Harbor
A Terracon Company

Application for State Construction Permit

NPDES Permit No. AR0053384

AFIN: 47-01073

November 2025

EXPLORATORY VENTURES, LLC
a U.S. Steel company

Prepared for:

Exploratory Ventures, LLC
1000 East County Road 860
P.O. Box 707
Osceola, Arkansas 72370
Phone: (870) 819-3031

Prepared by:

Harbor
5800 Evergreen Drive
Little Rock, Arkansas 72205
Phone: (501) 663.8800
Fax: (501) 588.0123
www.harborenv.com

Engineering | Compliance | Sustainability

November 20, 2025

Ms. Jessica Sears, P.E.
Managing Engineer
Water Permits Branch
Office of Water Quality
Division of Environmental Quality (DEQ)
Arkansas Department of Energy and Environment
5301 Northshore Drive
North Little Rock, Arkansas 72118-5317

RE: Application for State Construction Permit
Exploratory Ventures, LLC, Osceola, Mississippi County, Arkansas
NPDES Permit No. AR0053384, AFIN: 47-01073
Expedited Review is Requested

Dear Ms. Sears:

Harbor Environmental, Inc., a Terracon Company (Harbor), is pleased to submit the enclosed application for a State Construction Permit on behalf of Exploratory Ventures, LLC (EV) in Osceola, Arkansas. EV operates a new scrap steel-to-steel products manufacturing complex (the "Facility").

EV plans to install a new production unit for making Direct Reduced Iron (DRI) at the Facility. Iron ore will be converted into DRI using a reducing gas atmosphere (hydrogen and/or carbon monoxide) without melting the ore itself. The solid, pre-reduced, metal ("HDRI" and "HBI") will then be used as a high-quality raw material, mixed with steel scrap, in the electric arc furnaces operated at the Facility and an adjacent steel mill operated by Big River Steel. Construction of the DRI unit will begin in early 2026; the schedule for start-up has not yet been determined.

Cooling tower blowdown will be generated during the DRI manufacturing operations. The DRI unit will be equipped with its own wastewater treatment plant (DRI WWTP). EV plans to install a four−mile-long wastewater transfer pipeline between the DRI WWTP and the Mississippi River. The treated effluent will be discharged to the river at new Outfall EV203.

The purpose of the enclosed permit application is to obtain a State Construction Permit for installation of the DRI WWTP and the effluent pipeline. Detailed construction plans and specifications for the treatment system, pipeline, and outfall structure are provided herein. Installation of the DRI WWTP and associated facilities will commence upon issuance of the construction permit so that the new wastewater stream can be processed when the DRI plant becomes operational.

EV respectfully requests that the DEQ *expedite review* of the enclosed wastewater permit application to the extent possible. We will promptly answer any questions that arise during the permitting process. We will respond in a timely manner to any requests by the DEQ for additional information.

Your consideration of the construction permit application for EV is greatly appreciated. Please contact us at (501) 663-8800 if you have any questions or need further information.

Sincerely,

HARBOR ENVIRONMENTAL, INC.

David Carstens
Senior Project Manager
dcarstens@harborenv.com

Andrew Rike, P.E.
Principal
arike@harborenv.com

Encl.: Construction Permit Application (Electronic Document)

cc: Lenore Trammell, EV
Dean Caldwell, EV
Joe Hall, EV
Chrissie Gray, EV
Martin Booher, BakerHostetler

TABLE OF CONTENTS

	Cover Letter
Section A	Summary of Wastewater Permit Application
Section B	DEQ Application Form 1 (General Information)
Section C	Financial Reports (Submitted in lieu of DEQ Disclosure Statement)
Section D	Process Description and Design Calculations for Wastewater Treatment System
Section E	Process Flow Diagram and Water Flow Diagram
Section F	Facility Maps and Diagrams
Section G	Topographic Maps
Section H	FEMA Flood Plain Maps
Section I	Construction Plans and Specifications for Wastewater Treatment System

REVIEW PAGE

Prepared By: David Carstens

David Carstens
Senior Project Manager
Harbor Environmental, Inc.

Reviewed By: Andrew Rike

Andrew Rike, P.E.
Principal
Harbor Environmental, Inc.

Section A – Summary of Wastewater Permit Application

Section A
Summary of Wastewater Permit Application

Exploratory Ventures, LLC (EV), a subsidiary of U.S. Steel Corporation, operates a new scrap steel-to-steel products manufacturing complex located near the city of Osceola in Mississippi County, Arkansas (the "Facility"). The Facility is designed to produce a full range of high-strength steel products for key niche markets, primarily through the recycling of scrap metal.

EV operates the Facility under the authority of National Pollutant Discharge Elimination System (NPDES) Permit No. AR0053384 effective in September 2023. The permit is administered by the Division of Environmental Quality (DEQ) of the Arkansas Department of Energy and Environment. The current permit coverage expires in February 2028.

The NPDES permit covers two discharge points on the Mississippi River. Process wastewater effluent from the Facility's wastewater treatment plant (WWTP) is discharged at Outfall EV201, whereas wastewater (comingled quench water and stormwater runoff) from the slag yard pond is discharged at Outfall EV202.

EV plans to install a new production unit for making Direct Reduced Iron (DRI) at the Facility. Iron ore will be converted into DRI using a reducing gas atmosphere (hydrogen gas and/or carbon monoxide) without melting the ore itself. The solid, pre-reduced, metal ("HDRI" and "HBI") will then be used as a high-quality raw material, mixed with steel scrap, in the electric arc furnaces operated at the Facility and an adjacent steel mill owned by Big River Steel (BRS). Construction of the DRI unit will begin in early 2026; the schedule for start-up has not yet been determined.

Cooling tower blowdown will be generated during the DRI manufacturing operations. The DRI unit will be equipped with its own wastewater treatment plant (DRI WWTP). EV plans to install a four−mile-long wastewater transfer pipeline between the DRI WWTP and the Mississippi River. The treated effluent will be discharged to the river at new Outfall EV203.

The purpose of the enclosed permit application is to obtain a State Construction Permit for installation of the DRI WWTP and the effluent pipeline. Detailed construction plans and specifications for the treatment system, pipeline, and outfall structure are provided herein. Installation of the DRI WWTP and associated facilities will commence upon issuance of the construction permit so that the new wastewater stream can be processed when the DRI plant becomes operational.

In the near future, EV plans to file a separate application for modification of NPDES Permit No. AR0053384 to incorporate the discharge from the DRI WWTP and new Outfall EV203.

EV requests that the DEQ *expedite review* of the enclosed wastewater permit application to the extent possible. We will promptly answer any questions that arise during the permitting process. We will respond in a timely manner to any requests by the DEQ for additional information.

The application for a State Construction Permit is presented in the remaining sections of this document.

Section B – DEQ Application Form 1 (General Information)

NPDES Individual Permit Application
Form 1

5301 Northshore Drive
North Little Rock, AR 72118-5317

PURPOSE OF THIS APPLICATION (check all that apply)

☐ INITIAL APPLICATION FOR NEW FACILITY
☐ INITIAL APPLICATION FOR EXISTING FACILITY
☐ MODIFICATION OF EXISTING PERMIT
☐ REISSUANCE (RENEWAL) OF EXISTING PERMIT
☒ CONSTRUCTION PERMIT

SECTION A - GENERAL INFORMATION

A.1. Legal Applicant Name: Exploratory Ventures, LLC

A.2. Operator Type: Corporation (Domestic or Foreign, includes for-profit, nonprofit, and corporation d/b/a company)

A.3. Corporation, LLC, LP, or Cooperative? ☒ Yes ☐ No → Skip to A.4

State of Incorporation, if not Arkansas: Delaware

Attach a Proof/Status of Good Standing from Arkansas Secretary of State and from the state of incorporation, if applicable.

A.4. Facility Name: Exploratory Ventures, LLC

A.5. Is the applicant identified in A.1, the owner of the facility? ☒ Yes → Skip to A.6 ☐ No

Owner of the facility: _____

A.6. Is there an outstanding state construction permit for this facility that needs to be terminated?

☐ Yes ☒ No → Skip to A.7

A state construction permit can be terminated by submitting Notice of Completion of Construction for State Construction Permits found through the link below:

https://www.adeq.state.ar.us/water/permits/npdes/individual/pdfs/state-construction-permit-completion-of-construction.pdf

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

A.7. Indicate below any NPDES permits issued by DEQ to this facility, if applicable. (Check all that apply and list the corresponding permit number for each.)

NPDES permits issued by DEQ		
☒ NPDES Individual Discharge Permit AR000053384	☐ NPDES Non-Stormwater General Permit ARG_____	☐ NPDES Industrial Stormwater General Permit ARR00_____

A.8. List permit numbers and/or names of any permits issued by DEQ 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**
Title V Operating Permit	2445-AOP-R4	Exploratory Ventures
Construction Stormwater Permit	ARR157275	Exploratory Ventures

A.9. Is the facility required to file a disclosure statement?

☒ Yes, one has been attached ☐ Exempt

The disclosure statement form may be obtained from the DEQ web site at:

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

A.10. Facility Physical Location. Attach a location map if not previously submitted.

Street address 1000 East County Road 860			
City or town Osceola	State AR	ZIP code 72370	County Mississippi - 47

Front Door (gate) location of the facility.

	Degrees/Minutes/Seconds			OR	Decimal Degrees
Latitude:	35°	37’	8.43”		____°
Longitude:	90°	0’	0.26”		____°

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

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

Street Address		P.O. Box 707
City or town Osceola	State AR	ZIP code 72370

A.12. Neighboring states within 20 miles of the permitted facility (Check all that apply):

☐ Louisiana ☐ Mississippi ☐ Missouri
☐ Oklahoma ☒ Tennessee ☐ Texas

A.13. Standard Industrial Classification (SIC) code and North America Industrial Classification System (NAICS) code for primary process and secondary process if applicable.

Primary SIC 3312	Primary NAICS 331110
Secondary SIC ☒ N/A	Secondary NAICS ☒ N/A

A.14. Who prepared this application?

Contact Name (First and Last) David Carstens		Title Senior Project Manager
Company Name Harbor Environmental, Inc.		
E-mail Address dcarstens@harborenv.com		Phone Number (501) 663-8800
Street Address 5800 Evergreen Drive		
City or town Little Rock	State AR	ZIP Code 72205

A.15. Wastewater Operator Information

Name (First and Last)	**License Number**	**Municipal Wastewater Operator**	**Industrial Wastewater Operator**
Joe Hall (Lead Operator)	010267	Class Choose an item.	Advanced
		Class Choose an item.	Choose an item.
		Class Choose an item.	Choose an item.
		Class Choose an item.	Choose an item.

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

SECTION B - OUTFALL INFORMATION

B.1. Outfall Information (If more than two outfalls, attach additional pages)

<table>
<tr><td colspan="8">Outfall EV203 (New)</td></tr>
<tr><td colspan="8">(No changes will be made to existing Outfalls EV201 or EV202.)</td></tr>
<tr><td colspan="4">Design Flow
1.27 MGD</td><td colspan="4">Highest Monthly Average flow over the last two years
Not Applicable MGD</td></tr>
<tr><td rowspan="2">End-of-Pipe Location:</td><td rowspan="2">Latitude:</td><td>°</td><td>’</td><td>” N</td><td rowspan="2">Longitude:</td><td>°</td><td>’</td><td>” W</td></tr>
<tr><td colspan="3">OR Decimal: 35.65107336°</td><td colspan="3">OR Decimal: -89.91328031°</td></tr>
<tr><td rowspan="2">Monitoring Location (If different from End-of-Pipe Location:</td><td rowspan="2">Latitude:</td><td>°</td><td>’</td><td>” N</td><td rowspan="2">Longitude:</td><td>°</td><td>’</td><td>” W</td></tr>
<tr><td colspan="3">OR Decimal: 35.60939917°</td><td colspan="3">OR Decimal: -89.95277238°</td></tr>
<tr><td colspan="8">Name of Receiving Stream:</td></tr>
<tr><td colspan="8">Mississippi River</td></tr>
<tr><td colspan="8">Treatment system (Include all components of the treatment system and attach a process flow diagram):</td></tr>
<tr><td colspan="8">Treatment system will consist of collection basin, sand filters, filtered water basin, and backwash basin. See Section D (Process Description) and Section E (Process Flow Diagrams).</td></tr>
<tr><td colspan="8">How and where are effluent samples collected? Include a narrative description of where samples are collected relative to the treatment system.</td></tr>
<tr><td colspan="8">☐ Grab ☐ Composite ☒ Both</td></tr>
<tr><td colspan="8">Automated composite sampler: wastewater samples will be collected immediately after sand filters, prior to discharge of effluent to transfer pipeline to river. Grab samples will be collected from sampling faucet adjacent to composite sampler.</td></tr>
<tr><td colspan="8">How is flow measured and where (relative to the process flow diagram)?
Electronic flow meter with totalizer. Flow will be measured at pumping station for effluent transfer pipeline to river.</td></tr>
<tr><td colspan="8">Is the outfall equipped with a diffuser?
☐ Yes ☒ No</td></tr>
<tr><td colspan="8">What is the diameter of the effluent pipe?</td></tr>
<tr><td colspan="8">18 inches</td></tr>
</table>

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

B.2. Describe how influent is collected and conveyed to the treatment system.

Cooling tower blowdown will be pumped to collection basin (WDB1) for wastewater treatment plant for DRI unit.

B.3. Is this facility a publicly owned treatment works (POTW)?
(includes cities, public facilities boards, and improvement districts)

☐ Yes ☒ No → Skip to B.4

Is this a renewal or new application for an NPDES permit?

☐ Yes ☒ No → Skip to B.4

If "Yes" to both of the above questions, complete the table below:

Pollutant	Maximum Daily Influent		Average Daily Influent		
	Value	Units	Value	Units	Number of Samples[1]
$CBOD_5/BOD_5$[2]					
TSS					
How and where were the influent samples collected? Include a narrative description of where samples are collected relative to the treatment system.					
☐ Grab ☐ Composite ☐ Both					

[1] At a minimum, influent testing data must be based on at least three samples taken within 4.5 years prior to the date of the permit application. Existing data may be used, if available, in lieu of sampling done solely for the purpose of this application

[2] Influent testing must be for the parameter listed in the NPDES permit.

B.4. Attach a process flow diagram. See Section E (Process Flow and Water Flow Diagrams).

B.5. Attach a topographic map **extending at least one mile beyond the property boundary with the discharge location(s) (Outfalls) marked** with this application.

See Section G (Topographic Maps).

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

B.6. Is the WWTP located above the 100-year flood level? If the property is located in a Special Flood Hazard Area, this question must be marked no even if measures such as building up pond levees or changing the grading have been made so that the components of the WWTP are above the 100-year flood level.

☐ Yes ☒ No

If "No", what measures are (or will be) used to protect the facility? Protected by levee.

Has a FEMA map been submitted with a previous application?

☒ Yes ☐ No

If "No", a FEMA map must be submitted with this application as an attachment.

B.7. Population served for Municipal or Domestic Sewer Systems: N/A

B.8. Backup Power Generation for Treatment Plants

Are there any permanent backup generators? ☒ Yes ☐ No

If Yes, how many? 1 Total Horsepower (hp)? 3,621

If No, check all that apply.

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

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

SECTION C - WASTE STORAGE AND DISPOSAL INFORMATION

C.1. Are solids/sludge produced at this facility? The following information pertains to the wastewater treatment plant for the DRI unit.

☒ Yes ☐ No → Skip to Section D

C.2. Do solids/sludge remain in treatment lagoon(s)?

☐ Yes ☒ No → Skip to C.3

How many lagoon(s)? How old is the lagoon(s)?

Has sludge depth been measured? ☐ Yes ☐ No

If yes, when was it measured (MM/YYYY)? _____ Average sludge depth? _____ ft.

If no, when will it be measured? _____

Has sludge ever been removed? ☐ Yes ☒ No

If yes, when was it removed (MM/YYYY)? _____

C.3. Are solids/sludge disposed at a landfill?

☐ Yes ☒ No → Skip to C.4

Is the Landfill located in Arkansas? ☐ Yes ☐ No

If Yes, what is the DEQ solid waste permit issued to the landfill?

If No, which state? State: _____

Provide the solid waste permit Permit No. _____

C.4. Are solids/sludge disposed by land application?

☐ Yes ☒ No → Skip to C.5

Is the land application site located in Arkansas? ☐ Yes ☐ No

If Yes, what is the DEQ state permit issued to the land application site? _____

If No, what state and their state permit? State: _____ Permit No. _____

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

C.5. Are solids/sludge disposed by septic tank?

☐ Yes ☒ No → Skip to C.6

Arkansas Department of Health Permit No. _____

C.6. Are solids/sludge distributed and marketed?

☐ Yes ☒ No → Skip to C.7

Company Name receiving solids/sludge		
E-mail Address		Phone Number
Street Address		
City or town	State	ZIP Code
Distributed by (check all that applies) ☐ Pipe ☐ Rail ☐ Truck ☐ Other _____		

C.7. Are solids/sludge disposed by sludge storage lagoon? (Lagoon for which the sole purpose is storing sludge):

☐ Yes ☒ No → Skip to C.8

How many lagoon(s)? _____ How old is the lagoon(s)? _____ years

Total surface area of lagoon(s)? _____ acre

Has sludge depth been measured? ☐ Yes ☐ No

If yes, when was it measured (MM/YYYY)? _____Average depth? _____ ft.

If no, when will it be measured? _____

Has sludge ever been removed? ☐ Yes ☐ No

If yes, when was it removed (MM/YYY)? _____

Does lagoon(s) have a liner? ☐ Yes ☐ No

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

C.8. Are solids/sludge disposed by incineration?

☐ Yes ☒ No → Skip to C.9

Company Name		
E-mail Address		Phone Number
Street Address		
City or town	State	ZIP Code

C.9. Are solids/sludge disposed by **Other** method? (Provide complete description)

Filter backwash from wastewater treatment plant for DRI unit will be transferred to water treatment plant for recycling.

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

SECTION D - WATER SUPPLY

D.1. Are there any water supply sources which are downstream of the outfall location, i.e., those which could be affected by the discharge from this facility?

☒ Yes ☐ No → Skip to Section E

D.2. Is the water supply source subsurface water?

☒ Yes ☐ No → Skip to D.3

Private Well?

☒ Yes ☐ No

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

Municipal Water Utility?

☐ Yes ☒ No

City or town _____

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

D.3. Is the water supply source surface water

☐ Yes ☒ No → Skip to D.4

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

D.4. **Other** (Provide complete description)

N/A

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

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

SECTION E - TRUST FUND REQUIREMENTS

E.1. Is the facility considered a "nonmunicipal domestic sewage treatment works" (NDSTW) as defined in Ark. Code Ann. 8-4-203(b)?

☐ Yes ☒ No

If "yes", a completed NDSTW trust fund form must be submitted. The trust fund form may be obtained from the DEQ web site at:

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

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

SECTION F - INDUSTRIAL ACTIVITY

F.1. Is this facility subject to an effluent limit guideline?

☒Yes ☐ No → Skip to Section G

F.2. 40 C.F.R. reference for applicable effluent limit guidelines: Part 420 (Iron and Steel Manufacturing)

List all applicable Subpart(s) D, E, F, G, I, J, K, L, M (Facility as a whole)

F.3. Description of all operations at this facility including primary products or services (attach additional sheets if necessary):

Exploratory Ventures operates a scrap steel-to-steel products manufacturing complex. The mill produces a variety of high-strength, lightweight steel products, primarily through the recycling of scrap metal.
The DRI Plant is specifically subject to ELG Part 420, Subpart M (Other Operations).

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

SECTION G - MODIFICATION AND CONSTRUCTION INFORMATION

G.1. Was "Modification of existing permit" or "Construction permit" checked off on **Purpose of this Application**? (Above Section A - General Information)

☒ Yes ☐ No → Skip to Section H

G.2. List proposed construction activities and/or requested changes to the NPDES permit.

Installation of wastewater treatment system for DRI unit. Construction of four-mile-long effluent pipeline to Mississippi River and associated outfall structure.

G.3. If this application is for a State Construction permit, please note that, in accordance with Rule 6.202, plans and specifications and design calculations must be stamped and signed by a **Registered Professional Engineer in the State of Arkansas**. The basic design criteria for wastewater treatment plants in the State of Arkansas should be based on the latest edition of the "Recommended Standards for Sewage Works," published by the Great Lakes-Upper Mississippi Board of State Sanitary Engineers known as 10 States Standards, with few modifications. Exception to the criteria will only be approved by DEQ when fully justified. A comprehensive list of exceptions to 10 State Standards is listed in Rule 6.202(B) and can be viewed here: https://www.adeq.state.ar.us/regs/files/reg06_final_150918.pdf

Checklist of Items to Be Attached to Application
☒ Professional Engineer registered in the State of Arkansas
☒ Design calculations signed & stamped, including justification for exceptions to 10 State Standards
☒ Plans & drawings signed & stamped, including justification for exceptions to 10 State Standards
☒ Specifications, signed & stamped, including justification for exceptions to 10 State Standards
☐ If application is for a sanitary sewer WWTP, verification that the necessary submittals to the Arkansas Department of Health have been made.

G.4. In the case of construction, will the construction disturb one acre or more?

☒ Yes ☐ No → Skip to Section H

If the area disturbed is more than one acre up to, but not including, five acres, the facility is automatically covered under the Construction Stormwater General Permit ARR150000 and must comply with the terms and conditions of that permit.

If the area disturbed is five acres or more, a Construction Stormwater General Permit ARR150000 must be obtained by submitting a Notice of Intent and a Stormwater Pollution Prevention Plan to DEQ. The application information can be found here:

https://www.adeq.state.ar.us/water/permits/npdes/stormwater/

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

SECTION H: CHECKLIST AND SIGNATORY REQUIREMENTS

H.1. Mark the sections of Form 1 below that have been completed and are being submitted as part of the application. For each section, specify any attachments that will be enclosed. Note that not all applicants are required to provide all attachments.

Form 1 Section	Attachments
☒ Section A – General Information	☒ w/Proof of Good Standing from Arkansas Secretary of State ☒ w/Proof of Good Standing from State of Incorporation ☐ w/Notice of Completion of Construction for State Construction Permits ☒ w/Disclosure Statement ☒ w/location map
☒ Section B – Outfall Information	☒ w/additional outfall information ☒ w/topographic map **extending at least one mile beyond the property boundary with the discharge location (outfall) marked** ☒ w/FEMA flood plain map ☒ w/process flow diagram
☒ Section C – Waste Storage and Disposal Information	
☒ Section D – Water Supply	
☐ Section E – Trust Fund Requirements	☐ w/Nonmunicipal Domestic Sewage Treatment Works Trust Fund Certification form
☒ Section F – Industrial Activity	
☒ Section G – Modification and Construction Information	☒ w/design calculations ☒ w/design specifications ☒ w/plans and drawing

H.2 Is this submittal for a State Construction permit or the modification or renewal of an existing permit?

☒ Construction or Modification → Skip to H.3, EPA Form Not Required

☐ Renewal – an EPA Form(s) (in addition to this Form 1) are required for this application:

Check all boxes that are applicable

☐ EPA Form 2A – Publicly Owned Treatment Works (including cities, public facilities boards, and improvement districts)
☐ EPA Form 2B – Concentrated Animal Feeding Operations and Concentrated Aquatic Animal Production
☐ EPA Form 2C – Existing Dischargers of Process Wastewater
☐ EPA Form 2D – New Sources and New Dischargers Application for Permit to Discharge Process Wastewater
☐ EPA Form 2E – Facilities Which Do Not Discharge Process Wastewater (i.e., domestic/sanitary wastewater, cafeteria/restaurant wastewater, non-contact cooling water, etc.)
☐ EPA Form 2F – Stormwater Discharges Associated with Industrial Activity (industrial facilities discharging stormwater commingled with other process or non-process wastewaters must submit Form 2F in addition to the applicable form for process or non-process wastewater.)

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

H.2. **Cognizant Official** (Duly Authorized Representative)

40 C.F.R. 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:

Print name (First and Last)	Email
Dean Caldwell	DCaldwell@bigriversteel.com
Official title	Telephone number
Division Director Environmental	(870) 819-4354

H.3. **Additional Cognizant Officials** (If necessary)

If the applicant wishes to designate more than one person as a Cognizant Official, or duly authorized representative, for all purposes expressed in part H.3, additional spaces are provided below:

Print name (First and Last)	Email
Joe Hall	Jhall@bigriversteel.com
Official title	Telephone number
Water Treatment Supervisor	(731) 334-0443

Print name (First and Last)	Email
Chrissie Gray	CGray@bigriversteel.com
Official title	Telephone number
Environmental Manager	(870) 819-4853, ext. 644

Print name (First and Last)	Email
_____	_____
Official title	Telephone number
_____	_____

Print name (First and Last)	Email
_____	_____
Official title	Telephone number
_____	_____

NPDES Permit Number	AFIN	Facility Name	County
AR0053384	47-01073	Exploratory Ventures	Mississippi - 47

H.4. **Responsible Official**

"By my signature below, I certify that I met the requirement to be the signatory as defined in 40 C.F.R. § 122.22."

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

"By my signature below, I certify that, if this facility is a corporation, it is registered with the Secretary of State in Arkansas."

"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."

Print name (First and Last)	Official title	Email
Lenore Trammell	Chief Administrative Officer	LTrammell@bigriversteel.com
Signature L Trammell	Date signed 11-19-2025	Telephone number (870) 819-3031

Arkansas Secretary of State
Cole Jester
State Capitol Building ♦ Little Rock, Arkansas 72201-1094 ♦ 501-682-3409

Certificate of Good Standing

I, Cole Jester, Secretary of State of the State of Arkansas, and as such, keeper of the records of domestic and foreign corporations, do hereby certify that the records of this office show

EXPLORATORY VENTURES, LLC

formed under the laws of the state of Delaware, and authorized to transact business in the State of Arkansas as a Foreign Limited Liability Company, was granted a Registration of Foreign Limited Liability Company by this office June 13, 2022.

Our records reflect that said entity, having complied with all statutory requirements in the State of Arkansas, is qualified to transact business in this State.

In Testimony Whereof, I have hereunto set my hand and affixed my official Seal. Done at my office in the City of Little Rock, this 23rd day of September 2025.

Cole Jester
Secretary of State

Online Certificate Authorization Code: 50a9bfe0dc5b7e3
To verify the Authorization Code, visit sos.arkansas.gov

Department of State: Division of Corporations

Allowable Characters

HOME

Entity Details

THIS IS NOT AN OFFICAL CERTIFICATE OF STATUS

Status Retrieved: 09/23/2025 at 11:27 AM EST

Email Status

File Number:	**6141674**	Incorporation Date / Formation Date:	**8/4/2021** (mm/dd/yyyy)
Entity Name:	**EXPLORATORY VENTURES, LLC**		
Entity Kind:	**Limited Liability Company**	Entity Type:	**General**
Residency:	**Domestic**	State:	**State:**
Status:	**Good Standing**	Status as of:	**6/12/2024**

REGISTERED AGENT INFORMATION

Name:	**CORPORATION SERVICE COMPANY**		
Address:	**251 LITTLE FALLS DRIVE**		
City:	**WILMINGTON**	County:	**New Castle**
State:	**DE**	Postal Code:	**19808**
Phone:	**302-636-5401**		

Back to Entity Search

For help on a particular field click on the Field Tag to take you to the help area.

Section C – Financial Reports
(Submitted in Lieu of DEQ Disclosure Statement)

Section C
Financial Reports (Submitted in Lieu of Disclosure Statement)

Per the DEQ's regulations, certain applicants for a State Construction Permit must submit a Disclosure Statement as part of the application. However, those applicants that are publicly traded companies and their subsidiaries have the option of providing their most recent financial reports in lieu of filing a Disclosure Statement.

EV is a wholly owned subsidiary of U.S. Steel. EV has decided to submit the most recent Quarterly ("10-Q") Report and Annual ("10-K") Report for the parent corporation in lieu of filing a Disclosure Statement.

The 10-Q Report for the 1st Quarter of 2025 for U.S. Steel is available at the following web address: https://www.sec.gov/ix?doc=/Archives/edgar/data/0001163302/000116330225000030/x-20250331.htm

The 10-K Report for fiscal year 2024 for U.S. Steel is available at the following web address: https://www.sec.gov/ix?doc=/Archives/edgar/data/0001163302/000116330225000018/x-20241231.htm

Printed copies of the financial reports are available upon request.

Section D – Process Description and Design Calculations for Wastewater Treatment System

Harbor

A Terracon Company



EXPLORATORY VENTURES, LLC

a U.S. Steel company

PROCESS DESCRIPTION AND DESIGN CALCULATIONS FOR DRI WASTEWATER FACILITIES

HARBOR PROJECT NO. L8257501

NOVEMBER 2025

Prepared for:

EXPLORATORY VENTURES, LLC

1000 East County Road 860
P.O. Box 707
Osceola, Arkansas 72370
Phone: (870) 819-3031

Prepared by:

Harbor

5800 Evergreen Drive
Little Rock, AR 72205
P: 501.663.8800
F: 501.588.0123
www.harborenv.com

Engineering | Compliance | Sustainability

Section D
Process Description and Design Calculations for DRI Wastewater Treatment System

A description of the wastewater treatment system to be constructed and operated for the DRI manufacturing plant is presented in this section of the permit application. Design calculations and operating parameters for the treatment units are enclosed.

The Construction Plans and Specifications for the wastewater treatment components, effluent pipeline, and outfall structure are provided in Section I of the application. Drawings of the treatment units are enclosed therein as Sheets C100 through C302. Other pertinent documents include the following figures presented in Section E and Section F:

- Figure E-2 Simplified Water Flow and Water Balance Diagram
- Figure F-3 Layout of DRI Plant
- Figure F-4 Layout of DRI Wastewater Treatment Plant (WWTP)
- Figure F-5 Process and Instrumentation Drawing for DRI WWTP
- Figure F-6 Flow Diagram for DRI WWTP and Water Treatment Plants

1.0 Description of Overall Water Usage at Facility

EV operates a scrap steel-to-steel products manufacturing facility located in Osceola, Arkansas. It is designed to produce a full range of high-strength steel products for key niche markets, primarily through the recycling of scrap metal.

Raw water for the steel manufacturing operations is provided by two high-capacity groundwater withdrawal wells. The water is prepared for use in a series of water treatment plants located throughout the Facility. The conditioned water is subsequently used in the contact cooling water and non-contact cooling water circuits for various production units, including the new DRI plant.

The maximum volume of water to be supplied to the DRI plant will be approximately 450 cubic meters per hour (m^3/hr), which is equivalent to 1,981 gallons per minute (gpm) or 2.854 million gallons per day (MGD). Of that overall amount, approximately 250 m^3/hr maximum (1,101 gpm or 1.585 MGD) of water will be lost to evaporation in the plant's cooling tower and other DRI process equipment. EV will recondition a portion of the contact cooling water and non-contact cooling water streams in the water treatment systems for the DRI plant. These streams will be recycled to the extent possible; approximately 150 m^3/hr maximum (660 gpm or 0.951 MGD) of water will be reclaimed.

Approximately 200 m^3/hr (881 gpm or 1.269 MGD) of cooling tower blowdown will be generated in the DRI plant. It will be transferred to the DRI WWTP for treatment. The wastewater effluent will subsequently be continuously discharged to the Mississippi River at Outfall EV203.

2.0 Description of Wastewater Stream

The cooling tower for the DRI will be periodically blown down to maintain the proper concentration of total dissolved solids within the cooling water. The blowdown water will be pumped to the WWTP for treatment. The blowdown stream will be an intermittent discharge.

3.0 Stages of Wastewater Treatment Process

The WWTP for the DRI plant will have two (2) general stages of operation. These stages are as follows:

- Stage #1 Flow Equalization
- Stage #2 Filtration

A description of each stage of the wastewater treatment process is presented below:

- Stage #1 – Flow Equalization: The intermittent discharge of blowdown water from the cooling tower will be pumped to a storage basin to equalize the hydraulic loading to the downstream filtration process.

- Stage #2 – Filtration: The cooling tower blowdown will be filtered to remove total suspended solids (TSS). A bank of sand filters will be operated for this purpose. The filtered effluent will subsequently be processed in one of two ways: (1) the water will be transferred back to the water treatment systems in the DRI plant for recycling; or (2) the effluent will be pumped to the Mississippi River and discharged at Outfall EV203. The sand filters will be periodically backwashed to remove the captured solids. The backwash will be routed to a collection basin for subsequent recycling.

4.0 Wastewater Treatment Units

A brief description of the wastewater treatment units for the DRI plant is presented in this section. Pertinent design and operating parameters are provided. Refer to Section I, Construction Plans and Specifications, for more information. The layout of the overall wastewater treatment plant is shown on Sheet C301.

4.1 Blowdown Basin WDB1

Blowdown Basin WDB1 is the main collection unit for the DRI WWTP. It will be utilized for flow equalization. The basin will receive the blowdown from the cooling tower for the DRI plant.

Blowdown Basin WDB1 will be an aboveground concrete tank. The basin will have the following operating dimensions:

Blowdown Basin WDB1
- Volume = 32 m^3 (8,453 gal)
- Length = 4,400 mm (14.5 ft)
- Width = 4,400 mm (14.5 ft)
- Height = 2,500 mm (8.2 ft) (estimated)
- Height of Water Surface = 1,660 mm (5.5 ft) (estimated)

Pump Group WDP.1X will be used to transfer the wastewater from Blowdown Basin WDB1 to the Sand Filters. The pump group was selected based on the following operating parameters:

Pump Group WDP.1X (1+1)
- Flowrate = 200 m^3/hr (880 gpm)
- Pressure = 2 bar (29 psia)

4.2 Sand Filtration System WDF.2.1X

The blowdown from the cooling towers will be filtered to remove TSS. The filtered effluent will subsequently be processed in one of two ways: (1) the water will be transferred back to the DRI water treatment systems for recycling; or (2) the effluent will be pumped to the Mississippi River and discharged at Outfall EV203.

Sand Filtration System WDF.2.1X will receive the cooling tower blowdown from Blowdown Basin WDB1. The system will consist of four aboveground filter units (WDF.2.1.1 through WDF.2.1.4). The individual sand filters will be equipped for multiple operating configurations depending on the circumstances. Any group of two filters will have adequate capacity to treat the wastewater flow from Basin WDB1. The design parameters for the filtration equipment are provided below:

Sand Filtration System WDF.2.1X
- Filtration velocity = ≤19 meters per hour (m/hr) (1.0 feet per minute (ft/min))
- Backwash velocity = 25 m/hr (1.4 ft/min)
- Air backwash velocity = ≤55.8 m/hr (3.1 ft/min)

The basic operating characteristics for the sand filters will be as follows:

Sand Filters WDF.2.1X

- Number of filters = 4
- Diameter of each filter = 3,200 mm (10 ft)
- Height of each filter = 2,000 mm (6.6 ft)
- Total surface area = 7.92 m^2 (85 ft^2)
- Total volume of each filter = 8 m^3 (2,113 gal)
- Maximum backwash flow = 200 m^3/hr (881 gpm)

The sand filters will be periodically backwashed to remove the captured TSS. The equipment will be configured and automatically operated so that two filters remain in service while the other two units are being backwashed. The backwashed units will automatically return to service once the cleaning process has been completed. The backwash will be routed to Drain Basin WDB3 for storage pending recycling.

Pump Group WDP.1X will be used to transfer the wastewater from Blowdown Basin WDB1 to the Sand Filters. The operating parameters for this pump group are described above.

Pump Group WDP.2.1X will be used to backwash the sand filters. This pump group was selected based on the following operating parameters:

Pump Group WDP.2.1X (1+1)

- Flowrate = 200 m^3/hr (881 gpm)
- Pressure = 2.5 bar (36 psia)

Sand Filtration System WDF.2.1X will be equipped with a blower system for backwashing the filter media. Blower Group WDFB.1X will supply the air for the process. The blowers were selected based on the following operating conditions:

Blowers WDFB.2.1X (1+1)

- Flowrate = 1,200 normal m^3/hr (706 actual cubic feet per minute)
- Pressure = 0.7 bar (10 psia)

Sand Filtration System WDF.2.1X will be equipped with an automated hydrogen peroxide dosing system for periodic cleaning of the filtration units. It will be connected to the wastewater inlet line for the filters.

4.3 Filtered Water Basin WDB2

Filtered Water Basin WDB2 will be used to store the filtered wastewater effluent from Sand Filtration System WDF.2.1X. The effluent will subsequently be processed in one of two ways: (1) the water will be transferred back to the water treatment systems in the DRI plant for recycling; or (2) the effluent will be pumped to the Mississippi River and discharged at Outfall EV203.

Filtered Water Basin WDB2 will be an aboveground concrete tank. The basin will have the following operating dimensions:

Basin WDB2
- Volume = 64 m^3 (16,907 gal)
- Length = 8,400 mm (28 ft)
- Width = 4,400 mm (46 ft)
- Height = 2,500 mm (8.2 ft) (estimated)
- Height of Water Surface = 1,730 mm (5.7 ft) (estimated)

Pump Group WDP.2.2X will be used to transfer the wastewater effluent from Filtered Water Basin WDB2 to the Mississippi River (or to the DRI water treatment plants for recycling). The pump group was selected based on the following operating parameters:

Pump Group WDP.2.2X (1+1)
- Flowrate = 200 m^3/hr (881 gpm)
- Pressure = 4 bar (58 psia)

The wastewater basin will be equipped with a sampling station for the collection of both composite and grab samples of the treated effluent.

4.4 Drain Water Basin WDB3

Drain Water Basin WDB3 will be used to store the filter backwash from Sand Filtration System WDF.2.1.X. The water will subsequently be transferred back to the water treatment systems in the DRI plant for recycling.

Drain Water Basin WDB3 will be an aboveground concrete tank. The basin will have the following operating dimensions:

Basin WDB3
- Volume = 35 m^3 (9,246 gal)
- Length = 6,400 mm (21 ft)
- Width = 4,400 mm (46 ft)

- Height = 2,000 mm (6.6 ft)
- Height of Water Surface = 1,250 mm (4.1 ft)

Pump Group WDP.3.1X will be used to transfer the water from Drain Water Basin WDB3 to the water treatment systems for the DRI plant for recycling. This pump group was selected based on the following operating parameters:

Pump Group WDP.3.1X (1+1)

- Flowrate = 200 m^3/hr (881 gpm)
- Pressure = 3.5 bar (51 psia)

5.0 Wastewater Transfer Pipeline

EV plans to install a four−mile-long wastewater transfer pipeline between the DRI WWTP and the Mississippi River. The treated effluent will be discharged to the river at new Outfall EV203.

The wastewater pipeline will be constructed of high-density polyethylene pipe. The 18-inch diameter force main will be buried underground. The hydraulic calculations for the force main are attached.

Pump Group WDP.2.2X will be used to transfer the wastewater effluent from Filtered Water Basin WDB2 to the river. The operating parameters for this pump group are described above.

Upon request, EV will provide the DEQ with all available information, including additional equipment specifications, deemed necessary for completing the wastewater permitting process. This documentation will be forwarded to the Office of Water Quality in a timely manner.

Table D-1 – Summary of Wastewater Stream Discharged to DRI WWTP (Outfall EV203)

Influent Type	Process Area	Average Flow (m^3/hr)	Maximum Flow (m^3/hr)	Frequency	Effluent Characteristics
Cooling Tower Blowdown	DRI	TBD	200	Continuous (Effluent)	Filtered Water

m^3/hr = Cubic Meters per Hour

EXPLORATORY VENTURES
DRI WASTEWATER TREATMENT SYSTEM - FACILITY EFFLUENT
HARBOR
HYDRAULIC CALCULATIONS FOR DISCHARGE FORCE MAIN E
NOVEMBER 17, 2025

18" HDPE DR11 IPS

Line #	From Sta. #	To Sta. #	Flow, gpm	L, ft	Diam, in	H_L calc, ft	Static Head, ft	Total Head, ft	bar
MAIN D	21870	3978	3000	17892	15.741	104.9	38.0	142.9	4.27
MAIN D	3978	0	3000	3978	15.741	23.3	-3.1	20.2	0.60
								163.1	4.88

$$H_L = PipeLength \left[\frac{Q}{0.285\, C (d)^{2.63}} \right]^{1.852}$$

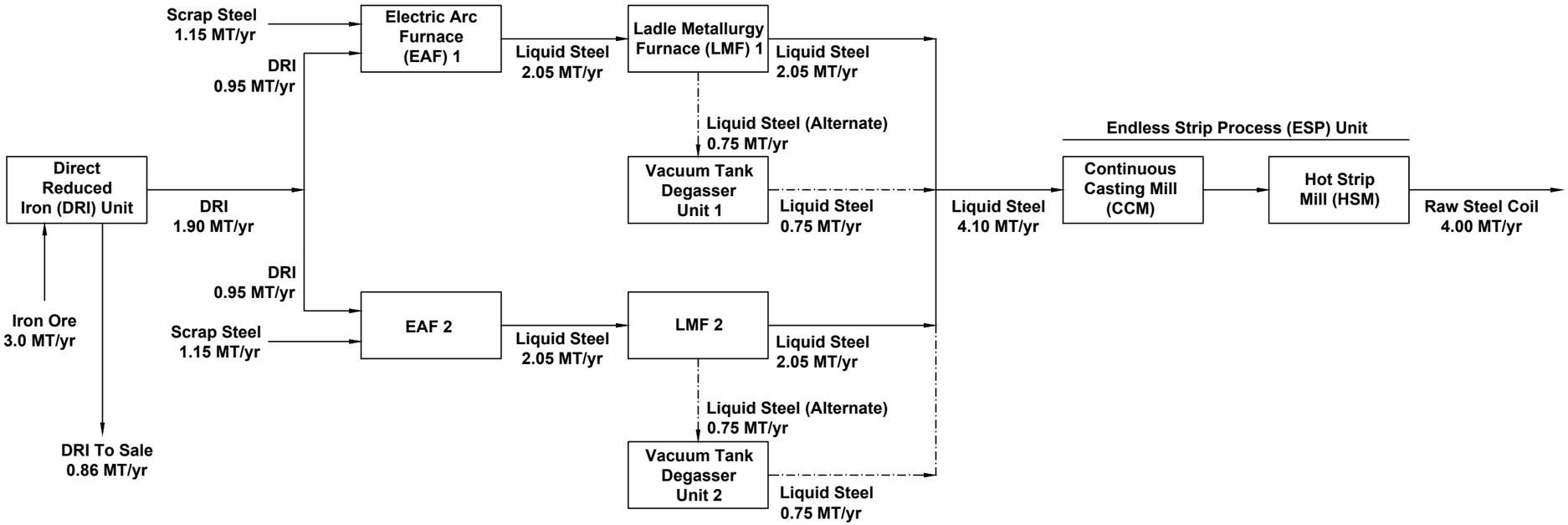
Where:

H_L is headloss in feet
Q = Peak flow, gpm
= Derived for NYS/EPA Presure Sewer Research Project Table
D = Pipe diameter, inches
C = Chezy coefficient = 120 for PVC pipe
L = Pipe Length in feet

The highest headloss is present in Main E.

The total dynamic head in the system is 163.1 feet

Section E – Process Flow Diagram and Water Flow Diagram



Applicable ELG Subparts

DRI Unit
Subpart M (Other Operations)
15,101 10^3-lb/day

MT/yr = Million Short Tons per Year
10^3-lb/day = 1,000 Pounds per Day

EAF 1 and EAF 2
Subpart D (Steelmaking)
11,233 10^3-lb/day Each

RH Degassers 1 and 2
Subpart E
(Vacuum Degassing)
4,110 10^3-lb/day Each

LMF 1 and LMF 2
No Applicable Subparts

CCM
Subpart F
(Continuous Casting)
21,918 10^3-lb/day

HSM
Subpart G
(Hot Forming)
21,918 10^3-lb/day

Harbor
A Terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501)663-8800
Fax (501)588-0123
www.harborenv.com

EXPLORATORY VENTURES, LLC
STEEL MANUFACTURING COMPLEX
OSCEOLA ARKANSAS

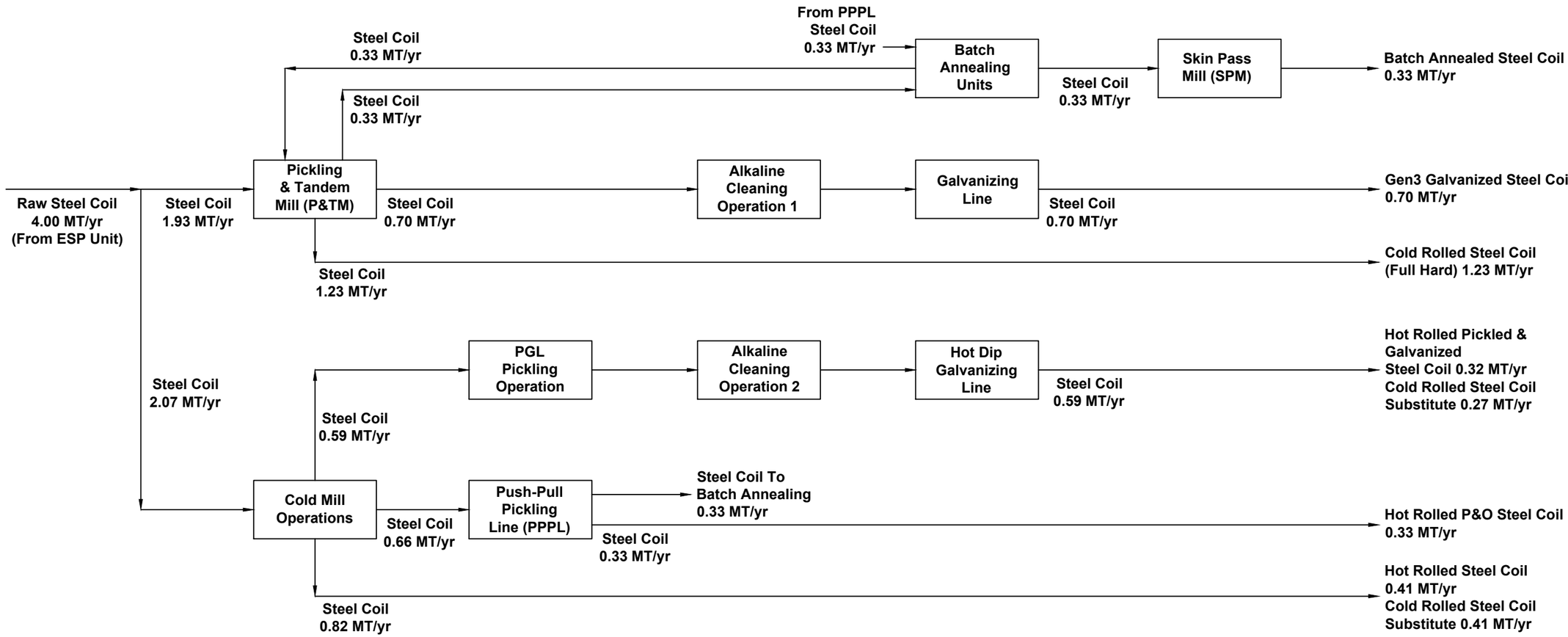
MANUFACTURING PROCESS FLOW DIAGRAM

NO	REVISION DESCRIPTION	DATE
X	X	X-X-X

Drawn By: AES
Date: 9-24-25
Project No: L8257501
Scale: NONE

E1-A

N:_HEILegacy\Public\Client Folders A - D\BHLP BakerHostetler\Drawings\BRS Works - MM2\Facilities EV - Compliance.dwg, 11/14/2025 12:53:55 PM



Applicable ELG Subparts

P&TM
Subpart I (Acid Pickling)
10,576 10^3-lb/day

P&TM
Subpart J
(Cold Forming)
10,576 10^3-lb/day

Cold Mill
Subpart J
(Cold Forming)
11,342 10^3-lb/day

PGL Pickling
Subpart I
(Acid Pickling)
3,232 10^3-lb/day

PPPL
Subpart I
(Acid Pickling)
3,616 10^3-lb/day

Acid Regen. Plant
No Applicable Subparts (No Discharge to WWTP)

Alkaline Cleaning 1
Subpart K (Alkaline Cleaning)
3,836 10^3-lb/day

Alkaline Cleaning 2
Subpart K (Alkaline Cleaning)
3,232 10^3-lb/day

Galvanizing Line
Subpart L (Hot Coating)
3,836 10^3-lb/day

HD Galvanizing Line
Subpart L
(Hot Coating)
3,232 10^3-lb/day

Batch Annealing Units
No Applicable Subparts

SPM
Subpart J (Cold Forming)
1,808 10^3-lb/day

Harbor
A Terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501)663-8800
Fax (501)588-0123
www.harborenv.com

EXPLORATORY VENTURES, LLC
STEEL MANUFACTURING COMPLEX
OSCEOLA **ARKANSAS**
MANUFACTURING PROCESS FLOW DIAGRAM

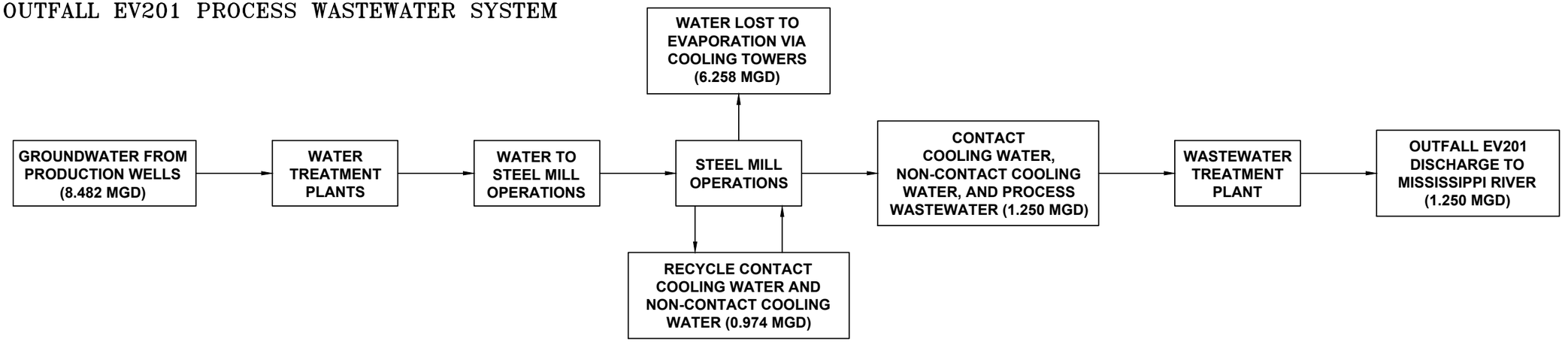
NO	REVISION DESCRIPTION	DATE
X	X	X-X-X

Drawn By: AES
Date: 9-24-25
Project No: L8257501
Scale: NONE

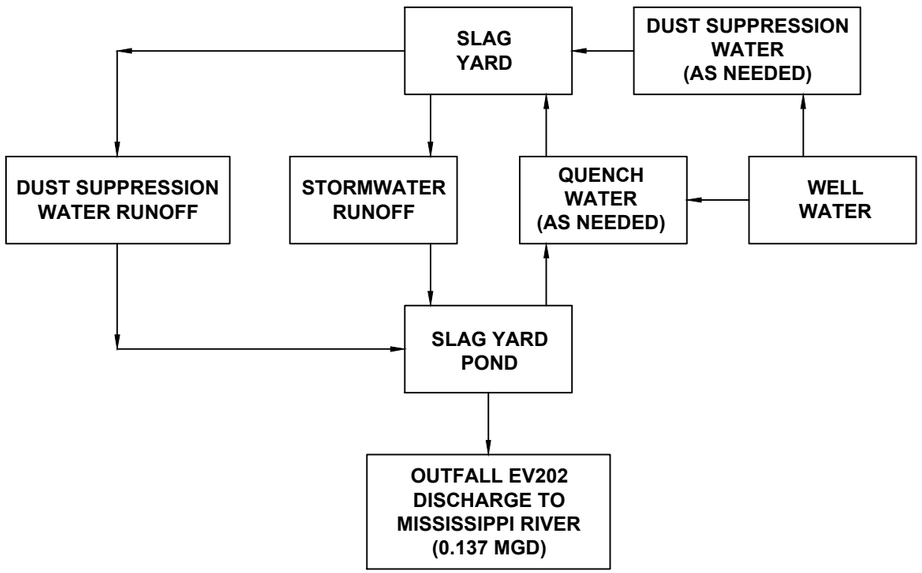
E1-B

N:_HEILegacy\Public\Client Folders A - D\BHLP BakerHostetler\Drawings\BRS Works - MM2\Facilities EV - Compliance.dwg, 11/14/2025 12:58:24 PM

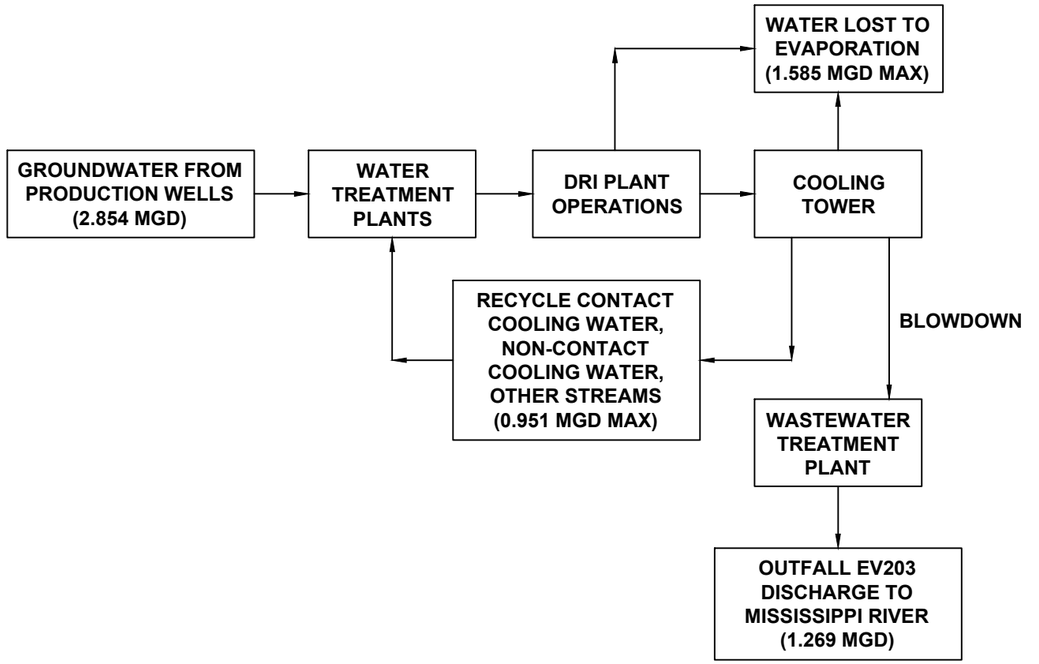
OUTFALL EV201 PROCESS WASTEWATER SYSTEM



OUTFALL EV202 SLAG YARD POND



OUTFALL EV203 DRI WASTEWATER SYSTEM



Harbor
A Terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501)663-8800
Fax (501)588-0123
www.harborenv.com

EXPLORATORY VENTURES, LLC
STEEL MANUFACTURING COMPLEX
OSCEOLA, ARKANSAS

SIMPLIFIED WATER FLOW AND WATER BALANCE DIAGRAM

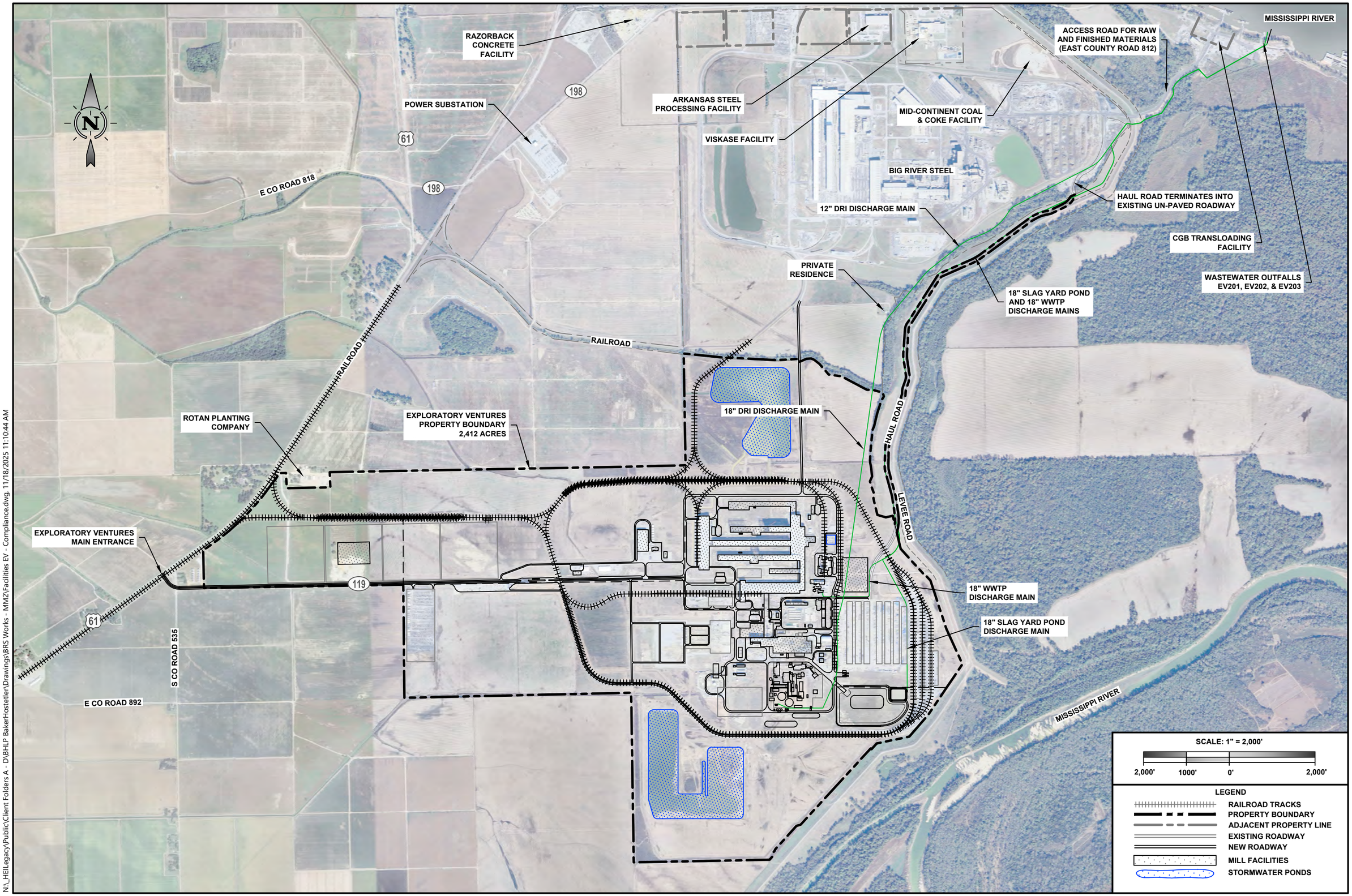
NO	REVISION DESCRIPTION	DATE
X	X	X-X-X

Drawn By: AES
Date: 9-24-25
Project No: L8257501
Scale: NONE

E-2

N:_HEILegacy\Public\Client Folders A - D\BHLP BakerHostetler\Drawings\BRS Works - MM2\Facilities EV - Compliance.dwg, 11/18/2025 11:07:35 AM

Section F – Facility Maps and Diagrams



N:_HEILegacy\Public\Client Folders A - D\BHLP Baker\Hostetter\Drawings\BRS Works - MM2\Facilities EV - Compliance.dwg, 11/18/2025 11:10:44 AM

Harbor
A Terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501)663-8800
Fax (501)588-0123
www.harborenv.com

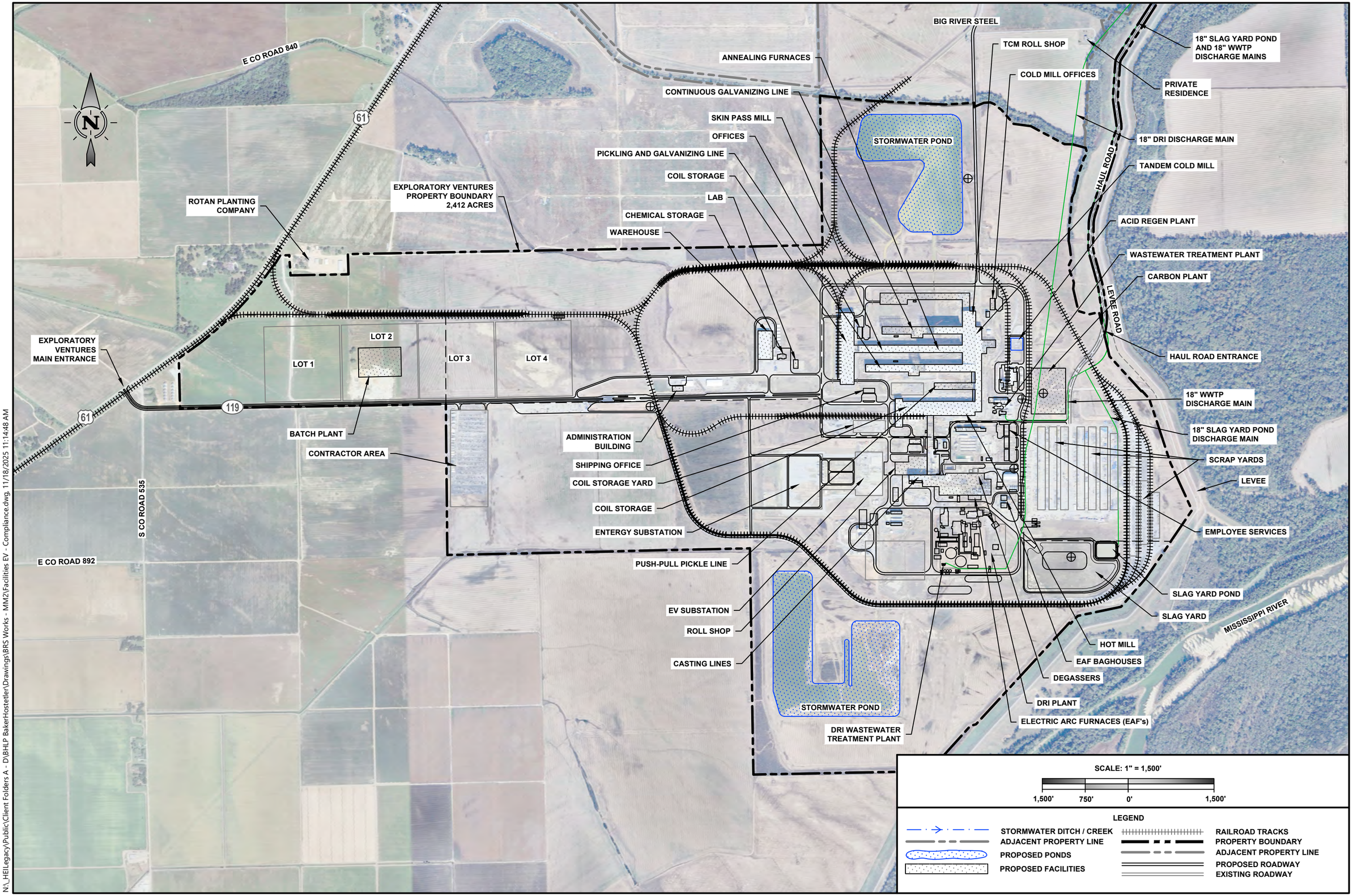
EXPLORATORY VENTURES, LLC
STEEL MANUFACTURING COMPLEX
OSCEOLA ARKANSAS

VICINITY MAP

NO	REVISION DESCRIPTION	DATE
X	X	X-X-X

Drawn By: AES
Date: 9-24-25
Project No: L8257501
Scale: NOTED

F-1



Harbor
A Terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501)663-8800
Fax (501)588-0123
www.harborenv.com

EXPLORATORY VENTURES, LLC
STEEL MANUFACTURING COMPLEX
ARKANSAS
OSCEOLA
FACILITY SITE MAP

NO	REVISION DESCRIPTION	DATE
X	X	X-X-X

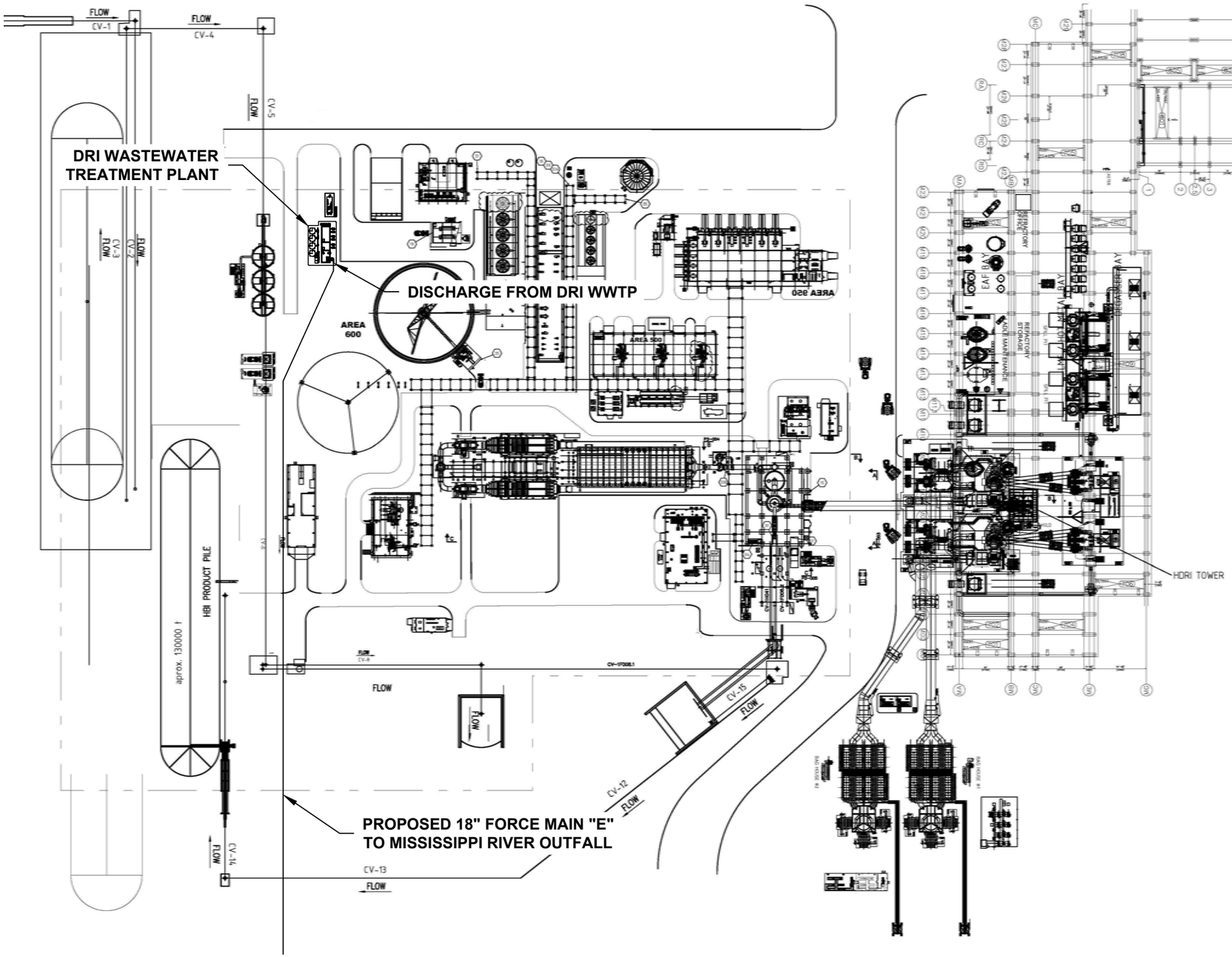
Drawn By: AES
Date: 9-24-25
Project No: L8257501
Scale: NOTED

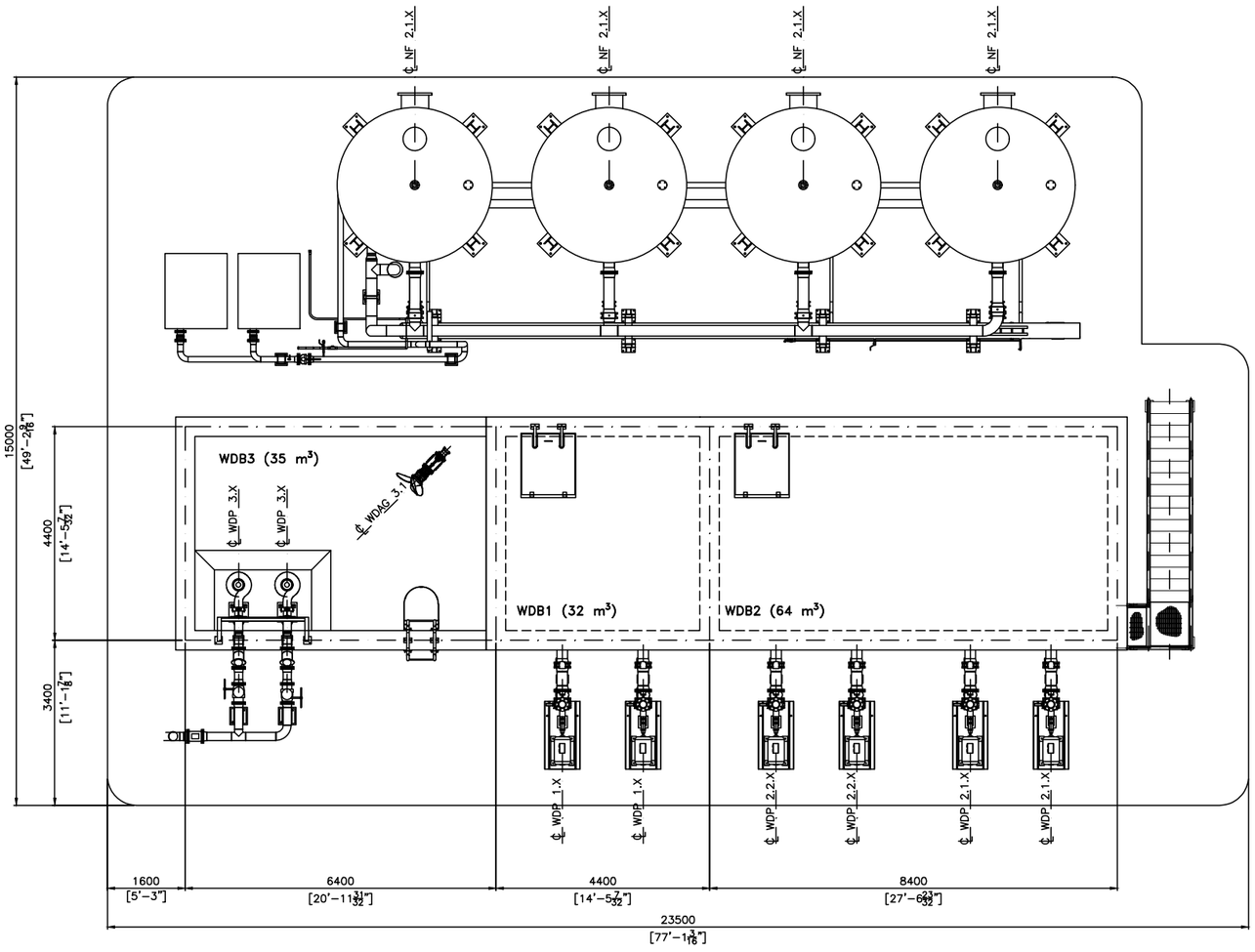
F-2

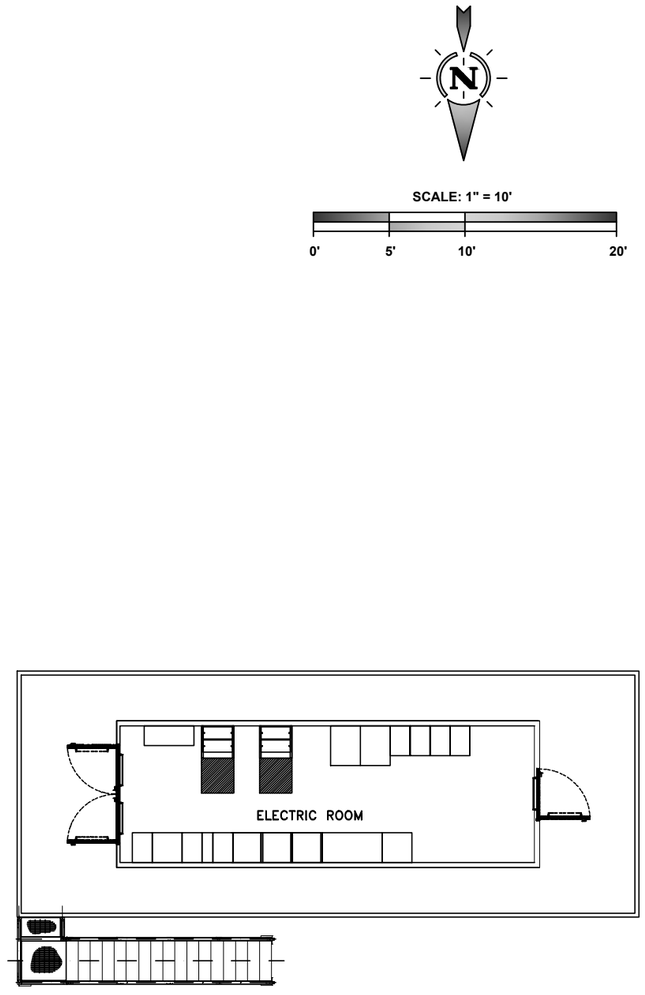
N:_HEILegacy\Public\Client Folders A - D\BHLP BakerHostetler\Drawings\BRS Works - MM2\Facilities EV - Compliance.dwg, 11/18/2025 11:14:48 AM

NOTES:

1. ALL ELEVATIONS ARE REFERENCED FROM PLANT ELEV. 0'-0.0 (EL.243' TOC OF SMS SLAB)
2. ALL DIMENSIONS AND ELEVATIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.


FLOW
CV-1
FLOW
CV-4
FLOW
CV-5
DRI WASTEWATER TREATMENT PLANT
DISCHARGE FROM DRI WWTP
AREA 600
AREA 850
CV-3
FLOW
FLOW
CV-2
HBI PRODUCT PILE
aprox. 130000 t
FLOW
CV-8
CV-9
FLOW
CV-15
FLOW
CV-12
FLOW
PROPOSED 18" FORCE MAIN "E"
TO MISSISSIPPI RIVER OUTFALL
CV-14
FLOW
CV-13
FLOW
EAF BAY
REFRACTORY STORAGE
HOT MAINTENANCE
HOT MAINTENANCE
HOT MAINTENANC





SCALE: 1" = 10'

0' 5' 10' 20'

NOTES:
1. ALL DIMENSIONS ARE EXPRESSED IN MILLIMETERS AND BETWEEN BRACKETS IN THE IMPERIAL SYSTEM, UNLESS OTHERWISE SPECIFIED.

Harbor
A Terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501)663-8800
Fax (501)588-0123
www.harborenv.com

EXPLORATORY VENTURES, LLC
STEEL MANUFACTURING COMPLEX
OSCEOLA ARKANSAS
DRI WWTP LAYOUT

NO	REVISION DESCRIPTION	DATE
X	X	X-X-X

Drawn By: AES
Date: 11-17-25
Project No: L8257501
Scale: NOTED

F-4

N:_HEILegacy\Public\Client Folders A - D\BHLP BakerHostetler\Drawings\BRS Works - MM2\Facilities EV - Compliance.dwg, 11/18/2025 11:22:19 AM

DRI CW BLOWDOWN

TOP

CUSTOMER RUSSULA

BLOWDOWN BASIN
WDB1

WDP 1.1

WDP 1.2

PEROXIDE

WD1–8"
200 m3/h

PUMP GROUP WDP 1.x
Qi=200 m3/h
Pi=2 bar
(1+1) units

SAND FILTERS WDF 2.1.X
Qt= 200 m3/h
(2+2) units

WDF 2.1.4

WDF 2.1.3

WDF 2.1.2

WDF 2.1.1

BLOWERS WDFB 2.1.X
(1+1) units
693 icfm @ 10psig

DRI CLARIFIERS

MAKE UP WATER
LAMELLAS DECANTERS

TOP

WD3 – 8"

CUSTOMER RUSSULA

WDB 3

WDAG 3.1

WDP 3.1

WDP 3.2

DRAIN BASIN

DRAIN

PUMP GROUP WDP 3.X
Qi=200 m3/h
Pi=3,5 bar
(1+1) units

FILTERED WATER BASIN
WDB2

WDP 2.2.1

WDP 2.2.2

WDP 2.1.1

WDP 2.1.2

RECYCLING SYSTEM

RIVER OUTFALL 203

TOP

WD2.2.2–8"

WD2.2.1–8"

SAMPLING STATION

200 m3/h

STOMER SSULA

PUMP GROUP WDP 2.2.x
Qi=200 m3/h
Pi=4 bar
(1+1) units

PUMP GROUP WDP 2.1.x
Qi=200 m3/h
Pi=2,5 bar
(1+1) units

Harbor
A Terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501)663-8800
Fax (501)588-0123
www.harborenv.com

EXPLORATORY VENTURES, LLC
STEEL MANUFACTURING COMPLEX
OSCEOLA ARKANSAS
DRI WWTP P & ID

NO	REVISION DESCRIPTION	DATE
X	X	X-X-X

Drawn By: AES
Date: 11-17-25
Project No: L8257501
Scale: NONE

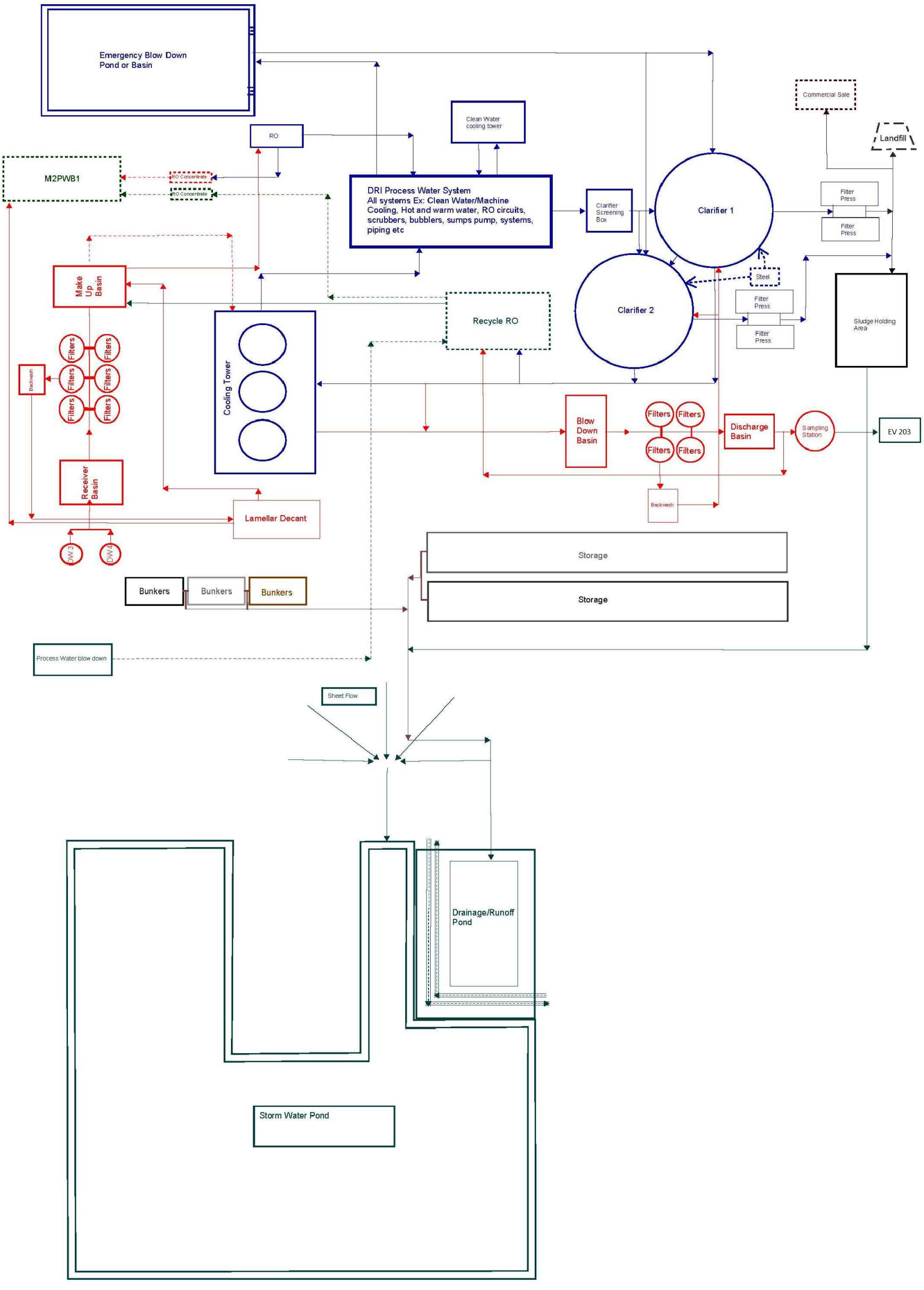
F-5

N:_HEILegacy\Public\Client Folders A - D\BHLP BakerHostetler\Drawings\BRS Works - MM2\Facilities EV - Compliance.dwg, 11/18/2025 11:23:51 AM

BRS New systems required for DRI

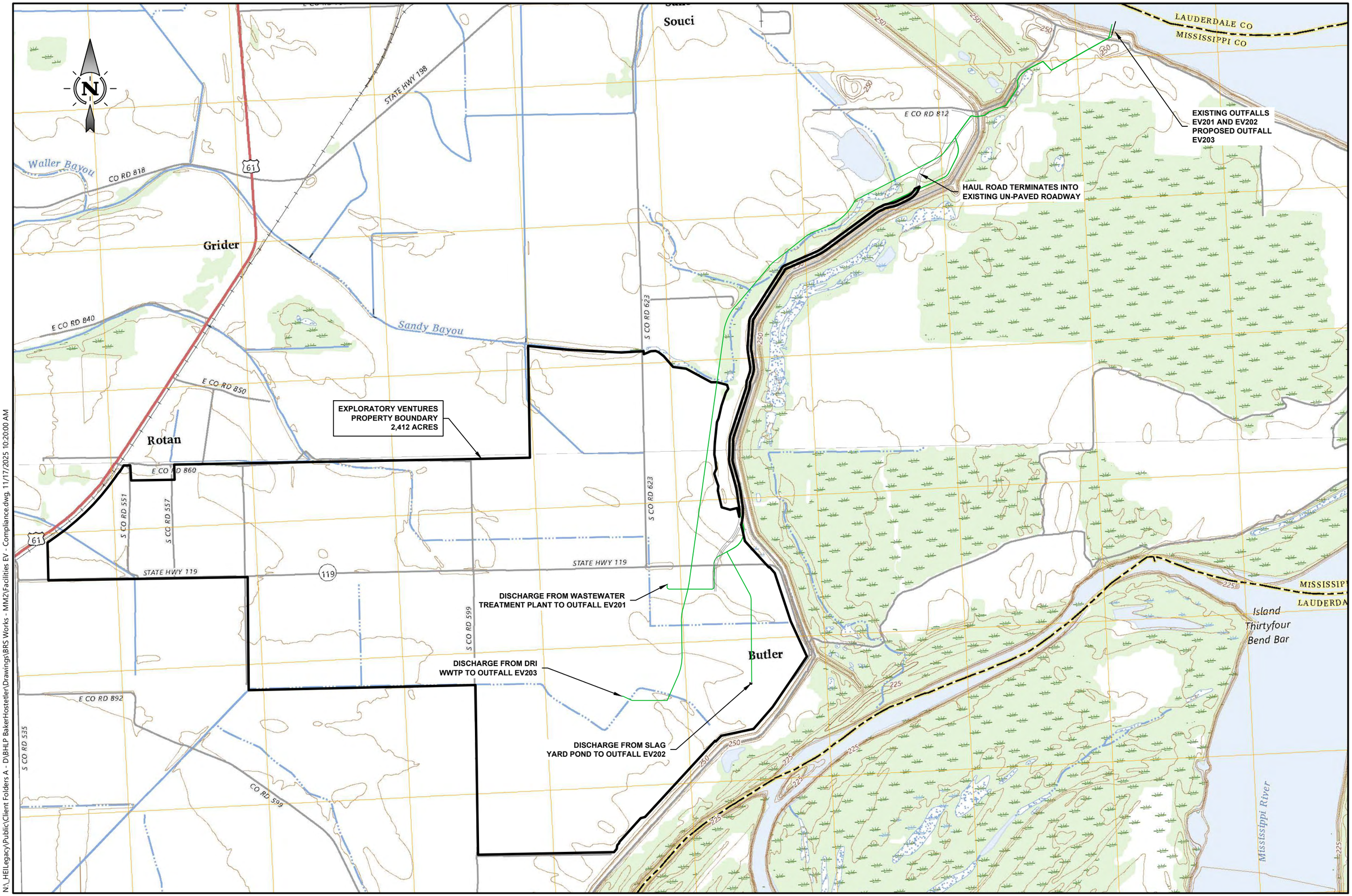
Midrex DRI scope of supply

BR2 DRI
Version F
10/7/2025



F-6	Scale: NONE	Project No: L8257501	Date: 11-17-25	Drawn By: AES	NO	REVISION DESCRIPTION	DATE	EXPLORATORY VENTURES, LLC STEEL MANUFACTURING COMPLEX OSCEOLA ARKANSAS FLOW DIAGRAM FOR DRI WATER AND WASTEWATER TREATMENT PLANTS	5800 Evergreen Drive Little Rock, AR 72205 Ph (501)663-8800 Fax (501)588-0123 www.harborenv.com	Harbor A Terracon Company
					X	X	X-X-X			

Section G – Topographic Maps



N:_HEILegacy\Public\Client Folders A - D\BHLP BakerHostetler\Drawings\BRS Works - MM2\Facilities EV - Compliance.dwg, 11/17/2025 10:20:00 AM

Harbor
A Terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501)663-8800
Fax (501)588-0123
www.harborenv.com

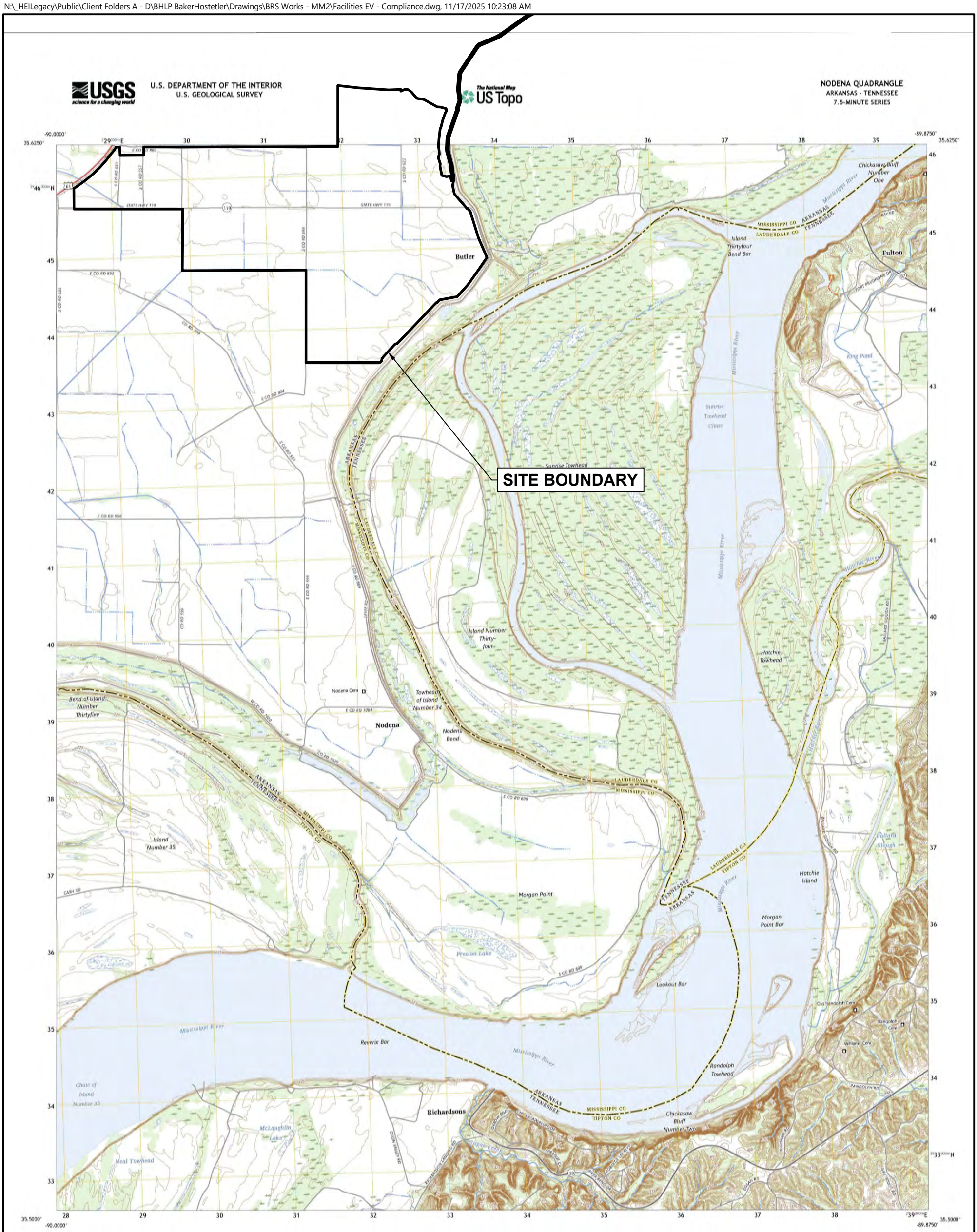
EXPLORATORY VENTURES, LLC
STEEL MANUFACTURING COMPLEX
OSCEOLA
ARKANSAS
TOPOGRAPHIC MAP

NO	REVISION DESCRIPTION	DATE
X	X	X-X-X

Drawn By: AES
Date: 9-24-25
Project No: L8257501
Scale: 1" = 2,000'

G-1

N:_HEILegacy\Public\Client Folders A - D\BHLP BakerHostetler\Drawings\BRS Works - MM2\Facilities EV - Compliance.dwg, 11/17/2025 10:23:08 AM



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 15S\16S
This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery	NAIP, June 2016 - August 2019
Roads	U.S. Census Bureau, 2016 - 2017
Names	GNIS, 1980 - 2023
Hydrography	National Hydrography Dataset, 2002 - 2022
Contours	National Elevation Dataset, 2022
Boundaries	Multiple sources; see metadata file 2020 - 2022
Public Land Survey System	BLM, 2018
Wetlands	FWS National Wetlands Inventory 1974 - 1981

UTM GRID AND 2023 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000
1 KILOMETERS 0.5 0 1 2
1000 500 0 METERS 1000 2000
1 MILES 0.5 0 1
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 FEET

CONTOUR INTERVAL 5 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard.

ADJOINING QUADRANGLES
1 Kelser
2 Osceola
3 Golddust
4 Wilson
5 Gilt Edge
6 Pecan Point
7 Drummonds
8 Munford

ROAD CLASSIFICATION
Expressway, Secondary Hwy, Ramp, Interstate Route, Local Connector, Local Road, 4WD, US Route, State Route

NODENA, AR, TN
2024

G-2	Scale: 1" = 4,000'	Project No: L8257501	Date: 9-24-25	Drawn By: AES

NO	REVISION DESCRIPTION	DATE
X	X	X-X-X

EXPLORATORY VENTURES, LLC
STEEL MANUFACTURING COMPLEX
OSCEOLA ARKANSAS
TOPOGRAPHIC MAP

5800 Evergreen Drive
Little Rock, AR 72205
Ph (501)663-8800
Fax (501)588-0123
www.harborenv.com

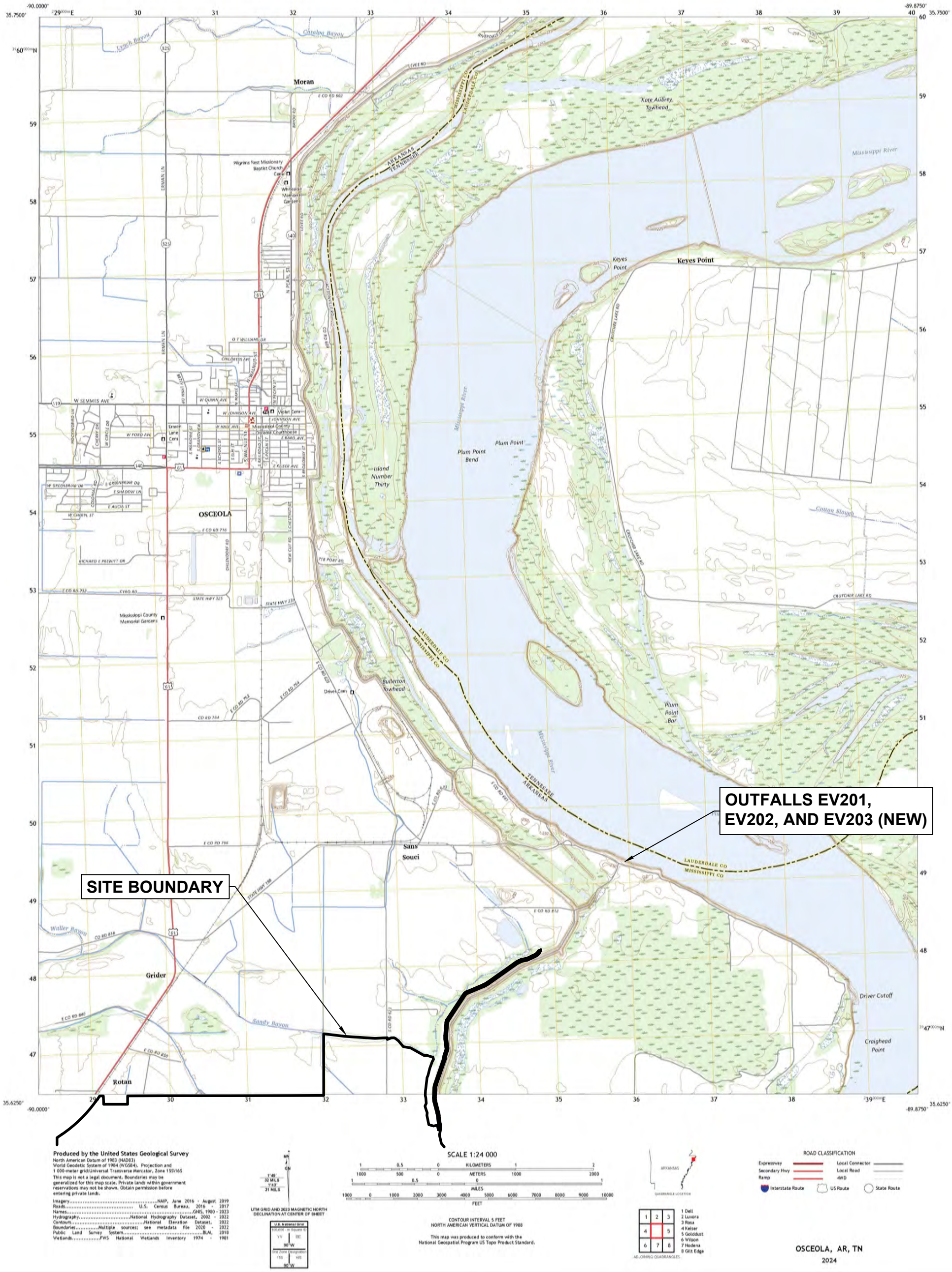
Harbor
A Tierracon Company

USGS science for a changing world

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

The National Map US Topo

OSCEOLA QUADRANGLE
ARKANSAS - TENNESSEE
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 15S\16S
This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery	NAIP,	June 2016 - August 2019
Roads	U.S. Census Bureau,	2016 - 2017
Names	GNIS,	1980 - 2023
Hydrography	National Hydrography Dataset,	2002 - 2022
Contours	National Elevation Dataset,	2022
Boundaries	Multiple sources; see metadata file	2020 - 2022
Public Land Survey System	BLM,	2018
Wetlands	FWS National Wetlands Inventory	1974 - 1981

UTM GRID AND 2023 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000
1 0,5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0,5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 5 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard.

ADJOINING QUADRANGLES
1 Dell
2 Luxora
3 Rosa
4 Keiser
5 Golddust
6 Wilson
7 Hodena
8 Gilt Edge

ROAD CLASSIFICATION
Expressway, Secondary Hwy, Ramp, Local Connector, Local Road, 4WD
Interstate Route, US Route, State Route

OSCEOLA, AR, TN
2024

G-3	Scale: 1" = 4,000'	Project No: L8257501	Date: 9-24-25	Drawn By: AES	NO	REVISION DESCRIPTION	DATE	EXPLORATORY VENTURES, LLC STEEL MANUFACTURING COMPLEX OSCEOLA ARKANSAS TOPOGRAPHIC MAP	5800 Evergreen Drive Little Rock, AR 72205 PH (501)663-8800 Fax (501)588-0123 www.harborenv.com
					X	X	X-X-X		

Harbor
A Terracon Company

Section H – FEMA Flood Plain Maps

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Arkansas State Plane north zone (FIPSZONE 0301). The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC- 3, #9202
1315 East- West Highway
Silver Spring, MD 20910- 3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on the FIRM was provided in digital format by the Arkansas Geographic Information Office (AGIO). This data was created in State Plane NAD 83 coordinates, U.S. Survey Feet and was produced at scales 1:1,200 (1"=100'); 1:4,800 (1"=400'). Aerial photography was captured in 2006.

This map reflects more detailed and up- to- date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

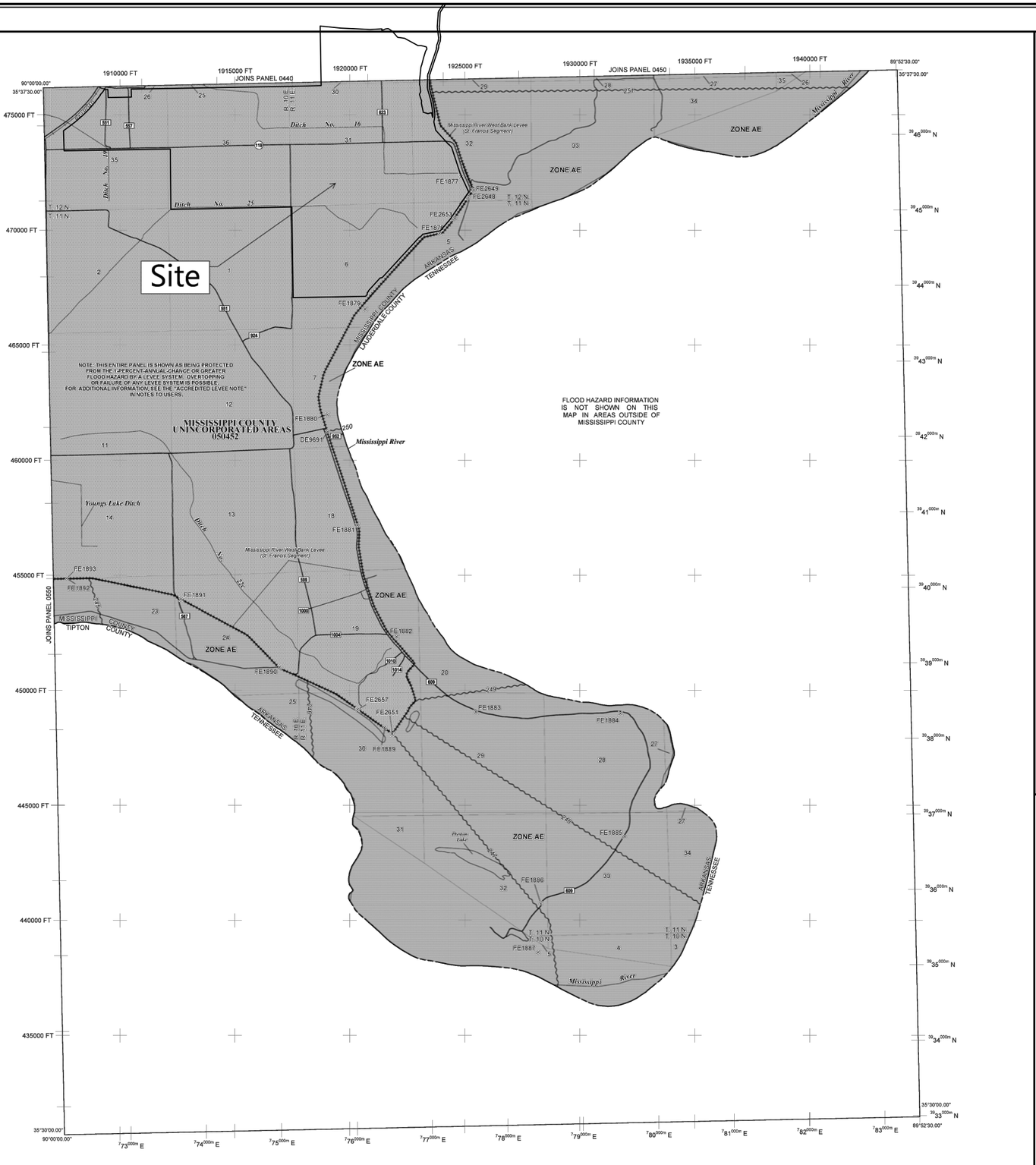
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de- annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1- 800- 358- 9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report,* and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1- 800- 358- 9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1- 877- FEMA MAP** (1- 877- 336- 2627) or visit the FEMA website at http://www.fema.gov/.

Accredited Levee Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1- percent- annual- chance- level) and Emergency Action Plan, on the levee system(s) shown as providing protection for area on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.


Site
1910000 FT
1915000 FT
1920000 FT
1925000 FT
1930000 FT
1935000 FT
1940000 FT
JOINS PANEL 0440
JOINS PANEL 0450
475000 FT
470000 FT
465000 FT
460000 FT
455000 FT
450000 FT
445000 FT
440000 FT
435000 FT
90°00'00.00"
89°52'30.00"
35°37'30.00"
35°30'00.00"
ZONE AE
FLOOD HAZARD INFORMATION IS NOT SHOWN ON THIS MAP IN AREAS OUTSIDE OF MISSISSIPPI COUNTY
NOTE: THIS ENTIRE PANEL IS SHOWN AS BEING PROTECTED FROM THE 1-PERCENT-ANNUAL-CHANCE OR GREATER FLOOD HAZARD BY A LEVEE SYSTEM. OVERTOPPING OR FAILURE OF ANY LEVEE SYSTEM IS POSSIBLE. FOR ADDITIONAL INFORMATION, SEE THE "ACCREDITED LEVEE NOTE" IN NOTES TO USERS.
MISSISSIPPI COUNTY UNINCORPORATED AREAS 050452
Mississippi River
Youngs Lake Ditch
Ditch No. 16
Ditch No. 24
Ditch No. 22
Ditch No. 23
Mississippi River West Bank Levee (St Francis Segment)
Western Drainage Ditch
Western Drainage Ditch No. 1
Western Drainage Ditch No. 2
Western Drainage Ditch No. 3
Western Drainage Ditch No. 4
Western Drainage Ditch No. 5
Western Drainage Ditch No. 6
Western Drainage Ditch No. 7
Western Drainage Ditch No. 8
Western Drainage Ditch No. 9
Western Drainage Ditch No. 10
Western Drainage Ditch No. 11
Western Drainage Ditch No. 12
Western Drainage Ditch No. 13
Western Drainage Ditch No. 14
Western Drainage Ditch No. 15
Western Drainage Ditch No. 16
Western Drainage Ditch No. 17
Western Drainage Ditch No. 18
Western Drainage Ditch No. 19
Western Drainage Ditch No. 20
Western Drainage Ditch No. 21
Western Drainage Ditch No. 22
Western Drainage Ditch No. 23
Western Drainage Ditch No. 24
Western Drainage Ditch No. 25
Western Drainage Ditch No. 26
Western Drainage Ditch No. 27
Western Drainage Ditch No. 28
Western Drainage Ditch No. 29
Western Drainage Ditch No. 30
Western Drainage Ditch No. 31
Western Drainage Ditch No. 32
Western Drainage Ditch No. 33
Western Drainage Ditch No. 34
Western Drainage Ditch No. 35
Western Drainage Ditch No. 36
Western Drainage Ditch No. 37
Western Drainage Ditch No. 38
Western Drainage Ditch No. 39
Western Drainage Ditch No. 40
Western Drainage Ditch No. 41
Western Drainage Ditch No. 42
Western Drainage Ditch No. 43
Western Drainage Ditch No. 44
Western Drainage Ditch No. 45
Western Drainage Ditch No. 46
Western Drainage Ditch No. 47
Western Drainage Ditch No. 48
Western Drainage Ditch No. 49
Western Drainage Ditch No. 50
Western Drainage Ditch No. 51
Western Drainage Ditch No. 52
Western Drainage Ditch No. 53
Western Drainage Ditch No. 54
Western Drainage Ditch No. 55
Western Drainage Ditch No. 56
Western Drainage Ditch No. 57
Western Drainage Ditch No. 58
Western Drainage Ditch No. 59
Western Drainage Ditch No. 60
Western Drainage Ditch No. 61
Western Drainage Ditch No. 62
Western Drainage Ditch No. 63
Western Drainage Ditch No. 64
Western Drainage Ditch No. 65
Western Drainage Ditch No. 66
Western Drainage Ditch No. 67
Western Drainage Ditch No. 68
Western Drainage Ditch No. 69
Western Drainage Ditch No. 70
Western Drainage Ditch No. 71
Western Drainage Ditch No. 72
Western Drainage Ditch No. 73
Western Drainage Ditch No. 74
Western Drainage Ditch No. 75
Western Drainage Ditch No. 76
Western Drainage Ditch No. 77
Western Drainage Ditch No. 78
Western Drainage Ditch No. 79
Western Drainage Ditch No. 80
Western Drainage Ditch No. 81
Western Drainage Ditch No. 82
Western Drainage Ditch No. 83
Western Drainage Ditch No. 84
Western Drainage Ditch No. 85
Western Drainage Ditch No. 86
Western Drainage Ditch No. 87
Western Drainage Ditch No. 88
Western Drainage Ditch No. 89
Western Drainage Ditch No. 90
Western Drainage Ditch No. 91
Western Drainage Ditch No. 92
Western Drainage Ditch No. 93
Western Drainage Ditch No. 94
Western Drainage Ditch No. 95
Western Drainage Ditch No. 96
Western Drainage Ditch No. 97
Western Drainage Ditch No. 98
Western Drainage Ditch No. 99
Western Drainage Ditch No. 100
Western Drainage Ditch No. 101
Western Drainage Ditch No. 102
Western Drainage Ditch No. 103
Western Drainage Ditch No. 104
Western Drainage Ditch No. 105
Western Drainage Ditch No. 106
Western Drainage Ditch No. 107
Western Drainage Ditch No. 108
Western Drainage Ditch No. 109
Western Drainage Ditch No. 110
Western Drainage Ditch No. 111
Western Drainage Ditch No. 112
Western Drainage Ditch No. 113
Western Drainage Ditch No. 114
Western Drainage Ditch No. 115
Western Drainage Ditch No. 116
Western Drainage Ditch No. 117
Western Drainage Ditch No. 118
Western Drainage Ditch No. 119
Western Drainage Ditch No. 120
Western Drainage Ditch No. 121
Western Drainage Ditch No. 122
Western Drainage Ditch No. 123
Western Drainage Ditch No. 124
Western Drainage Ditch No. 125
Western Drainage Ditch No. 126
Western Drainage Ditch No. 127
Western Drainage Ditch No. 128
Western Drainage Ditch No. 129
Western Drainage Ditch No. 130
Western Drainage Ditch No. 131
Western Drainage Ditch No. 132
Western Drainage Ditch No. 133
Western Drainage Ditch No. 134
Western Drainage Ditch No. 135
Western Drainage Ditch No. 136
Western Drainage Ditch No. 137
Western Drainage Ditch No. 138
Western Drainage Ditch No. 139
Western Drainage Ditch No. 140
Western Drainage Ditch No. 141
Western Drainage Ditch No. 142
Western Drainage Ditch No. 143
Western Drainage Ditch No. 144
Western Drainage Ditch No. 145
Western Drainage Ditch No. 146
Western Drainage Ditch No. 147
Western Drainage Ditch No. 148
Western Drainage Ditch No. 149
Western Drainage Ditch No. 150
Western Drainage Ditch No. 151
Western Drainage Ditch No. 152
Western Drainage Ditch No. 153
Western Drainage Ditch No. 154
Western Drainage Ditch No. 155
Western Drainage Ditch No. 156
Western Drainage Ditch No. 157
Western Drainage Ditch No. 158
Western Drainage Ditch No. 159
Western Drainage Ditch No. 160
Western Drainage Ditch No. 161
Western Drainage Ditch No. 162
Western Drainage Ditch No. 163
Western Drainage Ditch No. 164
Western Drainage Ditch No. 165
Western Drainage Ditch No. 166
Western Drainage Ditch No. 167
Western Drainage Ditch No. 168
Western Drainage Ditch No. 169
Western Drainage Ditch No. 170
Western Drainage Ditch No. 171
Western Drainage Ditch No. 172
Western Drainage Ditch No. 173
Western Drainage Ditch No. 174
Western Drainage Ditch No. 175
Western Drainage Ditch No. 176
Western Drainage Ditch No. 177
Western Drainage Ditch No. 178
Western Drainage Ditch No. 179
Western Drainage Ditch No. 180
Western Drainage Ditch No. 181
Western Drainage Ditch No. 182
Western Drainage Ditch No. 183
Western Drainage Ditch No. 184
Western Drainage Ditch No. 185
Western Drainage Ditch No. 186
Western Drainage Ditch No. 187
Western Drainage Ditch No. 188
Western Drainage Ditch No. 189
Western Drainage Ditch No. 190
Western Drainage Ditch No. 191
Western Drainage Ditch No. 192
Western Drainage Ditch No. 193
Western Drainage Ditch No. 194
Western Drainage Ditch No. 195
Western Drainage Ditch No. 196
Western Drainage Ditch No. 197
Western Drainage Ditch No. 198
Western Drainage Ditch No. 199
Western Drainage Ditch No. 200
Western Drainage Ditch No. 201
Western Drainage Ditch No. 202
Western Drainage Ditch No. 203
Western Drainage Ditch No. 204
Western Drainage Ditch No. 205
Western Drainage Ditch No. 206
Western Drainage Ditch No. 207
Western Drainage Ditch No. 208
Western Drainage Ditch No. 209
Western Drainage Ditch No. 210
Western Drainage Ditch No. 211
Western Drainage Ditch No. 212
Western Drainage Ditch No. 213
Western Drainage Ditch No. 214
Western Drainage Ditch No. 215
Western Drainage Ditch No. 216
Western Drainage Ditch No. 217
Western Drainage Ditch No. 218
Western Drainage Ditch No. 219
Western Drainage Ditch No. 220
Western Drainage Ditch No. 221
Western Drainage Ditch No. 222
Western Drainage Ditch No. 223
Western Drainage Ditch No. 224
Western Drainage Ditch No. 225
Western Drainage Ditch No. 226
Western Drainage Ditch No. 227
Western Drainage Ditch No. 228
Western Drainage Ditch No. 229
Western Drainage Ditch No. 230
Western Drainage Ditch No. 231
Western Drainage Ditch No. 232
Western Drainage Ditch No. 233
Western Drainage Ditch No. 234
Western Drainage Ditch No. 235
Western Drainage Ditch No. 236
Western Drainage Ditch No. 237
Western Drainage Ditch No. 238
Western Drainage Ditch No. 239
Western Drainage Ditch No. 240
Western Drainage Ditch No. 241
Western Drainage Ditch No. 242
Western Drainage Ditch No. 243
Western Drainage Ditch No. 244
Western Drainage Ditch No. 245
Western Drainage Ditch No. 246
Western Drainage Ditch No. 247
Western Drainage Ditch No. 248
Western Drainage Ditch No. 249
Western Drainage Ditch No. 250
Western Drainage Ditch No. 251
Western Drainage Ditch No. 252
Western Drainage Ditch No. 253
Western Drainage Ditch No. 254
Western Drainage Ditch No. 255
Western Drainage Ditch No. 256
Western Drainage Ditch No. 257
Western Drainage Ditch No. 258
Western Drainage Ditch No. 259
Western Drainage Ditch No. 260
Western Drainage Ditch No. 261
Western Drainage Ditch No. 262
Western Drainage Ditch No. 263
Western Drainage Ditch No. 264
Western Drainage Ditch No. 265
Western Drainage Ditch No. 266
Western Drainage Ditch No. 267
Western Drainage Ditch No. 268
Western Drainage Ditch No. 269
Western Drainage Ditch No. 270
Western Drainage Ditch No. 271
Western Drainage Ditch No. 272
Western Drainage Ditch No. 273
Western Drainage Ditch No. 274
Western Drainage Ditch No. 275
Western Drainage Ditch No. 276
Western Drainage Ditch No. 277
Western Drainage Ditch No. 278
Western Drainage Ditch No. 279
Western Drainage Ditch No. 280
Western Drainage Ditch No. 281
Western Drainage Ditch No. 282
Western Drainage Ditch No. 283
Western Drainage Ditch No. 284
Western Drainage Ditch No. 285
Western Drainage Ditch No. 286
Western Drainage Ditch No. 287
Western Drainage Ditch No. 288
Western Drainage Ditch No. 289
Western Drainage Ditch No. 290
Western Drainage Ditch No. 291
Western Drainage Ditch No. 292
Western Drainage Ditch No. 293
Western Drainage Ditch No. 294
Western Drainage Ditch No. 295
Western Drainage Ditch No. 296
Western Drainage Ditch No. 297
Western Drainage Ditch No. 298
Western Drainage Ditch No. 299
Western Drainage Ditch No. 300
Western Drainage Ditch No. 301
Western Drainage Ditch No. 302
Western Drainage Ditch No. 303
Western Drainage Ditch No. 304
Western Drainage Ditch No. 305
Western Drainage Ditch No. 306
Western Drainage Ditch No. 307
Western Drainage Ditch No. 308
Western Drainage Ditch No. 309
Western Drainage Ditch No. 310
Western Drainage Ditch No. 311
Western Drainage Ditch No. 312
Western Drainage Ditch No. 313
Western Drainage Ditch No. 314
Western Drainage Ditch No. 315
Western Drainage Ditch No. 316
Western Drainage Ditch No. 317
Western Drainage Ditch No. 318
Western Drainage Ditch No. 319
Western Drainage Ditch No. 320
Western Drainage Ditch No. 321
Western Drainage Ditch No. 322
Western Drainage Ditch No. 323
Western Drainage Ditch No. 324
Western Drainage Ditch No. 325
Western Drainage Ditch No. 326
Western Drainage Ditch No. 327
Western Drainage Ditch No. 328
Western Drainage Ditch No. 329
Western Drainage Ditch No. 330
Western Drainage Ditch No. 331
Western Drainage Ditch No. 332
Western Drainage Ditch No. 333
Western Drainage Ditch No. 334
Western Drainage Ditch No. 335
Western Drainage Ditch No. 336
Western Drainage Ditch No. 337
Western Drainage Ditch No. 338
Western Drainage Ditch No. 339
Western Drainage Ditch No. 340
Western Drainage Ditch No. 341
Western Drainage Ditch No. 342
Western Drainage Ditch No. 343
Western Drainage Ditch No. 344
Western Drainage Ditch No. 345
Western Drainage Ditch No. 346
Western Drainage Ditch No. 347
Western Drainage Ditch No. 348
Western Drainage Ditch No. 349
Western Drainage Ditch No. 350
Western Drainage Ditch No. 351
Western Drainage Ditch No. 352
Western Drainage Ditch No. 353
Western Drainage Ditch No. 354
Western Drainage Ditch No. 355
Western Drainage Ditch No. 356
Western Drainage Ditch No. 357
Western Drainage Ditch No. 358
Western Drainage Ditch No. 359
Western Drainage Ditch No. 360
Western Drainage Ditch No. 361
Western Drainage Ditch No. 362
Western Drainage Ditch No. 363
Western Drainage Ditch No. 364
Western Drainage Ditch No. 365
Western Drainage Ditch No. 366
Western Drainage Ditch No. 367
Western Drainage Ditch No. 368
Western Drainage Ditch No. 369
Western Drainage Ditch No. 370
Western Drainage Ditch No. 371
Western Drainage Ditch No. 372
Western Drainage Ditch No. 373
Western Drainage Ditch No. 374
Western Drainage Ditch No. 375
Western Drainage Ditch No. 376
Western Drainage Ditch No. 377
Western Drainage Ditch No. 378
Western Drainage Ditch No. 379
Western Drainage Ditch No. 380
Western Drainage Ditch No. 381
Western Drainage Ditch No. 382
Western Drainage Ditch No. 383
Western Drainage Ditch No. 384
Western Drainage Ditch No. 385
Western Drainage Ditch No. 386
Western Drainage Ditch No. 387
Western Drainage Ditch No. 388
Western Drainage Ditch No. 389
Western Drainage Ditch No. 390
Western Drainage Ditch No. 391
Western Drainage Ditch No. 392
Western Drainage Ditch No. 393
Western Drainage Ditch No. 394
Western Drainage Ditch No. 395
Western Drainage Ditch No. 396
Western Drainage Ditch No. 397
Western Drainage Ditch No. 398
Western Drainage Ditch No. 399
Western Drainage Ditch No. 400
Western Drainage Ditch No. 401
Western Drainage Ditch No. 402
Western Drainage Ditch No. 403
Western Drainage Ditch No. 404
Western Drainage Ditch No. 405
Western Drainage Ditch No. 406
Western Drainage Ditch No. 407
Western Drainage Ditch No. 408
Western Drainage Ditch No. 409
Western Drainage Ditch No. 410
Western Drainage Ditch No. 411
Western Drainage Ditch No. 412
Western Drainage Ditch No. 413
Western Drainage Ditch No. 414
Western Drainage Ditch No. 415
Western Drainage Ditch No. 416
Western Drainage Ditch No. 417
Western Drainage Ditch No. 418
Western Drainage Ditch No. 419
Western Drainage Ditch No. 420
Western Drainage Ditch No. 421
Western Drainage Ditch No. 422
Western Drainage Ditch No. 423
Western Drainage Ditch No. 424
Western Drainage Ditch No. 425
Western Drainage Ditch No. 426
Western Drainage Ditch No. 427
Western Drainage Ditch No. 428
Western Drainage Ditch No. 429
Western Drainage Ditch No. 430
Western Drainage Ditch No. 431
Western Drainage Ditch No. 432
Western Drainage Ditch No. 433
Western Drainage Ditch No. 434
Western Drainage Ditch No. 435
Western Drainage Ditch No. 436
Western Drainage Ditch No. 437
Western Drainage Ditch No. 438
Western Drainage Ditch No. 439
Western Drainage Ditch No. 440
Western Drainage Ditch No. 441
Western Drainage Ditch No. 442
Western Drainage Ditch No. 443
Western Drainage Ditch No. 444
Western Drainage Ditch No. 445
Western Drainage Ditch No. 446
Western Drainage Ditch No. 447
Western Drainage Ditch No. 448
Western Drainage Ditch No. 449
Western Drainage Ditch No. 450
Western Drainage Ditch No. 451
Western Drainage Ditch No. 452
Western Drainage Ditch No. 453
Western Drainage Ditch No. 454
Western Drainage Ditch No. 455
Western Drainage Ditch No. 456
Western Drainage Ditch No. 457
Western Drainage Ditch No. 458
Western Drainage Ditch No. 459
Western Drainage Ditch No. 460
Western Drainage Ditch No. 461
Western Drainage Ditch No. 462
Western Drainage Ditch No. 463
Western Drainage Ditch No. 464
Western Drainage Ditch No. 465
Western Drainage Ditch No. 466
Western Drainage Ditch No. 467
Western Drainage Ditch No. 468
Western Drainage Ditch No. 469
Western Drainage Ditch No. 470
Western Drainage Ditch No. 471
Western Drainage Ditch No. 472
Western Drainage Ditch No. 473
Western Drainage Ditch No. 474
Western Drainage Ditch No. 475
Western Drainage Ditch No. 476
Western Drainage Ditch No. 477
Western Drainage Ditch No. 478
Western Drainage Ditch No. 479
Western Drainage Ditch No. 480
Western Drainage Ditch No. 481
Western Drainage Ditch No. 482
Western Drainage Ditch No. 483
Western Drainage Ditch No. 484
Western Drainage Ditch No. 485
Western Drainage Ditch No. 486
Western Drainage Ditch No. 487
Western Drainage Ditch No. 488
Western Drainage Ditch No. 489
Western Drainage Ditch No. 490
Western Drainage Ditch No. 491
Western Drainage Ditch No. 492
Western Drainage Ditch No. 493
Western Drainage Ditch No. 494
Western Drainage Ditch No. 495
Western Drainage Ditch No. 496
Western Drainage Ditch No. 497
Western Drainage Ditch No. 498
Western Drainage Ditch No. 499
Western Drainage Ditch No. 500
Western Drainage Ditch No. 501
Western Drainage Ditch No. 502
Western Drainage Ditch No. 503
Western Drainage Ditch No. 504
Western Drainage Ditch No. 505
Western Drainage Ditch No. 506
Western Drainage Ditch No. 507
Western Drainage Ditch No. 508
Western Drainage Ditch No. 509
Western Drainage Ditch No. 510
Western Drainage Ditch No. 511
Western Drainage Ditch No. 512
Western Drainage Ditch No. 513
Western Drainage Ditch No. 514
Western Drainage Ditch No. 515
Western Drainage Ditch No. 516
Western Drainage Ditch No. 517
Western Drainage Ditch No. 518
Western Drainage Ditch No. 519
Western Drainage Ditch No. 520
Western Drainage Ditch No. 521
Western Drainage Ditch No. 522
Western Drainage Ditch No. 523
Western Drainage Ditch No. 524
Western Drainage Ditch No. 525
Western Drainage Ditch No. 526
Western Drainage Ditch No. 527
Western Drainage Ditch No. 528
Western Drainage Ditch No. 529
Western Drainage Ditch No. 530
Western Drainage Ditch No. 531
Western Drainage Ditch No. 532
Western Drainage Ditch No. 533
Western Drainage Ditch No. 534
Western Drainage Ditch No. 535
Western Drainage Ditch No. 536
Western Drainage Ditch No. 537
Western Drainage Ditch No. 538
Western Drainage Ditch No. 539
Western Drainage Ditch No. 540
Western Drainage Ditch No. 541
Western Drainage Ditch No. 542
Western Drainage Ditch No. 543
Western Drainage Ditch No. 544
Western Drainage Ditch No. 545
Western Drainage Ditch No. 546
Western Drainage Ditch No. 547
Western Drainage Ditch No. 548
Western Drainage Ditch No. 549
Western Drainage Ditch No. 550
Western Drainage Ditch No. 551
Western Drainage Ditch No. 552
Western Drainage Ditch No. 553
Western Drainage Ditch No. 554
Western Drainage Ditch No. 555
Western Drainage Ditch No. 556
Western Drainage Ditch No. 557
Western Drainage Ditch No. 558
Western Drainage Ditch No. 559
Western Drainage Ditch No. 560
Western Drainage Ditch No. 561
Western Drainage Ditch No. 562
Western Drainage Ditch No. 563
Western Drainage Ditch No. 564
Western Drainage Ditch No. 565
Western Drainage Ditch No. 566
Western Drainage Ditch No. 567
Western Drainage Ditch No. 568
Western Drainage Ditch No. 569
Western Drainage Ditch No. 570
Western Drainage Ditch No. 571
Western Drainage Ditch No. 572
Western Drainage Ditch No. 573
Western Drainage Ditch No. 574
Western Drainage Ditch No. 575
Western Drainage Ditch No. 576
Western Drainage Ditch No. 577
Western Drainage Ditch No. 578
Western Drainage Ditch No. 579
Western Drainage Ditch No. 580
Western Drainage Ditch No. 581
Western Drainage Ditch No. 582
Western Drainage Ditch No. 583
Western Drainage Ditch No. 584
Western Drainage Ditch No. 585
Western Drainage Ditch No. 586
Western Drainage Ditch No. 587
Western Drainage Ditch No. 588
Western Drainage Ditch No. 589
Western Drainage Ditch No. 590
Western Drainage Ditch No. 591
Western Drainage Ditch No. 592
Western Drainage Ditch No. 593
Western Drainage Ditch No. 594
Western Drainage Ditch No. 595
Western Drainage Ditch No. 596
Western Drainage Ditch No. 597
Western Drainage Ditch No. 598
Western Drainage Ditch No. 599
Western Drainage Ditch No. 600
Western Drainage Ditch No. 601
Western Drainage Ditch No. 602
Western Drainage Ditch No. 603
Western Drainage Ditch No. 604
Western Drainage Ditch No. 605
Western Drainage Ditch No. 606
Western Drainage Ditch No. 607
Western Drainage Ditch No. 608
Western Drainage Ditch No. 609
Western Drainage Ditch No. 610
Western Drainage Ditch No. 611
Western Drainage Ditch No. 612
Western Drainage Ditch No. 613
Western Drainage Ditch No. 614
Western Drainage Ditch No. 615
Western Drainage Ditch No. 616
Western Drainage Ditch No. 617
Western Drainage Ditch No. 618
Western Drainage Ditch No. 619
Western Drainage Ditch No. 620
Western Drainage Ditch No. 621
Western Drainage Ditch No. 622
Western Drainage Ditch No. 623
Western Drainage Ditch No. 624
Western Drainage Ditch No. 625
Western Drainage Ditch No. 626
Western Drainage Ditch No. 627
Western Drainage Ditch No. 628
Western Drainage Ditch No. 629
Western Drainage Ditch No. 630
Western Drainage Ditch No. 631
Western Drainage Ditch No. 632
Western Drainage Ditch No. 633
Western Drainage Ditch No. 634
Western Drainage Ditch No. 635
Western Drainage Ditch No. 636
Western Drainage Ditch No. 637
Western Drainage Ditch No. 638
Western Drainage Ditch No. 639
Western Drainage Ditch No. 640
Western Drainage Ditch No. 641
Western Drainage Ditch No. 642
Western Drainage Ditch No. 643
Western Drainage Ditch No. 644
Western Drainage Ditch No. 645
Western Drainage Ditch No. 646
Western Drainage Ditch No. 647
Western Drainage Ditch No. 648
Western Drainage Ditch No. 649
Western Drainage Ditch No. 650
FE1877
FE2649
FE2648
FE2653
FE1878
FE1879
FE1880
DE9691
FE1881B
FE1893
FE1892
FE1891
FE1890
FE2657
FE2651
FE1889
FE1883
FE1884
FE1885
FE1886
FE1887
T. 12 N.
T. 11 N.
T. 11 N
T. 10 N
ARKANSAS
TENNESSEE
MISSISSIPPI COUNTY
LAUDERDALE COUNTY
MISSISSIPPI COUNTY
TIPTON COUNTY
JOINS PANEL 0550
Boston Lake
Mississippi River
ZONE AE
ZONE AE
ZONE AE

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tablo in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Arkansas State Plane north zone (FIPSZONE 0301). The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC- 3, #9202
1315 East- West Highway
Silver Spring, MD 20910- 3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on the FIRM was provided in digital format by the Arkansas Geographic Information Office (AGIO). This data was created in State Plane NAD 83 coordinates, U.S. Survey Feet and was produced at scales 1:1,200 (1"=100'); 1:4,800 (1"=400'). Aerial photography was captured in 2006.

This map reflects more detailed and up- to- date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

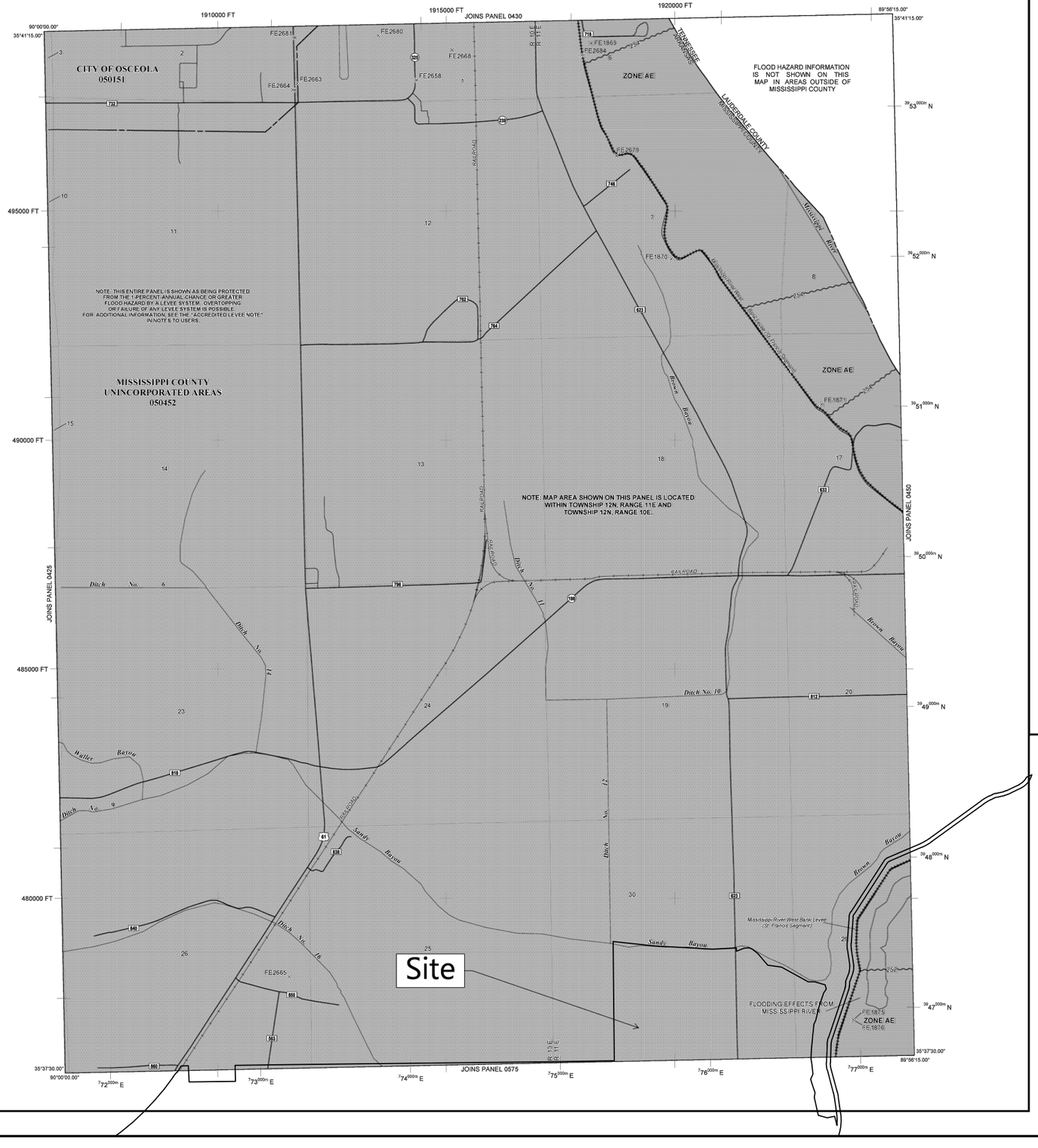
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de- annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1- 800- 358- 9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report,* and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1- 800- 358- 9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1- 877- FEMA MAP** (1- 877- 336- 2627) or visit the FEMA website at http://www.fema.gov/.

Accredited **Levee** Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1- percent- annual- chance- level) and Emergency Action Plan, on the levee system(s) shown as providing protection for area on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.


1910000 FT
1915000 FT
JOINS PANEL 0430
1920000 FT
89°56'15.00"
35°41'15.00"
90°00'00.00"
CITY OF OSCEOLA
050151
ZONE AE
FLOOD HAZARD INFORMATION IS NOT SHOWN ON THIS MAP IN AREAS OUTSIDE OF MISSISSIPPI COUNTY
TENNESSEE
ARKANSAS
LAUDERDALE COUNTY
MISSISSIPPI COUNTY
Mississippi River
MISSISSIPPI COUNTY
UNINCORPORATED AREAS
050452
NOTE: THIS ENTIRE PANEL IS SHOWN AS BEING PROTECTED FROM THE 1-PERCENT-ANNUAL-CHANCE OR GREATER FLOOD HAZARD BY A LEVEE SYSTEM. OVERTOPPING OR FAILURE OF ANY LEVEE SYSTEM IS POSSIBLE. FOR ADDITIONAL INFORMATION, SEE THE "ACCREDITED LEVEE NOTE" IN NOTE 5 TO USERS.
NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12N, RANGE 11E AND TOWNSHIP 12N, RANGE 10E.
Site
FLOODING EFFECTS FROM MISSISSIPPI RIVER
ZONE AE
JOINS PANEL 0450
JOINS PANEL 0425
JOINS PANEL 0575
495000 FT
490000 FT
485000 FT
480000 FT
39°53'00"N
39°52'00"N
39°51'00"N
39°50'00"N
39°49'00"N
39°48'00"N
39°47'00"N
35°37'30.00"
89°56'15.00"
90°00'00.00"
772000m E
773000m E
774000m E
775000m E
776000m E
777000m E
Ditch No. 6
Ditch No. 11
Ditch No. 14
Ditch No. 9
Ditch No. 10
Ditch No. 12
Ditch No. 16
Walker Bayou
Sandy Bayou
Brown Bayou
Missouri Pacific RR
Missouri Pacific RR
Missouri Pacific RR
Missouri Pacific RR
Mississippi River West Bank Levee (St. Francis Segment)
FE2681
FE2680
FE2668
FE2663
FE2664
FE2658
FE1869
FE2684
FE2679
FE1870
FE1871
FE2665
FE1875
FE1876
ZONE AE
ZONE AE
ZONE AE

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Arkansas State Plane north zone (FIPSZONE 0301). The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC- 3, #9202
1315 East- West Highway
Silver Spring, MD 20910- 3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on the FIRM was provided in digital format by the Arkansas Geographic Information Office (AGIO). This data was created in State Plane NAD 83 coordinates, U.S. Survey Feet and was produced at scales 1:1,200 (1"=100'); 1:4,800 (1"=400'). Aerial photography was captured in 2006.

This map reflects more detailed and up- to- date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the *Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

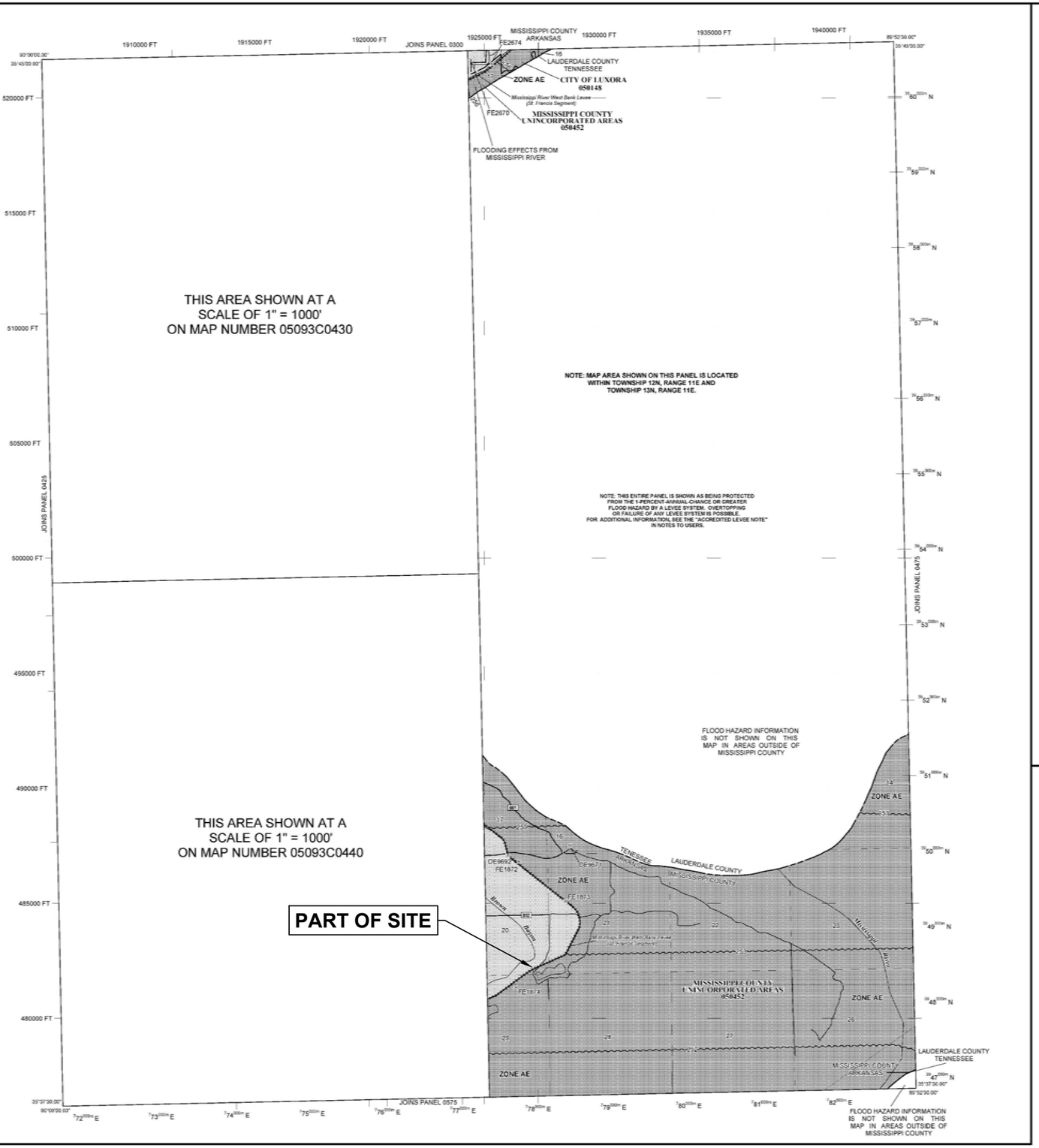
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de- annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1- 800- 358- 9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a *Flood Insurance Study report*, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1- 800- 358- 9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1- 877- FEMA MAP** (1- 877- 336- 2627) or visit the FEMA website at http://www.fema.gov/.

Accredited Levee Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1- percent- annual- chance- level) and Emergency Action Plan, on the levee system(s) shown as providing protection for area on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- ZONE A — No Base Flood Elevations determined.
- ZONE AE — Base Flood Elevations determined.
- ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR — Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99 — Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V — Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE — Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.
- ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base flood elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A — A — Cross section line
- 23 — 23 — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 15
- 6000000 FT — 5000-foot grid ticks: Arkansas State Plane coordinate system, north zone (FIPSZONE 0301), Lambert Conformal Conic
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
June 18, 2010
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 2000'
1000 0 2000 4000 FEET
600 0 600 1200 METERS

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0450E

FIRM
FLOOD INSURANCE RATE MAP
MISSISSIPPI COUNTY, ARKANSAS
AND INCORPORATED AREAS

PANEL 450 OF 650
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MISSISSIPPI COUNTY	050423	0450	E
LUXORA, CITY OF	050148	0450	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 05093C0450E
EFFECTIVE DATE JUNE 18, 2010

Federal Emergency Management Agency

Harbor
A Terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501)663-8800
Fax (501)588-0123
www.harborenv.com

EXPLORATORY VENTURES, LLC
STEEL MANUFACTURING COMPLEX
ARKANSAS
OSCEOLA
FEMA FLOOD PLAIN MAP

NO	REVISION DESCRIPTION	DATE
X	X	X-X-X

Drawn By: AES
Date: 11-17-25
Project No: L8257501
Scale: NONE

H-3

N:_HEILegacy\Public\Client Folders A - D\BHLP BakerHostetler\Drawings\BRS Works - MM2\Facilities EV - Compliance.dwg, 11/17/2025 10:51:03 AM

Section I – Construction Plans and Specifications for Wastewater Treatment System

NPDES PERMIT MODIFICATION

FOR

EXPLORATORY VENTURES, LLC

OSCEOLA ARKANSAS

DATE
NOVEMBER 2025

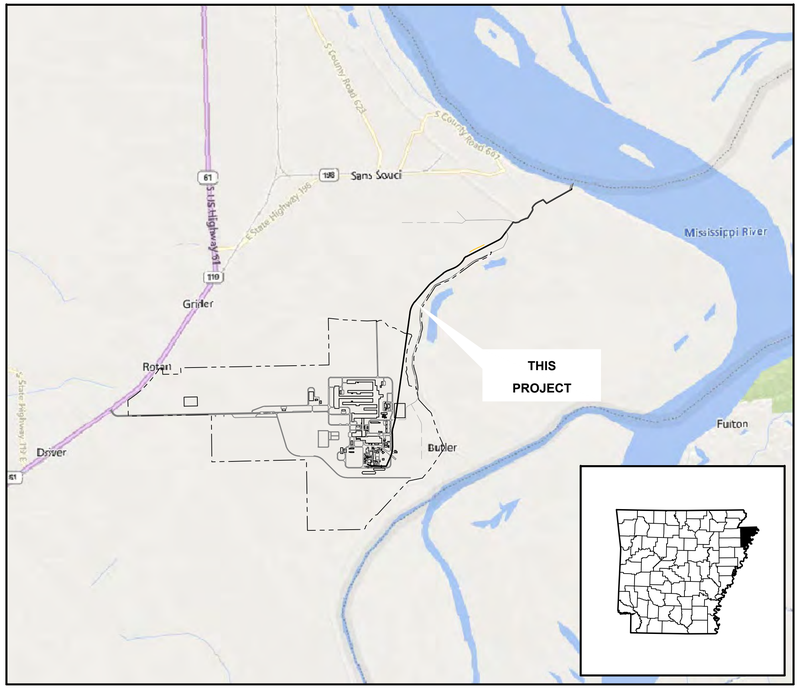
INDEX

SHEET TITLE	SHEET NUMBER
OVERALL PLAN	C100
PLAN - FORCE MAIN "E" STATION 0+00 TO 60+50	C101
PLAN - FORCE MAIN "E" STATION 60+50 TO 118+50	C102
PLAN - FORCE MAIN "E" STATION 118+50 TO 172+50	C103
PLAN - FORCE MAIN "E" STATION 172+50 TO 218+71	C104

INDEX cont.

SHEET TITLE	SHEET NUMBER
DISCHARGE STRUCTURE DETAILS	C200
MISCELLANEOUS DETAILS	C201
PROPOSED DRI PLANT	C300
PROPOSED DRI WASTEWATER TREATMENT PLANT	C301
PROPOSED DRI WASTEWATER TREATMENT PLANT P&ID	C302

HARBOR PROJECT NUMBER
L8257501



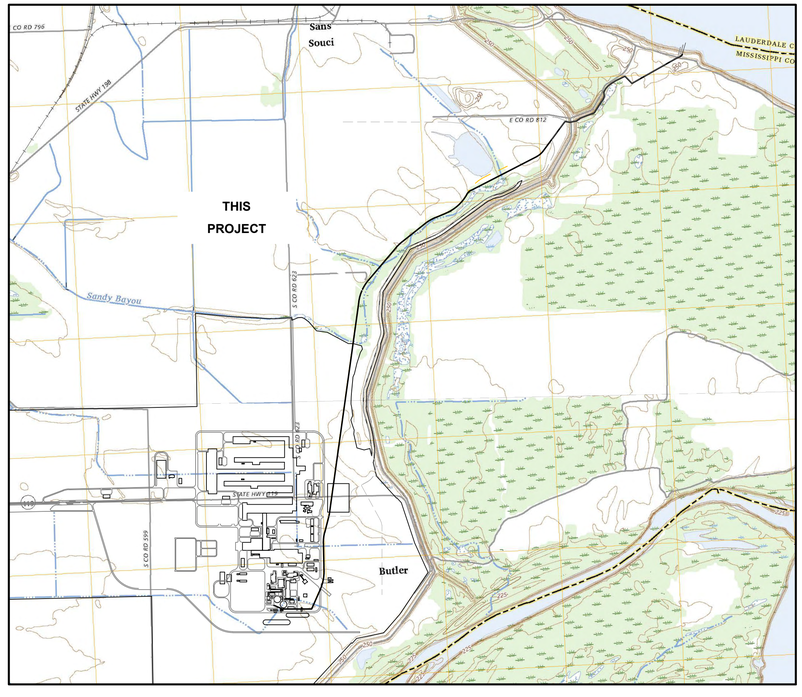
VICINITY MAP
SCALE: 1" = 4,000'

CERTIFICATE OF AUTHORIZATION
HARBOR ENVIRONMENTAL & SAFETY
No. 2171
ARKANSAS ENGINEER

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 10452
ANDREW H. RIVE

Harbor
A Terracon Company

5800 Evergreen Drive
Little Rock, AR. 72205
(501) 663-8800



PROJECT LOCATION
SCALE: 1" = 2,000'



Harbor
A terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501) 663-8800
Fax (501) 588-0123
www.harborenv.com

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 10452
ANDREW H. RIVE

EXPLORATORY VENTURES, LLC
NPDES PERMIT MODIFICATION

ARKANSAS

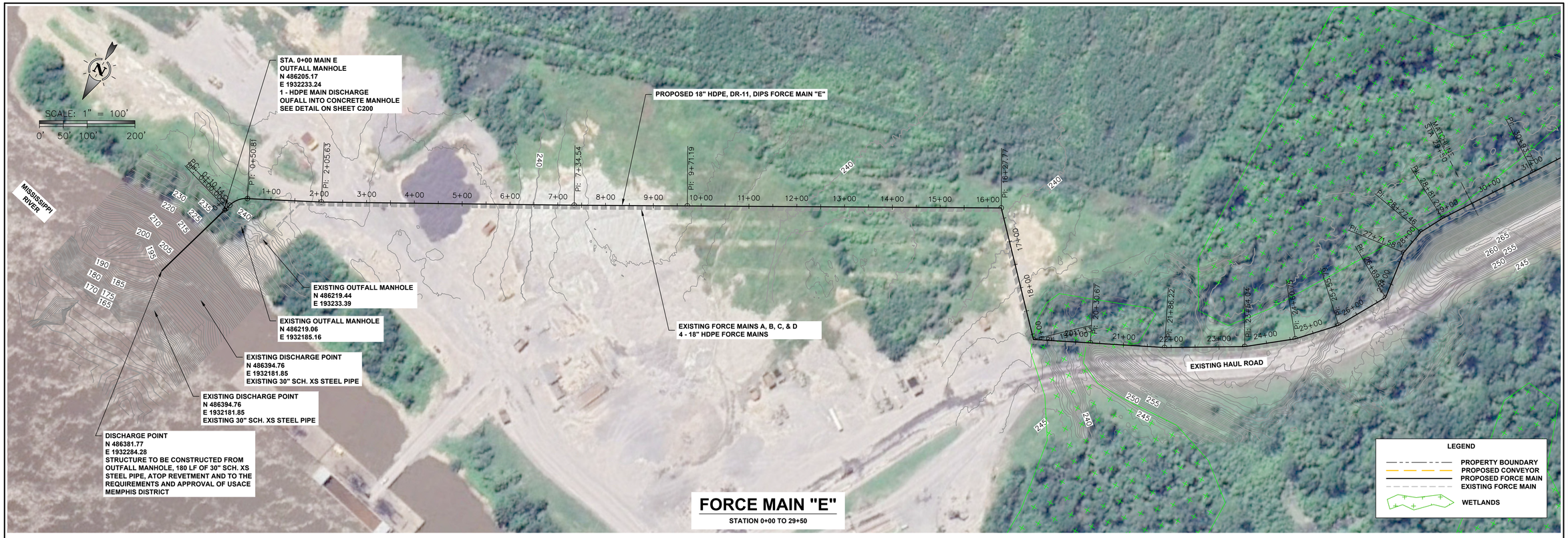
OSCEOLA

OVERALL SITE PLAN

NO	REVISION DESCRIPTION	DATE
XX	X	XX-XX-XX

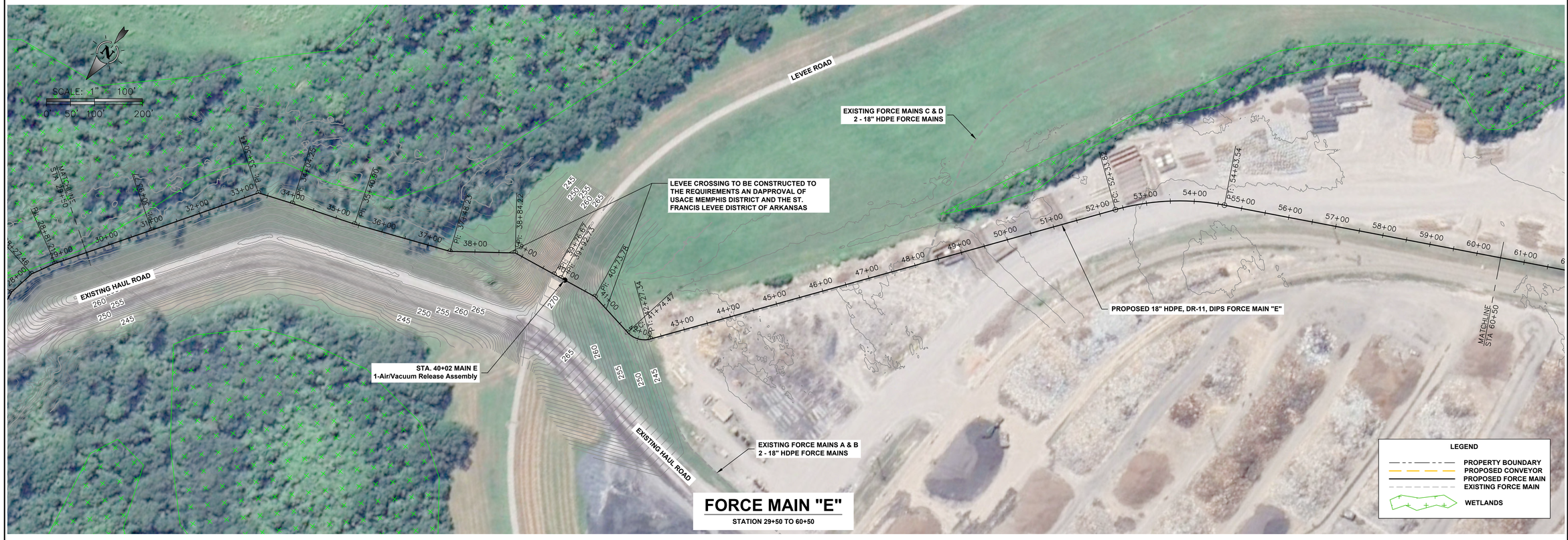
Drawn By: AES
Date: 11-13-25
Checked By: AHR
Scale: NOTED
Project Number: L8257501

C100



FORCE MAIN "E"

STATION 0+00 TO 29+50



FORCE MAIN "E"

STATION 29+50 TO 60+50

Harbor
A Terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501) 663-8800
Fax (501) 588-0123
www.harborenv.com

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 10424
ANDREW H. RICE

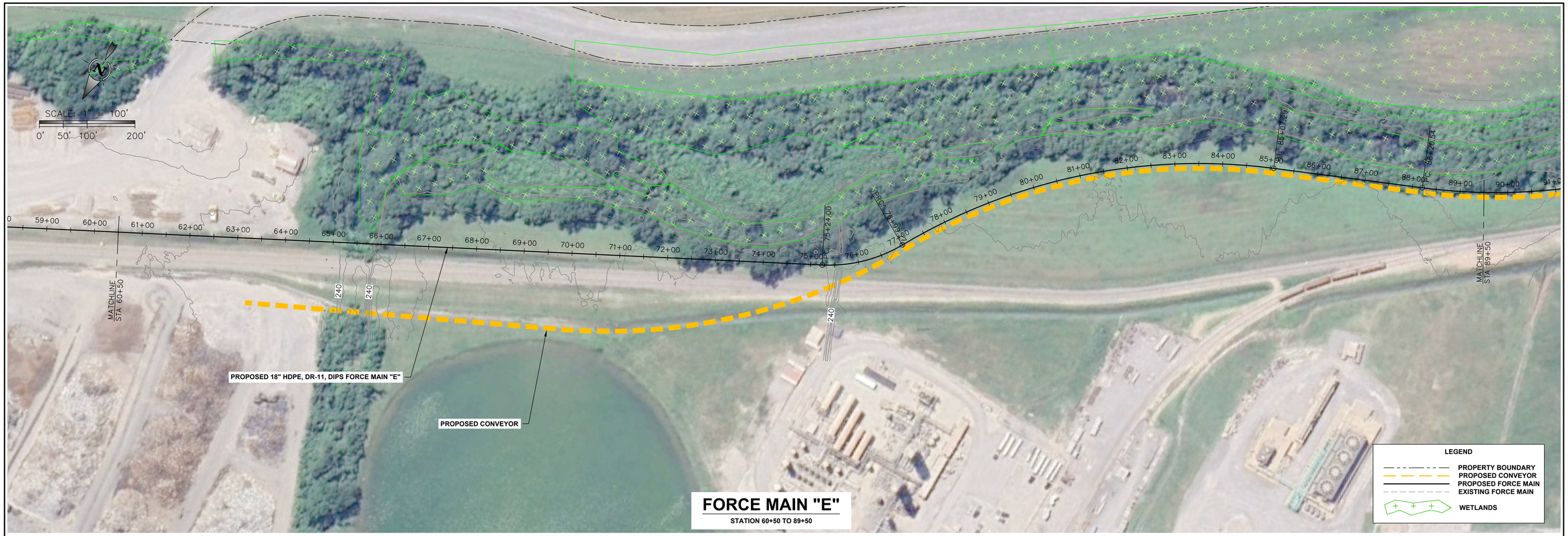
EXPLORATORY VENTURES, LLC
NPDES PERMIT MODIFICATION
OSCEOLA ARKANSAS
PLAN - FORCE MAIN "E" STATION 0+00 TO 60+50

NO	REVISION DESCRIPTION	DATE
XX	X	XX-XX-XX

Drawn By: AES	Date: 11-13-25
Checked By: AHR	Scale: NOTED

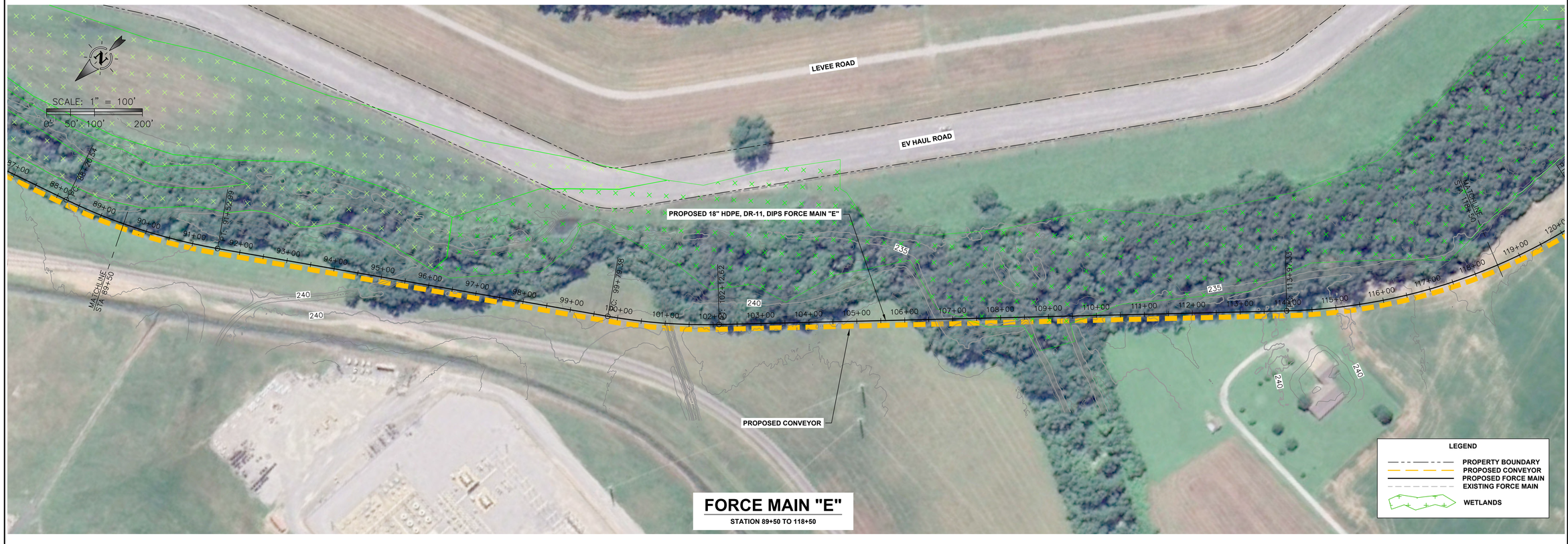
Project Number: L8257501

C101



FORCE MAIN "E"

STATION 60+50 TO 89+50



FORCE MAIN "E"

STATION 89+50 TO 118+50

Harbor
A terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501) 663-8800
Fax (501) 588-0123
www.harborenv.com

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 10452
ANDREW H. RUSE

EXPLORATORY VENTURES, LLC

NPDES PERMIT MODIFICATION

OSCEOLA ARKANSAS

PLAN - FORCE MAIN "E" STATION 60+50 TO 118+50

NO	REVISION DESCRIPTION	DATE
XX	X	XX-XX-XX

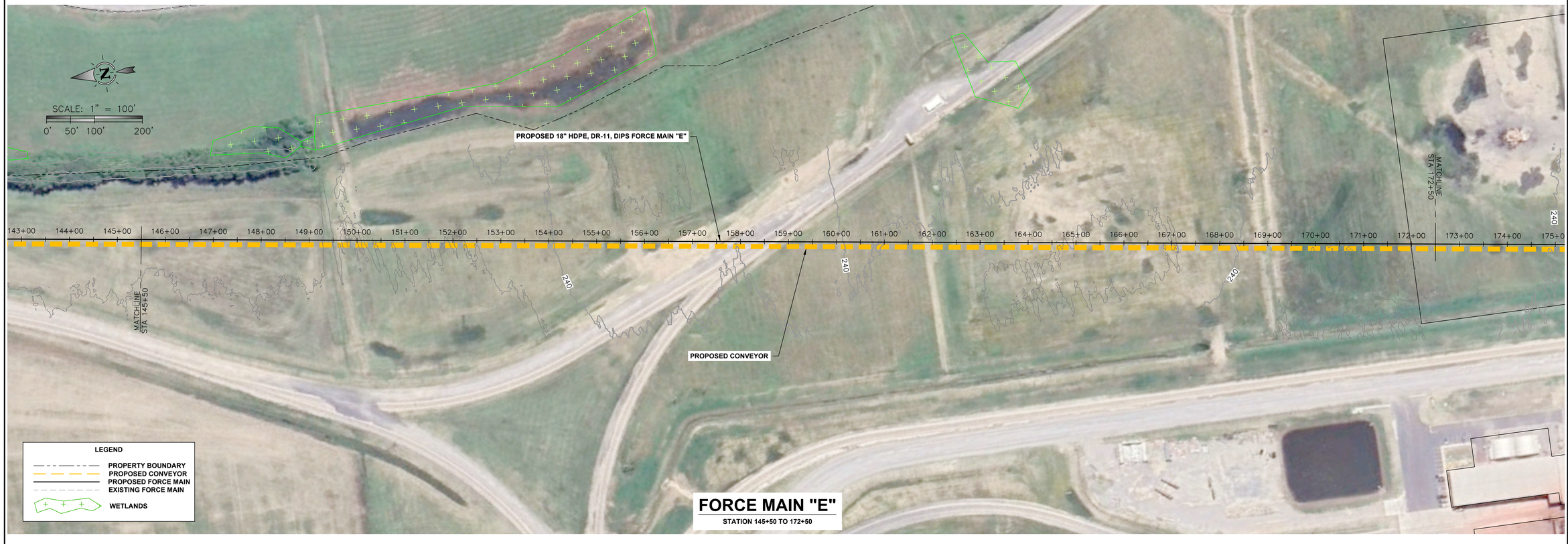
Drawn By: AES	Date: 11-13-25
Checked By: AHR	Scale: NOTED
Project Number: L8257501	

C102



FORCE MAIN "E"

STATION 118+50 TO 145+50



FORCE MAIN "E"

STATION 145+50 TO 172+50

Harbor
A Terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501) 663-8800
Fax (501) 588-0123
www.harborenv.com

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 10452
ANDREW H. RIVE

EXPLORATORY VENTURES, LLC

NPDES PERMIT MODIFICATION

ARKANSAS

OSCEOLA

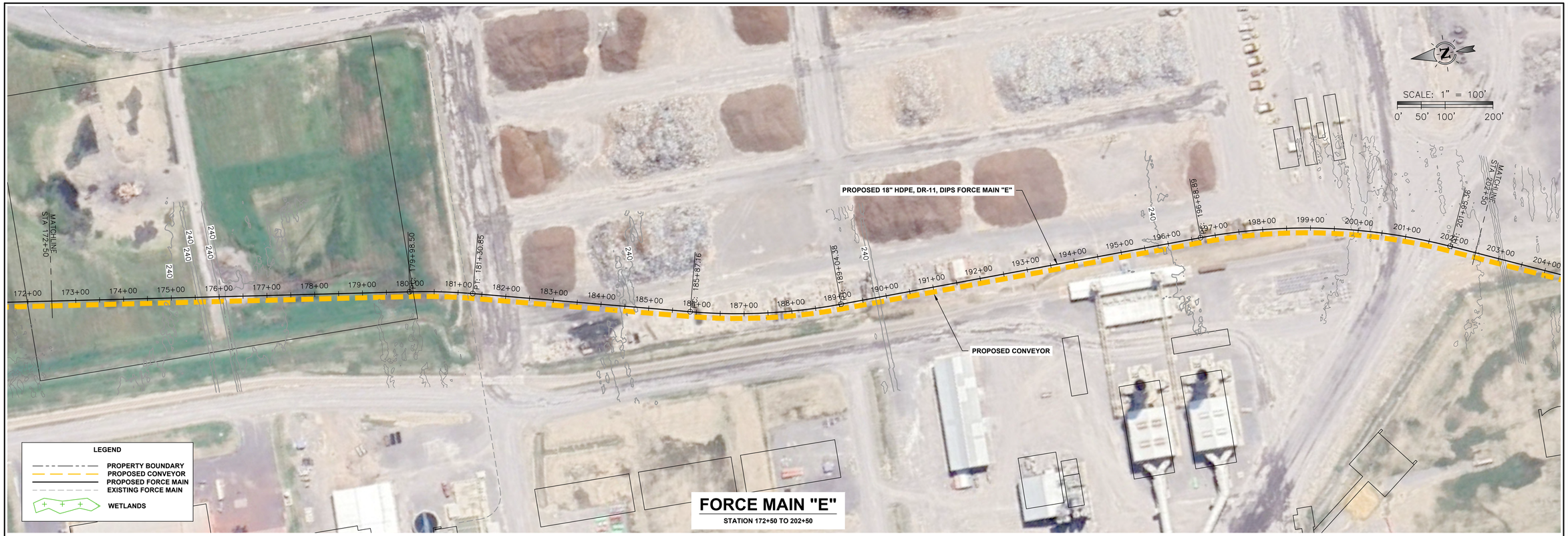
PLAN - FORCE MAIN "E" STATION 118+50 TO 172+50

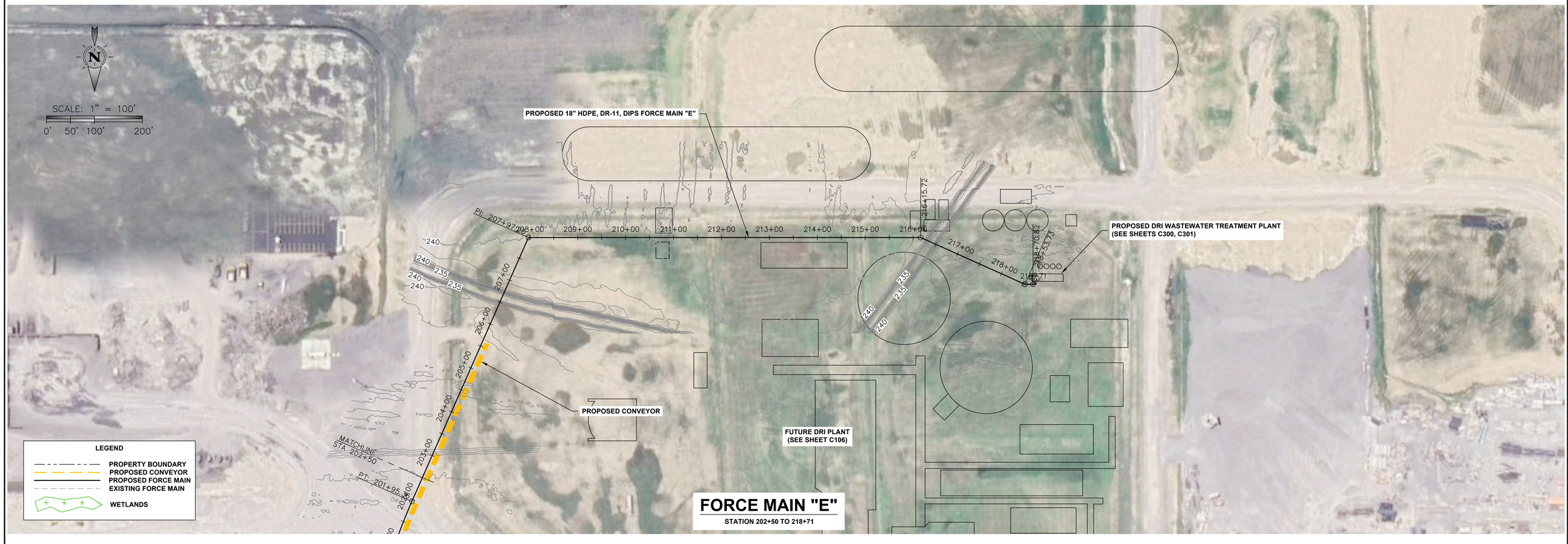
NO	REVISION DESCRIPTION	DATE
XX	X	XX-XX-XX

Drawn By: AES	Date: 11-13-25
Checked By: AHR	Scale: NOTED

Project Number: L8257501

C103





Harbor
A Terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501) 663-8800
Fax (501) 588-0123
www.harborenv.com

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 10452
ANDREW H. RUSE

EXPLORATORY VENTURES, LLC
NPDES PERMIT MODIFICATION

ARKANSAS

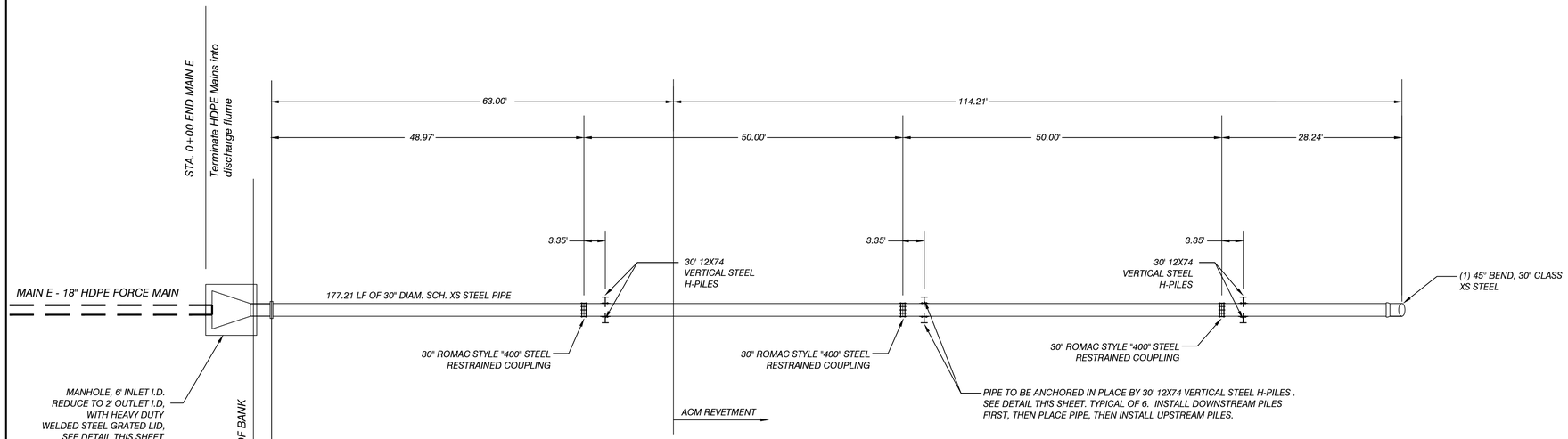
OSCEOLA

PLAN - FORCE MAIN "E" STATION 172+50 TO 218+71

NO	REVISION DESCRIPTION	DATE
XX	X	XX-XX-XX

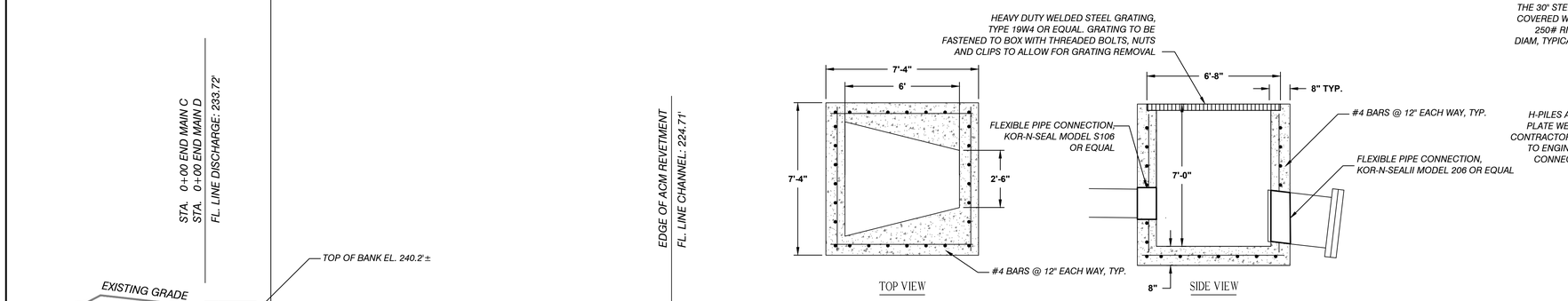
Drawn By: AES	Date: 11-13-25
Checked By: AHR	Scale: NOTED
Project Number: L8257501	

C104



PLAN VIEW OF DISCHARGE STRUCTURE

SCALE: 1" = 10'



PROFILE VIEW OF DISCHARGE STRUCTURE

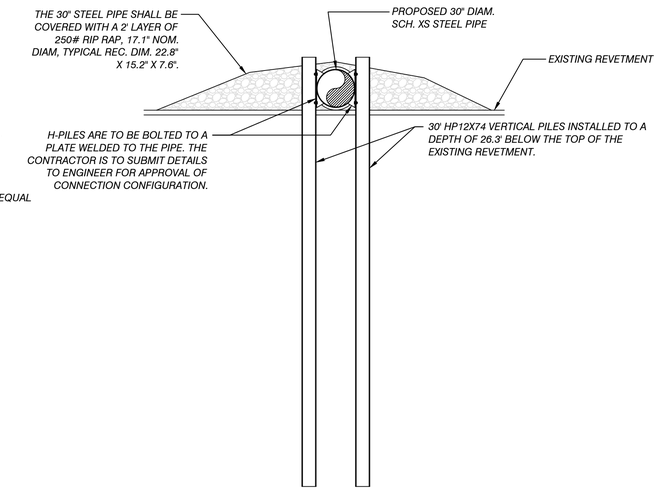
SCALE: 1" = 10'

NOTE:

THE 30" STEEL PIPE SHALL BE COVERED WITH A 2' LAYER OF 250# RIP RAP, 17.1" NOM. DIAM, TYPICAL REC. DIM. 22.8" X 15.2" X 7.6".

MANHOLE DETAILS

SCALE: N.T.S.



TYPICAL SECTION PROFILE OF DISCHARGE STRUCTURE

SCALE: N.T.S.

Harbor
A Terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501) 663-8800
Fax (501) 588-0123
www.harborenv.com

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 10452
ANDREW H. RILES

EXPLORATORY VENTURES, LLC
NPDES PERMIT MODIFICATION

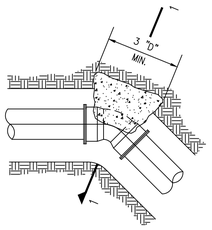
OSCEOLA ARKANSAS

DISCHARGE STRUCTURE DETAILS

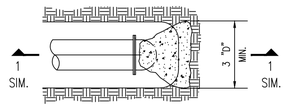
NO	REVISION DESCRIPTION	DATE
XX	X	XX-XX-XX

Drawn By: AES
Date: 11-13-25
Checked By: AHR
Scale: NOTED
Project Number: L8257501

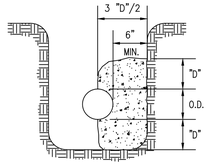
C200



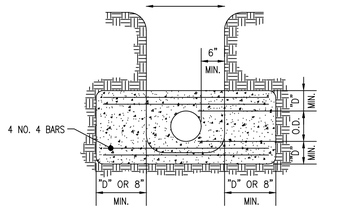
PLAN – 45° HORIZONTAL BEND THRUST BLOCKING



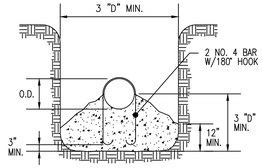
PLAN – DEAD END OR PLUG



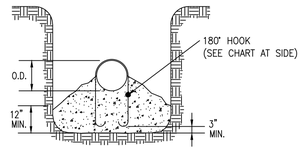
SECTION 1–1



SECTION 2–2

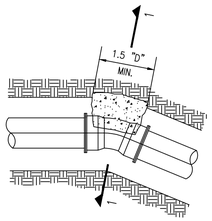


SECTION 3–3

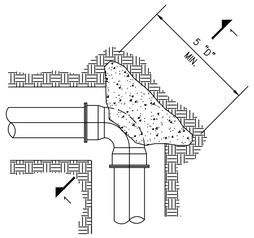


SECTION 4–4

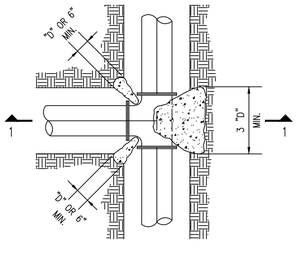
VOLUME & SIZES REQ'D FOR VERTICAL OVERBENDS										
90°			45°			22 1/2°			11 3/4°	
"V" CU. YDS	"B.A." SQ. FT.	REIN. RODS	"V" CU. YDS	"B.A." SQ. FT.	REIN. RODS	"V" CU. YDS	"B.A." SQ. FT.	REIN. RODS	"V" CU. YDS	"B.A." SQ. FT.	REIN. RODS
11/2	4	2#4	1	2	1#4	1/2	1	1#4	1/4	1	1#4
3	6	4#4	2	4	2#4	1	2	1#4	1/2	1	1#4
5	10	5#4	3	6	3#4	11/2	3	1#5	3/4	2	1#4
7	14	5#5	4	8	4#5	2	4	2#4	1	2	1#4



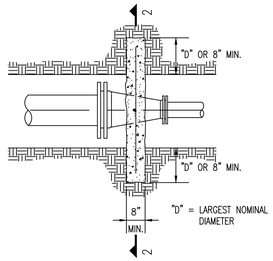
PLAN – 11.25° – 22.5° HORIZONTAL BEND THRUST BLOCKING



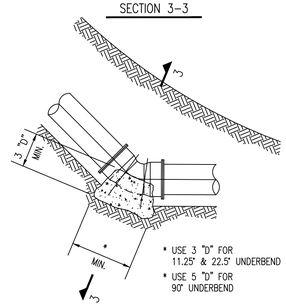
PLAN – 90° HORIZONTAL BEND THRUST BLOCKING



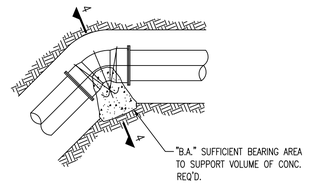
PLAN – TEE HORIZONTAL THRUST BLOCKING



PLAN – REDUCER THRUST BLOCKING



ELEV. – VERTICAL UNDERBEND THRUST BLOCKING



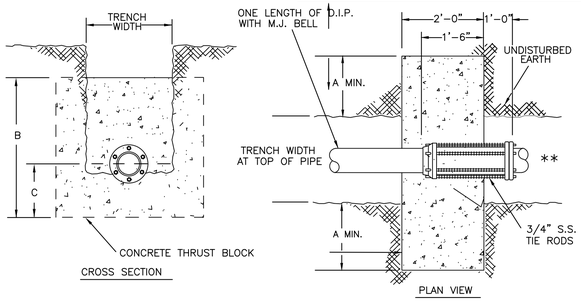
ELEV. – VERTICAL OVERBEND THRUST BLOCKING

STANDARD MASS CONCRETE THRUST BLOCKING FOR ALL PRESSURE PIPE

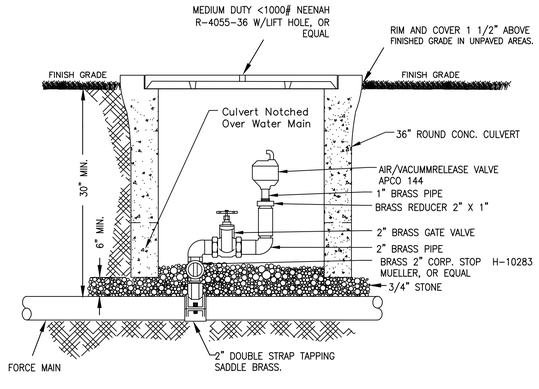
SCALE: N.T.S.

PIPE DIAMETER	A	B	C	NO. OF TIE RODS REQUIRED
4"	9"	36"	18"	2
6"	12"	36"	18"	2
8"	12"	36"	18"	2
10"	12"	36"	18"	2
12"	18"	36"	18"	2
16"	18"	48"	24"	4
18"	18"	48"	24"	4

DESIGN ENGINEER SHALL VERIFY ABOVE DIMENSIONS AND THE NUMBER OF TIE RODS.

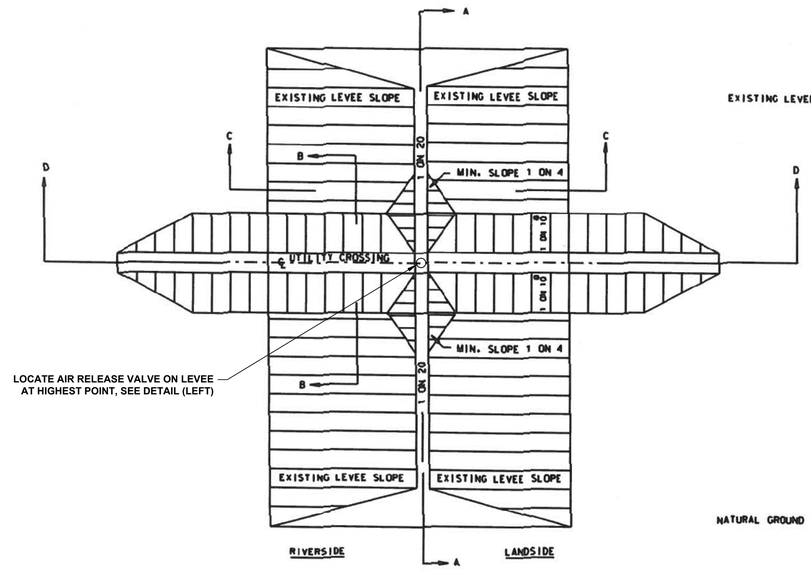


THRUST BLOCK DETAIL FOR LINE TERMINUS



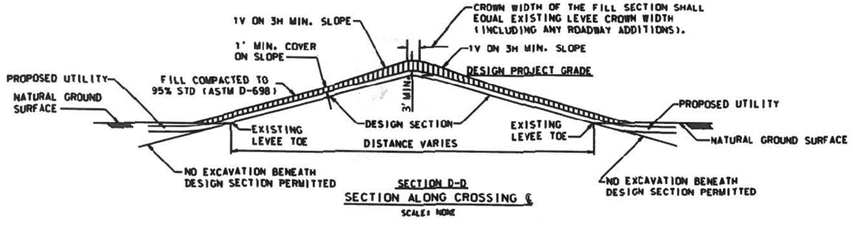
AIR RELEASE VALVE DETAIL

SCALE: N.T.S.



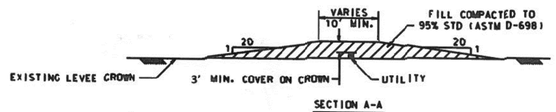
DETAIL PLAN

SCALE: NONE



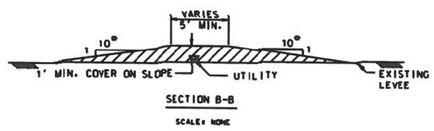
SECTION D-D
SECTION ALONG CROSSING ℄

SCALE: NONE



SECTION A-A

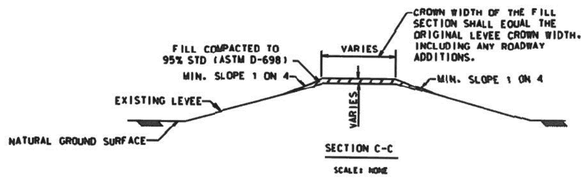
SCALE: NONE



SECTION B-B

SCALE: NONE

*1V ON 10H SLOPE SHALL BE CHANGED TO 1V ON 20H FOR CROSSINGS IN LOUISIANA.



SECTION C-C

SCALE: NONE

NOTES:

1. ALL DISTURBED TURFED AREAS SHALL BE SEEDED OR SODDED WITH BERMUDA OR TALL FESCUE OR APPROVED MIX. THE TURFING SHALL INCLUDE FERTILIZING AND MULCHING WHERE NEEDED.
2. THE LEVEE CROWN RAMP OVER THE UTILITY SHALL BE SURFACED TO MATCH EXISTING MATERIALS. THE SURFACING SHALL BE A MINIMUM OF 6 INCHES THICK.
3. FILL MATERIAL USED IN CONSTRUCTION OF UTILITY COVER SHALL BE SIMILAR TO MATERIAL IN EXISTING LEVEE SECTION.
4. UTILITIES SHALL BE PLACED ABOVE DESIGN SECTION OF LEVEE AND BERMS AT LOCATION OF THE CROSSING. EXISTING SURFACE OF BERM IS DESIGN SURFACE.
5. AREAS TO RECEIVE COVER SHALL HAVE EXISTING SURFACING OR TURF REMOVED PRIOR TO SCARIFYING AND PLACING OF COVER MATERIAL.

Harbor
A terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501) 663-8800
Fax (501) 588-0123
www.harborenv.com

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 10452
ANDREW H. RIVES

EXPLORATORY VENTURES, LLC
NPDES PERMIT MODIFICATION
ARKANSAS
OSCEOLA
MISCELLANEOUS DETAILS

NO	REVISION DESCRIPTION	DATE
XX	X	XX-XX-XX

Drawn By: AES
Date: 11-13-25
Checked By: AHR
Scale: NONE
Project Number: L8257501

C201

DRI BLOWDOWN TO WASTEWATER TREATMENT PLANT

DRI WASTEWATER TREATMENT PLANT

DISCHARGE FROM DRI WWTP STATION 218+71

PROPOSED 18" HDPE, DR-11, DIPS FORCE MAIN "E" TO MISSISSIPPI RIVER OUTFALL

AREA 600

AREA 500

HVAC PAD

008

007

011

012

013

015

004

SCALE: 1" = 30'

0' 15' 30' 60'

Harbor
A terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501) 663-8800
Fax (501) 588-0123
www.harborenv.com

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 10402
ANDREW H. RICE

EXPLORATORY VENTURES, LLC

NPDES PERMIT MODIFICATION

ARKANSAS

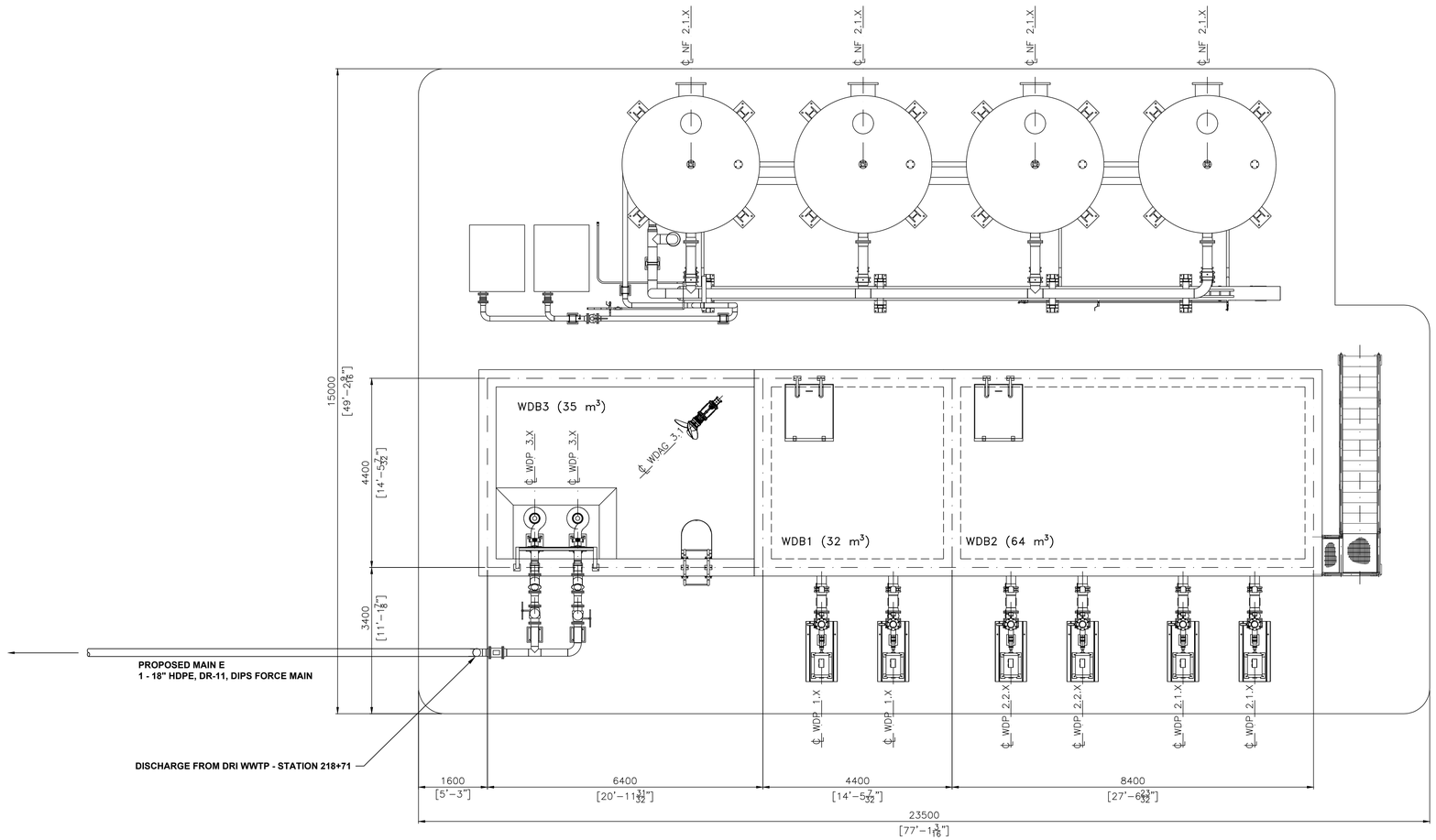
OSCEOLA

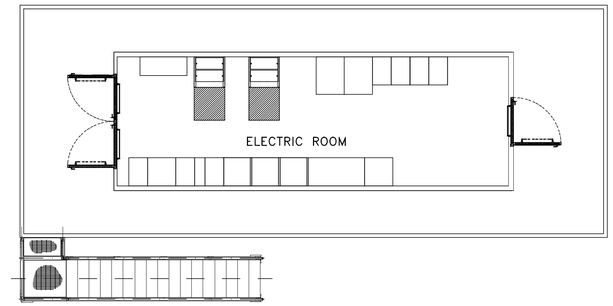
PROPOSED DRI PLANT

NO	REVISION DESCRIPTION	DATE
XX	X	XX-XX-XX

Drawn By: AES	Date: 11-13-25
Checked By: AHR	Scale: 1"=30'
Project Number: L8257501	

C300





NOTES:
1. ALL DIMENSIONS ARE EXPRESSED IN MILLIMETERS AND BETWEEN BRACKETS IN THE IMPERIAL SYSTEM, UNLESS OTHERWISE SPECIFIED.

Harbor
A terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501) 663-8800
Fax (501) 588-0123
www.harborenv.com

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 10452
ANDREW H. RICE

EXPLORATORY VENTURES, LLC
NPDES PERMIT MODIFICATION
ARKANSAS
OSCEOLA
PROPOSED DRI WASTEWATER TREATMENT PLANT

NO	REVISION DESCRIPTION	DATE
XX	X	XX-XX-XX

Drawn By: AES
Date: 11-13-25
Checked By: AHR
Scale: 1"=5'
Project Number: L8257501

C301

DRI CW BLOWDOWN

TOP

CUSTOMER
RUSSULA

BLOWDOWN BASIN
WDB1

WDP 1.1

WDP 1.2

PEROXIDE

WD1–8"
200 m3/h

PUMP GROUP WDP 1.x
Qi=200 m3/h
Pi=2 bar
(1+1) units

SAND FILTERS WDF 2.1.X
Qt= 200 m3/h
(2+2) units

WDF 2.1.4

WDF 2.1.3

WDF 2.1.2

WDF 2.1.1

BLOWERS WDFB 2.1.X
(1+1) units
693 icfm @ 10psig

DRI CLARIFIERS

MAKE UP WATER
LAMELLAS DECANTERS

WD3 – 8"

CUSTOMER
RUSSULA

WDAG 3.1

WDP 3.1

WDP 3.2

WDB 3

DRAIN BASIN

DRAIN

PUMP GROUP WDP 3.X
Qi=200 m3/h
Pi=3,5 bar
(1+1) units

FILTERED WATER BASIN
WDB2

WDP 2.2.1

WDP 2.2.2

WDP 2.1.1

WDP 2.1.2

RECYCLING SYSTEM

RIVER OUTFALL 203

WD2.2.2–8"

WD2.2.1–8"

SAMPLING
STATION

200 m3/h

CUSTOMER
RUSSULA

PUMP GROUP WDP 2.2.x
Qi=200 m3/h
Pi=4 bar
(1+1) units

PUMP GROUP WDP 2.1.x
Qi=200 m3/h
Pi=2,5 bar
(1+1) units

Harbor
A terracon Company
5800 Evergreen Drive
Little Rock, AR 72205
Ph (501) 663-8800
Fax (501) 588-0123
www.harborenv.com

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 10452
ANDREW H. RICE

EXPLORATORY VENTURES, LLC
NPDES PERMIT MODIFICATION
ARKANSAS
OSCEOLA
PROPOSED DRI WASTEWATER TREATMENT PLANT P&ID

NO	REVISION DESCRIPTION	DATE
XX	X	XX-XX-XX

Drawn By: AES	Date: 11-13-25
Checked By: AHR	Scale: NONE
Project Number: L8257501	

C302

TECHNICAL SPECIFICATIONS

FOR

DRI WASTEWATER FACILITIES

FOR

EXPLORATORY VENTURES, LLC

OSCEOLA, ARKANSAS

HARBOR PROJECT NO. L857501

NOVEMBER 17, 2025



HARBOR ENVIRONMENTAL & SAFETY
5800 EVERGREEN DRIVE
LITTLE ROCK, ARKANSAS 72205
(501) 663-8800

INDEX

GENERAL CONDITIONS

TECHNICAL SPECIFICATIONS

SUBMITTAL PROCEDURES	01300
CLEARING AND GRUBBING	02110
SITE EXCAVATION, BACKFILLING AND GRADING	02220
TRENCHING AND BACKFILLING	02221
SLOPE PROTECTION AND EROSION CONTROL	02270
EARTHWORK	02300
WASTEWATER TREATMENT SYSTEM	02530
INDUSTRIAL SEWER LINES AND FORCE MAINS	02610
CHAIN LINK FENCES, GATES AND BARBED WIRE	02831
HYDROMULCHING	02932
CONCRETE FORMWORK	03100
CONCRETE REINFOCEMENT	03200
CAST-IN-PLACE CONCRETE	03300
LUMBER	06650
PAINTS AND COATINGS	099123
PROCESS PIPING	402336

MECHANICAL

GENERAL MECHANICAL PROVISIONS	15010
BASIC MATERIALS AND METHODS	15050

ELECTRICAL

GENERAL ELECTRICAL REQUIREMENTS	16000
BASIC MATERIALS & METHODS	16050
CONDUITS AND RACEWAYS	16110
WIRE AND CABLE	16120
GROUNDING	16450

GENERAL CONDITIONS

INDEX

1. Contract Documents
2. Definitions
3. Materials and Workmanship
4. Permits, Regulations, and Taxes
5. Contractor’s License
6. Contractor’s Obligations and Superintendence
7. Accident Prevention
8. Changes in the Work
9. Time for Completion and Substantial Completion
10. Correction of the Work
11. Owner’s Right to Terminate Contract
12. Contract Surety and Payments by the Contractor
13. Payments to the Contractor
14. Nondiscrimination/Affirmative Action
15. Subcontractors
16. Warranties
17. Claims
18. Insurance
19. Consideration of Bids
20. Record Drawings
21. Access to Records/Maintenance of Records
22. Indemnification

PART 1. - CONTRACT DOCUMENTS

1.1 The Contract Documents consist of the documents listed in the table of contents of this specification or in the Owner’s invitation to bid the contract, in addition to which may be addenda, change orders, and other documents pertaining to the project.

1.2 The intention of the Contract Documents is to describe the labor, materials, equipment, performance standards, schedules, and costs set forward and agreed to by the Contractor and the Owner. In the event of a conflict or ambiguity in the Contract Documents, they shall be interpreted to include all necessary Work needed for a complete, working installation.

1.3 The purchase order will take precedence over all other documents, drawings, and changes both verbal and written.

PART 2. - DEFINITIONS

2.1 "Engineer” - A person, firm, or corporation named as such in the CONTRACT DOCUMENTS.

2.2 "Contractor" - A person, firm, or corporation who enters into a contractual agreement to assume responsibility for performing and completing all Work as set forth in the Contract Documents.

2.3 "Equals/Substitutions" - Means materials, equipment, or methods not specified in the Contract Documents that the Contractor proposes and warrants as suitable for the use intended and conforms to all other physical, functional, and performance requirements. Requests for Equals/Substitutions must be submitted to the Owner's Project Representative and electronic approval received prior to incorporation into the Work.

2.4 “Owner” – A public or quasi-public body or authority, corporation, association, partnership, or individual for whom the WORK is to be performed.

2.5 “Shop Drawings/Submittals” - Defines drawings, product data, samples, or other information to be submitted by the Contractor to the Engineer for approval before fabrication or installation. Shop Drawings/Submittals that are needed are identified in the Contract Documents or will be identified at the preconstruction meeting. The Contractor is responsible for assuring the drawing/submittals conformance with the requirements of this contract. Review and acceptance by the Engineer does not relieve the Contractor from responsibility for errors or omissions.

2.6 “Substantial Completion” - Defines the point in time when the Work is completed to the extent that the Owner can make beneficial use of the Work for the purposes intended and the point in time when warranties and guarantees go into effect. There may be a "Punch List" of minor items of the Work or deficiencies that remain to be completed or corrected following Substantial Completion.

2.7 “Work” - Defines all labor, materials, equipment and special project requirements necessary to produce the end result described by the Contract Documents.

PART 3. - MATERIALS AND WORKMANSHIP

3.1 The Contractor shall provide all labor, materials, and equipment in a good workmanlike manner in accordance with the Contract Documents and applicable industry standards, and to furnish upon request, to the Owner, information and test results having to do with the kind and quality of materials.

3.2 References to a standard specification of an association or manufacturer or to a State code means the most recent printed edition or catalog in effect on the date the contract is signed.

3.3 No material, equipment, or supply shall be purchased by the Contractor that is subject to any conditional agreement where title is retained by the seller. Any material, equipment, or supply will be furnished clear of any lien or claim.

3.4 Reference in the documents to a manufacturer’s trade name or number establishes a standard, and the Owner may consider any material or item that will perform adequately under the Contract Documents as Equals/Substitutions, subject to prior approval. No compromise in quality level is acceptable.

3.5 Use of any material or equipment other than what has been specified or approved by the Owner is not acceptable under the contract and shall be removed and replaced at the Contractor’s expense.

PART 4. - PERMITS, REGULATIONS, AND TAXES

4.1 The Contractor shall obtain all permits, licenses, and approvals needed for the performance of the Work and will give all notices and comply with all laws, codes, rules and regulations that pertain to the performance of the Work.

4.2 The Contractor will pay all taxes required by law.

4.3 The Contractor shall notify the Owner of any variance in the Contract Documents needed to comply with codes, rules, and regulation upon which the Owner will

correct the documents at no additional cost to the Contractor.

4.4 The Contractor shall include all charges in its bid and pay for water, sewer, and other utility connections made by municipalities.

4.5 All employees, agents, and representatives of the Contractor shall be subject to the reasonable rules and regulations at any time promulgated by the Owner for the safe, orderly, and efficient conduct of operations on the Owner's property. The Contractor shall enforce observance of such rules and regulations and shall maintain discipline and good order among its employees, agents, and representatives. The Contractor's employees, agents, and representatives, during such time as they are on the Owner's premises, shall abide by the same rules and regulations with respect to fire protection, security regulations, and safety that govern the Owner's employees.

PART 5. - CONTRACTOR'S LICENSE

Attention of bidders is directed to Act 124 of the Acts of Arkansas, approved February 24, 1939, being an "Act to Regulate the Practice of General Contracting in the State of Arkansas" as amended by Act 127 of the Acts of the General Assembly of Arkansas, for the year 1945, and further amended by Act 153 of the Acts of the General Assembly of Arkansas for the year 1951, approved February 23, 1951.

The Bidder must assume full responsibility for compliance with applicable Federal and State laws.

PART 6. - CONTRACTOR'S OBLIGATIONS AND SUPERINTENDENCE

6.1 The Contractor shall provide and pay for all equipment, materials, supplies, and labor necessary for the completion of the Work within the time agreed, including transportation, storing, superintending, and installing. The Contractor shall be responsible for insuring that all Work strictly conforms to the requirements of this contract and shall maintain adequate inspection and quality control procedures to assure the same. The presence and observation of the

Work by the Owner shall not relieve the Contractor of any obligations.

6.2 The Contractor shall attend a preconstruction meeting and any subsequent construction related meetings that are scheduled by the Owner's Project Representative. The Contractor shall make a timely submittal of all shop drawing/submittals that are required to describe how it will fulfill its responsibility under this contract. While the Contract Documents may identify minimum performance characteristics and brand names to establish the required level of quality, Equals/Substitutions may be considered. However, the Contractor shall be responsible to document the qualifications of a proposed Equal/Substitution, and any additional costs for achieving required performance shall be borne by the Contractor.

6.3 The Contractor shall give personal superintendence to the Work through a designated superintendent or foreperson knowledgeable and experienced with the Work and able to act for the Contractor in all matters. The Contractor shall schedule Work and coordinate the activities of any subcontractors to assure timely completion, and shall coordinate site access, storage, and construction activities with the Owner to minimize impacts on program operations.

6.4 The Contractor certifies that it is familiar with the site conditions that may affect the Work or its costs and shall perform the Work without additional expense to the State, except for Changes in the Work or unforeseen conditions that may arise.

6.5 The Contractor shall maintain a clean and safe work environment. Barricades and other appropriate safety measures required by Federal, State, or other governmental authority having jurisdiction shall be provided. Unused, discarded, or hazardous materials generated by the Work shall be properly managed and recycled or disposed in accordance with applicable rules or regulations. Disposal of hazardous materials shall be coordinated through the Owner's Project Representative.

6.6 The Contractor shall safely guard the Owner’s and any adjacent property from injury or loss in connection with the Work and shall make good any loss from damage

due to the Contractor’s actions or lack of actions. Stormwater runoff from excavations shall be properly managed to prevent soil erosion off site or into lakes, streams, or other surface waters.

6.7 The Contractor shall grant access to the Owner’s Project Representative, Engineer, and other authorized persons. Should it be necessary in order to examine the Work to tear out or remove portions, the Contractor shall immediately furnish all facilities necessary. If the Work is found defective, the Contractor shall assume all expenses for tearing out, inspecting, and satisfactory reconstruction. If the defective Work is found to be in compliance with the Contract Documents, the Contractor will be reimbursed for the direct costs involved.

6.8 The Contractor may use existing water and electrical sources available at the Work site at no cost. The Contractor shall provide, maintain, and pay for adequate toilet facilities for the Work. The Contractor shall make its own arrangements and pay for telecommunications services as needed.

6.9 No piping, manholes, conduit, or similar items are to be buried before having been inspected by the Engineer or the Engineer’s field inspector.

6.10 All Work must be complete, tested, and ready for use by the Owner prior to Substantial Completion. The Contractor shall also provide operating and maintenance instructions for each item of equipment or device installed, including parts lists, description of control cycles, and wiring diagrams. Any of these items developed by the contractor shall be provided to the Owner in the electronic format of either Word, AutoCad, or Adobe Acrobat.

6.11 The Contractor shall maintain a set of record drawings on which changes and deviations from Contract Documents shall be recorded. All buried or concealed piping, conduit, or similar items shall be located by dimensions and elevations on the record drawings. At the completion of the project, the Contractor shall submit the marked-up record drawings to the Owner's Project Representative prior to final payment.

6.12 By accepting this contract the Contractor agrees that any and all payments to their subcontractors, their agents, or employees will not be in any way the liability of the Owner, and that the Contractor agrees that they will hold harmless and indemnify the Owner, their agents or officials against any claims or disputes, to include legal fees resulting from the Contractor's non payment of subcontractors, their agents or employees.

PART 7. - ACCIDENT PREVENTION

7.1 The Contractor shall exercise proper precaution at all times for the protection of persons and property and shall be responsible for all damages to persons or property, either on or off the site, which occur as a result of his prosecution of the work. The safety provisions of applicable laws and buildings and construction codes, in addition to specific safety and health regulations described by all applicable provisions of 29 CFR 1926, shall be observed and the Contractor shall take or cause to be taken, such additional safety and health measures as the Owner may determine to be reasonably necessary.

7.2 The Contractor shall maintain an accurate record of all cases of death, occupational disease, or injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on work under the contract. The Contractor shall promptly furnish the Owner with reports concerning these matters.

7.3 The Contractor shall indemnify and save harmless the Owner and Engineer from any claims for damages resulting from property damage, personal injury and/or death suffered or alleged to have been suffered, by any person as a result of any work conducted under this contract.

7.4 Lockout/Tagout: All employees, agents, and representatives of the Contractor involved in servicing and maintenance of machinery, equipment, utilities, and/or facilities that have hazardous energy (i.e., electricity, hydraulic, pneumatic, steam, stored or residual energy, etc,.) in which unexpected start-up or release of stored energy could

cause injury to employees, must comply with OSHA regulation 29CFR1910.147, “the control of hazardous energy (lockout/tagout)”. The Contractor is required to comply with the Owner’s Lockout/Tagout Program when working at the Owner’s facility (or the Contractor must inform the Owner’s Safety Department of differences between the Contractor’s and the Owner’s Lockout/Tagout Programs). The Contractor will be responsible for providing its employees, agents, and representatives with Lockout/Tagout related hardware (i.e., locks, tags, lockout devices, hasps, etc.). A copy of the Owner’s written Lockout/Tagout Program can be obtained from the Owner’s Safety Department.

7.5 Confined Space: All employees, agents, and representatives of the Contractor performing work involving permit-required confined space entry must comply with OSHA regulation 29CFR1910.146. The Contractor is responsible for providing the required monitoring, protective, and rescue equipment necessary to perform permit-required confined space entry. A copy of the Owner’s written Confined Space Entry Procedure can be obtained from the Owner’s Safety Department.

7.6 Safety of Controlled or Hazardous Materials: The Contractor must take full responsibility for the following:

A. Should the Contractor, during the course of this project, encounter any type of hazardous material, chemicals, or any component thereof, the Contractor is to cease all efforts and remove all employees from the work area. The Contractor will contact the Owner’s Facilities Engineer and the Owner’s Safety Department within two (2) hours, and, in writing, define the concern and location of same.

B. Should the Contractor leave the work site due to any suspected or known hazardous materials, they will not return to the work site without authorization from the Owner’s Procurement Department.

C. Exiting from the work site, as stated above, will be considered a safety issue and will not be subject to remobilization or stand down costs.

PART 8. - CHANGES IN THE WORK

8.1 All changes shall be documented by a Change Order to adjust the contract amount. Changes may be either an add or a deduct. Changes may be initiated either by a Field Order from the Owner's Project Representative prior to determination of the final cost, or by a Change Order that is based upon the final agreed upon total cost. No change in the Work shall be made without the prior approval of the Owner.

8.2 Field Orders or other proposed changes in the Work can only be authorized by the Owner’s Project Representative. When a change is initiated, the Contractor shall provide the Owner's Project Representative with a proposal within 10 working days, unless both parties agree upon a different time period. The Contractor's proposal shall state the proposed cost of the change, with appropriate cost breakdown, any effect on the contract completion date, and pertinent information concerning the circumstances and scope of the change.

8.3 The cost of the change to be added or subtracted from the contract amount shall be calculated using one of the following methods:

A. By Unit Prices that are part of the approved contract or as agreed upon by the Owner's Project Representative.

B. A Lump Sum that is based upon the anticipated cost of labor, materials, equipment or large tool rental, and overhead and profit.

C. By Actual costs that are based upon documented labor and materials costs expended.

8.4 The overhead and profit markup on changes shall not exceed 15%. The markup for that portion of Work performed by a subcontractor shall be limited to 7.5%. A reasonable credit for overhead and profit shall be included in the amount of a deduct change. Overhead and profit includes expenses for estimating, change order processing, supervision, installation layout, small tools and supplies, job related general expenses, record drawings, and all other costs

relative to change order proposals and field and office supervision.

PART 9. - TIME FOR COMPLETION AND SUBSTANTIAL COMPLETION

9.1 The date of beginning the Work and the time of completion are essential conditions to the contract. All Work shall be prosecuted regularly and diligently and the Contractor agrees that the time for completion is reasonable.

9.2 The Contractor shall keep the Owner informed about Work activities, progress, delays, and anticipated completion date. Should delays be caused by reasons beyond the control of the Contractor, an extension of the contract completion date may be requested. Permitting the change shall not serve as a waiver on the part of the Owner of any right under the contract. The Contractor shall be responsible for damages resulting from delays that were not beyond the Contractor’s control.

9.3 When the Contractor considers that the Work is Substantially Complete, the Owner's Project Representative will conduct an inspection to verify completion of the Work and provide a list of any incomplete or defective Work. When in the judgment of the Owner's Project Representative the Work is Substantially Complete, notice will be provided to the Contractor and the Agency, a time will be fixed for completion of any remaining minor Punch List items, and responsibility will be established for operation, maintenance, and security.

PART 10. - CORRECTION OF THE WORK

10.1 Labor, materials, and equipment involved in the Work are subject to inspection at any time by the Owner. Labor, materials, and equipment that do not comply with contract requirements shall be replaced at the Contractor’s expense. Rejected items shall be immediately removed from the site.

10.2 If the Contractor neglects to perform the Work in accordance with the Contract Documents, the Owner may, after ten days written notice to the Contractor, repair the deficiency. The Owner will then issue a

change order to deduct from the amount owed the Contractor the cost of correcting the deficiency.

PART 11. - OWNER'S RIGHT TO TERMINATE CONTRACT

11.1 Should any provision of the contract be violated by the Contractor or any subcontractor, the Owner may serve written notice on the Contractor of its intention to terminate the contract and, unless the violation ceases and satisfactory corrections are made within ten days, the contract shall then terminate. The Owner will notify the contractor of the termination. The Owner may then take over and complete the Work by contract or otherwise and may take and use all materials on site necessary to complete the Work. The Contractor shall be liable for all excess costs involved in the completion.

11.2 The Owner shall also have the right to terminate this contract at any time without cause following the expiration of thirty days written notice to the Contractor. The Contractor shall be paid for all Work performed or expenses incurred prior to the date of termination. Expenses must be documented and shall not include lost profits. Materials not incorporated into the Work shall be turned over to the Owner.

PART 12. - CONTRACT SURETY AND PAYMENTS BY THE CONTRACTOR

12.1 A Payment and Performance Bond will not be required for the project unless such a requirement is included in the project documents. However, the following provisions for assurance of payment and performance do apply.

A. All contracts involving $30,000 or more require that the Contractor maintain a list of all subcontractors and suppliers performing labor or furnishing materials under the contract.

B. For contracts between $10,000 and $100,000, payments will generally be limited to a single payment for all Work upon completion of the project. Exceptions may be made for seasonal Work or Work delayed by the Owner. The Contractor shall provide a wavier of lien for

labor and materials provided for any partial payments authorized.

12.2 The Contractor shall within seven calendar days following receipt of payment from the Owner, make payment to each and every person or entity who furnished goods or services for the progress of the Work on the project, the value of which were included in the Contractors invoice or "Request and Certification for Payment". Upon request of the Owner, the Contractor shall furnish satisfactory evidence of payment under this article.

12.3 Prior to final payment, the Contractor shall furnish to the Owner a certification that all debts and claims have been paid or otherwise satisfied.

PART 13. - PAYMENTS TO THE CONTRACTOR

13.1 Requests for payment shall be in the form of an invoice from the Contractor, or in the form of a "Request and Certification for Payment", as determined in the notice to proceed. Any partial payments may have 10% of the amount retained until final payment is made.

13.2 All requests for payment shall be submitted to the Owner's Project Representative. The Contractor shall furnish any records or other satisfactory evidence requested by the Owner to establish the sum requested in the request for payment represents the value of Work completed.

13.3 Payments will not be made for incomplete or deficient Work. The Contractor shall certify that its invoice or request for payment is true and accurate and that all sums are earned and payable.

13.4 Final Payment will not be made until:

A. Project is substantially complete and all equipment tests and punch list items have been satisfactorily completed.

B. A certification has been submitted that all debts and claims have been paid or otherwise have been satisfied.

C. An affidavit of compliance with wage rates has been submitted, if applicable.

D. All record drawings, written warranties and special guarantees required for the project have been submitted.

E. All maintenance and operating instructions, part lists, description of control cycles and wiring diagrams, on-site training, keys or special tools have been completed or submitted as required.

13.5 Final payment to the Contractor constitutes a waiver of all claims by the Owner except those arising from unsettled liens, faulty or defective Work appearing after Substantial Completion, failure of the Work to comply with the Contract Documents, or terms of any special guarantees required by the contract.

13.6 Acceptance of final payment constitutes a waiver of all claims by the Contractor.

13.7 The Contractor may not assign any part of this contract or any money due under this contract without the written consent of the Owner.

13.8 The Contractor may receive progress payments upon furnishing a performance-payment bond equal to 100% of the contract amount.

13.9 The Contractor may be assessed liquidated damages if the Work is not completed within the allotted time per the Bid. The right of the contractor to proceed shall not be terminated or the contractor charged with liquidated damages because of any delays in the completion of the work due to unforeseeable causes beyond the control and without the fault or negligence of the contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather or delays of subcontractors due to such causes.

PART 14. - NONDISCRIMINATION/AFFIRMATIVE ACTION

14.1 In connection with the Work under this contract, the Contractor shall not discriminate against any employee

or applicant for employment because of age, race, religion, color, handicap, sex, physical condition, developmental disability, sexual orientation or national origin. This provision includes but is not limited to employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training including apprenticeship. Except with respect to sexual orientation, the Contractor shall take affirmative action to ensure equal employment opportunities.

PART 15. – SUBCONTRACTORS

15.1 Subject to approval by the Owner, the Contractor may subcontract portions of the Work to be performed under this contract. However, this does not relieve the Contractor from responsibility or liability for execution of the Work.

15.2 Requests for approval of subcontractors shall be submitted and approved in writing before their employment on the project. The Owner may request that the Contractor provide information to substantiate the proposed subcontractor's qualifications or ability to perform the Work.

PART 16. - WARRANTIES

16.1 The Contractor warrants to the Owner that all materials, equipment, and supply used in the Work are free from liens, claims or encumbrances, of good quality, and new unless otherwise permitted by the Contract Documents. The Contractor also warrants that the Work will be free from defects and strictly conform to the requirements of the Contract Documents.

16.2 The Contractor shall remedy and repair all defective Work and materials and pay for any damage to other Work resulting therefrom, which may appear within the warranty period, providing such defects and damages are not due to abuse or misuse by the Owner. The Owner will give notice of defects or damages with promptness.

16.3 The warranty period shall be one year from the date of Substantial Completion, or where warranties are

required in sections of the specification that are in excess of one year, the longer terms shall apply. The contractor will supply copies of manufactures' warranties for all equipment and other items deemed by the Owner as needed.

PART 17. – CLAIMS

17.1 In the event a dispute arises, the Contractor shall present its written claim to the Owner's Project Representative.

17.2 The Owner and the Contractor shall act in good faith to efficiently and fairly resolve claims and disputes arising under the contract. The Contractor shall proceed with the performance of the Work as directed by the Owner's Representative during the period of any claim or dispute.

PART 18. – INSURANCE

18.1 Insurance to be carried by the Contractor:
The Contractor shall not commence Work until the Contractor has obtained all the insurance required under this section and the Owner has approved such insurance. The Contractor shall not allow any subcontractor to commence Work until the insurance required of the subcontractor has been obtained and approved. The Contractor shall provide an insurance certificate showing coverage provided from a company licensed to do business in Arkansas. The Contractor may either require each subcontractor to maintain insurance equal to the following requirements or insure them under the Contractor's policy.

A. Workmen's Compensation Insurance: The Contractor shall maintain worker's compensation insurance as required by the laws of the state or the states in which the work is to be performed.

B. Employer's Liability Insurance: The Contractor shall maintain employer's liability insurance of not less than $100,000 per person/$300,000 for any one accident.

C. Public Liability Insurance: The Contractor shall maintain public liability insurance of not less

than $1,000,000 combined single limit per occurrence and annual aggregate. (Copy of certificate to be provided to the Owner).

D. If any part of the work hereunder is sublet, the Contractor shall provide Owner's and Contractor's Protective Liability Insurance having limits of not less than $1,000,000 combined single limit per occurrence and annual aggregate, plus name the Owner as an additional named insured. (Copy of certificate to be provided to the Owner).

E. Comprehensive Automobile Liability Insurance: The Contractor shall provide comprehensive automobile liability insurance limits of not less than $500,000 combined single limit per occurrence and annual aggregate.

F. Other Insurance: Such other insurance coverage may, from time to time, be required by the Owner with respect to performance hereunder.

G. Scope of Insurance and Special Hazards: The Contractor's commercial general liability insurance shall provide adequate protection against damage claims which may arise from operations under this contract, whether such operations be by the insured or by anyone directly or indirectly employed by the insured, and also against any of the special hazards which may be encountered in the performance of this contract. The Contractor is responsible for determining the special hazards that must be insured for on this project. Special hazards may include loading and unloading, excavating, filling, drilling, blasting, explosions, demolition, underpinning, elevator, or hoist. Insurer must also document on the insurance certificate that they have been notified, when applicable, of the Contractor's involvement in asbestos abatement and that insurance coverage provided specifically covers that activity.

PART 19. - CONSIDERATION OF BIDS

19.1 OPENING OF BIDS

Unless stated otherwise in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be opened and evaluated by Aerojet management. An abstract of the Base Bids and Alternate Bids, if any, will be made available to Bidders. When it has been stated that Bids will be opened privately, an abstract of the same information may, at the discretion of the Owner, be made available to the Bidders within a reasonable time.

19.2 REJECTION OF BIDS

A. The Owner shall have the right to reject any or all Bids and to reject a Bid not accompanied by any required bid security or by other data required by the Bidding Documents, or to reject a Bid which is in any way incomplete or irregular.

B. Whenever it is obvious from examination of the Bid Documents that it was the intent to submit a responsive bid and such bid (because of scrivener error), if accepted, would create a serious loss to the bidder, the Owner reserves the right to relieve the bidder and to reject his bid.

19.3 ACCEPTANCE OF BID (AWARD)

It is the intent of the Owner to award a Contract to the lowest responsible Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive any informality or irregularity in any Bid or Bids received and to accept the Bid or Bids which, in his judgment, is in his own best interests.

The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided herein, and to determine the low Bidder on the basis of the sum of the Base Bid and the Alternates accepted.

PART 20. - RECORD DRAWINGS

20.1 The Contractor shall keep a clean set of drawings at the jobsite at all times during the construction period upon which shall be marked neatly and accurately any and all deviations from the plans. Measurements as necessary shall be made by the Contractor to accurately portray and locate the "as constructed" work. These drawings shall be turned over to the Engineer at the end of the construction period for use in preparing the record drawings.

PART 21. - ACCESS TO RECORDS/MAINTENANCE OR RECORDS

21.1 The Contractor shall maintain accounts and records, including personnel, property, and financial records, adequate to identify other records as may be deemed necessary by the locality to assure proper accounting for all funds. These records will be available for audit purposes to the locality or the State or any other authorized representative, and will be retained for three years after contract completion unless permission to destroy them is granted by locality. Moreover, the locality, State, or any authorized representative shall have access to any books, documents, papers, and records of the Contractor which are directly pertinent to this contract for the purpose of making audit, examination, excerpts, and transcriptions.

PART 22. – INDEMNIFICATION

22.1 The Subcontractor or Contractor, as noted on the purchase order, by accepting the contract for this work, agrees to indemnify and hold harmless the Owner and the Engineer, their officers, employees, agents, and representatives from any and all claims, liabilities, losses and damages, costs or expenses, including reasonable attorney’s fees by reason of: a property damage or personal injury, including death or dismemberment, of whatever nature arising out of or as a result of or in connection with Subcontractor or Contractor, its employees, agents or lower tier subcontractors’ performance, expenses, or other charges incurred or anticipated to be incurred hereunder.

SECTION 01300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Work Included: The CONTRACTOR shall provide submittals for the ENGINEER's approval to show compliance with the specifications. Unacceptable submittals shall be revised and resubmitted as necessary until compliance with the specifications is achieved.

1.2 QUALITY ASSURANCE

A. Coordination of Submittals: The CONTRACTOR shall be responsible for reviewing the Specifications to ensure that the items being submitted conform in all respects with the requirements. All submittals shall be provided to the ENGINEER at least 1 week prior to commencing work on the items being submitted.

B. Substitutions:

(1) The CONTRACTOR is bound to the standards of quality established in the Contract Documents. Refer to Section 6.2 of the General Conditions regarding "Equal/Substitution".

(2) The substitution of materials, equipment or methods shall not be permitted unless prior approval for the substitution has been given in writing by the ENGINEER.

(3) The CONTRACTOR shall certify that the proposed substitution has been determined to be equal or superior to the product and/or construction method specified. The proposed substitution shall be in complete compliance with the provisions in the Contract Documents.

PART 2 - PRODUCTS

2.1 SUBMITTALS

A. General: The CONTRACTOR shall comply with Section 6.2 of the General Conditions regarding "Shop Drawings and Submittals".

B. Submissions: Submittals will be stamped by the ENGINEER in one of the following ways:

(1) "No Exceptions Taken" - No exceptions are taken, subject to compliance with the Contract Documents.
(2) "Furnish as Corrected" - Minor corrections are noted and a resubmittal is not required, subject to compliance with the corrections and the Contract Documents.
(3) "Rejected - See Remarks" - The submittal material, method or system is totally rejected and does not meet the intent of the Specifications.
(4) "Revise and Resubmit" - Revise prior to resubmittal is required.

C. Submission Procedures: The CONTRACTOR shall provide a minimum of 6 copies of each submittal to the ENGINEER for review. The ENGINEER will retain 2 copies, the OWNER’S representative receives 1 copy, the OWNER receives 2 copies, and the CONTRACTOR receives the remaining copy.

2.2 SHOP PLANS

A. Scale and Measurements: Shop plans shall be to a scale sufficiently large to show all pertinent aspects of the item.

B. Review Comments: The ENGINEER will show all review comments on each copy of the submittal to be distributed as stated in Section 2.1.

2.3 MANUFACTURER'S LITERATURE

General: The CONTRACTOR shall provide all manufacturer's data pertinent to the submittal, clearly showing which portions of the contents are being provided for review.

2.4 OPERATION AND MAINTENANCE MANUALS

General: The CONTRACTOR shall provide the ENGINEER, prior to submitting the 50 percent pay request, 4 copies of complete operation and maintenance manuals and other written recommendations for operation, as provided by the manufacturer.

2.5 RECORD PLANS

General: The CONTRACTOR shall submit to the ENGINEER certified record plans of the project in accordance with the requirements of the General Conditions.

PART 3 - EXECUTION

3.1 IDENTIFICATION OF SUBMITTALS

A. Numbering: All submittals shall be consecutively numbered. Resubmittals shall cite the original submittal number for reference.

B. Transmittal: Each submittal shall be accompanied by a transmittal letter showing all the information required for identification and checking, including the appropriate Specification sections.

C. Submittal Log: The CONTRACTOR shall maintain a submittal log for the duration of the Work that indicates current status of all submittals. The submittal log shall be available to the ENGINEER at all times for their review.

3.2 ENGINEER'S REVIEW

A. General: Review by the ENGINEER does not relieve the CONTRACTOR from responsibility for errors which may result from the submitted data.

B. Revisions: All revisions requested by the ENGINEER will be required. If the CONTRACTOR is considering any required revision to be changed, he shall notify the ENGINEER as provided in the General Conditions.

SECTION 02110
CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

A. Clearing - The removal of fences, trees, logs, brush, vegetation, rubbish and other objectionable material found above ground level.

B. Grubbing - The removal of roots, stumps and other objectionable material found below ground level.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Not Applicable.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.1 CLEARING

A. WATER AND SEWER LINES - The contractor shall clear the construction easement as required for the operation of his equipment. The entire width of the easement need not be cleared; only trees, brush, etc., inside the working easement shall be cut. Trees, logs, and other construction debris may be temporarily stored on the construction easement on the initial work.

B. BUILDINGS, ROADWAYS AND LEVEES - The contractor shall clear the area designated for clearing on the drawings.

3.2 GRUBBING

A. Limits of grubbing shall be designated on the plans.

B. Stumps, roots and other material shall be removed to a depth of 12 inches.

C. Footings shall be grubbed to the footing depth shown on the plans.

3.3 UTILITIES

The removal of existing utilities required to permit an orderly progression of the work will be done by local agencies, unless otherwise shown on the plans. Whenever power, telephone or telegraph poles, conduit, pipeline, sewer or other utilities encountered must be removed or relocated to complete the project, the contractor shall notify the Engineer who will notify the local owner and attempt to get prompt action. The contractor will cooperate with the local utility owners in maintaining service to include areas within the project limits and contiguous to the project.

3.4 DISPOSAL

A. Spoiled material shall be burned or removed to approved disposal areas. Ashes shall be spread or removed.

B. The contractor shall be responsible for controlling fires in compliance with all Federal, State and Local laws or regulations.

3.5 PRESERVATION OF TREES, ETC.

All trees designated for preservation that become damaged resulting from the contractor's operation shall be repaired by dressing, cutting and painting as directed by the Engineer.

3.6 CLEANUP

Upon completion of the work, the entire site within the project area shall be cleaned up, graded and left in a neat manner, free of the above mentioned items of debris. All cleanup shall be performed to the satisfaction of the Owner and the Engineer

3.7 BASIS OF PAYMENT

There shall be no special pay item for clearing and grubbing, unless otherwise noted in the bid. The cost for this item of work shall be included in the contract price for the several items and will not be paid for separately, unless otherwise noted in the bid.

SECTION - 02220
SITE & STRUCTURAL EXCAVATION, BACKFILLING AND GRADING

PART 1 - SCOPE

1.1 WORK INCLUDED IN THIS SECTION

A. Site Excavation - The removal of soil accurately to the line and grade shown on the plans and as established by the Engineer. Includes water and sewer line trenches, foundation excavation, etc. This work is conducted after all clearing and grubbing.

B. Site Grading - All work required to bring the soil elevation to the proper elevation below foundations, in trenches, around buildings, around foundations, etc. Includes finished grade work with topsoil and seeding.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Clearing and Grubbing - Section 02110.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.1 EXCAVATION OF TRENCH FOR WATER AND SEWER LINES

Trenches for water and sewer lines shall be of the width and depth necessary for the proper installation of the pipe. All pipe lines shall be laid in trenches of such depth as to provide a minimum cover of thirty inches (30) over the top of the pipe barrel unless otherwise shown on the plans. Contractor shall increase depth as necessary for crossing other pipe lines and to provide required cover for valves and valve boxes. Trench will be deepened to the extent necessary so as not to exceed the maximum permissible deflection of the pipe being installed, with maximum permissible deflection being as recommended by the pipe manufacturer.

Width of pipe trench for all water lines shall be adequate for the installation of the pipe and make-up joints, but in no case shall the width of the trench at the top of the pipe be wider than the outside diameter of the pipe plus two (2) feet.

The bottom of the trench shall be accurately graded so that the pipe will be in continuous and uniform contact with and have a longitudinal bearing on undisturbed soil for the full length of the pipe, except for such distance as necessary for adequate bell holes and proper sealing of the pipe joints. If water is encountered in the trench, appropriate dewatering shall be performed by the Contractor.

If the soil at the bottom of the trench is mucky or if the subgrade is too soft to properly support the pipe, the Contractor shall excavate below the lower extremity of the pipe as shown on the plans and place a cushion of sand, gravel or crushed stone in the trench to receive the pipe. Gravel or crushed stone used for this purpose shall not exceed 3/4" in size.

Refer to the water and sewer line sections of these specifications for other requirements regarding water and sewer lines.

3.2 STRUCTURAL EXCAVATION

The Contractor shall perform all structural excavation required by the plans. Excavation shall extend a sufficient distance from walls and footings to allow for forms and for proper inspection, except where the plans indicate that concrete may be deposited directly against excavated surfaces.

3.3 CLASSIFICATION AND FINISHED GRADE

All excavation, both in trench and for structure, shall be unclassified.

The Contractor shall perform all finish grading as indicated by the plans. Any backfill required for finish grading shall be placed in approximately six (6) inch lifts and shall be compacted until the material is of the same density as the undisturbed earth in the sides of the excavation.

Upon completion of this work, the work area shall have a clean, neat appearance and be free of all objectionable debris or material. Sodding and/or seeding as called for on the plans or specifications shall be placed immediately after completion of the finish grading in accordance with the plans and as called for by these specifications.

3.4 FILL UNDER CONCRETE FLOORS

A. Cut or fill areas as required to produce construction elevations shown on the drawings.

B. Fill material for underfloor area shall be inorganic, non-expansive clay, or clay gravel meeting Public Roads Administration Classification A-1, A-2, A-3, or A-4. The proposed fill material shall be tested in an established soil mechanics laboratory using modified proctor test ASTM D-1557-78. Necessary testing shall be paid for by the Contractor. Laboratory, test reports and fill material shall be approved by the Engineer before any fill material is delivered to the site.

C. Fill shall be placed in horizontal layers not over six inches deep. Each layer shall be compacted with machine or hand tampers to a density of 95% of maximum density obtained in the laboratory by the proctor test mentioned above. Contractor shall furnish and pay for two such tests, if required, during the filling operation, plus any other retesting that might be necessary to verify compliance with compaction requirements.

D. Under slabs place six-inch (6") thickness of drainage fill. This shall be either crushed rock or stone, washed bank gravel, or clean creek gravel mixed with sand. Submit sample of proposed fill for approval of Engineer before hauling begins. Largest size shall not exceed 1-1/2". Fill shall be tamped or vibrated to uniform compaction and grade.

3.5 BACKFILLING

After the Engineer has inspected the foundations and the work has taken its final set, the Contractor shall backfill with material originally excavated, in layers of 6" thickness; each layer to be thoroughly tamped before succeeding layer is placed. The backfill shall be high enough to drain water away from all walls.

3.6 WATER

Should water be encountered or caused by rainfall, the Contractor shall keep same pumped out of excavations until concrete is poured.

3.7 SITE GRADING AND FILL

A. Finish grade at wall lines shall be as shown on drawings. Fill or cut to this grade as required. Top 4" of outside grading

shall be top soil.

B. Finish site grading shall be extended out from building as shown on the drawings.

3.8 BENCH MARK

The elevations shown on the drawings relative to construction heights and grade line levels shall be determined from an established bench mark.

3.9 DISPOSITION OF UTILITIES

Rules and regulations governing the respective utilities shall be observed in the execution of all excavations, fills and site work. Inactive or abandoned utilities encountered shall be removed, plugged or capped.

3.10 CLEANING

Complete the grading operations after the building is finished, utilities installed, etc., removing from the site all materials, rubbish and debris. Leave finish grading clean.

3.11 SEEDING

When seeding is required the Contractor shall spread topsoil over the area disturbed by construction operations. The Contractor may utilize topsoil stockpiled on the site to give the seeding area at least a 4" covering of topsoil. The Contractor shall furnish all additional topsoil necessary to complete the aforementioned requirement.

The area shall then be seeded with a mixture of one-half fescue and one-half bermuda seed at a rate of not less than 50 lbs. per acre. The seeded area shall be watered by the Contractor until there is a sufficient stand of grass to prevent erosion. The Contractor shall repair all eroded areas and reseed as above all areas where grass does not grow. The Contractor shall mow the grass at least twice before final job acceptance.

3.12 MEASUREMENT AND PAYMENT

The cost of all excavation of water line trenches for the installation of pipe and appurtenances, will be considered

subsidiary to the cost of pipe or appurtenances, and no trench excavation will be measured or paid for separately. Sewer line trenches will be paid for as described in that portion of the specifications.

All structural excavation will be considered subsidiary to the cost of the appropriate unit contract price as given in the proposal. The volume of structural excavation, without regard to any changes which may occur during the prosecution of the work, will not be measured or paid for separately.

Contract unit price for the appropriate item shall include all shoring, dewatering, backfilling, maintenance of backfill, disposal of waste, and all other work incidental thereto.

All finish grading will be considered subsidiary to the cost of the appropriate unit contract price as given in the proposal and none will be measured or paid for separately.

SECTION 02221
TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

This section shall consist of excavation of trench, bedding of pipe and backfilling of trench.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Not applicable.

1.3 QUALITY ASSURANCE

A. Materials which have been rejected shall be removed from the job site.

B. Bedding or backfill that do not conform to the specifications shall be removed or reworked until the specifications are met.

1.4 PROTECTION

A. Existing Property –

(1) The contractor shall exercise reasonable care in excavating trenches for water lines or sewer force mains in order not to interfere with or damage existing improvements on public or private property. Any property damaged shall be replaced or repaired by the contractor at his own expense.

(2) Shrubs and ornamental trees along the centerline of trench shall be removed before and replaced after the pipe laying operation.

(3) The contractor shall restore the disturbed surfaces to as nearly original grade and conditions immediately after pipe laying and shall completely fill any areas where trench settlement has occurred and shall dress-up the construction area before the final inspection. The contractor shall also maintain the roadway and driveway trenches

throughout the period of construction and specified maintenance period so as to permit traffic to cross these trenches without hazard at all times. This work shall be considered a part of the pipe laying cost (except asphalt and concrete surfaces cut and replaced), and will not be paid for separately.

(4) The contractor shall conform to any requirements and regulations of the Arkansas State Highway and Transportation Department, relative to the crossing of highways, and to the trenching inside the highway rights-of-way, and also in compliance with the regulations of the railroad company relative to all railroad crossings.

(5) Brush and slash may be disposed of in the woods (with Owners permission). Stumps and rock too large for placement in the trench must be removed from the jobsite.

(6) Retainage in addition to normally retained amounts may be withheld by the Owner (max $0.25/LF) for not keeping up with clean-up.

B. Existing Utilities –

(1) The contractor shall be responsible for determining the exact location of existing utilities.

(2) Any utility line that is cut must be reported to the Owner and repaired immediately in order to maintain service to the customers. These repairs are considered part of the pipe laying cost and will not be paid for separately.

(3) The contractor shall coordinate with the utility company and the Owner in the event that utilities must be shut off.

1.5 SITE CONDITIONS

A. Excavations –

(1) Trenches and other excavations more than five feet deep (or less when hazardous ground movement is expected) shall be shored, laid back to a stable slope or some other means of protection provided (such as trench boxes) where employees may be exposed to moving ground or cave-ins.

(2) Additional precaution (shoring or bracing) shall be installed when trenches are exposed to vibrations (railroad, highway or machinery) or adjacent to backfill. Cross braces or trench jacks shall be placed in true horizontal position, be spaced vertically and be secured.

(3) Trenches over five feet deep shall have ladders or stairs every 50 feet.

(4) In all events all excavations and trenches shall be in compliance with all codes and ordinances especially the OSHA "Construction Standards for Excavations" 29CFR Part 1926.650 through 1926.652 Subpart P.

B. Dewatering - If dewatering is required, the contractor shall exercise care not to allow water to damage existing property or damage bedding.

C. Explosives –

(1) If explosives are used by the contractor to loosen rock, the contractor shall be responsible for obtaining any necessary permits and to carry insurance to hold the Owner and hold the Engineer harmless against any claim for injury or damage to persons and property resulting from the use of explosives.

(2) Explosives and caps shall be stored in accordance with applicable laws and regulations.

(3) Blasting mats or other approved devices shall be used at all times.

PART 2 - PRODUCTS

2.1 BEDDING

A. Water Main Bedding - Shall consist of naturally occurring soil or sand having a maximum particle size of 3/4 inch.

B. Sewer Main Bedding –

(1) CLASS I: Angular, 1/4" to 1 1/2" graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone or crushed shells.

(2) CLASS II: Coarse sands and gravels with maximum particle size of 1 1/2", including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types included in this class are: GW, GP, SW & SP.

(3) All sewer pipe must be bedded with one of the above materials. A tolerance of 3 percent will be allowed on particle size.

2.2 BORING OF HIGHWAY AND RAILROADS

A. Boring of highway and railroads for encasement pipe shall be constructed in accordance with the specifications of the Arkansas Highway and Transportation Department or the Railroad Company.

B. Pipe for encasement will be standard weight new steel pipe for Railroad crossings. For highway crossings, new steel pipe shall be used in thicknesses allowed by the Arkansas Highway Department, otherwise standard weight steel pipe will be used.

C. Spacers similar and equal to PSI Model PE and encasement seals similar to PSI Model W shall be used with all encasement pipe. No used pipe or fabricated seals will be allowed.

2.3 BACKFILL

A. WATER LINES - Initial backfill material shall consist of select soil (maximum particle size of 3/4 inch for angular rock or 1 1/2 inch for rounded rock) in accordance with A.W.W.A. C605-94. The initial backfill shall be carefully with rock fragments placed over the pipe until 12 inches of cover has been obtained over and around pipe.

B. SEWER LINES - Initial backfill material shall consist of select soil placed from the springline or top of pipe to a point above the top of the pipe and tamped in place. Select soil shall be good earth, sand, or gravel (maximum particle size 1-1/2") free of larger rock; hard, lumpy material; or spongy, wet, organic or otherwise unsuitable material.

C. Remaining backfill (called general backfill) shall be select material free of stones (maximum particle size of 6 inches). Stones or rock larger than 6 inches shall be removed from the work site.

D. The backfill shall be well rounded over the trench and as settlement occurs, the trench shall be refilled and maintained by the addition of material, if required.

E. Gravel surfaces (both driveways and county roads) cut shall be repaired by backfilling the entire depth of the trench with SB-2 or GB-2 as defined by the Arkansas Highway and Transportation Department.

PART 3 - EXECUTION

3.1 TRENCH EXCAVATION

A. Trenches shall be excavated to the depth specified. In the event rock is encountered in the excavation, the trench must be excavated to a depth not less than six (6) inches below grade and then filled back to grade with bedding material. There shall be no additional payment for the excavation of rock or the placing of the bedding in the bottom of the trench.

B. Rock or other unsuitable material excavated which

is not suitable for backfill shall be removed from the job site.

C. Trench Width - Water mains shall be of sufficient width for the proper installation of the pipe. Maximum widths are as follows:

PIPE SIZE	TRENCH WIDTH(Maximum)
1" - 3"	18"
4" - 8"	30"
10" - 12"	36"

The bottom of the trench shall be graded to a line so that the pipe as nearly as possible will have a bearing for its full length except at the couplings and fittings.

3.2 SEPARATION OF WATER AND SEWER LINES

A minimum 18-inch vertical separation (water over sewer) must be maintained whenever lines cross, otherwise a 10-foot horizontal separation must be maintained between water and sewer lines.

3.3 DEPTH OF TRENCH

Except when otherwise shown on the drawings, or herein specified, all water main trenches shall be constructed to a minimum depth of 36 inches; however, extra depth allowing a minimum cover of 30 inches is required on large diameter pipe. Pipe shall be laid deeper whenever necessary in order to maintain the required grade or in order to avoid obstructing other lines, water ways, etc. At creek, ditch, or box culverts, the excavation shall be carried down sufficiently to give the proper cover. The descent shall be on a gradual grade so as not to exceed the allowable designed deflection of the pipe being used.

Where culverts or other pipe lines may be encountered, the water line shall be placed at such depth as to be under the culvert of pipe line. The construction of water lines exposed through culverts and bridges will not be permitted. Where creek crossings are encountered, the water line shall be placed so that there is not less than 36" from the top of the bell or coupling to the natural bottom of the creek. Concrete encasements may be required wherever deemed necessary by the

Engineer.

3.4 METHOD OF PAYMENT AND MEASUREMENT

A. The trenching for the gravity sewers shall be paid for at the unit price per lineal foot for the various depths as set out in the proposal. Such payment shall constitute full compensation for labor, equipment, trench gravel, clean-up, and tools necessary for common excavation as specified.

B. Trenching for water and force main piping shall be subsidiary to the pipe laying and shall be included in the various sizes of pipe . Trenching will not be measured or paid for separately.

C. Permanent type pavement to be removed and replaced at street and driveway crossings shall be measured and paid for by the square yard based on the width actually cut to a maximum width of 36 inches, except in the case of highway crossings, which shall be measured in place.

D. Gravel surfaces cut and repaired shall be subsidiary to the trenching and will not be measured or paid for separately.

E. Rock excavation shall be subsidiary to the trenching and shall be included in the unit price for laying the various sizes of pipe and will not be paid for separately.

F. Encasement pipe shall be measured and paid for by the lineal foot in place, which shall include all cost of material, labor, and boring.

G. All items of work in this section shown on the plans or called for in the specifications which are not given in the list of variable quantities shall be included in the various unit contract prices of work.

SECTION 02270
SLOPE PROTECTION AND EROSION CONTROL

PART 1 - GENERAL

1.1 Furnish and install all materials and labor necessary for revegetation (seeding) of those areas disturbed by construction operations which are inside the boundaries of the National Forest or called for on the plans.

1.2 Measurement and Basis of Payment:

All items of work called for under this section of the specifications shall be paid for under the appropriate lump sum item or items as listed in the proposal and none shall be measured or paid for separately.

PART 2 - PRODUCTS

2.1 Seed:

Seed for revegatation shall consist of K-31 Fescue, Orchard Grass, and White Dutch Clover.

2.2 Fertilizer:

Fertilizer shall be 12-24-12 commercial grade fertilizer.

PART 3 - EXECUTION

3.1 Soil Preparation:

All areas to be seeded shall have the top 1/2 inch of surface soil in loose condition. Scarification shall be done with a springtooth harrow or equivalent. Fertilizer shall be applied uniformly either prior or after soil preparation. Seed shall be applied uniformly after soil preparation.

3.2 Application Methods:

Application Methods for Seed and Fertilizer - Mechanical seeders, seed drills, cultipacker seeders, fertilizer spreaders or other approved mechanical seeding equipment shall be used to apply seed or seed and fertilizer. Hand operated seeding devices may be used to apply seed and fertilizer.

3.3 Application Rates:

A. Seeding Rates:

Seed	Lbs./Acre
K-31 Fescue	15
Orchard grass	20
White Dutch Clover	4

B. Fertilizer - Fertilizer shall be spread at a rate of 400 lbs. per acre.

SECTION 02300
EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work Included: Excavate and grade in the areas designated in the Contract Documents as shown on the grading plan and specified herein, which shall include but not be limited to, the following:

(1) Excavation and site preparation.

(2) Grading to establish subgrades for slabs, walks, pavements, gravel surfaces, and grassed areas.

(3) Excavation, filling and backfilling and compaction.

(4) Dewatering or addition of water as required.

(5) Placing of topsoil and finish grading.

B. Related Sections: Additional Sections of the Documents which are referenced in this Section include:

(1) Section 01330 - Submittal Procedures

1.2 REFERENCES

A. General: The work shall comply with the most recent standards or tentative standards as published at the date of the contract and as listed in this specification using the abbreviation shown.

B. American Society for Testing and Materials (ASTM):

(1) D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

(2) D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

(3) D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

(4) D 2167 - Standard Test Method for Density and Unit Weight of Soil In Place by the Rubber Balloon Method

(5) D 2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

(6) D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

(7) D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

(8) D 2937 - Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method

(9) D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

(10) D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.3 DEFINITIONS

A. Controlled Fill: Controlled fill is fill required in all areas on which final grade is not placed on original excavated soil.

B. Unclassified Excavation: For the purposes of payment, material shall not be classified regardless of the type of material encountered.

C. Satisfactory Materials: Materials classified by ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC, ML, and CL are satisfactory as fill for overlot grading and are satisfactory in-situ. Materials shall have a minimum compacted density of 95 pounds per cubic foot and a plasticity index in excess of 15.

D. Unsatisfactory Materials: Materials classified by ASTM D 2487 as OL, OH, MH, CH, and PT are unsatisfactory in-

situ and as fill. Unsatisfactory materials also include those materials containing roots and other organic matter, trash, debris, frozen materials, and stones larger than 4 inches. Fill materials containing stones larger than 4 inches shall not be used in the uppermost 2 feet.

E. Cohesionless and Cohesive Materials: Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the minus #40 fraction has a plasticity index of zero as classified by ASTM D 4318.

F. Degree of Compaction: Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 698 or ASTM D 1557 as specified, abbreviated below as a percent of laboratory maximum density.

G. Topsoil: Material obtained from excavations, suitable for topsoils shall consist of friable clay loam, free from roots, stones, other undesirable material and shall be capable of supporting a good growth of grass.

H. Geotechnical Engineer: A representative of a commercial geotechnical testing laboratory which will be used by the CONTRACTOR to provide the required quality assurance testing.

1.4 SYSTEM DESCRIPTION

Soil Bearing Capacity: Soil underneath all footings and structures not supported by piles shall have a minimum bearing capacity of 2000 pounds per square foot.

1.5 SUBMITTALS

A. General: Submittals shall be in accordance with Section 01330 – Submittal Procedures. Copies of all test results and field and office worksheets shall be furnished to the ENGINEER within 72 hours after the tests are complete.

B. Test Reports: The testing agency shall submit following

reports, in duplicate, directly to ENGINEER from the testing services, with copy to the OWNER and CONTRACTOR.

(1) Test report on borrow material for soil classification.

(2) Field density reports and map of test location.

(3) One optimum moisture-maximum density curve for each type of soil used for controlled fill.

(4) Other reports of any testing hereinafter specified deemed necessary by Soils Engineer or requested by the OWNER and/or ENGINEER.

(5) A test location plan shall be included with each submittal.

1.6 QUALITY ASSURANCE

A. Geotechnical Engineer: The CONTRACTOR shall retain a licensed independent Geotechnical Engineer and Test Laboratory approved by the ENGINEER to insure that earthwork meets the requirements of the specifications for density and moisture content. The Geotechnical Engineer shall attend the Pre-Construction Conference.

B. Inclement Weather: When fill operations are ceased due to weather (rain, freezing, snow, etc.), construction shall not be resumed until the Geotechnical Engineer has verified soil strength has not been adversely affected. If soil strength has been decreased, the affected portion of fill shall be rescarified, moistened, or dried as required and recompacted to the specified density.

C. Inspection: The CONTRACTOR shall conduct daily inspections and more often if necessary to verify that the specifications are being met for the installation of materials.

D. Coordination: The CONTRACTOR shall coordinate the work with the OWNER's Project Representative (PR) by notifying the PR of scheduled work in advance. The CONTRACTOR shall coordinate work with other trades whose work will be affected on the site.

E. Utilities: Prior to any excavation the CONTRACTOR shall

verify the locations of all utilities which may be in the area.

F. Drainage: The CONTRACTOR shall be responsible for the proper drainage of the site during construction of the project. Water shall not be allowed to accumulate in any of the excavated areas. Storm or ground water collecting on site during construction shall be removed by pumping, ditching, or other suitable means.

1.7 PROJECT CONDITIONS

A. Test Borings: A subsurface investigation has been made at the site of the project in order to ascertain character of materials to be excavated. This information is available upon request for general information only. Attention is directed to the fact that these logs indicate materials encountered at boring locations only. Nothing in plans or specifications shall be taken as a guarantee that materials other than those disclosed by borings will be encountered or that proportions of various materials will not vary from those indicated. If the CONTRACTOR has any questions or desires additional information it is his responsibility to acquire this information at his own expense. All excavation for project is to be considered and bid as "unclassified" and no allowances will be made for rock encountered or removal and replacement of unsuitable material.

B. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

Should uncharted, incorrectly charted, unmarked in field, or incorrectly marked in the field, piping or other utilities be encountered during excavation, CONTRACTOR shall consult utility Owner immediately for directions. CONTRACTOR shall cooperate with OWNER and utility companies in keeping respective services and facilities in operation, and shall repair or arrange for repair, damaged utilities to satisfaction of utility owner.

C. Protection of Persons and Property: Barricade open excavations occurring as part of this work as required by

state and federal regulations. The CONTRACTOR shall protect structures and adjacent equipment from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials: All fill materials shall be free from mud, refuse, construction debris, organic material, rock or gravel greater than 4 inches in any dimension, frozen or otherwise unsuitable material. Materials for fills shall be secured from excavation after rejection of any unsuitable materials. Materials from other sources may be used upon approval by the Geotechnical Engineer.

B. Borrow: Material for use in replacing undercut areas or in construction of embankments shall be approved by the Geotechnical Engineer and obtained from approved sources.

C. Rock: Rock shall be removed to a minimum depth of 12 inches below the subgrade elevation. The excavated area shall be brought up to subgrade with approved material placed and compacted as described herein.

D. Porous Fill:

(1) For areas under on grade slabs, use clean, washed gravel or crushed stone which is free of clay, vegetable matter, loam or other deleterious matter.

(2) Material shall be ASTM D 448 #68 stone, unless shown otherwise on the plans.

E. Unsuitable Materials: Areas that exhibit excessive pumping or that do not meet density requirements due to unsuitable material as determined by Geotechnical Engineer shall be undercut and replaced with approved material in accordance with Part 3, Execution.

PART 3 - EXECUTION

3.1 TOPSOIL

A. Conservation of Topsoil: Topsoil shall be removed as

required without contamination with subsoil and stockpiled convenient to areas for later application or at locations specified. Any surplus of topsoil from excavations and grading shall be stockpiled in location approved by the OWNER. A silt fence shall be installed on the downslope side and the stockpiles seeded.

B. Placing Topsoil: On areas to receive topsoil, the compacted subgrade shall be scarified to a 2 inch depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry.

3.2 EXCAVATION

A. Excavation: Excavation shall be unclassified. After topsoil removal has been completed, excavation of every description, regardless of material encountered, within the grading limits of the project shall be performed to the lines and grades indicated. Satisfactory excavation material shall be transported to and placed in fill areas within the limits of the work. All unsuitable material including any soil which is disturbed by the CONTRACTOR's operations and surplus material shall be disposed of at locations off site secured by CONTRACTOR and approved by the OWNER. Excavations carried below the depths indicated, shall, except as otherwise specified, be refilled to the proper grade with satisfactory material as directed. All additional work of this nature shall be at the CONTRACTOR's expense. Excavation and filling shall be performed in a manner and sequence that will provide drainage at all times. Excavations shall be kept free from water while construction therein is in progress. If the CONTRACTOR fails to provide adequate drainage and any material becomes soft or otherwise unsuitable as a result, such material shall be removed and replaced with satisfactory on-site material or borrow material from approved sources, or shall be dried and recompacted as directed by the Geotechnical Engineer at no additional cost to the OWNER. Fill areas and slopes may be adjusted to balance earthwork quantities as approved by the ENGINEER. Material required for fills in excess of that produced by excavation within the grading limit shall be obtained from borrow areas at the CONTRACTOR's expense.

B. Unauthorized Excavation:

(1) Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific instruction from the ENGINEER or the Geotechnical Engineer.

(2) Under footings or foundations, fill unauthorized excavations by extending the indicated bottom elevation of the footing or base to the unauthorized excavation bottom, but in no way altering the required top elevation.

(3) Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations, unless otherwise directed by the Geotechnical Engineer.

C. Stability of Excavations: Maintain sides and slopes of excavations in a manner such that the excavation provides safety of personnel, protection of work, and compliance with requirements of governmental agencies having jurisdiction.

3.3 FILL

A. Preparation of Ground Surface for Fill: All vegetation such as roots, brush, heavy sods, heavy growth of grass, and all decayed vegetative matter, rubbish, and other unsatisfactory material within the area upon which fill is to be placed, shall be stripped or otherwise removed before the fill is started. In no case will unsatisfactory material remain in or under the fill area. The areas shall then be scarified to a depth of at least 6 inches, moistened or aerated as required and compacted with vibratory rollers, pneumatic rollers, sheepsfoot rollers or other mechanical means acceptable to the Geotechnical Engineer. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed shall be plowed, stepped, benched, or broken up, as directed, in such manner that the fill material will bond with the existing surface. Prepared surfaces

on which compacted fill is to be placed shall be wetted or dried as may be required to obtain the specified moisture content and density.

B. Fills and Embankments: Fills and embankments shall be constructed at the locations and to lines and grades indicated. The completed fill shall conform to the grading plan indicated. Approved material obtained during excavation may be used in forming required fill. Fill shall be satisfactory material and shall be free from roots, other organic material. No frozen material will be permitted in the fill. Stones having a dimension greater than 4 inches shall not be permitted in the upper 2 feet of fill or horizontal embankment. The material shall be placed in successive horizontal layers of 6 inches in loose depth for the full width of the cross section and shall be compacted as specified. Each layer shall be compacted before the overlaying lift is placed. Moisture content of the fill or backfill material shall be adjusted by wetting or aerating as necessary to provide the moisture content specified.

C. Stone Aggregate: A layer of ASTM D 448 #68 stone shall be placed underneath concrete slabs and footings at the locations shown on the plans. Stone depth shall be 6 inches where not shown otherwise on the plans.

3.4 COMPACTION

A. Subgrade Compaction: The cut sub-grade material shall be compacted to 95 percent of its maximum dry density as determined by ASTM D 698. The moisture content should be within +/-3 percentage points of the material's optimum as determined by ASTM D 2216.

B. Compaction: Each layer of the fill shall be compacted to at least 95 percent of the maximum theoretical density as determined by ASTM D 698. Moisture content shall be within +/-3 percent of optimum as determined by ASTM D 2216.

3.5 PROTECTION

Site Preservation: The CONTRACTOR shall protect newly graded areas from traffic and from erosion, and any

settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes. All work shall be conducted in accordance with the Erosion Control provisions of these specifications.

3.6 FIELD QUALITY CONTROL

A. Testing: Testing shall be the responsibility of the CONTRACTOR and shall be performed by an approved commercial testing laboratory qualified to perform such tests and approved by ENGINEER. Standard Proctor tests conforming to ASTM D 698, shall be made by the Geotechnical Engineer or his representative on each soil type found in the areas prepared to receive fill and in the soil to be used for fill. Field Density tests shall be made by the Geotechnical Engineer or his representative in accordance with ASTM D 1556 or ASTM D 2922 and ASTM D 3017 on the areas prepared to receive fill and on each layer of compacted fill. Testing shall be the responsibility of the CONTRACTOR and shall be performed at no additional cost to the OWNER. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted if necessary by the procedure described in ASTM D 2922, paragraph “ADJUSTING CALIBRATION CURVE”. ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture gauges along with density calibration checks as described in ASTM D 3017. ASTM D 2937 shall be used only for soft, fine-grained, cohesive soils. At least one test shall be performed on the compacted backfill. More tests shall be performed if in the judgment of the PR or ENGINEER the compactive effort of the CONTRACTOR will not result in the specified density.

B. Testing Frequency: The following submittals are required.

1) A minimum of one moisture-density test shall be performed for each classification of fill material, and existing subgrade material.

2) One Atterberg limits test and one gradation analysis is required for every six field density tests.

3) Field density tests shall be performed as follows: a minimum of two tests per lift are required for fill material and a minimum of two tests per lift are required for subgrades prior to filling.

C. Visual Inspection: Upon completion of all excavation of unsuitable material, and for all footings, the Geotechnical Engineer shall visually inspect the subgrade and excavations. The visual inspection shall be conducted to assure that the data obtained from the test borings and used as a basis of design was representative of the site conditions. Upon completion of the inspection, the Geotechnical Engineer shall provide written notification to the OWNER and ENGINEER.

D. Proof Rolling: Following visual inspection, CONTRACTOR shall demonstrate to the Geotechnical Engineer that the exposed subgrade does not contain previously unidentified soft areas by proof rolling. Proof rolling shall consist of rolling the entire surface with approved mechanical equipment while observing the subgrade for displacement or deformation.

SECTION 02610
INDUSTRIAL SEWER LINES AND FORCE MAINS

PART I - GENERAL

1.1 DESCRIPTION OF WORK

The work to be performed under this section of the specifications shall consist of furnishing and installing sewer pipe and force mains; including all clearing, grubbing, excavation, sheeting and shoring, dewatering, pipe laying, jointing, testing, backfilling and any other work that is required or necessary to complete the work as shown in the plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Clearing and Grubbing:	Section 02110
Trenching and Backfilling:	Section 02221

1.3 QUALITY ASSURANCE

A. The pipe manufacturer shall be a member of the Plastic Pipe Institute of the American Water Works Association or the National Clay Pipe Institute and shall have manufactured the pipe and joint proposed for use for not less than five (5) years.

B. The pipe shall be permanently marked by the manufacturer as set forth in ASTM and P.S. Standard Specifications.

C. The supplier shall furnish to the contractor a warranty governing both workmanship and material and shall be for a period of not less than one (1) year from date of acceptance by the Owner or his agents. The warranty of the material by the supplier shall be in writing to the contractor. Any material failure shall be replaced at no cost to the Owner.

1.4 GOVERNING STANDARDS

All work performed under this contract shall be in compliance with the "Specifications and Policy for Sanitary Sewers" as established by the manufacturer of the pipe except as modified

herein and the following standards:

1) "Recommended Practice for the Installation of PVC Sewer Pipe" - Uni-Bell Uni-B-5.

2) "Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe" - ASTM D2321.

3) Uni-Bell Handbook of PVC Pipe, 2nd Edition, 1982.

4) ”Recommended Practice for Installing Vitrified Clay Sewer Pipe" - ASTM C12.

PART 2 - PRODUCTS

2.1 MATERIALS FOR INDUSTRIAL SEWER

The pipe for the gravity sewer may be Vitrified Clay, ABS 'Truss', PVC (Smooth, Corrugated or Ribbed), Ductile Iron, or high density polyethylene (HDPE). Ductile iron pipe shall be required for certain runs of pipe or other applications as shown on the plans. All wyes, tees, and bends shall be manufactured of the same material as the sewer pipe used and all wyes or ends of service shall be equipped with a watertight plug. All sewer pipe shall be installed using either Class I or II embedment materials except that ductile iron pipe may be embedded as specified for 'Type I' laying conditions in ANSI A21.50 latest revision.

2.2 VITRIFIED CLAY PIPE

A. All vitrified clay pipe shall be extra strength pipe. All clay pipe shall be in conformance to ASTM Specification C-700 latest revision and shall be laid in conformance to ASTM C12 latest revision.

B. Unless otherwise approved by the Engineer, all clay pipe six inches (6") in diameter and larger shall be furnished in joints having a nominal laying length of not less than five (5) feet.

C. On all vitrified clay sewer pipe the joints shall

conform to current ASTM Designation C-425 "Compression Joints for Vitrified Clay Bell and Spigot Pipe."

D. Pipe bedding shall be crushed stone or rounded gravel material. The material shall have 95% passing a 3/4" sieve and 95% retained on a No. 4 sieve. This bedding shall have a minimum thickness of 4" beneath the pipe throughout its entire length.

2.3 PVC PIPE (SMOOTH, CORRUGATED OR RIBBED)

A. PVC pipe to be used in gravity sewers shall meet and/or exceed all of the requirements of ASTM Specification D-3034 (SDR 26 min) or ASTM D789, Type PS-115, and shall be made of plastic having a cell classification of 12454-B or 12164-A as defined in ASTM D-1784. Provisions must be made for contraction and expansion at each joint with a rubber ring. The bell shall consist of an integral wall section with solid cross section rubber ring factory assembled and securely locked in place to prevent displacement. The length of pipe sections shall not exceed twenty (20) feet.

B. All fittings and accessories shall be as manufactured from PVC having a minimum cell class of 12454-B, 12454-C, or 13343-C, and furnished by the pipe supplier or approved equal and have bell and/or spigot configurations identical to that of the pipe. The pipe and fittings shall be tested in accordance with ASTM designations D-2412, D-2152, and D-2444 and shall be rated the same as the pipe.

C. Minimum "pipe stiffness" at 5% deflection shall be 115 psi for all sizes when tested in accordance with ASTM Designation D-2412, "External Loading Properties of Plastic Pipe by Parallel-Plate Loading." All PVC sewer pipe shall have a minimum impact resistance of 210 ft-lbs.

D. Pipe and fittings shall be installed in accordance with ASTM D2321 with the following restrictions.

(1) Only Class I and Class II embedment materials will be considered suitable for use with PVC pipe. This requires that a granular material be used as embedment for the entire length of the sewer lines. Embedment material shall be brought to the top of the pipe in 14 feet or deeper trench cuts.

(2) Allowable deflection shall not exceed 5%.

(3) Measurements shall be made by pulling a mandrell through all sections of pipe within the system. All tests shall be performed by the contractor in the presence of the Engineer or his representative.

(4) Gasket materials shall meet the requirements of ASTM F477.

(5) Joint tightness shall meet the requirements of ASTM D-3212 and extrusion quality must meet the requirements of ASTM D-2152.

2.4 ABS and PVC 'TRUSS' PIPE

A. All 'Truss' pipe shall meet or exceed all requirements of ASTM Specification D-2680 or D-2751 latest revision. All solid wall pipe and fittings shall be SDR 26 or better and shall meet or exceed all requirements of ASTM Specification D-2750 or D-3034 latest revision. The pipe shall be furnished in standard 12.5 feet lengths and shall be free from visible cracks, holes, foreign inclusions or other injurious defects. Fittings shall include couplings, 'O'-rings, backup rings, laterals, tees, elbows, caps, plugs, adaptors, manhole water stops and clamps.

B. Pipe and fittings shall be installed in accordance 321. Only Class I, Class II, or Class

III embedment materials will be allowed. Class III bedding material must be compacted by hand or mechanical methods to achieve a minimum Standard Proctor Density of 90%. This requires a granular material to be used as embedment for the entire length of the sewer line. In addition, measurements shall be made by pulling a 5% mandrell through random sections within the system as selected by the Engineer.

2.5 DUCTILE IRON PIPE

A. Ductile iron pipe to be used for gravity sewer shall be ductile iron pipe of the rubber gasket type joint unless otherwise specifically shown on the plans or approved by the Engineer. All pipe shall be furnished in 20' nominal laying lengths and shall bear a mark denoting approval by the Underwriters' Laboratories of Chicago, Illinois.

B. Pipe of the rubber gasket type joint shall be manufactured in accordance with AWWA Specification C-151, latest revision. All joints shall be of the type which provides a recession in the bell for the employment of a single rubber gasket to be placed before the insertion of the succeeding spigot.

C. Ductile iron gravity sewer pipe shall be manufactured in accordance with ANSI/ASTM A746 Standards. The pipe thickness shall be based on the depth of bury as shown on the plans but in no case shall pipe lighter than Class 51 be supplied. The pipe shall have an asphaltic coating approximately 1 mil thick as specified in AWWA C-151 on the outside of the pipe. The inside coating shall consist of the standard cement lining as specified in AWWA C-104.

2.6 HDPE PIPE

A. HDPE pipe to be used for gravity sewer shall be high density polyethylene PE 3408 unless otherwise specifically shown on the plans or approved by the

Engineer. The pipe shall be furnished in standard 40/50 feet lengths and shall be free from visible cracks, holes, foreign inclusions or other injurious defects. Fittings shall include couplings, 'O'-rings, backup rings, laterals, tees, elbows, caps, plugs, adaptors, manhole water stops and clamps.

B. Only Class I, Class II, or Class III embedment materials will be allowed. Class III bedding material must be compacted by hand or mechanical methods to achieve a minimum Standard Proctor Density of 90%. This requires a granular material to be used as embedment for the entire length of the sewer line. In addition, measurements shall be made by pulling a 5% mandrell through random sections within the system as selected by the Engineer.

C. Segments may be joined by fusion welding or standard push-on couplings or mechanical coupling devices. Couplings or coupling devices must be made from HDPE or steel and be pressure rated compatible with the pipe.

2.7 MATERIALS FOR FORCE MAINS

A. The pipe for force mains may be either ductile iron, PVC, or HDPE as herein specified.

(1) Ductile iron pipe for force mains shall be the same as that previously specified for gravity sewer pipe. Fittings may be either cast or ductile iron and shall be coated and lined the same as the pipe.

(2) PVC Pipe - for force mains shall be Class 160 SDR-26 for 6-inch and smaller force mains, and Class 200 SDR-21 for 8-inch and larger force mains. The pipe shall meet all requirements of ASTM D-2241 and D-1784. All pipe must also meet the requirements as set forth in Commercial Standard PS-22-70 with standard dimension ratio (SDR), and bearing the National Sanitation Foundation seal.

a. Provisions must be made for contraction and expansion at each joint with a rubber ring, and integral bell as part of each joint. Nominal laying lengths shall be 20 feet.

b. All fittings for 3" and smaller PVC pipe shall be made from clean, virgin, NSF approved Type I, Grade 1 PVC conforming to ASTM Resin Specification D-1784. Joints shall be push-on type with rubber gaskets. Fittings for 4" and larger PVC pipe shall be of either cast or ductile iron as above.

(3) HDPE pipe to be used for force mains shall be high density polyethylene PE 3408 unless otherwise specifically shown on the plans or approved by the Engineer.
   a. Pipe shall meet standard ASTM D3350, ASTM F714 DR 26, 21, 17 or 11.
   b. Fusion welded joints should meet ASTM D3261. Segments may be joined by fusion welding or equivalent practice. Couplings or coupling devices must be made from HDPE or steel and be pressure rated compatible with the pipe.

(4) Concrete for Blocking - All fittings and bends shall be blocked. Concrete for this purpose shall be 2000 psi minimum strength either hand or batch mixed and shall conform to all other requirements of the 'Concrete' specification.

2.8 ENCASEMENT PIPE

Pipe for encasement across highways and railroads shall be new standard weight steel pipe of sizes as shown on the plans and shall be constructed in accordance with the specifications and requirements of the Arkansas Highway and Transportation Department.

PART 3 - EXECUTION

3.1 GENERAL

A. All equipment necessary and required for the proper construction of the sewers shall be on the project in first class working condition. The contractor shall provide the necessary hand tampers and pneumatic tampers to obtain the compaction of the pipe bed and backfill as specified. In order to comply with the requirements of the Arkansas State Health Department, the contractor shall maintain a minimum of ten (10) feet of horizontal separation between water and sewer lines when they are installed parallel and a vertical separation of 18" (minimum) when these lines cross.

B. Backfilling operations shall not lag more than 500 feet behind laying operations unless written authorization to do otherwise is given by the Engineer. The contractor shall mark all trenches left open at the end of each working day with appropriate barriers, lights, and signs as required by the various safety codes.

No consideration shall be given for reduction of retainage as per Section 3.2 of the General Conditions until such time as fifty percent (50%) of the final cleanup has been successfully completed.

3.2 EXCAVATION

A. The contractor shall do all excavation to the depth shown on the plans. Common excavation shall include all excavation including such rock as may be encountered in the trench. If the soil at the bottom of the trench is mucky, or in such condition that it cannot be properly shaped and graded, or if this material is too soft to properly support the bedding material, the contractor shall excavate below the normal subgrade elevation as directed by the Engineer.

Whenever excavation is carried below the subgrade, at the direction of the Engineer, the contractor shall provide and install a foundation material of gravel or crushed stone meeting ASTM D2774, ASTM D448 size 67, or AHTD Class 8, thoroughly tamped into place up to an elevation sufficient to prepare the bedding as specified. A minimum of 6 inches of such foundation material will be required.

B. Where rock excavation is encountered in trench, the contractor shall excavate to the depth shown on the plans plus at least six inches (6"). A bedding material of at least six inches (6") shall be placed between the rock and the bottom of the pipe. This bedding shall consist of ballast, concrete aggregate or other acceptable graded or crushed stone material as shown on the plans. The depth of cut shown on the plans is from the surface of the ground to the invert of the pipe. The width of the trench at the top of the pipe shall be the outside diameter of the pipe bells plus twelve inches, minimum, and plus sixteen inches maximum. The bed for the pipe shall be so shaped that at least the lower quarter of the pipe shall be in continuous contact with the top of the bedding. The contractor shall do all bracing, sheathing, and shoring necessary to perform and protect all excavations required to prepare trenches for laying and installing pipe, and other structures incidental to the construction of this sewer system.

3.3 LAYING AND INSTALLING PIPE

The contractor shall provide a laser beam type grade light to insure the pipe is laid to the lines and grade shown on the plans. The Engineer shall inspect all pipe before it is laid and reject any pipe damaged or defective. Laying of pipe shall be started at the lowest point and be laid up grade. The pipe shall be protected from water during placing and until joints are made.

3.4 BACKFILLING

All trenches and excavations shall be backfilled in a reasonable time after the pipe is installed and bedded. (See Paragraph 3.1(b). Backfill material shall be as shown on the standard detail drawings. Select backfill material containing stones or rock exceeding three inches (3") in diameter shall not be used adjacent to the pipe or until the fill over the pipe exceeds one foot (1') in common excavation and two feet (2') in rock excavation. No haunching or initial backfill material may be dropped from a height exceeding two feet (2') over the top of the pipe. Compaction of the bedding, haunching, and initial backfill material shall be obtained by hand tamping method until cover exists over the pipe as shown on the standard trench detail drawings. General backfill material containing large clods or stones larger than six inches (6") in diameter shall not be placed in trenches. In trenches located in paved streets, the general backfill shall be made in layers not to exceed six inches (6") and shall be compacted to a density of 95% Modified Proctor by pneumatic tampers or other equipment approved by the Engineer in such manner that minimal settling of the trench will occur. The contractor will top the backfill by placing the stone or gravel base material level with the existing surface. The crossing shall then be opened to traffic for a period of at least three weeks before the finished surface is placed. Where sufficient backfill material is not available for any of the above operations, it shall be hauled to the work site by the contractor.

3.5 CONNECTIONS

Where the plans call for connections to existing structures, these connections shall be watertight and so made that a smooth uniform flow will be obtained. Where sewer pipe penetrates a new or existing manhole wall, the connection shall be made watertight using either a manhole coupling or a rubber ring water stop.

3.6 MANHOLES

Manholes shall be constructed at the locations and of the materials and to the dimensions shown on the drawings.

Manholes in streets shall be adjusted to the finished street grade. When rigid sewer pipe is used, the contractor shall install a pipe bell within one foot (1') of the manhole wall for each pipe penetrating the manhole wall. When PVC sewer pipe is installed, the contractor shall install a mechanical pipe plug in the end of each pipe penetrating the manhole wall until the manhole has been constructed. The top of manholes constructed outside of streets, driveways, and ditches shall extend approximately 6" above natural ground unless otherwise noted on the plans.

3.7 SERVICE WYES

Shall be placed in locations to best serve the structure or as designated by field location. In shallow trenches wyes shall be laid horizontal, but in all trenches four feet (4') deep and deeper, wyes shall be inclined at 45 degrees from the horizontal unless otherwise specified. All wyes where service connections are not to be immediately installed shall be plugged with a pressure cap or other suitable means before being placed in the trench. Care shall be taken in backfilling to support the branch so that wyes will not be disturbed by backfilling. No wyes shall be covered until they have been inspected and located by the Engineer.

3.8 SERVICE CONNECTIONS

Service connections shall be installed from the main to the property line of structure to be served. Connection to the wye shall be made with a bend of the proper degree to make the house connection run perpendicular to the main, and pipe shall be laid to a uniform line and grade. No service connections shall be covered until they have been inspected and located by the Engineer. All service connections shall be plugged with a pressure cap before the terminal pipe is placed in the trench. The end of each service connection shall be clearly marked with 1" x 4" painted wooden marker twenty-four inches (24") long driven to within 6 inches of flush. A length of yellow nylon rope shall be attached to this marker and extend to a 1/2" x 1-1/2" x 18" stake buried immediately in front of the end of the service. Where a service connection is laid from an inclined wye in

a trench eight feet (8') or more deep, a block of concrete shall be placed as shown on the plans. This concrete shall be allowed to set before backfilling to a depth of more than one foot (1'). Wyes that are placed in trenches eight feet (8') and deeper and that do not serve existing buildings shall have sufficient pipe connected to them to provide for a future connection at a distance below natural grade of approximately six feet (6') unless otherwise directed by the Engineer. Such pipe shall be considered as pipe for service connections and shall be plugged the same as a service connection. Service connections shall include pipe, bends, plugs, jointing materials, markers, trench excavation, backfill, and all other work incidental to the construction.

3.9 CUTTING AND REPLACING SPECIAL SURFACES

A. Whenever it becomes necessary in excavating to disturb special surfaces, such as paved or gravel roadways, drives, walks, or parking areas, the original surface shall be restored to original condition or better after completion of the backfill. In these instances, care shall be used in making the backfill to eliminate future settlement and the surface shall be restored using the same type of materials that were used in the original surface.

B. In gravel-surfaced streets and other areas, the gravel will be disturbed in excavating for trenches. After the backfill has been so placed that no further appreciable settlement will occur, gravel over the trench shall be replaced to the same compacted thickness as the original surfacing. During construction, also, the gravel on the remainder of the street not occupied by the trench may be covered with dirt from the excavation. After completion of the backfill, such dirt shall be removed as completely as possible and additional gravel shall be placed on the street, until the surfacing is as weather resistant and traffic resistant as the original surfacing.

C. All sewer lines and force mains crossing under state highways will be bored and encasement pipe installed. All other street crossings including service crossings will be open cut. The contractor shall be aware and conform to any requirements and regulations of the Arkansas State Highway and Transportation Department relative to construction on their rights-of-way. The repair of highway surface shall conform to the requirements of the Arkansas State Highway and Transportation Department.

3.10 CUTTING AND REPLACING FENCES AND LAWN SOD

A. Wherever it becomes necessary in excavating to cut fences or disturb lawns, the fences and lawns shall be restored after completion of the backfill. Fences shall be restored to their original conditions using the same type of materials that were used in their original construction.

B. Trenches where lawn sod has been disturbed shall be backfilled in accordance with applicable provisions of Paragraph 3.4, and backfilled by hand, if necessary. After replacing the sod, it shall be covered loosely with earth, tamped lightly to protect the roots, and sprinkled with water. Shrubbery shall be taken up ahead of construction, stored, and reset in such manner as to damage it as little as possible.

3.11 INSPECTION

Prior to final approval of the sewer system, the Engineer, accompanied by the contractor's representative, shall make a thorough visual inspection by appropriate method, of the entire installation. Any indication of defects in material or workmanship, or obstructions to flow in the pipe system, shall be corrected. Defects due to contractor's negligence shall be corrected by the contractor and as directed by the Engineer.

3.12 TESTING OF GRAVITY SEWERS

A. Tests for water tightness shall be made on each section of sewer line by the contractor in the presence of the Engineer by one of the following methods:

(1) Exterior Saturated Ground Water Pressure - Infiltration due to exterior ground water pressure shall not exceed 50 gallons per mile per inch diameter per day. The contractor shall furnish all equipment necessary for the completion of this test. If dependable results cannot be achieved due to a low ground water table, the low pressure air loss method shall be used. This method (the E.S.G.W.P.) shall be used only when the ground water table is over the top of the sewer pipe.

(2) Low Pressure Air Loss - for testing the water tightness of sewer lines. The contractor shall furnish all equipment necessary for this test. The test shall be conducted following procedures outlined in the installation and testing handbook as published by the Johns-Manville Company. Air pressure in the lines shall not exceed 5.0 psig. An internal pressure of 3.5 psig minimum shall be maintained for at least 5 minutes. After the stabilization period, the time required for a pressure loss of 0.5 psig (3.5 psig to 3.0 psig) will be recorded. If the time for this pressure loss is greater than that shown in the table below, the section undergoing the test shall have passed.

Any section of sewer line failing the above tests shall be repaired and if necessary relaid until that section shall satisfactorily pass one of the above tests. Where high ground water tables are encountered, the air pressure will be increased by the height of water above the

top of the pipe. The costs of any corrective work and retesting shall be borne by the contractor.

TIME REQUIRED FOR AIR TESTING

Pipe Size	Time
4"	2.5 Minutes
6"	4.0 Minutes
8"	5.0 Minutes
10"	6.5 Minutes
12"	7.5 Minutes
15"	9.5 Minutes

B. Test of Force Mains - after the force main has been laid as specified, the entire line shall be given a hydrostatic pressure test. These tests shall be performed by the contractor in the presence of the Engineer. The contractor shall furnish all necessary pressure gauges, meters, and pumps, and make all taps and connections.

Hydrostatic Test - The section to be tested shall be slowly filled with water and all air expelled. Pressure shall be applied by means of a pressure pump and maintained for at least two hours or until the whole section can be examined. The test shall be at 50% above normal operating pressure for the line, however, in no case shall the testing pressure be lower than 50 psi or higher than the class rating of the pipe, on any portion of the line being tested. All leaks and defects found during the test shall be satisfactorily repaired and corrected by the contractor.

Leakage Test shall be in accordance with AWWA C605-94, "Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water" Section 7.3 (Equation 1).

C. Manhole Tests - All manholes shall be vacuum tested in accordance with Section 02601 Paragraph 3.4 (C.)

PART 4 - MEASUREMENT & PAYMENT

4.1 METHOD OF MEASUREMENT

A. The footage of pipe to be paid for shall be in the number of linear feet of pipe in place, measured along the centerline of the pipe. The several sizes shall be measured separately. All fittings and/or wyes shall be included in the footage.

B. The depth of trench as measured from the ground surface to the invert of the pipe, as determined from the construction drawings furnished the contractor by the Engineer, or measurements made or verified in the field by the Engineer, shall determine the depth.

C. Concrete for encasement shall be measured along the length of pipe encased for a maximum thickness (height) of twelve inches (12") and a width of twenty-four inches (24"). Concrete for blocking shall not be measured or paid for separately.

D. Service connections will be measured along the top centerline of the pipe as laid, including the 45 degree bend.

E. Pavement cut and replaced, both concrete and bituminous, will be measured by the square yard as determined by the horizontal length of pavement actually cut and replaced measured along the centerline of the trench multiplied by the actual width of trench cut to a maximum width of thirty-six (36) inches. Where a width greater than thirty-six (36) inches is required and authorized by the Engineer, the actual width of pavement so authorized to be cut shall be used in determining the quantity of pavement cut and replaced.

F. Gravel surfacing cut and replaced will not be measured or paid for separately.

G. Trench gravel used as pipe cushion in rock areas and in wet trench will not be measured or paid for separately.

H. Encasement pipe shall be measured by the lineal foot in place.

I. Manholes shall be measured from the bottom of the manhole ring to the invert of the gravity sewer line leaving the manhole.

4.2 BASIS OF PAYMENT

A. The footage of gravity sewer pipe shall be paid for at the unit price per lineal foot for the several sizes set out in the proposal, which price and payment shall constitute full compensation for all materials, equipment, hauling, installing, labor, tools, filling, compacting, testing, and incidentals necessary to install the pipe complete in place.

B. The trench for the gravity sewers shall be paid for at the unit price per lineal foot for the various depths as set out in the proposal. Such payment shall constitute full compensation for labor, equipment trench gravel, clean-up, and tools necessary for common excavation as specified.

C. The footage of force main pipe shall be paid for at the unit price per lineal foot as set out in the proposal, which price and payment shall constitute full compensation for all materials, fittings, blocking, equipment, hauling and installing, rock excavation, backfilling, compacting, testing, clean-up, and incidentals necessary to install the force main pipe complete in place.

D. Manholes shall be paid for at the unit price per each as set out in the proposal, which price and payment shall be full compensation for excavating and backfilling, all material, equipment, tools, labor, adjustment to the finished grade, testing, and incidentals necessary to install the manhole complete in place.

E. Gravel surfacing cut and replaced shall be paid for at the lump sum price for this item of work as set out in the proposal, which price shall include gravel, placing, spreading, compacting and all other work incidental thereto. Gravel for maintenance shall not be measured or paid for separately as such cost shall be incidental to the item as listed in the proposal.

F. Bituminous and concrete pavement cut and replaced shall be paid for at the unit price per square yard as set out in the proposal, which price shall include materials and all work incidental thereto.

G. Sewer wyes shall be paid for at the unit price per each as set out in the proposal, which price shall include all material and installation costs.

H. Sewer service connections shall be paid for at the unit price per lineal foot of pipe, which price shall include all labor, pipe, fittings, trench, and all incidentals necessary to complete installation except cutting of special surfacing which shall be paid for at the bid unit price as set out in the proposal.

I. Trench gravel shall not be paid for separately, but shall be included in the cost of pipe and trenching.

J. Encasement pipe under highway or railroad shall be paid for per lineal foot bored in place as set out in the proposal, which price shall include all material, and incidentals necessary to

install the encasement pipe. Carrier pipe shall be included in the footage of gravity sewer pipe and shall be paid for as outlined in Paragraph 6.a.

K. Concrete for encasement shall be paid for at the unit price per cubic yard in place. Such payment shall constitute full compensation for all work, materials and incidentals as associated with this work.

SECTION 02530
WASTEWATER TREATMENT SYSTEM

PART 1 – SCOPE

This section pertains to the design of the wastewater treatment system for the DRI process water.

PART 2 – TECHNICAL CHARACTERISTICS OF WASTEWATER SYSTEM COMPONENTS

See Design Calculations for determination of component sizing.

2.1 COLLECTING BASIN WDB1.

Table 1. Dimensions of WDB1 basin

Volume (m^3)	32
Length (mm)	4,400
Width (mm)	4,400
Height (mm)	2,500 (est.)
Water surface height (mm)	1,660 (est.)

Table 2. Transfer pump group WDP.1X (1+1)

Flowrate (m^3/h)	200
Pressure (bar)	2.0

2.2 SAND FILTERS WDF.2.1X.

Table 3. Design parameters of WDF.2.1X sand filtration

Filtration velocity (m/h)	≤ 19
Backwash velocity (m/h)	25
Air backwash velocity (m/h)	≤ 55.8

Table 4. Technical characteristics of filters WDF.2.1X

Number of filters	4
Diameter of each filter (mm)	3,200
Total surface (m^2)	7.92
Total volume (m^3)	8
Maximum backwash flow (m^3/h)	200

Table 5. Backwash pump group WDP.2.1X (1+1)

Flowrate (m^3/h)	200
Pressure (bar)	2.5

2.3 FILTERED WATER BASIN WDB2.

Table 6. Dimensions of WDB2 basin

Volume (m^3)	64
Length (mm)	8,400
Width (mm)	4,400
Height (mm)	2,500 (est.)
Water surface height (mm)	1,730 (est.)

Table 7. Transfer pump group WDP.2.2X (1+1)

Flowrate (m^3/h)	200
Pressure (bar)	4.0

2.4 DRAIN WATER BASIN WDB3.

Table 8. Dimensions of WDB3 basin

Volume (m^3)	35
Length (mm)	6,400
Width (mm)	4,400
Height (mm)	2,000 (est.)
Water surface height (mm)	1,250 (est.)

Table 9. Transfer pump group WDP.3.1X (1+1)

Flowrate (m^3/h)	200
Pressure (bar)	3.5

PART 3 - EQUIPMENT SPECIFICATIONS

3.1 CENTRIFUGAL PUMPS

Table 10. WDP.1X pumps

Parameter	Unit	Value
Quantity	-	2; (1+1)
Type	-	Centrifugal. Horizontal in a bench.
Work fluid	-	Clean Cooling Water
Guaranteed Nominal Flow	m^3/h	200
Guaranteed Flow (2^{nd} point)	m^3/h	200
Guaranteed Nominal Pressure	bar	2.0
Maximum NPSH required	m	<7
Volute material	-	Cast steel A216-WCB or similar

Parameter	Unit	Value
Impeller material	-	Ductile Iron
Elastomers material	-	NBR
Motor enclosure	-	NEMA 12 - IP55
Motor insulation class	-	F according to NEMA
Motor cooling method	-	IC 411
Motor driving	-	Variable Frequency Drive
Operation	-	Continuous
Installation	-	Outdoors

Table 11. WDP.2.1X pumps

Parameter	Unit	Value
Quantity	-	2; (1+1)
Type	-	Centrifugal. Horizontal in a bench.
Work fluid	-	Clean Cooling Water
Guaranteed Nominal Flow	m^3/h	200
Guaranteed Flow (2^{nd} point)	m^3/h	200
Guaranteed Nominal Pressure	bar	2.5
Maximum NPSH required	m	<7
Volute material	-	Cast steel A216-WCB or similar
Impeller material	-	Ductile Iron
Elastomers material	-	NBR
Motor enclosure	-	NEMA 12 - IP55
Motor insulation class	-	F according to NEMA
Motor cooling method	-	IC 411
Motor driving	-	Variable Frequency Drive
Operation	-	Continuous
Installation	-	Outdoors

Table 12. WDP.2.2X pumps

Parameter	Unit	Value
Quantity	-	2; (1+1)
Type	-	Centrifugal. Horizontal in a bench.
Work fluid	-	Clean Cooling Water
Guaranteed Nominal Flow	m^3/h	200
Guaranteed Flow (2^{nd} point)	m^3/h	200

Parameter	Unit	Value
Guaranteed Nominal Pressure	bar	4
Maximum NPSH required	m	<7
Volute material	-	Cast steel A216-WCB or similar
Impeller material	-	Ductile Iron
Elastomers material	-	NBR
Motor enclosure	-	NEMA 12 - IP55
Motor insulation class	-	F according to NEMA
Motor cooling method	-	IC 411
Motor driving	-	Variable Frequency Drive
Operation	-	Continuous
Installation	-	Outdoors

3.2 SAND FILTERS

Table 13. Sand filters WDF.2.1X

Type of fluid	Water + suspended solids
Type	Vertical filters
Number of filters	4 (2+2)
Type of sand	Silica sand
Diameter (mm)	3,200
Total flow rate (m^3/h)	200
Filtration velocity (m/h)	19
Backwash mode	Counter-washing with water
Backwash velocity (m/h)	25
Backwash flowrate (m^3/h)	200
Filter material	Carbon steel
Notes	Pneumatic valves, solenoid valves, and interconnecting piping are included

3.3 BLOWERS

Table 14. Blower WDFB.2.1X

Type:	Side Channel
Units:	2 (1+1)
Technical data:	-
Flow (Nm^3/h)	442
Structure	Stainless Steel
Motors:	-
Feeding	480 V/3 ph./60 Hz
Type of starter	Frequency converter

Type:	Side Channel
Installation	Outdoors

PART 4 – CIVIL WORKS SPECIFICATION

4.1 INTRODUCTION

The purpose of this Section is to explain the conditions, calculations, and results of wastewater basin structures in the DRI plant.

All engineering design criteria have a common goal: ensuring a safe structure and ensuring the functionality of the structure.

4.2 GEOTECHNICAL CONDITIONS

The subsurface study prepared for the construction project by "Professional Service Industries, Inc." about this area determine that the soil beneath the topsoil may be divided into an upper stratum consisted of predominantly fine-grained soils and a second stratum consisted of coarse-grained (sandy) soils.

With the goal of designing the best solution, wastewater basin foundations were designed between -400 mm (1 ft 3.74 in) and -4100 (13 ft 5.41 in). According to field boring data, this area includes inorganic clays of low to medium plasticity (CL soils, USCS classification) on top of inorganic clays of high plasticity (CH soils, USCS classification). Geotechnical study informs that to support the loads applied, the existing soils will need to be removed and replaced with a crushed stone.

All foundations consist of flat slabs, or slightly sloped slabs, of uniform thickness, with the exception of wastewater basins where the foundation of the wall must be reinforced. This is because of the loads that a structure is transmitting to another, lateral pressures as well as moments.

Surface run-off water should be drained away from the excavations and not be allowed to pond. Although, in order to guarantee the stability of slabs, the designer has considered hydrostatic forces due to the possibility of the existence of groundwater at ground level as a worst-case scenario for lateral earth pressure loads.

The subsurface study suggests that for subgrade prepared soil and properly compacted fill, a modulus of subgrade reaction of 150 pounds per cubic inch (pci) may be used in the grade slab design

based on values typically obtained from 1 ft x 1 ft plate load test. The value must be adjusted for larger areas and depending on cohesion or cohesionless soil.

4.3 LOADING CRITERIA

The loads applied to the structure for designing it were:

- Self-weight of the structure as a dead load.
- Concentrated loads because of the necessary equipment.
- The total lateral pressure which includes the static soil pressure plus the calculated seismic lateral pressure, according to geotechnical report recommendations. The PSI soils report has provided the static lateral pressure coefficients as 0.61 (at-rest) and 0.44 (active). The distribution of these forces would be taken as linear in relation to the depth.
- Loads due to nearby structures: Walls calculations must take into account the adjacent structures which will transmit extra loads and moments.
- Wind loads: In the calculation of design wind loads, the algebraic sum of the pressures acting on opposite faces of each building surface shall be taken into account.
- Wind loads were calculated for certain wastewater basins depending on:
    - o Basic wind speed according to location.
    - o Importance factor.
    - o Exposure category based on ground surface roughness.
    - o Topographic effects: wind speed-up at isolated hills, ridges, and escarpments.
    - o Gust effect factor depending on conditions of rigid or flexible structure.
    - o Enclosure classification because of number of openings.
    - o Internal pressure coefficient.
    - o External pressure coefficient.
    - o Velocity pressure evaluated at each height.
- Wind effects are not applied to water basin walls which are not exposed to it.
- Seismic loads: According to geotechnical engineering information and Arkansas Act 22, Osceola, Arkansas is in the general proximity of New Madrid which contains the highest level of seismicity in the central and eastern parts of the United States.

Structures designed are intended to resist earthquake motions through ductile inelastic response.

Furthermore, under seismic conditions, the direction of shear may not be predictable. The full shear force has been assumed in any direction for a safe design.

4.4 REQUIREMENTS FOR MATERIALS AND DESIGN

As to the characteristics of the materials used in the calculation:

- Concrete used shall be at least 4500 psi (316 Kg/cm^2) and meet requirements specified in ITM-STD40075.
- Reinforcing steel shall be at least ASTM A-615 Grade 60, yield strength (fyk)= 60000 psi (4200 Kg/cm^2). Details and placement shall be in accordance with ACI 315 and ACI 318.

All basins shall be perfectly waterproofed and coated. The walls and slabs shall be poured monolithically; alternatively, water stops may be provided. Contact surface between concrete pouring stages must be rough, and it must be cleaned and moistened just before pouring the next stage. Concrete pouring stages will be defined by the contractor in order to minimize slab and wall retraction when curing, see the suggested location of construction joints in drawings.

General geometric and dimensional tolerances for civil works are stated in Spec. 03300, cast-in-place concrete.

Required strength (U) as combinations of loads, used in design was:

- U= 1.4D
- U=1.2D + 1.6L + 0.5(Lr or S or R)
- U=1.2D+ 1.6(Lr or S or R) + (L or 0.5W)
- U=1.2D+ W + L + 0.5(Lr or S or R)
- U= 1.2D + E + L + 0.2S
- U= 0.9D + W
- U= 0.9D + E

Where terminology used are:
W: wind load
L: service live load
Lr: service roof live load
R: cumulative load effect of service rain load. It has not been used in calculation due to its low value.
D: service dead load
S: effect of service snow load. It has not been used in calculation due to its low value.
E: effect of horizontal and vertical earthquake-induced forces.
Limit state design requires the structure to satisfy two principal

criteria: the ultimate limit state (ULS) and the serviceability limit state (SLS).

To satisfy the ultimate limit state (ULS), the structure must not collapse when subjected to the peak design load for which it was designed. A structure is deemed to satisfy the ultimate limit state criteria if all factored bending, shear and tensile or compressive stresses are below the factored resistance calculated for the section under consideration.

To satisfy the serviceability limit state criteria, a structure must remain functional for its intended use subject to routine loading. A structure is deemed to satisfy the serviceability limit state when the constituent elements do not deflect by more than certain limits laid down in the building codes. Many of these limits depend on the finish materials used and correct execution.

In addition, calculating wastewater basin design, the designer has analyzed two cases according to the water level, always resulting worst case when they are empty. The presence of water helps to compensate for lateral pressures towards the interior of the basin.

Codes requirements applied for water basins were:

- Building Code Requirements for Structural Concrete (ACI 318-14) which refers to the proper design and construction of buildings of structural concrete. Among the subjects covered are as follows: design and construction for strength, serviceability, and durability; deflection limits; development and splicing of reinforcement and construction document information.

The Code also gives load factors for specific combinations of loads. In assigning factors to combinations of loading, some consideration is given to the probability of simultaneous occurrence.

- Minimum Design Loads for Buildings and Other Structures (ASCE/SEI 7-10) which provides requirements for general structural design and includes means for determining dead, live, soil, flood, snow, rain, earthquake, and wind loads.

Design requirements for earthquake-resistant structures are determined by the SDC (Seismic Design Categories) to which the structure is assigned. In general, the SDC relates to seismic hazard level, soil type, occupancy, and building use.

4.5 ANALYSIS OF RESULTS

A. WASTEWATER BASINS

In conformity with the results obtained about wastewater basins, the units were designed with concrete walls of 300 mm (12 in) thick with dropped beams and upper slab of 800 mm (31.5 in) thick. Reinforcement rebars will be #6 separated each 200 mm (7.87 in) to resist stress around 360 KN/m (24669.36 lb/ft).

B. GENERAL REQUIREMENTS

To ensure the correct behavior of the structures, rebars should be placed carefully trying to avoid any interference with anchor bolts for pumps or mechanical equipment. If rebars interfere with anchor bolts or any other embedded elements, rebars may be bent but never cut.

SECTION 02831
CHAIN LINK FENCES, GATES AND BARBED WIRE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Fence framework, fabric, barbed tape and accessories.

B. Excavation for post footings.

C. Concrete for post footings.

D. Gates and related hardware.

1.2 RELATED WORK

A. Clearing and grading.

B. Fence line layout and staking.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM) Standards.

A 90 - Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.

A 120 - Specification for Pipe, Steel, Black and Hot Dipped Zinc-Coated (Galvanized) Welded and Seamless, for ordinary uses.

A 121 - Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.

A 392 - Specification for Zinc-Coated Steel Chain-Link Fence Fabric.

A 428 - Test Method for Weight of Coating on Aluminum-Coated Iron or Steel Articles.

A 446 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

A 478 - Chromium-Nickel Stainless and Heat Resisting

Steel Weaving Wire.

A 491 - Specification for Aluminum-Coated Steel Chain Link Fence Fabric.

A 569 - Specification for Steel, Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled, Commercial Quality.

A 585 - Specification for Aluminum-Coated Steel Barbed Wire.

A 817 - Specification for Metallic-Coated for Chain Link Fence Fabric.

A 824 - Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence.

B 117 - Method of Salt Spray (Fog) Testing.

C 94 - Ready-Mixed Concrete.

F 567 - Standard Practice for Installation of Chain Link Fence.

F 626 - Specification for Fence Fittings.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in commercial quality fence products with at least five years' experience.

B. Fence framework, fabric, barbed wire and related accessories to be a complete system as specified herein.

1.5 SUBMITTALS

A. Shop Drawings: Include complete details of fence and gate construction, fence height, post spacing, dimensions and unit weights of framework and concrete footing details.

B. Product Data: Manufacturer's catalog cuts with printed specifications.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Allied Tube & Conduit Corp.

B. Anchor Fence, Inc.

C. Cyclone Fence/United States Steel Corp.

D. Substitutions: Products of other manufacturers equal to those specified can be used subject to prior approval.

2.2 MATERIALS

A. Framework: Type I or Type II Steel Pipe.

Type I - Schedule 40 steel pipe with 1.8 ounces of zinc coating per square foot of surface area confirming to Standard Specification ASTM A 120; or

Type II - Pipe manufactured from steel conforming to ASTM a 569, cold-formed, high frequency welded and having a minimum yield strength of 50,000 psi. External surface triple coated with 1.0 ounce +/- 0.1 ounce of zinc per square foot, 30 +/- 15 micrograms of chromate per square inch and 0.5 +/- 0.2 mils of clear, cross linked polyurethane. Internal surface coated, after welding, with a zinc-rich based organic coating having an 87% zinc powder loading capable of providing galvanic protection. Internal surface of 4" O.D. pipe only to be zinc-coated in accordance with ASTM A 446.

Pipe shall be straight, true to section and conform to the following weights:

Pipe Size Outside Diameter	Type I Weight Lbs./Ft.	Type II Weight lbs./Ft.
1-5/8"	2.27	1.84
2"	2.72	2.28
2-1/2"	3.65	3.12
3"	5.79	4.64
3-1/2"	7.58	5.71
4"	9.11	6.56
6-5/8"	18.97	--

B. Fabric: Zinc-Coated or Aluminum-Coated steel.

Zinc-coated fabric shall be galvanized after weaving with a minimum 2.0 ounces of zinc per square foot of surface area and conform to ASTM A 392, Class 2.

Aluminum-coated fabric shall be manufactured in accordance with ASTM A 491 and coated before weaving with a minimum of 0.4 ounces of aluminum per square foot of surface area. The steel wire and coating shall conform to ASTM A 817.

C. Fittings: Pressed steel or cast iron, galvanized with a minimum of 1.2 ounces of zinc per square foot of surface area, or cast aluminum alloy, all conforming to ASTM F 626.

2.3 CONCRETE MIX

A. ASTM C 94 Portland Cement concrete with maximum 3/4" aggregate having a minimum compressive strength of 3,000 psi at 28 days.

2.4 COMPONENTS

A. Corner Posts, End Posts, and Pull Posts:

1. Size - 3-1/2" O.D. Type I or Type II pipe.

2. All posts shall be plumb within 5 degree (+/- 1 degree)in two planes.

3. Deflection - When a force of 70 pounds is applied perpendicular to the fence at the top of the post, it shall not deflect more than 1" at that location.

4. Pull posts shall be used at all abrupt changes in grade, direction, and at intervals no greater than 300 feet.

5. Posts shall be horizontally braced at mid-point with 1-5/8" O.D. brace rails and diagonally trussed with 3/8" O.D. truss rods and turnbuckles to adjacent post.

B. Line Posts:

1. Size - 2" O.D. Type I or Type II pipe.

2. Space posts equidistant in the fence-line, with a maximum of 10' on centers.

3. All posts to be plumb within 5 degrees (+/- 1 degree) in two planes.

4. Deflection - When a force of 38 pounds is applied perpendicular to the fence at the top of the post, it shall not deflect more than 1" at that location.

C. Top Rail:

1. Install top rails continuously through post caps or extension arms.

2. Size - 1-5/8" O.D. Type I or Type II pipe.

3. Each joint where a rail meets a post shall be secured so that no perceivable movement between

the two pieces takes place when the fence fabric is flexed.

D. Fabric: Galvanized or aluminum-coated steel wire, 9 gauge, woven in a 2" diamond mesh with top selvage twisted and barbed and bottom selvage knuckled. Furnish one piece fabric widths.

E. Gate Posts: Furnish posts for supporting gates of a size shown on the drawings.

F. Gates: Fabricate swing gate perimeter frames of 2" O.D. pipe, Type I or Type II. Metal and finish to match framework. Provide horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware and accessories. Space so that frame members are not more than 8' apart. Barbed wire shall be installed at top of gates.

Assemble gate frames by welding and repair weld areas with zinc-rich coating applied per manufacturer's direction. Install fabric with tension bars at vertical edges. Bars may also be used at top and bottom edges. Attach tension bars to gate frame at not more than 15" on centers. Attach hardware to provide security against removal or breakage. Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.

1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide 1-1/2 pair of hinges for each leaf. Hinges to be heavy duty ball and socket, malleable iron, hot-dip galvanized.

2. Locks: Gates shall be furnished and installed with forked type or plunger bar type latch for installation of owner-furnished padlocks.

G. Vehicular Slide Gates: (If required) Vehicular slide gate perimeter frames of 3" O.D. are Type I or Type II. Provide additional horizontal and vertical members to insure proper gate operation and for attachment of fabric, hardware and accessories. Assemble gate frames by welding for rigid connections. Use same fabric as for fence. Install fabric with tension bars

at vertical edges and tie at top and bottom edges. Attach tension bars to gate frame at not more than 15" on centers. Attach hardware with rivets or by other means which will provide security against removal or breakage. Gates shall be equipped with "J" vehicular chain link fence gate operators with remote electric locking and unlocking operation with chain drive. Contractor shall furnish, coordinate, and install vehicular slide gates and appurtenances as required to accept electric locks and gate operators as specified. Contractor to perform all required excavation, backfill and concrete work to allow security hardware contractor to install gate operators. posts and bottom rails.

H. Fittings:

Post Caps - Pressed steel, cast iron or cast aluminum alloy designed to fit snugly over posts to exclude moisture. Supply cone type caps for terminal posts and loop type for line posts. All caps to be equipped with set screws.

Rail and Brace Ends - Pressed steel, cast iron or cast aluminum alloy, cup-shaped to receive rail and brace ends.

Top Rail Sleeves - Tubular steel, 0.051 thickness x 7" long, expansion type.

Tension Bars - Steel strip 5/8" wide x 3/16" thick.

Tension Bands - Pressed steel, 14 gauge thickness x 3/4" wide.

Brace Bands - Pressed steel, 12 gauge thickness x 3/4" wide.

Truss Rods - Steel rod, 3/8" diameter merchant quality with turnbuckle.

Barbed Wire Arms - Pressed steel, cast iron or cast aluminum alloy fitted with clips or slots for attaching three strands of barbed wire. Arms shall be set outward on a 45 degree angle and be capable of supporting a 250 pound load at outer barbed wire connecting point without causing permanent deflection.

I. Tension Wire: Marcelled 7 gauge steel wire with minimum coating of 0.80 ounces of zinc or 0.40 ounces of aluminum per square foot of wire surface and conforming to ASTM A 824.

J. Barbed Wire: Commercial quality steel, 12-1/2 gauge, two strand twisted line wire with 4 point barbs at 5" spacing. Coating shall consist of a minimum of 0.80 ounces of zinc per square foot of wire surface conforming to ASTM A 121 or a minimum of 0.30 ounces of aluminum per square foot of wire surface conforming to ASTM A 585.

K. Tie Wires: Steel, 9 gauge, hot-dip galvanized.

PART 3 EXECUTION

3.1 INSPECTION

Installer shall examine site and report in writing to Engineer/Owner any conditions detrimental to the proper and timely completion of the work. Clearing, grading and fence line layout and staking of terminals to be completed by others before start of fence installation.

3.2 INSTALLATION

A. General: Fence installation to conform to requirements of ASTM F 567.

B. Height: Provide fence height as indicated on contract drawings.

C. Post Spacing: Space line posts at intervals not exceeding 10'.

D. Post Setting: Set terminal, gate and line posts plumb in concrete footings as indicated on contract drawings. Top of footing to be 2" above grade and sloped to direct water away from posts.

E. Bracing: Brace gate and terminal posts back to adjacent line posts with horizontal brace rails and diagonal truss rods.

F. Top Rail: Install through line post loop caps connecting sections with sleeves to form a continuous

rail between terminal posts. Fasten to terminal posts.

G. Bottom Tension Wire: Stretch between terminal posts 6" above grade and fasten to outside of line posts with tie wires.

H. Fabric: Pull fabric taut to provide a smooth uniform appearance, free from sag, with bottom selvage 2" above grade. Fasten to terminal posts with tension bars threaded through mesh and secured with tension bands at maximum 15" intervals. Tie to line posts and top rails with tie wires spaced at maximum 12" on posts and rails. Attach to bottom tension wire with hog rings at maximum 12" intervals.

I. Barbed Wire: Anchor to terminal extension arms, pull taut to remove all sag and firmly install in slots of line post extension arms.

J. Install gates plumb, level and secure for full opening without interference. Adjust hardware for smooth operation.Gates shall be erected in strict accordance with the manufacturer's recommendations. All gates must be adjusted for smooth unimpeded operations. Construct gate supporting structure according to details of the drawings.

K. Fasteners: Install nuts for fittings, bands and hardware bolts on inside of fence. Peen ends of bolts or score threads to prevent removal.

3.3 COMPLETION

The area of installation shall be left neat and free of any debris caused by the erection of the fence.

SECTION 02932
HYDROMULCHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Seeding and fertilizing by the hydromulching method finish-graded slopes and areas disturbed by construction Work.

1.2 RELATED SECTIONS

A. Section 02220 – Site Excavation, Backfilling and Grading

1.3 QUALITY ASSURANCE

A. Furnish seed labeled in accordance with current rules and regulations of Arkansas Plant board.

1.4 SUBMITTALS

A. Submit results of soil analysis of samples taken from seeding area and imported topsoils.

B. Submit labels from seed bags, lime and fertilizers.

C. Submit sample of mulching material.

D. Submit soil stabilizer information.

1.5 REFERENCES

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

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver grass seed in original containers showing analysis of seed mixture, percentage or pure seed, year of production, net weight, date of packaging, and location of packaging. Damaged packages are not acceptable.

B. Deliver fertilizer and lime in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.7 PRICES

A. Hydromulching: Hydromulch seeding in place as specified in this section and shown on the drawings. All items of work called for under this section of the specifications shall be paid for under the appropriate lump sum item or items as listed in the proposal and none shall be measured or paid for separately.

B. Topsoil: Imported topsoil incorporated into the work as specified in this section and shown on the drawings. All items of work called for under this section of the specifications shall be paid for under the appropriate lump sum item or items as listed in the proposal and none shall be measured or paid for separately.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: Use topsoil excavated from the site only if conforming to the specified requirements.

1. Existing Topsoil: Natural, fertile agricultural soil capable of sustaining vigorous plant growth, not in frozen or muddy condition, containing not less than 3% organic matter, and corrected to pH value of 5.9 to 7.0. Free from subsoil, slag, clay, stones, lumps, live plants, roots, sticks, crabgrass, coughgrass, noxious weeds, and foreign matter.
2. Imported Topsoil: Natural, fertile, agricultural soil typical of locality, capable of sustaining vigorous plant growth, from well-drained site free of flooding, not in frozen or muddy condition, not less than 3% organic matter, and pH value of 5.9 to 7.0. Free from subsoil, slag, clay, stones, lumps, live plants, roots, sticks, crabgrass, coughgrass, noxious weeds and foreign matter.
3. Very fine sandy loams and silt loams are not allowed.
4. Have topsoil analyzed and submit written analysis stating the nitrogen, phosphorus, and potassium requirements, organic matter content, and pH value of the soil.

B. Fertilizer: Commercial type conforming to FS O-F- 241, proportions 10N-20P-10K.

C. Lime: Lime, if required, shall be agricultural grade ground limestone ground to pass an 8-mesh sieve with 25 percent passing a 100-mesh sieve. Calcareous lime-stone shall contain not less than 50 percent calcium oxide, and dolomitic lime-stone shall contain not less than 40 percent magnesium oxide. Coarser materials will be acceptable provided the specified rates of application are increased proportionately, on the basis of quantities passing the 8 and 100 mesh sieves, but no additional payment will be made for the increase quantity.

D. Seed, General:

1. Labeled in accordance with current rules and regulations of Arkansas State Plant Board.
2. Minimum 98% pure seed and 85% germination by weight.
3. Allowable noxious weed seeds: 50 per pound of seed with no Johnson grass, wild onion, wild garlic, field bindweed, or nut grass seed allowed in any amount whatsoever.
4. Furnish seed in sealed, standard containers.

E. Seed varieties: Refer to seed mix control schedule in subsection 2.2 - A of this section.

F. Mulching material/soil stabilizer:

1. Virgin wood cellulose fiber combined with COHEREX, as manufactured by Witco Chemical, Golden Bear Division, Bakersfield, CA; or
2. CONWED 2000, as manufactured by Conwed Corporation, Environmental Products Division, St. Paul, MN

G. Water: Irrigation quality, free of impurities that would be detrimental to plant growth.

2.2 MIXING

A. Seed Mix: Seed shall be composed of the varieties and amount by weight as shown below, based on time of application.

Variety	Period	Rate
1. Turf Type Seeding Mix	Turf	
Common Bermuda Grass	4-1 to 8-15	100lbs/Acre
Perennial Ryegrass	8-16 to 12-30	200lbs/Acre

B. Hydromulching Mixture:

1. 2000 lbs. of virgin wood cellulose fiber per acre; COHEREX in proportion as recommended by manufacturer for mixing with cellulose fiber.
2. Fertilizer: Minimum 600 lbs. per acre or maximum 800 lbs. per 1500 gallons of water.
3. CONWED 2000 in proportion to rest of mixture as recommended by manufacturer.
4. Seed: As specified for type of seed or seed mixture and time of application.
5. Water.

PART 3 - EXECUTION

3.1 PREPARATION

A. Furnish and install all materials and labor necessary for revegatation (seeding) of those areas disturbed by construction operations.

B. Have the seeding areas tested for lime and fertilizer requirements by the County Extension Agent, other public service agency, or private testing service at Contractor's expense. At least three soil samples shall be taken from each area. Submit a report of the soil analysis recommendation to the Architect/Engineer.

C. Verify that seeding area has been cleaned up and dressed to final shape.

3.2 INSTALLATION

A. Subgrade Preparation:

1. Fine grade sub-grade, eliminating uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas and rake until smooth.
2. Remove foreign materials, undesirable plants and their roots, stones and debris. Do not bury foreign material beneath areas to be hydromulched.
3. Remove sub-soil which has been contaminated with petroleum products.
4. Scarify and pulverize sub-soil to a depth of 3 inches where topsoil is to be placed. Repeat pulverizing in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

5. If lime is required, apply at rate determined by soil analysis, uniformly spreading on areas prior to their being scarified. Thoroughly mix lime with sub-soil to the scarified depth.

B. Placing Topsoil:

1. Spread topsoil to a minimum layer depth of 3 inches over entire area to be seeded.
2. Place topsoil during dry weather and on dry, unfrozen sub-grade.
3. Remove stones, roots, grass, weeds, debris, and other foreign non-organic matter while spreading.
4. If lime is required, apply at rate determined by soil analysis, uniformly spreading on topsoiled areas. Thoroughly mix lime with topsoil layer.

C. Hydromulching:

1. Prior to hydromulching, lightly firm seeding area with a cultipacker.
2. Verify that seeding area is ready to receive hydromulching and notify architect/engineer of schedule for application.
3. Apply mixture of mulch, seed, fertilizer, soil stabilizer, and water with the proper equipment to achieve complete coverage at the specified rate.

3.3 MAINTENANCE

A. Maintain hydromulched areas by watering, fertilizing, reseeding, and repairing as for a period of 90 days after germination, to provide a healthy, growing stand of grass. Water seeded areas to maintain adequate moisture levels for vigorous germination and growth. Apply additional granular or liquid fertilizer every 30 days following germination.

B. Mow turf type grass areas to a height of 3 to 4 inches when height of grass reaches 6 inches. Mowing is not required in areas hydromulched for slope protection.

C. Repair and reseed damaged ground surfaces outside of normal Work areas due to negligence of the Contractor.

D. It is intended that an established live and growing stand of grass be provided with no bare spots larger than one 3 square foot in area. The Contractor shall re-seed areas as necessary to obtain this result.

E. The time required for maintenance after the Contract Time ends will not be assessed as liquidated damages provided all other Work under the Contract has been completed.

End of Section

SECTION 03100
CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

This section shall consist of the requirements for the furnishing of all necessary materials and erection of concrete formwork.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Submittal Procedures – Section 01330

B. Concrete Formwork - Section 03100

C. Concrete Reinforcement - Section 03200

1.3 QUALITY ASSURANCE

Comply with Standard ACI 347 "Recommended Practice for Concrete Formwork".

PART 2 - PRODUCTS

2.1 MATERIALS

A. Form material may be plywood or metal sufficiently substantial and tight to prevent leakage of concrete.

B. Cylindrical forms of paper or fiber may be used provided the forms can resist the loading of wet concrete without deflection.

2.2 DESIGN

The forms shall be designed and constructed so as to safely support loads that may be applied and maintain their position and shape.

PART 3 - EXECUTION

3.1 GENERAL

A. Forms shall conform to the shape, lines and

dimensions of numbers called for on plans. They shall be properly braced or tied together to maintain their position and shape when concrete is tamped or vibrated.

B. Provide 3/4" chamfer on all exposed edges unless otherwise shown on the plans.

C. Forms for footings may be omitted when the soil and workmanship permit accurate excavation to size; and the omission is approved by the Engineer.

D. Removal of forms shall be done in a manner which will assure complete safety of the structures. When the structures as a whole are supported on shores, the removable forms, beams and sides and similar vertical forms may be removed after twenty-four (24) hours, provided the concrete is sufficiently hard and will not be injured. In no case shall the supporting forms or shoring be removed until the members have acquired sufficient strength to support their weight and the loads safely.

E. Forms for permanently exposed surfaces shall produce a smooth, even level finish without fins or board marks.

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

This section shall consist of the requirements for the furnishing and installation of concrete reinforcement work.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Submittal Procedures – Section 01330

B. Concrete Formwork - Section 03100

C. Concrete Reinforcement - Section 03200

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with requirements of the latest edition of the following codes and standards, except as herein modified:

(1) Concrete Reinforcing Steel Institute, "Manual of Standard Practice for Placing Reinforced Concrete Construction."

(2) American Concrete Institute, ACI 318 "Building Code Requirements for Reinforced Concrete."

(3) American Concrete Institute, ACI 315: "Manual of Standard Practice for Detailing Reinforced Concrete Structures."

(4) ASTM A615: Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

1.4 SHOP DRAWINGS

Shop Drawings shall be submitted to the Engineer for approval.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Metal reinforcement shall be deformed bars, conforming to the latest revision of one of the following requirements:

(1) ASTM "Standard Specifications for Deformed Billet-Steel Bars for Concrete Reinforcement," A-615.

(2) ASTM "Standard Specifications for Rail-Steel Deformed Bars for Concrete Reinforcement," A-616.

(3) ASTM "Standard Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement," A-82.

(4) ASTM "Standard Specifications for Welded Steel Wire Fabric for Concrete Reinforcement," A-185.

B. Metal accessories including spacers, chairs, ties and other devices necessary for properly assembling, placing, spacing, and supporting all reinforcement in place, shall be provided.

C. All reinforcing steel shall be Grade 60 unless otherwise indicated on the plans.

2.2 FABRICATION

Bars shall be accurately bent as indicated on the drawing and shall conform to the standards of CRSI "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Contractor shall comply with the standards as specified.

B. Reinforcement shall be free from scale, rust, or coatings which will reduce the bond to the concrete.

C. Bars shall be placed as indicated on the shop drawings and securely supported and fastened to prevent movement during the placement of concrete.

D. Protection for reinforcement shall be as follows:

(1) Concrete deposited against ground without use of forms - three inches (3").

(2) Concrete exposed to ground but poured in forms - two inches (2").

(3) Concrete exposed to weather - One and one-half inches (1-1/2").

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

This section consists of furnishing all required material and labor necessary completion of all cast-in-place concrete work, as indicated on the drawings or as specified.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Concrete Formwork - Section 03100

B. Concrete Reinforcement - Section 03200

1.3 QUALITY ASSURANCE

A. Codes and Standards - 1) Comply with the following codes:

a. ACI 301 "Specifications for Structural Concrete for Buildings."

b. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".

c. ACI 311 "Recommended Practice for Concrete Inspection".

d. ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures".

e. ACI 318 "Building Code Requirements for Reinforced Concrete".

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

1.4 TESTING

A. Testing and inspection of concrete and materials shall be made under the direction of the Engineer, who shall have access to all places where concrete materials are stored, proportioned, mixed or placed.

B. Tests shall be made by a recognized testing laboratory approved by the Engineer. The contractor will pay for all testing direct, as a part of the Contract. The contractor under the direction of the Engineer shall arrange for the proper sampling, molding of the test cylinders, job storage and transportation to the testing laboratory, all in accordance with ASTM C-94, C-172, C-143, C-138, C-1064, C-31

and ACI 301. This means that the concrete must be sampled by and the test specimens made by a Certified Concrete Field Testing Technician.

C. Material to be tested:

Cement
Fine Aggregate
Coarse Aggregate
Concrete as poured on the job

D. Testing shall be as follows:

(1) Cement - Test at mill source of supply. Test for each car or fraction of a car shipment.

(2) Fine and Coarse Aggregate - Complete preliminary tests before source is approved; then gradation tests on each car of aggregate shipped.

(3) Concrete as Poured on the Job - Test cylinders as per ASTM C-31, sets of three (3) each made at such time as directed by the Engineer; test one cylinder seven (7) days and two (2) at twenty-eight (28) days. Cylinders to be cured under conditions approaching that of concrete poured on the job as nearly as possible. Three cylinders for each 75 CY or fraction thereof, of concrete shall be taken.

1.5 STORAGE OF MATERIALS

A. Cement and aggregate shall be stored in a manner that prevents deterioration or intrusion of foreign matter. Any material which has deteriorated or has been damaged shall not be used for concrete.

B. Store admixtures so as to prevent contamination and protect from extreme temperatures.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement shall conform to ASTM "Standard Specifications for Portland Cement," C-150, Type I, latest revision. Type III High-Early strength may be used when approved.

B. Aggregates for concrete shall conform to ASTM "Standard Specifications for Concrete Aggregates," C-33, latest revision.

Fine aggregate shall be natural sand or sand prepared from stone, blast furnace slag, or gravel or other inert materials having similar characteristics when given approval by the Engineer.

Coarse aggregate shall be crushed stone, gravel, blast furnace slag, or other approved inert materials of similar characteristics, or combinations thereof having hard, strong, durable pieces, free from adherent coatings. Maximum size of pieces shall be one (1) inch, except for pavements.

C. Water shall be clean, and free from injurious amounts of oil, acid, alkali, organic materials, or other deleterious substances.

D. Vapor Barrier:

(1) Polyethylene sheeting conforming to Product Standard PS17, not less than 6 mil nominal thickness.

(2) Other similar material having a vapor permeance rating not exceeding 0.5 perm as determined under ASTM E96, Procedure E.

2.2 CONCRETE ADMIXTURES

A. Admixtures shall be used only if approved by the Engineer and in accordance with the manufacturer's recommendations.

B. Air-Entraining Admixture in accordance with ASTM C 260.

C. Calcium chloride will not be permitted in concrete, unless approved by the Engineer.

D. Fly-Ash may be used in the concrete mix as long as properly prepared mix designs have been submitted to the Engineer.

2.3 CONCRETE CURING MATERIALS

A. Burlap Cover - Keep the slab wet by light sprinkling for the first twelve (12) hours and then cover with two (2) layers of burlap kept continually wet for the balance of the curing period.

B. Liquid Membrane - Forming curing compounds for curing concrete shall conform to ASTM "Standard Specifications for Liquid

Membrane-Forming Compound for Curing Concrete," Designation C309. The Type Z, white pigmented compound shall be used.

2.4 CONCRETE DESIGN

All structural concrete shall have a minimum twenty-eight (28) day compressive strength of 4,000 pounds per square inch, unless otherwise noted on the plans, or called for in these specifications. All other concrete for sidewalks, headwalls, etc., shall have a minimum twenty-eight (28) day compressive strength of 3,000 pound per square inch (psi) unless otherwise noted on the plans.

PART 3 - EXECUTION

3.1 CONCRETE MIXING

A. Mix all concrete ingredients in power batch mixers, for not less than One (1) minute after all ingredients are in a mixer having a capacity of one (1) cubic yard or less. Increase mixing period fifteen (15) seconds for each one-half (1/2) cubic yard additional capacity of the mixer.

B. Concrete Proportions and Consistency - Proportion aggregates to cement so as to produce a mixture which will work readily into corners and angles of forms and around reinforcement, without permitting the materials to separate or excess free water to collect on surface.

Combined aggregates to be of such composition that when separated on the No. 4 sieve the weight passing the sieve shall not be less than thirty percent (30%) nor greater than fifty percent (50%) of the total. Proportion concrete materials by weight, provide accurate scales for this purpose. This requirement must be complied with. There shall be added to all concrete a cement dispersion agent which will reduce the amount of water required for a given consistency by not less than ten percent (10%) and which complies fully with the water cement ratio law. It shall be added in such amounts as recommended by the manufacturer to achieve the above results.

C. Ready-Mix Concrete - Ready-mix concrete, if used, shall conform to ASTM C-94 "Standard Specifications for Ready-Mix Concrete".

D. One brand of cement only shall be used unless written permission is given by the Engineer.

3.2 CONCRETE PLACEMENT

A. The footings and soil bottoms for slabs shall be approved before placement of concrete.

B. Remove water and all foreign matter from forms and excavations. Unless otherwise directed, wood forms and subgrades shall be thoroughly wetted just prior to placing concrete.

C. Deposit concrete as closely as practicable in its final position to avoid segregation due to rehandling or flowing. Place no concrete until all reinforcing steel, pipes, conduits, sleeves, hangers, and other work required to be built into concrete has been inspected and approved by the Engineer.

D. Retempering - No concrete that has partially hardened, become contaminated by foreign materials, or been retempered, shall be used.

E. Continuity of placing concrete shall generally be carried on as a continuous operation until the placing of an individual section is completed. When construction joints are necessary they shall be made and located with the approval of the Engineer. Concrete shall be carefully worked around reinforcement and embedded fixtures, along surfaces and into corners of forms. Vibrators may be used, provided they are operated under experienced supervision, and forms constructed to withstand their action.

F. Construction Joints - Before placing new concrete, the surface of the concrete already in place shall be picked, brushed clean, and given a coat of neat cement grout for a proper bond.

G. Cold Weather Requirements - Unless the temperature is at least 40 degrees F and rising water and/or aggregates shall be heated so that the temperature of the concrete, when placed, is not less than 55 degrees F. Provisions shall be made for maintaining the concrete at a minimum temperature of not less than 50 degrees F for a period of 5 days. Thereafter, until curing is complete, the concrete shall be maintained at a temperature which will prevent freezing. Other methods may be used as recommended in ACI 306-66 or latest revision.

H. Hot Weather Requirements - When the ambient temperature is 90 degrees F or above, special precautions shall be taken during mixing, placing, and curing. The use of a set retarding admixture

may be used upon the approval of the Engineer. In any event, the temperature of the mixing water with crushed or shaved ice is an acceptable practice. Curing shall be started as soon as finishing has been completed and/or the water sheen has disappeared.

Detailed recommendations for hot-weather concrete as given in ACI 605-59 or latest revision shall be followed.

3.3 CURING

Protect all concrete work and cement finished against injury from the elements and defacement of any nature during construction operation. All concrete made with normal Portland Cement shall be maintained in a moist condition for at least the first seven (7) days after placing; a high early strength concrete for at least the first three (3) days.

3.4 REPAIR OF TIEHOLES AND MINOR DEFECTS

Imperfect surfaces where concrete strength is not impared may be patched in accordance with Chapter 9 of ACI 301-66 or latest revision.

Fins and projections shall be removed and the concrete surface affected thereby shall be rubbed smooth with carborundum brick.

Small voids and cavities caused by form ties shall be filled with a non-shrink, non-staining grout pressed into holes and floated smooth. Exposed surfaces of headwalls and structure walls shall be rubbed smooth with carborundum brick until all form prints are removed. Pressure grouting shall be used for sealing cracks and crevices in hydraulic structures to maintain water tightness.

3.5 REPAIR OF HONEYCOMBED AREAS

Where concrete strength or structural integrity is not compromised, the area shall be cut out to a depth at which sound concrete is exposed, and filled with a non-shrink, non-staining grout matching the color of the concrete. The edges shall be undercut to insure a good mechanical bond.

3.6 BACKFILLING

No backfilling shall be allowed against a concrete structure or wall within 14 days of the placement of concrete. An additional time period may be required at the discretion of the Engineer.

3.7 MEASUREMENT AND BASIS OF PAYMENT

There shall be no measurement or separate pay item for the work covered under this section. The cost for this work shall be included in the contract unit price for the items as listed in the proposal.

SECTION 06650
LUMBER

PART 1 - SCOPE

This division shall relate all wood construction in accordance with the details of the drawings and in conformity with the lines and dimensions as shown on the drawings or required by the Engineer.

PART 2 - PRODUCTS

2.1 Lumber, unless otherwise designated on the plans, shall be No. 2 Common, Southern Pine or Cypress of the rough stock sizes shown on the plans. All lumber shall be dressed to Yard Size Standards given in American Lumber Standards and shall be dried to a moisture content not to exceed fifteen (15) percent. All lumber shall bear the "Grade Mark" of the Association under whose rules it is graded, or each shipment shall be accompanied by a "Certificate of Inspection" issued by the said Association.

2.2 All work adjacent to concrete on grade or masonry at grade will be Wolmanized.

2.3 Miscellaneous building materials such as nails, spikes, screws, etc., shall be of suitable types and sizes to draw and securely hold the members in place. Bolts, washers, and nuts shall be of standard manufacture approved by the Engineer.

2.4 All plywood shall be of the exterior type. Plywood used for the ceiling or eave trim shall be one side Grade B or better veneer finish. Roof deck shall be 1/2" thick Yellow Pine sheathing grade plywood.

PART 3 - EXECUTION

3.1 PROTECTION

A. All lumber shall be protected and kept under cover both in transit and at the job site.

B. Materials shall not be delivered unduly long before it is required for proper conduct of the work.

C. Lumber shall not be stored within the structure during the process of drying out of masonry or concrete work.

3.2 MEASUREMENT AND PAYMENT

A cost involved in the cost of wood and lumber construction shall be considered as subsidiary to other items and will not be measured or paid for separately.

SECTION 09 91 23
PAINTS AND COATINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required to prepare surfaces and apply paints and coatings as specified within this Section, unless otherwise indicated on the Drawings.

1.02 REFERENCES

A. ANSI/NSF 61 - Drinking Water System Components - Health Effects.

B. ASTM D 16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.

C. ASTM D 4263 - Indicating Moisture in Concrete by the Plastic Sheet Method.

D. ASTM F 1 869 - Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

E. AWWA C 652 - Disinfection of Water-Storage Facilities.

F. AWWA D 1 02 - Painting Steel Water Storage Tanks.

G. International Concrete Repair Institute (ICRI) Guideline No. 03732 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

H. SSPC-SP 1 - Solvent Cleaning.

I. SSPC-SP 2 - Hand Tool Cleaning.

J. SSPC-SP 3 - Power Tool Cleaning.

K. SSPC-SP 5/NACE 1 - White Metal Blast Cleaning.

L. SSPC-SP 6/NACE 3 - Commercial Blast Cleaning.

M. SSPC-SP 1 0/NACE 2 - Near-White Metal Blast Cleaning.

N. SSPC-SP 1 3/NACE 6 - Surface Preparation of Concrete.

1.03 DEFINITIONS

A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.

B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1 000 inch}.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.

C. Manufacturer's Quality Assurance: Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.

D. Applicator's Quality Assurance: Submit list of a minimum of 5 completed projects of similar size and complexity to this Work. Include for each project:

1. Project name and location.
2. Name of owner.
3. Name of contractor.
4. Name of engineer.
5. Name of coating manufacturer.
6. Approximate area of coatings applied.
7. Date of completion.

E. Warranty: Submit manufacturer's standard warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Specialize in manufacture of coatings with a minimum of 10 years successful experience.
2. Able to demonstrate successful performance on comparable projects.
3. Single Source Responsibility: Coatings and coating application accessories shall be products of a single manufacturer.

B. Applicator's Qualifications:

1. Experienced in application of specified coatings for a minimum of 5 years on projects of

similar size and complexity to this work.

2. Applicator's Personnel: Employ persons trained for application of specified coatings.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

1. Coating or material name.
2. Manufacturer.
3. Color name and number.
4. Batch or lot number.
5. Date of manufacture.
6. Mixing and thinning instructions.

B. Storage:

1. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
2. Keep containers sealed until ready for use.
3. Do not use materials beyond manufacturer's shelf life limits.

C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Weather:

1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
5. Wind: Do not spray coatings if wind velocity is above manufacturer's limit.

B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with AWWA D 102.

C. Dust and Contaminants:

1. Schedule coating work to avoid excessive dust and airborne contaminants.
2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tnemec Company Incorporated

B. Benjamin Moore

C. Sherwin Williams

D. Or Approved Equal

1. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COATING SYSTEMS FOR STEEL - STRUCTURAL, TANKS, PIPE, AND EQUIPMENT

A. Exterior Exposed:

1. System Type: Epoxy/urethane.
2. Surface Preparation: SSPC-SP 6.
3. Primer: Series 66 Hi-Build Epoxoline: DFT 3.0 to 5.0 mils.
4. Intermediate Coat: Series 66 Hi-Build Epoxoline: DFT 2.0 to 3.0 mils.
5. Finish Coat: Series 73 Endura-Shield: DFT 2.0 to 5.0 mils.
6. Total DFT: 7.0 to 13.0 mils.
7. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.

B. Interior Exposed:

1. System Type: Epoxy.

2. Surface Preparation: SSPC-SP 6.
3. Primer: Series 66 Hi-Build Epoxoline: DFT 3.0 to 5.0 mils
4. Finish Coat: Series 66 Hi-Build Epoxoline: DFT 4.0 to 6.0 mils.
5. Total DFT: 7.0 to 11.0 mils.
6. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.

C. Immersion:
1. System Type: Coal tar epoxy.
2. Surface Preparation: SSPC-SP 10.
3. Finish Coat: Series 46H-413 Hi-Build Tneme-Tar: DFT 14.0 to 20.0 mils.
4. Total DFT: 1 4.0 to 20.0 mils.
5. Finish Color: Black.

D. Below Grade:
1. System Type: Coal tar epoxy.
2. Surface Preparation: SSPC-SP 10.
3. Finish Coat: Series 46H-413 Hi-Build Tneme-Tar: DFT 14.0 to 20.0 mils.
4. Total DFT: 1 4.0 to 20.0 mils.
5. Finish Color: Black.

E. Marginally Prepared Surfaces (Maintenance, Non-Immersion):
1. System Type: Epoxy.
2. Surface Preparation: In accordance with manufacturer's instructions.
3. Primer: Series 135 Chembuild: DFT 4.0 to 6.0 mils.
4. Finish Coat: Series 66 Hi-Build Epoxoline: DFT 4.0 to 6.0 mils.
5. Total DFT: 8.0 to 12.0 mils.
6. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.

2.03 COATING SYSTEMS FOR FACTORY PRIMED STEEL - DOORS, FRAMES, AND MISCELLANEOUS EQUIPMENT

A. Exterior Exposed:
1. System Type: Epoxy/urethane.
2. Surface Preparation: Clean and dry.
3. Primer: Factory primed.
4. Intermediate Coat: Series 27 Typoxy: DFT 2.0 to 3.0 mils.
5. Finish Coat: Series 73 Endura-Shield: DFT 2.0 to 3.0 mils.
6. Total DFT: 4.0 to 6.0 mils.
7. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.

B. Interior Exposed:
1. System Type: Epoxy.
2. Surface Preparation: Clean and dry.
3. Primer: Factory primed.
4. Intermediate Coat: Series 27 Typoxy: DFT 2.0 to 3.0 mils.
5. Finish Coat: Series 66 Hi-Build Epoxoline: DFT 2.0 to 3.0 mils.
6. Total DFT: 4.0 to 6.0 mils.
7. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.

2.04 COATING SYSTEMS FOR NONFERROUS METAL - PIPE AND MISCELLANEOUS FABRICATIONS

A. Exterior Exposed:
1. System Type: Epoxy/urethane.
2. Surface Preparation: In accordance with manufacturer's instructions.
3. Primer: Series 66 Hi-Build Epoxoline: DFT 2.0 to 3.0 mils.
4. Finish Coat: Series 73 Endura-Shield: DFT 2.0 to 3.0 mils.

5. Total DFT: 4.0 to 6.0 mils.
6. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.

B. Interior Exposed:
1. System Type: Epoxy.
2. Surface Preparation: In accordance with manufacturer's instructions.
3. Primer: Series 66 Hi-Build Epoxoline: DFT 2.0 to 3.0 mils.
4. Finish Coat: Series 66 Hi-Build Epoxoline: DFT 2.0 to 3.0 mils.
5. Total DFT: 4.0 to 6.0 mils.
6. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.

C. Immersion:
1. System Type: Epoxy.
2. Surface Preparation: SSPC-SP 1 followed by abrasive blast.
3. Primer: Series 66 Hi-Build Epoxoline: DFT 3.0 to 5.0 mils.
4. Finish Coat: Series 66 Hi-Build Epoxoline: DFT 4.0 to 6.0 mils.
5. Total DFT: 7.0 to 11.0 mils.
6. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.

2.05 COATING SYSTEMS FOR DUCTILE OR CAST IRON - PIPE, PUMPS AND VALVES

A. Exterior Exposed:
1. System Type: Epoxy.
2. Surface Preparation: In accordance with manufacturer's instructions.
3. Primer: Series 66 Hi-Build Epoxoline: DFT 3.0 to 5.0 mils.
4. Intermediate Coat: Series 66 Hi-Build Epoxoline: DFT 4.0 to 6.0 mils.
5. Finish Coat: Series 73 Endura-Shield: DFT 2.0 to 3.0 mils.
6. Total DFT: 9.0 to 14.0 mils.
7. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.
8. Note: Factory Coated Pumps and Valves shall not be coated by Contractor.

B. Below Ground:
1. System Type: Coal tar epoxy.
2. Surface Preparation: In accordance with manufacturer's instructions.
3. Finish Coat: Series 46H-413 Hi-Build Tneme-Tar: DFT 14.0 to 20.0 mils. 4. Total DFT: 14.0 to 20.0 mils.
5. Finish Color: Black.
6. Note: Factory Coated items shall not be coated.

C. Interior Exposed:
1. System Type: Epoxy.
2. Surface Preparation: In accordance with manufacturer's instructions.
3. Primer: Series 66 Hi-Build Epoxoline: OFT 3.0 to 5.0 mils.
4. Finish Coat: Series 66 Hi-Build Epoxoline: OFT 4.0 to 6.0 mils.
5. Total OFT: 7.0 to 1 1 .0 mils.
6. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.

D. Immersion:
1. System Type: Coal tar epoxy.
2. Surface Preparation: In accordance with manufacturer's instructions.
3. Finish Coat: Series 46H-41 3 Hi-Build Tneme-Tar: OFT 1 4.0 to 20.0 m ils.
4. Total OFT: 1 4.0 to 20.0 mils.
5. Finish Color: Black.

2.06 COATING SYSTEMS FOR PVC

A. Exterior Exposed:

1. System Type: Epoxy/urethane.
2. Surface Preparation: Scarify.
3. Primer: Series 66 Hi-Build Epoxoline: OFT 2.0 to 3.0 m ils.
4. Finish Coat: Series 73 Endura-Shield: OFT 2.0 to 3.0 m ils.
5. Total OFT: 4.0 to 6.0 mils.
6. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.

B. Interior Exposed:

1. System Type: Epoxy.
2. Surface Preparation: Scarify.
3. Primer: Series 66 Hi-Build Epoxoline: OFT 2.0 to 3.0 mils.
4. Finish Coat: Series 66 Hi-Build Epoxoline: OFT 2.0 to 3.0 mils.
5. Total OFT: 4.0 to 6.0 mils.
6. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.

2.07 COATING SYSTEMS FOR INSULATED PIPE

A. Interior/Exterior Exposed:

1. System Type: Acrylic.
2. Surface Preparation: Clean and dry.
3. Primer: Series 6 Tneme-Cryl: OFT 2.0 to 3.0 mils.
4. Finish Coat: Series 6 Tneme-Cryl: OFT 2.0 to 3.0 m ils.
5. Total OFT: 4.0 to 6.0 mils.
6. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.

2.08 COATING SYSTEMS FOR PRECAST CONCRETE AND CONCRETE MASONRY UNITS

A. Exterior Exposed:

1. System Type: Acrylate.
2. Surface Preparation: SSPC-SP 1 3/NACE 6. Clean and dry.
3. Primer: Series 1 56 Enviro-Crete: OFT 4.0 to 8.0 mils.
4. Finish Coat: Series 1 56 Enviro-Crete: OFT 4.0 to 8.0 mils.
5. Total OFT: 8.0 to 1 6.0 mils.
6. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.

B. Interior Exposed:

1. System Type: Epoxy.
2. Surface Preparation: SSPC-SP 13/NACE 6. Brush-off blast.
3. Primer: Series 66 Hi-Build Epoxoline: OFT 4.0 to 6.0 mils.
4. Finish Coat: Series 66 Hi-Build Epoxoline: OFT 4.0 to 6.0 mils.
5. Total OFT: 8.0 to 12.0 mils.
6. Finish Color: See Schedule of Colors. If not specified, as selected by Owner from manufacturer's standard colors.

2.09 COATING SYSTEMS FOR CONCRETE FLOORS

A. See Section 03300 - "Cast-In-Place Concrete".

2.10 COATING SYSTEMS FOR CONCRETE MASONRY UNITS

A. Exterior

1. Primer: Two-Component, heavy-duty cementitious acrylic block filler
    a. Cement-Plex 875 B62W200/B42V201, @ 13.0 - 25.0 mils OFT, as manufactured by The Sherwin Williams Co.
2. Finish: One Component, Pigmented Acrylic
    a. DTM Acrylic Coating, Gloss or Semi Gloss, 866 Series, @ 2.5 - 4.0 mils DFT per coat (two coats), as manufactured by The Sherwin Williams Co.

B. Interior

1. Primer: Two-Component

a. PrepRite Masonry Primer, B28W300, @ 1.0 - 1.5 mils OFT, as manufactured by The Sherwin-Williams Company

2. Finish: One-Component, Pigmented Alkyd Coating, Gloss

a. Industrial Enamel VOC, 8542 Series, @ 2.0 - 3.0 mils OFT per coat (two coats), as manufactured by The Sherwin-Williams Co.

2.11 ACCESSORIES

A. Coating Application Accessories:

1. Accessories required for application of specified coatings in accordance with manufacturer's instructions, including thinners.

2. Products of coating manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which coating systems are to be applied. Notify Engineer of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.02 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.

B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.03 SURFACE PREPARATION OF STEEL

A. Prepare steel surfaces in accordance with manufacturer's instructions.

B. Fabrication Defects:

1. Correct steel and fabrication defects revealed by surface preparation.

2. Remove weld spatter and slag.

3. Round sharp edges and corners of welds to a smooth contour.

4. Smooth weld undercuts and recesses.

5. Grind down porous welds to pinhole-free metal.

6. Remove weld flux from surface.

C. Ensure surfaces are dry.

D. Immersion or Below Grade Surfaces: Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 10/NACE 2.

E. Exterior Exposed or Interior Exposed Surfaces: Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3.

F. Interior or Immersion Surfaces, Severe Exposure: Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 5/NACE 1.

G. Marginally Prepared Surfaces (Maintenance): Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with manufacturer's instructions.

H. Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.

I. Shop Primer: Prepare shop primer to receive field coat in accordance with manufacturer's instructions.

3.04 SURFACE PREPARATION OF NONFERROUS METAL

A. Prepare galvanized steel and nonferrous metal surfaces in accordance with manufacturer's instructions.

B. Surface preparation recommendations will vary depending on substrate and exposure conditions.

C. Ensure surfaces are dry.

D. Immersion Service: Clean surfaces by abrasive blasting.

E. Remove Rust From Galvanized Steel:

1. Remove white rust from galvanized steel by hand or power brushing.
2. Remove rust from old galvanized steel in accordance with SSPC-SP 2 or SP 3.
3. Do not damage or remove galvanizing.

F. Increase mechanical adhesion under moderate to severe conditions, such as exterior exposure or chemical environments, by abrasive blast and/or chemical cleaning.

3.05 SURFACE PREPARATION OF DUCTILE OR CAST IRON

A. Prepare ductile or cast-iron surfaces in accordance with manufacturer's instructions.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

3.06 SURFACE PREPARATION OF PVC

A. Prepare PVC surfaces in accordance with manufacturer's instructions.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

C. Scarify PVC surfaces.

3.07 SURFACE PREPARATION OF INSULATED PIPE

A. Prepare insulated pipe surfaces in accordance with manufacturer's instructions.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

3.08 SURFACE PREPARATION OF CONCRETE

A. Interior, Wet Substrate:

1. Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732.
2. Allow concrete to cure for a minimum of 28 days.
3. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.
4. Abrasive blast surface to remove laitance and solid contaminants and to provide clean, sound substrate with uniform anchor profile.
5. Fill holes, pits, voids, and cracks with Tnemec 63-1500 Filler and Surfacer.
6. Ensure surfaces are clean, dry, and free of oil, grease, chalk, form release agents, and other contaminants.

B. Exterior:

1. Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732.
2. Allow concrete to cure for a minimum of 7 days.
3. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.
4. Level concrete protrusions and mortar spatter.
5. Ensure surfaces are clean, dry, and free of oil, grease, chalk, form release agents, and other contaminants.

C. Exterior, Previously Painted:

1. Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732.
2. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.
3. Remove chalk and old paint not tightly bonded to surface.
4. Patch cracks in accordance with manufacturer's instructions.
5. Level concrete protrusions and mortar spatter.
6. Determine compatibility of primer over unknown previously-applied coatings by preparing a test patch.
7. Ensure surfaces are clean, dry, and free of oil, grease, and other contaminants.

3.09 SURFACE PREPARATION OF CONCRETE FLOORS

A. Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 1 3/NACE 6, and ICRI 03732.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

C. Allow concrete to cure for a minimum of 28 days before coating.

D. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.

3.10 SURFACE PREPARATION OF POROUS CONCRETE MASONRY UNITS

A. Prepare porous concrete masonry unit surfaces in accordance with manufacturer's instructions and SSPC-SP 13/NACE 6.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

C. Allow mortar to cure for a minimum of 28 days before coating.

D. Level protrusions and mortar spatter.

3.11 APPLICATION

A. Apply coatings in accordance with manufacturer's instructions.

B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.

C. Keep containers closed when not in use to avoid contamination.

D. Do not use mixed coatings beyond pot life limits.

E. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.

F. Uniformly apply coatings at spreading rate required to achieve specified OFT.

G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

H. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

3.12 DISINFECTION

A. Disinfection of Water Contact Surfaces and Filling of Water Storage Tanks:

1. Do not disinfect water contact surfaces or fill water storage tanks until application of coating systems is complete, coatings have fully cured, and field quality control inspection is complete.

2. Allow number of days in accordance with manufacturer's instructions and as directed by Engineer for full cure of coating systems on water contact surfaces before flushing, disinfecting, or filling with water.

3. Disinfection: AWWA C 652 or as directed by Engineer.

3.13 REPAIR

A. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.

B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.

C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.14 CLEANING

A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.15 PROTECTION OF COATING SYSTEMS

A. Protect surfaces of coating systems from damage during construction.

3.16 ONE-YEAR INSPECTION

A. Owner will set date for one-year inspection of coating systems.

B. Inspection shall be attended by Owner and Contractor.

C. Repair deficiencies in coating systems as determined by Engineer in accordance with manufacturer's instructions.

END OF SECTION

SECTION 40 23 36
PROCESS PIPING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and all pipe and appurtenances as shown on the Drawings and specified herein.

B. The material specified herein shall comply with the American Iron and Steel provision of the Clean Water Act as it applies to the State Revolving Loan Funds and as administered by the State of Arkansas. It is the Contractor's responsibility to determine if the Approved Manufacturers comply with the requirements of the provision.

1.02 RELATED SECTIONS

A. Section 31 23 23 - Fill.

B. Section 09 91 23 - Paints and Coatings.

1.03 REFERENCES

A. ASME 816. 1 - Cast Iron Pipe Flanges and Flanged Fittings; The American Society of Mechanical Engineers; 1998.

B. ASME 831.9 - Building Services Piping; The American Society of Mechanical Engineers; 1996 (ANSI/ASME 831.9).

C. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2001.

D. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2002.

E. ASTM A 74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2003.

F. ASTM A 105 - Standard Specification for Steel Pipe Flanges.

G. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

H. ASTM C 564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2003.

I. ASTM D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 1999.

J. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SOR Series); 2000.

K. ASTM D 2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2002a.

L. ASTM D 2846/D 2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems; 1999.

M. ASTM D 2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2002).

N. ASTM F 493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 1997.

0. AWWA C104/A21.4 - ANSI Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water (1995).

P. AWWA C110 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids; American Water Works Association; 1998.

Q. AWWA C11 1/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2000 (ANSI/AWWA C111/A21.11).

R. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2002 (ANSI/AWWA C151/A21.51).

S. AWWA C153 - American National Standard for Ductile-Iron and Gray-Iron Compact Fittings for Water and Other Liquids; American Water Works Association.

T. AWWA C200 - Steel Water Pipe - 6 inches and Larger (1997).
U. AWWA C206 - Field Welding of Steel Water Pipe (1997).
V. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 inches Through 144 inches (2001).
W. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings (2001).
X. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances (2005)
Y. AWWA C604 - Installation of Steel Water Pipe - 4 In. and Larger (2006)
Z. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water (2005)
AA. AWWA C651 - Disinfecting Water Mains; American Water Works Association; 1999 (ANSI/AWWA C651).
AB. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution; American Water Works Association; 1 997 (ANSI/AWWA C900).
AC. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. for Water Transmission and Distribution (1997).
AD. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; Cast Iron Soil Pipe Institute; 2001.
AE. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; Cast Iron Soil Pipe Institute; 1997.
AF. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1993.
AG. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2002.
AH. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1998.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
C. Project Record Documents: Record actual locations of valves.

1.05 QUALITY ASSURANCE

A. All non-metallic below grade piping shall be installed with a 12-gauge coated copper wire attached to the crown of the pipe with duct tape in not less than 2 places per length of pipe to provide detectors a means of locating buried lines.
B. Upon completion of backfilling for trenches, the Contractor shall be responsible for matching the existing surface conditions.
C. Identify and label all visible pipe with markings indicating the direction of flow.

1.06 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of Virginia plumbing code.
B. Conform to applicable code for installation of backflow prevention devices.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. In accordance with Section 01 60 00.
B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 SANITARY SEWER PIPING, BURIED

A. Ductile Iron Pipe: AWWA C151/A21.51, minimum pressure class 350 psi

1. Fittings:

a. 90 Bends: Ductile or gray iron, standard thickness, conforming to AWWA C110 (ANSI 21 .10).

b. All other Bends/Fittings: Ductile or gray iron, conforming to AWWA C153 (ANSI 21.53).

2. Joints: AWWA C1 1 1/A21.11, rubber gasket with 3/4 inch diameter rods and concrete thrust blocks as indicated on the Drawings.

3. Flanges: ASME B1 6.1 - 125 pound template.

4. Lining: AWWA C104 (ANSI 21.4).

2.02 PROCESS AND WATER PIPING, BURIED

A. Ductile Iron Pipe: AWWA C1 51/A21.51, minimum pressure class 350 psi

1. Fittings:

a. 90 Bends: Ductile or gray iron, standard thickness, conforming to AWWA C110 (ANSI 21 .10).

b. All other Bends/Fittings: Ductile or gray iron, conforming to AWWA C153 (ANSI 21 .53).

2. Joints: AWWA C1 1 1 /A21 .11, rubber gasket with 3/4 inch diameter rods and concrete thrust blocks as indicated on the Drawings. Under slabs and foundations, restrained joint fittings shall be provided.

3. Flanges: ASME B16.1 - 1 25 pound template.

4. Lining: AWWA C104 (ANSI 21 .4).

5. Fittings: Ductile or gray iron, standard thickness.

B. PVC Pipe: AWWA C900 and AWWA C905, minimum pressure class 150 psi

1. Provisions must be made for expansion and contraction at each joint with an elastomeric gasket.

2. Fittings:

a. 90 Bends: Ductile or gray iron, standard thickness, conforming to AWWA C110 (ANSI 21.10).

b. All other Bends/Fittings: Ductile or gray iron, conforming to AWWA C153 (ANSI 21.53).

3. Joints: Under slabs and foundations, restrained joint fittings shall be provided.

4. Random lengths shall not be less than 10 feet long.

2.03 PROCESS AND WATER PIPING, ABOVE GRADE

A. Steel Pipe 8 Inches and Smaller: ASTM A 53/A 53M, Schedule 40, Black Steel; unless otherwise noted to be galvanized.

1. Fittings and unions: AWWA C206 and AWWA C208 with a minimum working pressure of 150 psi.

2. Screw Joints: Perfectly tight with a still mixture of graphite and mineral oil, or an approved, non-toxic, non-hardening pipe joint compound applied to the male threads only.

3. Flanges: AWWA C207.

4. The interior of the pipe shall not be coated

5. The exterior of the pipe shall be coated in accordance with Section 09900.

B. Steel Pipe 10 Inches and Larger: ASTM A 53/A 53M and AWWA C200, Schedule 20, Black Steel; unless otherwise noted to be galvanized.

1. Fittings and unions: AWWA C206 and AWWA C208 with a minimum working pressure of 150 psi.

2. Flanges: Flanges shall be steel slip on or welding neck type, raised face, Class 150, conforming to ASTM A 105 and ANSI B16.5.

3. Pipe shall have beveled ends for welding.

4. Pipe ends shall be provided to suit the field joints indicated on the Drawings.

5. Field welded joints shall be single (outside) lap or butt type conforming to AWWA C206.
6. The interior of the pipe shall not be coated.
7. The exterior of the pipe shall be coated in accordance with Section 09900.

C. Ductile Iron Pipe: AWWA C151/A21.51, minimum pressure class 350 psi

1. Fittings: Ductile or gray iron, standard thickness, conforming to AWWA C110 (ANSI 21.10).
2. Joints: AWWA C111/A21.11, rubber gasket with 3/4 inch diameter rods and concrete thrust blocks as indicated on the Drawings.
3. Flanges: ASME B16.1 - 125 pound template.
4. Lining: AWWA C104 (ANSI 21.4).

2.04 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:

1. Ferrous pipe: Class 150 malleable iron threaded unions.

B. Flanges for Pipe Size Over 1 Inch:

1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

C. Grooved and Shouldered Pipe End Couplings:

1. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
2. Sealing gasket: "C" shape composition sealing gasket.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.05 PIPE, HANGERS, AND SUPPORTS

A. Process Piping:

1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

B. Plumbing Piping - Water:

1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1 /2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron pipe roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

10. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast-iron pipe roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.06 PIPE PENETRATION SEALS

A. Wall/floor penetration seals shall be used to continuously fill the annular space between pipe and wall/floor. Wall/floor penetration seals, once expanded, shall provide a seal between the pipe and wall/floor opening.

B. Where walls or floors have pipe penetrations that are continuously wet on one or both sides, the use of wall sleeves with water stops shall be employed along with the wall/floor penetration seal to achieve a watertight seal between pipe and wall/floor opening.

C. The wall/floor opening size and/or type shall be selected according to recommendations found in seal penetration manufacturer's representative catalog. The wall/floor opening refers to a steel or plastic sleeve, core drilled hole or cast-formed hole.

D. Penetration Seal Rubber Links

1. The wall/floor penetration seal shall be made of mechanically interlocked, solid synthetic rubber links. There shall be a sufficient quantity of links about the pipe that once expanded, shall achieve a 20-PSI hydrostatic seal between pipe and wall/floor opening.
2. The elastomer element shall be EPDM elastomer.
3. Penetration seal pressure plates shall be molded of glass reinforced nylon.
4. Hardware Fasteners shall consist of stainless steel bolts and hex nuts.

E. Wall Sleeves

1. Cast in place concrete wall sleeves are to be fabricated from galvanized heavy wall welded or seamless carbon steel pipe. All sleeves are to have a 2" wide, full perimeter water stop, welded on both sides.

2.07 TRACER WIRE AND ACCESS BOXES

A. All new non-metallic buried piping shall be installed with tracer wire. Metallic pipes do not require a tracer wire. Metallic pipe systems require access points along the route for direct connection. The tracer wire shall be installed continuously along the new pipe route with access points at 300 feet maximum. The tracer wire shall be brought to the ground surface at the access points. Access points may include valve boxes, handholes, manholes, vaults, or other covered access devices. Access point covers shall be clearly marked with a pipe description. Splices in the tracer wire shall be connected by means of a split bolt or compression type connector to ensure continuity. Wire nuts shall not be used. A waterproof or corrosion-proof connector for direct bury applications shall be used. After installation, the tracer wire shall be tested to verify continuity of the tracer wire system.

B. For locations where valve boxes are not present, the tracer wire access point shall be composed of one SnakePit Tracer Wire Access Box, or approved equal, installed at each proposed access point.

C. At each valve location, a loop of wire is to be brought up the outside of the valve box and looped inside the box through a hole drilled two (2) inches below the bottom of the lid.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install to the required lines and grades with fittings, valves, and accessories at the required locations; spigots centered in the bells; and all valves and appurtenances properly aligned. The laying of pipe shall conform to the applicable portions of AWWA C600, AWWA C604, or AWWA C605.

C. Pressure test all piping in accordance with AWWA C600, AWWA C604, or AWWA C605 to a minimum test pressure of 150 psi, unless otherwise indicated.

D. All piping and fittings shall be rigidly supported.

E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls, except as indicated otherwise on the Drawings.

G. Install piping to maintain headroom, conserve space, and not interfere with use of space.

H. Group piping whenever practical at common elevations.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

J. Deflections from a straight line or grade made necessary by vertical or horizontal curves or offsets shall not exceed the manufacturer's recommendations. If the required alignment requires deflections in excess of those recommended, the Contractor shall either provide special bends, as approved by the Engineer, of a sufficient number of shorter lengths of pipe to provide angular deflections within the required limit.

K. Laying of pipe shall be commenced immediately after the excavation is started, and every means must be used to keep pipe laying closely behind the trenching. The Engineer may stop the trenching when, in the opinion of the Engineer, the trench is open too far in advance of the pipe laying operation. Pipe may be laid in the best manner adapted to securing speed and good results.

L. Inspect pipe and fittings for defects and all lumps, blisters, excess coal-tar coating and other foreign material shall be removed from the bell and spigot end of each cast iron or PVC pipe, or inside of PVC couplings and fittings. All pipe, couplings, adapters, and other pipe connections shall be wiped clean and dry before the pipe is laid.

M. After placing a length of pipe in the trench, center the spigot end in the bell and force the spigot end into the bell end.

N. Secure the pipe in place with approved backfill material tamped under it except at the bells. Pipe and fittings which do not allow a sufficient and uniform space for joints shall be removed and replaced with pipe and fittings of proper dimensions to insure each uniform space.

0. Prevent dirt from entering the joint space.

P. The cutting of cast iron pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe.

Q. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

R. Establish elevations of buried piping outside the building to ensure not less than 3 ft of cover.

S. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

T. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

U. Provide restrained joint fittings under all slabs.

V. Provide support for utility meters in accordance with requirements of utility companies.

W. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 91 23.

X. Excavate in accordance with Section 31 23 16 for work of this Section.

Y. Backfill in accordance with Section 31 23 23 [] for work of this Section.

Z. Install bell and spigot pipe with bell end upstream.

AA. Install valves with stems upright or horizontal, not inverted; unless indicated otherwise on the Drawings.

AB. PVC Pipe: Make solvent-welded joints in accordance with ASTM D 2855.

AC. Sleeve pipes passing through partitions, walls and floors.

AD. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

AE. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
7. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
8. Support cast iron drainage piping at every joint.

3.04 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.

E. Provide spring loaded check valves or as otherwise indicated on the drawings on the discharge of all water and wastewater pumps.

3.05 ERECTION TOLERANCES

A. Drainage Piping: Establish invert elevations within 1 /2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:
    a. Pipe size: 1/2 inches to 1-1/4 inches:
        1) Maximum hanger spacing: 6.5 ft.
        2) Hanger rod diameter: 3/8 inches.
    b. Pipe size: 1-1 /2 inches to 2 inches:
        1) Maximum hanger spacing: 10 ft.
        2) Hanger rod diameter: 3/8 inch.
    c. Pipe size: 2-1 /2 inches to 3 inches:
        1) Maximum hanger spacing: 10 ft.
        2) Hanger rod diameter: 1/2 inch.
    d. Pipe size: 4 inches to 6 inches:

1) Maximum hanger spacing: 1 0 ft.
2) Hanger rod diameter: 5/8 inch.

e. Pipe size: 8 inches to 12 inches:
1) Maximum hanger spacing: 14 ft.
2) Hanger rod diameter: 7/8 inch.

f. Pipe size: 14 inches and Over:
1) Maximum hanger spacing: 20 ft.
2) Hanger rod diameter: 1 inch.

2. Plastic Piping:

a. All Sizes:
1) Maximum hanger spacing: 5 ft.
2) Hanger rod diameter: 3/8 inch.

END OF SECTION

SECTION 15010
GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL AND SPECIAL CONDITIONS

a. Note that the General and Special Conditions of the specifications are applicable to this division of the specifications. In the event of any conflict between the general and special conditions and this division, the requirements of this division shall take precedence.

PART 2 - MEANS AND METHODS

a. Unless otherwise expressly provided in the contract drawings, specifications, and addenda, the means and methods of construction shall be such as the contractor may choose; subject, however, to the Engineer's right to reject means and methods proposed which: (1) will constitute or create a hazard to the work, or to persons or property; or (2) will not produce finished work in accordance with the terms of the contract.

b. The Engineer's approval of means and methods of construction or his failure to exercise his right to reject such means or methods, shall not relieve the contractor of his obligation to accomplish the result intended by the contract; nor shall the exercise of such right to reject create a cause of action for damages.

PART 3 - SITE AND JOB CONDITION INSPECTION

a. Before submitting a bid, thoroughly inspect the job site and existing facilities to insure complete understanding of conditions to be met in carrying out the requirements of this contract. Verify at the job site all measurements necessary for the proper installation of the work.

b. Where work consists of modification of or addition to an existing facility, the contract documents do not indicate all of the existing mechanical installations. Inspect the existing installation to determine full extent of effect of existing conditions on work under this contract.

PART 4 - RELATIONSHIP BETWEEN DRAWINGS AND SPECIFICATIONS

a. The drawings and specifications are complementary documents. In the event of conflict between them, the drawings shall take precedence.

b. Generally, the specifications provide general instructions for completion of work and fix the quality of equipment supplied and of workmanship in performance of work.

c. Generally, the drawings show quantities, capacities and indicate diagrammatically the location of the various components of the mechanical systems and the method of connecting, circuiting and controlling them. Exact location of components must be determined from detail drawings, rough-in drawings, shop drawings, and by measurements on the job and are subject to approval of the Architect/Engineer.

PART 5 - SUBSTITUTIONS

a. Where manufacturer's names appear, other manufacturers may be substituted upon obtaining written approval of Engineer at least seven (7) days prior to opening of bids.

b. Assume any additional charges, including engineering charges and any charges for changes in the work resulting from substitutions.

c. If substitutions in materials, equipment, or designs are made, with or without the Engineer's approval, other than those authorized herein, assume full responsibility for the effects of such substitutions on the entire project.

d. Should a substitute item prove unsatisfactory for the service intended within the guaranty period, replace it at no additional cost.

PART 6 - SUBMITTAL DATA

a. Provide submittal data for all mechanical equipment, air distribution equipment, automatic controls, piping specialties, insulation and vibration isolators, or other items as required by the Engineer.

b. Provide 5 copies of all submittals derived from manufacturer's literature to the Engineer within 30 days of the date the contract is approved. Indicate positively the exact items offered with capacities and dimensions clearly marked and options to be provided. Submittals shall be permanent copies and not copies which age rapidly. Include the name, address

and telephone number of the supplier or manufacturer's representative through whom the equipment is to be procured.

PART 7 - SHOP DRAWINGS

a. Generally, shop drawings shall be required only to show departures from the plans as prepared by the Engineer, shall consist of working scale drawings showing clearly each such departure, and shall be approved by the Engineer before the work is started. Detailed installation drawings need not be submitted for approval unless specifically required.

b. Wherever shop drawings are called for, furnish 5 copies after receiving approval on materials and equipment and in sufficient time that no delay or changes will result. Shop drawings shall be permanent copies and not copies which age rapidly.

PART 8 - AS-BUILT DRAWINGS

a. During progress of construction, record on one set of prints any deviation from original design with respect to size and location of all mechanical system components. Record final location of all underground lines by depth from finished grade and by distance from buildings, curbs, or walks.

b. On completion of the contract, submit these drawings to the Architect/Engineer for approval and record.

PART 9 - CODES, ORDINANCES AND REGULATIONS

a. Install all components of the mechanical system in accordance with the current editions of local, state and national codes, ordinances, or regulations pertaining to the class of work. If any conflict between these codes and the plans and specifications occurs, notify the Engineer and request a resolution of the conflict.

b. Arrange for inspection and testing of systems by constituted authorities as required by local codes and ordinances. Obtain and deliver to the Architect/Engineer final certificates of acceptance from authorities.

c. Applicable portions of the following ordinances, codes and regulations in effect on the bid opening date shall be used:

(1) National Electrical Code
(2) American Gas Association Recommended Practices
(3) National Fire Protection Association Recommended Practices
(4) American Society of Mechanical Engineers Piping and Boiler Codes
(5) National Safety Code
(6) Arkansas State Plumbing and Gas Code
(7) Arkansas Fire Prevention Code
(8) Arkansas State Mechanical Code
(9) Other Applicable State or Local Ordinances or Codes

PART 10 - PERMITS AND FEES

a. Obtain all permits required for installation of work and pay any fees required for these permits.

PART 11 - UTILITIES LOCATIONS, METERS AND CONNECTIONS

a. Locations and elevations of utilities given on plans are from utility maps or other reliable sources but are offered as a general guide only with no guarantee as to accuracy. Verify the location and elevation of all utilities affecting work, prior to installation of any piping.

b. Arrange with proper authorities and utility companies for service connections, verifying locations and arrangements and paying all charges pertaining thereto.

c. Furnish meters and pressure regulators as indicated on plans when not furnished by the utility company. Furnish meter loops and bypasses and set meters furnished by utilities companies. All piping shall conform to Utility Company specifications.

d. When connections to existing lines, rerouting of utility lines, modifications to services, etc., would interrupt service or interfere with normal use of the buildings, arrange work such that outages are minimized and schedule outages to occur at times satisfactory to the Owner.

PART 12 - SKILLED LABOR AND SUPERVISION

a. Accomplish all work with workmen skilled in their trade or under continuous supervision of skilled craftsmen. Provide a superintendent on the job with experience in the type of work

involved and capable of coordinating and directing the installation of the mechanical system.

PART 13 - OPERATING AND MAINTENANCE INSTRUCTIONS

a. Prior to final inspection, submit to the Engineer, in draft form, three sets of instructions for operating and maintaining systems and equipment. After approval of draft, provide finished copies, framed with glass cover, and mount in suitable locations on the job.

b. Provide three copies of a bound manual containing repair operating instructions for each component of the mechanical system.

PART 14 - GUARANTEE

a. Furnish a written certificate of guarantee of materials, equipment and labor to be free of defects for one year from date of final acceptance and agree thereby to replace, repair or in other manner make good any defects appearing in that period without additional cost to the Owner.

b. This guarantee shall specifically include the replacement of drive belts, bearings, seals, and other similar items whose improper installation or lack of attention could be cause for failure within the one-year period, but does not include the replacement of air filters, or similar expendable items.

PART 15 - EXISTING FACILITY

a. Coordinate all work with the Owner in such a way that interference with the operation of the existing facility will be minimized. Refer to special scheduling requirements specified in Architectural divisions of the specifications.

b. Schedule utilities outages as required by provisions of paragraph "Utilities Locations, Meters and Connections."

c. Adhere strictly to requirements pertaining to the protection of existing facility from construction dust or damage resulting from construction.

PART 16 - EXISTING AND OWNER SUPPLIED EQUIPMENT

a. Relocate and reconnect existing equipment where noted on the plans. Install equipment in accordance with all requirements of this contract and perform any cleaning and adjusting of relocated equipment required to place equipment in operation. Any major repairs requiring parts will constitute an extra to the contract.

PART 17 - CONDITIONS OF WORK-IN-PLACE

a. Examine work-in-place on which specified work is in any way dependent. Report, in writing, to the Engineer any defects which may influence satisfactory completion and performance of specified work. The absence of such notification shall be construed as acceptance of work-in-place.

b. Should incorrectly charted piping or other utilities be encountered during demolition, consult the Engineer immediately for directions as to procedure. Cooperate with Owner in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of Owner.

c. Data on indicated conditions are not intended as representations or warrants of continuity of such conditions. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data are made available for the convenience of Contractor.

d. Additional exploratory operations may be made by Contractor at no additional cost to the Owner, provided such operations are acceptable to Engineer.

PART 18 - SALVAGE ITEMS

a. All salvage items are considered as property of the Owner and are to be transported to a storage area by the Contractor, as directed by Owner or Owner's representative. Any items rejected by the Owner or Owner's representative are to be removed from the job site by the Contractor.

b. Notify the Engineer or Owner's representative of any items removed that may be of value to the Owner before disposing of it.

c. All salvage items removed are to be removed with the greatest

of care not to damage their finish or shape. Store in a manner that will protect each item from damage.

PART 19 - DISPOSAL OF WASTE MATERIALS

Remove all waste materials and rubbish from the site. Do not stockpile on site.

SECTION 15050
BASIC MATERIALS AND METHODS

PART 1 - APPEARANCE OF WORK

a. Arrange and install all exposed portions of work specified under this division such as access doors, grilles, escutcheons, thermostats, etc., to fit in and harmonize with the work specified in other divisions to the satisfaction of the Architect/Engineer.

b. Run piping and ductwork exposed in mechanical rooms and concealed in chases, attic and crawl spaces, or in enclosures or furring unless indicated otherwise. Traps, supplies and stops to plumbing fixtures may be exposed unless otherwise noted.

PART 2 - PAINTING

a. Mechanical equipment, unless otherwise specified, shall have standard factory finish or at least a prime coat finish. Restore marred surfaces of mechanical equipment to original condition.

b. Paint all exposed gas piping within building, exposed outside building, in boiler rooms and in furnace rooms. Apply one coat of inhibiting primer coat and two finish coats.

c. Paint all refrigerant piping insulation outdoors with two coats of exterior enamel.

d. Other painting and finishes are specified elsewhere.

PART 3 - EQUIPMENT IDENTIFICATION

a. Provide nameplates or identification labels for all mechanical equipment and main or riser shut off valves. Nameplates shall be laminated bakelite with letters at least 3/8" high. Attach permanently to the equipment in a conspicuous location. Do not attach to removable parts of equipment such as starter covers.

PART 4 - PROTECTION OF APPARATUS

a. Protect equipment stored on the job site or installed on the job from damage. This shall include construction of temporary

shelters to protect equipment stored in the open, cribbing of equipment above the floor, and the covering of equipment in the uncompleted buildings.

b. Keep ends of pipe and conduits, including those extending through roofs, drains, openings in equipment, and fixture branches, closed with caps or plugs to prevent foreign material from entering them during construction.

c. Do not operate equipment furnished under this contract during construction, except as required for testing, without written permission of the Engineer.

PART 5 - FIXTURE AND EQUIPMENT SUPPORTS AND FASTENINGS

a. Support fixtures and equipment so they can function properly without damage to structure or equipment or hazard to occupants. Support from structural components such as joists or studs, or proper blocking, etc., and not from suspended ceilings or wall panels or plaster.

b. Use expansion sleeves, wood screws, through bolts, Phillips "Red Head" self-drilling anchors or Ramset fasteners where applicable and as recommended by the manufacturers.

c. Install floor mounted equipment on concrete bases, not less than 4" high unless otherwise noted. Corners of the foundations shall be neatly chamfered. Place foundation bolts in the forms when the concrete is poured, correctly located by means of templates. Allow 1" below equipment bases for alignment and grouting. After grouting remove the forms and hand rub the surface of foundations with carborundum.

d. Furnish special piping and equipment supports as specified under other sections of this division.

PART 6 - VIBRATION ISOLATION

a. Provide resilient motor bases, vibration isolators on equipment, flexible connectors in piping and ductwork and vibration isolating hangers for piping as required or specified to prevent transmission of objectionable vibrations to occupied spaces. All vibration isolators shall be by a single manufacturer unless provided as an integral part of an item of

equipment.

PART 7 - ROOF CURBS AND ROOF AND WALL PENETRATIONS

a. Provide curbs for relief vents, rooftop exhaust fans, H.V.A.C. equipment, etc., where required. Equipment on sloping roofs shall have sloped curbs to match roof slope. Coordinate location and size of all roof openings with other trades affected.

b. Provide proper sheet metal flashing and counterflashing for all places where piping, ducts, etc., specified in this division penetrate the roof. Provide sheet lead plumbing vent flashing as specified.

c. Install fire dampers with access doors, at all duct penetrations of fire rated walls and floors.

d. Provide 22 gage galvanized iron sleeves where pipes penetrate interior walls and galvanized wrought iron sleeves where pipes penetrate exterior masonry walls, concrete beams, walls or floors. Size sleeves to permit insertion of pipes, continuation of insulation through walls and proper waterproofing and sealing where required. Finish wall sleeves flush with the walls and floor sleeves 1" above finished floor.

e. Provide "fire-stop" caulk or sealant around all pipe penetrations of fire rated walls or floors.

f. Install chromium-plated sectional plates around pipes at all wall, ceiling and floor penetrations except in attics and crawl spaces.

PART 8 - ACCESSIBILITY OF EQUIPMENT

a. Install valves, unions, junction boxes, expansion joints, flexible connections, instruments, air vents, bearings, filters, cleanouts, strainers, and other items requiring servicing or repairs in accessible location where possible.

b. Furnish and install Milcor metal access panels, style and type as required for access to equipment above ceilings, in chases, etc., to which access will be required for servicing, testing, balancing, etc., and which are not otherwise accessible.

PART 9 - EXCAVATION AND TRENCHING

a. Excavate and trench as required to install portions of the mechanical systems required to be located below grade. Arrange cutting of streets and walks with cognizant authorities and patch cuts to conform to their requirements.

b. Exercise care to protect the roots of trees to remain. Perform all the trenching within the branch spread by hand. When trench is opened, install the utility immediately, prune injured roots cleanly and backfill as soon as possible.

c. Keep trenches free from water while construction therein is in progress. Pump or bail water from bell holes to permit proper joining of pipes. Conduct discharge from dewatering to drains or natural drainage channels.

d. Unless otherwise shown or approved by the Engineer, provide separate trenches for sewers, water lines, and gas lines. Provide a minimum of 10' of undisturbed earth between water and sewer trenches.

e. Grade bottom of trenches to provide uniform bearing support for each sections of pipe on undisturbed soil. Dig bell holes with only sufficient room for making up joints. Where trench is in rock, excavate at least 4" over depth and backfill with loose moist earth thoroughly tamped to desired depth. Where unstable soil in trench is incapable of supporting pipe, remove it and backfill to trench bottom grade with coarse sand or fine gravel. Round bottom of trench so that at least 1/3 of the circumference of the pipe will rest on undisturbed or tamped soil.

f. Backfill trenches only after required tests have been completed. Backfill and tamp in 6" layers with materials free of large stones or clods or earth to cover of 1' for water lines and 2' for sewer and gas lines. Backfill the remainder of trenches in 1' layers. Do not use blasted rock, broken concrete or large boulders for backfill. Backfill entire depth of trenches to be covered with roads, walks, or concrete slabs in 6" layers with each layer moistened and compacted to at least 95% compaction as specified by Modified Compaction Procedures (ASTM D-1557).

g. All buried lines shall have a minimum of 18" cover unless noted otherwise. Utilities lines beyond 2' from building shall not be installed until all rough grading is completed. Allowances shall be made for finished grading operations to insure adequate final cover over lines.

PART 10 - CUTTING AND PATCHING

a. Hold all cutting of walls, floors, ceilings, roofs, etc., to a minimum by providing sleeves or arranging to have proper openings left. Perform cutting required to install the mechanical systems. Openings shall be only as large as required and provided with structural supports where necessary. Do not cut structural members or load bearing masonry walls without permission from the Engineer. Provide for patching of openings by the trade whose work is disturbed.

PART 11 - BELT DRIVES

a. Equip each belt driven machine with a v-belt drive with endless belts of reinforced cord and rubber construction. Cords shall be long staple cotton, rayon, nylon, or other suitable fiber. Belts shall be correct cross section to fit properly in sheave grooves and carefully matched for each drive.

b. Provide sheaves of cast iron or steel, bored to fit shafts and secured with keys of proper size. The use of set screws alone will not be permitted. Pitch diameters of sheaves shall be not less than 2" for 1/4 HP, 2.5" for 1/2 HP, and 3" for "A" section and 5.4" for "B" section belts above 1/2 HP. Select variable pitch sheaves so the required RPM will be obtained with sheave set in mid-position, and pitch diameter in that position shall be as specified above. Driving and driven shafts shall be parallel and sheaves so located that corresponding grooves will be in the same place. The driven sheave shall have the same groove spacing as motor sheave.

c. Drive rating shall be as recommended by the equipment manufacturer but at least 1.5 times the nameplate rating of the motor, with proper allowance for sheave diameters, center distance and arc of contact less than 180 degrees.

PART 12 - GUARDS

a. Equip each exposed drive assembly with a guard constructed of 12 gauge diamond mesh wire screen, or equivalent, welded to 1" steel angle frames enclosing all belts and sheaves. Construct tops and bottoms of guards of not less than 18 gage galvanized sheet metal. Secure guards to the driven machines or to the foundations by heavy angle supports and angle bolts. Do not secure to motors and do not "bridge" the sound and vibration isolators. Guards shall permit movement of the motor to adjust belt tension, oiling, use of speed counters, and other maintenance and testing operations with guard in place.

b. Equip each fan which has blades or wheels exposed with a guard consisting of diamond mesh or welded wire screen. Openings in screen shall be no larger than 1/2". Guards shall be removable as required for access to fan parts which require adjustment and maintenance and shall be easily replaced.

PART 13 - ELECTRICAL MOTORS

a. All motors shall be of recognized American manufacturer wound for the voltage specified, and conform to latest standards of manufacture and performance of the National Electrical Manufacturers Association and the American Institute of Electrical Engineers. Motors shall be rated for continuous duty at 100% of rated capacity, with temperature rise of 40 degrees centigrade for open type; 50 degrees centigrade for drip and splash proof; and 55 degrees centigrade for explosion proof and totally enclosed, above an ambient of 40 degrees centigrade.

b. Unless otherwise required, integral horsepower polyphase motors shall be Class B, general purpose, squirrel cage, open type induction motors. Single phase fractional horsepower motors shall be of the open capacitor type. Generally, motors 1/3 horsepower and less shall be split capacitor type unless otherwise specified. Motors rated 1/3 horsepower or less shall have integral overcurrent protection. The insulation resistance between stator conductors and frames of motors shall be not less than 1/2 megohm.

c. Motors inside building shall be open type drip-proof. Motors outside building exposed to weather to be totally enclosed,

fan-cooled. Motors in hazardous locations or duty shall be explosion proof of the type required for the service.

PART 14 - MOTOR AND EQUIPMENT CONTROL

a. Each motor or piece of electrical equipment will be provided with controllers or pilot devices as specified. Thermostats, humidistats, etc., which may control motors directly or indirectly are specified under "Automatic Controls System." Motors furnished with packaged equipment shall be furnished with contactors or starters and motor protective devices as specified under that equipment.

b. Furnish a complete typewritten list of motors or electrical equipment furnished under this division, showing for each one complete nameplate data including voltage, number of phases, full load amps, locked rotor amps and other applicable data. This list shall be turned over to the Owner with operating manuals specified elsewhere in this specification division.

PART 15 - WIRING

a. Unless specifically stated otherwise in the plans or specifications, provide all wiring and conduit for equipment and automatic controls specified in this division except wiring which is part of the electrical distribution system. Wiring of automatic temperature control devices, internal wiring of equipment, interlock and remote control wiring are included. Wiring of safety disconnects, motor starters, circuit protective devices and power connections to equipment are to be accomplished as part of wiring specified under Electrical Division of the specifications.

b. All automatic temperature control wiring shall be installed in conduit, and shall conform to requirements of the Electrical Division of these specifications. One-half inch conduit may be used and #18 AWG wiring may be used for low voltage control wiring.

PART 16 - WELDING

a. Welding of pipe joints shall conform to the applicable requirements of the American Standard Code for Pressure Piping (ASA B31.1-1951), and any later supplements that are in force.

b. Welders shall show proof satisfactory to the Engineer that they have passed qualification tests prescribed by and that they have been certified by the National Certified Pipe Welding Bureau or by other reputable agency, acceptable to the Engineer, using welding procedures as set forth in the ASME Boiler Construction Code, Section IX, "Welding Qualifications." No welder shall be employed who does not meet the above requirements.

PART 17 - TEST AND ACCEPTANCE

a. Arrange for or conduct all tests and balancing operations necessary to put system into proper operating condition. These shall include testing of mechanical system components to assure proper operation and balancing of air and water flows to provided rated quantities at each outlet or system component. Furnish a written tabulation indicating the results of these tests including specified and achieved quantities at each point in system where measurements were made.

b. Prior to balancing of system, flush out piping systems, clean strainers, replace filters in air systems and clean or replace other components as required or specified elsewhere in this division to assure proper results from balancing procedure.

c. Perform any other tests during construction or before final acceptance as specified elsewhere in this division.

PART 18 - STANDARD PRODUCTS

a. Each item of equipment furnished under these specifications, is to be essentially the standard product of the manufacturer.

b. All material and equipment shall be of the best quality normally used in good commercial practice, being products of reputable manufacture. Each major component shall bear a nameplate stating name and address of the manufacturer and catalog number or designation. All materials shall be of the manufacturer's latest design standard.

SECTION 16000
GENERAL ELECTRICAL REQUIREMENTS

PART 1 - SCOPE

A. General Conditions apply to this Division.

B. Provide labor, materials, appurtenances and equipment necessary for completion of the work of this Division as described in Drawings.

PART 2 - CODES

NEC and local ordinances and regulations shall govern.

PART 3 - STANDARDS

Material and equipment provided shall be new, meet standards of NEMA or UL, and bear their label wherever standards have been established and label service is available.

PART 4 - MEANS AND METHODS

A. Unless otherwise expressly provided in the contract drawings, specifications, and addenda, the means and methods of construction shall be such as the Contractor may choose; subject, however, to the Engineer's right to reject means and methods proposed which: (1) will constitute or create a hazard to the work, or to persons or property; or (2) will not produce finished work in accordance with the terms of the contract.

B. The Engineer's approval of means and methods of construction or his failure to exercise his right to reject such means or methods, shall not relieve the contractor of his obligation to accomplish the result intended by the contract; nor shall the exercise of such right to reject create a cause of action for damages.

PART 5 - SITE AND JOB CONDITION INSPECTION

A. Before submitting a bid, thoroughly inspect the job site and existing facilities to insure complete understanding of conditions to be met in carrying out the requirements of this contract. Verify at the job site all measurements necessary for the proper installation of the work.

B. Where work consists of modification of or addition to an existing facility, the contract documents do not indicate all of the existing electrical installations. Inspect the existing installation to determine full extent of effect of existing conditions on work under this contract.

PART 6 - RELATIONSHIP BETWEEN DRAWINGS AND SPECIFICATIONS

A. The drawings and specifications are complementary documents. In the event of conflict between them the drawings shall take precedence.

B. Generally, the specifications provide general instructions for completion of work and fix the quality of equipment supplied and of workmanship in performance of work.

C. Generally, the drawings show quantities, capacities and indicate diagrammatically the location of the various components of the electrical systems and the method of connecting, circuiting and controlling them. Exact location of components must be determined from detail drawings, rough-in drawings, shop drawings, and by measurements on the job and are subject to approval of the Architect/Engineer.

PART 7 - SUBSTITUTES

A. Where Manufacturer's names appear, other Manufacturers may be substituted upon obtaining written approval of Engineer at least ten (10) days prior to opening of bids.

B. Assume any additional charges, including engineering charges and any charges for changes in the work resulting from substitutions.

C. If substitutions in materials, equipment, or designs are made, with or without the Engineer's approval, other than those authorized herein, assume full responsibility for the effects of such substitutions on the entire project.

D. Should a substitute item prove unsatisfactory for the service intended within the guaranty period, replace it at no additional cost.

PART 8 - SUBMITTAL DATA

A. Provide submittal data for all electrical distribution, equipment, starters, safety switches, devices and plates, light fixtures, kitchen equipment, and other items as required by the Engineer.

B. Provide six (6) copies of all submittals to the Engineer within thirty (30) days of the date the contract is approved. Indicate positively the exact items offered with capacities and dimensions clearly marked and options to be provided. Submittals shall be permanent copies and not copies which age rapidly. Include the name, address, and telephone number of the supplier or manufacturer's representative through whom the equipment is to be procured.

PART 9 - AS BUILT DRAWINGS

A. During progress of construction, record on one set of prints any deviation from original design with respect to size and location of all electrical system components. Record final location of all underground lines by depth from finished grade and by distance from buildings, curbs, or walks.

B. On completion of the contract, submit these drawings to the Architect/Engineer for approval and record.

PART 10 - PERMITS AND FEES

A. Obtain all permits required for installation of work and pay any fees required for these permits.

B. Arrange utilities connections with proper authorities and utilities companies and pay charges for connections.

PART 11 - UTILITIES LOCATIONS, METERS AND CONNECTIONS

A. Locations and elevations of utilities given on plans are from utility maps or other reliable sources but are offered as a general guide only with no guarantee as to accuracy. Verify the location and elevation of all utilities affecting work.

B. Arrange with proper authorities and utility companies for service connections, verifying locations and arrangements.

C. Furnish meters as indicated on plans when not furnished by the utility company.

D. When connections to existing lines, rerouting of utility lines, modifications to services, etc., would interrupt service or interfere with normal use of the buildings, arrange work such that outages are minimized and schedule outages to occur at times satisfactory to the owner.

E. Voltage that appears on the drawings and elsewhere in these specifications has been obtained from the serving utility company. Before ordering equipment and starting the job, this contractor shall verify the voltage with the utility company. If voltage differs from that noted on the drawings and in the specifications, the Architect/Engineer shall be notified at once. If the Engineer is not notified before the equipment is ordered or construction is started, this contractor shall provide an acceptable and operable system at no additional cost to the owner.

PART 12 - SKILLED LABOR AND SUPERVISION

Accomplish all work with workmen skilled in their trade or under continuous supervision of skilled craftsmen. Provide a superintendent on the job with experience in the type of work involved and capable of coordinating and directing the installation of the electrical systems.

PART 13 - OPERATING AND MAINTENANCE INSTRUCTIONS

Provide three (3) copies of a bound manual containing repair parts list, detailed maintenance instructions and detailed operating instructions for each component of the electrical system.

PART 14 - GUARANTEE

Furnish a written certificate of guarantee of materials, equipment, and labor to be free of defects for one year from date of final acceptance and agree thereby to replace, repair or in other manner make good any defects appearing in that period without additional cost to the owner.

SECTION 16050
BASIC MATERIALS & METHODS

PART 1 - GENERAL

General Conditions apply to this Section.

PART 2- APPEARANCE OF WORK

a. Arrange and install all exposed portions of work specified under this division such as devices, fixtures, panels, safety switches, etc., to fit in and harmonize with work specified in other divisions to the satisfaction of the Engineer.

b. Run conduits, etc., concealed or exposed in mechanical rooms and electrical equipment rooms and concealed in chases, attics, or cable trenches unless indicated otherwise.

c. Arrange and support all exposed conduit in a neat workmanlike manner acceptable to the Engineer.

PART 3 - PAINTING

a. Furnish all electrical equipment unless otherwise specified, with standard factory finish. Restore marred or damaged finish of equipment to original condition. All equipment shall be protected from corrosion.

PART 4 - EQUIPMENT IDENTIFICATION

a. Provide nameplates or identification labels for all electrical equipment, panels and safety switches. Nameplates shall be laminated bakelite with letters at least 3/8" high. Attach permanently to the equipment in a conspicuous location. Do not attach to removable parts of equipment such as starter covers.

b. Provide typewritten panel schedules fixed inside panel doors describing load served by each circuit.

PART 5 - PROTECTION OF MATERIALS

a. Protect equipment stored on the job site or installed on the job from damage. This shall include construction of temporary shelters to protect equipment stored in the open,

cribbing of equipment above the floor, and the covering of equipment in the buildings.

b. Keep ends of pipe and conduits, including those extending through roofs and equipment closed with caps or plugs to prevent foreign material from entering the pipe during construction.

PART 6 - FIXTURE AND EQUIPMENT SUPPORTS AND FASTENINGS

a. Support fixtures and equipment so they can function properly without damage to structure or equipment or hazard to occupants. Support from structural components such as joists or studs, and not from suspended ceilings or wall panels or plaster.

b. Use expansion sleeves, wood screws, through bolts, Phillip "Red Head" self-drilling anchors or Ramset fasteners where applicable and as recommended by the manufacturers.

PART 7 - ROOF FLASHING

a. Provide proper sheet metal flashing and counterflashing for all places where conduit, etc., specified under this division penetrates the roof. Flashing, etc., shall be 28 gage 304 stainless steel or l8 gage galvanized steel.

PART 8 - ACCESSIBILITY

a. Junction boxes, starters, relays, light fixtures, etc., requiring servicing or repairs shall be installed in an accessible location.

b. Furnish for installation by appropriate trade Milcor metal access panels of style and type required for access to electrical equipment mounted in chases or above ceilings where they would be no ready access otherwise.

PART 9 - EXCAVATION AND TRENCHING

a. Excavate and trench as required to install portion of the electrical systems required to be located below grade. Arrange cutting of streets and walks with cognizant authorities and patch cuts to conform to their requirements.

b. Exercise care to protect the roots of trees to remain. Perform all the trenching within the branch spread by hand. When trench is opened, install the utility immediately, prune injured roots cleanly and backfill as soon as possible.

c. Keep trenches free from water while construction therein is in progress. Conduct discharge from dewatering to drains or natural drainage channels.

d. Backfill trenches only after required tests have been completed. Backfill and tamp in 6" layers with materials free of large stones or clods of earth to cover of 1'. Backfill the remainder of trenches in 1' layers. Do not use blasted rock, broken concrete or large boulders for backfill. Backfill entire depth of trenches to be covered with roads, walks, or concrete slabs in 6" layers with each layer moistened and compacted such that trench and surrounding earth can be rolled and compacted to required bearing valve.

e. All buried lines shall have a minimum of 18" cover unless noted otherwise. Utilities lines beyond 2' from the building shall not be installed until all rough grading is completed. Allowances shall be made for finished grading operations to insure adequate final cover over lines.

PART 10 - CUTTING AND PATCHING

a. Hold all cutting of walls, floors, ceilings, roofs, etc., to a minimum by providing sleeves or arranging to have proper openings left. Perform cutting required to install the electrical systems. Openings shall be only as large as required and provided with structural supports where necessary. Do not cut structural members or load bearing masonry walls without permission from the Engineer. Provide for patching of openings by the trade whose work is disturbed. Seal all penetrations with a fire resistant sealant (3M or equal) with equal rating or greater than the fire rating of the penetrated structure.

PART 11 - WIRING RESPONSIBILITY

a. Unless specifically stated otherwise in the plans or specifications, all wiring except wiring internal to equipment furnished under some other division of the specifications is a part of wiring specified under this division.

b. Wiring internal to equipment shall be considered as wiring from a terminal in one enclosure to another terminal in the same enclosure or wiring between two enclosures on a piece of packaged equipment. Wiring from a terminal or connection in an enclosure to a terminal or connection in another enclosure not on the same piece of packaged equipment regardless of the distance, is considered as external to the equipment and is a part of this division.

PART 12 - TESTS

a. Test all panel feeders, motor circuits, and conductors larger than #8 with a 600 volt Megger to prove insulation resistances.

b. Record all readings and submit three copies of the tabulated results to the Engineer prior to the final inspection.

c. Upon completion of the installation of equipment, work with other trades to start all equipment and make necessary tests and adjustments to place all systems in first-class operating condition.

d. Perform other special tests required elsewhere in these specifications.

PART 13 - CONNECTION OF EQUIPMENT NOT SPECIFIED UNDER THIS DIVISION

a. Provide all necessary materials and make connections to electrical equipment specified elsewhere or furnished by others and shown on the plans or specified elsewhere in this division to be connected under this contract.

b. Rough-in for connection of this equipment according to shop drawings furnished with the equipment or by actual measurements taken from equipment on site. Provide junction boxes, disconnect switches, etc., required to properly connect each piece of equipment unless specifically stated

otherwise.

c. Equipment will be furnished assembled and set in place by the supplier ready for final connection unless otherwise specified.

PART 14 - STANDARD PRODUCTS

a. Each item of equipment furnished under these specifications, is to be essentially the standard product of the manufacturer.

b. All material and equipment shall be of the best quality normally used in good commercial practice, being products of reputable manufacture. Each major component shall bear a nameplate stating name and address of the manufacturer and catalog number or designation. All materials shall be of the manufacturer's latest design standard.

PART 15 - CLEARANCES

a. Maintain clearances in front of electrical equipment as required by Code. Report any discrepancies to Architect/Engineer.

SECTION 16110
CONDUIT AND RACEWAYS

PART 1 - GENERAL

Scope:

a. Includes - 1) All conduit and fittings used except as excluded below. See Sections relating to power, lighting, signal, sound, and telephone for additional requirements.

PART 2 - PRODUCTS

2.l Conduit:

a. Three-Fourth inch (3/4") minimum unless indicated otherwise and use restricted as indicated by product. Half-inch (1/2") conduit may be used for switch legs. Install size and type as indicated on plans. If not indicated on plans, install as shown below.

b. Galvanized rigid steel -

1) May be used in all areas above grade.

c. Galvanized rigid steel (PVC coated)-

1) Used for all underground feeders.

d. Flexible Steel Conduit - 1/2 inch minimum

1) Use in indoor final connections to:

a. Mechanical equipment, not to exceed 36 inches.
b. Recessed fluorescent lighting fixtures, not to exceed 72 inches.

e. Liquid-tight flexible steel conduit -

1) Use in outdoor final connections to mechanical equipment, not to exceed 36 inches.

f. Install rigid steel conduit for all underground panel feeders; or Schedule 40 PVC encased in 6" minimum concrete all around, with rigid steel 90` bend and rigid steel through floor slab. Concrete encased conduit shall be as

shown in figure 310-1 of 1987 N.E.C.

g. Install proper sized wiremold for exposed raceways with proper fittings and devices. Run wiremold in neat workmanlike manner in least conspicuous manner. Run with lines parallel to building lines.

2.2 FITTINGS:

a. Conduit fittings shall be designed and approved for the specific use intended. Rigid conduits shall have insulated bushings, unless grounding bushings are required by N.E.C. Article 250. Grounding bushings shall have insulated throats.

b. Rigid metal conduit shall be hot-dipped galvanized. Fittings shall be threaded type. Expansion fittings shall be OZ Type DX.

c. Liquid-tight flexible conduit and fittings shall consist of single strip, continuous, flexible interlocked, double-wrapped steel, galvanized inside and outside, forming smooth internal wiring channel with liquid-tight covering of flexible polyvinyl chloride (PVC). It shall be furnished with a sealing O-ring where entering an enclosure subject to moisture. Where O-Rings are used, ground type bushings shall be used in the box or enclosure.

d. PVC-
1) PVC fittings shall be PVC type. Use PVC adapters at all boxes.
2) Brush apply PVC cement.
3) All PVC components, (conduit, fittings, cement) shall be from same Manufacturer.

2.3 USE OF THE FOLLOWING IS PROHIBITED:

a. Aluminum conduit.

b. EMT crimp-on, tap-on, indenter type fittings.

c. EMT malleable iron or cast set-screw fittings.

d. Spray (aerosol) PVC cement.

PART 3 - EXECUTION

3.1 Conceal raceways within ceilings, walls and floors except where exposed raceways are specifically permitted (such as in mechanical rooms).

3.2 Keep raceway runs a minimum distance of six inches from hot water pipes.

3.3 Run two 3/4 inch spare conduits from each panel to ceiling access area and cap so no foreign matter will enter conduit while not in use.

3.4 Run conduit in concrete slabs at center of slab. Conduits shall have outside diameter less than 1/3 slab thickness.

3.5 Support conduit and boxes in an approved manner by:

a. Expansion shields in concrete or solid masonry.

b. Toggle bolts on hollow masonry units.

c. Wood screws on wood.

d. Metal screws on metal.

3.6 Install conduit parallel or perpendicular to buildings lines, concealed in finished areas of the building and concealed or exposed in unfinished areas. Maintain conduit clearance of 12" heat sources such as from hot water pipesflues, heating appliances, etc. Provide 12" between telephone and power conduits.

3.7 Join conduits with couplings and fittings and bond throughout to form a continuous circuit. Make field bends uniform and symmetrical without flattening and of code radius. Remove burrs and sharp edges from end cuts. Do not use running threads.

3.8 Underground and in damp locations install conduits and cast boxes with liquid-tight joints and connectors, so that moisture cannot enter the system. Use liquid-tight connectors on

Sealtite.

3.9 Provide grounding type expansion fittings at building expansion joints and elsewhere as required to allow for conduit and building expansion.

3.10 At connections to switchboards, panelboards, and boxes provide plastic insulated bushings T&B 1222 series and 141 locknut outside enclosure on all conduit. Provide T&B 222 series bushings and two locknuts on conduits over 1-1/4". On EMT use T&B raintight 5123 series and 5031. Where holes are required in cabinets, punch with Greenlee type punch.

3.11 Cap or plug conduit ends during construction with T&B 1470 Push Penny Plugs.

3.12 Clean conduits after installation and prior to pulling conductors.

3.13 Install concealed outlet and switch boxes flush with the finished surface and provide with the proper type extension rings or plaster covers where required. Install pull boxes in accessible locations.

3.14 Install grounding conductor in PVC conduit.

3.15 Bending of PVC shall be by hot box bender and, for PVC two inch in diameter and larger, expanding plugs.

3.16 The following are prohibited:

a. Use of wooden plugs inserted in concrete or masonry units as base for fastening conduits, tubing, boxes, cabinets, or other equipment.

b. Installation of conduit or tubing which has been crushed or deformed.

c. Torches for bending PVC conduit.

3.17 Schedule 40 PVC conduit may be used for underground branch circuits. Conduits must be 30" minimum below floor slab. Install rigid steel conduit at slab penetration and down to 24" below grade.

3.18 Use galvanized rigid steel conduit from condensing unit disconnect switches on building, to unit connection; final 12" may be liquid-tight flexible steel conduit. All conduit shall be rigidly clamped to building and to Unistrut supports where crossing concrete pads at grade. All connectors shall be liquid-tight.

SECTION 16120
WIRE AND CABLE

PART 1 - GENERAL

1.1 Scope:

a. Includes - 1) All conductors except as excluded below.

b. Related Work Specified Elsewhere -

1) Conductors for temperature control system specified in Division 15900.

PART 2 - PRODUCTS

2.1 Conductors:

a. Copper.

b. Minimum size shall be No. 12 except where specified otherwise. Use #10 for branch circuits over 50 feet to the first outlet on 120 volt circuits or 100 feet at 208 volts.

c. Conductor size No. 8 and larger shall be stranded.

2.2 Insulation: (Local codes shall apply)

a. Conductor size No. 10 and smaller -

Type THWN or THHN. Branch circuit conductors which run through ballast compartments of lighting fixtures shall be code approved for such use.

b. Conductor Size No. 8 and larger - Type THW, THWN, or THHN.

c. Use THHN for dry location feeders and THWN for damp location feeders.

d. Use Type 'USE' for underground service feeders, or as per Power Company's specifications.

e. Conduit sizes on plans are based on THWN.

2.3 Steel spring wire connectors or pressure type terminal lugs as specified.

PART 3 - EXECUTION

3.1 Install conductors in raceway unless indicated otherwise.

3.2 Pulling Conductors:

a. Do not pull conductors into conduit until raceway system is complete and cabinets and outlet boxes are free of foreign matter and moisture.

b. Do not use heavy mechanical means for pulling conductors.

c. Only wire pulling lubricant may be used.

3.3 Conductors shall be continuous from outlet to outlet.

3.4 Make splices for conductors No. 8 and smaller with steel spring wire connections. Splice larger conductors with pressure type terminal lugs.

3.5 Route circuits at own discretion, however, circuit numbers shall be according to Drawings. Home runs may be grouped together in a conduit provided the proper size conduit is used and wire derating factors applied.

3.6 On three phase, four wire systems, do not use a common neutral for more than three circuits.

3.7 On single phase, three wire systems, do not use a common neutral for more than two circuits.

3.8 Where a common neutral is run for two or three home run circuits, connect phase conductors to breakers in panel which are attached to separate phase legs in order that the neutral conductors will carry only the unbalanced current. Neutral conductors shall be of same size as phase conductors unless specifically noted otherwise.

3.9 Run conductors of same circuit in same conduit.

3.10 Run conductors of different voltage systems in separate conduits.

3.11 Color code conductors as follows:

a. Black - Phase A

b. Red - Phase B

c. Blue - Phase C

d. Green - Ground

e. White - Neutral

SECTION 16450
GROUNDING

PART 1 - GENERAL

1.1 SCOPE:

a. Includes - Provide grounding for entire electrical installation as shown below and described on Drawings.

1. Electrical service, its equipment and enclosures.

2. Conduits and other conductor enclosures.

3. Neutral conductor of interior wiring system.

4. Main panelboard, power and lighting panelboards.

5. Non-current-carrying metal parts of fixed equipment such as motors, starter and controller cabinets, instrument cases, and lighting fixtures.

6. Communication systems.

PART 2 - PRODUCTS

2.1 Size and type of ground conductors and method of securing them to obtain electrical continuity and effective grounding as per NEC, Article 250.

PART 3 - EXECUTION

3.1 EXECUTION

a. Provide and connect system grounding conductor to a made electrode assembly.

b. All grounded conductors (neutrals) shall be connected back to the ground at the main distribution panel through the neutral bus in the panels. Safety grounds shall be carried to the ground at the main panel but by separate green insulated wire to each panel ground bus. Do not connect safety grounds to neutral bus of panels, or cross connect grounded conductors and safety ground except at service entrance or main switch. Pull separate green insulated ground in all circuits.

c. Ground jumpers shall be installed across all water meters and flanged gasketed pipe joints. Jumpers shall be stranded bare copper cable or copper bus attached by means of approved bolt pressure connectors to the water pipe.

d. Ground rods shall be installed, with the top of the rods above finished grade. Ground conductors shall be so installed as to permit shortest and most direct path from equipment to ground. All connections to ground conductors shall be accessible for inspection and made with approved bolted connectors. All contact surfaces shall be thoroughly cleaned before connections are made to insure good metal-to-metal contact.

e. Conduit is not acceptable as a ground.

f. Extend a #8 ground wire in 1/2" conduit to telephone terminal boards and leave 6' of wire coiled on board.

End of Wastewater Permit Application