

# MCE McCLELLAND CONSULTING ENGINEERS, INC.

DESIGNED TO SERVE

900 West Markham Street • P.O. Box 34087  
 Little Rock, Arkansas 72203-4087  
 P: 501-371-0272 • F: 501-371-9932

## LETTER OF TRANSMITTAL

DATE: 4-21-15	JOB No. 14-5799
ATTENTION: Ms. Eleanor Goins	
RE: Mountain View WWTP (AR0020117)	
Digester Conversion	

TO: Ms. Eleanor Goins, PE
ADEQ Water Division

### PLEASE NOTE:

WE ARE SENDING YOU

☐ Shop Drawings

☐ Copy of Letter

☒

Attached

☐ Prints

☐

Change Order

☐

Under separate cover via \_\_\_\_\_ the following items:

☐ Plans

☐

Samples

☐

Specifications

COPIES	DATE	NUMBER	DESCRIPTION
1	4/15/15		Form 1 w/ calculations, maps and drawings
1	4/15/15		General Facility Information
1	4/15/15		Plans
1	4/15/15		Specifications

### THESE ARE TRANSMITTED as checked below:

<input checked="" type="checkbox"/> For Approval	<input type="checkbox"/> Approved as Submitted	<input type="checkbox"/> Resubmit _____ Copies for Approval
<input type="checkbox"/> For Your Use	<input type="checkbox"/> Approved as Noted	<input checked="" type="checkbox"/> Submit <u>3</u> Copies for Distribution
<input type="checkbox"/> As Requested	<input type="checkbox"/> Returned for Corrections	<input type="checkbox"/> Return _____ Corrected Prints
<input type="checkbox"/> For Review and Comment	<input type="checkbox"/> Reviewed with Notes	
<input type="checkbox"/> FOR BIDS DUE _____ 20____	<input type="checkbox"/> PRINTS RETURNED AFTER LOAN TO US	

REMARKS: Please find attached the documents for Mountain View WWTP digester conversion.

COPY TO:

RECEIVED

APR 21 2015

Ha 2:32

SIGNED:



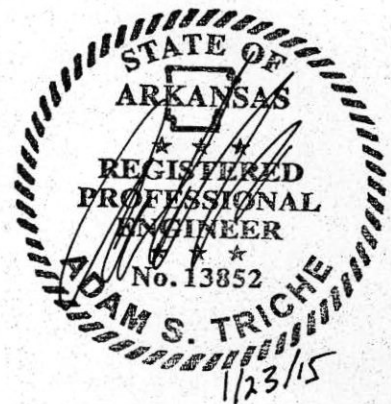
If enclosures are not as noted, kindly notify us at once.

# PROJECT MANUAL

## MOUNTAIN VIEW WASTEWATER TREATMENT PLANT DIGESTER CONVERSION



JANUARY, 2015



MCE PROJECT NO. LR14-5799

**MCE** McCLELLAND  
CONSULTING  
ENGINEERS, INC.  
DESIGNED TO SERVE

NPDES PERMIT APPLICATION  
**FORM 1**

ARKANSAS DEPARTMENT OF ENVIRONMENTAL QUALITY  
WATER DIVISION  
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 (who has ultimate decision making responsibility over the operation of a facility or activity):

Mountain View WWTP

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

2. Operator Type: Private ☐ State ☐ Federal ☐ Partnership ☐ Corporation ☐ Other ☒

State of Incorporation: \_\_\_\_\_

3. Facility Name: City of Mountain View Wastewater Treatment Plant

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

5. NPDES Permit Number (If Applicable): AR0020117

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

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

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:

Permit Name

Permit Number

Held by

9. Give driving directions to the wastewater treatment plant with respect to known landmarks:  
Turn west from Montain View Hwy 66. Go 1.5 miles to Westwood Ave. Turn north onto Westwood Ave. Go 0.25 miles to the plant entrance.

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

Street: 340 Westwood Ave.

City: Mountain View

County: Stone

State: AR

Zip: 72560

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

Name: Joe Thatcher Title: Wastewater Manager  
Street: \_\_\_\_\_ P.O. Box 360  
City: Mountain View State: AR Zip: 72560  
E-mail address\*: \_\_\_\_\_ Fax: 870-269-3293

\* 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

9121 SIC Facility Activity under this SIC or NAICS:  
92112 NAICS \_\_\_\_\_

14. Design Flow: 0.74 MGD Highest Monthly Average of the last two years Flow: 1.07 MGD

15. Is Outfall equipped with a diffuser? ☐ Yes ☒ No

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

Name: Don Smith Title: Water/Wastewater Superintendent  
Address: P.O. Box 360 Phone Number: 870-269-3778  
E-mail Address: cityhall@mtnviewcity.com  
City: Mountain View State: AR Zip: 72560

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

Name: Joe Thatcher Title: WWTP Manager  
Address: P.O. Box 360 Phone Number: 870-269-3293  
E-mail Address: \_\_\_\_\_  
City: Mountain View State: AR Zip: 72560

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

Contact Name: Adam Triche  
Company Name: McClelland Consulting Engineers  
Address: P.O. Box 34087 Phone Number: 501-371-0272  
E-mail Address: atrich@McClelland-Engrs.com  
City: Little Rock State: AR Zip: 72201

19. Wastewater Operator Information

Wastewater Operator Name: Joe Thatcher License number: 01463  
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 **front door (Gate)** location of the facility):

Lat: 35 ° 51 ' 59.48 " Long: -92 ° 08 ' 53.83 " County: Stone Nearest Town: Mountain View

2. **Outfall** Location (The location of the end of the pipe Discharge point.):

**Outfall No. 001:**

Latitude: 35 ° 51 ' 57.32 " Longitude: -92 ° 08 ' 42.52 "

Where is the collection point? \_\_\_\_\_

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

Hughes Creek, then to Like Fork Creek, then to South Sylamore Creek, then to WhiteRiver (Segment 4F of the White River Basin)

**Outfall No. \_\_\_\_\_:**

Latitude: \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ " Longitude: \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ "

Where is the collection point? \_\_\_\_\_

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

3. **Monitoring** Location (If the monitoring is conducted at a location different than the above **Outfall** location):

**Outfall No. \_\_\_\_\_:**

Lat: \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ " Long: \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ "

**Outfall No. \_\_\_\_\_:**

Lat: \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ " Long: \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ "

**Outfall No. \_\_\_\_\_:**

Lat: \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ " Long: \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ "

4. Type of Treatment system (Included all components of treatment system and Attach the process flow diagram):

Extended areation system-components: initial screening, extended aeration in oxidation ditch, final clarifier, and disinfection by UV

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

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

6. 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](http://www.fema.gov).

If "No", what measures are (or will be) used to protect the facility? All facilities are outside of Area A flood zone.

7. Population for Municipal and Domestic Sewer Systems: 3680

8. Backup Power Generation for Treatment Plants

Are there any permanent backup generators? Yes ☒ No ☐

If Yes, How many? 1 Total Horespower (hp)? 490

If No, Please explain? \_\_\_\_\_

## SECTION C – WASTE STORAGE AND DISPOSAL INFORMATION

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

☒ **Landfill**

Landfill Site Name Nabors Sanitation, Inc

ADEQ Solid Waste Permit No. S-249

☐ **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 (Lagooning):**

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): \_\_\_\_\_

## SECTION D - WATER SUPPLY

Water Sources (check as many as are applicable):

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

☐ **Municipal Water Utility** (Specify City): Star City

Distance from Discharge point: ☒ Within 5 miles ☐ Within 50 miles

☒ **Surface Water**- Name of Surface Water Source: White River

Distance from Discharge point: ☐ ☐ ☐ Within 5 miles ☒ Within 50 miles

Lat: 35 ° 55 ' 30.2 " Long: -92 ° 05 ' 30.48 "

☐ **Other** (Specify): \_\_\_\_\_

Distance from Discharge point: ☐ ☐ ☐ Within 5 miles ☐ Within 50 miles

## 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):

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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.

## SECTION G - WASTEWATER DISCHARGE INFORMATION

Facilities that checked "Yes" in question 1 of Section F are considered Categorical Industrial Users and should skip to question 2.

1. **For Non-Categorical Users Only:** List average wastewater discharge, maximum discharge, and type of discharge (batch, continuous, or both), for each plant process. Include the reference number from the process flow schematic (reference Figure 1) that corresponds to each process. [New facilities should provide estimates for each discharge.]

No.	Process Description	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: \_\_\_\_\_

**Answer questions 2, 3, and 4 only if you are subject to Categorical Standards.**

2. For Categorical Users: Provide the wastewater discharge flows for each of your processes or proposed processes. Include the reference number from the process flow schematic (reference Figure 1) that corresponds to each process. [Note: 1) New facilities should provide estimates for each discharge and 2) Facilities should denote whether the flow was measured or estimated.]

No.	Regulated Process	Average Flow (GPD)	Maximum Flow (GPD)	Type of Discharge (batch, continuous, none)

No.	Unregulated Process	Average Flow (GPD)	Maximum Flow (GPD)	Type of Discharge (batch, continuous, none)





## 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 treatment system. Include the types of control equipment to be installed along with their methods of operation and control efficiency.

Conversion of existing Anerobic digester to Aerobic digester by means of:

Jet Aeration with PD blowers, submersible pump mixing and ORP controls.

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. 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 ADEQ.

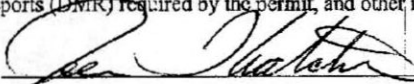
**SECTION I: SIGNATORY REQUIREMENTS****Cognizant Official (Duly Authorized Representative)**

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 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: 4-21-15

Printed name of Cognizant Official:

Joe Thatcher

Official title of Cognizant Official:

WWTP Manager

Telephone Number: 870-269-3293

**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.

JS (Initial) "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 Department considers the applicant to be the responsible official for the facility and only reports, etc., signed by the applicant will be accepted by the Department.

JS (Initial) "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: 4-15-15

Printed name of Responsible Official:

Don Smith

Official title of Responsible Official:

Water/Wastewater Superintendent

Telephone Number: 870-269-3778

Mountain View WWTP

MCE Job No. LR 14-5799

Digester conversion to aerobic process

February 18, 2015

Sludge treatment will be accomplished by converting an existing anaerobic digestion chamber to aerobic sludge stabilization for Class B sludge suitable for land application in accordance with Title 40 of the Code of Federal Regulations (CFR) Part 503. The sludge treatment option is for "Pollution Concentration Biosolids" with a pathogen reduction achieved by monitoring of indicator organisms (geometric mean fecal coliform density less than 2,000,000 colony forming units (CFU) or most probable number (MPN) per gram of biosolids (dry weight basis) and vector attraction achieved by meeting a specific oxygen uptake rate (equal to or less than 1.5 milligrams of oxygen per hour per gram of total biosolids (dry weight basis) at 20° C.)

Determine sludge volume requirement:

Existing Digester volume: using a SWD of 24 feet (HWL) of 23.0 feet with a 35 feet diameter = **22,128.6 cubic feet = 165,521.9 gallons (at maximum overflow elevation)**

Ten State Standards (2004) require that digester capacity is based on solids concentration of 2 percent with supernatant separation in a separate tank. If supernatant is performed in the digestion tank, a minimum of 25 percent additional volume is required.

Ten State Standards 85.31 Volume Required

	Volume/Population Equivalent
Sludge source	ft <sup>3</sup> /P.E.
Extended Aeration activated sludge	3.0
Mountain View Population = 2748	
2748 people X 3.0 ft <sup>3</sup> = 8,244ft <sup>3</sup> required + 25% = 2,061.0ft <sup>3</sup> = <b>10,305.0ft<sup>3</sup> required</b>	
Existing Digester capacity = 22,128.6 ft <sup>3</sup> > 10,305.0ft <sup>3</sup>	
Existing digester volume large enough for 22,128.6 – 25% = 5532.2 = 16,596.0/3.0ft <sup>3</sup> = <b>5,532PE</b>	

2748 people X 100 gallons/day = 274,800 gpd

Use:

Average Flow = 0.27 MGD

Peak Flow = 0.55 MGD

BOD5 = 200

TSS = 200

- Digester volume required By Ten State Standards Section 85.31 Tank Volume

Using 274,800 gpd flow and using BOD of 200 mg/L

Influent BOD<sub>5</sub> = 200 mg/l x 8.34 x 0.27 mgd = 450.4 lbs. /day

BOD<sub>5</sub> removed = (200-10) x 8.34 x 0.27 mgd = 427.8 lbs. /day

Sludge produced = 427.8 x 0.5 lbs. produced/ day per lb. / removed = 213.92lbs/day

TSS removed - (200-15) x 8.34 x 0.27 mgd = 416.6 lbs. /day

Total sludge = 213.9 + 416.6 = 630.5 lbs. /day

Using 1% solids for sludge = 630.5 / (8.34 x 0.01) = 7,559.9gpd

Digester criteria are:

7,560 gpd

Using 15 day detention time = 7,560 x 15 = 113,400.0 gal = 15,160.4 ft<sup>3</sup>

Total volume required = 15,160.4ft<sup>3</sup> + 25 % (no primary settling) 3,790.1 ft<sup>3</sup>= **18,950.5 ft<sup>3</sup>**

Existing Anaerobic Digester dimensions = 35 feet diameter = 17.5 feet radius, SWD = 24 feet to 23 feet HWL. Maximum Volume = 17.5<sup>2</sup> x 3.1416 (π) x 23.0' HWL = **22,128.6 ft<sup>3</sup>**

>18,950.5ft<sup>3</sup>

**Digester has 1.167 safety factor using 1% solids for sludge.**

Using 2% solids for sludge = 630.5 / (8.34 x 0.02) = 3,779.9gpd

Digester criteria are:

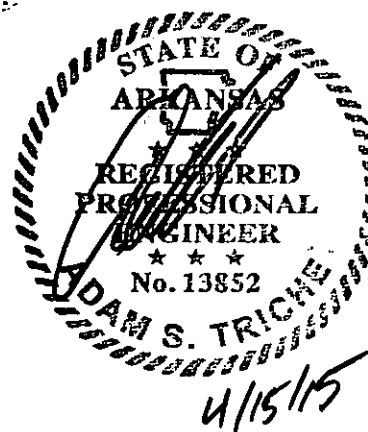
3,780.0 gpd

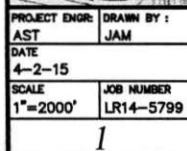
Using 15 day detention time = 3780.0 x 15 = 56,700.0 gal = 7,580.2 ft<sup>3</sup>

Total volume required = 7,580.2ft<sup>3</sup> + 25 % (no primary settling) 1,895.0 ft<sup>3</sup>= **9,475.2 ft<sup>3</sup>**

Existing Digester dimensions = 35 feet diameter = 17.5 feet radius, SWD = 24 feet to HWL 23 feet. Maximum Volume = 17.5<sup>2</sup> x 3.1416 (π) x 23.0' HWL = **22,128.6 ft<sup>3</sup>** > 9,475.2 ft<sup>3</sup>

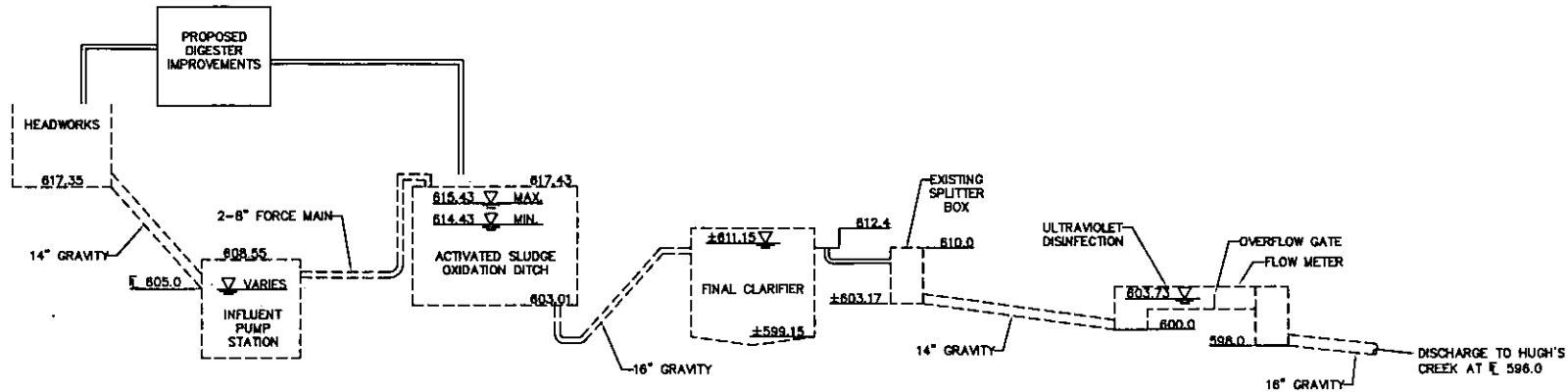
**Digester has 2.33 safety factor using 2% solids for sludge.**



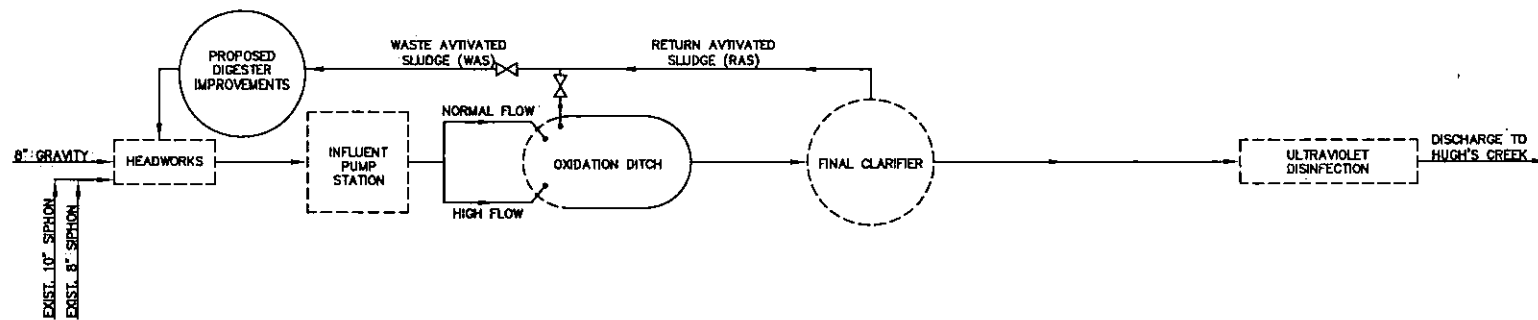


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HYDRAULIC PROFILE  
N.T.S.



FLOW SCHEMATIC  
N.T.S.

HYDRAULIC PROFILE

WWTP MOUNTAIN VIEW, AR

PROJECT ENGINEER	DATE	SCALE	JOB NUMBER
AM	4-5-15	N.T.S.	LR14-5799
DRAWN BY:			
JAM			





PROJECT ENGR:	DRAWN BY :
AST	JAM
DATE	
4-3-15	
SCALE	JOB NUMBER
1"=1000'	LR14-5799
1	

## Wastewater Plant Facilities

### Mt. View WWTP

**MCE** McCLELLAND  
CONSULTING  
ENGINEERS, INC.

DESIGNED TO SERVE  
900 West Markham 1810 N. College  
Little Rock, Arkansas 72201 Fayetteville, Arkansas 72702  
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Fax # 501.371.9932 Fax # 479.443.9241  
[HTTP://WWW.MCCLELLAND-ENGRS.COM/COMPANY/](http://www.mcclelland-engineers.com/company/)



ATTACHMENT 1  
GENERAL FACILITY INFORMATION

City of Mountain View Wastewater Treatment Plant

1. Facility Name:

2. Type of Facility: Domestic wastewater treatment facility

3. Population Served:

Present: 2748 Design: 0.75 mgd

4. Flow:

	Present	Design
Average	0.48 MGD	0.27 MGD
Maximum	0.72 MGD	0.55 MGD
Peak		

5. Water Quality:

Assumed ☐ Actual ☒ Source: \_\_\_\_\_

Influent:			Effluent:	
BOD5		mg/l	4.90	mg/l
TSS		mg/l	3.70	mg/l
NH3-N		mg/l		mg/l

Basis for Assumptions, if made:

\_\_\_\_\_

6. Is the system above the 100-year flood plain? Yes ☐ No ☒

7. List Treatment System:

a. Existing:

- |                                |                              |
|--------------------------------|------------------------------|
| 1. <u>Headworks</u>            | 5. <u>Digester</u>           |
| 2. <u>Influent Pumpstation</u> | 6. <u>Final Clairfier</u>    |
| 3. <u>Oxidation Ditch</u>      | 7. <u>UV Disinfection</u>    |
| 4. <u>WAS Pump to Digester</u> | 8. <u>Discharge to Creek</u> |

b. Proposed:

- |                                |                                     |
|--------------------------------|-------------------------------------|
| 1. <u>Headworks</u>            | 5. <u>Digester (rehabilitation)</u> |
| 2. <u>Influent Pumpstation</u> | 6. <u>Final Clairfier</u>           |
| 3. <u>Oxidation Ditch</u>      | 7. <u>UV Disinfection</u>           |
| 4. <u>WAS Pump to Digester</u> | 8. <u>Discharge to Creek</u>        |

ATTACHMENT 2  
FLOW MEASUREMENT, SCREENING AND GRIT REMOVAL

A. Flow Measurement

1. Type Metering Device: \_\_\_\_\_
2. Location: Influent \_\_\_\_\_ Effluent downstream from UV
3. Indicating and Recording Mechanism: \_\_\_\_\_

B. Bar Screen

1. Area: Total \_\_\_\_\_ ft<sup>2</sup>      Effective \_\_\_\_\_ ft<sup>2</sup>.
2. Space Between Bars: \_\_\_\_\_ inches
3. Velocity: \_\_\_\_\_ ft/s    4. Slope of Screen: \_\_\_\_\_
5. Is Drainage Platform Provided?    Yes ☐      No ☐
6. Method of Cleaning:    Manual ☐      Mechanical ☐
7. Mechanical Screen:  
Capacity \_\_\_\_\_ MDG      Type \_\_\_\_\_
8. Auxiliary Bar Screen:    Yes ☐      No ☒

C. Comminutoring Device

1. Location \_\_\_\_\_
2. Size: \_\_\_\_\_ inches    3. Capacity: \_\_\_\_\_ MGD
2. Auxiliary Bar Screen:    Yes ☐      No ☐

D. Grit Chamber

1. No. of Chambers \_\_\_\_\_
2. Type \_\_\_\_\_
3. Cross Section Area:  
Each \_\_\_\_\_ ft<sup>2</sup>      Total \_\_\_\_\_ ft<sup>2</sup>      Length \_\_\_\_\_ ft  
Width \_\_\_\_\_ ft      Diameter \_\_\_\_\_ ft
4. Calculated Velocity of Flow \_\_\_\_\_ ft/s
5. Method of Cleaning:      Manual ☐      Mechanical ☐
6. Surge prevention:      Yes ☐      No ☐
7. Method of Velocity Control \_\_\_\_\_
8. Detention Period:  
Present \_\_\_\_\_ Seconds      Design \_\_\_\_\_ Seconds
9. Drain Provided:      Yes ☐      No ☐

ATTACHMENT 3  
ACTIVATED SLUDGE

1. Process:

Conventional ☐      Contact Stabilization ☐      Extended Aeration ☐  
Sequence Batch Reactor ☐      Step Aeration ☐      Complete Mix ☐  
Other \_\_\_\_\_

2. Number of Tanks: \_\_\_\_\_ 3. Are all tanks same size? Yes ☐ No ☐

4. Shape of Tank: \_\_\_\_\_ 5. Are waterstops provided? Yes ☐ No ☐

5. Inside Dimensions of Each Tank (ft):

Length \_\_\_\_\_ Width \_\_\_\_\_ Depth \_\_\_\_\_ Diameter \_\_\_\_\_

6. Effective Volume of each Tank: \_\_\_\_\_ gallons

7. Total Tank Volume: \_\_\_\_\_ gallons

8. Recirculation Rate: \_\_\_\_\_ MGD

9. Design Flow (including recirculation): \_\_\_\_\_ MGD

10. Percentage of Daily Flow of Return Sludge to Tank: \_\_\_\_\_

11. Detention Time: \_\_\_\_\_ minutes

12. Aeration Tank Organic Loading: \_\_\_\_\_ lb BOD<sub>5</sub>/day/1000ft<sup>3</sup>

13. F/M Ratio: \_\_\_\_\_ lb BOD<sub>5</sub>/day/ lb MLVSS

14. MLSS: \_\_\_\_\_ mg/L Assumed ☒ or Actual ☐

15. MLVSS/MLSS Ratio: \_\_\_\_\_

16. Are the inlets and outlets for each aeration tank suitably equipped to permit controlling the flow to any unit and to maintain reasonably constant liquid levels?  
Yes ☐ No ☐

17. Freeboard in Aeration Tanks (minimum 24 inches): 24 inches

18. Is the type of aeration system able to provide the necessary oxygen requirements?  
Yes ☐ No ☐



19. Sludge Return Pumps:

Number Pumps: \_\_\_\_\_ Type: \_\_\_\_\_ Capacity Each: \_\_\_\_\_ gpm

Total Capacity: \_\_\_\_\_ gpm Rated Heads: \_\_\_\_\_ ft

Computed Heads: \_\_\_\_\_ ft

20. Sequence Batch Reactors **Only**:

Cycle Duration: \_\_\_\_\_ minutes Mixing Duration: \_\_\_\_\_ minutes

Low water level: \_\_\_\_\_ ft High water level: \_\_\_\_\_ ft

Hydraulic Retention Time: \_\_\_\_\_ minutes

ATTACHMENT 4  
AERATION SYSTEM

1. Required Air: \_\_\_\_\_ ft<sup>3</sup>/lb BOD<sub>5</sub>/day
2. Furnished Air: \_\_\_\_\_ ft<sup>3</sup>/ lb BOD<sub>5</sub>/day
3. Type of System: Diffused Air ☐ Mechanical ☐
4. Diffused Air Equipment:

Number Blowers \_\_\_\_\_ Capacity of each \_\_\_\_\_ ft<sup>3</sup>/m

Total Capacity of Blowers \_\_\_\_\_ ft<sup>3</sup>/m

Diffusers: Plates ☐ Fixed Tubes ☐ Swing Diffusers ☐  
Impingement Aerator ☐ Jet Aerator ☐

5. Mechanical Aeration Equipment:

Number Units \_\_\_\_\_ Type of Unit \_\_\_\_\_

Capacity of Each Unit \_\_\_\_\_ hP

Operated Intermittently by Clock Time? Yes ☐ No ☐

ATTACHMENT 5  
LAGOONS

1. Type: Controlled Discharge Facultative Lagoon System ☐  
Flow-Through Facultative Lagoon System ☐  
Aerated Lagoon System ☐  
Combination \_\_\_\_\_

2. Number of Ponds: \_\_\_\_\_ 3. Number of Cells per Pond: \_\_\_\_\_

4. Ponds in Series or Parallel Operation: \_\_\_\_\_

5. Pond/Cell Depth (ft):

Pond Number	Maximum	Minimum	Average
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____

6. Freeboard of Each Pond (ft):

Pond 1: \_\_\_\_\_ Pond 2: \_\_\_\_\_ Pond 3: \_\_\_\_\_

7. Pond/Cell Width (ft):

Pond Number	Maximum	Minimum	Average
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____

8. Pond/Cell Length (ft):

Pond Number	Maximum	Minimum	Average
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____

9. Volume of Each Pond/Cell (gallons):

Pond Number	At Maximum Depth	At Minimum Depth	At Average Depth
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____

7. BOD Loading of Each Pond/Cell (mg/l):

Pond Number	Present	Design
1	<hr/>	<hr/>
2	<hr/>	<hr/>
3	<hr/>	<hr/>

8. Retention Time at Average Depth (minutes):

Pond Number	Present	Design
1	<hr/>	<hr/>
2	<hr/>	<hr/>
3	<hr/>	<hr/>

9. Liner Material of Each Pond:

Pond 1: \_\_\_\_\_ Pond 2: \_\_\_\_\_ Pond 3: \_\_\_\_\_

10. If synthetic liner, how is liner attached? Is liner vented?

\_\_\_\_\_

12. How is the bank protected?

\_\_\_\_\_

13. Slope of internal banks: \_\_\_\_\_

14. Outlet

Adjustable: Yes ☐ No ☐ Height above bottom of Pond: \_\_\_\_\_ ft

15. Is lagoon aerated? Yes ☐ No ☐

ATTACHMENT 6  
RECIRCULATING SAND FILTER

1. Type of Pretreatment: \_\_\_\_\_
2. Filter Media:  
Material \_\_\_\_\_ Effective Size \_\_\_\_\_ mm  
Uniformity Coefficient \_\_\_\_\_ Depth \_\_\_\_\_ ft
3. Underdrains:  
Type \_\_\_\_\_ Slope \_\_\_\_\_ Bedding \_\_\_\_\_
4. Hydraulic Loading: \_\_\_\_\_ gpd/ft<sup>2</sup>
5. Organic Loading: \_\_\_\_\_ lb/day/ft<sup>2</sup>
6. Recirculation Ratio: \_\_\_\_\_
7. Recirculation Tanks:  
Volume \_\_\_\_\_ gallons Number of Tanks \_\_\_\_\_
8. Dosing:  
Time On \_\_\_\_\_ minutes Time Off \_\_\_\_\_ minutes  
Frequency \_\_\_\_\_ Volume/orifice \_\_\_\_\_ gallons/orifice

ATTACHMENT 7  
CLARIFIERS

1. Type: \_\_\_\_\_
2. Number of Tanks: \_\_\_\_\_
3. Surface Dimensions (ft):  
Width \_\_\_\_\_ Length \_\_\_\_\_ Diameter \_\_\_\_\_
4. Sidewall Depth: \_\_\_\_\_ ft
5. Detention Period (minutes):  
At design flow \_\_\_\_\_ At peak flow \_\_\_\_\_
6. Overflow Rate (gpd/ft<sup>2</sup>):  
At design flow \_\_\_\_\_ At peak flow \_\_\_\_\_
7. Surface Area: \_\_\_\_\_ ft<sup>2</sup>



ATTACHMENT 8  
SLUDGE TREATMENT

A. Sludge Digestion Tanks

1. Number of Units 1      2. Type Aerobic Digester
3. Capacity: 165,522 gal      4. Single or Two Stage: Single
5. Type of Cover: none      6. Is Tank Insulated? Yes ☐ No ☒
7. Heating (pipe coils): Diameter of Pipes: N/A inches  
Total Surface Area: N/A ft<sup>2</sup>
8. Heating (heat exchanger): Capacity of unit N/A
9. Is there a cross connection between the liquor selector flushing line and the drinking water supply? Yes ☐ No ☒
10. Thermometers: Yes ☐ No ☒      11. Flame or Drip Traps: N/A
12. Waste Burner: Yes ☐ No ☒      13. Manholes in Cover: Yes ☐ No ☒
14. Supernatant Outlets: Yes ☒ No ☐
15. Disposal of Supernatant: return to headworks
16. Provisions for Recirculation of Sludge? Yes ☒ No ☐
17. Provisions for Sampling? Yes ☒ No ☐
18. Sludge Removal Lines: Yes ☒ No ☐
19. Explosion Proof switches, fixtures: Yes ☒ No ☐
20. Disposal of Wet Sludge: drying beds

B. Sludge Drying Beds

1. Number Units: \_\_\_\_\_ 2. Required Area: \_\_\_\_\_ ft<sup>2</sup>
3. Area Each Bed: \_\_\_\_\_ ft<sup>2</sup> 4. Total Area: \_\_\_\_\_ ft<sup>2</sup>
4. Area per Capita: Present \_\_\_\_\_ ft<sup>2</sup> Design \_\_\_\_\_ ft<sup>2</sup>

5. Gravel:  
Layer Depths: \_\_\_\_\_ ft, \_\_\_\_\_ ft \_\_\_\_\_ ft  
Sizes: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
6. Sand: Depth \_\_\_\_\_ ft Size \_\_\_\_\_
7. Underdrains: Size \_\_\_\_\_ Spaced \_\_\_\_\_
8. Freeboard above Sand: \_\_\_\_\_ ft
9. Slope of Delivery Pipe: \_\_\_\_\_
10. Suitable Splash Plate: Yes ☐ No ☐
11. Disposal of Sludge Bed Drainage: \_\_\_\_\_
12. Disposal of Dry Sludge: \_\_\_\_\_

ATTACHMENT 9  
DISINFECTION

A. CHLORINATION

1. Type of Chlorination: Tablet ☒ Gas ☐
2. Capacity: \_\_\_\_\_ #/24 hr      3. Location: \_\_\_\_\_
4. Ventilation: Yes ☐ No ☐
5. Point of Application in Process: \_\_\_\_\_
5. Contact Chamber:  
Design Flow \_\_\_\_\_ MGD      Peak Flow \_\_\_\_\_ MGD  
Volume \_\_\_\_\_ gallons  
  
Inside Dimensions (ft)  
Length \_\_\_\_\_ Width \_\_\_\_\_ Depth \_\_\_\_\_ Diameter v  
  
Detention Time \_\_\_\_\_ minutes      Drain Provided? Yes ☐ No ☐
6. Scum Baffle: Yes ☐ No ☐
7. Point of Application: \_\_\_\_\_

B. ULTRA VIOLET

1. Design Flow : \_\_\_\_\_ MGD      2. Peak Flow: v MGD
3. Number of Channels: \_\_\_\_\_      4. Number of Banks per Channel: \_\_\_\_\_
5. Space between lamps: \_\_\_\_\_ inches
6. UV Radiation Dosage: \_\_\_\_\_ mW s/cm<sup>2</sup>

ATTACHMENT 10  
FLOW EQUALIZATION

1. Use: \_\_\_\_\_
2. Location in process: \_\_\_\_\_
3. Type: \_\_\_\_\_
4. Shape: \_\_\_\_\_
5. Dimensions (ft):  
Width \_\_\_\_\_ Length \_\_\_\_\_ Diameter \_\_\_\_\_ Depth \_\_\_\_\_
6. Effective Volume: \_\_\_\_\_ gallons
7. Will excess flow being diverted to the equalization basin undergo preliminary treatment first? Yes ☐ No ☐
8. Is aeration or mechanical equipment used for mixing? Yes ☐ No ☐

ATTACHMENT 11  
PRIMARY SEDIMENTATION

A. Settling Tanks:

1. Type: \_\_\_\_\_ 2. Number of units: \_\_\_\_\_
3. Dimensions: (ft)  
Width \_\_\_\_\_ Length \_\_\_\_\_ Diameter \_\_\_\_\_ Depth \_\_\_\_\_  
Surface Loading: \_\_\_\_\_ gpd/ft<sup>2</sup>
6. Overflow Rate: \_\_\_\_\_ gpd/ ft. weir
7. Design of inlet and outlet baffles: \_\_\_\_\_
8. Design for skimming: \_\_\_\_\_
9. Disposal of scum: \_\_\_\_\_
10. Diameter sludge pipes: \_\_\_\_\_ inches
11. Provision for flushing and draining sludge lines? Yes ☐ No ☐

B. Other:

Describe the type of primary sedimentation provided in detail. Provide pertinent design information and details.

\_\_\_\_\_

# ATTACHMENT 12 TRICKLING FILTERS

## A. High Rate:

### 1. Dimensions (ft):

Width

Length

Diameter

Depth

First Stage

Second Stage

### 2. Area (ft<sup>3</sup>):

### 3. Recirculation:

Ratio

How Controlled?

How Measured?

Where returned?

### 3. Organic Loading (lb BOD/Ac-ft./day):

### 5. Hydraulic Loading (Mg/Ac/day):

### 6. Type of distributor:

### 7. Dosing Method:

### 8. Minimum Head On Distributor Arms (ft):

### 9. Size Filter Rock (inches):

### 10. Sodium Sulfate Cycle Test

### 11. Provision for ventilation?

Yes ☐

No ☐

Yes ☐

No ☐

### 12. Provision for flooding?

Yes ☐

No ☐

Yes ☐

No ☐

### 13. Filter efficiency, after settling %:

B. Standard Rate:

1. Dimensions (ft):  
Width \_\_\_\_\_ Length \_\_\_\_\_ Diameter \_\_\_\_\_ Depth \_\_\_\_\_
2. Area: \_\_\_\_\_ ft<sup>3</sup>
2. Organic Loading: \_\_\_\_\_ ( lb BOD/Ac-ft./day)
3. Hydraulic Loading: \_\_\_\_\_ (MGD/Ac)
4. Type of distributor: \_\_\_\_\_
5. Dosing Method: \_\_\_\_\_
6. Detention Time in Dosing Tank: \_\_\_\_\_ minutes
7. Is Siphon Capacity Adequate? Yes ☐ No ☐
8. Minimum Head on Distributor Arms: \_\_\_\_\_ ft
9. Size Filter Rock: \_\_\_\_\_ inches
10. Sodium Sulfate Cycle Test: \_\_\_\_\_
11. Provision for Ventilation: Yes ☐ No ☐
12. Provision for flooding: Yes ☐ No ☐
13. Provision for Recirculation: Yes ☐ No ☐

**REQUEST FOR CHANGE OF AUTHORIZATION  
(CERTIFICATION AND SIGNATORY REQUIREMENTS)**NPDES Permit Number: AR0020117Facility Name: Mountain View WWTP

Type of Change: ☐ New Cognizant Official (or duly authorized representative) (sections 1 and 2)  
(check one) ☒ New Responsible Official (complete section 2 only)  
☐ Both (sections 1 and 2)

**NEW COGNIZANT OFFICIAL** (or duly authorized representative) (See 122.22(b); the individual, authorized by the ranking official in writing, as having responsibility for the overall operation of the regulated facility or activity responsibility, or having overall responsibility for environmental matters for the company.)

The ranking official hereby designates the following individual as the cognizant official, (duly authorized representative), for signing the permit required reports, etc., including Discharge Monitoring Reports (DMR) required by the permit, and other information requested by the Director:

\_\_\_\_\_  
Signature of the Cognizant Official (Duly Authorized Representative)

\_\_\_\_\_  
Name (First Name, MI, Last Name) Typed or Printed

\_\_\_\_\_  
Mailing Address

\_\_\_\_\_  
City, State, and Zip

\_\_\_\_\_  
Title

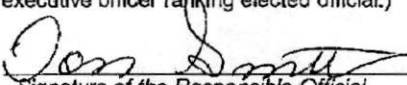
( )  
A/C Phone

\_\_\_\_\_  
Fax

\_\_\_\_\_  
Email Address:

By signature below, the responsible official certifies that the above named individual is qualified to act as the duly authorized representative under the provisions of 40 CFR 122.22(b).

**RESPONSIBLE OFFICIAL** (Note: The responsible official is the person authorized to sign the permit application in 40 CFR 122.22(a). For a Corporation: it is the responsible corporate officer. Partnership or Sole Proprietorship: the general partner or proprietor. Municipality, State, Federal or other Public Agency: the principal executive officer ranking elected official.)

  
Signature of the Responsible Official

4-15-15  
Date

Don Smith

\_\_\_\_\_  
Name (First Name, MI, Last Name) Typed or Printed

\_\_\_\_\_  
P.O. Box 360

\_\_\_\_\_  
Mountain View, AR 72560

\_\_\_\_\_  
Mailing Address

\_\_\_\_\_  
City, State, and Zip

\_\_\_\_\_  
Water/Wastewater Superintendent

( 870 ) 269-3804  
A/C Phone

\_\_\_\_\_  
870-269-3778

\_\_\_\_\_  
Title

\_\_\_\_\_  
Fax

\_\_\_\_\_  
Email Address: cityhall@mtviewcity.com

**Certification:** I certify under penalty of law that this document and all attachments were prepared under my direct 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.

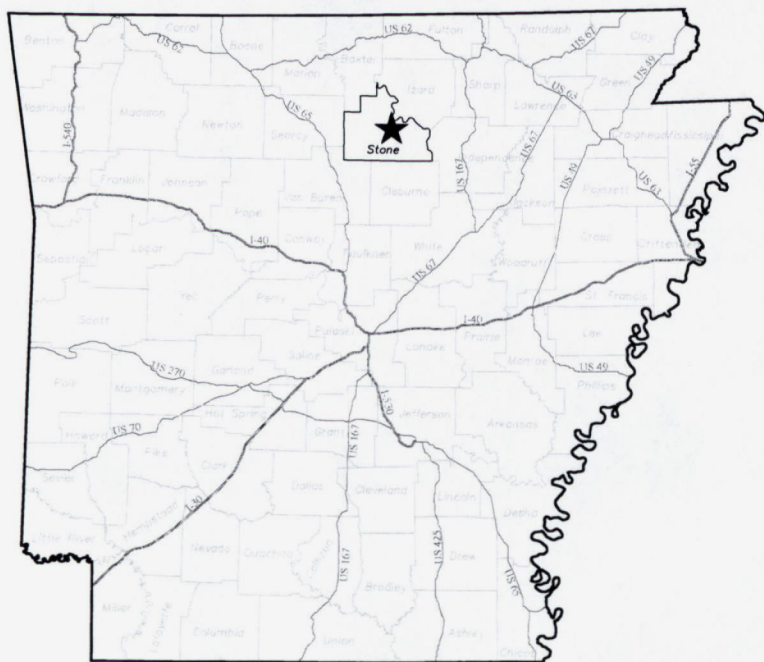
Will the Responsible Official also be the person signing submittals?

☐ Yes ☐ No

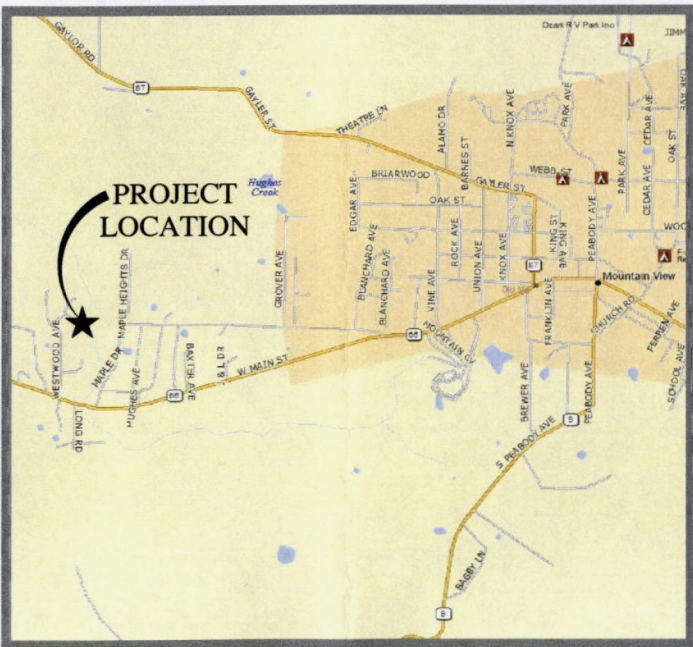


# MOUNTAIN VIEW WWTP DIGESTER CONVERSION

## MOUNTAIN VIEW, ARKANSAS



LOCATION MAP



VICINITY MAP

### INDEX TO DRAWINGS

1. COVER SHEET
2. SITE LAYOUT & YARD PIPING
3. DIGESTER DETAILS
4. DIGESTER DETAILS
5. MISCELLANEOUS DETAILS
- S1.1 STAIR PLAN & SECTIONS

JANUARY, 2015  
MCE PROJECT NO. LR14-5799

**MCE** McCLELLAND  
CONSULTING  
ENGINEERS, INC.

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ORIGINAL SIGNATURE ON FILE



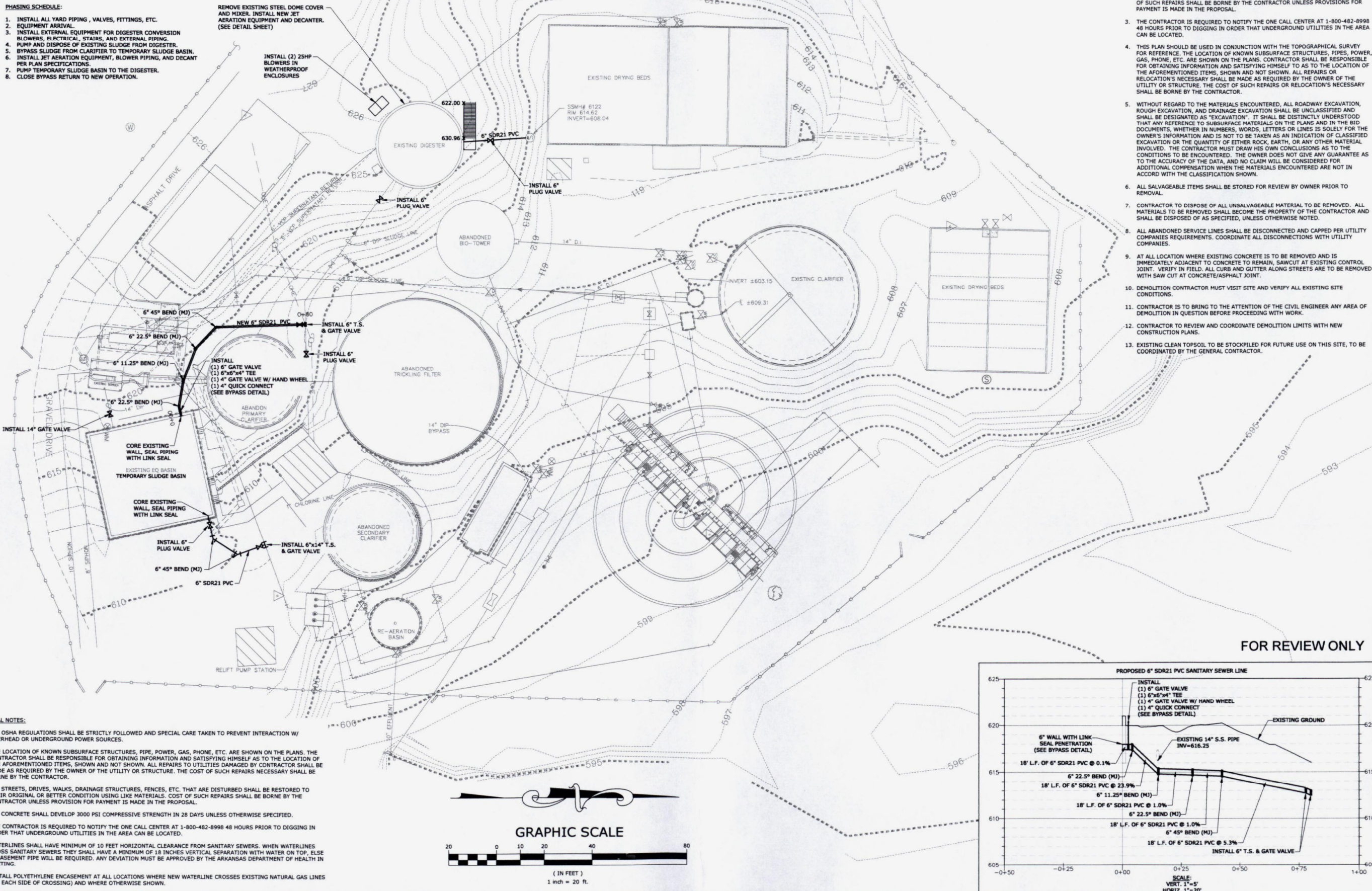
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#### PHASING SCHEDULE:

1. INSTALL ALL YARD PIPING, VALVES, FITTINGS, ETC.
2. EQUIPMENT ARRIVAL
3. INSTALL EXTERNAL EQUIPMENT FOR DIGESTER CONVERSION BLOWERS, ELECTRICAL, STAIRS, AND EXTERNAL PIPING.
4. PUMP AND DISPOSE OF EXISTING SLUDGE FROM DIGESTER.
5. BYPASS SLUDGE FROM CLARIFIER TO TEMPORARY SLUDGE BASIN.
6. INSTALL JET AERATION EQUIPMENT, BLOWER PIPING, AND DECANT PER PLAN SPECIFICATIONS.
7. PUMP TEMPORARY SLUDGE BASIN TO THE DIGESTER.
8. CLOSE BYPASS RETURN TO NEW OPERATION.

REMOVE EXISTING STEEL DOME COVER AND MIXER. INSTALL NEW JET AERATION EQUIPMENT AND DECANTER. (SEE DETAIL SHEET)

INSTALL (2) 25HP BLOWERS IN WEATHERPROOF ENCLOSURES



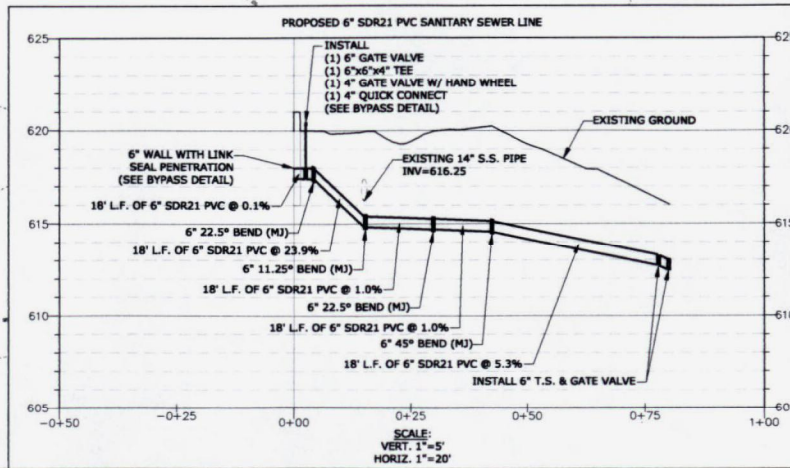
#### GENERAL NOTES:

1. ALL OSHA REGULATIONS SHALL BE STRICTLY FOLLOWED AND SPECIAL CARE TAKEN TO PREVENT INTERACTION W/ OVERHEAD OR UNDERGROUND POWER SOURCES.
2. THE LOCATION OF KNOWN SUBSURFACE STRUCTURES, PIPE, POWER, GAS, PHONE, ETC. ARE SHOWN ON THE PLANS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING INFORMATION AND SATISFYING HIMSELF AS TO THE LOCATION OF THE AFOREMENTIONED ITEMS, SHOWN AND NOT SHOWN. ALL REPAIRS TO UTILITIES DAMAGED BY CONTRACTOR SHALL BE MADE AS REQUIRED BY THE OWNER OF THE UTILITY OR STRUCTURE. THE COST OF SUCH REPAIRS NECESSARY SHALL BE BORNE BY THE CONTRACTOR.
3. ALL STREETS, DRIVES, WALKS, DRAINAGE STRUCTURES, FENCES, ETC. THAT ARE DISTURBED SHALL BE RESTORED TO THEIR ORIGINAL OR BETTER CONDITION USING LIKE MATERIALS. COST OF SUCH REPAIRS SHALL BE BORNE BY THE CONTRACTOR UNLESS PROVISION FOR PAYMENT IS MADE IN THE PROPOSAL.
4. ALL CONCRETE SHALL DEVELOP 3000 PSI COMPRESSIVE STRENGTH IN 28 DAYS UNLESS OTHERWISE SPECIFIED.
5. THE CONTRACTOR IS REQUIRED TO NOTIFY THE ONE CALL CENTER AT 1-800-482-8998 48 HOURS PRIOR TO DIGGING IN ORDER THAT UNDERGROUND UTILITIES IN THE AREA CAN BE LOCATED.
6. WATERLINES SHALL HAVE MINIMUM OF 10 FEET HORIZONTAL CLEARANCE FROM SANITARY SEWERS. WHEN WATERLINES CROSS SANITARY SEWERS THEY SHALL HAVE A MINIMUM OF 18 INCHES VERTICAL SEPARATION WITH WATER ON TOP, ELSE ENCASEMENT PIPE WILL BE REQUIRED. ANY DEVIATION MUST BE APPROVED BY THE ARKANSAS DEPARTMENT OF HEALTH IN WRITING.
7. INSTALL POLYETHYLENE ENCASUREMENT AT ALL LOCATIONS WHERE NEW WATERLINE CROSSES EXISTING NATURAL GAS LINES (20" EACH SIDE OF CROSSING) AND WHERE OTHERWISE SHOWN.

#### DEMOLITION NOTES:

1. THE INTENT OF THE DEMOLITION PLAN IS TO REMOVE ALL ITEMS NECESSARY FOR THE COMPLETION OF THE PROJECT. THE MAIN ITEMS TO BE REMOVED ARE: ALL THE CURB AND GUTTER, SIDEWALKS, ASPHALT (PARKING LOTS), BUILDINGS CONCRETE APRONS PLANTERS, LIGHTS, BOLLARDS, ETC. THE EXISTING UTILITY SERVICES ARE TO BE DISCONNECTED AND CAPPED PER UTILITY COMPANIES REQUIREMENTS. THE MAIN ITEMS TO REMAIN INCLUDE: FIRE HYDRANTS, TRAFFIC SIGNALS/CONTROLS AND OTHER UTILITY MAINS ON OR NEAR THE PROPERTY.
2. THE CONTRACTOR IS TO PROTECT ALL ITEMS TO REMAIN, STREETS, DRIVES, WALKS, DRAINAGE STRUCTURES, FENCES, SIGNS, ETC. THAT ARE DISTURBED SHALL BE RESTORED TO THEIR ORIGINAL OR BETTER CONDITION USING LIKE MATERIALS. COST OF SUCH REPAIRS SHALL BE BORNE BY THE CONTRACTOR UNLESS PROVISIONS FOR PAYMENT IS MADE IN THE PROPOSAL.
3. THE CONTRACTOR IS REQUIRED TO NOTIFY THE ONE CALL CENTER AT 1-800-482-8998 48 HOURS PRIOR TO DIGGING IN ORDER THAT UNDERGROUND UTILITIES IN THE AREA CAN BE LOCATED.
4. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE TOPOGRAPHICAL SURVEY FOR REFERENCE. THE LOCATION OF KNOWN SUBSURFACE STRUCTURES, PIPES, POWER, GAS, PHONE, ETC. ARE SHOWN ON THE PLANS. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING INFORMATION AND SATISFYING HIMSELF AS TO THE LOCATION OF THE AFOREMENTIONED ITEMS, SHOWN AND NOT SHOWN. ALL REPAIRS OR RELOCATION'S NECESSARY SHALL BE MADE AS REQUIRED BY THE OWNER OF THE UTILITY OR STRUCTURE. THE COST OF SUCH REPAIRS OR RELOCATION'S NECESSARY SHALL BE BORNE BY THE CONTRACTOR.
5. WITHOUT REGARD TO THE MATERIALS ENCOUNTERED, ALL ROADWAY EXCAVATION, ROUGH EXCAVATION, AND DRAINAGE EXCAVATION SHALL BE UNCLASSIFIED AND SHALL BE DESIGNATED AS "EXCAVATION". IT SHALL BE DISTINCTLY UNDERSTOOD THAT ANY REFERENCE TO SUBSURFACE MATERIALS ON THE PLANS AND IN THE BID DOCUMENTS, WHETHER IN NUMBERS, WORDS, LETTERS OR LINES IS SOLELY FOR THE OWNER'S INFORMATION AND IS NOT TO BE TAKEN AS AN INDICATION OF CLASSIFIED EXCAVATION OR THE QUANTITY OF EITHER ROCK, EARTH, OR ANY OTHER MATERIAL INVOLVED. THE CONTRACTOR MUST DRAW HIS OWN CONCLUSIONS AS TO THE CONDITIONS TO BE ENCOUNTERED. THE OWNER DOES NOT GIVE ANY GUARANTEE AS TO THE ACCURACY OF THE DATA, AND NO CLAIM WILL BE CONSIDERED FOR ADDITIONAL COMPENSATION WHEN THE MATERIALS ENCOUNTERED ARE NOT IN ACCORD WITH THE CLASSIFICATION SHOWN.
6. ALL SALVAGEABLE ITEMS SHALL BE STORED FOR REVIEW BY OWNER PRIOR TO REMOVAL.
7. CONTRACTOR TO DISPOSE OF ALL UNSALVAGEABLE MATERIAL TO BE REMOVED. ALL MATERIALS TO BE REMOVED SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE DISPOSED OF AS SPECIFIED, UNLESS OTHERWISE NOTED.
8. ALL ABANDONED SERVICE LINES SHALL BE DISCONNECTED AND CAPPED PER UTILITY COMPANIES REQUIREMENTS. COORDINATE ALL DISCONNECTIONS WITH UTILITY COMPANIES.
9. AT ALL LOCATION WHERE EXISTING CONCRETE IS TO BE REMOVED AND IS IMMEDIATELY ADJACENT TO CONCRETE TO REMAIN, SAWCUT AT EXISTING CONTROL JOINT. VERIFY IN FIELD. ALL CURB AND GUTTER ALONG STREETS ARE TO BE REMOVED WITH SAW CUT AT CONCRETE/ASPHALT JOINT.
10. DEMOLITION CONTRACTOR MUST VISIT SITE AND VERIFY ALL EXISTING SITE CONDITIONS.
11. CONTRACTOR IS TO BRING TO THE ATTENTION OF THE CIVIL ENGINEER ANY AREA OF DEMOLITION IN QUESTION BEFORE PROCEEDING WITH WORK.
12. CONTRACTOR TO REVIEW AND COORDINATE DEMOLITION LIMITS WITH NEW CONSTRUCTION PLANS.
13. EXISTING CLEAN TOPSOIL TO BE STOCKPILED FOR FUTURE USE ON THIS SITE, TO BE COORDINATED BY THE GENERAL CONTRACTOR.

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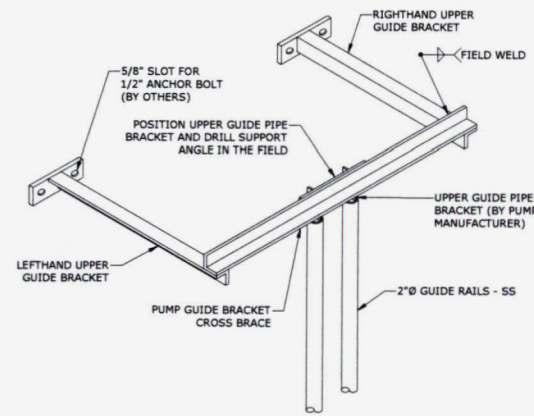


REVISIONS	DESCRIPTION
NO.	DATE

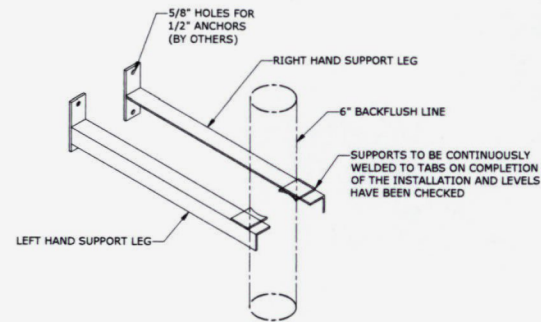




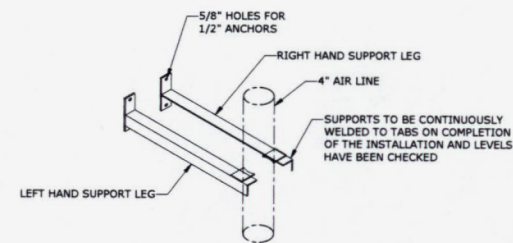




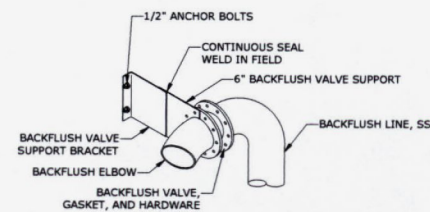
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N.T.S.



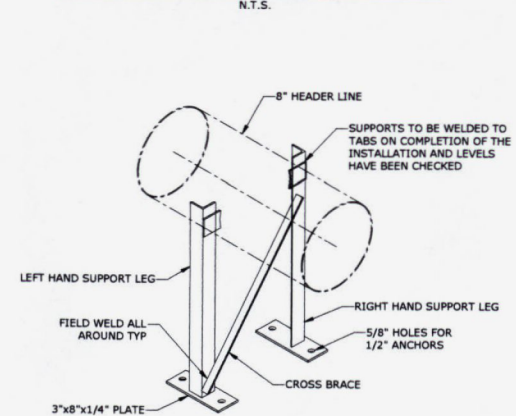
**BACKLINE FLUSH LINE SUPPORT DETAIL**  
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**AIR LINE SUPPORT DETAIL**  
N.T.S.

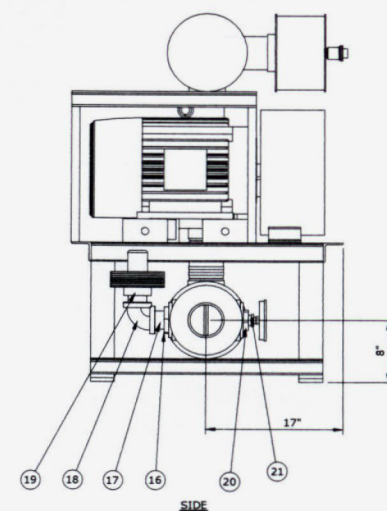


**BACKFLUSH VALVE SUPPORT DETAIL**  
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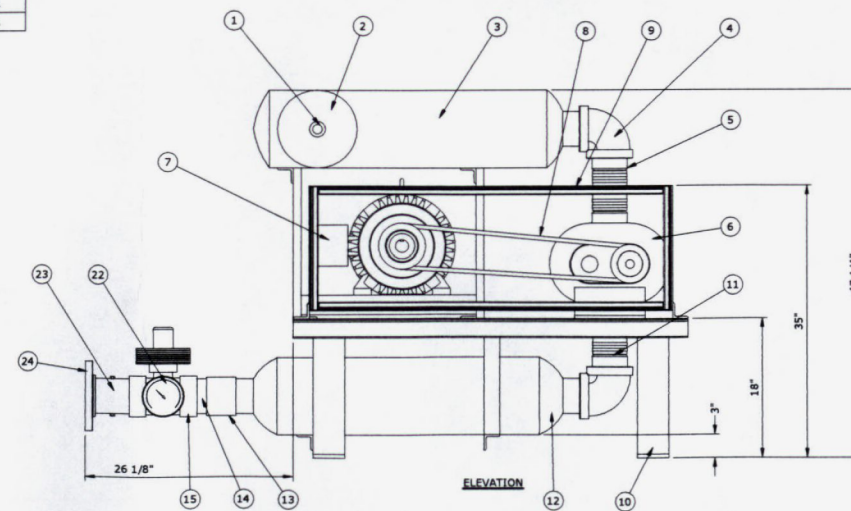


**HEADER SUPPORT DETAIL**  
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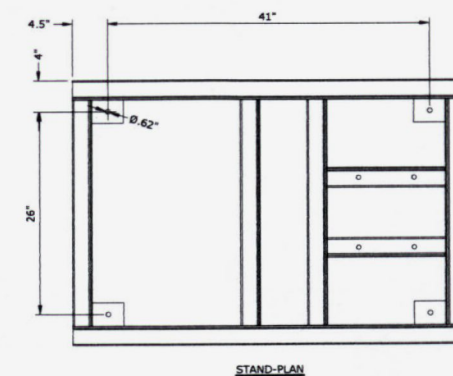
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1		FILTER RESTRICTION INDICATOR	1
2	CF-4, FNPT	CARTRIDGE TYPE FILTER w/ PAPER ELEMENT	1
3	DRSI-J 4	4\" INLET SILENCER	1
4		4\" 90 DEG. THREADED ELBOW	1
5		4\" THREADED INLET FLEX JOINT	1
6	SM	LEGEND P BLOWER (RHC)	1
7	M2334T	25HP, 1800 RPM, TEFC, 3/60/230/460	1
8	D07016A	V-BELT DRIVE ASSEMBLY @ 1.4 S.F.	1
9	BG07016A	A200 BELT GUARD w/ ACCESS PANEL	1
10		A200 BLOWER / MOTOR BASE w/ MOTOR RAILS	1
11		4\" THREADED DISCHARGE FLEX JOINT	1
12	DRS-4, MNPT	GRADE I, DISCHARGE SILENCER	1
13		4\" THREADED COUPLING	1
14		4\" CLOSE NIPPLE	1
15		4\" THREADED CROSS	1
16		4\"x2\" HEX BUSHING	1
17		2\" CLOSE NIPPLE	1
18		2\" 90 DEG. THREADED ELBOW	1
19	2\"	2\" WEIGHTED PRV	1
20		4\"x1\" HEX BUSHING	1
21		1\"x1/2\" HEX BUSHING	1
22	TS0025	5\" BIMETAL REAR MOUNT THERMOMETER	1
23	502-M-040	4\" THREADED CHECK VALVE	1
24		4\" COMPANION FLANGE	1
25	P5081G	4-1/2\", 0-15 PSI, PRESSURE GAUGE	1



**BLOWER DETAIL**  
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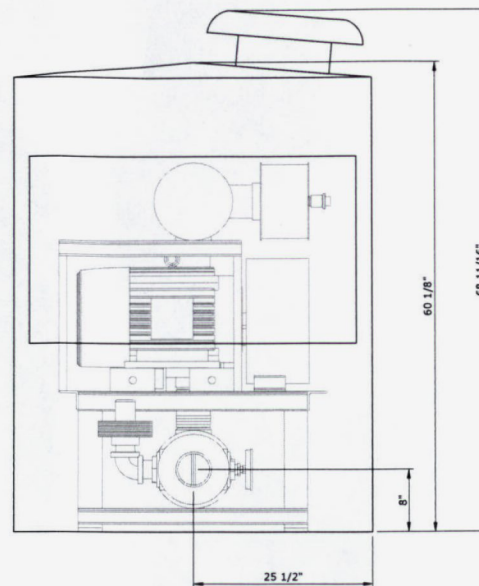


**BLOWER ENCLOSURE DETAIL**  
(SEE MANUFACTURES DRAWINGS)  
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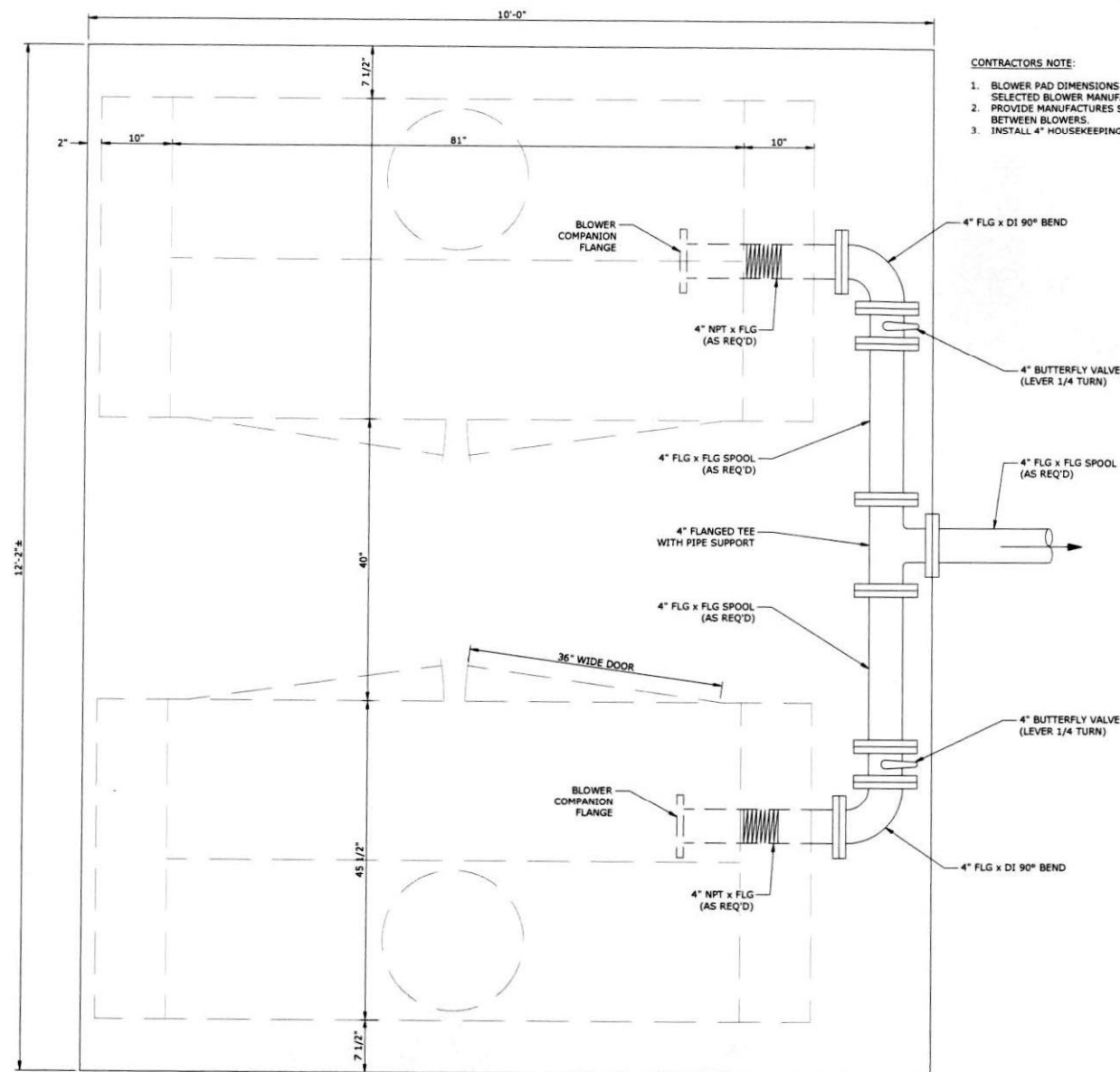


**STAND-PLAN**

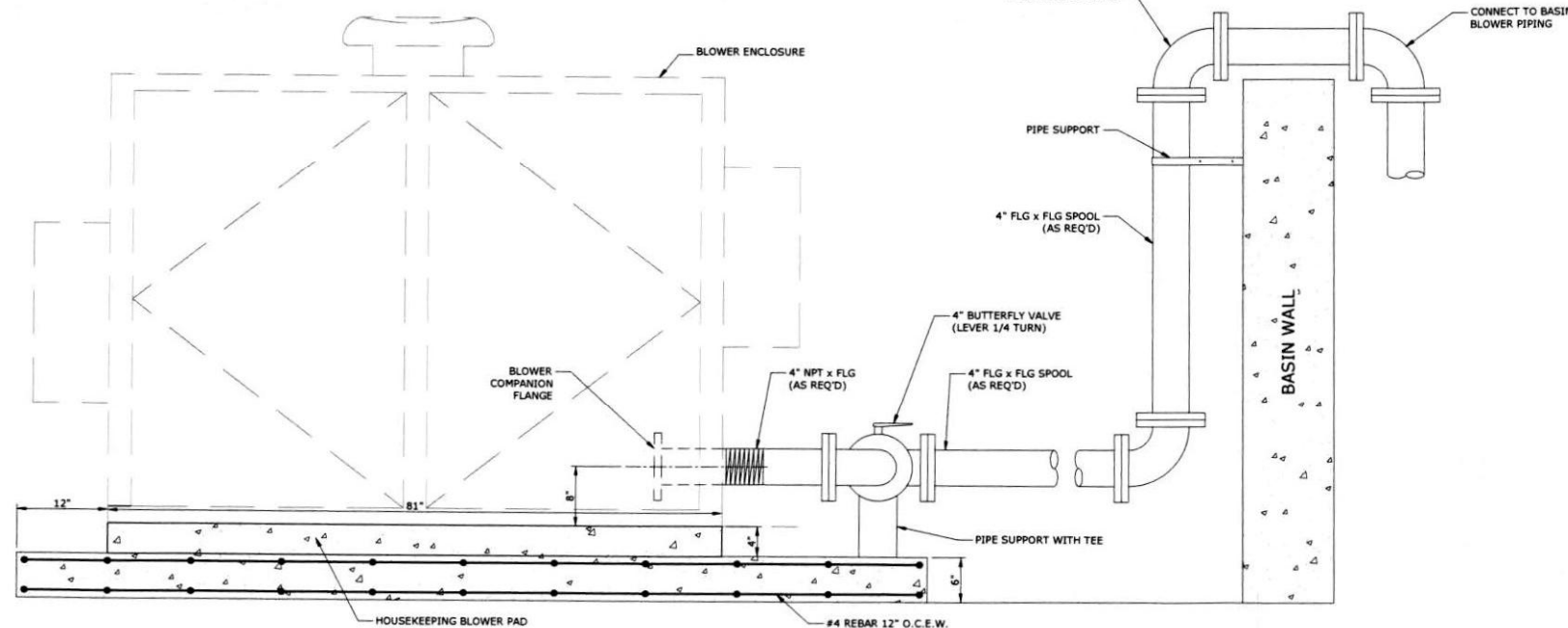
- ENCLOSURES SPECIFICATION:
1. MATERIAL OF CONSTRUCTION: 1/8" ALUMINUM
  2. QTY (4) HINGED DOORS (2 PER SIDE)
  3. QTY (8) 1/2 TURN COMPRESSION LATCHES (2 PER DOOR)
  4. QTY (1) ENCLOSURE EXHAUST FAN (1/60/120V, 4.3 AMPS)
  5. ENCLOSURE AND VENT BOX LINED w/2" ACOUSTICAL FOAM



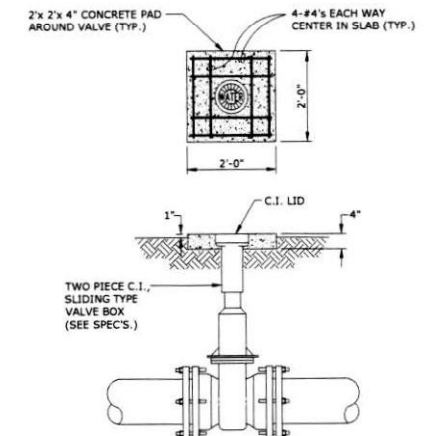




- CONTRACTOR'S NOTE:
1. BLOWER PAD DIMENSIONS MAY CHANGE WITH SELECTED BLOWER MANUFACTURER.
  2. PROVIDE MANUFACTURER'S SUGGESTED CLEARANCES BETWEEN BLOWERS.
  3. INSTALL 4" HOUSEKEEPING PAD UNDER BLOWER HOUSING.

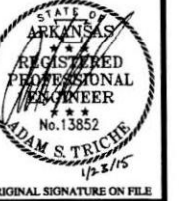


**BLOWER PAD LAYOUT**  
N.T.S.



**DETAIL-VALVE BOX**  
N.T.S.

**MCE McCLELLAND CONSULTING ENGINEERS, INC.**  
DESIGNED TO SERVE  
1810 N. College  
900 West Main  
P.O. Box 443,377  
Fairfax, VA 22031  
PH 479 443,377  
FAX 479 443,377  
http://www.mcclelland-engrs.com



MOUNTAIN VIEW WWTP  
DIGESTER CONVERSION  
MOUNTAIN VIEW, ARKANSAS

One Call  
**811**

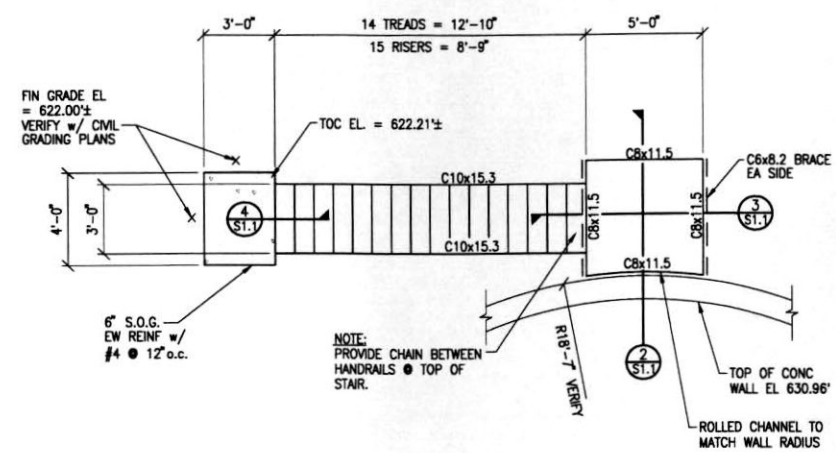
Know what's below.  
Call before you dig.

NO.	DATE	REVISIONS	DESCRIPTION

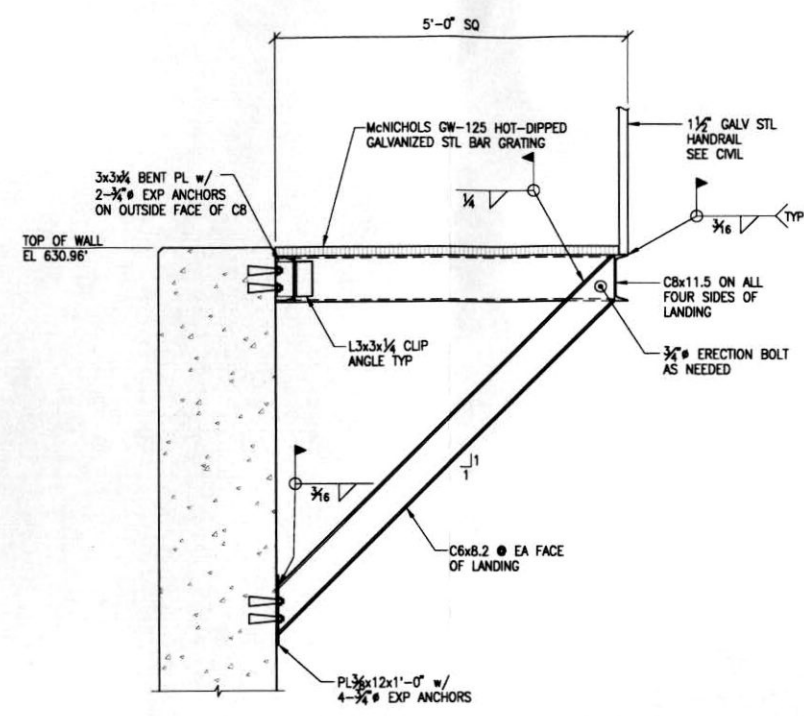
MISCELLANEOUS  
DETAILS

PROJECT ENGR: **AST** DRAWN BY:  
DATE: **JANUARY 2015**  
SCALE: **AS SHOWN** JOB NUMBER: **LR14-5799**

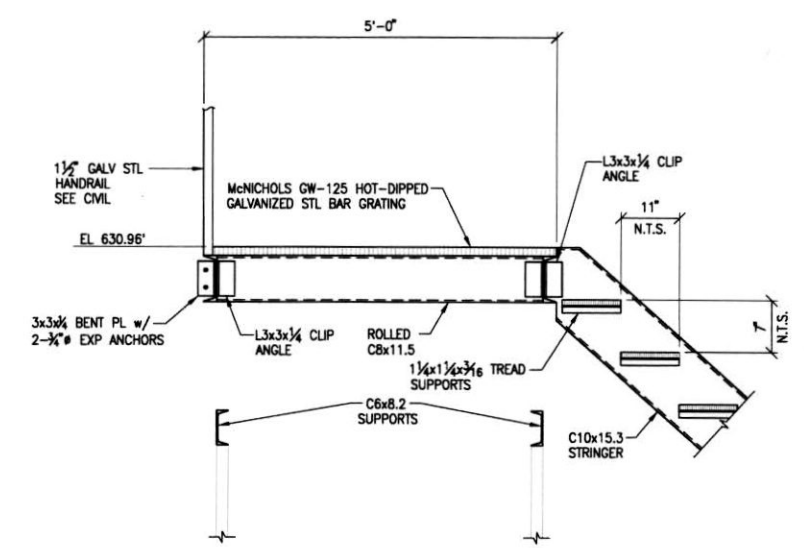
FOR REVIEW ONLY



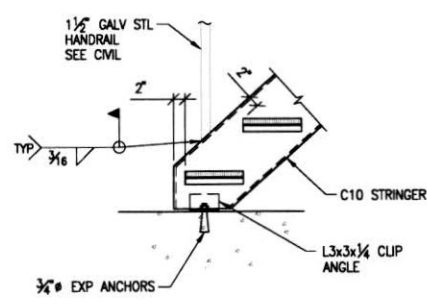
**1**  
S1.1 ENLARGED STAIR PLAN  
1/4" = 1'-0"



**2**  
S1.1 SECTION  
3/4" = 1'-0"



**3**  
S1.1 SECTION  
3/4" = 1'-0"



**4**  
S1.1 SECTION  
N.T.S.



FOR REVIEW ONLY

**MCE McClelland Consulting Engineers, Inc.**  
DESIGNED TO SERVE  
1810 N. College  
900 West Markham  
Little Rock, Arkansas 72201  
PH 501.371.0272  
FAX 501.371.9932  
HTTP://WWW.MCCLELLAND-ENG.COM

MOUNTAIN VIEW WWTP  
DIGESTER CONVERSION  
MOUNTAIN VIEW, ARKANSAS

NO.	DATE	REVISIONS	DESCRIPTION

STAIR PLAN & SECTIONS

PROJECT ENGR:	DRAWN BY:
CDD	CDD
DATE:	JANUARY 2015
SCALE:	Per Dwg.
JOB NUMBER:	LR14-5799

S1.1

# **PROJECT MANUAL**

## **MOUNTAIN VIEW WASTEWATER TREATMENT PLANT DIGESTER CONVERSION**

**JANUARY, 2015**

**MCE PROJECT NO. LR14-5799**

**Prepared By:**

**McClelland Consulting Engineers, Inc.**

**P. O. Box 34087**

**Little Rock, Arkansas 72203**

**Phone 501/371-0272**

**Fax 501/371-9932**

**MOUNTAIN VIEW WASTEWATER TREATMENT PLANT  
DIGESTER CONVERSION  
LR14-5799**

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## SECTION 02086

### MANUALLY OPERATED VALVES

#### PART 1. GENERAL

##### 1.1 SUMMARY

- A. Furnish and install manually operated valves.

##### 1.2 RELATED SECTIONS

- A. Section 02514 - Cement-Lined Ductile Iron Pipe and Fittings.
- B. Section 02515 - Polyvinyl Chloride (PVC) Pipe and Fittings.

##### 1.3 REFERENCES

- A. American Water Works Association, 6666 West Quincy Avenue, Denver, Colorado 80235.
  - 1. AWWA C500-02 - Gate Valves for Water and Sewerage Systems.
  - 2. AWWA C509-01 - Resilient-Seated Gate Valves for Water and Sewage Systems.
- B. ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959.
  - 1. ASTM A126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  - 2. ASTM B61 - Specification for Steam of Valve Bronze Castings.

#### PART 2. MATERIALS

##### 2.1 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.

## **2.2 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 percent zinc and 2 percent 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.

## **2.3 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 pounds 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 run 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-inch x 2-inch square operating nut.
- J. Above-ground valves to have handwheel operators.

## **2.4 VALVE BOXES**

- A. Buffalo two-piece sliding type, cast iron, with 5-1/4-inch shaft of appropriate length for the installation.
- B. The word SEWER shall be cast into the top of the lid.
- C. Extension pieces, if required, shall be the manufacturer's standard type.
- D. Manufacturers: Mueller H-10364, Clow Corporation F-2452, or equal.
- E. Furnish units complete with all necessary bases and accessories.

## **2.5 EXTENSION STEMS FOR VALVE OPERATORS**

- A. Where the depth of the valve is such that its centerline is more than 4 feet below grade, provide operating extension stems to bring the operating nut to a point 6 inches below the surface of the ground and/or box cover.
- B. Constructed of steel.
- C. Complete with 2-inch square operating nut.
- D. Bolt to valve stem to prevent separation.

## **2.6 GATE VALVES**

- A. Acceptable Manufacturers:
  - 1. Mueller, Model No. A-2360.
  - 2. American Flow Control, Product Series 500.
- B. Gate Valves:
  - 1. Resilient seat type in accordance with AWWA C509-01 with resilient wedge.
  - 2. Mechanical joint with non-rising stems and two inch square operating nut.
  - 3. 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.

## **2.7 TAPPING SLEEVES AND VALVES**

- A. Acceptable Manufacturers:
  - 1. Mueller; Product H-615.
  - 2. Or equal.
- B. Resilient seat or resilient wedge with a flange on one side for connection to the tapping sleeve.

## **PART 3. EXECUTION**

### **3.1 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.

### **3.2 PLACEMENT OF VALVES**

- A. Buried valves shall be installed with valve boxes in accordance with the details shown on the Drawings.
- B. Buried valves shall have bolts protected by wrapping in polyethylene material.

### **3.3 ACCESS**

- A. Location of valves shall be as required to provide accessibility for control and maintenance.

### 3.4 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. Valve manufacturer shall furnish an affidavit stating the materials options furnished comply with these and other referenced Specifications.

**END OF SECTION**

## SECTION 02200

### SITE PREPARATION

#### PART 1. GENERAL

##### 1.1 SUMMARY

- A. Remove interfering or objectionable material from designated areas of Work.
- B. Preserve vegetation and existing objects designated to remain from injury or defacement.
- C. Cut trees only at direction of Engineer.
- D. Contractor shall be responsible for implementing and following a Storm Water Pollution Prevention Plan as required by the Arkansas Department of Environmental Quality and in accordance with NPDES ARR10A00. The successful Bidder (Contractor) shall develop a Storm Water Pollution Prevention Plan to meet all State and Federal regulations and submit to the Engineer for review and approval prior to commencing work.

##### 1.2 DEFINITIONS

- A. Clearing:
  - 1. Cutting, removing, and disposing of trees, snags, stumps, shrubs, brush, limbs, and other vegetative growth.
  - 2. Removing evidence of their presence from the surface, inclusive of sticks and branches greater than 2 inches in diameter or thickness.
  - 3. Removing and disposing of trash piles, rubbish, and fencing.
- B. Grubbing:
  - 1. Removing and disposing of wood or root matter below the ground surface remaining after clearing.
  - 2. Includes stumps, trunks, roots, or root systems greater than 2 inches in diameter or thickness to a depth of 18 inches below the ground surface.
- C. Stripping: Removing and disposing of organic sod, topsoil, grass and grass roots, and other objectionable material from the areas designated to be stripped that remain after clearing and grubbing.

##### 1.3 RELATED SECTIONS

- A. Section 02300 - Earthwork.

## **PART 2. MATERIALS**

### **2.1 GENERAL**

- A. Provide materials, suitable and in adequate quantity, required to accomplish Work of this Section.

## **PART 3. EXECUTION**

### **3.1 PREPARATION**

- A. Review with Engineer's representative the location, limits, and methods to be used prior to commencing Work under this Section.

### **3.2 CUTTING TIMBER**

- A. Exercise care when clearing near the clearing limits to avoid damage to existing trees, vegetation, structures, or utilities which are outside of the clearing limits.
- B. Trees shall be leveled into the area to be cleared.
- C. Flush cut stumps not designated for grubbing by cutting to within 2 inches of the ground surface.
- D. Timber is the property of the Contractor.
- E. Dispose of stumps, limbs, brush, snags, non-marketable timber, and other vegetative growth off-site.

### **3.3 PRESERVATION OF TREES, SHRUBS, AND OTHER VEGETATION**

- A. Trees, shrubbery, and other vegetation not designated for removal shall be protected from damage.
- B. Cut and remove tree branches only where, in the opinion of the Engineer, cutting is necessary to effect construction operation.
- C. Remove branches other than those required to effect the Work to provide a balanced appearance of any tree, as approved prior to removal.
- D. Treat scars resulting from the removal of branches with an approved tree sealant.

### **3.4 CLEARING AND GRUBBING LIMITS**

- A. Clear and grub areas within the limits of construction.
- B. Clear and grub in stages as the construction area is increased to avoid unnecessary clearing and grubbing.

### **3.5 DISPOSAL OF CLEARING AND GRUBBING DEBRIS**

- A. Haul the material from the Work site and dispose of in accordance with state, federal, and local laws. Off-site disposal shall be at the Contractor's sole expense.

### **3.6 AREAS TO BE STRIPPED.**

- A. The exact depth of stripping shall be determined by the Engineer.
- B. Topsoil requirements are specified in Section 02300.
- C. Strip areas that are cleared and grubbed.
- D. Strip areas in stages to avoid unnecessary stripping.

### **3.7 DISPOSAL OF STRIPPINGS**

- A. Do not mix strippings with borrow excavation.
- B. Stockpile topsoil from the strippings for use in landscape grading.
- C. Dispose of excess topsoil.
- D. Strippings not suitable for use as topsoil shall become the property of the Contractor and shall be removed from the site.

**END OF SECTION**



## SECTION 02231

### CLEARING AND GRUBBING

#### PART 1. GENERAL

##### 1.1 DESCRIPTION

- A. Work shall consist of cutting, removing from the ground, and properly disposing of trees, stumps, hedge, brush, roots, logs, weeds, rubbish, sod refuse dumps, sawdust piles, lumbering slash, and other materials within the designated area.
- B. The work shall also include selective clearing, preserving existing vegetation, scalping, and the preservation of objects designated to remain.

##### 1.2 DEFINITIONS

- A. Clearing - The removal of all trees, brush, and other objectionable growth, and the removal and disposal of logs, rubbish piles, refuse dumps, sawdust piles, lumbering slash, and other objectionable matter from the surface of the ground in the areas shown on the plans or as designated by the Engineer.
- B. Grubbing - The grubbing and removal of all stumps, roots, and other objectionable matter, lying wholly or in part below the surface of the ground.
- C. Selective Clearing - The trimming of selected trees and shrubs, the removal from the ground and disposal of logs, root pods, brush, refuse dumps, and other undesirable debris, and the cutting, removal, and disposal of all undergrowth, stumps, and standing trees, except those trees and shrubs designated to be preserved. The selective clearing areas will be shown on the plans.
- D. Scalping - Areas not classified as clearing and grubbing and that are within construction limits shall be scalped, if appropriate. Scalping shall include the removal and disposal of material such as saplings less than 4-inches in diameter measured 12-inches above the ground, logs, brush, roots, grass, residue of agricultural crops, refuse dumps, and decayed matter.
- E. Clearing and Grubbing Trees.- The cutting, grubbing and removal of individual, isolated trees and stumps greater than 4-inches diameter measured 12-inches above the ground as shown on the plans or designated by the Engineer to be removed.

## **PART 2. MATERIALS**

### **2.1 GENERAL**

- A. Provide materials suitable and in adequate quantity required to accomplish the work of this Section.

## **PART 3. EXECUTION**

### **3.1 CONSTRUCTION REQUIREMENTS**

- A. The project site shall be cleared as defined above, except those objects designated to remain shall be carefully protected from abuse, marring, or damage during construction operations.
- B. Trees shall be felled and removed in such a manner as to avoid injury to other trees or objects designated to remain. In case of injury to bark, limbs, or roots of vegetation designed to remain, the Contractor shall repair such damage by corrective pruning or other appropriate methods. Trees or other debris falling outside the construction area shall be removed and disposed of according to these specifications.
- C. Holes remaining after removal of trees, stumps, etc. shall be backfilled with material approved by the Engineer and compacted as directed except in areas to be excavated. The Contractor shall complete the operation by blading, bulldozing, or other approved methods so that the site shall be free of holes, ditches, or other abrupt changes in elevations that resulted from the clearing and grubbing operations.

### **3.2 CLEARING AND GRUBBING**

- A. The site shall be cleared of stumps, brush, logs, rubbish, trees, and shrubs, with the exception of such trees, shrubs, and areas designed on the plans or by the Engineer for preservation. Grubbing will not be required in areas that will have a fill height of 3-feet or more above disturbed stumps cut within 6-inches of the natural ground. Sound stumps may be left outside the construction limits when they are severed flush with or below the natural ground, or the slope line in areas to be rounded at the top of the back slopes.
- B. Merchantable timber in the clearing area shall become the property of Contractor, unless otherwise provided.
- C. When perishable material is burned, it shall be under the constant care of a competent watcher. Burning shall be accomplished at such times and in such manner that the surrounding vegetation, adjacent property, or anything designated

to remain on the site will not be jeopardized. Upon notice from the Engineer that meteorological conditions render burning undesirable, the Contractor shall cease all burning until notified by the Engineer that meteorological conditions are suitable for a resumption of burning operations.

- D. When specified, burning will not be permitted unless the material to be burned is placed in an incineration pit and an acceptable forced air combustion device is used that will minimize the emission of smoke, fly ash, and other pollutants. This device shall be constructed so that the forced air is directed over the fire by plenums or ducts. The use of open fans or mulch blowers will not be permitted.
- E. The Contractor shall comply with all Federal, State, County, and City laws, regulations, or ordinances applicable to the disposal of clearing and grubbing material. Materials and debris that cannot be burned shall be removed from the project site and disposed of at locations off the project, outside the limits of view from any public road, street, park, or other public facility. The Contractor shall make all necessary arrangements with the property owner for obtaining suitable disposal locations.
- F. Disposal operations and final cleanup of the site, including seeding and stabilization, shall comply with these specification requirements. When requested by the Engineer, the Contractor shall furnish copies of all agreements with property owners.

### **3.3 SELECTIVE CLEARING**

- A. This work shall be performed in such a manner as to leave the designated areas in a park-like condition and susceptible to economical mowing. Disposal of all material shall comply with the methods set out in the Clearing and Grubbing requirements.
- B. Stumps, trees, and shrubs, except those designated to be preserved, shall be severed flush with or below the ground.
- C. Movement and operation of equipment shall be such that roots, branches, and trunks of trees and shrubs selected for retention will not be scarred, broken, or otherwise damaged to the extent that the life of the plant is endangered.

### **3.4 PRESERVED VEGETATION**

- A. Trees, shrubs, brush, vines, and other natural perennial vegetation shall be protected in the areas designated as Preserved Vegetation.
- B. Areas designated as Preserved Vegetation shall not be used for parking, storage, or other construction support activities that will damage vegetation or compact the soil. Care shall be taken to prevent spills of materials hazardous to vegetation such

as oil, hydraulic fluid, salts, etc.. Erosion and sedimentation control shall be such that sediment is not deposited in depths greater than 2-inches within any portion of the Preserved Vegetation area.

- C. Clearing and grubbing may be required through preserved vegetation areas for drainage outlets, channels, or other required construction.

### **3.5 SCALPING**

- A. The Contractor shall scalp areas where excavation or embankment is to be made, except that mowed sod need not be removed where the embankment to be constructed is more than 3-feet in height.
- B. All suitable material resulting from the scalping operation shall be placed on finished slopes, adjacent to the area from which it is obtained, after excavation or embankment operations are complete.
- C. Unsuitable material shall be disposed of as specified for Clearing and Grubbing.

**END OF SECTION**

## **SECTION 02300**

### **EARTHWORK**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Perform earthwork.
- B. Meet requirements for excavation safety, or to facilitate construction due to wet conditions.
- C. Perform excavation regardless of type, nature, or condition of materials encountered.
- D. Contractor shall make his own estimate of the type and extent of the various materials to be excavated in order to accomplish the work.
- E. There will be no extra compensation for dewatering.

##### **1.2 RELATED SECTIONS**

- A. Section 01001 - Basic Requirements.
- B. Section 02200 - Site Preparation.
- C. Section 02315 - Trench Excavation, Backfill, and Compacting.
- D. Section 02900 - Landscaping.

##### **1.3 REFERENCES**

- A. Arkansas State Highway and Transportation Department, Standard Specifications for Highway Construction, latest edition.
  - 1. AHTD Section 303 - Aggregate Base Course.
- B. ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959 USA Phone: (610) 832-9585 Fax: (610) 832-9555.
  - 1. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb Rammer and 12-in. Drop.
  - 2. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
  - 3. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 10 lb Rammer and 18-in. Drop.

4. ASTM D2216 - Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
  5. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
  6. ASTM D3017 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place of 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. Arkansas Statute 291 of 1993.

#### **1.4 DEFINITIONS**

- A. Relative Compaction:
1. The ratio, in percent, of the as-compacted field dry density to the laboratory maximum dry density as determined by the Standard Proctor Test, ASTM D698, or as determined by the Modified Proctor Test, ASTM D1557, as applicable.
  2. Corrections for oversize material may be applied to either the as-compacted field dry density or the maximum dry density, as determined by the Engineer.
- B. Optimum Moisture Content:
1. Moisture content of the material for which the maximum dry density is obtained as determined by ASTM D698 or D1557.
  2. Field moisture contents shall be determined on the basis of the fraction passing the 3/4-inch sieve.
- C. Completed Course: A course or layer that is ready for the next layer or the next phase of construction.

#### **1.5 SUBMITTALS**

- A. Submit in accordance with Section 01001.
- B. Provide the following:
1. Samples of imported material.
  2. Samples of onsite material to be used as fill.
  3. Certification that imported materials conform to the Specification requirements along with copies of the test results from a qualified commercial testing laboratory.
  4. Proctor curves on fill material as prepared by approved laboratory.

#### **1.6 PROJECT CONDITIONS**

- A. Beginning work of this Section means acceptance of existing conditions.

## **PART 2. PRODUCTS**

### **2.1 FILL**

- A. Free from roots, organic matter, trash, and debris with maximum particle size of 1-1/2 inches.
- B. It is intended that structural backfill material be obtained from on site to the maximum extent possible.

### **2.2 IMPORTED GRANULAR FILL**

- A. Provide granular fill beneath structures as noted on Drawings.
- B. Imported granular fill to consist of a natural or artificial mixture of gravel and soil mortar, uniformly well graded from coarse to fine.
- C. Conform to the AHTD Section 303 classifications for Class 7 as designated on the Drawings.

### **2.3 TOPSOIL**

- A. Selected topsoil at the site, properly stored and protected, free from roots, sticks, hard clay, and stones which will not pass through a 2-inch square opening.
- B. Provide imported topsoil of equal quality if required to accomplish the work.

### **2.4 COMPACTION EQUIPMENT**

- A. Provide compaction equipment of suitable type and adequate to obtain the densities specified.
- B. Operate compaction equipment in strict accordance with the manufacturer's instructions and recommendations.
- C. Hand-operated equipment shall be capable of achieving the specified densities.

### **2.5 MOISTURE CONTROL EQUIPMENT**

- A. Provide equipment for applying water of a type and quality adequate for the work; it shall not leak; and be equipped with a distributor bar or other approved device to assure uniform application.
- B. Provide equipment for mixing and drying out material consisting of blades, discs, or other approved equipment.

## **2.6 WATER REMOVAL EQUIPMENT**

- A. Provide and operate equipment adequate to keep excavation and trenches free of water.

## **2.7 IMPORTED MATERIAL ACCEPTANCE**

- A. Import only if insufficient material is available on-site.
- B. Locate and arrange use of a site near the construction area for obtaining borrow material.
- C. Additional tests required at the borrow area:
  - 1. Standard Proctor.
  - 2. Remolded permeability.
  - 3. Atterberg limits.
- D. Upon completion of removal of borrow material, grade the site to drain, place topsoil on disturbed areas, and establish grass as outlined in Section 02900.
- E. Cost for testing and imported material shall be the responsibility of the Contractor.

## **2.8 SELECTED MATERIAL ACCEPTANCE**

- A. Provide samples for testing representative of the actual material to be installed in the work. Take samples from each 2,000 cubic yards of material stockpiled. Depending on the uniformity of the material, Engineer may request more frequent samples.
- B. Forward test results to the Engineer at least 10 days before the material is required for use. If tests indicate that the material does not meet Specification requirements, the material shall not be installed in the work.
- C. Material which is placed in the work but does not conform to the Specification requirements shall be removed and replaced at the Contractor's sole expense.

## **PART 3. EXECUTION**

### **3.1 CLEARING AND GRUBBING**

- A. Complete clearing and grubbing work as specified in Section 02231 prior to beginning work in this Section.



### 3.2 STRIPPING TOPSOIL

- A. Remove existing grass and overburden before excavating topsoil.
- B. Prior to beginning excavation or fill, strip the topsoil to a depth of at least 6 inches or to a depth sufficient to remove organic material and stockpile for future use.
- C. In general, remove topsoil where structures are to be built, trenches dug, and roads, parking lots, walks, and similar improvements constructed within the areas presently covered with topsoil.
- D. Store topsoil clear of the construction area.
- E. Take reasonable care to prevent the topsoil from becoming mixed with subsoil or eroding.

### 3.3 STRUCTURAL EXCAVATION

- A. Contractor shall be solely responsible for trench and excavation safety systems in accordance with ACT 291 of 1993 and OSHA requirements.
- B. Identify required lines, levels, and grades.
- C. Identify known underground utilities. Contractor will be responsible for locating utilities.
- D. The method of excavation is optional, however, no equipment shall be operated in a manner that will endanger existing structures and their integrity.
- E. Use excavation support system such as sheet piling where ever necessary.
- F. Allow for forms, working space, granular base, and finish topsoil where shown on Drawings or required.
- G. Do not carry excavation for footings and slabs deeper than the elevation shown on Drawings after allowing for base material. Excavation of material to depths below the grades indicated, unless so directed by the Engineer or Owner's representative, will be deemed unauthorized excavation.
- H. If undercutting occurs below the planned dirt grade, the same fill material as specified for backfill shall be placed and compacted to 100 Percent Standard Proctor Density as defined in this Section up to the planned dirt grade in 8 inch lifts, at no additional cost to the Owner. Do not attempt to over compact excessively wet soil. Allow to dry first by scarifying and aerating before remolding.

### 3.4 DEWATERING EXCAVATION

- A. Remove water during periods when concrete is being deposited, pipe is being laid, and placing of backfill unless water settling is required, and at other times as required for efficient and safe execution of the work.
- B. Accomplish removal of groundwater in a manner that will preserve the strength of the foundation soils, will not cause instability of the excavation slopes, and will not result in damage to existing structures.
- C. Where necessary to these purposes, lower the water level in advance of excavation, utilizing wells, well points, or similar methods.
- D. Maintain the water level in the gravel stratum as measured in piezometers, a minimum of 3 feet below the prevailing excavation level or as needed to prevent bottom heave of the excavation.
- E. Open pumping, sumps, and ditches: If these result in boils, loss of fines, softening of the ground or instability of slopes, areas shall not be accepted.
- F. Install wells and well points with suitable screens and filters so that continuous pumping of fines does not occur.
- G. Operate well points continuously to prevent boils and loss of consolidation.
- H. Arrange discharge to facilitate collection of samples by Engineer.
- I. Avoid settlement or damage to adjacent property.
- J. Dispose of water in a manner that will not damage adjacent property, as approved.

### 3.5 GRANULAR FILL MATERIAL UNDER FACILITIES

- A. Place fill granular material as specified in this Section within the influence area beneath slabs, walks, structures, roads, and parking areas, and as shown on the Drawings.
- B. Do not exceed loose lifts of 6 inches.
- C. Compact each lift to not less than 95 Percent Modified Proctor Density.
- D. Place and compact a 6-inch layer of granular fill to at least 95 Percent Modified Proctor density immediately beneath spread footings, slabs on grade, or other concrete structures.
- E. Moisten material as required to aid compaction ( $\pm 2$  percent optimum moisture).

- F. Place material in horizontal lifts and in a manner to avoid segregation.
- G. Correct and repair subsequent damage to slabs, piping, concrete structures, facilities, or other structures caused by settlement of fill material.

### **3.6 BACKFILL AND STRUCTURES**

- A. Remove form materials and trash from excavation before placing backfill.
- B. Do not operate earth-moving equipment within 5 feet of walls of concrete structures for the purpose of depositing or compacting backfill material.
- C. Compact backfill adjacent to concrete walls with hand-operated tampers or similar equipment that will not damage the structure.
- D. Backfill water-holding basins only after satisfactory leakage tests have been conducted.
- E. Place earth fill in areas not designated to be structural fill or granular fill.
- F. Deposit material in maximum 6-inch loose lifts, and compact each lift to not less than 95 Percent Standard Proctor.

### **3.7 FILL NOT BENEATH STRUCTURES OR FACILITIES**

- A. Place earth fill to the lines and grades shown.
- B. Place fill material in maximum 6-inch loose lifts and compact each lift to not less than 95 Percent Standard Proctor.
- C. Make proper allowance for topsoil where required.

### **3.8 MOISTURE CONTROL**

- A. During compacting operations, maintain optimum practicable moisture content required for compaction purposes in each lift of fill.
- B. Maintain moisture content uniform throughout the lift.
- C. Add water to the material at the site of excavation. Supplement, if required, by sprinkling the fill.
- D. At the time of compaction, maintain the water content of the material at optimum moisture content, plus or minus 2 percentage points, except as otherwise specified for embankments.

- E. Do not attempt to compact fill material that contains excessive moisture.
- F. Aerate material by blading, discing, harrowing, or other methods, to hasten the drying process.

### **3.9 FIELD DENSITY TESTS**

- A. Test Methods: ASTM D2922, D1556, D2216, and D3017.
- B. Cooperate with testing work by leveling small test areas designated by the Engineer.
- C. Backfill test areas.
- D. Field density test shall be performed for every 3,000 cubic yards of fill material placed.
- E. Engineer may order testing of lift of fill at any time, location, or elevation.

### **3.10 SITE GRADING**

- A. Perform earthwork to lines and grades as shown on Drawings with proper allowance for topsoil where specified or shown on Drawings.
- B. Shape, trim, and finish slopes to conform with the lines, grades, and cross sections shown.
- C. Slopes shall be free of loose exposed roots and stones exceeding 3-inch diameter.
- D. Round tops of banks to circular curbs, in general, not less than a 6-foot radius.
- E. Neatly and smoothly trim rounded surfaces; over-excavating and backfilling to the proper grade are not acceptable.
- F. Finished site grading shall be reviewed by the Engineer.

### **3.11 DISPOSAL OF EXCESS EXCAVATION**

- A. Dispose of excess excavated materials, not required or suitable for use as backfill or fill, outside of the area of work.
- B. Compact excess material as specified for fill, dress the completed disposal area to slopes no greater than 4:1 (horizontal:vertical), and slope to drain.

### 3.12 SETTLEMENT

- A. Settlement in backfill, fill, or in structures built over the backfill or fill, that may occur within the 1-year guarantee period in the General Conditions shall be considered to be caused by improper compaction methods.
- B. Restore structures damaged by settlement to original condition.

END OF SECTION

## SECTION 02315

### TRENCH EXCAVATION, BACKFILL, AND COMPACTING

#### PART 1. GENERAL

##### 1.1 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 including rock to depths shown or as directed by Engineer.
- C. Pipe zone includes full width of excavated trench from bottom of pipe to a point 6 inches 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 extra compensation for dewatering and rock excavation.

##### 1.2 RELATED SECTIONS

- A. Section 02515 - Polyvinyl Chloride (PVC) Pipe and Fittings.

### 1.3 REFERENCES

- A. Arkansas Highway and Transportation Department, P.O. Box 2261, Little Rock, Arkansas 72203, latest edition.
  - 1. AHTD 303 - Aggregate Base Course.
- B. ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959.
  - 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-inch (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-inch (457-mm) Drop.
  - 4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes.
  - 5. ASTM D2922 - Test Methods for Density of Soils and Soil-Aggregates in Place by Nuclear Method.
- 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

### 2.1 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 compaction, and meeting ASTM D448 Size No. 67 (Concrete Aggregate).

### 2.2 PIPE ZONE MATERIAL

- A. Select material shall consist of fine loose earth or sand free from clods or rocks larger than 3/4 inches 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 1/4-inch to 3/4-inch.

### **2.3 COMMON FILL MATERIALS**

- A. Material shall not contain pieces larger than 3 inches, and shall be free of roots, debris, or organic matter.

### **2.4 SELECT FILL MATERIALS**

- A. Class 7, Class 3, and Class 4 as established by Section 303 of Arkansas Highway and Transportation Department Standard Specifications for Highway Construction.
- B. ASTM Soil Classification GC as set forth in ASTM Designation D2487-92. On site material may be used, provided it is in accordance with ASTM D2487-92.

### **2.5 BEDDING MATERIAL**

- A. Pea gravel, sand, or other locally available bedding material, as approved.

### **2.6 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.

### **2.7 PVC WATER AND SEWER PIPE TRENCH**

- A. See Drawings for trench details.

### **2.8 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 in such condition so that it will deliver manufacturer's rated compactive effort.

### **2.9 IMPORTED TOPSOIL**

- A. Suitable sandy loam from an approved source.
- B. Must 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**

### **3.1 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.

### **3.2 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.

### **3.3 DISPOSAL OF CLEARED MATERIAL**

- A. Dispose of material in such a manner to meet 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.

### **3.4 REMOVAL OF OBSTRUCTIONS**

- A. Remove obstructions within trench area or adjacent thereto 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.

### **3.5 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 inches for full width of trench to be excavated.

- B. Use equipment capable of removing a uniform depth of material.
- 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 inches.
- 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.

### **3.6 TRENCH WIDTH**

- A. Minimum width of unsheeted trenches where pipe is to be laid shall be 18 inches greater than the outside diameter of the pipe, or as approved.
- B. Maximum width at top of trench will 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 owner.

### **3.7 EXCAVATION**

- A. 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.
- B. If trench is excavated below required grade, correct with foundation stabilization material.
- C. Place material over full width of trench in compacted layers not exceeding 6 inches deep to established grade with allowance for pipe base or special bedding.

### **3.8 PREPARATION OF TRENCH - LINE AND GRADE**

- A. Do not deviate more than ½ inch from line or ½ inch 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.

### **3.9 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.

### **3.10 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.

### 3.11 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 under 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.

### 3.12 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 inches 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 percent organic material by volumetric sampling or when it will not support a reading of 1.5 on a hand penetrometer.

### 3.13 ROCK IN PIPE TRENCH

- A. Where rock is encountered in bottom of trench, support pipe on bedding material.
- B. Minimum Bedding Thickness: Minimum of 4 inches or one eighth of the outside diameter of pipe, whichever is greater.
- C. Extend bedding up pipe sides one sixth of outside diameter of the pipe, minimum.
- D. Backfill over pipe according to pipe zone type.

### **3.14 PIPE ZONE BACKFILL**

- A. Depth of the pipe zone above pipe barrel varies with pipe material.
- B. Particular attention must 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-inch 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 determined by class of backfill.
- F. In lieu of selected material for pipe zone in upper portion of pipe zone, imported pipe zone material approved by Engineer for trench backfill may be substituted.
- G. If the Engineer determines that the existing material is insufficient or unsuitable at trench side for selected material for pipe zone in upper portion of pipe zone, provide suitable material from other trench excavation along pipeline or imported pipe zone material.

### **3.15 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 such a way as to permit free fall of material until at least 2 feet 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  $\frac{1}{2}$  cubic foot.

### **3.16 EXCESS EXCAVATED MATERIAL**

- A. Dispose of excess excavated material off project site in an approved area.

### **3.17 DRAINAGE CULVERTS**

- A. Replace drainage culverts which 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.

### **3.18 PIPE COVER**

- A. Place select material from excavation over pipe to provide minimum coverage, as shown on Drawings or as directed by Engineer.

### **3.19 DRAINAGE DITCH RESTORATION**

- A. Undercrossings of minor drainage ditches not covered in another Specification Section shall be backfilled so that upper 1 foot of material in ditch between ditch banks is clay.
- B. Compact material for full ditch width by 6 passes of vibratory compactor (or equivalent).
- C. Where indicated on Drawings, provide concrete arch, and/or riprap on ditch banks.

### **3.20 SETTLEMENT**

- A. Correct settlement noted in backfill, fill, or in structures built over backfill or fill within warranty period.

### **3.21 IMPORTED TOPSOIL**

- A. Should regenerative material be present in soil, remove both surface and root which appears in within 1 year following acceptance of Project in a manner satisfactory to Owner.

**END OF SECTION**

## SECTION 02514

### CEMENT-LINED DUCTILE IRON PIPE AND FITTINGS - WATER

#### PART 1. GENERAL

##### 1.1 SUMMARY

- A. Provide cement-lined ductile iron pipe and gray cast iron or ductile iron fittings specified.
- B. Pipe and fittings shall be manufactured in the United States. Foreign made products shall be unacceptable.
- C. Service shall include potable waterline.

##### 1.2 RELATED SECTIONS

- A. Section 02315 - Trench Excavation, Backfilling, and Compacting.
- B. Section 02515 - Polyvinyl Chloride (PVC) Pipe and Fittings.

##### 1.3 REFERENCES

- A. American National Standards Institute, 25 West 43rd Street, 4 floor, New York, NY, 10036.
  - 1. ANSI/AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
  - 2. ANSI/AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings, 3 in Through 48 in, for Water and other Liquids.
  - 3. ANSI/AWWA C111/A21.11 - Rubber Gasket Joints for Ductile-Iron and Gray-Iron Fittings Pressure Pipe and Fittings.
  - 4. ANSI/AWWA C115/A21.15 - Flanged Ductile-Iron Pipe with Threaded Flanges.
  - 5. ANSI/AWWA C150/A21.50 - Thickness Design of Ductile-Iron Pipe.
- B. ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959.
  - 1. ASTM A307 - Specifications for Carbon Steel Externally Threaded Standard Fasteners.
  - 2. ASTM A563 - Specification for Carbon and Alloy Steel Nuts.
  - 3. ASTM D1248 - Specification for Polyethylene Plastic Molding and Extrusion Materials.

- C. American Water Works Association, 6666 West Quincy Avenue, Denver, Colorado 80235.
  - 1. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in., for Water and Other Liquids.
  - 2. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
  - 3. AWWA C115 - Standard for Flanged Ductile-Iron Pipe with Threaded Flanges.
  - 4. AWWA C207 - Standard for Steel Pipe Flanges for Waterworks Service, Sizes 4 in. Through 144 in.

## **PART 2. PRODUCTS**

### **2.1 PIPE**

- A. Buried Pipe: Pressure Class 250 or 300, as shown on Drawings and in compliance with applicable requirements of ANSI A21.50. Flanged pipe shall meet or exceed ANSI/AWWA C115/A21.15.
- B. Pipe shall be jointed with push-on, mechanical, flanged, restrained, or flexible joints meeting applicable requirements of ANSI A21.11-72 and ANSI 21.15-75.
- C. Ductile iron pipe shall receive standard thickness cement lining and bituminous seal coat in conformance with ANSI/AWWA C104/A21.4.
- D. Ductile iron pipe shall be coated on the exterior with either coal tar or asphalt base material approximately 1 mil thick.
- E. Flexible Joint (Ball and Socket) Pipe: Class 58.

### **2.2 FITTINGS**

- A. Ductile iron, Pressure Class 250 or 300 Class as shown on Drawings, cement-lined and seal-coated. Where taps are shown on fittings, tapping bosses shall be provided.
  - 1. Flanged Joint: ANSI/AWWA C115/A21.15, faced and drilled. 125-pound ANSI standard.
  - 2. Mechanical Joint: ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11.
  - 3. Flexible Joint: American Flex-Lox pipe or equal.
- B. Cement Linings: In accordance with ANSI/AWWA C104/A21.4
- C. Fittings shall receive an exterior coating of 1 mil thick bituminous material in accordance with ANSI/AWWA C104/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.

## **2.3 FLANGES**

- A. ANSI/AWWA C115/A21.15, threaded, 250 psi working pressure, ANSI 125-pound drilling.

## **2.4 BOLTS**

- A. For Class 125 FF flanges use carbon steel, ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts.
- B. For Class 250 RF flanges use carbon steel, ASTM A307, Grade B hex head bolts and ASTM A563, Grade A heavy hex head nuts.
- C. For mechanical joint use manufacturer's standard.

## **2.5 GASKETS**

- A. Gaskets for mechanical joints shall be rubber, conforming to ANSI/AWWA C111/A21.11.
- B. Gaskets for flanged joints shall be 1/8-inch thick, cloth-inserted rubber conforming to applicable parts of ANSI/AWWA C115/A21.15 and AWWA C207.
- C. Gasket Material: Free from corrosive alkali or acid ingredients and suitable for use in potable waterlines.
- D. Gaskets shall be full-face type for 125-pound FF flanges.

## **2.6 LUBRICANT**

- A. Lubricant for push-on or mechanical joint end piping shall be manufacturer's standard.

# **PART 3. EXECUTION**

## **3.1 HANDLING PIPE**

- A. Do not damage the cement lining when handling the pipe.

### **3.2 RELATION TO SEWER LINE**

- A. Laying water main, follow Health Department requirements. Maintain 10-foot horizontal separation and 18-inch vertical separation in crossing.

### **3.3 CUTTING PIPE**

- A. Cut pipe with milling type cutter, rolling pipe cutter, or abrasive saw cutter. Do not flame cut.

### **3.4 DRESSING CUT ENDS**

- A. Dress cut ends of pipe in accordance with the type of joint to be made.
- B. Dress cut ends of mechanical joint pipe to remove sharp edges or projections which may damage the rubber gasket.
- C. Dress cut ends of pipe for flexible couplings and flanged coupling adapters as recommended by the coupling or adapter manufacturer.

### **3.5 MECHANICAL JOINT**

- A. Join pipe with mechanical joints in accordance with the manufacturer's recommendations. Provide special tools and devices, special jacks, chokers, and similar items required for proper installation. Pipe manufacturer shall provide lubricant for the pipe gaskets, no substitutes shall be permitted.

### **3.6 FABRICATION OF FLANGED PIPE AND FITTINGS**

- A. Flanged pipe and fittings shall be fabricated in the shop, not in the field, and delivered to the job site with flanges in place and properly faced.
- B. Threaded flanges shall be individually fitted and machine tightened on the threaded pipe by the manufacturer.
- C. Flanges shall be faced after fabrication in accordance with ANSI/AWWA C115/A21.15.

### **3.7 JOINTING FLANGED PIPE**

- A. Prior to connecting flanged pipe, the faces of the flanges shall be thoroughly cleaned of oil, grease, and foreign material.
- B. The rubber gaskets shall be checked for proper fit and thoroughly cleaned.
- C. Care shall be taken to assure proper seating of the flanged gasket.
- D. Bolts shall be tightened so that the pressure on the gasket is uniform.

- E. Use torque-limiting wrenches shall be used to ensure uniform bearing insofar.
- F. If joints leak when the hydrostatic test is applied, the gaskets shall be removed and reset and bolts retightened.

### 3.8 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.

### 3.9 TESTING

- A. Lines shall be hydrostatically or mechanically tested. Test procedures shall be as specified in Section 02530.

### 4.0 POLYETHYLENE MATERIAL FOR DUCTILE IRON PIPE PROTECTION

- A. Polyethylene material, either in tubing form or flat sheets or rolls, as specified herein, shall be placed around all Ductile Iron pipe and fitting joints and all valves and fire hydrants with mechanical joint ends, and all saddles, sleeves, couplings, tapping saddles and any other appurtenances with exposed bolts, as directed by the Owner. Ductile iron pipe and appurtenances shall be completely encased in polyethylene tubing material.

Specific requirements for the polyethylene material are:

The material shall conform to ANSI A21.5 (AWWA C-105). The tubing material shall be made from virgin polyethylene extended in the form of a tube and shall have the following characteristics:

Minimum thickness	8 mils
ASTM D1248, Type I, Class C (black)	Grade E-1
Maximum flow index	0.4
Minimum tensile strength	1,200 p.s.i.
Minimum elongation	300%
Dielectric strength (raw material)	Volume resistivity minimum
Dielectric strength (sheet material)	800 V/mil

Tape for field application shall be Polyken #900 or Scotchwrap #50 or equal, at least two (2) inches wide.

**END OF SECTION**

## SECTION 02515

### POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS - SEWER

#### PART 1. GENERAL

##### 1.1 SUMMARY

- A. Provide polyvinyl chloride (PVC) pipe and fittings.

##### 1.2 RELATED SECTIONS

- A. Section 02315 - Trench Excavation, Backfill, and Compacting.

##### 1.3 REFERENCES

- A. Arkansas Department of Health.
  - 1. ADHHS: *"Rules and Regulations Pertaining to Public Water Systems, latest Edition."*
- B. ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959.
  - 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.
- C. American Water Works Association, 6666 West Quincy Avenue, Denver, Colorado 80235.
  - 1. AWWA C110/A21.10-03 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. For Water and Other Liquids.
  - 2. AWWA C605-05 - Underground installation of Polyvinyl chloride (PVC) Pressure Pipe and Fittings for Water.
  - 3. AWWA: *"The Ten States Standards for Water, 2007 Edition or latest version."*

## **PART 2. PRODUCTS**

### **2.1 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. Pipe and fittings shall be manufactured in the United States. Foreign made products shall be unacceptable.
- C. Pipe shall be permanently marked at 5-foot 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.

### **2.2 JOINTS**

- A. Buried Pipe: Gasketed slip joint.
- B. Comply with ASTM D3139.

### **2.3 FITTINGS**

- A. Fittings 4 Inches and Larger: Ductile iron, 350 psi pressure class, cement-lined and seal-coated. Where taps are shown on fittings, tapping bosses shall be provided.
  - 1. Flanged Joint: ANSI/AWWA C110/A21.10-03 and ANSI B16.1, faced and drilled 125-pound ANSI standard.
  - 2. Mechanical Joint: ANSI/AWWA C110/A21.10-03 and ANSI/AWWA C110/A21.11-07.
  - 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 Inches: PVC.

## **2.4 GASKETS**

- A. As recommended by pipe manufacturer to conform to pipe.
- B. Comply with ASTM F477.

## **2.5 MARKING TAPE**

- A. Install on pressure systems.
- B. Terra Tape "Extra Stretch."
- C. Or equal.

# **PART 3. EXECUTION**

## **3.1 GENERAL**

- A. Any connection to water main for the purpose of connecting any water line to the water main, shall use a minimum of Schedule 40, Polyvinyl chloride (PVC) pipe.
- B. Rigid PVC pipe shall be cut, made up, and installed in accordance with the pipe manufacturer's recommendations.
- C. Offset shall be as recommended by the manufacturer for the maximum temperature variation between time of installation and final use.

## **3.2 TRACE WIRE**

- A. Furnish and install a 14-gage insulated copper trace wire with PVC pressure pipe.
- B. Run wire continuous from valve box to valve box, meter box, air release vault, cleanout, or other access points.

- C. Bring wire up inside boxes and vaults in an accessible method.
- D. Bring wire around or tape wire to each pipe section.
- E. Pipe testing shall include following trace wire.
- F. Wire breaks shall be repaired at no additional expense to the Owner.

### **3.3 MARKING TAPE**

- A. On pressure installations of non-metallic pipe, metallic marking tape, Terra Tape Extra Stretch or equal shall be installed 6 to 12 inches above the top of pipe or service line.
- B. The tape shall be in addition to the trace wire specified.

### **3.4 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.

### **3.5 TESTING**

- A. Pressure lines shall be hydrostatically tested at the pressures listed in Section 02530.
- B. Use pipe-locating equipment to test continuity of trace wire.
- C. Engineer shall observe and document trace wire test.

**END OF SECTION**

## **SECTION 02530**

### **SEWAGE COLLECTION SYSTEM**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Provide sewage collection system.
- B. Perform pressure and leakage testing of piping.

##### **1.2 RELATED SECTIONS**

- A. Section 02315 - Trench Excavation, Backfill, and Compacting.
- B. Section 02514 - Cement-Lined Ductile Iron Pipe and Fittings - Sewer.
- C. Section 03003 - Site Cast-in-Place Concrete.
- D. Section 05500 - Fabricated Metalwork and Castings.

##### **1.3 SHOP DRAWINGS**

- A. Submit specific selection of pipe material and joint type for each pipeline in accordance with Section 01001.

##### **1.4 STANDARDS, SPECIFICATIONS, AND CODES**

- A. Building drainage (including floor drains) and vent systems shall conform to Arkansas Plumbing Code.

#### **PART 2. PRODUCTS**

##### **2.1 GENERAL**

- A. Unless otherwise specified or shown on Drawings, pipe used for wastewater conveyance shall be ductile iron.
- B. Like items of material provided shall be the end products of one manufacturer.
- C. To assure uniformity and compatibility of piping components in piping systems, fittings and couplings shall be furnished by the same manufacturer.



## **2.2 PIPE ENDS FOR BURIED PIPING**

- A. Use mechanical joint or push-on joint pipe ends for buried pipe.
- B. Within limitations noted above, pipe materials and joints do not necessarily have to be the same for all lines in a specific service, except that materials and joints for any particular building, or between any two buildings, or for any particular buried line, shall be the same.
- C. No change in material or joint selection will be permitted after submittal of shop drawings and their final review by Engineer.

## **PART 3. EXECUTION**

### **3.1 PIPE PREPARATION AND HANDLING**

- A. Inspect exposed pipe and fittings prior to installing in trench.
- B. Inspect interior and exterior protective coating, repair damaged areas in the field with material similar to the original.
- C. Clean ends of pipe thoroughly.
- D. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.
- E. Use proper implements, tools, and facilities for the safe and proper protection of the pipe.
- F. Avoid any physical damage to the pipe.
- G. Do not drop or dump pipe into trenches.

### **3.2 PREPARATION OF TRENCH - LINE AND GRADE**

- A. Do not deviate more than 1/2 inch from line or 1/2 inch 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.

### **3.3 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.

### **3.4 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.

### **3.5 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.

### **3.6 PIPE COVER**

- A. Minimum Pipe Cover: 2-1/2 feet unless otherwise indicated.

### **3.7 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, in the opinion of the Engineer, trench conditions are unsuitable.
- C. Joints shall be made as specified for the respective types.
- D. Prevent uplift and floating of the pipe prior to backfilling.

### **3.8 TESTING - GENERAL**

- A. Conduct pressure and leakage tests on newly installed pipelines.
- B. Provide necessary equipment and material and make taps in the pipe, as required.
- C. The Engineer will monitor the tests.

### **3.9 TESTING NEW PIPE WHICH CONNECTS TO EXISTING PIPE**

- A. New pipelines that are to be connected to existing pipelines shall be tested by isolating the new pipe with grooved end pipe caps, spectacle blinds, or blind flanges.

### **3.10 GRAVITY SEWERS - ALIGNMENT**

- A. Prior to final acceptance of the Work, the Engineer will test lines for light.
- B. Provide assistance to Engineer and lanterns testing.
- C. Should any line deviate more than 1/2 inch from a straight line between manholes, the line may be rejected by Engineer.
- D. Remove and replace lines rejected by Engineer at no additional cost to Owner.

### **3.11 GRAVITY SEWERS LEAK TEST**

- A. Sewers shall pass leakage tests as specified.
- B. Leakage test shall be performed in the presence of Owner's representative.
- C. Leakage Test by Low Pressure Air Loss:
  - 1. Plug pipe outlets with suitable test plugs.
  - 2. Brace each plug securely.
  - 3. Pipe air supply to pipeline to be tested so that air supply may be shut off, pressure observed, and air pressure released from the pipe without entering the manhole.
  - 4. A valved branch should be left in the supply line past the shut-off valve terminating in a 1/4-inch female pipe thread for installation of the Owner's test gage.
  - 5. Add air slowly to portion of pipe under test until test gage reads at least 4 psig but less than 5 psig.
  - 6. Shut air supply valve and allow at least 2 minutes for internal pressure to stabilize.
  - 7. Determine time in seconds for pressure to fall .5 psig pressure drop from 3.5 psig to 3.0 psig.

8. Compare observed time with minimum allowable times in the Test Chart for Air Testing at the end of this Section for pass or fail determination.
9. Where ground water level is above the crown of the pipe being tested, test pressure should be increased by 0.4333 psi for each foot the ground water level is above the invert.
10. Do not enter manhole while the line is pressurized.

### **3.12 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 percent.
- D. Mandrel dimensions based on 5 percent deflection shall be as follows:
  1. 6-inch diameter pipe: 5.70-inch Mandrel OD.
  2. 8-inch diameter pipe: 7.60-inch Mandrel OD.
  3. 10-inch diameter pipe: 9.50-inch Mandrel OD.
  4. 12-inch diameter pipe: 11.40-inch Mandrel OD.

### **3.13 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 Engineer.

### **3.14 INTERIM CLEANING**

- A. During fabrication prevent the accumulation of weld rod, weld spatter, pipe cuttings and filings, gravel, cleaning rags, and other debris within piping sections.
- B. Examine pipe to assure removal foreign objects prior to assembly.
- C. Shop cleaning may employ using a conventional commercial cleaning method if it does not corrode, deform, swell, or alter the physical properties of the material being cleaned.

### 3.15 EXTERIOR PROTECTION FOR BURIED OR SUBMERGED PIPING ACCESSORIES

- A. Wrap buried, submerged, or embedded mechanical joint fittings and valves with 8 mil polywrap.

#### TEST CHART FOR AIR TESTING SEWERS LEAKAGE TESTING OF SEWERS BY LOW PRESSURE AIR LOSS-- TIME PRESSURE DROP METHOD

Minimum time in (min:sec) for 0.5 psig drop (3.5 psig to 3.0 psig)

Distance Between Manholes	Nominal Pipe Diameter								
	<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>36</u>
100	2:50	3:47	4:43	5:40	7:05	8:30	9:55	11:24	12:54
150	2:50	3:47	4:43	5:40	7:05	9:37	13:05	17:57	20:15
200	2:50	3:47	4:43	5:42	8:54	12:49	17:27	22:48	25:43
250	2:50	3:47	4:57	7:08	11:08	16:01	21:49	28:30	32:09
300	2:50	3:48	5:56	8:33	13:21	19:14	26:11	34:11	38:35
350	2:50	4:26	6:55	9:58	15:35	22:26	30:32	39:53	45:09
400	2:51	5:04	7:54	11:24	17:48	25:38	34:54	45:35	51:28
450	3:12	5:42	8:54	12:50	20:02	28:51	39:16	51:17	57:54

END OF SECTION

**SECTION 02730**  
**GRAVEL SURFACING**

**PART 1. GENERAL**

**1.1 SECTION INCLUDES**

- A. Gravel paving course, compacted.

**1.2 RELATED SECTIONS**

- A. Section 02315 - Trench Excavation, Backfill, and Compacting.

**1.3 REFERENCES**

- A. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
  - 1. ASTM C136 - Method for Sieve Analysis of Fine and Course Aggregates.
- B. Arkansas Highway and Transportation Department, P.O. Box 2262, Little Rock, Arkansas 72203.
  - 1. AHTD 303 - Aggregate Base Course.

**1.4 TESTS**

- A. Gradation of stone materials will be performed in accordance with ASTM C136 and under provisions of Section 01001.

**PART 2. PRODUCTS**

**2.1 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**

### **3.1 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.

### **3.2 PLACING GRAVEL PAVING**

- A. Spread gravel material over prepared base to a total compacted thickness of 6 inches.
- B. Level surfaces to elevations and gradients indicated.
- C. Compact placed gravel materials to achieve 95 Percent Modified Proctor density in accordance with 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 02900

### LANDSCAPING

#### PART 1. GENERAL

##### 1.1 SUMMARY

- A. Provide finish grading and grass establishment.
- B. The intention of this Specification is that the Contractor establish turf on pipelines and areas damaged as a result of construction.
- C. Where lawns are disturbed due to construction, restore lawns using same grass type as found in lawn prior to construction.

#### PART 2. MATERIALS

##### 2.1 TOPSOIL

- A. Existing topsoil shall be reused where practical.
- B. Imported Topsoil:
  - 1. Furnished 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 percent and a maximum of 50 percent organic matter.

##### 2.2 SEED

- A. Certified, blue tag, clean, delivered in original, unopened packages and bearing an analysis of the contents, guaranteed 95 percent pure and to have a minimum germination rate of 85 percent, within 1 year of test.

##### 2.3 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**

### **3.1 PROJECT SCHEDULE**

- A. Project Schedule shall show an anticipated time for grading and seeding to take place, so that seasonal consideration can be given attention.

### **3.2 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 inch 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.

### **3.3 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.

### **3.4 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 inches in diameter from area to a depth of 2 inches prior to preparation and planting grass.

### **3.5 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.

### **3.6 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.

### **3.7 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.

### **3.8 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.

### **3.9 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.

### **3.10 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 percent of total area with bare spots larger than 1 square foot.
  - 3. Not more than 15 percent of total area with bare spots larger than 6 inches square.

**END OF SECTION**

## SECTION 02923

### SEEDING

#### PART 1. GENERAL

##### 1.1 SUMMARY

- A. This item shall consist of furnishing and applying lime, fertilizer, seed, mulch cover, and water according to these specifications at locations shown on the plans or as directed.
- B. The work under this item shall be accomplished as soon as practicable after the grading in an area has been completed in order to deter erosion.

##### 1.2 REFERENCES

- A. Arkansas State Highway and Transportation Department (AHTD), Standard Specifications for Highway Construction, latest edition.

#### PART 2. MATERIALS

##### 2.1 TOPSOIL

- A. Existing topsoil shall be reused where practical.
- B. Imported Topsoil:
  - 1. Furnished 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 percent and a maximum of 50 percent organic matter.

##### 2.2 LIME

- A. Lime shall be agricultural grade ground limestone or equivalent as approved by the Engineer.

##### 2.3 FERTILIZER

- A. Fertilizer shall be a commercial grade, uniform in composition, free flowing, and suitable for application with mechanical equipment.
- B. Fertilizer shall be delivered to the site in labeled containers conform to current Arkansas fertilizer laws and bearing the name, trademark, and warranty of the producer.

## 2.4 SEED

- A. Seed shall have a minimum of 98% pure seed and 85% germination by weight, and shall contain no more than 1% weed seeds.
- B. A combined total of 110 noxious weed seeds shall be the maximum amount per 50 pounds of seed with the following exceptions: Johnson grass seed, wild onion seed, wild garlic seed, field bindweed seed, nut grass seed, sickle pod seed, sesbania seed, indigo seed, morning-glory seed, and cocklebur seed will not be allowed in any amount.
- C. Seed shall be furnished in sealed, standard containers. Seed that has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable.
- D. Legumes shall be inoculated with an approved culture as recommended by the manufacturer, just prior to seeding.
- E. Seeds shall be composed of the varieties and amounts by weight as shown below.

## 2.5 SEED MIX

- A. Seed shall be Common Bermuda Grass, applied at the following rates:

	<u>lbs./acre</u>
<b>March 1 - August 31</b>	
Bermuda Grass (Common) unhulled - husk in tact	10
Bermuda Grass (Common) hulled - husk removed	5
<b>September 1 - February 28/29</b>	
Bermuda Grass (Common) unhulled - husk in tact	20

## 2.6 MULCH COVER

- A. Mulch cover shall consist of straw from threshed rice, oats, wheat, barley, or rye; of wood excelsior; or of hay obtained from various legumes or grasses, such as lespedeza, clover, vetch, soybeans, bermuda, carpet sledge, bahia, fescue, or other legumes or grasses; or a combination thereof. Mulch shall be dry and reasonably free from Johnson grass or other noxious weeds, and shall not be excessively brittle or in an advanced state of decomposition. All material will be inspected and approved prior to use.

## 2.7 TACKIFIERS

- A. Tackifiers used in mulch anchoring shall be of such quality that the mulch cover will be bound together to form a cover mat that will stay intact under normal climatic conditions.

## **2.8 WATER**

- A. Water shall be of irrigation quality and free of impurities that would be detrimental to plant growth.

## **PART 3. EXECUTION**

### **3.1 PROJECT SCHEDULE**

- A. Project Schedule shall show an anticipated time for grading and seeding to take place, so that seasonal consideration can be given attention.

### **3.2 SITE GRADING**

- A. Shape, trim, and finish slopes to conform with lines and grades shown.
- B. Make slopes free of loose exposed roots and stones exceeding 2 inches in 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.

### **3.3 PREPARATION OF SEEDBED**

- A. Areas to be seeded shall be dressed to the shape and section shown on the plans.
- B. If the plans call for replacing topsoil, this shall be done before any preparations for seeding.
- C. Before beginning the seedbed preparation, soil samples shall be obtained from each major soil area for lime requirement analysis.
- D. Lime at the rate determined by the lime requirement test, shall be uniformly spread on areas to be seeded prior to their being roughened or scarified. The seedbed shall be thoroughly pulverized by means of disk harrows or other approved methods, thoroughly mixing lime and soil to a depth of not less than 4 inches (2 inches for slopes 4:1 or steeper) below finish slope elevations. Regardless of the pulverizing method used, the soil shall be broken with the contour of the slope.
- E. Objectionable foreign matter shall be removed and the soil left in a suitable horticultural condition to receive fertilizer and seed. Water may be applied before, during, and after seedbed preparation in order to maintain the desired moisture content in the soil.

- F. When no lime is required, seedbed preparation shall be accomplished as specified above, regardless of the method used in the distribution of fertilizer, seed, and mulch cover.
- G. Rake the area to a uniform grade so that areas drain in the same manner as at the start of the Project.
- H. Lightly compact before planting grass.
- I. Remove trash and stones exceeding 2 inches in diameter from area to a depth of 2 inches prior to preparation and planting grass.

### **3.4 FERTILIZATION**

- A. Fertilizer shall be applied at the rate of 800 pounds per acre of 10-20-10. Fertilizer shall be uniformly incorporated into the soil alone, or in conjunction with the required lime. If the Contractor so elects, the fertilizer may be drilled into the soil or combined with the seed in the hydro-seeding operation.

### **3.5 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.

### **3.6 MECHANICAL SEEDING**

- A. Sow grassed areas evenly with a mechanical spreader, or as otherwise instructed by the Engineer. Roll with cultipacker to cover seed. Method of seeding may be varied at discretion of Contractor on his own responsibility to establish a smooth, uniformly grassed area.

### **3.7 HYDRO-SEEDING**

- A. If hydro-seeder is used for seeding, fertilizer and seed may be incorporated into one operation but a maximum of 800 pounds of fertilizer shall be permitted for each 1500 gallons of water. If the Contractor so elects, the fertilizer may be applied during preparation of the seedbed. The area shall be lightly firmed with a cultipacker immediately before hydro-seeding.

### **3.8 WINTER PROTECTIVE SEEDING**

- A. Winter barley or annual rye grass applied at a rate of 30 pounds/acre shall be used between September 1 and March 1.
- B. Areas receiving temporary winter protective seeding shall be re-seeded when weather conditions become favorable.

### **3.9 MULCH COVER**

- A. Mulch cover shall be applied at the rate of 4,000 pounds per acre immediately after seeding and shall be spread uniformly over the entire area by approved power mulching equipment. When approved by the Engineer, the Contractor may use hand methods to apply mulch cover to small or inaccessible areas.

### **3.10 MULCH ANCHORING**

- A. The mulch shall be effectively pressed into the soil using steel cleated track or cleated roller equipment. The anchoring shall be performed so that the grooves formed are perpendicular to the flow of water down backslopes and foreslopes. The equipment and method used shall produce acceptable results.

### **3.11 WATER**

- A. After application of the mulch cover, water shall be applied in sufficient quantity, as Directed by the Engineer, to thoroughly moisten the soil to the depth of pulverization and then as necessary to germinate the seed.
- B. When directed by the Engineer, the Contractor shall apply water in an amount such that, in conjunction with any rainfall, the seeded and mulched area will receive an amount equivalent to a minimum of 1 inch of water each week beginning the week after seeding and continuing for a minimum of 3 weeks.

### **3.12 MAINTENANCE**

- A. Begin maintenance immediately after each portion of grass is planted and continue until a reasonable stand of grass has been obtained. Repair washed out areas by filling with topsoil, fertilizing, and seeding.

### **3.13 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 15 percent of total area with bare spots larger than 6 inches square.

**END OF SECTION**

## **SECTION 02924**

### **SODDING**

#### **PART 1. GENERAL**

##### **1.1 SUMMARY**

- A. Provide slab sod, fertilizer, and water to establish and maintain grass. Owner shall provide access to water at no cost.
- B. Planting Period: As recommended by sod producer for time of year, subject to Engineer's approval.

##### **1.2 REFERENCES**

- A. Federal Specifications.
  - 1. FS O-F-241 - Fertilizers, Mixed, Commercial.

##### **1.3 DEFINITIONS**

- A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

##### **1.4 REGULATORY REQUIREMENTS**

- A. Comply with regulatory agencies for herbicide composition.

##### **1.5 QUALITY CONTROL**

- A. Grass that has been cut more than 48 hours before placing shall not be used.
- B. Sod shall not be loaded in bulk on vehicles and dumped in bulk on planting site.

##### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver to site, store, and protect products at site.
- B. Sod:
  - 1. Cut sod with approved sod cutters to minimum depth of 2-1/2 inches in satisfactory and uniform widths and convenient lengths for handling.
  - 2. Place cut sod flat, grass side up, on boards and haul to site with soil intact.
  - 3. Sod shall not hang over the edges of the boards.



- C. Fertilizer: Deliver in waterproof bags showing weight, chemical analysis, and name of manufacturer.

## **PART 2. PRODUCTS**

### **2.1 SLAB SODDING**

- A. Type: Common Bermuda.
- B. Certified nursery grade cultivated grass sod, 95 percent weed free.
- C. Sod shall be live, fresh, and uninjured at time of placing.

### **2.2 FERTILIZER**

- A. FS O-F-241, Type and Grade as recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil to the proportions of nitrogen, phosphoric acid, and soluble potash as recommended by County Extension Agent and/or seed manufacturer, subject to Engineer's approval.

### **2.3 WATER**

- A. Clean, fresh, and free of substances or matter which could inhibit vigorous growth of grass.

### **2.4 HERBICIDES**

- A. As recommended by sod producer and as approved by Engineer.

## **PART 3. EXECUTION**

### **3.1 PREPARATION**

- A. Fine grade to eliminate uneven areas and low spots. Allow for thickness of topsoil and sod.
- B. Spread topsoil to minimum 3-inch depth and rake smooth.

### **3.2 FERTILIZING**

- A. Apply approximately 90 percent over entire area to receive slab sodding.
- B. Apply remaining 10 percent over sod after placing and rolling.

### **3.3 SODDING**

- A. Upon delivery to site transfer sod from boards to soil surface.
- B. Place slabs closely, leaving a minimum amount of space between slabs.
- C. Use appropriate tools to pull together slabs that do not fit closely.
- D. Do not handle sod by hand except when filling small cracks or at locations where it would be impractical to use boards.

### **3.4 ROLLING**

- A. Roll slab sod as soon after planting as practicable with plain rollers or cultipackers.
- B. Tamp sod with approved hand methods where rolling is impractical.

### **3.5 MAINTENANCE**

- A. Water to prevent grass and soil from drying out.
- B. Control growth of weeds.
- C. Apply herbicides in accordance with manufacturer's instructions.
- D. Remedy damage resulting from improper use of herbicides.
- E. Immediately re-sod areas which show bare spots.
- F. Protect sodded areas with warning signs during maintenance period.

**END OF SECTION**

## SECTION 03001

### SITE CONCRETE WORK

#### PART 1. - GENERAL

##### 1.1 WORK INCLUDED:

- A. Cast-in-place concrete, including formwork.

##### 1.2 RELATED WORK:

- A. Section 03002 - Site Concrete Reinforcing Steel.
- B. Section 03003 - Site Concrete Fibrous Concrete Reinforcing.

##### 1.3 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 305R: Hot Weather Concreting.
  - 9. ACI 306R: 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 318: Building Code Requirements for Reinforced Concrete.
  - 14. ACI 347: Recommended Practice for Concrete Formwork.

- B. American Society of Testing For Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103 (latest revision).
1. ASTM C31: Making and Curing Concrete Test Specimens in the Field.
  2. ASTM C33: Specification for Concrete Aggregates.
  3. ASTM C42: Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
  4. ASTM C143: Test for Slump of Portland Cement Concrete.
  5. ASTM C150: Specifications for Portland Cement.
  6. ASTM C172: Sampling Freshly Mixed Concrete.
  7. ASTM C173: Test for Air Content of Freshly Mixed Concrete by the Volumetric Method.
  8. ASTM C231: Test for Air Content of Freshly Mixed Concrete by the Pressure Method.
  9. ASTM C260: Specification for Air-Entraining Admixtures for Concrete.
  10. ASTM C309: Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  11. ASTM C494: Specification for Chemical Admixtures for Concrete.
  12. ASTM E329: Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.
- C. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."
- D. Local Codes and Ordinances: Wherever provisions of the Standard Building Code or the local current ordinances are more stringent than the above referenced Specifications and Standards, the local codes and ordinances shall govern.

#### 1.4 SUBMITTALS:

- A. Submit the following in accordance with the Frontend Documents:
1. Product Data: Submit manufacturer's product data for reinforcement and forming accessories, patching compounds, curing compounds, and other materials.
  2. Shop Drawings: Submit for review prior to Installation, Shop Drawings of all reinforcing steel, including bar cutting lists, typical bar bend diagrams, construction of forms including jointing, reveals, and location and pattern of form tie placement.
  3. Design Mix: Prior to placement of concrete, the Contractor shall submit a design mix showing the proportions and compressive strength obtained from the concrete at 7 and 28 days. The design mix shall include a complete list of materials including type, brand, source, and amount of; cement, fly ash, ground slag, coarse aggregate, fine aggregate, water, air content and admixtures, if applicable. The mix design shall be submitted to the Architect at least ten (10) days prior to the start of operations. Placement of concrete shall not begin until the mix design is approved in writing by the Architect.

## 1.5 QUALITY ASSURANCE/ACCEPTANCE:

- A. Inspection: Architect 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. Evaluation and acceptance of concrete shall conform to ACI 318.
- D. The Contractor shall engage a testing laboratory acceptable to Owner and Architect to perform material evaluation tests and to design concrete mixes. All testing shall be paid for by the Contractor.
- E. The mixing or alternate use of cement from different manufactures will not be permitted. The source of any materials shall not be changed without the written approval of the Architect.
- F. If the cement furnished produces erratic results under field conditions incident to the placing of the concrete, or in regard to the strength of the finished product, or in the time of the initial or final set, the Contractor shall, without notice from the Architect, cease the use of that source of cement.
- G. Should a change in sources be made, or admixtures added or deleted from the mix, a new design mix must be submitted to the Architect for approval.
- H. The Contractor is responsible for product quality control during handling, blending, mixing, transporting, and placement operations, and for necessary adjustments in proportioning of the materials to produce an acceptable mix. The Contractor shall perform all applicable quality control sampling and testing required to ensure that the completed concrete complies with all requirements and specifications. The Contractor shall furnish all personnel, equipment, and facilities necessary to perform the required sampling and pay for testing.
- I. The Contractor shall be responsible for ensuring that all concrete cylinders, including those made for determination of quality acceptance, are properly cured while at the jobsite.

J. Field Sampling and Testing:

1. Field samples shall be made and cured in accordance with ASTM C31, for each concrete strength, at the rate of 4 test cylinders and one slump test for each 50 cubic yards of concrete from each days pour. Make air content check for each set of test cylinders in accordance with ASTM C173 or ASTM C231. Air content and slump shall be checked and recorded at both truck discharge and point of placement for pumped concrete from the first load each day and every 50 cubic yards thereafter.
2. Test Cylinders: One at 7 days, two at 28 days, and reserve the remaining cylinder for testing after a longer period as required by the Architect if the 28 day tests do not meet or exceed the required strength.
3. The taking of samples from small pours of 10 cubic yards or less may be omitted at the discretion of the Architect.
4. Additional Test Slumps: Every 25 cubic yards, recording location for report.
5. When early form removal is requested, field cure cylinders will be tested at 7 days or less to determine sufficient strength.

K. Testing: Where average strength of any group of 3 cylinders falls below the minimum comprehensive strength, or an individual cylinder falls more than 500 psi below minimum compressive strength specified, the Contractor will be required to have a certified laboratory core the concrete and test it in accordance with ASTM C42. Specimens shall be selected by the Architect from location in structure represented by test specimen or specimens which failed. At the discretion of the Architect, Swiss hammer testing may or may not be used to aid in determination of acceptable concrete.

1. Specimens shall be secured, prepared, and tested in accordance with ASTM C42, within a period of 60 days after placement of concrete.
2. Concrete will be deemed approved meeting the strength requirements of this Section if it meets the strength requirements of ACI 318.
3. The cost of cutting specimens from the structure, patching the resulting holes, and making laboratory analysis shall be at the sole expense of the Contractor.
4. Holes from which the cored samples are taken shall be packed solid with no slump concrete proportioned in accordance with ACI 211. Patching shall have the same design strength as the specified concrete.
5. Should laboratory analysis indicate that the proper concrete mix has not been used, all concrete poured where inappropriate mix was used shall be subject to rejection, before, during, or after the pour.
6. If any of the specimens cut from the structure fail to meet the requirements of ACI 318, the Architect shall have the right to require the defective concrete to be replaced, at the Contractors sole expense, and at no additional cost to the Owner.

- L. Sampling: In addition the slump test specified in this Section, the Contractor shall keep a cone and rod apparatus on the Project site for random testing of batches. When concrete does not meet the specified slump requirements, and when directed by the Architect, the Contractor will immediately perform a slump test in accordance with ASTM C143. Concrete not meeting the slump requirements shall be removed from the Project site.
- M. The Contractor shall provide an opportunity for the Architect to observe all quality control sampling and testing procedures.

## **PART 2. - PRODUCTS**

### **2.1 CEMENT:**

- A. Portland cement: ASTM C150 Type I.

### **2.2 WATER:**

- A. Clean and free from oil, acid, alkali, salt, organic matter, or other deleterious substances.
- B. Potable.

### **2.3 CONCRETE AGGREGATES:**

- A. General:  
Natural aggregates, well graded, free from deleterious coatings and organic materials conforming to ASTM C33 (latest revision).
  - 1. Import non-reactive aggregates if local aggregates are reactive. (Appendix XI-ASTM C33).
  - 2. Wash aggregates uniformly before use.
  - 3. Other aggregate gradations can be approved by Architect.
- B. Fine Aggregates:
  - 1. Clean, sharp, natural or manufactured sand, free of loam, clay, lumps, or other detrimental materials and conforming to ASTM C33.
  - 2. Less than 2 percent passing the No. 200 sieve.
  - 3. Maximum size 1-1/2 inches.

- C. Course Aggregates:
  - 1. Natural gravel, crushed gravel, crushed stone, or combination of these materials.
  - 2. Less than 15 percent float or elongated particles (long dimension >5 times short dimension).
  - 3. Less than 0.5 percent passing the No. 200 sieve.

## **2.4 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.
  - 3. Master Builders, MB-VR.
  - 4. Or approved equal.
- B. ASTM C260; nontoxic after 30 days.
- C. Use only the specified non-corrosive non-chloride accelerator. Calcium chloride is not permitted.
- D. Provide for concrete exposed to freezing and thawing, required to be watertight or placed during cold weather. Air Content: 5 to 6 percent.

## **2.5 ADMIXTURES:**

- A. Water-Reducing Admixture: Conforming to ASTM C494, Type A:
  - 1. Eucom WR-75 by the Euclid Chemical Company.
  - 2. Pozzolith 200N by Master Builder.
  - 3. Plastocrete 160 by Sika Chemical Corporation.
- B. Water-Reducing Retarding Admixture: Conforming to ASTM C494, Type D:
  - 1. Eucom Retarder-75 by the Euclid Chemical Company.
  - 2. Pozzolith 100XR by Master Builder.
  - 3. Plastiment by Sika Chemical Company.
- C. High-Range Water-Reducing Admixture (Superplasticizer): Conforming to ASTM C494, Type F or G:
  - 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:
  - 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 percent chloride ions.
- F. Certification: Submit written conformance to the requirements and chloride ion content of the admixture to Architect prior to mix design review.

## 2.6 FORMS:

- A. Unexposed Finish Concrete: Plywood, lumber, metal or other acceptable material approved by the Architect. Lumber shall be dressed on at least 2 edges and 2 sides for a tight fit if used.
- B. Form Coatings: Commercial formulation from coating compound with maximum VOC of 350 mg/l that will not bond, stain, or adversely affect concrete surfaces in contact with and will not impair succeeding treatments of concrete surfaces.
- C. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent deflection and spalling of concrete upon removal. Units provided shall not leave any metal closer than 1-1/2 inch to exposed surface. Provide ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

## 2.7 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 Architect'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.

## **2.8 BOND BREAKER:**

- A. Manufacturers:
  - 1. Williams Tilt-Up Compound, Williams Distributors Inc., Seattle, Washington.
  - 2. Silcoseal 77, Superior concrete Accessories, Franklin Park, Illinois.
  - 3. Or Equal.
- B. Nonstaining type.
- C. Provide positive bond prevention.
- D. Submit copies of manufacturer's data, recommendations, and instructions for specific use on this Project for review.

## **2.9 CURING COMPOUND:**

- A. Liquid Membrane-Forming Curing Compound: ASTM C309, Type I; Class A.  
Moisture loss not more than 0.005 gr./sq. cm. applied at 200 square feet per gallon.
  - a. Conspec, Conspec Cure & Seal.
  - b. Sonneborn, Kure-N-Seal.
  - c. Master Builders, MasterKure.
  - d. Or approved equal.

## **2.10 BONDING AND REPAIR MATERIALS:**

- A. Rewettable Bonding Compounds:
  - 1. Polyvinyl acetate type.
  - 2. Manufacturer:
    - a. Euco Weld by the Euclid Chemical Co.
    - b. Weldcrete by the Larsen Co.
    - c. Sonnocrete by Sonneborn.
    - d. Daraweld C by W. R. Grace.
  - 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 Co.
    - 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. 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 Co. 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.
- E. Underlayment Compound:
  - 1. Free-flowing, self-leveling, pumpable cementitious base compound.
  - 2. Manufacturer:
    - a. Flo-Top by the Euclid Chemical Co.
    - b. Or approved equal.
- F. Repair Topping:
  - 1. Self-leveling, polymer modified high strength topping.
  - 2. Manufacturer: Thin Top SL by the Euclid Chemical Co.

### **PART 3. - EXECUTION**

#### **3.1 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 Architect by the testing laboratory for approval.
- D. Do not place concrete prior to receipt of Architect's written approval of mixes and cylinder test results.
- E. Design mix and perform tests to meet the requirements as specified.
- F. Slump: 2-4"

- G. Water/Cement Ratio:
  - 1. Watertight concrete exposed to fresh water and freeze/thaw: 0.50 max.
  - 2. Air entrained concrete exposed to fresh water: 0.50 max.
- H. Combined Aggregate Gradings:
  - 1. Aggregates for concrete shall be proportioned in accordance with "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete." ACI 211.1.
  - 2. Maximum aggregate size: Do not exceed one-fifth the narrowest dimension between sizes of forms or 3/4 of the clear space between reinforcing bars, 1-1/2 inch maximum.

### 3.2 MIXES:

- A. Strength: Concrete minimum strength at 28 days as noted on Drawings or as specified in other Sections.
- B. Mix Designs:
  - 1. Prepare design mixes for each type of concrete, in accordance with ACI 301 and ACI 318, except as otherwise specified.
- C. Conform to ACI 304 current edition for measuring, mixing, transporting and placing concrete.
- D. Concrete Mix Adjustments: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, and as approved by Architect. Laboratory test data for revised mix design and strength results shall be submitted to and approved by Architect prior to using in Work.

### 3.3 FORMS:

- A. Coordinate with other trades whose work may be located within or below concrete.
- B. Coordinate installation of joint materials and vapor retarders with placement of forms and reinforcing steel.
- C. Notify Architect 1 full working day prior to erection of forms for inspection.
- D. Cleaning and Tightening:
  - 1. Clean forms thoroughly and adjacent surfaces to receive concrete.
  - 2. Remove chips, wood, sawdust, dirt or other debris immediately prior to concrete placement.
  - 3. Retighten forms after concrete placement to eliminate leaks.

- E. 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.
- F. Reuse of Forms: Do not reuse forms unless they are in new and undamaged condition.
- G. Chamfer exposed corners and edges 3/4 inch unless otherwise specified or shown on Drawing. Use wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- H. Preparation of Form Surfaces: Coat the contact surfaces of forms with a form-coating compound where applicable prior to placement of reinforcement.
- I. Other Trades: Provide openings in concrete form work to accommodate Work of other trades. Determine size and location of openings, recesses, and chases for other trades providing such ties. Accurately place and securely support items built-in to form.
- J. Form Tolerances: Construct forms to sizes, shapes, lines, and dimensions shown, work in finished structures.
- K. 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. Do not remove forms until the concrete has attained 67 percent of 28 day strength or a minimum of 4 days. Use a method of form removal which will not cause overstressing of the concrete.

### 3.4 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.

### 3.5 PLACING CONCRETE - GENERAL:

- A. Do not place concrete without Architect being present.
- B. Allow other trades reasonable time to complete portions of work which must be completed before concrete is placed.
- C. Notify Architect 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 Architect 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 1.5 feet deep:
  - 1. Without segregation or loss of ingredients.
  - 2. Without splashing forms or steel above.
- G. Do not use concrete truck chutes, pipes, finishing tools, etc., constructed of aluminum.
- H. 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.
- I. Before placing concrete, clean and inspect form work, reinforcing steel, and items to be embedded or cast-in-place. Notify other trades prior to placement of concrete to permit the installation of their Work. Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.
- J. Conveying:
  - 1. Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials.
  - 2. 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. Provide equipment for chuting, pumping, and pneumatically conveying concrete of proper size and design to insure a practically continuous flow of concrete at the point of delivery and without segregation of the materials.
4. Keep open troughs and shutes clean and free from coatings of hardened concrete.
5. Do not allow concrete to drop freely more than 10 feet. Equipment and methods used for conveying are subject to the approval of Architect.

### **3.6 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 Architect'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 ratio will not be exceeded.
- C. All concrete shall be 4000 psi at 28 days with a maximum cement water ratio of .45 unless noted otherwise on Design Drawings.

### **3.7 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. 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.
- E. Do not use vibrators to transport concrete in forms.

### **3.8 PLACING CONCRETE IN HOT WEATHER:**

- A. Comply with the requirements of ACI 305.
- B. Do not place concrete at times when temperature is forecast to exceed 100 degrees F within 12 hours after the concrete is placed.
- C. Fog spray forms, reinforcing steel, and subgrade just before placing concrete.

- D. Make every effort to maintain concrete temperature:
  - 1. Temperature of concrete shall be below 90 degrees F at time of placement, cool the ingredients before mixing by use of chilled water.
  - 2. Concrete batches with temperature in excess of 90 degrees F will be rejected.
- E. Place concrete promptly upon arrival at Project and vibrate immediately after placement.
- F. Do not add water to retemper.
- G. Consider placing concrete in late afternoon as opposed to early morning.
- H. Protect and cure exposed surfaces by one of the following:
  - 1. Continuous water curing.
  - 2. Moisture-cover curing.

### **3.9 PLACING CONCRETE IN COLD WEATHER (ACI 306R-78):**

- A. Preparation:
  - 1. Comply with the requirements of 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.
- B. Placement:
  - 1. Surfaces to be in contact with concrete shall be free of snow, ice, and frost and shall be above 40 degrees F.
  - 2. Do not place concrete on frozen subgrade.
  - 3. Placement of insulating material, tarpaulins, or other movable 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 covered and maintain concrete temperature at a minimum of 50 degrees 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 forms be left 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.



### 3.10 PATCHING - GENERAL:

- A. Prior to starting patching work, except as specified, obtain Architect's approval of proposed patching techniques and mixes.

### 3.11 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 Architect, 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. 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-inch 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 Architect, 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 Architect.

### **3.12 BLOCKOUTS AT PIPES OR OTHER PENETRATIONS:**

- A. Submit proposed blockouts for review in accordance with the Frontend Documents.

### **3.13 CONCRETE CURING:**

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301. Avoid rapid drying at end of final curing period.
- B. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as specified herein.
  1. Provide moisture curing by keeping concrete surface continuously wet by covering with water, by water-fog spray, or by covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4 inch lap over adjacent absorptive covers.
  2. Provide moisture-cover curing by covering concrete surface with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  3. Provide curing and sealing compound on interior slabs left exposed and to exterior slabs and walks, as follows:
    - a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - b. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

- C. Curing Formed Surfaces:
  - 1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for full curing period or until forms are removed.
  - 2. If forms are removed, continue curing by methods specified above, as applicable.
- D. Curing Unformed Surfaces:
  - 1. Cure unformed surfaces; i.e., slabs and other flat surfaces by application of appropriate curing compound.
  - 2. Final cure concrete surfaces to receive finish flooring by moisture-retaining cover, unless otherwise directed by Architect.

### 3.14 SURFACE FINISHES:

- A. As-Cast Finish:
  - 1. For formed concrete surfaces not exposed-to-view in the finished work or by other construction, unless otherwise indicated.
  - 2. This is concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- B. Smooth Form Finish:
  - 1. For formed concrete surfaces exposed-to-view, or that will be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, i.e.; waterproofing, damp-proofing, painting or other similar system.
  - 2. This is cast-in-place concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams.
  - 3. Repair and patch defective areas with fins or other projections completely removed and smoothed.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise specified or shown on Drawings.
- D. Float Finish: Apply float finish to slab surfaces to receive trowel finish and other finishes specified.
  - 1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units.

2. Check and level surface plane to tolerances of Ff 18 - Fl 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to uniform, smooth, granular texture.
- E. Grout Cleardown Finish:
1. After repairing defects, saturate surface thoroughly and keep saturated during grouting operations.
  2. Use a grout consisting of 1 part cement, 1-1/2 to 2 parts of fine sand and sufficient water for a thick creamy consistency.
  3. Apply by brush, trowel or rubber float to completely fill air bubbles and holes.
  4. Float vigorously with a wood, sponge-rubber or cork float immediately after applying grout. Excess grout shall be scraped off with a sponge-rubber float.
  5. After grout has been allowed to stand undisturbed to allow some loss of plasticity, but not damp appearance, the surface should be rubbed with a clean, dry burlap to remove all excess grout. All air holes shall be filled but no visible film of grout shall remain after the rubbing.
- F. Trowel Finish: After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of Ff 20 - fl 17. Grind smooth surface defects which would telegraph through applied floor covering. Apply where exposed-to-view, and where slab surfaces are to be covered other than finish coating system.
- G. Non-Slip Broom Finish:
1. Finish concrete as specified, except only trowel the surface once.
  2. Finish surface by drawing fine-hair broom lightly across surface.
  3. Brooming:
    - a. Broom in same direction and parallel to expansion joints.
    - b. Inclined slab: Broom perpendicular to slope. Texture shall be as approved by the Architect from sample panels.
    - c. Round Roof Slab: Broom surface in radial direction.
- H. Class 2, Rubbed Finish in accordance with Standard Specifications for Highway Construction, Section 802.20, Arkansas State Highway and Transportation Department, Edition of 1996 and this Section:
1. After removal of forms, rubbing of concrete shall be start as soon as its condition will permit.
  2. Immediately before starting this Work, concrete shall be thoroughly saturated with water. Sufficient time shall have elapsed before wetting down to allow the mortar used in the pointing of rod holes and defects to thoroughly set.
  3. Surfaces to be finished shall be rubbed with a medium coarse carborundum stone using a small amount of mortar on its face.

4. Mortar shall be composed of cement and fine sand mixed in proportions used in the concrete being finished.
5. Rubbing shall be continued until form marks, projections, and irregularities have been removed, voids filled, and a uniform surface has been obtained.
6. Paste produced from rubbing shall be left in place at this time.
7. After concrete above the surface being treated has been cast, the final finish shall be obtained by rubbing with a fine carborundum stone and water. Rubbing shall be continued until the entire surface is smooth texture.
8. Finish will not be acceptable if a uniform texture and color have not been achieved. Should the finish not be acceptable, the surface shall be given a sprayed finish or other approved finish that is satisfactory to the Architect.
9. After final rubbing is completed and the surface is dried, it shall be rubbed with burlap to remove loose power and left free from all unsound patches, paste, powder, and objectable marks.

I. Class 3, Sprayed Finish in accordance with Standard Specifications for Highway Construction, Section 802.20, Arkansas State Highway and Transportation Department, Edition of 1996 and this Section:

1. Material provided for sprayed finish shall be a commercial paint type texturing product produced specifically for this purpose, and shall consist of a synthetic non-alkyd resin containing mica, perlite, non-biodegradable fibers, and durable tinting pigments. Material shall be approved by Architect.
2. Unless otherwise specified in the Contract, off-white in color the exact shade shall be selected by the Owner.
3. Surfaces to be coated shall be free of efflorescence, flaking, coatings, dirt, oil, and other foreign substances.
4. The sprayed finish shall not be applied over surfaces cured with membrane curing compound until 30 days has elapsed from application of the membrane.
5. Prior to application of spray finish, the surfaces shall be free of moisture, as determined by sight and touch, and in a condition consistent with manufacturer's published recommendations.
6. Sprayed finish shall be applied at a rate as recommended by the manufacturer and as approved by the Architect.
7. Sprayed finish shall be applied with heavy duty spray equipment capable of maintaining a constant pressure as necessary for proper application.
8. Completed finish shall be tightly bonded to the structure and shall present a uniform appearance and texture equal to or better than the required for rubbed finish.
9. If necessary, an additional coat or coats shall be applied to produce the desired surface texture and uniformity.
10. Upon failure to adhere positively to the structure without chipping or cracking, or to attain the desired surface appearance, the coating shall be removed from the structure and the surface given a rubbed finish, or another approved finish satisfactory to the Architect.

### **3.15 WATER LEAKAGE TESTS - WATER HOLDING STRUCTURES:**

- A. Subject water holding structures to leakage tests after concrete has been cured and obtained its design strength and before backfill, brick facing, or other Work that will cover exposed faces of walls is begun.
- B. Fill basins to be subjected to leakage tests with water to normal liquid level line.
- C. After basin has been kept full for 48 hours, it will be assumed, for purposes of the test, that moisture absorption by the concrete in the basin is complete.
- D. Valves and gates to the structure shall then be closed, and the change in water surface measured for a 24-hour period.
- E. During test period, examine exposed portions of the structure and mark visible leaks or damp spots; such leaks or damp spots shall be later patched or corrected in a manner acceptable to Architect.

### **3.16 MISCELLANEOUS ITEMS:**

- A. Filling Holes:
  - 1. Fill in holes and openings left in concrete for the passage of Work by other trades after their Work is in place.
  - 2. Mix, place, and cure concrete to blend with in-place construction. Provide other miscellaneous concrete filling required to complete Work.
- B. Non-Shrink Grout Application: Grout base plates, equipment bases, clarifier base, and other location indicated with specified non-shrink grout. Provide non-metallic type where grout is exposed.

### **3.17 PROTECTION:**

- A. No Work or walking on finished surfaces will be allowed for 16 hours after the concrete is placed.
- B. Provide plywood or other acceptable protective cover at all traffic areas throughout the job.
- C. Protect exposed concrete floors, steps, and walks from paint and other materials or equipment which may blemish or damage these surfaces.

**END OF SECTION**

## SECTION 03002

### SITE CONCRETE REINFORCING STEEL

#### PART 1. - GENERAL

##### 1.1 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 Architect when reinforcing is ready for inspection and allow sufficient time for this inspection prior to casting concrete.

##### 1.2 RELATED SECTIONS:

- A. Section 03001 - Site Concrete Work.

##### 1.3 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 D1.4-79 - 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.

#### **1.4 SUBMITTALS:**

- A. Submit the following in accordance with the Frontend Documents:
  - 1. Bending lists.
  - 2. Placing drawings.
  - 3. Shop drawings.
- B. Shop Drawings:
  - 1. Bars for footings, including dowels, shall not be fabricated and shipped without prior review of Shop Drawings by the Architect.
  - 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.

#### **1.5 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**

#### **2.1 DEFORMED REINFORCING BARS:**

- A. Deformed billet-steel bars conforming to ASTM A615, Grade 60.

#### **2.2 WELDED WIRE FABRIC:**

- A. Conform to ASTM A185 or A497.

#### **2.3 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**

### **3.1 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 Architect'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 Architect prior to pouring if there is a need to work out a solution to prevent field bending.

### **3.2 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.

### **3.3 WELDING REINFORCEMENT:**

- A. Welding shall not be permitted unless Contractor submits detailed Shop Drawings, qualifications, and radiographic nondestructive testing procedures for review by Architect.
  - 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 percent of welds using radiographic, nondestructive testing procedures in accordance to the above referenced codes.

### **3.4 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 inches of edges of slab.
  - 2. Lap splices at least 1-1/2 courses of fabric and a minimum of 6 inches.
  - 3. Tie laps and splices securely at ends and at least every 24 inches with 16-gage black annealed steel wire.
  - 4. Place welded wire fabric at the proper distance above bottom of slab.

**END OF SECTION**

## SECTION 03003

### SITE CAST-IN-PLACE CONCRETE

#### PART 1. GENERAL

##### 1.1 WORK INCLUDED

- A. Cast-in-place concrete, including formwork.

##### 1.2 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 305R: Hot Weather Concreting.
  - 9. ACI 306R: 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 318: Building Code Requirements for Reinforced Concrete.
  - 14. ACI 347: Recommended Practice for Concrete Formwork.
- B. American Society of Testing For Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103 (latest revision).
  - 1. ASTM C31: Making and Curing Concrete Test Specimens in the Field.
  - 2. ASTM C33: Specification for Concrete Aggregates.
  - 3. ASTM C42: Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
  - 4. ASTM C143: Test for Slump of Portland Cement Concrete.
  - 5. ASTM C150: Specifications for Portland Cement.
  - 6. ASTM C172: Sampling Freshly Mixed Concrete.

7. ASTM C173: Test for Air Content of Freshly Mixed Concrete by the Volumetric Method.
8. ASTM C231: Test for Air Content of Freshly Mixed Concrete by the Pressure Method.
9. ASTM C260: Specification for Air-Entraining Admixtures for Concrete.
10. ASTM C309: Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
11. ASTM C494: Specification for Chemical Admixtures for Concrete.
12. ASTM E329: Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

C. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."

D. Local Codes and Ordinances: Wherever provisions of the Standard Building Code or the local current ordinances are more stringent than the above referenced Specifications and Standards, the local codes and ordinances shall govern.

### 1.3 SUBMITTALS

A. Submit the following:

1. Product Data: Submit manufacturer's product data for reinforcement and forming accessories, patching compounds, curing compounds, and other materials.
2. Shop Drawings: Submit for review prior to Installation, Shop Drawings of all reinforcing steel, including bar cutting lists, typical bar bend diagrams, construction of forms including jointing, reveals, and location and pattern of form tie placement.
3. Design Mix: Prior to placement of concrete, the Contractor shall submit a design mix showing the proportions and compressive strength obtained from the concrete at 7 and 28 days. The design mix shall include a complete list of materials including type, brand, source, and amount of; cement, fly ash, ground slag, coarse aggregate, fine aggregate, water, air content and admixtures, if applicable. The mix design shall be submitted to the Engineer at least ten (10) days prior to the start of operations. Placement of concrete shall not begin until the mix design is approved in writing by the Engineer.

### 1.4 QUALITY ASSURANCE/ACCEPTANCE

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. Evaluation and acceptance of concrete shall conform to ACI 318.
- D. The Contractor shall engage a testing laboratory acceptable to Owner and Engineer to perform material evaluation tests and to design concrete mixes. All testing shall be paid for by the Contractor.
- E. The mixing or alternate use of cement from different manufactures will not be permitted. The source of any materials shall not be changed without the written approval of the Engineer.
- F. If the cement furnished produces erratic results under field conditions incident to the placing of the concrete, or in regard to the strength of the finished product, or in the time of the initial or final set, the Contractor shall, without notice from the Engineer, cease the use of that source of cement.
- G. Should a change in sources be made, or admixtures added or deleted from the mix, a new design mix must be submitted to the Engineer for approval.
- H. The Contractor is responsible for product quality control during handling, blending, mixing, transporting, and placement operations, and for necessary adjustments in proportioning of the materials to produce an acceptable mix. The Contractor shall perform all applicable quality control sampling and testing required to ensure that the completed concrete complies with all requirements and specifications. The Contractor shall furnish all personnel, equipment, and facilities necessary to perform the required sampling and pay for testing.
- I. The Contractor shall be responsible for ensuring that all concrete cylinders, including those made for determination of quality acceptance, are properly cured while at the jobsite.
- J. Field Sampling and Testing:
  - 1. Field samples shall be made and cured in accordance with ASTM C31, for each concrete strength, at the rate of 4 test cylinders and one slump test for each 50 cubic yards of concrete from each days pour. Make air content check for each set of test cylinders in accordance with ASTM C173 or ASTM C231. Air content and slump shall be checked and recorded at both truck discharge and point of placement for pumped concrete from the first load each day and every 50 cubic yards thereafter.

2. Test Cylinders: One at 7 days, two at 28 days, and reserve the remaining cylinder for testing after a longer period as required by the Engineer if the 28 day tests do not meet or exceed the required strength.
  3. The taking of samples from small pours of 10 cubic yards or less may be omitted at the discretion of the Engineer.
  4. Additional Test Slumps: Every 25 cubic yards, recording location for report.
  5. When early form removal is requested, field cure cylinders will be tested at 7 days or less to determine sufficient strength.
- K. Testing: Where average strength of any group of 3 cylinders falls below the minimum comprehensive strength, or an individual cylinder falls more than 500 psi below minimum compressive strength specified, the Contractor will be required to have a certified laboratory core the concrete and test it in accordance with ASTM C42. Specimens shall be selected by the Engineer from location in structure represented by test specimen or specimens which failed. At the discretion of the Engineer, Swiss hammer testing may or may not be used to aid in determination of acceptable concrete.
1. Specimens shall be secured, prepared, and tested in accordance with ASTM C42, within a period of 60 days after placement of concrete.
  2. Concrete will be deemed approved meeting the strength requirements of this Section if it meets the strength requirements of ACI 318.
  3. The cost of cutting specimens from the structure, patching the resulting holes, and making laboratory analysis shall be at the sole expense of the Contractor.
  4. Holes from which the cored samples are taken shall be packed solid with no slump concrete proportioned in accordance with ACI 211. Patching shall have the same design strength as the specified concrete.
  5. Should laboratory analysis indicate that the proper concrete mix has not been used, all concrete poured where inappropriate mix was used shall be subject to rejection, before, during, or after the pour.
  6. If any of the specimens cut from the structure fail to meet the requirements of ACI 318, the Engineer shall have the right to require the defective concrete to be replaced, at the Contractor's sole expense, and at no additional cost to the Owner.
- L. Sampling: In addition the slump test specified in this Section, the Contractor shall keep a cone and rod apparatus on the Project site for random testing of batches. When concrete does not meet the specified slump requirements, and when directed by the Engineer, the Contractor will immediately perform a slump test in accordance with ASTM C143. Concrete not meeting the slump requirements shall be removed from the Project site.
- M. The Contractor shall provide an opportunity for the Engineer to observe all quality control sampling and testing procedures.

## **PART 2. PRODUCTS**

### **2.1 CEMENT**

- A. Portland cement: ASTM C150 Type I.

### **2.2 WATER**

- A. Clean and free from oil, acid, alkali, salt, organic matter, or other deleterious substances.
- B. Potable.

### **2.3 CONCRETE AGGREGATES**

- A. General:  
Natural aggregates, well graded, free from deleterious coatings and organic materials conforming to ASTM C33 (latest revision).
  - 1. Import non-reactive aggregates if local aggregates are reactive. (Appendix XI-ASTM C33).
  - 2. Wash aggregates uniformly before use.
  - 3. Other aggregate gradations can be approved by Engineer.
- B. Fine Aggregates:
  - 1. Clean, sharp, natural or manufactured sand, free of loam, clay, lumps, or other detrimental materials and conforming to ASTM C33.
  - 2. Less than 2 percent passing the No. 200 sieve.
  - 3. Maximum size 1-1/2 inches.
- C. Course Aggregates:
  - 1. Natural gravel, crushed gravel, crushed stone, or combination of these materials.
  - 2. Less than 15 percent float or elongated particles (long dimension >5 times short dimension).
  - 3. Less than 0.5 percent passing the No. 200 sieve.

### **2.4 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.
  - 3. Master Builders, MB-VR.
  - 4. Or approved equal.
- B. ASTM C260; nontoxic after 30 days.

- C. Use only the specified non-corrosive non-chloride accelerator. Calcium chloride is not permitted.
- D. Provide for concrete exposed to freezing and thawing, required to be watertight or placed during cold weather. Air Content: 5 to 6 percent.

## 2.5 ADMIXTURES

- A. Water-Reducing Admixture: Conforming to ASTM C494, Type A:
  - 1. Eucom WR-75 by the Euclid Chemical Company.
  - 2. Pozzolith 200N by Master Builder.
  - 3. Plastocrete 160 by Sika Chemical Corporation.
- B. Water-Reducing Retarding Admixture: Conforming to ASTM C494, Type D:
  - 1. Eucom Retarder-75 by the Euclid Chemical Company.
  - 2. Pozzolith 100XR by Master Builder.
  - 3. Plastiment by Sika Chemical Company.
- C. High-Range Water-Reducing Admixture (Superplasticizer): Conforming to ASTM C494, Type F or G:
  - 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:
  - 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 percent chloride ions.
- F. Certification: Submit written conformance to the requirements and chloride ion content of the admixture to Engineer prior to mix design review.

## 2.6 FORMS

- A. Unexposed Finish Concrete: Plywood, lumber, metal or other acceptable material approved by the Engineer. Lumber shall be dressed on at least 2 edges and 2 sides for a tight fit if used.



- B. Form Coatings: Commercial formulation from coating compound with maximum VOC of 350 mg/l that will not bond, stain, or adversely affect concrete surfaces in contact with and will not impair succeeding treatments of concrete surfaces.
- C. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent deflection and spalling of concrete upon removal. Units provided shall not leave any metal closer than 1-1/2 inch to exposed surface. Provide ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

## **2.7 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.

## **2.8 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. Nonstaining type.
- C. Provide positive bond prevention.
- D. Submit copies of manufacturer's data, recommendations, and instructions for specific use on this Project for review.

## **2.9 CURING COMPOUND**

- A. Liquid Membrane-Forming Curing Compound: ASTM C309, Type I, Class A. Moisture loss not more than 0.005 gr./sq. cm. applied at 200 square feet per gallon.
  - 1. Conspec, Conspec Cure & Seal.
  - 2. Sonneborn, Kure-N-Seal.
  - 3. Master Builders, MasterKure.
  - 4. Or approved equal.

## 2.10 BONDING AND REPAIR MATERIALS

- A. Rewettable Bonding Compounds:
  - 1. Polyvinyl acetate type.
  - 2. Manufacturer:
    - a. Euco Weld by the Euclid Chemical Co.
    - b. Weldcrete by the Larsen Co.
    - c. Sonnocrete by Sonneborn.
    - d. Daraweld C by W. R. Grace.
  - 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 Co.
    - 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. 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 Co. 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.
- E. Underlayment Compound:
  - 1. Free-flowing, self-leveling, pumpable cementitious base compound.
  - 2. Manufacturer:
    - a. Flo-Top by the Euclid Chemical Co.
    - b. Or approved equal.
- F. Repair Topping:
  - 1. Self-leveling, polymer modified high strength topping.
  - 2. Manufacturer: Thin Top SL by the Euclid Chemical Co.

## **PART 3. EXECUTION**

### **3.1 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.
- F. Slump: 2-4"
- G. Water/Cement Ratio:
  - 1. Watertight concrete exposed to fresh water and freeze/thaw: 0.50 max.
  - 2. Air entrained concrete exposed to fresh water: 0.50 max.
- H. Combined Aggregate Gradings:
  - 1. Aggregates for concrete shall be proportioned in accordance with "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete." ACI 211.1.
  - 2. Maximum aggregate size: Do not exceed one-fifth the narrowest dimension between sizes of forms or 3/4 of the clear space between reinforcing bars, 1-1/2 inch maximum.

### **3.2 MIXES**

- A. Strength: Concrete minimum strength at 28 days shall be 4000 psi or as noted elsewhere.
- B. Mix Designs:
  - 1. Prepare design mixes for each type of concrete, in accordance with ACI 301 and ACI 318, except as otherwise specified.

- C. Conform to ACI 304 current edition for measuring, mixing, transporting and placing concrete.
- D. Concrete Mix Adjustments: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, and as approved by Engineer. Laboratory test data for revised mix design and strength results shall be submitted to and approved by Engineer prior to using in Work.

### 3.3 FORMS

- A. Coordinate with other trades whose work may be located within or below concrete.
- B. Coordinate installation of joint materials and vapor retarders with placement of forms and reinforcing steel.
- C. Notify Engineer 1 full working day prior to erection of forms for inspection.
- D. Cleaning and Tightening:
  - 1. Clean forms thoroughly and adjacent surfaces to receive concrete.
  - 2. Remove chips, wood, sawdust, dirt or other debris immediately prior to concrete placement.
  - 3. Retighten forms after concrete placement to eliminate leaks.
- E. 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.
- F. Reuse of Forms: Do not reuse forms unless they are in new and undamaged condition.
- G. Chamfer exposed corners and edges 3/4 inch unless otherwise specified or shown on Drawing. Use wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- H. Preparation of Form Surfaces: Coat the contact surfaces of forms with a form-coating compound where applicable prior to placement of reinforcement.
- I. Other Trades: Provide openings in concrete form work to accommodate Work of other trades. Determine size and location of openings, recesses, and chases for other trades providing such ties. Accurately place and securely support items built-in to form.

- J. Form Tolerances: Construct forms to sizes, shapes, lines, and dimensions shown, work in finished structures.
- K. 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. Do not remove forms until the concrete has attained 67 percent of 28 day strength or a minimum of 4 days. Use a method of form removal which will not cause overstressing of the concrete.

### 3.4 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.

### 3.5 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 1.5 feet deep:
  - 1. Without segregation or loss of ingredients.
  - 2. Without splashing forms or steel above.
- G. Do not use concrete truck chutes, pipes, finishing tools, etc., constructed of aluminum.

- H. 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.
- I. Before placing concrete, clean and inspect form work, reinforcing steel, and items to be embedded or cast-in-place. Notify other trades prior to placement of concrete to permit the installation of their Work. Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.
- J. Conveying:
  - 1. Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials.
  - 2. 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. Provide equipment for chuting, pumping, and pneumatically conveying concrete of proper size and design to insure a practically continuous flow of concrete at the point of delivery and without segregation of the materials.
  - 4. Keep open troughs and chutes clean and free from coatings of hardened concrete.
  - 5. Do not allow concrete to drop freely more than 10 feet. Equipment and methods used for conveying are subject to the approval of Engineer.

### **3.6 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 ratio will not be exceeded.
- C. All concrete shall be 4000 psi at 28 days with a maximum cement water ratio of .45 unless noted otherwise on Design Drawings.

### **3.7 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. 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.
- E. Do not use vibrators to transport concrete in forms.

### **3.8 PLACING CONCRETE IN HOT WEATHER**

- A. Comply with the requirements of ACI 305.
- B. Do not place concrete at times when temperature is forecast to exceed 100 degrees F within 12 hours after the concrete is placed.
- C. Fog spray forms, reinforcing steel, and subgrade just before placing concrete.
- D. Make every effort to maintain concrete temperature:
  - 1. Temperature of concrete shall be below 90 degrees F at time of placement, cool the ingredients before mixing by use of chilled water.
  - 2. Concrete batches with temperature in excess of 90 degrees F will be rejected.
- E. Place concrete promptly upon arrival at Project and vibrate immediately after placement.
- F. Do not add water to retemper.
- G. Consider placing concrete in late afternoon as opposed to early morning.
- H. Protect and cure exposed surfaces by one of the following:
  - 1. Continuous water curing.
  - 2. Moisture-cover curing.

### **3.9 PLACING CONCRETE IN COLD WEATHER (ACI 306R-78)**

- A. Preparation:
  - 1. Comply with the requirements of 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.

B. Placement:

1. Surfaces to be in contact with concrete shall be free of snow, ice, and frost and shall be above 40 degrees F.
2. Do not place concrete on frozen subgrade.
3. Placement of insulating material, tarpaulins, or other movable 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 covered and maintain concrete temperature at a minimum of 50 degrees 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 forms be left 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.

### 3.10 PATCHING - GENERAL

- A. Prior to starting patching work, except as specified, obtain Engineer's approval of proposed patching techniques and mixes.

### 3.11 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. 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-inch 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.

### **3.12 BLOCKOUTS AT PIPES OR OTHER PENETRATIONS**

- A. Submit proposed blockouts for review in accordance with Section 01001.

### **3.13 CONCRETE CURING**

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301. Avoid rapid drying at end of final curing period.
- B. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as specified herein.
  - 1. Provide moisture curing by keeping concrete surface continuously wet by covering with water, by water-fog spray, or by covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and

- keeping continuously wet. Place absorptive cover to provide **coverage of** concrete surfaces and edges, with 4 inch lap over adjacent absorptive covers.
2. Provide moisture-cover curing by covering concrete surface with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  3. Provide curing and sealing compound on interior slabs left exposed and to exterior slabs and walks, as follows:
    - a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - b. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
- C. Curing Formed Surfaces:
1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for full curing period or until forms are removed.
  2. If forms are removed, continue curing by methods specified above, as applicable.
- D. Curing Unformed Surfaces:
1. Cure unformed surfaces; i.e., slabs and other flat surfaces by application of appropriate curing compound.
  2. Final cure concrete surfaces to receive finish flooring by moisture-retaining cover, unless otherwise directed by Engineer.

### **3.14 SURFACE FINISHES**

- A. As-Cast Finish:
1. For formed concrete surfaces not exposed-to-view in the finished work or by other construction, unless otherwise indicated.
  2. This is concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- B. Smooth Form Finish:
1. For formed concrete surfaces exposed-to-view, or that will be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, i.e.; waterproofing, damp-proofing, painting or other similar system.

2. This is cast-in-place concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams.
  3. Repair and patch defective areas with fins or other projections completely removed and smoothed.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise specified or shown on Drawings.
- D. Float Finish: Apply float finish to slab surfaces to receive trowel finish and other finishes specified.
1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units.
  2. Check and level surface plane to tolerances of Ff 18 - Fl 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to uniform, smooth, granular texture.
- E. Grout Cleardown Finish:
1. After repairing defects, saturate surface thoroughly and keep saturated during grouting operations.
  2. Use a grout consisting of 1 part cement, 1-1/2 to 2 parts of fine sand and sufficient water for a thick creamy consistency.
  3. Apply by brush, trowel or rubber float to completely fill air bubbles and holes.
  4. Float vigorously with a wood, sponge-rubber or cork float immediately after applying grout. Excess grout shall be scraped off with a sponge-rubber float.
  5. After grout has been allowed to stand undisturbed to allow some loss of plasticity, but not damp appearance, the surface should be rubbed with a clean, dry burlap to remove all excess grout. All air holes shall be filled but no visible film of grout shall remain after the rubbing.
- F. Trowel Finish: After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of Ff 20 - fl 17. Grind smooth surface defects which would telegraph through applied floor covering. Apply where exposed-to-view, and where slab surfaces are to be covered other than finish coating system.

- G. Non-Slip Broom Finish:
1. Finish concrete as specified, except only trowel the surface once.
  2. Finish surface by drawing fine-hair broom lightly across surface.
  3. Brooming:
    - a. Broom in same direction and parallel to expansion joints.
    - b. Inclined slab: Broom perpendicular to slope. Texture shall be as approved by the Engineer from sample panels.
  4. Provide this finish to sidewalks.
- H. Class 2, Rubbed Finish in accordance with Standard Specifications for Highway Construction, Section 802.20, Arkansas State Highway and Transportation Department, Edition (latest edition) and this Section:
1. After removal of forms, rubbing of concrete shall be start as soon as its condition will permit.
  2. Immediately before starting this Work, concrete shall be thoroughly saturated with water. Sufficient time shall have elapsed before wetting down to allow the mortar used in the pointing of rod holes and defects to thoroughly set.
  3. Surfaces to be finished shall be rubbed with a medium coarse carborundum stone using a small amount of mortar on its face.
  4. Mortar shall be composed of cement and fine sand mixed in proportions used in the concrete being finished.
  5. Rubbing shall be continued until form marks, projections, and irregularities have been removed, voids filled, and a uniform surface has been obtained.
  6. Paste produced from rubbing shall be left in place at this time.
  7. After concrete above the surface being treated has been cast, the final finish shall be obtained by rubbing with a fine carborundum stone and water. Rubbing shall be continued until the entire surface is smooth texture.
  8. Finish will not be acceptable if a uniform texture and color have not been achieved. Should the finish not be acceptable, the surface shall be given a sprayed finish or other approved finish that is satisfactory to the Engineer.
  9. After final rubbing is completed and the surface is dried, it shall be rubbed with burlap to remove loose power and left free from all unsound patches, paste, powder, and objectable marks.
  10. Apply this finish to exposed retaining wall surfaces.
- I. Class 3, Sprayed Finish in accordance with Standard Specifications for Highway Construction, Section 802.20, Arkansas State Highway and Transportation Department, Edition (latest edition) and this Section:
1. Material provided for sprayed finish shall be a commercial paint type texturing product produced specifically for this purpose, and shall consist of a synthetic non-alkyd resin containing mica, perlite, non-biodegradable fibers, and durable tinting pigments. Material shall be approved by Engineer.
  2. Unless otherwise specified in the Contract, off-white in color the exact shade shall be selected by the Owner.
  3. Surfaces to be coated shall be free of efflorescence, flaking, coatings, dirt, oil, and other foreign substances.

4. The sprayed finish shall not be applied over surfaces cured with membrane curing compound until 30 days has elapsed from application of the membrane.
5. Prior to application of spray finish, the surfaces shall be free of moisture, as determined by sight and touch, and in a condition consistent with manufacturer's published recommendations.
6. Sprayed finish shall be applied at a rate as recommended by the manufacturer and as approved by the Engineer.
7. Sprayed finish shall be applied with heavy duty spray equipment capable of maintaining a constant pressure as necessary for proper application.
8. Completed finish shall be tightly bonded to the structure and shall present a uniform appearance and texture equal to or better than the required for rubbed finish.
9. If necessary, an additional coat or coats shall be applied to produce the desired surface texture and uniformity.
10. Upon failure to adhere positively to the structure without chipping or cracking, or to attain the desired surface appearance, the coating shall be removed from the structure and the surface given a rubbed finish, or another approved finish satisfactory to the Engineer.

### **3.15 WATER LEAKAGE TESTS - WATER HOLDING STRUCTURES**

- A. Subject water holding structures to leakage tests after concrete has been cured and obtained its design strength and before backfill, brick facing, or other Work that will cover exposed faces of walls is begun.
- B. Fill basins to be subjected to leakage tests with water to normal liquid level line.
- C. After basin has been kept full for 48 hours, it will be assumed, for purposes of the test, that moisture absorption by the concrete in the basin is complete.
- D. Valves and gates to the structure shall then be closed, and the change in water surface measured for a 24-hour period.
- E. During test period, examine exposed portions of the structure and mark visible leaks or damp spots; such leaks or damp spots shall be later patched or corrected in a manner acceptable to Engineer.

### **3.16 MISCELLANEOUS ITEMS**

- A. Filling Holes:
  1. Fill in holes and openings left in concrete for the passage of Work by other trades after their Work is in place.
  2. Mix, place, and cure concrete to blend with in-place construction. Provide other miscellaneous concrete filling required to complete Work.

- B. Non-Shrink Grout Application: Grout base plates, equipment bases, clarifier base, and other location indicated with specified non-shrink grout. Provide non-metallic type where grout is exposed.

### **3.17 PROTECTION**

- A. No Work or walking on finished surfaces will be allowed for 16 hours after the concrete is placed.
- B. Provide plywood or other acceptable protective cover at all traffic areas throughout the job.
- C. Protect exposed concrete floors, steps, and walks from paint and other materials or equipment which may blemish or damage these surfaces.

**END OF SECTION**

## SECTION 05000

### MISCELLANEOUS METALS

#### PART 1. GENERAL

##### 1.1 SCOPE

- A. This section covers the furnishing and installation of all miscellaneous metals, including stainless steel, cast iron, and aluminum items not covered in other sections of the Specifications. Work generally included but is not limited to ladders, gratings, handrails and railings, anchorage devices, metal fabrications, and metal stairs.

##### 1.2 GENERAL

- A. Furnish all miscellaneous items such as anchor bolts, tie down bolts, nuts and washers, supports, connections, expansion and toggle bolts, etc., required by the work. Supplementary parts necessary to complete each item, though such work is not definitely shown or specified, shall be included. Furnish to appropriate trades all anchors, sockets or fastenings required for securing metal work to other constructions and wood items to concrete. Details and specifications of items for which standard products are available are representative guides of requirements for such items. Standard products generally meeting such requirements, will be accepted. Welding shall be continuous along entire area of contact, except where tack welding is permitted. Tack welding will not be permitted on exposed surfaces. All exposed welds shall be ground smooth. Riveting, where exposed, shall be flush type.

##### 1.3 QUALITY ASSURANCE

- A. Codes and Standards and Current Editions of:

(1)Aluminum: Aluminum Association "Specification for Aluminum Structures".

(2)Stainless Steel: ASCE "Specification for the Design of Cold-Formed Stainless Steel Structural Members".

Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting wherever taking field measurements before fabrication might delay work.

Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

## 1.4 RELATED SECTIONS

- A. Section 01001 - Basic Requirements.

## 1.5 SUBMITTALS

- A. Submit for Engineer's review, 5 sets of shop drawings for fabrication and erection of miscellaneous metal items. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others. Submit duplicate samples of all prefinished or shop finished items for approval of finishes. Submit complete descriptive literature for each component and in accordance with Section 01001.

## 1.6 MATERIALS AND COMPONENTS

- A. Metal Surface, General:  
For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.
- B. Ferrous Metals:  
Except as otherwise specified herein or noted on the Plans, stainless steel and wrought metals shall meet the requirements of the following standards (current edition):

Gray Iron Castings: ASTM A 48, Class 30.

Malleable Iron Castings: ASTM A 47, grade as selected.

Stainless Steel Plates, Shapes, Bars, Tubes shall be AISI Type 304 (18-8) mill finish.

Stainless Steel Castings shall be AISI Type 304 conforming to ASTM A 296, Iron-Chromium-Nickel Alloy.

- C. Non-Ferrous Metals:  
Aluminum Bar Grating: ASTM B 221, Alloy 6061 or 6063-T6 for bearing bars; ASTM B 221 or B 210 for cross bars or bent connecting bars.

Aluminum Extrusions: ASTM B 221; alloy 6063-T5, except alloy 6061-T6 for pipe; unless otherwise indicated.

Clear anodized finish AA-M21C11A41, unless otherwise indicated.

Aluminum Sheet or Plate: ASTM B 209; alloy 6061-T4; unless otherwise indicated. Mill finish.



D. Fasteners:

General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Provide AISI Type 303, stainless steel fasteners where exposed to liquids of treatment process or where noted to be stainless steel. Select fasteners for the type, grade and class required.

Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.

Machine Screws: Cadmium plated steel, FS FF-S-92.

Plain Washers: Round, carbon steel, FS FF-W-92.

Concrete & Masonry Anchorage Devices: Expansion shields, FS FF-S325, Galvanized or Stainless Steel. "Redhead Wedge Type Anchors" by ITT Phillips Drill Div., Michigan City, Indiana or "Kwik-Bolt" by HILTI Fastening System, Inc. Standford, Conn., or equal, size as noted on the Drawings. Length shall provide minimum embedment in concrete as specified by manufacturer's literature.

Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.

Lock Washers: Helical spring type carbon steel, FS FF-W-84.

Note! All fasteners in constant exposure to water in filters and sedimentation basins shall be stainless steel.

## 1.7 FABRICATION, GENERAL

- A. Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using industry proven details of fabrication and support. Use type of materials shown or specified for various components of work.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- C. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, use phillips flat-head (countersunk) screws or bolts.

- E. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- F. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

## **1.8 PAINTING**

- A. All aluminum surfaces that will be in contact with concrete, steel or other dissimilar material shall be coated with asphaltic paint or aluminum impregnated caulking compound or other approved permanent insulation to prevent electrolytic action.

## **PART 2. MATERIALS**

### **2.1 LADDERS**

- A. All ladders unless otherwise indicated, shall have 3" x 1/2" flat bar side rails with eased edges spaced 18" o.c. (on center) with 4 row type button tread ladder rungs (Morton Tread-Grip or equal) welded to side rails at 12" o.c. maximum vertical spacing. Ladders shall be securely attached to supporting construction and extend at least 42" above top rung except where prohibited by overhead or other construction. Where steel ladders are required by the drawings, provide galvanized anchor bolts or expansion anchors. Where aluminum ladders are required by the drawings provide stainless steel anchor bolts or expansion anchors.

### **2.2 GRATING**

#### **General:**

- A. Use materials of the size and thickness shown, or if not shown, of the size recommended by NAAMM tables. Work to the dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use the type of materials shown or specified for the various components of the work. Comply with NAAMM "Metal Bar Grating Manual" and as herein specified.
- B. Except where noted otherwise, provide removable grating sections with end-banding bars for each panel, 4 saddle clip anchors designed to fit over 2 bearing bars, and 4 stud bolts with washers and nuts, unless otherwise indicated.
- C. Notch gratings for penetrations as indicated. Layout units to allow grating removal without disturbing items penetrating grating. All grating to be removable unless otherwise noted.

- D. Provide banding for openings in grating separated by more than 4 bearing bars, of same material and size as bearing bars, unless otherwise indicated.
- E. Notching of bearing bars at supports to maintain elevations will not be permitted.
- F. Weld stud bolts to receive saddle clip anchors to supporting metal members.

#### Aluminum Grating:

- A. All aluminum grating shall be "I-Bar" type 19-SGI- 2 as manufactured by Ohio Gratings, Inc. Bearing bar depth shall be 1½" minimum unless noted as deeper on the drawings. Provide aluminum clip anchors and stud bolts where grate is supported by aluminum members and stainless steel slip anchors and stud bolts where grade is supported by steel members. Coat surfaces in contact with concrete or steel with asphaltic paint or aluminum impregnated caulking compound or other approved permanent insulation. Stair treads to have checkered plate or abrasive nosings.
- B. To be considered equal a grating must have the same load capacity as the size grating noted on the Drawings. Fiberglass grating meeting this requirement and other provisions of these specifications may be substituted for aluminum grating at the Contractor's option. One type of grating shall be used throughout the job. The depth may vary from that shown on the Drawings, provided adequate provisions are made to make modifications to the bearing and anchorage details.

## 2.3 PIPE RAILINGS

#### General:

- A. Fabricate pipe railings to dimensions and details shown, with smooth bends and welded joints ground smooth and flush. Where details are not shown, use 1½" diameter pipe.
- B. Adjust railings prior to anchoring to ensure matching alignment at butting joints. Space posts not more than 6'-0" on centers, unless otherwise shown. Plumb posts in each direction. Secure posts and rail ends to supporting construction as follows:
- C. Anchor posts and rail ends to concrete and masonry with plate flanges welded to pipe and anchored into wall construction with expansion bolts.
- D. Provide removable railing sections as indicated. Furnish slip-fit metal socket or sleeve for casting into concrete. Accurately locate sleeves to match post spacing.
- E. Secure handrails to walls with wall brackets and end fittings. Provide brackets with not less than 3" clearance from inside face of handrail to the finish wall

surface. Drill wall plate portion of bracket to receive bolt, unless indicated for concealed anchorage. Locate brackets as indicated or, if not indicated, at not more than 6' - 0' o.c. Provide flush-type wall return fittings with same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to supporting construction as follows:

- F. For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.
- G. For hollow masonry anchorage, use toggle bolts having square heads.

#### Aluminum Pipe Railings:

- A. Pipe handrails of aluminum shall be installed in the locations shown on the Drawings. Fabrication to conform to NAAMM "Pipe Railing Manual".
- B. Aluminum pipe handrails and wall rails shall be all welded 1½" I.D. schedule 40 pipe of aluminum alloy 6061-T6. Aluminum posts shall be 1½" schedule 80 pipe of aluminum 6061-T6. All joints to be welded and ground smooth. Welds are to be made with Alloy 5154 filler wire. Where required, the various pieces of the rail shall be joined together in a manner to present a smooth surface free of ridges or depressions that would collect debris and dirt. Finish to be a Class I clear Anodic Finish AA-M12C22A41 (Mechanical Finish nonspecular as fabricated; Anodic Coating: Architectural Class I, clear coating 0.7 mil complying with AAMA 607.1).
- C. Fittings at field splices shall be attached to the rails by internal welding.
- D. Submit handrails sample of welded connections.
- E. Contractor may submit, for approval, 1½" square tube section handrail of the same strength as the 1½" schedule 40 pipe. Contractor shall be responsible for design of modifications to handrail anchor details to fit tube handrail. Submit modifications for approval of the Engineer.
- F. Set Aluminum posts in sleeves with epoxy grout except where supported by existing construction then use stainless steel expansion anchors.

## 2.4 STAIR NOSINGS

- A. Provide cast iron or cast aluminum abrasive nosings for all concrete stairs. All nosings are to be three (3) inches wide and have a one (1) inch lip. Nosings shall be the length of the tread less 3" at each end.
- B. Abrasive is to be #20 aluminum oxide (AL203), integrally cast into the walking surface to a minimum depth of 1/32". Fastener screws shall not protrude above that

tread surface. Cross-hatching and fluting shall be 1/16" deep minimum and shall be clean, sharp, well-defined and free from washes, scabs, buckles, blow holes, knots, cuts, cracks and pin-holes. Abrasive cast aluminum to have sand blasted finish. Abrasive cast iron to have one coat of shop black paint.

## **2.5 CONSTRUCTION CASTINGS**

- A. Provide cast iron construction castings as detailed. See drawings for locations, sizes, types and details. Unless otherwise indicated, units shall be McKinley Iron Works, or Neenah Foundry Co, castings or equal.

## **PART 3. EXECUTION**

### **3.1 INSTALLATION**

- A. Install miscellaneous metals per manufacturer's recommendations and as shown on Drawings.

**END OF SECTION**

## SECTION 05500

### FABRICATED METALWORK AND CASTINGS

#### PART 1. GENERAL

##### 1.1 SUMMARY

- A. Provide fabricated metalwork and castings.
- B. Miscellaneous metalwork required to secure the various parts together and provide a complete installation, shall be included under this Section.
- C. Insofar as practical, products provided shall be factory assembled.

##### 1.2 RELATED SECTIONS

- A. Section 09901 - Painting.

##### 1.3 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 - Specifications for Carbon Steel Externally Treated Standard Fasteners.
  - 7. ASTM A325 - Specification for High-Strength Bolts for Structural Steel Joints.
  - 8. ASTM A446 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical Quality).
  - 9. ASTM A449 - Specification for Quenched and Tempered Steel Bolts and Studs.
  - 10. ASTM A525 - Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process.
  - 11. ASTM B241 - Specification for Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

- 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.

#### **1.4 SUBMITTALS**

- A. Submit the following in accordance with Section 01001 - Basic Requirements:
  - 1. Shop Drawings, including calculations where required.
  - 2. Test pieces and samples.
  - 3. Certificates, test reports, and other required data.

#### **1.5 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. PRODUCTS**

#### **2.1 GENERAL**

- A. Unless otherwise indicated, materials shall conform to latest issue of the following ASTM Specifications:
  - 1. Steel Shapes and Plates: ASTM A36.
  - 2. Stainless Steel:
    - a. Exterior and Submerged: ASTM A167, Type 316.
    - b. Industrial Uses: ASTM A167, Type 316.
    - c. Interior and Architectural: ASTM A167, Type 304.
    - d. Bolts: ASTM A193, 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: ASTM A325-F.
  - 5. Galvanized Bolts: ASTM A307, ASTM A153.
  - 6. Connection Bolts for Wood Members: ASTM A307.
  - 7. Connection Bolts for Aluminum: ASTM A449; or use appropriate stainless steel.
  - 8. Cast Iron: ASTM A48, Class 30

## 2.2 ANCHOR BOLTS

- A. Steel Anchor Bolts (Nonsubmerged Use):
  - 1. 1/2-inch minimum diameter with hex nuts, or as shown.
  - 2. Bolts and nuts: galvanized steel.
- B. Coated Steel Anchor Bolts (Submerged Use):
  - 1. Submerged use is defined as any connection to concrete from a point 1'-6" above the maximum water surface in a water-holding basin and any connection below that point.
  - 2. ASTM A167, Type 316 stainless steel.
  - 3. 1/2-inch minimum diameter with hex nuts, or size as shown.
  - 4. Coat as specified in Section 09900, using Fusion Bonded Coating, System No. 29.
  - 5. Coating of anchor bolt threads is not required.
  - 6. Where threads are covered with a fusion bonded coating, provide nut of proper size to fit, and provide a connection of equal strength to the embedded bolt.
- C. Machine Anchor Bolts:
  - 1. For equipment with motors 3 HP or greater, fabricate as shown or as required.
  - 2. Size of fastening stud and anchor bolts as required by equipment manufacturer.
  - 3. Stainless steel.

## 2.3 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.

## **2.4 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.

## **2.5 STEEL ROOF DECK**

- A. Manufacturer:
  - 1. United Steel Deck, Inc.
  - 2. Or equal.

- B. Type F profile.
- C. Conforming to ASTM A446, 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 pounds per square inch.
- D. Gage: 18.
- E. Finish: Galvanized conforming to ASTM A525, field painted.

## **2.6 HANDRAILS**

- A. Double rails as shown on Drawings.
- B. Top rail to be 42 inches above surface (walkway or wall).
- C. Schedule 40 1-1/2-inch aluminum pipe (1.90 inches O.D.), ASTM B241, seamless.
- D. Connections: Mechanical, splice sleeves, etc., 6063 or 6061 alloy.

## **2.7 STRUCTURAL STEEL SUPPORTS**

- A. Provide structural steel supports of sizes and weights shown on Drawings.
- B. Weld connections unless otherwise shown on Drawings.

## **2.8 MACHINE BOLTS, INSERTS, AND FASTENERS**

- A. Machine bolts, inserts, and fasteners permanently embedded in concrete shall be Type 316 stainless steel.
- B. 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.
- C. 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.

## **2.9 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.

## **2.10 LIFTING LUGS**

- A. Provide equipment on each field-disassembleable part over 100 pounds in weight proper lifting lugs for easy handling.

# **PART 3. EXECUTION**

## **3.1 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 directed.
- 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 on Drawings 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 a 1/8-inch minimum radius; 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.

### 3.2 ALUMINUM

- A. Fabricate aluminum as shown on Drawings 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.

### 3.3 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 degrees 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. 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. Requalification, if ordered by Engineer, shall be done at expense of Contractor.

### **3.4 INSTALLATION OF FABRICATED METALWORK**

- A. Perform erection work by skilled workmen.
- B. Completed installations shall, in all cases, be rigid, substantial, and neat in appearance.
- C. Install commercially manufactured products in accordance with manufacturer's recommendations as approved.

### **3.5 OPEN WEB STEEL JOISTS**

- A. Erect in accordance with SJI Standard Specifications for open web steel joist and manufacturer's recommendations.

### **3.6 STEEL ROOF DECK**

- A. Erect in accordance with manufacturer's specifications and erection layout.

### **3.7 ANCHOR BOLTS**

- A. Accurately locate anchor bolts and hold in place with templates at time concrete is poured.

### **3.8 EXPANSION ANCHORS OR WEDGE ANCHORS**

- A. Installation shall not start 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.

### **3.9 ELECTROLYTIC PROTECTION**

- A. Where aluminum is in contact with dissimilar metals, or to be embedded in masonry or concrete, protect surfaces in accordance with 2.3 B of Section 09901.
- 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-inch 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 09901, utilizing appropriate painting system.

**END OF SECTION**

## SECTION 09901

### PAINTING

#### PART 1. GENERAL

##### 1.1 GENERAL

- A. 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, concrete block, and equipment as specified herein.
- B. All metal surfaces to be painted shall be sound, clean and free of harmful scale, rust, dirt, oil, grease, moisture, or any other foreign matter, which might, in any way, lessen the life or usefulness of the coating.
- C. 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.
- D. Shop coated surfaces shall be thoroughly cleaned before the application of subsequent paint coats in the field.
- E. 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.
- F. All painting at the site of the work is hereby defined as field painting and shall be under the observation of the Engineer to the extent that he shall determine where and when painting meets specification. All surfaces to be painted shall have their readiness for painting approved by the Engineer before work is started.
- G. In all cases, paints and coatings shall be applied according to manufacturer's recommendations.
- H. Surfaces of exposed members inaccessible after erection shall be cleaned and painted before erection.
- I. 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.

- J. Painting found defective shall be removed and the surface repainted as directed by the Engineer.
- K. All paints on surfaces in contact with potable water must be NSF 61 approved for use in potable water systems.

## 1.2 SHOP PAINTING

- A. Certain items which will be subjected to immersion in water or sewage 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.
- B. Items specified for shop priming shall receive one (1) shop coat of the primer specified. In all cases, shop primer shall be compatible with the field coat specified and be from the same manufacturer.

## PART 2 PRODUCTS

### 2.1 SURFACE PREPARATION FERROUS METALS, PROCESS EQUIPMENT

- A. Surface preparation of all ferrous metal to be primed in the shop shall have all rust, dust and scale, as well as all other foreign substances, removed by sandblasting or pickling. Cleaned metal shall be primed or pre-treated immediately after cleaning to prevent new rusting. All ferrous metals not primed in the shop shall be sandblasted in the field prior to application of the primer, pretreatment or paint. Grades of sandblasting shall be as indicated for the specific application below and shall conform to the following definitions:

White Metal Blast	- NACE No. 1 or SSPC-SP-5
Near White Metal Blast	- NACE No. 2 or SSPC-SP-10
Commercial Blast	- NACE No. 3 or SSPC-SP-6
Brush Off Blast	- NACE No. 4 or SSPC-SP-7

- B. Unless otherwise specified, surface preparation shall be equivalent to a minimum NACE No. 3 or a more stringent surface preparation as required by paint system and paint manufacturer.



## 2.2 SURFACE PREPARATION - ARCHITECTURAL AND STRUCTURAL MATERIALS

- A. General: Listing below does not necessarily imply that each and every substrate condition listed will be encountered in this Project.
  - a. Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
  - b. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.
  - c. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
- B. Cementitious Materials: Prepare cementitious surfaces of concrete, concrete block, cement plaster and cement-asbestos board to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
  - a. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint.
  - b. Do not paint over surfaces where the moisture content exceeds 8%, unless otherwise permitted in the manufacturer's printed directions.
- C. Structural and Misc. Ferrous Metals (Non Process): Clean non-galvanized, ferrous surfaces that have not been shop-coated of all oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning complying with Steel Structures Painting Council (SSPC) - SP3.
  - a. Touch-up shop-applied prime coats which have damaged or bare areas. Wire-brush, solvent clean, and touch-up with the same primer as the shop coat.
- D. Galvanized Surfaces: Clean free of oil and surface contaminants with acceptable non-petroleum based solvent. Approximately 24 hours before application of prime coat (and immediately after cleaning), chemically treat surfaces with a phosphoric acid or copper sulfate solution, applied according to directions of manufacturer of paint being used.

## 2.3 PAINTS

- A. The paints and paint products listed below are as manufactured by Tnemec Company, Inc., and are intended to establish standards of quality. Paint products for this project shall be equal in all respects to the products listed. No request for substitution will be considered which decreases the film thickness designated and/or the number of coats to be applied, or which offers a change from the generic type of coating specified. Any request for substitution shall contain the full name of each product, descriptive literature, directions for use, generic type, nonvolatile content by volume, and a list of at least ten (10) water treatment plants where each of the coatings has been used on new construction and has rendered satisfactory service for at least three (3) years. Submitted paint system shall be used throughout entire project.
- a. Series 10-1009 Tnemec Primer; 2.0 to 3.5 mils/coat.
  - b. Series N69 HB Epoxoline II; 4 to 6 mils/coat.
  - c. Series 1029 Enduratone; 2.0 to 3.0 mils/coat.
  - d. Series 446 Perma-Shield MCU; 5 to 10 mils/coat.
  - e. Series 130 Envirofill 80 to 100 ft<sup>2</sup>/gal.
  - f. Series N69 HB Epoxoline II; 4 to 6 mils/coat.
  - g. Series 180 W. B. Tneme-Crete; 4 to 8 mils/coat.
  - h. Series 1074 Endura-Shield; 2 to 3 mils/coat.
  - i. Series 54-660 Masonry Filler; 75-100 ft<sup>2</sup>/gal.
  - j. Series 10-99(white) Tnemec Primer; 2.5 to 3.5 mils/coat.
  - k. Series 1028 Enduratone; 2.0-3.0 mils/coat.
  - l. Series N140/N140F Pota-Pox Plus; 4.0 to 6.0 mils/coat
  - m. Series 141 Epoxyline; 4.0 to 6.0 mils/coat
  - n. Series 90-97 Tnemec Zinc; 3.0 to 5.0 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.

- B. The asphaltic paint listed below is to establish a standard of quality. Asphaltic paint is to be used at aluminum surfaces in contact with concrete.
- a. Hercules Chemical Companies
- C. The mastic paint shall be in compliance with one of the following manufacturers:
- a. Carboline
  - b. Sherwin-Williams

## PART 3 - EXECUTION

### 3.1 PAINTING SCHEDULE

The number of coats shall be not less than called for hereunder. Letter designations of various coats of paint refer to the same letter designation of paints given in the preceding subsection. Colors shall be as designated by the painting scheme at the end of this section, or as selected by the Owner from the standard color line of each particular paint type and manufacturer. Surface areas to be painted include, but are not limited to, the following items:

- A. All indoor pump/blower components, motors and base plates: Shop Coat - one (1) coat of (a); Field Coat - one (1) coat of (a) and two (2) coats of (c).
- B. Pump Motors: Manufacturer's Standard Paint System. Contractor to touch up all areas damaged during shipment and installation.
- C. All indoor exposed Iron Pipe, Valves, Fittings and Appurtenances:
  - a. Field Sand Blast to NACE No. 3; Field Coat - two (2) coats of (f).
- D. All outdoor exposed Iron Pipe, Valves, Fittings, Appurtenances:
  - a. Field Sand Blast to NACE No. 3; Field Coat - one (1) coat of (f) and two (2) coats of (h).
- E. Exterior Structural Steel and Miscellaneous Steel Items: Total 7-11 mils
  - a. Shop Coat - one (1) coat of (f); field touch up primer and one (1) coat of (f) and one (1) coat of (h).
- F. Interior Structural Steel and Miscellaneous Steel Items:
  - a. Shop coat - one (1) coat of (f); field touch up primer; and one (1) coat of (h).
- G. All Submerged Iron Pipe and Interior/Exterior Steel Pipe and miscellaneous steel:
  - a. Field Sand Blast NACE No. 2; Field Coat of Exterior Pipe two (2) coats of (l).
- H. Galvanized surfaces identified to be painted:
  - a. Field Coat - One (1) coat of (f) and one (1) coat of (h).
- I. Catwalks and other structure Steel Exposed to Water:
  - a. Primer - one (1) coat (n); two coats (b).
- J. Interior of steel pipe and fittings in pipe gallery:
  - a. Field Sand Blast NACE No. 1; Field coat three (3) coats of (m).

### 3.2 PAINT APPLICATION - ARCHITECTURAL AND STRUCTURAL MATERIALS

#### A. General:

- a. Apply paint with brush, roller, spray, or other acceptable practice in accordance with the manufacturer's directions. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by the paint manufacturer for material and texture required.
- b. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried. Sand between each enamel or varnish coat application with fine sandpaper.
- c. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.
- d. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
- e. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint, before final installation of equipment.
- f. Paint the backsides of access panels, removable or hinged covers to match the exposed surfaces.
- g. Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

#### B. Brush Application:

- a. Brush-out and work all brush coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable. Neatly draw all glass and color break lines.
- b. Brush-apply all primer or first coats, unless otherwise permitted to use mechanical applicators.

#### C. Mechanical Applicators:

- a. Use mechanical methods for paint application only when permitted by governing ordinances and trade union regulations. If permitted, limit to only those surfaces impracticable for brush applications.
- b. Limit roller applications (generally) to interior wall and ceiling finishes for second and third coats. Apply each roller coat to provide the equivalent hiding as brush-applied coats.

- c. Confine spray application (generally) to metal framework, siding, decking, wire mesh and similar surfaces where hand brush work would be inferior and other surfaces specifically recommended by paint manufacturer.
  - d. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building up film thickness of two coats in one pass.
- D. Required Condition of Completed Work: Must match approved samples for color, texture and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.
- E. Protection:
  - a. Protect work of other trades, whether to be painted or not, against damage by the painting and finishing work. Correct any damages by cleaning, repairing or replacing, and repainting, as acceptable to the Engineer.
  - b. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
- F. Clean Up:
  - a. During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each workday.
  - b. Upon completion of painting work, clean all paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
  - c. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

### **3.3 PAINTING COLOR SCHEME**

- A. Finish colors will be as selected by Owner from paint manufacturer's color charts. Contractor to submit color charts to Owner for color selection.

**END OF SECTION**

## SECTION 11401

### DECANTING EQUIPMENT

#### PART 1. GENERAL

##### 1.1 SUMMARY

- A. Provide digester decanting equipment where indicated on the Drawings for the digester conversion at the Mountain View WWTP. The work includes providing all operating equipment and special materials to be complete with all accessories and appurtenances as required for a complete decanting system. The decanting swivel shall be 6" (150 psi rated) for submerged applications. The swivel shall be fitted with standard 125 pound flanges and flanged bolted aluminum extension piece Schedule 40 aluminum pipe-22'-0"± long, with an eyelet welded to the top of the extension. The aluminum decant swivel and arm shall be fitted with Bun-N- O-rings seals with 316 stainless steel bearings. The swivel and extension piece shall be raised and lowered by a Thern Silverline Hand Winch (or equal) and a mounting plate (see drawing) fastened to the digester wall to allow easy raising and lowering of the decant arm.

##### 1.2 RELATED SECTIONS

- A. Section 01001 - Basic Requirements.
- B. Section 05000 - Miscellaneous Metals
- C. Section 05500 - Fabricated Metalwork and Castings

##### 1.3 REFERENCES

- A. American Society for Testing and Materials, 1961 Race Street, Philadelphia, Pennsylvania 19103.
  1. ASTM B241& ASTM B-429 - Specifications for Extruded Seamless Aluminum Pipe for General Purpose

##### 1.4 SUBMITTALS

- A. Provide the following submittals in accordance with Section 01001:
  1. Complete operation and maintenance instructions for all equipment shall be submitted after the Shop Drawings are approved, but prior to shipment of equipment.

## **1.5 QUALITY ASSURANCE**

- A. Supplier Qualifications: Aluminum fabricator to have at least five (5) years in aluminum fabrication and experience in similar aluminum equipment fabrication in Arkansas and shall furnish references on Arkansas equipment installations.

## **PART 2. PRODUCTS**

### **2.1 SWIVEL JOINTS:**

The 6" Aluminum Swivel Joint shall be flanged at each end and fitted with Buna-N O-ring seals and 316 Stainless Steel Ball bearings. Flanges shall have 150# rating. Swivel joint shall be for submerged service and shall be equal to:

USA Blue Book Stock # 21474

### **2.2 ALUMINUM PIPE EXTENTION:**

The 6" Aluminum pipe shall be 6061-T Schedule 40 extruded pipe meeting ASTM B221 requirements. The pipe shall be fitted a 150# aluminum flanges on the swivel joint end and extension pieces for a total length of 22'-0" to be above the maximum water level. The short 2'-0" extension piece shall have a 1 inch welded eyelet on the top of the open end for the hook from the hoist to fit for raising and lowering the decanting arm.

### **2.3 DECANT ARM SUPPORT BRACKET**

A decant arm support shall be manufactured and installed in the bottom of the digester for support when the decant arm is lowered all the way down for decanting or draining of the digester. The decant support shall be like the drawings and be manufactured out of Aluminum Schedule 40 Pipe and ¼" aluminum plate. The U-shaped arm rest shall be fitted with Buna-N rubber or other sewage resistant rubber or plastic, so that the decant arm does not lie on bear metal creating a wear point. The bottom of the U-support on the decant support bracket shall be set at elevation 609.0. The mounting bottom mounting flanges shall be anchored with a minimum of 4- ½" 6" long epoxy anchors.

### **2.4 HAND WINCHES:**

Thern Silverline 304 Stainless Steel Manufacture # TSSBW600  
USA Blue Book Stock # 21474

Hand winches to be fitted with 3/16" X 50' stainless steel cable with stainless steel hook.

USA Blue Book Stock # 44936

## **2.5 HAND WINCHE WALL MOUNTING BRACKET**

A winche support bracket shall be manufactured to mount the Thurn hand winche to the outside of the Digester basin wall as shown in the Drawings. The hand winche center of the handle shall be mounted a minimum of 16 inches above the top of the basin wall to allow ease of operation of the hand operated winche. The support bracket shall be made out of 2" x 4" aluminum tubing with 1/4" aluminum anchor plates for mounting the winche and the bracket to the digester wall. All anchors shall be stainless steel for bolting the winche to the anchor plate and 1/2" stainless steel epoxy anchors minimum 4" embedment in to the basin wall.

**END OF SECTION**



## SECTION 11815

### JET AERATION EQUIPMENT

#### PART 1. GENERAL

##### 1.1 SUMMARY

- A. Provide jet aeration equipment where indicated on the Drawings for the digester conversion at the Mountain View WWTP. The work includes providing all operating equipment and special materials complete with all accessories and appurtenances required for a complete mix jet aeration system. The jet aeration system shall consist of all in-basin submerged air and liquid piping, in-basin submerged supports; jet mixing pump with accessories, shelf spare jet mixing pump and positive displacement blower packages. Intent is to have a complete turnkey jet aeration mixing pumping system in the converted digester using Manufacture standard equipment or, as stated in the Specifications. **Aeration system consisting of mixing pump and blower combination shall provide sufficient air and mixing to maintain dissolved oxygen between 1.5 mg/L and 2.0 mg/L.**
- B. The Contractor shall coordinate the work specified in this section with the work of other Contractors in order that all necessary items shall be provided as required for satisfactory operation and that the various items of equipment will properly fit and operate in the spaces allotted to them.

##### 1.2 RELATED SECTIONS

- A. Section 01001 - Basic Requirements.
- B. Section 02086 - Manually Operated Valves.
- C. Section 16000- Electrical

##### 1.3 REFERENCES

- A. American Society for Testing and Materials, 1961 Race Street, Philadelphia, Pennsylvania 19103.
  - 1. ASTM A48 - Specification for Gray Iron Castings.
  - 2. ASTM A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - 3. ASTM A193 - Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
  - 4. ASTM A519 - Specifications for Seamless Carbon and Alloy Steel Mechanical Tubing.

5. ASTM B505 – Specifications for Copper – Base Alloy Continuous Castings.
  6. ASTM B584 – Specifications for Copper Alloy Sand Castings for General Applications.
- B. Institute of Electrical and Electronics Engineers, 245 East 47th St., New York, NY 10017.
1. IEEE 112 - Standard Test Procedure for Polyphase Induction Motors and Generators.
- C. National Electrical Manufacturers Association, 2101 L Street North West, Suite 300, Washington, D.C. 20037.
1. NEMA MG1 - Motors and Generators.

#### **SYSTEM COORDINATION:**

- D. Service Conditions:
- |                           |                        |
|---------------------------|------------------------|
| 1. Liquid Pumped:         | Waste Activated Sludge |
| 2. Largest Solid Passing: | Enclosed Impeller      |
| 3. Stages                 | One (1)                |
| 4. Specific Gravity:      | 1.0.                   |

The Jet aeration pump and mixing equipment shall operate at constant speed and the Pump and Blower Control Systems shall be operated by a pump and blower selection switches on the pump and blower respective control panels.

#### **1.4 SUBMITTALS**

- A. Provide the following submittals in accordance with Section 01001:
1. Performance data curves showing head, capacity, horsepower demand, pump efficiency, and NPSH (required) over entire operating range of pump, from shutoff to maximum capacity.
  2. Equipment manufacturer shall indicate separately: Head, capacity, horsepower demand, and pump efficiency at guarantee points.
  3. Performance requirements: As defined in Hydraulic Institute Standards.
  4. Provide complete motor nameplate data, as defined by NEMA, motor manufacturer; and any motor modifications.
  5. For energy-efficient motors, provide certified copy of test report for an identical motor tested in accordance with NEMA Standards Publication No. MG1-12.53.a and IEEE Standard No. 112.
  6. Pumps & blower components provided shall be the product of one manufacturer and clarification from the supplier must be provided for approval.
  7. Complete operation and maintenance instructions for all equipment shall be submitted after the Shop Drawings are approved, but prior to shipment of equipment.

## **1.5 QUALITY ASSURANCE**

- A. Supplier Qualifications: Pump and blower supplier shall be an established supplier of non-clog submersible pumps and jet aeration equipment in Arkansas and shall furnish references on Arkansas installations over the past 5 years.

## **PART 2. PRODUCTS**

### **2.1 JET AERATION SYSTEM:**

The equipment furnished shall be a jet type aeration system. A total of one (1) jet aeration manifold shall be provided to mix and aerate the aerobic digester. The jet aeration manifold shall include eight (8) jet aeration mixing nozzles. The orifice size of each liquid nozzle shall be no less than 1 1/2 inches in diameter to avoid plugging problems. Layout of the jet aeration manifolds shall be as shown on the drawings. The aeration equipment shall be capable of producing fine bubbles to increase the transfer efficiency. The aerators shall be manufactured of stainless steel for prolonged life. All materials must be resistant to a complete range of operating temperature, salinity, hardness, corrosiveness, and abrasives experienced in domestic wastewater treatment. The equipment must further be capable of continuous operation over extended periods with compressed air temperatures up to 100° C. The aeration system shall be designed to accomplish the design oxygen transfer and to provide rapid dispersion of oxygen throughout the liquid mass.

The aeration system shall have a high oxygenation rate by providing high transfer efficiency per unit energy input and per time input. The aeration system shall be designed to provide mixing such that when operated under design conditions, it shall suspend biological floc and mixed liquor suspended solids throughout the liquid mass.

The flexibility of the operation shall be provided by varying the airflow rate to the system.

### **2.2 Jet Aeration Air-Liquid Manifold:**

Each multiple jet aerator module shall be comprised of a liquid duct and an air duct. The liquid duct shall be a circular, cylindrical tube having a plurality of liquid nozzles which are longitudinally spaced units, and which are aligned on a common plane. The air duct shall be made of circular, cylindrical tube. The air duct shall have a plurality of air-liquid nozzles longitudinally spaced along its perimeter in corresponding number to, and disposed respectively in radial alignment with, the liquid nozzles of the liquid duct. The liquid and air ducts shall be fabricated of corrosion resistant structurally sound material. Each multiple jet aerator assembly shall form a structural unit. All components of the manifold shall be constructed of 304 stainless steel.

Each air-liquid jet manifold shall be constructed such that the liquid duct, air duct, mixing chamber, liquid nozzle, and air-liquid nozzle comprise one self-contained integrally formed unit, and shall be shipped as such, completely ready for installation.

A back flush system shall be incorporated to flush clean the liquid nozzles in each bank. Minimum size of the flush out line piping shall be 4". All piping supports, valves, and fittings required shall be provided as part of the back flush system. The back flush valve shall be installed such that it may be easily operated.

### **2.3 Jet Nozzles**

Nozzles shall have both an inner and outer assembly to facilitate mixing and increase tank turnover. All nozzles shall be fabricated out of 304 stainless steel. Nozzles shall come prewelded to the jet manifold as shown in the Drawings.

### **2.4 Jet Aeration Piping:**

All in basin submerged air and liquid piping shall be provided by the System Supplier as part of the aeration system to the extent shown on the plans. All piping shall be 304 stainless steel Schedule 10. Air supply piping shall terminate with a flange connection at approximately 6" above the top water level to mate to contractor supplied air piping. All interconnecting hardware, gaskets and anchor bolts are to be provided by the installing contractor.

### **2.5 Jet Aeration Header Supports:**

All necessary supports for the air-liquid jet manifold and air piping shall be supplied as part of the system. The supports shall be manufactured of 304 stainless steel.

All necessary supports for the air-liquid jet manifold back flush piping and air piping shall be supplied as part of the air jet system. The supports shall be manufactured of 304 stainless steel. The supports shall consist of dual leg angle welded to a supporting base. A cross brace shall be provided and field welded for additional support. The base shall be leveled and grouted in place if required. The support angle shall be field welded directly to the jet manifold.

### **2.6 Mixing Pumps**

Furnish one (1) installed and one (1) shelf spare submersible non-clog mixing pump as an integral part of the jet aeration/mixing system. Each pump shall be equipped with a submersible electric motor, connected for operation on 460 volts, 3 phase, 60 hertz service. The power cable shall be sized according to NEC and ICEA standards.

Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be of stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

The pump shall be supplied with a mating cast iron six inch discharge connection *The operating pump shall be automatically and firmly connected to the discharge connection, guided by no less than two (2) schedule 40 304 stainless steel guide bars extending from near the top of the tank to*

*the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. The pump shall be fitted with a chain sling with 30' stainless steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight.*

## **2.7 Motor**

The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of no less than 15 evenly spaced starts per hour. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.

The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals.

The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80° C.

## **2.8 Bearings**

The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a single ball type bearing to handle radial loads. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L<sub>10</sub> bearing life shall be 50,000 hours at any usable portion of the pump curve.

## **2.9 Mechanical Seals**

Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

## **2.10 Pump shaft**

The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. The shaft shall be stainless steel – ASTM A479 S43100-T.

## **2.11 Impellers**

The impeller shall be of gray cast iron with high chrome, ASTM A-48 Class 35B, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller shall be hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 6% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The Impeller shall be locked to the shaft and held by an impeller bolt.

## **2.12 Volute/Suction Cover**

The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. The internal volute bottom shall provide effective sealing between the multi-vane semi-open impeller and the volute.

## **2.13 Motor Protection**

Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.

The thermal switches and float switch shall be connected to a control and status monitoring unit. The monitoring unit shall be designed to be mounted in the pump control panel.

Fluid: Wastewater

Temperature: 10 degrees C

S.G.: 1.0

Pump Speed: 1800 RPM maximum

HP: 15

## **2.14 Positive Displacement Blowers:**

A total of two (2) blower package shall be provided with one being a complete spare unit.

The blower package shall be of rotary positive displacement design with two lobe volute type rotors complete with accessories. All blowers and accessory valves, piping, and gauges shall be mounted on a common base plate and completely assembled for shipment as a single unit ready for operation. Inlet filters may be shipped separately for outdoor mounting. Blowers shall be as manufactured by Gardner Denver, Roots, Sutorbilt or other pre-approved Blower supplier.

The impeller case shall be strongly ribbed to prevent distortion when operating at rated pressure. The unit shall be equipped with four heavy-duty anti-friction bearings. The impellers shall be close grain cast iron strongly ribbed internally. The impellers shall be machined on all exterior surfaces. The impellers shall be dynamically balanced. The shafts shall be made of machined steel and securely fastened to the impellers.

The unit shall have two timing gears accurately machined to position the impellers in the impeller housing. The gears and bearings shall be enclosed in an oil tight housing and shall be lubricated by a splash oiling system from oil maintained in the gear housing. Grease vents shall be located in the bearing housing to prevent rupture of greased seals from over greasing.

The air vents shall be located between the seals and the impeller chamber to relieve excessive pressure on the seals. The blowers shall be equipped with thrust control features so that no thrust from the driver will be transmitted to the blower impellers.

The blower shall be provided with an inlet filter, inlet silencer, discharge silencer, flexible connectors, check valve, and pressure relief valve as indicated on the Plans.

Suction and discharge air piping shall be provided by the aeration system supplier as part of the Blower Assembly to the extent shown on the Drawings.

**2.14.1 Drive** - Each blower shall be furnished with a V-belt, or flexible coupling drive, and belt, or coupling guards of sheet metal and expanded mesh conforming to OSHA and applicable safety codes.

The V-belt drive shall be of the high capacity matched belt, multiple groove type, oil and heat resistant and static dissipating with a 1.4 service factor. The pulleys shall be of the split hub taper lock design dynamically balanced.

The coupling shall be a flexible, all steel, dynamically balanced coupling equal to Falk Steelflex and shall provide for axial movement and shaft misalignment.

2.14.2 Intake Air Filter/silencer - The manufacturer shall provide a combination inlet filter/silencer for each blower. The filter shall be arranged for to a pipe flange. The filter elements shall be of the dry, washable, synthetic media type; selected to filter 99% to 10 micron and above particles. The filter shall be complete with a filter restriction indicator. Two extra filters shall be provided.

2.14.3 Discharge Silencer - The manufacturer shall provide a discharge silencer for each blower, designed for maximum silencing. The silencers to be of the chamber absorption type and shall be complete with matching 125 lb drilled flanges and shall be of an all welded steel construction, with connections sized and located as shown on Contract Drawings. Ensure silencers, inlet air piping, and inlet air filters are adequately supported.

2.14.4 Pressure Relief Valves - Each blower shall be provided with spring loaded pressure relief valve, set at 1/2 psig above the maximum working pressure and capable of discharging total blower output with 10% pressure accumulation.

2.14.5 Check Valves - Each blower discharge line shall be furnished with a dual metal, plate hinged type check valve, designed for heavy on-duty type shut-off service similar or equal to those manufactured by Techno Check or equal.

2.14.6 Butterfly Valves - Each blower discharge shall be provided with a lever operated butterfly valve, flanged or wafer, per blower manufacturer's recommendations as indicated on the plans.

2.14.7 Flexible Connection - Each blower suction and discharge line shall be provided with a single arch type, multiple-ply rubber or synthetic elastomer, reinforced flexible connection shall be complete with steel backing rings.

2.14.8 Pressure Gauge - Each blower shall be furnished one discharge pressure gauge. Gauges shall be 2-1/2 inch dial face type with NPT (National Pipe Thread) fittings for pipe insertion.

2.14.9 Bases - Each blower shall be mounted with its motor on a common base. The motors shall be horizontally mounted on an adjustable slide base for maintaining rated speeds, belt adjustment, and future changes in capacity.

2.14.10 Enclosure - Each blower shall be fitted with an enclosure. The material of construct shall be 1/8" aluminum. Each blower enclosure shall have four (4) hinged doors (two (2) per side. Doors shall be fitted with eight (8) 1/2 turn compression latches (two (2) per door. Each blower enclosure shall have one (1) enclosure exhaust fan (1/60 HP / 120 volts, 4.3 Amps. Enclosure and vent box shall be lined with 2" acoustical foam to reduce noise.



### 2.15 Operating and Design Requirements for Blowers (one blower to be a spare)

Motors shall be furnished with the blowers as a complete unit and shall meet the following requirements:

Horsepower.....	25	Hertz.....	60
Enclosure.....	TEFC	Voltage.....	460/3/60
Phase.....	3	Service Factor.....	1.15

### **3.1 SUPPLIERS'/MANUFACTURERS' SERVICES**

- A. Field Service and Training:
- B. The Contractor shall provide the services of a factory trained technician with at least three years factory experience in jet mixing equipment. The factory technician shall be qualified to inspect installation, test for proper installation, conduct start-up, and train operator in the operation of the equipment and the process. A minimum of three (3) man days on the job site in a minimum of one (1) trip shall be provided.

**END OF SECTION**

# **APPENDIX**

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**Contractor is responsible for adherence to all applicable  
Federal and State Laws and Regulations  
including, but not limited to,  
the following and any applicable amendments:**

**Ark Act 291 of 1993**  
Trench and Excavation Safety Systems

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**Code of Federal Regulations Title 29**  
website: <http://ecfr.gpoaccess.gov/>

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**Arkansas State Licensing Law for Commercial Contractors**  
website: [www.arkansas.gov/clb](http://www.arkansas.gov/clb)

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