device, material, or process covered by letter, patent, or copyright, the manufacturer shall provide for such use by suitable legal agreement with the patentee or owner and the prices bid hereunder shall, without exception, indemnify and save the Owner from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright used in connection with any equipment to be furnished hereunder.

1.05 GUARANTEE

- A. The Contractor shall secure a guarantee from the manufacturer to the Owner for all equipment against (1) faulty or inadequate design, (2) improper assembly, (3) defective workmanship or materials, and (4) leakage, breakage, or premature failure. The guarantee period shall be for a period of one year from the date of start-up and final acceptance by the Engineer as defined in the General Conditions. Manufacturer's stated warranty shall be submitted with the shop drawings for record.

1.06 WORKMANSHIP & MATERIALS

- A. All equipment shall be designed, fabricated, and assembled in accordance with the best modern engineering and shop practice. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests. All parts subject to wear and replacement shall be readily available standard products.

1.07 OPERATION AND MAINTENANCE MANUALS

- A. Provide a minimum of six (6) sets of Operation and Maintenance Manuals for all equipment supplied, including applicable items which may be specified in other sections of these Specifications. The information required in the manuals shall include, as a minimum the following:
 1. Equipment function, normal operating characteristics, and limiting conditions.
 2. Assembly, installation, alignment, adjustment, and checking instructions.
 3. Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.
 4. Lubrication and maintenance instructions.
 5. Guide to "troubleshooting".
 6. Parts lists and list of parts subject to wear.
 7. Outline, cross-section, and assembly drawings; engineering data; and electrical requirements, including motor performance and wiring and instrumentation schematics.
 8. Test data and performance curves and guarantees of performance, where required.
 9. Weights of the equipment, including the heaviest piece to be handled during construction.
 10. Nearest location of factory maintenance and service facilities that will be available to service the equipment provided.

Reduce drawings or diagrams bound in manuals to a 8½ x 11 in. or 11 x 17 in. size. Where reduction is not practicable, fold larger drawings separately and place in envelopes which are bound into manuals. Identify on outside of each envelope.

1.08 NUMBER IDENTIFICATION PLATES

Identify each unit of equipment with a number plate. Numerals not less than 2" high, baked enamel on anodized aluminum plate, and have a number corresponding to designation code shown on the plans. Locate number plates and attach to equipment as directed by Engineer.

1.09 CONSUMABLE ITEMS

Purchase all necessary consumable items and charge systems as recommended by manufacturers. Provide operating treatment as well as initial treatment, and turn equipment over to Owner with adequately charged systems. Prepare a list showing brand names, types, and company names and addresses of local suppliers of all consumable items. Consumable items shall consist of, but not be limited to: filters, recorder paper, process chemicals, lubricants, belts for drive assemblies, soap, toilet paper and paper towels.

PART 2. PRODUCTS

2.01 LUBRICATION

- A. Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during start-up or shut-down and shall not waste lubricants.
- B. Lubricants of the type recommended by the equipment manufacturer shall be provided by the Contractor in sufficient quantity for all consumption prior to completion of required testing and acceptance of equipment by the Owner. Additionally, a one year supply of all required lubricants shall be provided to the Owner by the Contractor. The Contractor shall provide for the initial fill and lubrication of all equipment prior to start-up and as recommended by the suppliers during storage.
- C. All drives and gear reducers shall be fitted with weatherproof vent plugs, oil fill, and oil drain fittings, and oil level indicators as appropriate. Vent plugs and fittings shall be stainless steel, or other approved corrosion resistant material.
- D. Grease lubricated bearings: For all grease lubricated bearings provide grease lines and fittings routed to a safe and accessible location for ease of operator maintenance. Grease lines shall be rigidly mounted and neatly routed, and shall be copper or stainless steel. Plastic grease piping will not be allowed.

2.02 ELECTRIC MOTORS

- A. Motors shall be designed and applied in compliance with NEMA, ANSI, IEEE, and AFBMA standards and the NEC for the specific duty imposed by the driven equipment.
- B. Where frequent starting occurs, design motors for frequent starting duty equivalent to duty service required by the equipment.
- C. Motors shall have NEMA class B or F insulation system with temperature rise limited to 40°C ambient. Insulation system shall be premium-grade non-hygroscopic epoxy type.
- D. Motors shall be sized such that any point on the equipment load curve does not exceed 85% of a 1.0 service factor motor nor 100% (1.0 service factor level) of a 1.15 service factor motor.
- E. Motors shall be designed for full voltage or reduced voltage starting as required.

- F. Motor bearings shall be regreasable with a design life which meets or exceeds AFMBA B-10 for a life of 100,000 hours.
- G. Motors shall be manufacturer's "severe duty" or "chemical duty" type for corrosive environments.
- H. All motors over 1 Hp shall be protected against reduced or loss of power to one or more phases.
- I. Where practical, fractional horsepower motors shall be C-flange mounted to gear reducers and drives.
- J. Coordinate with all requirements of Division 16050 – ELECTRICAL BASIC MATERIALS AND METHODS. Especially refer to 16050 – 2.07-A.(17) for motoring testing requirements.

2.03 DRIVE UNITS

- A. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nominal output horsepower of the drive motor.
- B. Drive units shall be designed for 24 hours continuous service and shall be constructed so that oil leakage around shafts is precluded.
- C. Gearmotors shall be rated AGMA Class II and shall bear an AGMA nameplate.
- D. Each gear reducer shall be totally enclosed, oil lubricated, with antifriction bearings throughout. Worm gear reducers shall have a service factor of at least 1.75. Shaft mounted gear reducers shall be rated AGMA Class II. Other helical, spiral bevel, and combination bevel-helical gear reducers shall have a service factor of at least 1.50.
- E. Each V-belt drive shall include a sliding base or other suitable tension adjustment. V-belt drives shall have a service factor of at least 2.0 at maximum speeds. Contractor shall supply an extra set of matched V-belts for each size of equipment requiring V-belt drive.

2.04 SAFETY GUARDS

- A. All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard meeting OSHA requirements. Safety guards shall be fabricated from 16 USS gauge or heavier aluminum or stainless sheet steel. Each guard shall be designed for safe and easy installation and removal and shall be neat in appearance. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be stainless steel. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water. Guards shall be sized for adequate clearance to allow tension adjustments and prevent chains or belts from contacting the safety guard.

2.05 ANCHOR BOLTS

- A. Equipment suppliers shall determine the size and number of anchor bolts for each respective item of equipment.
- B. Cast-in-place anchors, including machinery anchors, shall be Type 304 stainless steel, minimum $\frac{3}{4}$ " diameter, with suitable thread projection unless specified

otherwise. Threads shall be cleaned, retapped, and oiled as needed, prior to settling equipment.

- C. Expansion anchors for mounting process equipment shall be minimum $\frac{3}{8}$ " diameter and shall be equal to MOLLY "Parabolt" Grade 5 stainless steel, with 304 stainless steel clip.
- D. Anchor bolts for stainless steel items shall be Type 316 stainless steel.

2.06 BASE PLATES

- A. A welded steel baseplate or frame, shall be provided for each pump, compressor, and other item of equipment which is to be installed on a concrete base. Each baseplate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units. Baseplates shall be anchored to the concrete with suitable anchor bolts and grouted in place. All base plates mounted directly to the concrete shall be hot-dip-galvanized after fabrication.
- B. Machinery style anchors shall be used as needed to assist in aligning anchor bolts to baseplates. No torching of equipment bases will be allowed to fit anchors without approval by the Engineer.

2.07 SPECIAL TOOLS & ACCESSORIES

- A. Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling such as slings, eye bolts, etc., shall be furnished complete with those devices.

PART 3. EXECUTION

3.01 PROTECTION

- A. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times.
- B. Equipment shall be furnished with suitable tags and mark numbers coordinated with the supplier's certified shop drawings to assist the Contractor in correct installation and assembly.
- C. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to installation and acceptance shall be repainted to the satisfaction of the Engineer.
- D. Electrical equipment, controls, and insulation shall be protected against moisture or water damage. All space heaters provided in the equipment shall be connected and operating at all times until equipment is placed in operation.
- E. All equipment shall be stored as recommended by the manufacturer. All equipment or fabricated steel materials damaged or bent during shipping, storage, handling and erection, shall be repaired or replaced to the satisfaction of the Engineer.

3.02 FIELD MODIFICATIONS

- A. No field modifications, cutting, torching, rewelding, etc. will be allowed unless the reasons, methods, and procedures are approved by the Engineer in writing.
- B. Unauthorized field modifications of fabricated equipment may be grounds for rejection.

3.03 MANUFACTURER'S REPRESENTATIVE

- A. An experienced, competent, and authorized, representative of the manufacturer, or supplier, of each item of equipment listed in Division 11 shall visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation unless otherwise approved by the Engineer. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the job site as often as necessary until any and all problems are corrected and the equipment installation and operation is satisfactory to the Engineer.
- B. Prior to final acceptance by the Engineer, each equipment supplier's representative shall furnish to the Owner, through the Engineer, a written report certifying that: (1) the equipment has been properly installed and lubricated; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping or anchor bolts; (4) has been operated under full load conditions and that it operated satisfactorily; and (5) is ready for full time beneficial use by the Owner.
- C. All costs for services under this section shall be included in bid prices for the equipment supplied.

END OF SECTION

SECTION 11226

BRIDGE SUPPORTED PERIPHERAL FEED CLARIFIER

PART 1. GENERAL

1.01 SUMMARY

- A. Section provides for installation of two (2) Type FPS-S, bridge supported, spiral blade type sludge collector(s).
- B. Each unit shall be a peripheral feed and center overflow type collector as manufactured by AMWELL, North Aurora, IL, or pre-approved equal.
- C. The collector mechanism shall be a complete assembly including: worm gear drive, overload protection systems, access bridge, inlet baffle skirt, hangers and trough, drive shaft assembly, sludge collector arms with spiral blade, pivoting scum breaker, tilting scum trough, center takeoff effluent trough with weirs, and necessary anchorage.
- D. No underwater bearings to carry any part of the vertical thrust load will be permitted.
- E. All gearing shall be completely enclosed and oil bath lubricated.
- F. Collector shall be designed for installation in a concrete tank with a 28'-0" diameter, a 11'-6" total wall depth, and a 1":12" floor slope.
- G. Unless specifically noted otherwise, all structural steel shall conform to ASTM Specification A36 and all underwater structural steel shall have a minimum 1/4" thickness.
- H. All cast iron shall conform to ASTM Specification A48.

1.02 RELATED SECTIONS

- A. Section 01330 – Submittal Requirements.
- B. Section 03210 – Reinforcing Steel.
- C. Section 03300 – Cast-in-Place Concrete.
- D. Division 16 – Electrical.

PART 2. PRODUCTS

2.01 MANUFACTURERS

- A. AMWELL, North Aurora, Illinois.
- B. Or pre-approved equal.

2.02 MANUFACTURED UNITS

- A. Fabricated Steel Work:
 - 1. Center Drive Shaft:
 - a. The steel center drive shaft shall be fabricated from minimum 1/4" wall pipe construction or solid shafting designed to support the

weight of the suspended structure and to withstand the cutout torque of the drive.

2. Access Bridge:

- a. The collector mechanism shall be provided with a structural steel beam type access bridge, which shall extend across the tank diameter with each end supported on the peripheral tank wall.
- b. The bridge walkway shall not be less than 36" wide extending from the tank edge to the center drive mechanism.
- c. The bridge walkway shall be aluminum I-bar grating 1¼" thick minimum with 1½" O.D. x 42" high double pipe aluminum handrail along each side and around one end.
- d. A 4" high kick plate fabricated from aluminum plate shall be furnished around the walkway.
- e. An expanded platform shall be provided around the worm gear drive.
- f. The structural steel members of the bridge shall be capable of supporting a 50 lbs/ft² live load with a deflection not to exceed 1/360 of the span.

3. Influent Trough:

- a. A fabricated curved inlet trough shall direct the influent flow in a spiral motion along the peripheral tank wall.
- b. Trough shall be mounted to the tank wall with anchor bolts.
- c. The baffle skirt shall be fabricated with a minimum of ⅛" FRP.
- d. The bottom of the skirt shall be no more than 24" above the tank floor and shall not interfere with the rotation of the sludge scraper mechanism.
- e. Baffle skirt support brackets, anchor bolts and hangers shall be supplied for suspending the skirt from the inside of the tank wall.
- f. Supports shall be installed above the maximum water surface elevation in the tank as shown on the Drawings.

4. Collector Mechanism:

- a. The collector mechanism shall be furnished with two (2) fabricated structural steel arms conforming to the slope of the tank floor.
- b. The arms shall be rigidly connected to the collector mechanism torque tube.
- c. Each arm shall be furnished with spiral steel flights complete with adjustable spring brass squeegee blades.
- d. The blades shall scrape the settled sludge along the tank bottom to the sludge draw-off hopper at the center of the tank.
- e. Truss rods as required shall be made from 304 SS construction.

B. Skimmer and Scum Trough:

1. The scum removal assembly shall include, but is not limited to, a rotating scum breaker and scum pipe.
2. The scum breaker shall continuously move surface scum around the tank periphery and into the scum pipe for removal.
3. Scum breaker shall consist of a support stand, pivoting arm and counterweight, and be fitted with a squeegee of sufficient length to remove all scum trapped between the baffle skirt and the peripheral tank wall.
4. A backer plate shall be provided to support the squeegee.
5. Scum breaker shall be supported by one of the scraper rake arms.
6. Scum breaker shall be fitted with a pivot joint between the support stand and pivoting arm to allow the squeegee to pass under the influent trough, scum pipe, and effluent pipe as it rotates around the tank.
7. The counterweight shall return the skimmer blade to the surface once past the obstacle.
8. The support stand shall be fitted with a stop pad to prevent damage from the counterweight.
9. A slotted, tilting scum pipe shall be fixed to the scum pipe wall casting for removal of floating materials.
10. A handle shall be provided for changing the tilt of the scum pipe and shall be so designed to allow rotational tilting to the left and right of center.

C. Effluent Weir:

1. An effluent weir trough shall be centrally located within the tank and shall be rigidly supported by means of outriggers and adjustable rods from the access bridge.
2. Each joint in the weir trough shall be provided with leak-tight gaskets.
3. V-notch dimensions shall be as shown on the Drawings.
4. An ANSI 150# flanged connection shall be provided on the bottom of the effluent weir trough for connection to the effluent pipe.

D. Drive Unit

1. The collector drive assembly shall consist of a gear motor, drive and driven sprockets with drive chain, intermediate worm gear speed reducer, output shaft with rigid coupling, combination cast iron drive support and bearing housing, overload alarm, and cut-off actuating system.
2. The drive shall have a continuous output torque rating 1,600 ft-lbs, an alarm torque setting of 1,600 ft-lbs, and a cut-out torque rating of 1,900 ft-lbs with an additional shear pin overload shear rating of 2,400 ft-lbs.
3. The gear motor shall be of the totally enclosed horizontal type, mounted on top of the worm gear housing.

4. The totally enclosed motor shall operate on 3-phase, 60 hertz, 480 volt power and shall be at least 1/2-HP and be designed for outdoor service.
5. The worm gear reduction unit shall consist of a worm gear with a minimum pitch diameter of 9.59" and a face width of 1 3/4" driven by an integral worm and shaft supported by anti-friction, grease lubricated ball bearings.
6. The worm and shaft shall be fabricated from heat treated alloy steel.
7. The worm gear shall be centrifugally cast bronze.
8. The horizontal gear motor shall drive the worm shaft through steel, self-lubricated roller chain with steel sprockets, all enclosed in a steel guard.
9. The drive output shaft shall be fabricated of alloy steel and provided with a rigid steel or cast iron coupling for connecting to the collector mechanism shaft.
10. The center drive mechanism, as well as other parts of the machine, shall be designed to withstand a momentary peak torque equal to twice the continuous output torque rating of the drive unit.
11. The center mechanism and drive unit shall be capable of sustaining operation at the continuous torque rating without excessive wear and to develop the peak torque rating without damage to, or failure of, the drive components.
12. The drive shall be designed in conformance to ANSI/AGMA 6034-B92.
13. The drive shall be provided with an indicating overload device actuated by thrust from the worm shaft, which shall operate two (2) weatherproof limit switches.
14. One switch shall have an electrically isolated N.O. contact, which shall operate a remote alarm when the load on the mechanism reaches a preset level.
15. The other switch, which shall have an electrically isolated N.C. contact, shall open the motor circuit when a preset overload occurs.
16. The overload switches shall be enclosed in weatherproof housings.
17. A shear pin coupling shall also be provided for additional protection.

E. Electrical Work

1. Clarifier manufacturer shall furnish a NEMA 4 control panel for outdoor service.
2. Panel shall include a door handle disconnect switch, which turns the mechanism off upon opening, a non-reversing motor starter with overload relay, control transformer, fuses, relays, on-off selector switch, overload reset and alarm horn silence pushbuttons, and terminal block.
3. Panel shall be located inside the control room building as indicated on the drawings.
4. Contractor shall provide approved disconnect switches near each of the clarifiers to meet all local, state, and federal codes.

F. Painting

1. All fabricated steel work shall receive surface preparation per Specification SSPC-SP10 and given one (1) shop coat, 2.0 mils DFT of Sherwin-Williams Dura-Plate Epoxy primer.
2. All items shop assembled such as motors and reducers shall be given one (1) shop coat of the Manufacturer's standard paint.
3. The Contractor shall furnish and apply all touch-up prime and finish coats of paint.
4. The Contractor shall be responsible for the compatibility of the primer with the finish paint.

G. Anchorage and Assembly Fasteners

1. The equipment manufacturer shall furnish all 304 stainless steel anchor bolts, nuts, washers, and templates for the equipment.
2. The Contractor shall place the anchorage in accordance with certified prints supplied by the equipment manufacturer.

PART 3. EXECUTION

3.01 INSTALLATION

- A. Equipment of this Section shall be installed according to manufacturer's instructions and in accordance with the Plans.
- B. The Contractor shall construct the concrete tank as shown on the Plans and specified in Sections 03210 and 03300 of these technical specifications.
- C. Once the equipment is capable of being operated, the Manufacturer's representative shall be present for a period of one (1) day to check the equipment for correct installation.

3.02 ELECTRICAL WORK

- A. The Contractor shall furnish and install all required field wiring including correct size wire, conduit, fittings, and supports as shown on the Plans and specified in Division 16 of these technical specifications.
- B. All electrical devices furnished by the equipment manufacturer shall be installed and wired by the Contractor.

END OF SECTION

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SECTION 11303

AERATION AND MIXING SYSTEM

PART 1. GENERAL

1.01 SUMMARY

A. Scope of Work

1. The Contractor shall be responsible for providing and installing a complete wastewater treatment system as indicated on the Drawings. This system shall include aerators, mounting supports, and hardware.
2. The equipment Manufacturer shall include, but not be limited to, the following equipment:
 - a. Aeration and mixing system.
 - b. All mounting supports and hardware to mount the equipment.

B. Equipment Design Criteria

1. The equipment must deliver the following oxygen in clean water per a third party, certified test, performed on the specified equipment in the last 5-years.
 - a. Triton 2.0, 10-Hp: 32.4 lbs O₂/hr

C. Related Work Specified Elsewhere

1. Manufacturer shall provide an installation list of a minimum of 10 installations of a similar design.

1.02 QUALITY ASSURANCE

- A. The treatment process shall be provided by Aeration Industries International. All equipment shall be new and design specifically for this installation.
- B. Equipment manufacturers not listed above shall submit, four (4) weeks prior to the bid opening, the following information to the Engineer:
 1. Materials of construction for the aeration equipment to be provided.
 2. Complete installation list showing at least ten (10) installations operating at least five (5) years under the conditions specified above.
 3. Controls description showing how the system will react to changes in flow and load.
 4. Design calculations showing process performance, including all design factors.
 5. Complete list of exceptions to be taken.

6. All required spare parts, special equipment, and electrical components required to meet the specifications.
- C. The Contractor shall be responsible for all costs associated with electrical and structural changes if the clean water efficiency requirements below cannot be met.
 - D. Standards
 1. All materials and equipment listed in this section shall be the standard equipment provided by the equipment Manufacturer.
 2. The equipment Manufacturer must submit a clean water oxygen transfer test in accordance to the American Society of Civil Engineers "Measurement of Oxygen Transfer in Clean Water", that is stamped by a third party, and was completed on the specified equipment size in the last five (5) years with the bid submission. Theoretical calculations are not acceptable. If a clean water oxygen transfer test stamped by an independent third party is not submitted at the time of the bid, the equipment supplier shall meet the oxygen output specified above in the equipment design criteria or will need to use an efficiency of 1.4 lbs/hr-Hp SAE to ensure adequate oxygen is supplied.
 3. If third party testing shows oxygen output is not met, (or 1.4 lbs/hr-Hp SAE is used) Bidder is required to include costs for any redesign and/or modifications, including but not limited to, mechanical, structural, electrical, instrumentation and controls, power feed, generator capacity, etc., and incorporate additional costs to the aforementioned in the Base Bid Price and Equipment Schedule.
 4. The equipment Manufacturer shall maintain an inventory of spare parts for the equipment provided and shall be able to ship expendable parts to the job site within two (2) man-days of receiving notice to ship.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. The unloading of the system components shall be the responsibility of the Contractor.
- B. Equipment shall be kept in its original containers or provided with equivalent protection and stored in a warehouse free from extreme temperatures, humidity, and corrosive atmospheres.

1.04 GUARANTEE

- A. The equipment manufacturer shall warrant the aeration and mixing equipment against defects in manufacturing and materials for a period not less than three (3) years from date of delivery.

PART 2. PRODUCTS

2.01 MANUFACTURER

- A. The equipment shall be manufactured by Aeration Industries International, 4100 Peavey Road, Chaska, MN 55318 (Phone: 952-448-6789; www.aireo2.com).

2.02 AERATION SYSTEM COMPONENTS

A. General

1. The aeration and mixing equipment shall be comprised of AIRE-O2 Triton 2.0 aerator/mixers to provide aeration and mixing below the water surface while at the same time imparting a horizontal velocity to the liquid in the aerated basin to facilitate movement of the wastewater. Units that self-aspirate or create aerosols are not acceptable.
2. Size and location of the aerator/mixers shall be properly selected to provide the proper amount of oxygen and mixing as required by the Manufacturer for the application.

B. Aerator Drive Motor

1. The motors shall deliver 10-Hp at 900 RPM nominal and shall be rated for 230/460 volts, 60 cycles, and 3-phase service. Motors shall be specifically designed for operating at an angle.
2. Motor enclosure configuration shall be totally enclosed, fan cooled.
3. The motor shall, in all cases, equal or exceed current NEMA specifications.
4. The motor windings shall be non-hygroscopic.
5. Insulation shall equal or exceed NEMA Class F with Class B temperature rise.
6. A service factor of 1.15 shall be furnished.
7. A condensate drain shall be located at the lowest point in the lower end-bell housing.
8. A stainless steel nameplate shall be provided with each motor and shall be securely fastened thereto. Information shall include voltage, speed, phase, insulation class, amperage, service factor, wiring diagram, and motor serial number.
9. The motor shaft shall be balanced to within 1-mil to be measured on any part of the motor frame including the C-face.
10. The motor terminal box shall be firmly bolted to the motor frame at four points. The terminal box shall be sized to meet the NEMA standards.
11. The terminal box shall be drilled and tapped to receive one compression watertight fitting to accommodate the appropriate electrical service cables.
12. Complete internal rotating assembly and stator winding shall be epoxy coated to maximize corrosion protection of electrical components.
13. The motor must be supplied with premium insulation for extended life in harsh environments.
14. The motor must use thrust bearings. Conrad-type bearings are not acceptable.

C. Blower

1. The equipment shall include a high efficiency regenerative blower sized to provide sufficient airflow to yield the rated oxygen transfer capacity. Each blower includes the following features:
 - a. Maintenance free.
 - b. Aluminum alloy construction.
 - c. Inlet and outlet sound attenuating silencers to minimize noise.
 - d. Inlet filters with epoxy-coated wire mesh media rated for 70-microns or better.
 - e. CE compliant – Declaration of Conformity on file.
 - f. The blowers shall be tropicalized for corrosion resistance and deliver 2-Hp maximum rated for 230/460 volts, 60 cycles, and 3-phase service.
 - g. Blower motors shall be wired separately.

D. Mounting Flange

1. The mounting flange shall be stainless steel and shall permit removal of the mixer mechanism leaving the motor in place. The mounting flange will allow the mixer/aerator to be rotated out of the water for inspection, maintenance, or storage.

E. Shaft/Universal Joint Coupling

1. The shaft shall be stainless steel full-welded to a carbon steel universal joint coupling. The shaft must be hollow to promote maximum airflow and oxygen transfer. Units with solid shafts are not acceptable. The shaft shall be dynamically balanced.
2. The universal joint coupling shall include standard grease fitting for maintenance lubrication. Units that utilize flexible couplings to attach to the shaft of the motor are not acceptable.
3. The shaft shall be stabilized by replaceable water lubricated bearing located within one (1") inch from the propeller hub. The area of the shaft supported by the bearing shall be fitted with a replaceable hardened non-metallic sleeve.
4. Units supplied with couplings that require alignment are not acceptable.
5. Any shafts requiring factory replacement to validate warranty requirements are not acceptable.

F. Housing

1. The housing shall be stainless steel and flanged for mounting to the aerator. The housing shall form a guard around the hollow shaft and support a field replaceable, water-lubricated bearing press-fitted into the housing lower end. Water lubrication holes shall penetrate the housing in the area surrounding the bearing.

G. Bearing

1. The aerator shall be supplied with a field replaceable water lubricated lower support bearing. The bearing shall be constructed of an appropriate material for the application inside a fiber backing. The bearing shall be press-fitted into the housing to allow ease of replacement.
2. Units utilizing a cantilever design without a lower support bearing or regreaseable tapered roller bearings are not acceptable.
3. Bearings requiring factory replacement to validate warranty requirements are not acceptable. If the bearing is not field replaceable, one (1) spare replacement set is required for every unit supplied.

H. Sleeve

1. The replaceable sleeve shall be the only moving part in contact with the bearing and shall spin with the shaft as one unit. The sleeve shall be solid and homogeneous. Units supplied without sleeves are not acceptable.

I. Propellers

1. The stainless steel mixing propeller shall be specifically designed to maximize oxygen transfer and mixing characteristics. The entire flow of air shall pass through the propeller shaft via the hollow drive shaft along the axis of the propeller hub. Aluminum and standard marine type propellers are not acceptable.
2. The propeller design shall be tested in clean water and shown to draw a minimum of 85% of the recommended full motor amperage load at nameplate voltage and power factor.
3. The propeller shall be designed to allow easy removal and replacement in the field.

J. Saturn Ring Diffuser

1. The aerator shall be equipped with a stainless steel Saturn Ring diffuser, smaller than the mixing propeller, consisting of two (2) concentric rings of differing diameters fixed to the diffuser body. The rings shall be specially designed to maximize oxygen transfer and to prevent self-aspiration when the regenerative blower is turned off to accomplish anoxic mixing.
2. The entire flow of forced air shall exit through the Saturn Ring diffuser opening.

K. Vortex Shield

1. A vortex shield shall be furnished with each mounting assembly to eliminate the formation of vortices. Units without vortex shields are not acceptable.

L. Flotation Assembly

1. The aerator flotation assemblies shall be constructed of molded low-density polyethylene with ultraviolet inhibitor. The pontoon shape shall be designed with smooth, beveled edges to allow freezing into ice without breakage. The pontoons shall be connected by stainless steel structural members to prevent corrosion. To allow for servicing by not removing the aerator from the flotation, the flotation assembly shall be designed so the aerator may be pivoted completely out of the water. Structural aluminum is not acceptable. Welded stainless steel floats will not be acceptable.

M. Mounting Structure

1. Aerators shall be mounted to the bridge platform or other structure as to be surface mounted, visible in operation, and completely accessible by the operator.
2. The bridge mount assemblies shall be constructed of stainless steel structural members to prevent corrosion. Structural aluminum or galvanized steel are not acceptable.
3. The bridge mount assemblies shall be able to operate the aerator at multiple angles in both the horizontal and vertical directions. The angle of operation shall be fully adjustable by the operator. The aeration equipment shall be able to slide up the assembly for maintenance. A static or fixed mount is not acceptable.
4. The operating depth of the aerator shall be fully adjustable from the bridge platform through adjustment of the mount.
5. The retractable mount shall allow the operator to remove the equipment from operation in the basin without the use of a maintenance platform or leaning over the basin to protect the operator's safety.

N. Electrical Service Cable

1. Cable shall be CSA/UL approved for severe environments, suitable for underwater service, and one continuous length.
2. The cable shall be jacketed, flexible stranded cable with individually wrapped conductors rated SEO-OW or equivalent.

2.03 ANCHOR BOLTS

- A. Anchor bolts shall be 304 stainless steel adhesive anchors supplied by the Contractor.

PART 3. EXECUTION

3.1 FIELD QUALITY CONTROL

- A. All inspections shall be performed by a factory-trained representative of the equipment Manufacturer.

- B. Contractor will notify Engineer and Manufacturer a minimum of two (2) weeks prior to inspection that the system is ready to be inspected.
- C. The wet inspection/start-up shall be for a period of not less than one (1) and not more than two (2) man-days on site, exclusive of travel time.
- D. Wet inspection/start-up shall also include operator training.
- E. The Contractor is to make all adjustments required by the Manufacturer.

END OF SECTION

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SECTION 11312

SUBMERSIBLE NON-CLOG SEWAGE PUMP STATION

PART 1. GENERAL

1.01 SUMMARY

- A. Contractor shall furnish all labor, materials, equipment and incidentals required to provide and install two (2) non-clog submersible centrifugal sewage pump(s) as specified herein.
- B. The contractor shall supply a control panel that contains all necessary components for proper starting and operation of the pump. This panel shall also provide a circuit that monitors the seal sensors in the pump.
- C. Pumps shall be equipped with stainless steel nameplates and shall be from a single manufacturer.

1.02 RELATED SECTIONS

- A. Section 01330 – Submittal Requirements.
- B. Section 02315 – Trench Excavation, Backfill, and Compacting.
- C. Section 03300 – Cast-in-Place Concrete.
- D. Division 16 – Electrical.

1.03 OPERATING CONDITIONS

- A. The operating condition for the lift station is as follows:
 - 1. Each pump shall be rated 20-Hp, 480-volts, 3-phase, 60 hertz, 1750-rpm. The unit shall produce 500-gpm at 77' TDH. The pump shall be capable of handling a 3" spherical solid. The pump shall be non-overloading throughout the entire range of operation without employing service factor. The pump shall reserve a minimum service factor of 1.15. The performance curve submitted for approval shall state in addition to head and capacity performance, the pump efficiency, solid handling capacity, and reflect motor service factor.

PART 2. PRODUCTS

2.01 PUMP

- A. The pump shall be a centrifugal, non-clog, solids handling, submersible, wastewater type. The pump volute, motor and seal housing shall be high quality gray cast iron, ASTM A-48, Class 30. The pump discharge shall be fitted with a 4" standard ASA 125-lb. flange, faced and drilled. All external-mating parts shall be machined and Buna N Rubber O-ring sealed on a beveled edge. Gaskets shall not be acceptable. All fasteners exposed to the pumped liquids shall be 300 series stainless steel.

2.02 ELECTRICAL POWER CORD

- A. Electrical power cord shall be STW-A, water resistant 600V, 60°C., UL and CSA approved and applied dependent on amp draw for size.
- B. The pump shall be triple protected with a compression fitting and an epoxy potted areas at the power cord entry to the pump. A separation between the junction box area of the pump and the motor by a stator lead sealing gland or terminal board shall not be acceptable.
- C. The power cable entry into the cord cap assembly shall first be made with a compression fitting. Each individual lead shall be stripped down to bare wire at staggered intervals, and each strand shall be individually separated. This area of the cord cap shall then be filled with an epoxy compound potting which will prevent water contamination to gain entry even in the event of wicking or capillary attraction.
- D. The power cord leads shall then be connected to the motor leads with extra heavy connectors having brass inserts with a screwed wire to wire connection, rather than a terminal board that allows for possible leaks.
- E. The connection box wiring shall be separated from the motor housing wiring by stripping each lead down to bare wire, at staggered intervals, and separating each strand. This area shall be filled with an epoxy compound potting. Fiberglass terminal boards which are subject to heat fatigue and cracking, and which may lead to possible leaks shall not be acceptable.
- F. The cord cap assembly where bolted to the connection box assembly and the connection box assembly where bolted to the motor housing shall each be sealed with a Buna N Rubber O-ring on a beveled edge to assure proper sealing.

2.03 MOTOR

- A. The stator, rotor and bearings shall be mounted in a sealed submersible type housing. The stator windings shall have Class F insulation, (155°C or 311°F), and a dielectric oil filled motor, NEMA B design. Further protection shall be provided by on winding thermal sensors. Because air-filled motors do not dissipate heat as efficiently as oil-filled motors, they shall not be acceptable.
- B. The pump and motor shall be specifically designed so that they may be operated partially or completely submerged in the liquid being pumped. The pump shall not require cooling water jackets. Dependence upon, or use of, water jackets for supplemental cooling shall not be acceptable.
- C. Stators shall be securely held in place with a removable end ring and threaded fasteners so they may be easily removed in the field without the use of heat or a press. Stators held by a heat shrink fit shall not be acceptable. Stators must be capable of being repaired or rewound by local motor service station. Units, which require service only by the factory, shall not be acceptable. No special tools shall be required for pump and motor disassembly.
- D. Pump shall be equipped with heat sensors. The heat sensor(s) (one on single phase, two on three phase) shall be a low resistance; bi-metal disc that is temperature sensitive. It shall be mounted directly on the stator windings and sized to open at 120°C and automatically reset at 30-35°C differential. The sensors shall be connected in series with motor starter coil so that the pump

cease operation when an over-temperature condition is sensed. The starter shall be equipped with 3-leg overload relay with heaters sized for the pump's full load amps. The pump shall cease operation when the overload is tripped. The overload shall be manually reset.

2.04 BEARINGS AND SHAFT

- A. An upper radial bearing and a lower thrust bearing shall be required. These shall be heavy-duty single row ball bearings that are permanently lubricated by the dielectric oil that fills the motor housing. Double row, sealed grease packed bearings shall not be acceptable. Bearings, which require lubrication according to a prescribed schedule, shall not be acceptable. The upper radial bearing shall have a minimum B-10 life at the specified condition of 40,000 hours and the lower thrust bearing shall have a minimum B-10 life at the specified condition of 40,000 hours. Bearings shall be locally available.
- B. The shaft shall be machined from a solid 400 series stainless steel forging and is a large diameter design with minimum overhang to reduce shaft deflection and prolong bearing life.

2.05 SEALS

- A. The pump shall have two mechanical seals, mounted in tandem, with an oil chamber between the seals. John Crane Type 21, BF1C1, seals shall be used with the rotating seal faces being carbon and the stationary seal faces to be ceramic. The lower seal shall be replaceable without disassembly of the seal chamber and without the use of special tools. Pump-out vanes shall be present on the backside of the impeller to keep contaminants out of the seal area. Units that require the use of foreign manufactured seals shall not be acceptable. Seals shall be locally available.
- B. The pump shall be equipped with a seal leak detection probe and warning system. This shall be designed to alert maintenance personnel of lower seal failure without having to take the unit out of service for inspection or requiring access for checking seal chamber oil level and consistency.
- C. There shall be an electric probe or seal failure sensor installed in the seal chamber between the two tandem mechanical seals. If the lower seal fails, contaminants which enter the seal chamber shall be detected by the sensor and send a signal to operate the specified warning device.
- D. Units equipped with opposed mechanical seals shall not be acceptable.

2.06 IMPELLER

- A. Impeller shall be of the single-vane, enclosed non-clogging design and have pump-out vanes on the front and backside of the impeller to prevent grit and other materials from collecting in the seal area. Impeller shall not require coating. Because most impeller coatings do not remain beyond the very early life of the impeller, efficiency and other performance data submitted shall be based on performance with an uncoated impeller. Attempts to improve efficiency by coating impeller shall not be acceptable.

- B. Impellers shall be dynamically balanced. The tolerance values shall be listed below according to the International Standard Organization grade 6.3 for rotors in rigid frames. The tolerance is to be split equally between the two balance planes that are the two impeller shrouds.

| RPM | Tolerance |
|------|----------------------------------|
| 1750 | .02"- oz./lb. of impeller weight |

- C. The impeller shall be slip fit to a tapered shaft and key driven. A300 series stainless steel washer and impeller bolt shall be used to fasten the impeller to the shaft. Straight end shafts and/or threaded shafts for attachment of the impeller shall not be acceptable.

2.07 CASING

- A. The casing shall be of the end suction volute type having sufficient strength and thickness to withstand all stress and strain from service at full operating pressure and load. The casing shall be of the centerline discharge type equipped with an automatic pipe coupling arrangement for ease of installation and piping alignment. The design shall be such that the pumps will be automatically connected to the discharge piping when lowered into position with the guide rails. The casing shall be accurately machined and bored for register fits with the suction and casing covers.
- B. A volute case wearing ring shall be provided to minimize impeller wear. The wear ring shall be alloy 230 brass, ASTM B584-836 and held by 300 series stainless steel fasteners. The wear ring shall be easily replaceable in the field. Wear rings of any other material shall not be acceptable.

2.08 PAINTING

- A. The pump shall be painted after assembly, and testing, with a dark green water reducible air dry enamel. The paint shall be applied in one coat covering all exterior surfaces. The pump shall be air dried after testing and before painting.

2.09 SERVICEABILITY

- A. The complete rotating assembly shall be capable of being removed from the volute without disturbing the suction piping, discharge piping, and volute. The motor housing, seal housing with seal plate and impeller still attached to the shaft shall be capable of being lifted out of the volute case from the top as one assembly.

2.10 LIFTOUT RAILING

- A. Pump to be installed and removed by simple upward force on stainless steel cable without requiring personnel to enter basin.
- B. Stainless steel guide rail.
- C. Two-piece brass sliding disconnect device with "O"-ring seal.

2.11 CONTROL PANEL

- A. NEMA 3R enclosure with hasp for lock. Locks shall be keyed alike and shall be interchangeable.
- B. Flashing red high level alarm light and siren, NEMA 4 rated.
- C. 230/460-volt, 3-phase.
- D. Provide for each pump:
 - 1. Circuit breaker.
 - 2. NEMA magnetic starter with quick trip ambient compensated overload.
 - 3. H-O-A switch.
 - 4. Yellow run light.
 - 5. Red seal fail light.
 - 6. Connection terminal strip.
- E. Alternator for alternation of pumps.
- F. Control circuit breaker.
 - 1. Alarm test push button.
 - 2. Alarm silence push button.
- G. Override circuit to start second pump if water level in basin continues to rise or first pump fails to start.
- H. Schematic Wiring Diagram: Paste to inside cover of box.
- I. Terminals: Clearly label with proper designation.
- J. Elapsed time meter.
- K. Lightning arrestor.
- L. Duplex 115-volt GFI receptacle.
- M. Panel shall be mounted independently off of the wet-well basin, with gas-tight seal between wet-well and panel. Pedestal mounted with cord grip seal connector panels shall not be allowed on this project.

2.12 LEVEL CONTROLS

- A. Mercury tube seated in polyurethane float and weighted to hold position in wet-well.
- B. Connecting Cord: SJO type.
- C. Attach mounting bracket to basin wall to support controls.
- D. Connect control cords to junction box with cord grip seal connectors, if junction box is used.
- E. Four switches required at each station:
 - 1. Lead on.
 - 2. Lag on.
 - 3. Both pumps off.
 - 4. High level alarm.

PART 3. EXECUTION

3.01 INSTALLATION

- A. Contractor to install equipment of this Section according to manufacturer's instructions and in accordance with the Contract Drawings.
- B. Contractor shall be responsible for providing electrical service to this pump station. Any and all costs associated with providing electrical service to this pump station shall be paid for by the Contractor at no additional cost to the Owner.

3.02 TESTING

- A. Commercial testing shall be required and include the following:
 - 1. The pump shall be visually inspected to confirm that it is built in accordance with the specification as to HP, voltage, phase and hertz.
 - 2. The stator motor leads shall be tested for integrity using a megoh meter at the highest setting.
 - 3. Pump shall be allowed to run dry to check for proper rotation.
 - 4. Discharge piping shall be attached; the pump submerged in water and amp readings shall be taken in each leg to check for an imbalanced stator winding. If there is a significant difference in readings, the stator windings shall be checked with a bridge to determine if an unbalanced resistance exists. If so, the stator shall be replaced.
 - 5. The pump shall be removed from the water, megoh meter tested again, dried and the motor housing filled with dielectric oil.
- B. Manufacturer's representative shall be present during testing and startup.

3.03 WARRANTY

- A. The pump station or any part thereof shall be warranted against defects in material or workmanship for a period of not less than one year from date of startup.

END OF SECTION

SECTION 11330

HEADWORKS SYSTEM

PART 1. GENERAL

1.01 SUMMARY

- A. The Contractor shall furnish, install and place into satisfactory operating condition a screening and grit removal head works system for removing floating, fibrous, and grit material as shown on the Drawings and described in these Specifications.
- B. Screening Equipment
 - 1. The screening equipment shall be one (1) shaftless spiral screen that consists of a shaftless spiral assembly, U-trough sieve zone, U-trough transport zone, wash zone, press zone, discharge zone, drive system, and controls.
 - 2. The system shall be designed to receive influent flow through a channel. The influent shall be directed into the sieve zone where fine solids pass through the sieve. Larger solids are collected and are conveyed by the shaftless spiral up the U-trough through the transport zone, washed in the wash zone, compacted in the press zone, and discharged at the discharge zone into a dumpster for collection and disposal.
- C. Grit Removal Equipment
 - 1. The grit removal equipment shall be all-hydraulic, self-activating, and shall not require instrumentation, internal moving parts, or external power.

1.02 RELATED SECTIONS

- A. Section 01330 – Submittal Requirements.

1.03 REFERENCES

- A. American Institute of Steel Construction (AISC).
- B. American Society of Testing and Materials (ASTM).
- C. American Society of Civil Engineers (ASCE).
- D. American Welding Society (AWS).
- E. Steel Structures Painting Council (SSPC).

1.04 SUBMITTALS

- A. The manufacturer shall submit a general arrangement drawing that illustrates the layout of the equipment, principal dimensions and other

related data including descriptive literature, electrical control drawings, catalog cut sheets for individual components and drive motor data.

1.05 DELIVERY AND STORAGE

A. Shipping

1. Ship equipment, material and spare parts complete. Partial disassembly may be required to comply with transportation regulations and/or for component protection.
2. Spare parts shall be packaged with labels bearing the description and quantity of the contents.

B. Receiving: Store and safeguard equipment, material, and spare parts in accordance with the manufacturer's recommendations.

PART 2. PRODUCTS

2.01 MANUFACTURER

- A. Shaftless Spiral Screen shall be the SPIRALMAN™ manufactured by Headworks® Inc., Houston, Texas.
- B. Grit Removal System shall be manufactured by Hydro International, Hillsboro, Oregon.

2.02 DESIGN, MATERIALS, AND CONSTRUCTION

A. Screening Unit

1. Shaftless Spiral Assembly

- a. The shaftless spiral assembly shall consist of a spiral with a stub end shaft, abrasive resistant brush assembly. Shafter spirals shall not be allowed.
- b. The shaftless spiral shall be manufactured from two (2) concentric flights formed from high strength carbon bar and welded together to form a single spiral. The outer thickness shall be $\frac{3}{4}$ " and the inner thickness shall be $\frac{5}{8}$ ".
- c. The diameter of the shaftless spiral assembly shall be 15.1" in diameter and shall be constant over the length of the assembly. Spiral assemblies that taper to a smaller diameter in the transport section shall not be allowed.
- d. For ease of maintenance and inspection, the shaftless sieve spiral assembly shall be removable by lifting the assembly directly out of the U-trough.

2. Sieve Zone

- a. The sieve zone design shall consist of U-trough sieve and a U-trough collection chamber. Designs using a tube in lieu of a U-trough shall not be allowed.
- b. The sieve zone shall be constructed of 14-gauge perforated Grade 316 stainless steel plate. The perforations shall be $\frac{1}{4}$ " or $\frac{1}{8}$ " diameter. Fasteners shall be Grade 316 stainless steel.
- c. The sides of the sieve zone shall be fitted with contour conforming rubber seals. The seals shall direct the influent into the sieve zone to prevent any short circuiting of the flow.
- d. The shaftless spiral assembly in the sieve zone shall have an abrasive resistant brush assembly. The brushes shall be Nylon 6.12. Stainless steel brush holders shall be used to attach the brush to the shaftless spiral. Each brush holder shall be attached with two (2) Grade 316 stainless steel hex bolts with nuts and lock washers.
- e. The spiral brush assembly shall be accomplished by two (2) workers in not more than two (2) hours. Designs that use a single piece spiral shall not be allowed.
- f. The unit shall be capable of pivoting out of the channel.

3. Transport Zone

- a. The transport zone design shall consist of a constant size U-trough with bolted removable covers. Designs using a tube in lieu of a U-trough shall not be allowed. Fasteners shall be Grade 316 stainless steel.
- b. The transport zone shall be fitted with wear bars constructed of $\frac{3}{8}$ " (minimum) thick high strength carbon steel. Wear bars shall be bolted. Welded wear bars shall not be allowed.
- c. The transport zone shall be a U-trough constructed of 14-gauge Grade 316 stainless steel with side flanges for attaching the bolted covers. The bolted covers shall be constructed of 16-gauge Grade 316 stainless steel.

4. Wash Zone

- a. The wash zone design shall consist of a U-trough with bolted, removable covers. Designs using a tube in lieu of a U-trough shall not be allowed. Fasteners shall be Grade 316 stainless steel.
- b. The wash zone shall be a U-trough constructed of 14-gauge Grade 316 stainless steel with side flanges for attaching the bolted covers. The bolted covers shall be constructed of 16-gauge Grade 316 stainless steel.
- c. The bolted covers in the wash zone shall include spray nozzles to deliver a flow of water to wash the screening and reduce the organic content. The spray wash shall run the entire time the

screen is in operation. The wash zone shall accept plant water or potable water. The wash zone shall include a solenoid valve to deliver wash water at a rate of maximum 20-gpm at 40 to 50-psig.

5. Press Zone

- a. The press zone shall be constructed of 14-gauge Grade 316 stainless steel plate with $\frac{1}{8}$ " diameter perforations with side flanges for attaching the bolted covers. The bolted covers shall be constructed of 16-gauge Grade 316 stainless steel.
- b. The press zone design shall consist of U-trough sieve, collection chamber, and bolted removable covers. Fasteners shall be Grade 316 stainless steel.
- c. Periodically, water shall be introduced into the collection chamber under the press zone to flush the chamber clean. Flushing with water shall be fifteen (15) seconds in duration and engage once every five (5) minutes of equipment cycle time. The press zone shall accept plant water or potable water. After each flushing cycle, the organics/inorganics flow down to the base of the collection trough to the drain outlet and back into the wastewater flow. The press zone shall include a solenoid valve to deliver wash water at a rate of 10 to 20-gpm.

6. Discharge Zone

- a. The discharge zone design shall be cylindrical with a discharge chute constructed of 14-gauge Grade 316 stainless steel with side flanges for attaching the bolted cover and one (1) end flange for mounting the drive system.
- b. The discharge zone shall discharge directly below the shaftless spiral screen. The clear height of the discharge chute shall be set at the minimum that allows for placement of a receptacle (dumpster) to collect the screenings or for process continuation.

7. Drive System

- a. Electric Motor shall be a 1-Hp, 230/460V, 3 phase, 60-Hz, TEFC, rated for the required electrical area classification.
- b. Gear Reducer shall utilize a shaft mounted parallel helical type gear reducer driven by a direct coupled motor. The reducer shall have a cast iron housing. The service factor shall be 1.0 minimum.

8. Controls

- a. The shaftless spiral screen control panel enclosure shall be sized as required to house the required components and shall be suitable for wall mounting or mounting to strut-type supports. The

enclosure shall be rated NEMA 4X stainless steel. The control panel shall be pre-wired and tested, requiring only mounting and connection to external wiring by the electrical contractor in the field.

- b. The control panel shall operate the shaftless spiral screen when the influent flow reaches a predetermined set point.
- c. The control panel shall have front panel mounted NEMA 4X pilot lights indicating Power, Run, Fault, Forward, and Reverse.
- d. The control panel shall include fused disconnect, full voltage reversing motor starter, control power transformer, adjustable timer, panel heater, and other components to allow for sequencing the system.
- e. The control panel shall have front panel mounted switches for Hand-Off-Automatic, Forward/Reverse, and Emergency Stop.
- f. Output dry contacts shall be provided for Run, Fault, Forward, and Reverse.
- g. The control panel shall incorporate solid state overloads. Upon an overload/fault trip, an alarm contact shall be initiated.
- h. Emergency Shutdown: Pull Cord and Switch. Provide an emergency pull cord and safety switch. The cord shall run the full length of the conveyor. The safety switch shall immediately stop the system when the switch is actuated.

B. Grit Removal System

1. Grit Separator

a. Design Data

- | | |
|-------------------------------|--|
| 1) Number of Units | 1 |
| 2) Size | 8' diameter |
| 3) Configuration | In Situ |
| 4) Performance | 95% removal of all grit (specific gravity 2.65) ≥ 106 microns at average flow |
| 5) Performance | 95% removal of all grit (specific gravity 2.65) ≥ 125 microns at peak flow |
| 6) Average Flow/Unit | 1 mgd with no more than 3" headloss |
| 7) Peak Flow/Unit | 1.5 mgd with 7" headloss |
| 8) Depth of Flow Peak/Average | 8"/7" |
| 9) Recommended Underflow Rate | 100 gpm |
| 10) Influent Connection | 8" plain end pipe |
| 11) Effluent Connection | 24" plain end pipe |
| 12) Underflow Connection | 3" flanged pipe |
| 13) Underflow Layout | Dry Mount Pump |
| 14) NPW Connection | 1" NPT |
| 15) HDPE Components | dip plate, center shaft, cone |
| 16) 304 SS Components | inlet pipe, deflector plate, fluidizing ring, support frame |

b. Operation

- 1) The grit separator shall be designed to separate grit and sand from screened raw wastewater using Hydro-dynamic separation and boundary layer effects to aid gravitational forces.
- 2) All flow passages shall be self-cleaning and free of sharp projections or fittings that may snag stringy or fibrous materials.
- 3) The grit separator shall be characterized by a predetermined flow path caused by the vessel geometry and flow modifying components to maximize the concentration and removal of settleable solids.
- 4) The grit separator shall include a fluidizing system to prevent the collected grit from compacting in the collection area, release entrapped organics, and aid in transporting the accumulated grit to the grit dewatering escalator.

c. Construction

- 1) The grit separator shall consist of a circular precast concrete chamber installed by the Contractor. The precast shall come in segments to be assembled by the Contractor. The base of the chamber shall have a grouted cone, installed by the Contractor, sloped towards the grit collection area located in the chamber sump.
- 2) The stainless steel tangential inlet pipe shall be cast into the chamber by the Contractor as shown on the contract drawings.
- 3) The internal components of the grit separator shall consist of a dip plate with annulus baffle plate and overflow channel and a center shaft and cone fabricated from HDPE.
- 4) The center shaft and cone shall be mounted so that its edge is clear of the sloping base of the vessel. It shall be removable from the top of the unit.
- 5) All suspended components shall be attached to a stainless steel support frame anchored to the concrete chamber walls.
- 6) A stainless steel fluidizing ring shall be mounted to the floor of the grit collection under the cone.
- 7) All flanges shall conform to ANSI B16.1 bolt patterns.

d. Valves and Accessories

- 1) The grit separator shall be supplied with the following valves:
 - a) One (1) 1" NEMA 4X bronze solenoid valve to automate the fluidizing water supply.

- b) One (1) 1" brass pressure regulator to adjust the fluidizing water pressure.
 - c) Two (2) 1" bronze ball valves to shut off the fluidizing water and isolate the solenoid valve.
- 2) The following pressure gauges shall be provided for the grit removal system:
- a) One (1) 0-100 psig pressure gauge to monitor the fluidizing water delivery pressure.

2. Grit Pump

a. Design Data

- | | |
|------------------------------|---|
| 1) Number of Units | 1 |
| 2) Make | Hayward Gordon Torus/Wemco Model C |
| 3) Type | Horizontal dry pit |
| 4) Flow Rate | 100 gpm |
| 5) Total Dynamic Head | 5 ft |
| 6) Seal | Single mechanical |
| 7) Materials of Construction | Ni-hard/high chrome impeller, casing, wearplate |

b. Operation

The grit pump shall operate intermittently whenever there is flow entering the grit concentrator unit.

c. Construction

- 1) The horizontal mount, recessed impeller pump uses a belt-driven TEFC motor and accommodates 0.5 to 2.0% solids concentrations. The pump shall be of a fully recessed impeller design, with the impeller mounted completely out of the flow path between pump inlet and outlet connections. Pumps shall be of a heavy duty construction, capable of handling large solids and abrasive particles.
- 2) Casing: Where radial vane impellers are used, the pump casing shall consist of a one piece casting with integral suction and discharge nozzles plus a back plate with integral wear element. The casing will have cast on feet, which will fully support the volute, to allow removal of the complete rotating assembly without disturbing suction and discharge piping. For cup type impellers, the casing shall consist of a removable suction piece large enough for the impeller to be withdrawn without the need to disturb the discharge piping; a center volute casing with integral discharge flange plus a separate

rear wear liner. Casing thickness shall be a minimum of 1/2" for 3" pumps, 3/4" for 4" & 6" pumps, and 1" for 8" pumps with normal casting tolerances.

- 3) Impeller: Impellers shall be fully recessed out of the casing passage and must be either a heavy duty radial vane or cup-type vane design. Impellers shall be fitted with full back pump out vanes to restrict flow behind the impeller and shall be keyed to the shaft and secured by a shrouded securing bolt and lock washer. The minimum thickness at the front edge of the impeller vane shall be 0.2" for impeller diameters up to 8", 1/2" for impeller diameters over 8" and up to 12", and 5/8" for impeller diameters over 12".
- 4) Wear Element: Pumps with radial vane impellers shall be fitted with a rear casing wear plate and integral radial wear element, which will protect the area behind and at the periphery of the impeller from the brunt of abrasive wear. The radial wear element will be of a tapered design to promote flow of solids out of the impeller recess. Minimum thickness at the base of the radial wear element shall be 7/8" for impeller diameters up to 8", 1 1/8" for impeller diameters over 8" and up to 11", and 1 1/4" for impeller diameters over 11". Minimum thickness at the tip of the radial wear element shall be 0.3" for impeller diameters up to 8", 3/4" for impeller diameters over 8" and up to 11", and 7/8" for impeller diameters over 11". Pumps with cup-type impellers shall have a separate removable suction piece to absorb wear in the suction area, where this impeller directs abrasive material. The suction wear piece shall have a minimum thickness of 7/8" for a 3", 1 1/4" for 4" and 6", and 1.3" for 8" pumps.
- 5) Materials of Construction: The case, impeller, and wear elements shall be constructed from Ni-Hard ASTM A-532 with minimum hardness of 550 BHN.
- 6) Shaft: The shaft shall be constructed of 4140 steel protected through the seal area by a renewable 410 stainless steel hardened hook type shaft sleeve. An O-ring between the sleeve and shaft will prevent pump fluid contacting the pump shaft.
- 7) Bearing Frame: The bearing frame will be manufactured from cast iron and shall be fitted with a constant level sight glass oiler and vent and drain plugs for oil lubrication or grease nipples for grease lubrication. Bearing lives are to be rated for a minimum of 100,000 hrs. L10 life, based on calculated loads due to hydraulic thrust at the duty point, as well as other mechanical loading due to belt drives or shaft and impeller weight.
- 8) Pump and Motor Base (Horizontal): The pump and motor base shall be fabricated from steel, designed to provide rigid support of the pump and motor. Each base shall be furnished

with suitable bolt and grout holes to facilitate mounting at site. Units shall be provided with either V-belts and sheaves or a direct drive coupling to provide the required pump speed to meet performance conditions. Suitable OSHA guards are required.

3. Decanter Grit Dewatering Unit

a. Design Data

- | | |
|-----------------------------|--|
| 1) Number of Units | 1 |
| 2) Size | 1.5 CY |
| 3) Style | Front loading |
| 4) Overflow Connection | 3" NPT |
| 5) Drain Connection | 2" NPT |
| 6) Screening | 0.10" 304 SS wedgewire |
| 7) Material of Construction | Galvanized steel |
| 8) Performance | 95% removal of all grit (specific Gravity 2.65) \geq 106 microns |

b. Operation

- 1) The grit dewatering unit shall be designed to dewater concentrated, washed grit slurry from the grit separator.
- 2) The grit dewatering unit shall capture and dewater all grit removed by the grit separator.
- 3) During normal operation the drain connection shall remain closed to allow the solids to settle from the grit slurry.
- 4) When the grit dewatering unit fills, decanted water shall flow into the overflow weir and discharge via the overflow line.
- 5) Before the grit dewatering unit is emptied, the drain valve shall be opened to let the standing water drain through the wedgewire drain screen.

c. Construction

- 1) The body of the grit dewatering unit shall be constructed of 14-gauge steel with 12-gauge top reinforcements and 3/16" wrap around corner reinforcements.
- 2) The grit dewatering unit shall be provided with an overflow weir at least 44" in length.
- 3) The grit dewatering unit shall be equipped with four (4) 6" diameter wheels, each rated at 1,200-lbs carrying capacity. All wheels shall swivel.
- 4) The grit dewatering unit shall be manufactured within the requirements of front or rear-loading local garbage/compactor trucks and shall conform to ANSI Z245.60 compatibility dimensions and ANSI Z245.30 safety requirements.

5) The grit dewatering unit shall be provided with a 0.10" opening, non-clog 304 stainless steel wedgewire dewatering screen located at the bottom of the unit. Screened water shall drain via a 2" NPT discharge connection at the base of the decanting unit.

d. Valves and Accessories

1) The grit dewatering unit shall be supplied with the following valves.

a) One (1) 2" plug valve to shut off the drain connection.

4. Controls and Instrumentation

a. One (1) control panel shall be furnished, completely pre-wired, and tested.

b. The control panel shall adhere to the following specifications:

| | |
|---------------------|--------------------|
| 1) Enclosure Rating | NEMA 4X |
| 2) Material | 304 SS |
| 3) Voltage | 480 Volts |
| 4) Phase | 3 Phase |
| 5) Frequency | 60 Hz |
| 6) Logic | Programmable Relay |

c. The control panel shall contain all timers, VFDs, switches, indicator lights, and other components necessary to operate the following equipment:

- 1) One (1) grit separator
- 2) One (1) grit pump

d. The control panel shall be supplied with a transformer with 480 volt primary winding and 120 volt secondary winding with fused secondary.

e. The control panel shall be supplied with applicable control relays and time delay relays with a minimum one extra normally closed and one extra normally opened contact provided for each relay.

f. Where remote monitoring is required, the panel shall be provided with all dry contact necessary.

g. The panel door layout shall include the following items:

- 1) Front panel mounted combination main disconnect switch and circuit breaker.
- 2) Back lit power maintained 2-way switch.
- 3) System three position HOA switch.
- 4) System emergency stop push button.

- 5) System alarm reset push button.
- 6) Grit removal cycle start push button.
- 7) Grit separator fluidizing water solenoid Open/Close switch.
- 8) Grit separator fluidizing water valve OPEN indicating light.
- 9) Grit pump running light.
- 10) Grit pump three position HOA switch.
- 11) Grit pump fail indicating light.
- 12) Grit pump manual START push button.
- 13) Grit pump manual STOP push button.
- 14) Grit pump manual speed potentiometer.

5. Sequence of Operation

- a. The system shall be controlled to provide automatic or manual operation, manual starting and stopping, and system shut down when a fault is detected.
- b. Clarified plant water shall be supplied to the grit separator and the grit pump (if seal water is required).
- c. Grit separator
 - 1) Screened raw wastewater shall be gravity fed into the grit separator continuously.
 - 2) A time clock (TC) shall initiate when grit discharge cycles occur. The time clock shall be adjustable to initiate cycles up to every 20 minutes.
 - 3) Concurrently, the control panel shall send a signal to open the solenoid valve located on the fluidizing line for an adjustable time period (typically 60 seconds).
 - 4) After the fluidizing time runs out and the solenoid valve closes, the grit pump shall operate for an adjustable period of time.

6. Utility Requirements

- a. Water – the grit separator shall require an intermittent supply of minimum 50-gpm clarified non-potable water at 50-psi supplied to the grit fluidizing pipe via a NPT connection.
- b. Electrical – the system shall require one (1) 480 VAC, 3-phase electrical service connection to operate.

7. Materials and Finishes

- a. Materials – All stainless steel used for the fabrication of the equipment shall conform to the following standards:

| | |
|-----------------|-----------|
| Plate and Sheet | ASTM A167 |
| | ASTM A240 |
| Bar | ASTM A276 |
| | ASTM A479 |

Tube

ASTM A312

b. Exterior Surface Finishes

- 1) All surfaces shall be free of sharp edges, weld spatter and residue. All welds shall be ground smooth.
- 2) All stainless steel surfaces shall be acid washed.
- 3) All non-submerged exterior surfaces shall be glass bead blasted to a uniform finish.

PART 3. EXECUTION

3.01 INSTALLATION

- A. Equipment and material shall be shipped complete except where partial disassembly is required by transportation regulations or for protection of components.
- B. Spare parts shall be packed in containers bearing packing lists clearly designating contents and pieces of equipment for which they are intended.
- C. The Contractor shall unload, store, and safeguard equipment, materials, and spare parts in accordance with manufacturer's recommendations.
- D. All equipment shall be installed in strict conformance with manufacturer's recommendations.

3.02 START-UP SERVICES

- A. The equipment manufacturer shall provide the services of a field service representative for a total of one (1) trip for a total of not more than three (3) working days for the purpose of instruction and assisting the Contractor and the Owner's personnel in the start-up and proper operation of the equipment.
- B. Operating and maintenance instructions for the equipment shall be furnished to the Contractor by the equipment manufacturer.
- C. Separate process service, if requested, will be furnished by the equipment manufacturer on a per diem basis.

3.03 FUNCTIONAL TESTING

- A. Prior to plant startup, all equipment shall be inspected for proper alignment, operation, connection, and satisfactory operation by means of a functional test. It is the Contractor's responsibility to duly notify the Manufacturer of any inability to perform functional testing prior to operator training.

END OF SECTION

SECTION 15110

MANUALLY OPERATED VALVES

PART 1. GENERAL

1.01 SUMMARY

- A. Furnish and install manually operated valves.
- B. All materials shall be AIS compliant.

1.02 REFERENCES

- A. American Water Works Association, 6666 West Quincy Avenue, Denver, Colorado 80235.
 - 1. AWWA C500 – Gate Valves for Water and Sewerage Systems.
 - 2. AWWA C509 – Resilient-Seated Gate Valves for Water and Sewerage Systems.
 - 3. AWWA C600 – Installation of Ductile-Iron Water Mains and Their Appurtenances.
- B. American Society for Testing and Materials, 1961 Race Street, Philadelphia, Pennsylvania 19103.
 - 1. ASTM A126 – Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - 2. ASTM B61 – Specification for Stem of Valve Bronze Castings.

PART 2. MATERIALS

2.01 GENERAL

- A. Items specified shall be the end products of one manufacturer in order to achieve standardization for operation, maintenance, spare parts, and manufacturer's services.
- B. Valves to be complete with necessary operators, valve boxes, extension stems, floor stands, worm and gear operators, operating nuts, etc., required for proper completion of work.
- C. Valves of equal quality by other manufacturers will be considered in accordance with the General Conditions.
- D. Renewable parts including discs, packing, and seats shall be of types recommended by valve manufacturer for intended service.
- E. Units shall have name of manufacturer and size of valve cast on the body or bonnet or shown on a permanently attached plate in raised letters.

2.02 DESIGN FEATURES

- A. Brass and bronze components of valves and appurtenances which have surfaces in contact with the water shall be alloys containing less than 16% zinc and 2% aluminum.
- B. Stainless steel Alloy 18-8 may be substituted for bronze at the option of the manufacturer and with the approval of the Engineer.
- C. All gland bolts on iron body valves shall be bronze and shall be fitted with brass nuts.

2.03 VALVE OPERATORS

- A. Open by turning counterclockwise.
- B. Worm and gear operators to be of totally enclosed design, so proportioned as to permit operation of the valve under full operating head with a maximum pull of 40-lbs. on the operator.
- C. Self-locking type to prevent the disc or plug from creeping.
- D. Self-locking worm gears to be a one-piece design of gear bronze material, accurately machine cut.
- E. Worm to be hardened alloy steel with thread ground and polished.
- F. Reduction gearing to turn in a proper lubricant.
- G. Provide gear operators with position indicators, where specified, to show the position of the valve disc or plug.
- H. Operators to be galvanized and painted the same color as the valve and associated pipeline.
- I. Buried valves to have 2" x 2" square operating nut.
- J. Above-ground valves to have handwheel operators.

2.04 VALVE BOXES

- A. Buffalo two-piece sliding type, cast iron, with 5¼" shaft of appropriate length for the installation.
- B. The word WATER shall be cast into the top of the lid on water line only.
- C. Extension pieces, if required, shall be the manufacturer's standard type.
- D. Manufacturers: Tyler 562-S, East Jordan Iron Works Series-8550, or Clow Corporation F-2452.
- E. Furnish units complete with all necessary bases and accessories.

2.05 EXTENSION STEMS FOR VALVE OPERATORS

- A. Where the depth of the valve is such that its centerline is more than 4' below grade, provide operating extension stems to bring the operating nut to a point 6" below the surface of the ground and/or box cover.
- B. Constructed of steel.
- C. Complete with 2" square operating nut.
- D. Bolt to valve stem to prevent separation.

2.06 GATE VALVES

A. Acceptable Manufacturers:

1. Mueller; "Series 2360.
2. Or approved equal.

B. Gate Valves:

1. Mechanical joint with non-rising stems and two inch square operating nut.
2. Open by turning to the left or counter clockwise.

C. Gate Valve Body and Bonnet:

1. Cast Iron.
2. Conform to ASTM A126, Class B.
3. "O" ring type seals and smooth unobstructed waterway when in fully open position.
4. Mechanical joint ends underground; flange joint ends above ground.

2.07 PLUG VALVES

A. Acceptable Manufacturers:

1. Val-Matic.
2. Dezurik.
3. Or approved equal.

B. Connections

1. Flanged valves shall have flanges with drilling to ANSI B16.1, Class 125.
2. Mechanical Joint valves shall fully comply with ANSI/AWWA C111/A21.11.
3. Threaded valves shall have NPT full size inlets. The connection shall be hexagonal for a wrench connection.

C. Design

1. Port areas of not less than 100% of pipe area shall be supplied on valves three (3") inches and smaller, 85% on sixteen (16") inches and smaller, 80% on eighteen (18") inches through twenty-four (24") inches, and 70% on thirty (30") and larger.
2. The valve seat shall be a welded overlay of 99% pure nickel applied directly to the body on a pre-machined, cast seating surface and machined to a smooth finish.
3. Shaft seals shall conform to ANSI/AWWA C504 and consist of V-type packing in a fixed gland with an adjustable follower designed to prevent over compression of the packing and to meet design parameters of the packing

manufacturer. Removable, slotted shims shall be provided under the follower flanges to provide for adjustment and prevent over tightening.

4. Permanently lubricated, radial shaft bearings shall be supplied in the upper and lower bearing journals. Thrust bearings shall be provided in the upper and lower journal areas.
5. Both the packing and bearings in the upper and lower journals shall be protected by a Grit-Guard shaft seal located on the valve shaft to minimize the entrance of grit into the bearing journal and shaft seal areas.

D. Materials

1. The valve body and cover shall be constructed of ASTM A126 Class B cast iron for working pressures up to 175 psig. The words "SEAT END" shall be cast on the exterior of the body seat end.
2. The plug shall be of one-piece construction and made of ASTM A126 Class B cast iron with a resilient facing per ASTM D2000-BG and ANSI/AWWA C504 requirements.
3. Radial shaft bearings shall be constructed of self-lubricating type 316 stainless steel. The top thrust bearing shall be Teflon. The bottom thrust bearing shall be Type 316 stainless steel. Cover bolts shall be corrosion resistant with zinc plating.

E. Actuators

1. Eight (8") inches and smaller valves shall be equipped with a 2" square nut for direct quarter turn operation. The packing gland shall include a friction collar and an open position memory stop. The friction collar shall include a nylon sleeve to produce friction without exerting pressure on the valve packing.
2. When specified, four (4") inches and larger valves shall include a totally enclosed and sealed worm gear actuator with position indicator (above ground service only) and externally adjustable open and closed stops. The worm segment gear shall be ASTM A536 Grade 65-45-12 ductile iron with a precision bore and keyway for connection to the valve shaft. Bronze radial bearings shall be provided for the segment gear and worm shaft. Alloy steel roller thrust bearings shall be provided for the hardened worm.
3. All gear actuators shall be designed to withstand, without damage, a rim pull of 200-lbs. on the handwheel and an input torque of 300 ft-lbs for nuts.
4. Buried service actuators shall be packed with grease and sealed for temporary submergence to 20' of water. Exposed worm shafts shall be stainless steel.

2.08 TAPPING SLEEVES AND VALVES

A. Acceptable Manufacturers:

1. American Darling, 2800 Series.
2. Or approved equal.

- B. Resilient seat or resilient wedge with a flange on one side for connection to the tapping sleeve.

PART 3. EXECUTION

3.01 GENERAL

- A. Bolt holes of flanged valves shall straddle the vertical centerline of the pipe run.
- B. Prior to installing flanged valves, the flange faces shall be thoroughly cleaned.
- C. After cleaning, insert gasket and bolts, and tighten the nuts progressively and uniformly.
- D. If flanges leak under pressure, loosen or remove the nuts and bolts, reseal or replace the gasket, retighten or reinstall the nuts and bolts, and retest the joints.
- E. Joints shall be watertight at test pressures before acceptance.
- F. Thoroughly clean threads of screwed joints by wire brushing, swabbing, or other approved methods.
- G. Apply approved joint compound to threads prior to making joints.
- H. Joints shall be watertight at test pressures before acceptance.

3.02 PLACEMENT OF VALVES

- A. Generally, unless otherwise indicated on the Drawings, all valves installed in horizontal runs of pipe shall be installed with their operating stems vertical.
- B. Valves installed in vertical runs of pipe shall have their operating stems orientated to facilitate the most practicable operation, as approved by the Engineer.
- C. Buried valves shall be installed with valve boxes in accordance with the details shown on the drawings.
- D. Buried valves shall have bolts protected by wrapping in polyethylene material.

3.03 ACCESS

- A. Location of valves shall be as required to provide accessibility for control and maintenance.

3.04 TESTING

- A. Valves: Test at same time adjacent pipeline is tested.
- B. Joints shall show no visible leakage under test.
- C. Repair joints that show signs of leakage prior to final acceptance.
- D. If there are any special parts of control systems or operators that might be damaged by the pipeline test, they shall be properly protected. The Contractor will be held responsible for damage caused by the testing.
- E. If requested by the Engineer, the valve manufacturer shall furnish an affidavit stating the materials options furnished and/or that he has complied with these and other references Specifications.

END OF SECTION

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SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1. GENERAL

1.01 SUMMARY

- A. This Section covers general requirements applying to all Sections included in Division 16.
- B. Install complete system in accordance with the intent of these Contract Documents.
- C. Furnish and install all incidental items not actually shown or specified, but which are required by good practice to provide complete functional systems.
- D. Coordinate details of facility equipment and construction for all Specification Sections which affect the Work covered under this Division.
- E. Drawings show only general locations of equipment and devices. Proper routing, connecting, and testing of all electrical work, complete, is the responsibility of the Contractor.

1.02 DEPARTURES FROM CONTRACT DOCUMENTS

- A. Submit to the Engineer in writing details of any necessary proposed departures from these Contract Documents, and the reasons therefore. Submit such requests as soon as practicable and within 30-days after award of the Contract. Make no such departures without written approval of the Engineer.

1.03 SUBSTITUTION OF MATERIALS AND EQUIPMENT

- A. In accordance with provisions elsewhere in these Contract Documents, manufacturers' names and catalog numbers stated herein are intended to indicate the type and quality of equipment or materials desired.
- B. Substitution will be considered if submitted in accordance with these Specifications.

1.04 SUBMITTALS

- A. Provide complete manufacturer's descriptive information and shop drawings for all equipment, material, and devices furnished under this Division, including certified outline drawings, arrangement drawings, elementary (schematic) diagrams, and interconnection and connection diagrams, in accordance with provisions of Section 01330 – Submittal Requirements.
- B. Provide the number of copies specified in Section 01330 for the Engineer, Contractor, and Operation and Maintenance Manuals.
- C. Provide certified shop drawings, literature, and requested samples showing items proposed for use, size, dimensions, capacity, special features required, schematic (elementary) control diagrams, equipment schedules, rough-in, etc., as required by the Engineer for complete review and for installation. Use NEMA device

designations and symbols for all electric circuit diagrams submitted. Make content of schematic (elementary) connection or interconnection diagrams in accordance with the latest edition of NEMA ICS.

- D. Check submittals for proper number of copies, adequate identification, correctness, and compliance with Drawings and Specifications, and initial all copies indicating this has been done. Revise, change, and/or resubmit all submittal information until acceptable to the Engineer.
- E. Obtain Engineer's acceptance before commencing fabrication or installation of any materials or equipment. Review of submittal information by the Engineer shall not relieve the Contractor from responsibility for deviations from Drawings and Specifications, unless he has in writing at time of submission requested and received written approval from the Engineer for specific deviations. Review of submittal information shall not relieve the Contractor from responsibility for errors and omissions in shop drawings or literature.
- F. Manufacturer's standardized elementary diagrams shall not be acceptable unless applicable portions of the diagram have been clearly identified and nonapplicable portions deleted or crossed out.

1.05 CODES, PERMITS, AND REGULATIONS

- A. Perform all Work, and furnish and install materials and equipment in full accordance with the latest applicable rules, regulations, requirements, and specifications of the followings:
 - 1. Local laws and ordinances.
 - 2. State and federal laws.
 - 3. National Electric Code (NEC).
 - 4. State Fire Marshall.
 - 5. Underwriters Laboratories (UL).
 - 6. National Electric Safety Code (NESC).
 - 7. American National Standards Institute (ANSI).
 - 8. National Electrical Manufacturer's Association (NEMA).
 - 9. Institute of Electrical and Electronics Engineers (IEEE).
 - 10. Insulated Cable Engineers Association (ICEA).
 - 11. Occupational Safety and Health Act (OSHA).
 - 12. American Society of Testing and Materials (ASTM).
- B. Conflicts, if any, that may exist between the above items will be resolved at the direction of the Engineer.
- C. Wherever the requirements of the Specifications or Drawings exceed those of the items above, the requirements of the Specifications or Drawings shall govern.
- D. Code compliance is mandatory. Nothing in the Contract Documents shall be construed as permitting work not in compliance with these codes.
- E. Obtain all permits and pay all fees required by any governmental agency having jurisdiction over the Work. Arrange all inspections required by these agencies.
- F. On completion of the Work, furnish satisfactory evidence to the Engineer that the Work is acceptable to the regulatory authorities having jurisdiction.

PART 2. PRODUCTS

2.01 GENERAL

- A. Unless otherwise indicated, provide all first-quality, new materials and equipment, free from any defects, in first-class condition, and suitable for the space provided.
- B. Provide materials and equipment listed by UL wherever standards have been established by that agency. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

2.02 STANDARD PRODUCTS

- A. Unless otherwise indicated, provide materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment.
- B. Provide the manufacturers' latest standard design that conforms to these Specifications.

2.03 EQUIPMENT FINISH

- A. Provide materials and equipment with manufacturers' standard finish system, in accordance with Division 9, FINISHES. Provide manufacturers' standard finish color, except where specific color is indicated. If manufacturer has no standard color, finish equipment with ANSI No. 61, light gray color.

2.04 OUTDOOR EQUIPMENT

- A. Equipment and devices to be installed outdoors or in unheated enclosures shall be capable of continuous operation within an ambient temperature range of 105°F to -5°F.

PART 3. EXECUTION

3.01 GENERAL

- A. Install materials and equipment in a workmanlike manner utilizing craftsmen skilled in the particular trade. Provide work which has a neat and finished appearance.
- B. Coordinate electrical work with Owner and Engineer and work of other trades to avoid conflicts, errors, delays, and unnecessary interference with operation of the plant during construction.
- C. Check the approximate locations of light fixtures, electrical outlets, equipment, and other electrical system components shown on Drawings for conflicts with openings, structural members, and components of other systems and equipment

having fixed locations. In the event of conflicts, consult the Engineer. The Engineer's decision shall govern. Make modifications and changes required.

3.02 PROTECTION DURING CONSTRUCTION

- A. Throughout this Contract, provide protection for materials and equipment against loss or damage in accordance with provisions elsewhere in these Contract Documents.
- B. Protect everything from the effects of weather. Prior to installation, store items in clean, dry, indoor locations. Store in clean, dry, indoor, heated locations items subject to corrosion under damp conditions, and items containing electrical insulation, such as transformers, conductors, motors, and controls.
- C. Energize all space heaters furnished with equipment. Protect materials and equipment from corrosion, physical damage, and the effects of moisture on insulation.
- D. Cap conduit runs during construction with manufactured seals. Keep openings in boxes or equipment closed during construction.

3.03 MATERIAL AND EQUIPMENT INSTALLATION

- A. Follow manufacturers' installation instructions explicitly, unless otherwise indicated. Wherever any conflict arises between manufacturers' instructions, codes and regulations, and these Contract Documents, follow Engineer's Decision.
- B. Keep copy of manufacturers' installation instructions on the job site available for review at all times.

3.04 REMOVAL OR RELOCATION OF MATERIALS AND EQUIPMENT

- A. Where existing materials and equipment are removed or relocated, remove all materials no longer used such as studs, straps, conduits, and wires. Remove or cut off concealed or embedded conduit, boxes, or other materials and equipment to a point at least $\frac{3}{4}$ " below the final finished surface.
- B. Repair affected surfaces to conform to the type, quality, and finish of the surrounding surface in a neat and workmanlike manner. Utilize skilled craftsmen of the trades involved.

3.05 CUTTING AND PATCHING

- A. Lay out work carefully in advance.
- B. Do not cut or notch any structural member or building surface without specific approval of Engineer.
- C. If required, carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment.
- D. Following such work, restore surfaces neatly to original condition.
- E. Use skilled craftsmen of the trades involved.

3.06 LOAD BALANCE

- A. After installation, balance electrical load between phases as nearly as possible on switchboards, panelboards, motor control centers, etc.

3.07 MOTOR ROTATION

- A. After final service connections are made, check and correct if necessary the rotation of all motors.
- B. Coordinate rotation checks with the Engineer and the Contractor responsible for the driven equipment.
- C. Submit a written report to the Engineer for each motor verifying that rotation has been checked and corrected.

3.08 CLEANING AND TOUCHUP PAINTING

- A. Keep the premises free from accumulation of waste material or rubbish.
- B. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of all devices and equipment.
- C. Touchup scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish.

3.09 INSPECTION

- A. All materials, equipment, and workmanship shall be subject to inspection at any time by the Engineer or his representative.
- B. Correct any work, materials, or equipment not in accordance with these Contract Documents or found to be deficient or defective, in a manner satisfactory to the Engineer.

3.10 OPERATIONS AND MAINTENANCE MANUALS

- A. Provide operations and maintenance manuals in accordance with provisions of Section 01330. Provide the number of copies specified therein containing:
 - 1. Operation, maintenance, recommended spare parts, and renewal parts information for all equipment furnished under this Division.
 - 2. Set of complete as-reviewed information herein required to be submitted for review following Contract award.
 - 3. Index of all equipment suppliers listing current names, addresses, and telephone numbers of those who should be contacted for service, information, and assistance.
 - 4. Provide Record Drawings marked with red indelible pencil to show all departures from original Drawings, and all electrical work revisions; prepare by obtaining new, clean sets of Contract Drawings from Engineer, and pay all costs for same; field marked Record Drawings shall be initialed by the Engineer or his representative.

5. All field and factory test results.
6. Information listed under individual Specification items.
7. All material to be clean and filed under dividers with heading in accordance with Specification item title.
8. Submit material to Engineer for approval prior to delivery to Owner; make additions or changes as required by the Engineer.

3.11 SERVICE CONTINUITY

- A. Maintain continuity of electric service to all functioning portions of the process or buildings during hours they are normally in use.
- B. Temporary outages will be permitted during cutover work at such times and places as can be prearranged with the Engineer and the Owner. Such outages shall be kept to a minimum number and minimum length of time.
- C. Make no outages without prior approval.
- D. Include all costs for temporary wiring and overtime work required in the Contract price. Remove all temporary wiring at the completion of the Work.

3.12 TEMPORARY ELECTRIC POWER

- A. Make arrangements for temporary electric power and pay all costs.

3.13 SALVAGED MATERIAL

- A. Unless otherwise indicated, all material required to be removed and salvaged shall become the property of the Owner and shall be delivered by the Contractor for on-site storage where directed by the Owner.

3.14 CHECKOUT AND STARTUP

- A. During checkout and startup of the various plant systems, provide a crew of skilled craftsmen to be available for check-out and troubleshooting activities as required by the Engineer.
- B. Since coordination with other crafts and contractors will often be required, the craftsmen assigned to checkout must be available outside normal working hours when necessary.

3.15 TESTS – GENERAL

- A. Carry out tests specified hereinafter and as indicated under individual items of materials and equipment specified in other Sections.

3.16 OPERATIONS

- A. After the electrical system installation is completed and at such time as the Engineer may indicate, conduct an operating test for approval. Demonstrate that the equipment operates in accordance with the requirements of these Specifications and Drawings. Perform the test in the presence of the Engineer or

his authorized representative. Furnish all instruments and personnel required for the tests. The Owner will furnish the necessary electric power.

3.17 VOLTAGE

- A. When the installation is essentially complete and the plant is in operation, check the voltage at the point of termination of the power company supply system to the Project.
- B. Check voltage amplitude and balance between phases for loaded and unloaded conditions.
- C. At the request of the Engineer, record the supply voltage for 24-hours during a normal working day.
- D. If the unbalance (as defined by NEMA) exceeds 1%, or if the voltage varies throughout the day and from loaded to unloaded conditions more than plus or minus 4% of nominal, make a written request to the power company that the condition be corrected.
- E. If corrections are not made, obtain from a responsible power company official a written statement that the voltage variations and/or unbalance are within their normal standards.

3.18 EQUIPMENT LINE CURRENT

- A. Check the line current in each phase for each piece of equipment. If any phase current in any piece of equipment is above the rated nameplate current, determine and submit in writing to the Engineer the cause of the problem.

3.19 POWER FACTOR

- A. Measure and record power factor of total load of services and individual motor circuits.

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SECTION 16050

BASIC MATERIALS AND METHODS

PART 1. GENERAL

1.01 SUMMARY

- A. Provide materials specified in this Section.

1.02 REFERENCE STANDARDS

- A. Federal Specifications:
 - 1. W-S-896-E
 - 2. W-C-596

1.03 SUBMITTALS

- A. Submittals after award of Contract shall be made in accordance with Section 01330 and Section 16010.

PART 2. PRODUCTS

2.01 CAST STEEL BOXES

- A. Provide boxes of cast ferrous metal with gasketed, watertight, cast ferrous metal covers and stainless steel screws, throughout the project for all outlet, device, and junction boxes.
- B. Provide boxes with threaded conduit hubs and cast mounting lugs where lugs are required.
- C. Use Crouse-Hinds or Appleton Type FS or FD boxes, service elbows, and similar conduit fittings, or equal.

2.02 JUNCTION AND PULL BOXES

- A. Where outlet boxes are used as junction or pull boxes, use materials as specified under 2.01, CAST STEEL BOXES.
- B. Where larger sheet steel boxes are required, utilize boxes of code-gage, galvanized steel with full-access screw covers mounted with corrosion-resistant machine screws.
- C. Where larger cast metal boxes are required, use neoprene gasketed, watertight boxes, with cast metal covers, stainless steel screws, and drilled and tapped conduit entrances. Use Crouse-Hinds Series W, O.Z./Gedney Series Y boxes, or equal.

2.03 WIRING DEVICES – SWITCHES

- A. General Use Switches: Provide UL listed, specification grade, totally enclosed, ac type, quiet tumbler switches meeting NEMA WD 1 performance standards and Federal Specification W-S0896E, and capable of control of 100% tungsten filament and fluorescent lamp loads. Use switches rated at 20-amps, 120/277 volts. Provide phenolic operating handles colored ivory. Use switches with screw terminals.
- B. Weatherproof Switches: Use switches as specified mounted in a cast metal box with gasketed, weatherproof device plate as specified in Paragraph 2.09 below.
- C. Manufacturers: Hubbell, General Electric, or equal.

2.04 RECEPTACLES – SINGLE AND DUPLEX

- A. Provide UL listed, specification grade receptacles meeting NEMA WD 1 performance standards and Federal Specification W-C0596 and having a contact arrangement such that contact is made on two sides of each inserted blade without détente. Use two-pole, three-wire grounding type receptacles rated 20-amps, 125 volts, NEMA Configuration 5-20R and with screw type wire terminals suitable for No. 10 AWG. Provide phenolic composition bases colored ivory.
- B. Manufacturers: Hubbell, General Electric, or equal.

2.05 WEATHERPROOF RECEPTACLES

- A. Use receptacles as specified mounted in a cast metal box with gasketed, weatherproof device plate as specified in Paragraph 2.09 below.

2.06 GROUND FAULT INTERRUPTER (GFI) RECEPTACLES

- A. Provide duplex, UL listed, specification grade GFI receptacles tripping at 5-milliamps, rated 20-amps, 120 volts, NEMA Configuration 5-20R and capable of interrupting 1000-amps without damage. Use units meeting NEMA WD 1 fitting standard sized outlet boxes, having No. 12 AWG copper TW insulated pigtails, having provision for testing, and ivory in color. Use standard model where ground fault protection is needed at an individual location.
- B. Use feed-through model where ground fault protection is specified for "downstream" conventional receptacles. Provide receptacles accepting standard device plates.
- C. Manufacturers: Hubbell, General Electric, or equal.

2.07 DEVICE PLATES – GENERAL

- A. Provide plates fitting closely and tightly to the box on which they are to be installed. On surface mounted boxes, provide stainless steel plates on indoor switches and receptacles.

2.08 CAST METAL PLATES

- A. Provide cast metal device plates of malleable ferrous metal or copper-free aluminum with gaskets and stainless steel screws with oval heads.

2.09 WEATHER PLATES

- A. Where weatherproof receptacles are designated, the receptacle shall be installed in the specified box with a gasketed, weatherproof, cast metal plate with individual cap over each receptacle opening and stainless steel mounting screws. Utilize plates with caps held tightly closed with stainless steel springs when receptacle is not in use. Manufacturers: Hubbell, General Electric, or equal.
- B. Where weather proof switches are designated, the switch shall be installed in the specified box with a gasketed, weatherproof, cast-metal cover plate incorporating an external operator for the internal switch and with stainless steel mounting screws. Manufacturers and types: Crouse-Hinds DS-181 or DS-185, Appleton FSK-IVTS or FSK-IVS, or equal.

2.10 CIRCUIT BREAKERS

- A. Furnish indicating type bolt-on branch circuit breakers providing On/OFF and TRIPPED positions of the operating handle. Furnish thermal-magnetic, quick-make, quick-break circuit breakers which are non-interchangeable in accordance with the NEC. Do not use tandem or dual circuit breakers in normal single-pole spaces. Do not use single-pole circuit breakers with handle ties where multipole circuit breakers are indicated. Utilize multipole circuit breakers designed so that an overload on one pole automatically causes poles to open. Provide circuit breakers meeting requirements of UL and NEMA AB 1. Provide circuit breaker handle padlocking provisions where indicated or required.
- B. Manufacturers: Square D, Westinghouse, ITE, or equal.

2.11 FUSED SWITCHES, INDIVIDUAL, 0 TO 600 VOLTS

- A. Provide NEMA 3R, raintight enclosure equipped with raintight bolt-on conduit hubs for switches mounted outdoors. Provide switches that can be locked in the OFF position. Enclosure and switches shall be interlocked to prevent opening the cover with the switch in the ON position.
- B. Provide switches which are quick-make, quick-break, motor rates, load-break, heavy-duty (HD) type having external marking clearly indicating ON and OFF positions. Switches shall meet the requirements of UL and NEMA KS 1, and be suitable for use as service equipment.
- C. Manufacturer: Square D or equal.

2.12 PUSHBUTTONS, INDICATING LIGHTS, AND SELECTOR SWITCHES

- A. For nonhazardous, indoor, dry locations, including motor control centers, control panels, and individual stations, provide heavy-duty, oiltight type pushbuttons,

indicating lights, selector switches, and stations for these devices. Utilize General Electric Type CR 2940, or equivalent by Square D, Allen-Bradley, or other acceptable manufacturer.

- B. For nonhazardous, outdoor, or normally wet locations, or where otherwise indicated, provide heavy-duty oiltight type pushbuttons, indicating lights, or selector switches mounted in NEMA 4 watertight enclosures. Provide boots and special gasketing required to make complete station watertight. For pushbuttons, use boots of the identical color specified for the actual pushbutton. For indicating lights, utilize translucent boots designed for the purpose. Utilize General Electric Type CR 2940, or equivalent by Square D, Allen-Bradley, or other manufacturers.
- C. Provide devices meeting the requirements of NEMA ICS, and having individual, extra large nameplates indicating their specific function. Provide pushbutton stations with laminated plastic nameplates indicating the drive they control. Install provisions for locking pushbuttons and selector switches in the OFF position where lockout provisions are indicated.
- D. Utilize selector switches having standard operating levers. Provide ON or START pushbuttons colored black. Provide OFF or STOP pushbuttons colored red.

2.13 CONTROL RELAYS

- A. Provide magnetic control relays, IDEC type RH with sockets, mounted in MCC, or equal.
- B. Where time delay relays are specified or required, unless otherwise noted, provide magnetic control relays with a timer attachment adjustable from 0.2 to 60-seconds (minimum) and field convertible from ON delay to OFF delay and vice-versa.

2.14 FUSES

- A. Provide a complete set of current-limiting fuses where fuses are indicated. Supply a set of three spare fuses of each type and each current rating installed. Utilize fuses that fit mountings specified with switches and which provide features rejecting Class H fuses.
- B. Manufacturer: Bussman.

2.15 NAMEPLATES

- A. Nameplates: Laminated phenolic plastic with engraved letters.

2.16 WIRE MARKERS

- A. Wire Markers: Pre-marked, self-adhesive, wraparound type, equal to T&B E-Z Code, or Brady; polyethylene equal to Almetek Industries mini-tags with nylon ties in Mechanical Room.

2.17 STRUT FRAMEWORK

- A. Strut Framework: Hot-dip galvanized steel, equal to B-Line or Unistrut, including channels, fittings, bolts, washers, and nuts.

PART 3. EXECUTION

3.01 INSTALLATION

- A. Mount boxes plumb and level. Make edges of boxes flush with finished surface. Provide proper type extension rings or plaster covers for this purpose. For flush-mounted boxes, make holes in the surrounding surface no larger than required to receive the box. Use surface-mounted boxes with exposed conduits at all other locations, unless otherwise noted.
- B. Install boxes in a secure, substantial manner supported independently of conduit by attachment to the building structure or a structural member. Use bar hangers in frame construction, or fasten boxes directly with wood screws on wood, bolts, and expansion shields on concrete or brick, toggle bolts on hollow masonry units, and machine screws or welded, threaded studs on steel work. Threaded studs driven in by a powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields. Boxes embedded in concrete or masonry need not be additionally supported. Utilize galvanized mounting hardware in industrial areas.
- C. Open no more knockouts in sheet steel boxes than are actually required. Seal any unused openings in box.

3.02 JUNCTION AND PULL BOXES

- A. Where necessary to terminate, tap-off, or re-direct multiple conduit runs, provide and install appropriately designed junction boxes. Furnish and install pull boxes where necessary in the raceway system to facilitate conductor installation. Provide pull boxes to limit conduit runs to less than 200-feet and to contain no more than the equivalent of three right-angle bends unless accepted by the Engineer.
- B. Use cast steel Type FS or FD, or equal.
- C. Use outlet boxes as junction boxes and pull boxes wherever possible and allowed by applicable codes.
- D. Installation:
 - 1. Make boxes accessible. Do not install boxes in finished areas unless accepted by the Engineer. Mount boxes plumb and level.
 - 2. Install boxes in a secure, substantial manner, supported independently of conduit by attachment to the building structure or a structural member. Use bar hangers in frame construction, or fasten boxes directly with wood screws on wood, bolts and expansion shields on concrete or brick, toggle bolts on hollow masonry units, and machine screws or welded threaded studs on steel work. Threaded studs driven in by a powder charge and provided with lock

washers and nuts are acceptable in lieu of expansion shields. Boxes embedded in concrete or masonry need not be additionally supported. Utilize galvanized mounting hardware in industrial areas.

- E. If adjacent structure is available, the box may be mounted on the structure surface just above finished grade in accessible but unobtrusive location. If it is found desirable to locate boxes in paved areas, roadways, or walkways, obtain Engineer's approval and utilize boxes and covers suitable for the weights to which they may be subjected.

3.03 IDENTIFICATION

- A. The following items shall be equipped with nameplates:
 - 1. Motor starters, pushbutton stations, control panels, and time switches.
 - 2. Disconnect switches, fused or unfused; switchboard, and panelboard, circuit breakers.
 - 3. Power receptacles, where the nominal voltage between a pair of contacts is greater than 150 volts.
 - 4. Electrical systems shall be properly identified at junction and pull boxes, terminal cabinets and equipment racks.
- B. Nameplates shall adequately describe the function of or use of the particular equipment involved. Nameplates for panelboard and switchboard shall include the panel designation voltage and phase of the supply. The name of the machine or the motor nameplates for a particular pump shall be the same as the one used on motor starter, disconnect and pushbutton station nameplates for the respective pump.
- C. Nameplate lettering shall be 3/16" high at pushbutton station, thermal overload switches, receptacles, wall switches, and similar devices, where the nameplate is attached to the device plate. At other locations, letter shall be 1/4" high, unless otherwise noted on the Drawings. Nameplates shall be securely fastened to the equipment with No. 4 Phillips, round-head, cadmium plated, steel self-tapping screws or nickel plated brass bolts.
- D. Wire Marking: Circuits shall be identified by wire markers at the following locations:
 - 1. Power and lighting branch circuits, feeders and control wiring at pull boxes, fixtures, outlets, motors, and similar items shall be marked with markers indicating panel and circuit number at which each circuit or feeder originates.
 - 2. Branch circuits shall be marked in the panelboard gutters. Markers shall indicate corresponding branch circuit numbers.
 - 3. Signal and control wires shall be marked at termination points, cabinets, terminal boxes, equipment racks, control panels, consoles, and similar items. Marking shall be in accordance with approved schedules prepared by the equipment manufacturer or by the Contractor.

4. Both ends of pull wires shall be identified by means of labels or tags, reading "PULL WIRE" and shall be numbered to refer to the same pull wire.

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SECTION 16060

GROUNDING

PART 1. GENERAL

1.01 SUMMARY

- A. Provide electrical grounding system.

1.02 SUBMITTALS

- A. Provide in accordance with Section 01330 and Section 16010.

PART 2. PRODUCTS

2.01 GROUND RODS

- A. Provide copper-clad steel ground rods not less than $\frac{5}{8}$ " , 10' long, driven full length into earth. Special requirements shall be as shown and as specified.

2.02 GROUND CONDUCTORS

- A. Provide grounding conductors of size and type specified in Section 16120 and shown on Drawings.

2.03 GROUND CONNECTIONS

- A. Below-Grade Connections: Provide exothermic-welded connectors as manufactured by Cadweld, Thermoweld, or equal.
- B. Above-Grade Connections: Provide exothermic-welded, compression, or brazed connectors.

PART 3. EXECUTION

3.01 GENERAL

- A. Except where specifically indicated otherwise, ground exposed noncurrent-carrying metallic parts of electrical equipment, raceway systems, and the neutral of wiring systems in strict accordance with NEC, state, and other applicable laws and regulations.
- B. Where grounding conductors are shown, or called for, bond wires to metallic enclosures at each end and to intermediate metallic enclosures. Connect grounding conductors to grounding bushings on raceways. Where equipment contains ground bus, extend and connect grounding conductors to that bus. Connect enclosure of equipment containing ground bus to that bus. Run ground conductors inside conduits enclosing power conductors.

- C. Make connections of grounding conductors to motors 10-hp and above or circuits 20-amps or above by solderless terminal and 5/16" minimum bolt tapped to motor frame or equipment housing. Ground connections to smaller motors or equipment may be made by fastening terminal to connection box. Connect junction boxes to equipment grounding system with grounding clips mounted directly on box or with 3/8" machine screws. Completely remove paint, dirt, or other surface coverings at grounding conductor connection points so that good metal-to-metal contact is made.
- D. Install sufficient ground rods in addition to code-required grounding so that resistance to ground as tested by standard methods does not exceed 3-ohms unless otherwise accepted. Where more than one rod is required, install rods at least 3' apart.
- E. Ground shields of shielded power cable at each splice or termination in accordance with recommendations of splice or termination manufacturer. Ground shields of control cables in accordance with details shown.
- F. Ground metal sheathing and exposed metal vertical structural elements of buildings. Ground metal fences enclosing electrical equipment. Bond metal equipment platforms which support electrical equipment to that equipment. Provide good electrical contact between metal frames and railings supporting pushbutton stations, receptacles, instrument cabinets, etc., and raceways carrying circuits to these devices.
- G. Bond neutrals of transformers within buildings to system ground network, and to additional indicated grounding electrodes.

3.02 GROUNDING CONNECTIONS

- A. Unless shown otherwise, make connections of grounding conductors to ground rods at upper end of rod with end of rod and connection point below finished grade.

3.03 FIELD TESTS

- A. Test ground resistance of reconnected grounding system in Engineer's presence.
- B. Provide copies of reports of grounding system tests for inclusion in Operation and Maintenance Manuals and for review by Engineer.

END OF SECTION

SECTION 16120

CONDUCTORS

PART 1. GENERAL

1.01 SUMMARY

- A. Provide conductor systems as specified herein.

1.02 CONDUCTOR IDENTIFICATION SYSTEM

- A. Provide a conductor identification system that utilizes tag numbers for equipment and terminal numbers used in control panels. Identify each control cable or grouping of conductors, and individually number each conductor in control circuits. The same number shall be used throughout for each cable and conductor. In addition, the destination of each cable shall be identified at each end.

1.03 SUBMITTALS

- A. Provide the following submittals in accordance with Section 01330 and Section 16010:
 - 1. Shop Drawings.
 - 2. Certificates, Test Reports, etc.

PART 2. PRODUCTS

2.01 MANUFACTURERS

- A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard quality and general configuration desired only. Products of other manufacturers will be considered in accordance with the General Conditions.

2.02 CONDUCTORS 600 VOLTS AND BELOW

- A. In raceways, ducts, cables; provide copper conductors with the type of insulation specified. Provide conductors, including insulation, cabling, jacket, filler, shielding, covering, and testing, that meet applicable requirements of ICEA S-19-81 and S-61-402, the NEC and UL. Unless noted otherwise, conductor sizes indicated are based on copper conductors. Do not provide conductors smaller than those indicated.
- B. Provide stranded conductors for all classes and sizes of conductors. For conductors No. 6 AWG or larger, provide insulation of heat- and moisture-resistance Grade XHHW or THWN. Provide smaller conductors with thermoplastic

insulation Type THHN/THWN. Provide factory, color-coded conductor with a separate color for each voltage used consistently throughout the system.

2.03 CONDUCTOR TAGS

- A. Conductor tags for conductors No. 12 AWG and below shall be legible permanent sleeve of yellow or white PVC with machine printed black marking. Tags relying on adhesives or taped-on markers are not acceptable.

2.04 EQUIPMENT GROUNDING CONDUCTORS

- A. Provide stranded copper conductors, size as required by NEC, for equipment grounding. Provide conductors with green Type TW insulation with a minimum thickness of 1/32" inch.

2.05 DIRECT BURIED GROUNDING CONDUCTORS

- A. Provide bare stranded copper conductors, size as indicated on the Drawings, for the ground system at transformers, switchgear, and where indicated.

PART 3. EXECUTION

3.01 GENERAL

- A. Do not exceed cable manufacturer's recommendations for maximum pulling tensions and minimum bending radii. Where pulling compound is used, use only UL listed compound compatible with the cable out jacket and with the raceway involved.

3.02 CONDUCTORS 600 VOLTS AND BELOW

- A. Run cables as indicated on Drawings, with no splices except as indicated or accepted by the Engineer. Wire nuts may be used on solid conductors of 120-volt and 277-volt lighting and 120-volt receptacle circuits only. Use crimp connectors with tools by same manufacturer and/or UL listed for connectors of all stranded conductors. Soldered mechanical joints insulated with tape will not be acceptable. Vinyl plastic tape of suitable quality is acceptable in lieu of rubber and friction tapes.
- B. Where conductors will be connected by others, provide adequate length pigtails.
- C. Provide terminals and connectors acceptable for the type of material used.
- D. Arrange wiring in cabinets, panels, and motor control centers neatly cut to proper length, and remove surplus wire. Attach Thomas & Betts insulated ring-type "Stakon" compression terminals, and bridle and secure in an acceptable manner. Identify all circuits entering motor control centers or other control cabinets in accordance with the conductor identification system specified.
- E. Attach compression terminals with a tool specifically designed for that purpose.

3.03 CABLE

- A. Maintaining the integrity of shielding of control cables is essential to the operation of the control systems. Take special care in cable installation to ensure that grounds do not occur because of damage to the jacket over the shield.

3.04 FIELD TESTS

- A. Perform insulation resistance testing of all power and control circuits below 600-volts with a 500-volt megger. Prepare a written test report of the results and submit to the Engineer prior to final inspection. Equipment which may be damaged during this test should be disconnected. Perform tests with all other equipment connected to the circuit.

END OF SECTION

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SECTION 16130

RACEWAYS

PART 1. GENERAL

1.01 SUMMARY

- A. Provide electrical raceway systems.

1.02 RELATED SECTIONS

- A. Section 01330 – Submittal Requirements.
- B. Section 02315 – Trench Excavation, Backfill, and Compacting.
- C. Section 03300 – Cast-in-Place Concrete.
- D. Section 16010 – Basic Electrical Requirements.
- E. Section 16060 – Grounding.
- F. Section 16120 – Conductors.

1.03 REFERENCE STANDARDS

- A. American National Standards Institute, 1430 Broadway, New York, New York 10018.
 - 1. ANSI C80 – Rigid Steel Conduit-Zinc Coated.
- B. Federal Specifications.
 - 1. WC-1094

1.04 SUBMITTALS

- A. Submittals after award of Contract shall be in accordance with Section 01330 and Section 16010.

PART 2. PRODUCTS

2.01 RIGID STEEL CONDUIT

- A. Use rigid steel conduit, including couplings elbows, nipples, and other fittings, galvanized by hot-dipping, electroplating, sheradizing, or metalizing process and meeting the requirements of ANSI C80, NEMA FB 1, UL, and the NEC. Do not use setscrew type couplings, elbows, and nipples.

2.02 FLEXIBLE METAL CONDUIT, LIQUID TIGHT

- A. Use UL listed liquid-tight flexible metal conduit consisting of galvanized steel flexible conduit covered with an extruded PVC jacket and terminated with nylon

bushings or bushings with steel or malleable iron body and insulated throat and sealing O-ring.

2.03 WARNING TAPE

- A. Provide heavy-gauge, yellow, plastic tape of 3" minimum width for use in trenches containing electric circuits. Utilize tape made of material resistant to corrosive soil. Use tape with printed warning that an electric circuit is located below the tape. Manufacturers and types: ITT Blackburn Type YT, Griffolyn Co., Terra-Tape, or equal.

PART 3. EXECUTION

3.01 GENERAL

- A. Provide raceway systems meeting or exceeding the requirements of the NEC.

3.02 PROTECTION DURING CONSTRUCTION

- A. In addition to the requirements of the GENERAL CONDITIONS, General Requirements, and Section 16010 prior to installation, store all products specified in this Section in a dry location. Following installation, protect products from the effects of moisture, corrosion, and physical damage during construction. Keep openings in conduit and tubing capped with manufactured seals during construction.

3.03 TYPE TO BE USED

- A. Use rigid steel conduit in all locations.
- B. Use no circular raceway less than ¾". Install noncircular raceways where indicated.

3.04 FINAL CONNECTION TO CERTAIN EQUIPMENT

- A. Make final connection to motors, wall or ceiling mounted fans and unit heaters, dry type transformers, valves, local instrumentation, and other equipment where flexible connection is required to minimize vibration or where required to facilitate removal or adjustments of equipment, with 18" minimum, 60" maximum lengths of liquid-tight, PVC-jacketed, flexible steel conduit where the required conduit size is 4" or less. For larger sizes, use nonflexible conduit as specified.

3.05 LOCATION, ROUTING, AND GROUPING

- A. Conceal or expose raceways as indicated. Group raceways in same area together. Locate raceways at least 12" away from parallel runs of flues, and steam or hot water pipes. Run exposed raceways parallel or perpendicular to walls, structural members or intersections of vertical plans to provide a neat

appearance. Follow surface contours as much as possible. Avoid obstruction of passageways. Run concealed raceways with a minimum of bends in the shortest practical distance considering the building construction and other systems. In block walls, do not run raceways in the same horizontal course with reinforcing steel.

- B. In outdoor, underground or wet locations, use watertight couplings, and connections in raceways. Install and equip boxes and fittings so as to prevent water from entering the raceway.
- C. Do not notch structural members for passage of raceways except with prior approval of the Engineer. Do not run raceways in equipment foundation pads. Locate raceways concealed in poured concrete other than duct banks so that the minimum concrete covering is not less than 1½". Locate raceways in the center ⅓ of slabs wherever possible. Except at raceway crossings, separate raceways in slabs not less than six times the raceway outside diameter.
- D. Install concealed, embedded, and buried raceways so that they emerge at right angles to the surface and have none of the curved portion of the bend exposed. Provide support during pouring of concrete to ensure that raceways remain in position.

3.06 SUPPORT

- A. Support raceways at intervals not exceeding NEC requirements unless otherwise indicated. Support multiple raceways adjacent to each other by ceiling trapeze. Support individual raceways by wall brackets, strap hangers, or ceiling trapeze, fastened by wood screws on wood, toggle bolts on hollow masonry units, expansion shields on concrete or brick, and machine screws or welded thread studs on steel work. Threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion shields.
- B. Support all raceways from structural members only. Do not support from pipe hangers or rods, cable tray, or other conduit.
- C. Do not use nails anywhere or wooden plugs inserted in concrete or masonry as a base for raceway or box fastenings. Do not weld raceways or pipe straps to steel structures. Do not use wire in lieu of straps or hangers.

3.07 BENDS

- A. Make changes in direction of runs with symmetrical bends or cast metal fittings. Make bends and offsets of the longest practical radius. Avoid field-made bends and offsets where possible, but where necessary, make with an acceptable hickey or conduit bending machine. Do not heat metal raceways to facilitate bending.
- B. Make bends in parallel or banked runs of raceways from the same center or centerline so that bends are parallel and of neat appearance. Factory elbows may be used in parallel or banked raceways if there is a change in the plane of the run and the raceways are of the same size. Otherwise, make field bends in parallel runs.
- C. Make no bends in flexible conduit that exceed allowable bending radius of the cable to be installed or that significantly restricts the conduits flexibility.

3.08 BUSHINGS AND INSULATING SLEEVES

- A. Install insulated grounding bushings on the ends of all rigid metallic raceways, except where raceways terminate in threaded hubs, in which case insert manufacturer's standard insulating sleeves.

3.09 EXPANSION JOINTS

- A. Provide suitable expansion fittings for raceways crossing expansion joints in structures or concrete slabs, or provide other suitable means to compensate for expansion and contraction.

3.10 PENETRATIONS

- A. Seal all raceways entering structures at the first box or outlet with oakum or suitable plastic expandable compound to prevent the entrance into the structure of gasses, liquids, or rodents.
- B. Dry pack with nonshrink grout around raceways that penetrate concrete walls, floors, or ceilings aboveground, or use one of the methods specified for underground penetrations.
- C. Where an underground conduit enters a structure through a concrete roof or a membrane waterproofed wall or floor, provide an acceptable, malleable iron, watertight, entrance sealing device. When there is no raceway concrete encasement specified or indicated, provide such a device having a gland type sealing assembly at each end with pressure bushings which may be tightened at any time. When there is raceway concrete encasement specified or indicated, provide such a device with a gland type sealing assembly on the accessible side. Securely anchor all such devices into the masonry construction with one or more integral flanges. Secure membrane waterproofing to such devices in a permanently watertight manner.
- D. Where an underground raceway without concrete encasement enters a structure through a nonwaterproofed wall or floor, install a sleeve made of Schedule 40 galvanized pipe. Fill the space between the conduit and sleeve with a suitable plastic expandable compound, or an oakum and lead joint, on each side of the wall or floor in such a manner as to prevent entrance of moisture. A watertight entrance-sealing device as specified may be used in lieu of the sleeve.

3.11 UNDERGROUND DIRECT BURIAL AND CONCRETE-ENCASED RACEWAYS

- A. Meet the following additional requirements for underground raceways:
 1. Coordinate installation of underground raceways with other outside and building construction work. Maintain existing outside utilities in operation unless otherwise indicated by the Engineer.
 2. Remove and properly install all raceway installations not in compliance with these requirements entirely.
 3. Do not use union type fittings underground except with approval of the Engineer.

3.12 TRENCH EXCAVATION AND BACKFILL

- A. Follow the requirements of Section 02315. Provide a minimum cover of 2' over all underground raceways unless otherwise indicated.

3.13 WARNING TAPES

- A. Bury warning tapes approximately 6" above all underground conduit. Align parallel to and within 6" of centerline of runs.

3.14 ARRANGEMENT AND ROUTING

- A. Arrange multiple conduit runs substantially in accordance with the Drawings.
- B. Make minor changes in location or cross-section as necessary to avoid obstructions or conflicts. Where raceway runs cannot be installed substantially as shown because of conditions not discoverable prior to digging of trenches, refer the condition to the Engineer for instructions before further work is done.
- C. Where other utility piping systems are encountered or being installed along a raceway route, maintain a 12" minimum vertical separation between raceways and other systems at crossings. Maintain a 12" minimum separation between raceways and other systems in parallel runs. Do not place raceways over valves or couplings in other piping systems. Refer conflicts with these requirements to the Engineer for instructions before further work is done.
- D. Provide insulated grounding bushings on all metallic raceways entering manholes. Provide bell-ends flush with manhole walls on all nonmetallic raceways entering manholes.
- E. In multiple conduit runs, stagger raceway-coupling locations so that couplings in adjacent raceways are not in the same transverse line.

3.15 PREPARATION FOR PULLING IN CONDUCTORS

- A. Do not install crushed or deformed raceways. Avoid traps in raceways where possible. Take care to prevent the lodging of plaster, concrete, dirt, or trash in raceways, boxes, fittings, and equipment during the course of construction. Make raceways entirely free of obstructions or replace them. Ream all raceways, remove burrs, and clean raceway interior before introducing conductors or pull wires.
- B. Immediately after installation, plug or cap all raceway ends with watertight and dust-tight seals until the time for pulling in conductors.

END OF SECTION

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SECTION 16221

GENERATOR SET

PART 1. SCOPE

1.01 SUMMARY

- A. 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 Drawings and specified herein.
- B. All equipment shall be new and of current production by a firm which manufactures the generator and controls.

1.02 RELATED SECTIONS

- A. Section 01100 – Summary of Work.
- B. Section 01330 – Submittal Requirements.

1.03 GENERAL REQUIREMENTS

- A. It is intent of this specification to secure a generator system that has been tested during design verification, production, and at the final job site.
- B. The generator set will be of the lasted commercial design and will be complete with all of the necessary accessories for complete installation as shown on the Drawings and specified herein.
- C. The equipment supplied and installed shall meet the requirements of the National Electrical Code (NEC), along will all applicable local codes and regulations.
- D. All equipment shall be new and current production of a national firm that manufactures the generator and controls, transfer switches, switchgear, and assembles the generator sets as a complete and coordinated system.
- E. There will be one source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.

1.04 SUBMITTALS

- A. The submittals shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimensional 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 the specifications.

1.05 REFERENCES

- A. The generator set shall conform to the requirements of the following codes and standards
1. CSA C22.2, No. 14-M91 Industrial Control Equipment.
 2. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.
 3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 4. IEC8528 Part 4. Control System for Generator Sets.
 5. IEC Std. 801.2, 801.3, and 801.5 for Susceptibility, Conducted, and Radiated Electromagnetic Emissions.
 6. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
 7. Mil Std. 461D – 1993. Military Standard, Electromagnetic Interference Characteristics.
 8. Mil Std. 462D – 1993. Military Standard, Measurement of Electromagnetic Interference Characteristics.
 9. NFPA 70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
 10. NFPA 99 – Essential Electrical Systems for Health Care Facilities.
 11. NFPA 110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype test required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.
 12. UL2200. The genset shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed.

1.06 TESTING

- A. To assure 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.
1. Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subject to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models, which will not be sold, shall have been used for the following tests.
 - a. Maximum power (kW)
 - b. Maximum motor starting (kVA) at 25% instantaneous voltage dip.
 - c. Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-22.40 and 16.40.
 - d. Governor speed regulation under steady-state and transient conditions.

- e. Voltage regulation and generator transient response.
- f. Fuel consumption at $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and full load.
- g. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
- h. Three-Phase short circuit tests.
- i. Alternator cooling air flow.
- j. Torsional analysis to verify that the generator set is free of harmful torsional stresses.
- k. Endurance Tests.

B. Production Tests

1. Final Production Tests. Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
 - a. Single-step load pickup.
 - b. Transient and steady-state governing.
 - c. Safety shutdown device testing.
 - d. Voltage regulation.
 - e. Rated Power @ 0.8 PF.
 - f. Maximum Power.
 - g. Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.

C. Site Tests

1. Site Tests: An installation check, start-up, and building load test shall be performed by the manufacturer's local representative. The Engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:
 - a. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
 - b. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, generator strip heaters, remote annunciator, etc.
 - c. Start-up 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 running, normal and emergency line-to-line voltage and frequency, and phase rotation.
 - d. Automatic start-up by means of 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 voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be

connected to the system if sufficient building load is unavailable to load the generator to the nameplate kW rating.

1.07 WARRANTY AND MAINTENANCE

- A. A one (1) year warranty for the generator set shall be included to guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from date of start-up. Optional warranties shall be available upon request.
- B. The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventative maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulating operating conditions, adjustment to the generator, transfer switch, and switchgear controls as required, and certifications in the Owner's maintenance log of repairs made and proper functioning of all systems.

PART 2. PRODUCTS

2.01 EQUIPMENT

- A. The generator set shall (as a minimum) provide 300 kW when operating at 277/480 volts, 0.8 power factor. The generator set shall be capable of this rating while operating in an ambient condition of 77°F (59.2°C) and 5,000 feet above sea level.
- B. The generator set shall be capable of starting motor loads, with a maximum voltage dip of 25%.
- C. Vibration isolators shall be provided between the engine-generator and heavy-duty steel base.

2.02 ENGINE

- A. The engine shall be equipped with the following:
 - 1. A mechanical governor capable of +0.33% steady-state frequency regulation.
 - 2. 24-Volt positive engagement solenoid shift-starting motor.
 - 3. 55-Ampere minimum automatic battery charging alternator with solid-state voltage regulation.
 - 4. Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
 - 5. Dry-type replaceable air cleaner elements for normal applications.
 - 6. Engine-driven or electric fuel transfer pump capable of lifting fuel 3', fuel filters, and electric solenoid fuel shut-off valve.
- B. The turbocharged engine shall be fueled with No. 2 diesel.

- C. The engine shall have a minimum of 6 cylinders, and be liquid-cooled by a unit-mounted radiator, blower fan, water pump, and thermostats. This system shall properly cool the engine with up to 0.5" H₂O static pressure on the fan in an ambient temperature up to 122°F (50°C).
- D. The engine shall be EPA certified.

2.03 GENERATOR

- A. The alternator shall be salient-pole, brushless, 12-lead re-connectable, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed stator for smooth voltage waveform. The insulation shall meet the NEMA standard (MG1-22.40 and 16.40) for Class H and be insulated with epoxy varnish to be fungus resistant per MIL 1-24092. Temperature rise of the rotor and stator shall be limited to 150°C. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator capable of maintaining voltage within $\pm 2\%$ at any constant load from 0% to 100% of rating. The regulator must be isolated to prevent tracking when connected to SCR loads, and provide individual adjustments for voltage range, stability and volts-per-hertz operations; and be protected from the environment by conformal coating.
- B. The generator set shall meet the transient performance requirements of ISO 8528-5, level G-2.
- C. The alternator excitation shall be of a permanent magnet exciter design.
- D. The generator shall be inherently capable of sustaining at least 250% of rated current for at least 10-seconds under a 3-phase symmetrical short circuit without the addition of separate current support devices.
- E. The generator, having a single maintenance-free bearing, shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

2.04 CONTROLLER

- A. Set-mounted controller capable of facing right, left, or rear, shall be vibration isolated on the generator enclosure. The controller shall be moisture proof and capable of operation from 40°C - 85°C. Relays will only be acceptable in high-current circuits.
- B. Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall include the following features:
 - 1. Fused DC circuit.
 - 2. Complete 2-wire start/stop control, which shall operate on closure of a remote contact.
 - 3. Speed sensing and a second independent starter motor disengagement systems shall protect against starter engagement with a moving flywheel. Battery charging alternator voltage will not be acceptable for this purpose.

4. The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then re-engage the starter.
5. Cranking cyler with 15-second ON and OFF cranking periods.
6. Overcrank protection designed to open the cranking circuit after 75-seconds if the engine fails to start.
7. Circuitry to shut down the engine when signal for high coolant temperature, low oil pressure, or overspeed are received.
8. Engine cooldown timer factory set at 5-minutes to permit unloaded running of the standby set after transfer of the load to normal.
9. 3-position (Automatic-OFF-TEST) selector switch. In the TEST position, the engine shall start and run regardless of the position of the remote starting contacts. In the Automatic position, the engine shall start when contacts in the remote control circuit close and stop 5-minutes after those contacts open. In the OFF position, the engine shall not start even though the remote start contacts close. This position shall also provide for immediate shutdown in case of an emergency. Reset of any fault shall also be accomplished by putting the switch to the OFF position
10. Alarm horn with silencer switch per NFPA 110.

C. Standard indicating lights to signal the following shall be included:

1. Not-in-Auto (flashing red).
2. Overcrank (red).
3. Emergency Stop (red).
4. High Engine Temperature (red).
5. Overspeed (red).
6. Low oil pressure (red).
7. Battery Charger Malfunction (red).
8. Low Battery Voltage (red).
9. Low Fuel (red).
10. Auxiliary Prealarm (yellow).
11. Auxiliary Fault (red).
12. System Ready (green).

D. Test button for indicating lights.

E. Terminals shall be provided for each indicating light above, plus additional terminals for common fault and common prealarm.

2.05 INSTRUMENT PANEL

A. The instrument panel shall include the following:

1. Dual range voltmeter 3½", ±2% accuracy.
2. Dual range ammeter 3½", ±2% accuracy.
3. Voltmeter-ammeter phase selector switch.
4. Lights to indicate high or low meter scale.

5. Direct reading pointer-type frequency meter 3½", 0.5% accuracy, 45 to 65 HZ scale.
6. Panel-illuminating lights.
7. Battery charging voltmeter.
8. Coolant temperature gauge.
9. Oil pressure gauge.
10. Running-time meter.
11. Voltage-adjust rheostat.

2.06 ACCESSORIES

- A. Line circuit breaker of 600-amperes, 600-amps sensor, 600-volt rated, molded case type, generator mounted.
- B. Engine block heater. Thermostatically controlled and sized to maintain manufacturer's recommended engine coolant temperature to meet the start-up requirements of NFPA-99 and NFPA-110, Level 1.
- C. Weather housings shall be constructed of rugged steel, cleaned, phosphated, and electrocoat painted inside and out with rust inhibiting primer and exterior coat of the manufacturer's standard color. Side panels will be lockable and easily removed for servicing.
- D. Battery rack and battery cables, capable of holding the manufacturer's recommended batteries, shall be supplied.
- E. 12-volt lead-antimony battery(ies) capable of delivering the manufacturer's recommended minimum cold-cranking Amps required at 0°F, per SAE Standard J-537, shall be supplied.
- F. 10-Ampere automatic float and equalize battery charger with ±1% constant voltage regulation from no load to full load over ±10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambient temperatures from -40°C to +60°C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected.
- G. The engine exhaust silencer shall be coated to be temperature and rust resistance, rated for critical application. The silencer shall reduce total engine exhaust noise by 25-35 dB(A).
- H. Gas-proof, seamless, stainless steel, flexible exhaust bellows with threaded NPT connection.
- I. Two flexible fuel lines rated 300°F and 100-psi ending in pipe thread.
- J. Generator prealarm senders.

2.07 DOUBLE WALL SECONDARY CONTAINMENT SUB-BASE FUEL TANK

- A. A sub-based fuel tank used in conjunction with a diesel powered generator set of 300kW with sufficient fuel capacity to support the generator set for a period of 45-hours at 100% or rated load and 58-hours at 75% or rated load.
- B. The sub-based fuel system shall be listed under UL 142, sub-section entitled Special Purpose Tanks EFVT category, and shall 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 shall be 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. Construction:
1. Primary Tank – The primary tank shall be rectangular in shape and constructed in clamshell fashion to ensure maximum structural integrity and allow the use of a full throat fillet weld.
 2. Steel Channel Support System – Reinforced steel box channel for generator support, with a load rating of 5,000 lbs. per genset mounting hole location. Full height gussets at either end of channel and at genset mounting holes shall be utilized.
 3. Exterior Finish – The exterior coating shall be tested to withstand continuous salt spray testing at 100% exposure for 244-hours to a 5% salt solution at 92-97°F. The coating shall be subjected to full exposure humidity testing to 100% humidity at 100°F for 24-hours. Tests shall be conducted in accordance with the American Standard Testing Methods Society.
- E. Venting – 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 1¼-inch (3 cm.) nominal inside diameter. A 1¼-inch atmospheric mushroom cap shall be furnished and the installing Contractor shall pipe above the highest fill point as a minimum.
- F. Emergency Venting – 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% of the primary tank. A zinc plated emergency pressure relief vent cap shall be furnished for the primary tank. The vent shall be spring-pressure operated: opening pressure shall be 0.5 psig and full opening pressure shall be 2.5 psig. Limits shall be stamp marked on top of each vent. The emergency relief vent shall be sized to accommodate the total venting capacity of both normal and emergency vents.
- G. Fuel Fill – There shall be a 2" NPT opening within the primary tank with an 8" raised fill pipe and lockable manual fill cap.
- H. Fuel Level – A direct reading, UL listed, magnetic fuel level gauge with a hermetically-sealed vacuum tested dial shall be provided to eliminate fogging.
- I. Low Fuel Level Switch – The low fuel level switch shall consist of a 50-watt float switch for remote or local annunciation of a (50% standard) low fuel level condition.

PART 3. INSTALLATION

3.01 GENERAL

- A. The Contractor shall install all equipment and appurtenances for a completely functional emergency backup system.

3.02 FINAL ACCEPTANCE

- A. Final acceptance will be given, if during this inspection, it is found that all work has been completed in accordance with the specifications and contract documents.
- B. Final payment will be made in accordance with the General Conditions after the Contractor has submitted his affidavit and completion certificate as outlined in the Special Conditions.

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SECTION 16400

AUTOMATIC TRANSFER SWITCH

PART 1. SCOPE

1.01 SUMMARY

- A. This Section includes transfer switches rated 600-V and less, including the following:
 - 1. Automatic transfer switches.
 - 2. Remote annunciation systems.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
 - 1. Technical data on all major components of all transfer switches and other products described in this section. Data is required for the transfer switch mechanism, control system, cabinet, and protective devices specifically listed for use with each transfer switch. Include steady state and fault current ratings, weights, operating characteristics, and furnished specialties and accessories.
 - 2. Single Line Diagram: Show connections between transfer switch, power sources and load.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
 - 1. Dimensioned outline drawings of assembly, including elevations, sections, and details including minimal clearances, conductor entry provisions, gutter space, installed features and devices and material lists for each switch specified.
 - 2. Internal electrical wiring and control drawings.
 - 3. Interconnection wiring diagrams, showing recommended conduit runs and point-to-point terminal connections to generator set.
 - 4. Installation and mounting instructions, including information for proper installation of equipment to meet seismic requirements.
- C. Manufacturer and Supplier Qualification Data
 - 1. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Features and operating sequences, both automatic and manual.
 - 2. List of all factory settings of relays, timers and protective devices; provide setting and calibration instructions where applicable.
- E. Warranty documents demonstrating compliance with the project's contract requirements.

1.03 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked as suitable for use in emergency, legally required or optional standby use as appropriate for the connected load.
- B. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:
 - 1. Transfer switches and enclosures shall be UL 1008 listed and labeled as suitable for use in emergency, legally required, and optional standby applications.
 - 2. CSA 282, Emergency Electrical Power Supply for Buildings, and CSA C22.2, No. 14-M91 Industrial Control Equipment.
 - 3. NFPA 70, National Electrical Code. Equipment shall be suitable for use in systems in compliance with Articles 700, 701 and 702.
 - 4. Comply with NEMA ICS 10-1993 AC Automatic Transfer Switches.
 - 5. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
 - 6. EN55011, Class B Radiated Emissions and Class B Conducted Emissions.
 - 7. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity.
 - 8. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity.
 - 9. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity.
 - 10. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity.
 - 11. IEC 1000-4-6 Conducted Field Immunity.
 - 12. IEC 1000-4-11 Voltage Dip Immunity.
 - 13. IEEE 62.41, AC Voltage Surge Immunity.
 - 14. IEEE 62.45, AC Voltage Surge Testing.
- C. Comply with NFPA 99 – Essential Electrical Systems for Healthcare Facilities
- D. Comply with NFPA 110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems, regardless of the actual circuit level.
- E. The manufacturer shall warrant the material and workmanship of the transfer switch equipment for a minimum of two (2) year from the warranty start date.
- F. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, and etc. during the minimum noted warranty period described above.

1.04 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:
1. Notify Owner no fewer than 3 days in advance of proposed interruption of electrical service.
 2. Do not proceed with interruption of electrical service without Owner's written permission.
 3. Do not energize any new service or distribution equipment without notification and permission of the Owner.

1.05 COORDINATION

- A. Size and location of concrete bases and anchor bolt inserts shall be coordinated. Concrete, reinforcement and formwork must meet the requirements specified in Division 03.

PART 2. PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cummins Power Generation.
 2. Kohler.
 3. Approved Equal.

2.02 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Provide transfer switches in the number and ratings that are shown on the drawings.
- B. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer.
- C. Fault-Current Closing and Withstand Ratings: UL 1008 WCR ratings must be specifically listed as meeting the requirements for use with protective devices at installation locations, under specified fault conditions. Withstand and closing ratings shall be based on use of the same set of contacts for the withstand test and the closing test.
- D. Solid-State Controls: All settings should be accurate to +/- 2% or better over an operating temperature range of - 40 to + 60°C (- 40 to + 140°F).
- E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- F. Electrical Operation: Accomplished by a non-fused, momentarily energized solenoid or electric motor operator mechanism, mechanically and electrically

interlocked in both directions (except that mechanical interlock is not required for closed transition switches).

- G. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
1. Switches using molded-case switches or circuit breakers, or insulated case circuit breaker components are not acceptable.
 2. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the Source 1 and Source 2 positions.
 3. Main switch contacts shall be high pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
 4. Contacts shall be operated by a high-speed electrical mechanism that causes contacts to open or close within three electrical cycles from signal.
 5. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.
 6. The transfer switch shall include the mechanical and control provisions necessary to allow the device to be field-configured for operating speed. Transfer switch operation with motor loads shall be as is recommended in NEMA MG1.
 - a. Phase angle monitoring/timing equipment is not an acceptable substitute for this functionality
 7. Transfer switches designated on the drawings as "3-pole" shall have a full current-rated neutral bar with lugs.
 8. Transfer switches designated on the drawings as "service entrance" switches shall meet the requirements of section "SERVICE ENTRANCE TRANSFER SWITCHES" of this specification.
- H. Factory wiring: Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.
- I. Terminals: Terminals shall be pressure type and appropriate for all field wiring. Control wiring shall be equipped with suitable lugs, for connection to terminal strips.
- J. Enclosures: All enclosures shall be third-party certified for compliance to NEMA ICS 6 and UL 508, unless otherwise indicated:
1. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70, regardless of the direction from which the conduit enters the enclosure.
 2. Exterior cabinet doors shall provide complete protection for the system's internal components. Doors must have permanently mounted key-type latches. Bolted covers or doors are not acceptable.
 3. Transfer switches shall be provided in enclosures that are third party certified for their intended environment per NEMA requirements.

2.03 AUTOMATIC TRANSFER SWITCHES

- A. Comply with requirements for Level 1 equipment according to NFPA 110.
- B. Indicated current ratings:
 - 1. Refer to the Project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
 - 2. Main contacts shall be rated for 600 VAC minimum.
 - 3. Transfer switches shall be rated to carry 100% of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60°C (-40 to +140°F), relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000 meters).
- C. Relay Signal: Control shall include provisions for addition of a pre-transfer relay signal, adjustable from 0 to 60 seconds, to be provided if necessary for elevator operation, based on equipment provided for the project.
- D. Transfer switches that are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.
- E. The transfer switch physically located closest to the generator and not more than 50-ft (15 meters) away, except those served by generator paralleling equipment, shall be provided with a battery charger suitable for the requirements of the application and in compliance with NFPA 110 requirements for Level 1 systems. If no transfer switch is located within this distance, a battery charger shall be installed on the generator set.
- F. Automatic Transfer Switch Control Features
 - 1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600 VAC. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
 - 2. All transfer switch sensing shall be configurable from an operator panel or from a Windows XP or later PC-based service tool. Designs utilizing DIP switches or other electromechanical devices are not acceptable.
 - 3. The transfer switch shall provide a relay contact signal prior to transfer or re-transfer. The time period before and after transfer shall be adjustable in a range of 0 to 60 seconds.
 - 4. The control system shall be designed and prototype tested for operation in ambient temperatures from - 40°C to + 60°C (- 40 to +140°F). It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.
 - 5. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.
 - 6. The transfer switch network monitoring equipment, when supplied, shall be provided with a battery-based auxiliary power supply to allow monitoring of the transfer switch when both AC power sources are non-operational.

- G. Transfer Switch Control Panel: The transfer switch shall have a microprocessor-based control with a sealed membrane panel incorporating pushbuttons for operator-controlled functions, and LED lamps for system status indicators. The panel shall also include an alphanumeric display for detailed system information. Panel display and indicating lamps shall include permanent labels.
1. The indicator panel LEDs shall display:
 - a. Which source the load is connected to (Source 1 or Source 2)
 - b. Which source or sources are available
 - c. When switch is not set for automatic operation, the control is disabled
 - d. When the switch is in test/exercise mode
 2. The indicator shall have pushbuttons that allow the operator to activate the following functions:
 - a. Activate pre-programmed test sequence
 - b. Override programmed delays, and immediately go to the next operation
 - c. Reset the control by clearing any faults
 - d. Test all of the LEDs by lighting them simultaneously
 3. The alphanumeric digital display shall be vacuum fluorescent-type, clearly visible in both bright sunlight and no-light conditions over an angle of 120°, and shall display the following:
 - a. AC voltage for all phases, normal and emergency
 - b. Source status: connected or not connected.
 4. The display panel shall be password-protected, and allow the operator to view and make adjustments:
 - a. Set nominal voltage and frequency for the transfer switch
 - b. Adjust voltage and frequency sensor operation set points
 - c. Set up time clock functions
 - d. Set up load sequence functions
 - e. Enable or disable control functions including program transition
 - f. View real-time clock data, operation log (hours connected, times transferred, failures) and service history
- H. Control Functions: Functions managed by the control shall include:
1. Software adjustable time delays:
 - a. Engine start (prevents nuisance genset starts in the event of momentary power fluctuation): 0 to 120 seconds (default 3 sec)
 - b. Transfer normal to emergency (allows genset to stabilize before load is transferred): 0 to 120 seconds (default 3 sec)
 - c. Re-transfer emergency to normal (allows utility to stabilize before load is transferred from genset): 0 to 30 minutes (default 3 sec)
 - d. Engine cooldown: 0 to 30 minutes (default 10 min)

- e. Programmed transition: 0 to 60 seconds (default 3 sec)
2. Voltage imbalance sensing:
 - a. Dropout: 2 to 10% (default 4%)
 - b. Pickup: 90% of dropout
 - c. Time delay: 2.0 to 20 seconds (default 5 sec)
 3. Phase rotation sensing:
 - a. Time delay: 100 msec
 4. Loss of single-phase detection:
 - a. Time delay: 100 msec
- I. Control features shall include:
 1. Programmable genset exerciser: A field-programmable control shall periodically start and run the generator with or without transferring the load for a preset time period, then re-transfer and shut down the generator after a preset cool-down period.
 2. In event of a loss of power to the control, all control settings, real-time clock setting and the engine start-time delay setting will be retained.
 3. The system continuously logs information including the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. An event recorder stores information, including time and date-stamp, for up to 50 events.
 4. Re-Transfer Inhibit Switch: Inhibits automatic re-transfer control so automatic transfer switch will remain connected to emergency power source as long as it is available regardless of condition of normal source.
 5. Transfer Inhibit Switch: Inhibits automatic transfer control so automatic transfer switch will remain connected to normal power source regardless of condition of emergency source.
 - J. Control Interface
 1. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10-amps 250 VAC.
 2. Unassigned Auxiliary Contacts: Two normally open, 1-pole, double-throw contacts for each switch position, rated 10A at 240 VAC.
 - K. Engine Starting Contacts
 1. One isolated and normally closed pair of contacts rated 10A at 32 VDC minimum.

2.04 SERVICE ENTRANCE TRANSFER SWITCHES

- A. Transfer switches must be specifically intended for service entrance applications, and labeled "Suitable for service entrance use only"
- B. Transfer switch shall meet NEC requirements for emergency, legally required and standby applications as specified in UL 1008.
- C. Entire transfer switch including enclosure must be listed and labeled to UL 1008; switches with only the mechanism listed are not acceptable.
- D. Molded case circuit breaker must be UL 489 listed.

2.5 REMOTE ANNUNCIATOR SYSTEM

- A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:
 - 1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
 - 2. Switch position.
 - 3. Switch in test mode.
 - 4. Failure of communication link.
- B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.
 - 1. Indicating Lights: Grouped for each transfer switch monitored.
 - 2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
 - 3. Switch in test mode.
 - 4. Lamp Test: Push-to-test or lamp-test switch on front panel.
- C. Malfunction of annunciator or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation.
- D. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation. The remote annunciation system shall not prevent transfer to the alternate source when the primary power source fails, nor prevent return to the primary source if the alternate source fails

PART 3. EXECUTION

3.01 INSTALLATION

- A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details.
- B. Floor-Mounting Switch: Anchor to floor by bolting.
 - 1. Floor-mounted transfer switches (except drawout switches supported by wheeled carriages, which must be rolled out at floor level) shall be mounted on concrete bases complying with the following requirements:

- a. Concrete Bases: 4" (100-mm) high, reinforced, with chamfered edges. Extend base no more than 4" (100-mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support.
- C. Annunciator Panel Mounting: Flush in wall, unless otherwise indicated.
- D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.02 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.
- C. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs shall be suitable for the number and size of conductors shown on the drawings.
- D. Ground equipment according to Electrical Specifications.

3.03 SOURCE QUALITY CONTROL

- A. Prior to shipping, factory shall test and inspect components, assembled switches, and associated equipment to ensure proper operation.
- B. Factory shall check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements.
- C. Factory shall perform dielectric strength test complying with NEMA ICS 1.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: The supplier of the transfer switch(es) and associated equipment shall inspect, test, and adjust components, assemblies, and equipment installations, including connections, and report results in writing.
- B. Manufacturer's representative shall perform tests and inspections and prepare test reports.
- C. After installing equipment and after electrical circuitry has been energized, installer shall test for compliance with requirements.
 - 1. Perform recommended installation tests as recommended in manufacturer's installation and service manuals.
 - 2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch.
 - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Verify time-delay settings.
 - c. Verify that the transfer switch is accurately metering AC voltage.

- d. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

3.05 DEMONSTRATION

- A. After generator set installation, the generator and transfer switch supplier shall conduct a complete operation, basic maintenance, and emergency service seminar covering generator set and transfer switch equipment, for up to 10 people employed by the Owner.
 1. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service and maintenance tools provided under this contract, and emergency operation procedures.
 2. The class duration shall be at least 8-hours in length, and include practical operation with the installed equipment.

3.06 SERVICE AND SUPPORT

- A. The manufacturer shall supply the Service Provider with a complete set of the service and maintenance software required to support the product. The software shall be provided at a training class attended by the user, to qualify the user in proper use of the software. The software shall have the following features and capabilities:
 1. The software shall allow adjustment of all functions described herein, adjustment of operating levels of all protective functions, and programming of all optional functions in the controller. Adjustments shall be possible over modem from a facility that is remote from the generator set.
 2. The software shall be capable of storing and displaying data for any function monitored by the generator set control. This data shall be available in common file formats, and on graphical "strip chart" displays.
 3. The software shall automatically record all control operations and adjustments performed by any operator or software user, for tracking of changes to the control.
 4. The software shall display all warning, shutdown, and status changes programmed into transfer switch controller. For each event, the control shall provide information on the nature of the event, when it last occurred, and how many times it has occurred.
- B. 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 Drawings and specified herein.
- C. All equipment shall be new and of current production by a firm which manufactures the generator and controls.

END OF SECTION