



RE: Resolution #2025-02 to have city council approval for RFB for the Water tower #9

Background:

The RDE water system that was acquired by the city in October 2022 has one 47,000 gallon stand pipe at Well #13 and a 250,000 gallon ground storage tank and booster pump system that keeps water pressure throughout the RDE system at well #12. The booster pumps are started and stopped by the water level in the standpipe. We have had several communication and mechanical problems between both well sites, and the booster pumps are old and unreliable and have caused several problems in the past 2 years, and they can't produce enough pressure to have adequate fire protection in the system.

Analysis:

In our 2025 CIPS we have allocated money to Build a new 1,000,000-gallon composite tower like the one at well #9 and #10 which would eliminate both the standpipe and ground storage tank and booster pump station. Olsson engineering has completed the design and has forwarded the plans to DNR for the permit to build. With the council's approval of this resolution allowing us to go out for bid for a contractor, we can move forward on this project to keep safe reliable water to this system.

Recommendation:

Staff recommend approval for this RFB.

MEMO SUBMITTED BY:

Jason Stutesmun | Water quality Superintendent

jstutesmun@nixa.com | 417-725-2353

RESOLUTION NO. 2025-02

A RESOLUTION OF THE COUNCIL OF THE CITY OF NIXA AUTHORIZING THE CITY ADMINISTRATOR TO SOLICIT BIDS FOR THE CONSTRUCTION OF A 1,000,000-GALLON COMPOSITE WATER TOWER.

WHEREAS the Nixa City Code authorizes the City Administrator to purchase supplies, materials, equipment, and services on behalf of the City when a competitive procurement method is utilized; and

WHEREAS said provisions require the City Administrator to obtain an authorizing resolution from the City Council prior to soliciting for purchases totaling \$10,000.00 or more; and

WHEREAS City staff is seeking authorization to solicit bids for the construction of a new 1,000,000-gallon composite water tower; and

WHEREAS the City Council desires to authorize the City Administrator to undertake the purchase described herein.

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF NIXA, AS FOLLOWS, THAT:

SECTION 1: The City Administrator, or designee, is hereby authorized, pursuant to the provisions of Chapter 2, Article VI, of the Nixa City Code, to solicit and undertake the purchase described in "Resolution Exhibit A," which said Exhibit is attached hereto and incorporated herein by this reference.

SECTION 2: The City Administrator and the officers of the City are hereby authorized to do all things necessary or convenient to carry out the terms and intent of this Resolution.

SECTION 3: This Resolution shall be in full force and effect from and after its final passage by the City Council and after its approval by the Mayor, subject to the provisions of section 3.11(g) of the City Charter.

[Remainder of page intentionally left blank. Signatures follow on next page.]

RESOLUTION NO. 2025-02

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ADOPTED BY THE COUNCIL THIS _____ DAY OF January 2025.

ATTEST:

PRESIDING OFFICER

CITY CLERK

APPROVED BY THE MAYOR THIS _____ DAY OF January 2025.

ATTEST:

MAYOR

CITY CLERK

APPROVED AS TO FORM:

CITY ATTORNEY



RFB-004-2025/Water

**Construction of the Ashley Drive 1-MGallon Composite
Elevated Water Tower**

Issue Date: 1/29/2025

Questions Deadline: 2/14/2025 12:00 PM (CT)

Response Deadline: 2/27/2025 10:00 AM (CT)

Contact Information

Contact: Stephanie Ewing
Address: Purchasing
715 W. Mt. Vernon Street
PO Box 395
Nixa, MO 65714
Phone: (417) 449-0555
Email: sewing@nixa.com

Event Information

Number: RFB-004-2025/Water
Title: Construction of the Ashley Drive 1-MGallon Composite Elevated Water Tower
Type: Request for Bid
Issue Date: 1/29/2025
Question Deadline: 2/14/2025 12:00 PM (CT)
Response Deadline: 2/27/2025 10:00 AM (CT)
Notes: The City of Nixa is issuing a Request for Bid for the construction of a new 1-MGallon composite elevated water tower located on Ashley Drive in Nixa, MO.

The City highly encourages electronic submissions via this online bidding system as it expedites the process and helps to alleviate errors.

Paper bids will still be accepted. All bid content must be in a sealed envelope, if submitting via mail or in person. Bids must be delivered by the stated close date and time. NO EMAILED OR FAXED bids will be accepted.

The Response Deadline is the date and time public unsealing of bid responses will be held.

Public unsealing of bid responses will take place at:

City of Nixa
Purchasing
715 W. Mt. Vernon St.
Nixa, MO 65714

The City of Nixa reserves the right to accept or refuse any or all bids.

Ship To Information

Contact: Travis Cossey
Address: Public Works
1111 Kathryn Street
PO Box 395
Nixa, MO 65714
Phone: (417) 725-2353
Email: tcossey@nixa.com

Billing Information

Contact: Accounts Payable
Address: Finance
City Hall
715 W. Mt Vernon St.
PO Box 395
Nixa, MO 65714
Phone: (417) 725-3785
Email: accountspayable@nixa.com

Bid Attachments

24-12-13_024-02777 Nixa MO Ashley Drive 1-MGal CET Water Tower Plans_Sealed.pdf

Water Tower Plans

[View Online](#)

24-12-13_Nixa MO Ashley Drive 1-MGal CET Water Tower Technical Specs_Sealed.pdf

Water Tower Technical Specs

[View Online](#)

Prevailing Wage Order 31.pdf

Prevailing Wage Order 31

[View Online](#)

Affidavit of Business Entity.pdf

E-Verify

[View Online](#)

Terms_and_Conditions-Formal.pdf

Terms and Conditions

[View Online](#)

Vendor Application.pdf

Vendor Application Form

[View Online](#)

ACH Authorization Form.pdf

ACH Authorization Form

[View Online](#)

W-9.pdf

W-9

[View Online](#)

Requested Attachments

E-Verify

(Attachment required)

Please download the "Affidavit of Business Entity", located on the Attachment tab. Complete the document and upload it here.

Vendor Application Form

If you have never done business with the City of Nixa, or if it has been over a year since any business was completed, please download the Vendor Application, from the "Attachments tab" and upload the completed form here.

ACH Form

If you have never done business with the City of Nixa, or if it has been over a year since any business was completed, please download the ACH Authorization Form from the "Attachments tab" and upload the completed form here.

W-9

If you have never done business with the City of Nixa, or if it has been over a year since any business was completed, please download the the W-9 form from the "Attachments tab" and upload the completed form here.

Other Attachment

If you have additional documentation you wish to provide, please upload it here. File size limitation is 250MB. If your files are larger than the limitation, a zip file containing the documents can also be uploaded.

Bid Attributes

1 Introduction

There are attributes, including this one, associated with this proposal. Some are notes and require no response, but most have a required response. ****Please select each page on the right-hand side of the blue bar below (at the bottom of this list of attributes) in order to view the next page of Bid Attributes, if applicable.****

2 RFB Submission Response

The City of Nixa prefers responses to be submitted online via our electronic system. Submissions may be submitted manually. Manual submissions must be delivered to the Purchasing Department, in a sealed envelope by the date and time stated. No fax or email submissions will be accepted. Only one format is needed. For any questions, please contact the Purchasing Department at 417.449.0555.

3 Bid Opening

Any bid received later than the specified time shall be disqualified.

Questions pertaining to the proposal should be addressed in the Questions Tab or directly to the Purchasing Department at 417.449.0555.

If the City of Nixa office where bids/proposals are to be submitted is closed due to inclement weather, natural disaster, or for any other cause including if the electronic bid system is unavailable on the due date, the deadline for submission shall be extended until the next City calendar business day, unless the bidder is otherwise notified. The time of day for submission shall remain the same.

4 Attachments Required

Be sure to upload all required documents and forms to the "Response Attachments" Tab.

5 Bid Award

The City of Nixa reserves the right to award Bids to the Vendor whose bid response best serves the City's best interest. The City reserves the right to reject any and all Bids or waive any minor irregularity or technicality in Bids received.

I acknowledge.

(Required: Check if applicable)

6 Technical Specs and Plans

Download the Technical Specs and Plans, located on the "Attachments" tab. Thoroughly review the document and understand these are the documents you are to follow for construction of the project. Please indicate below you acknowledge.

I have downloaded, read and agree to comply.

(Required: Check if applicable)

7 Bid Bond/Performance Bond/Insurance Requirements

The City of Nixa has requirements which will need to be completed by the awarded vendor. Please review the information below regarding Bid Bond/Security information as well as information on insurance and special requirements expected from the awarded vendor for this project. Acknowledge your understanding below.

Requirement for Bid Security – Bid security bond is required for all construction when the bid amount is \$20,000.00 or greater or deemed necessary by the City. Bid security shall be a bond provided by a surety company authorized to do business in this state, or the equivalent in cash, or otherwise supplied in a form satisfactory to the City in an amount equal to at least 5% of the amount of the bid. Failure to provide security will result in the bid being rejected. If the bidder fails to honor his bid for any reason, then such bid security may be retained by the City and deposited to the General Fund. The City has the right to hold bidders' bonds until the awarded contract is executed.

Contract Performance and Payment Bonds – When a construction contract is awarded, for an amount exceeding \$20,000.00, a bond shall be delivered to the City and shall become binding on the parties upon the execution of the contract; which bond shall be a performance, labor, and materials bond satisfactory to the City, executed by a surety company authorized to do business in this state or otherwise secured in a manner satisfactory to the City, in an amount equal to 100% of the price specified in the contract. If the amount of the contract is less than \$20,000.00, such bond may be required at the recommendation of the contracting department.

Insurance - All contracts between the City and a Contractor shall state that Contractor shall include the City as "additional insured" during the term of the contract. Workers Compensation amount and type shall be in full compliance with applicable statutory requirements, and Employer Liability Coverage limits is to be provided consistent with any applicable legal requirements. Commercial General Liability and Comprehensive Automobile Liability coverage are to be in the amount equal to the sovereign immunity limits for Missouri public entities as calculated and published in Section 537.610 RSMo. In addition, for any projects utilizing state or federal transportation funds, Insurance requirements shall meet those necessary to comply with those funding requirements.

Prevailing Wage Requirement - Subject to prevailing wage requirements, only for those projects required by State law, the vendor must comply with Section 290.250 RSMo by paying to all personnel employed for applicable services actually provided under the contract not less than the prevailing wage hourly rate of wages as determined by the Department of Labor and Industrial Relations, Division of Labor Standards, specified in the current wage order for Christian County. If a project qualifies for prevailing wage, pertinent information will be in the solicitation document.

E-Verify, Federal Work Authorization - Pursuant to RSMo 285.530, if the Vendor meets the definition of RSMo 285.525 of a "Business Entity", the Vendor must affirm its enrollment and participation in the E-Verify federal work authorization program with respect to its employees hired after enrollment in the program who are proposed to work in connection with the services the City is bidding / contracting. The document is required for services when the awarded dollar value is equal or greater than \$5,000.00. OSHA Training Program - Contractors on public works projects shall comply with all requirements of Section 292.675, RSMo., regarding completion of a construction safety program by all employees on the project.

I acknowledge.

(Required: Check if applicable)

8 Contract for Services

Download the Contract for Services, located on the "Attachments" tab. If there are any changes you like to be made or addressed, please let us know at this time. Thoroughly review, upload any changes to the "Response Attachments-Additional Documentation". Indicate below you have read and understand the Contract will be used unless other terms have been agreed to prior to Bid Award.

I have downloaded, read and agree.

(Required: Check if applicable)

9 Insurance Requirements

Please Note!

The City of Nixa has insurance requirements for this project. Please ensure you can meet these terms and fulfill the contract requirements.

14.1. Without limiting any of the other obligations or liabilities of the Contractor, Contractor shall at all times during the Term of this Contract, and for a period of three years thereafter, unless waived in writing by the City, at Contractor's sole cost and expense, at least the following types and amounts of insurance:

14.1.1. Commercial General Liability Insurance with limits no less than \$505,520.00 per occurrence and \$3,370,137.00 in the aggregate, including bodily injury and property damage, which policy shall include contractual liability coverage insuring the activities of Contractor under this Contract;

14.1.2. Worker's Compensation Insurance with statutory coverage as provided for in RSMo. 287.010 et seq.;

14.1.3. Employers Liability Insurance with limits no less than \$505,520.00 per occurrence and \$3,370,137.00 in the aggregate;

14.1.4. Commercial Automobile Liability with limits no less than \$505,520.00 per occurrence and \$3,370,137.00 in the aggregate; and

14.1.5. Owner's and Contractor's Protective Liability Insurance. To protect the City, its agents, servants, and employees from claims which may arise from the performance of this Contract, with limits of at least \$3,370,137.00 for all claims arising out of a single accident or occurrence and at least \$505,520.00 with respect to injuries and/or death of any one person in a single accident or occurrence. The Owner's and Contractor's Protective Liability Insurance must:

14.1.5.1. Be a separate policy with the named insured being: The City of Nixa, Missouri; and

14.1.5.2. Be with the same insurance company with which the Contractor carries its Commercial General Liability Insurance and Automotive Liability Insurance; and

14.1.5.3. Contain an endorsement that disclaims coverage for any claim barred by the doctrines of sovereign immunity or official immunity, except attorney's fees and other litigation costs incurred in defending a claim. Nothing contained in this policy (or this endorsement thereto) shall constitute any waiver of whatever kind of these defenses or sovereign immunity or official immunity for any monetary amount whatsoever.

14.2. All insurance policies required pursuant to Paragraph 14 shall:

14.2.1. Be issued by insurance companies reasonably accepted by the City, able to transact business within the State of Missouri, and with an A.M. Best Rating of no less than B+ Rating;

14.2.2. Provide that such insurance carriers give the City at least 30 days' prior written notice of cancellation or non-renewal of policy coverage; provided that, prior to such cancellation, the Contractor shall have new insurance policies in place that meet the requirements of this Paragraph 14;

14.2.3. Waive any right of subrogation of the insurers against the City or any of its officials, employees, or agents;

14.2.4. Provide that such insurance be primary insurance and any similar insurance in the name of and/or for the benefit of the City shall be excess and non-contributory;

14.2.5. Name the City and its officials, employees, and agents, as additional insured;

14.2.6. Not be met by the use of a single limit policy.

14.3. Contractor shall provide the City with copies of the certificates of insurance and policy endorsements for all insurance coverage required by this Paragraph 14 at the time of execution of this Contract and shall not do anything to invalidate such insurance.

14.4. Failure of the Contractor to maintain the coverages set out in this Paragraph 14 shall not relieve it of any contractual responsibility or obligation or liability in general or under this Contract.

14.5. This Paragraph 14 shall not be construed in any manner as waiving, restricting, or limiting the liability of the Contractor for any obligations imposed under this Contract (including but not limited to, any provisions requiring a party hereto to indemnify, defend, and hold harmless under this Contract).

14.6. Subcontracts. In case any or all the performance of this Contract is sublet, the Contractor shall require the subcontractor to procure and maintain all insurance required in this Paragraph 14. Contractor shall provide evidence of such insurance from said subcontractor.

14.7. Changes in policy limits. In the event the scope or extent of the City's tort liability as a governmental entity as described in Section 537.600 through 537.650 RSMo. is broadened or increased during the term of this Contract by legislative or judicial action or in the event that the Sovereign Immunity limits for a given calendar year, as published annually on the Missouri Register by the Missouri Department of Insurance are increased during the term of this Contract, the City may require Contractor, upon 10 days written notice, to execute a contract addendum whereby the Contractor agrees to provide, at a price not exceeding Contractor's actual increased premium cost, additional liability insurance coverage as the City may require to protect the City from increased exposure as the result of increase. Any such additional insurance coverage shall be evidenced by an appropriate certificate of insurance and shall take effect within the time set forth in the addendum.

14.8. Survival. The provisions of this Paragraph shall survive the termination or expiration of this Contract.

I acknowledge.

(Required: Check if applicable)

**1
0** **Anti-Collusion Statement**

By offering a submission to this Bid, the bidder certifies the bidder has not divulged, discussed, or compared the Bid with other bidders and has not colluded with any other bidder or parties whatsoever. The bidder also certifies, and in the case of a joint Bid, each party thereto certifies as to their own organization, that in connection with this Bid:

Any prices and/or cost data submitted have been arrived at independently, without consultation, communication, or agreement for the purpose of restricting competition, as to any matter relating to such prices and/or cost data, with any other bidder or with any competitor.

Any prices and/or cost data for this Bid have not knowingly been disclosed by the bidder and will not knowingly be disclosed by the bidder prior to the scheduled opening directly or indirectly to any other bidder or to any competitor.

No attempt has been made or will be made by the bidder to induce any other person or firm to submit or not to submit a Bid for the purpose of restricting competition.

The only person or persons interested in this Bid, principal or principals are named therein and that no person other than therein mentioned has any interest in this Bid or in the contract to be entered into.

No person or agency has been employed or retained to solicit or secure the contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee exempting bona fide employees or established commercial agencies maintained by the Purchaser for the purpose of doing business.

I affirm that I am duly authorized to execute this contract; that this company, corporation, firm, partnership or individual has not prepared this bid in collusion with any other Bidder, and that the contents of this bid as to prices, terms or conditions of said bid have not been communicated by the undersigned nor by any employee or agent to any other person engaged in this type of business prior to the official opening of this bid.

I agree.

(Required: Check if applicable)

**1
1** **General Terms and Conditions**

Download the General Terms and Conditions, located on the "Attachments" tab. Thoroughly review and indicate below.

I have downloaded, read and understand.

(Required: Check if applicable)

1 **Vendor Application/W-9/ACH**

2

If you have never done business with the City of Nixa, or if it has been over a year since conducting business with the City, please download the Vendor Application Form, the ACH Authorization Form, and the W-9 Form located on the "Attachments" tab, complete and upload in the "Response Attachments" tab.

I acknowledge.
(Required: Check if applicable)

Bid Lines

1 Please indicate the total cost to complete the project.

(Response required)

UOM: EA Price: \$ Total: \$

Supplier Notes: _____

No bid
 Additional notes
(Attach separate sheet)

Supplier Information

Company Name: _____

Contact Name: _____

Address: _____

Phone: _____

Fax: _____

Email: _____

Supplier Notes

By signing below, the bidder shall hereby declare understanding, agreement and certification of compliance to provide the items and/or services, at the prices quoted, in accordance with all requirements and specifications contained herein and the Terms and Conditions. The bidder shall further agree that the language of this RFB shall govern in the event of a conflict with his/her bid. In addition, the bidder shall further agree that upon receipt of an authorized purchase order from the City of Nixa or when a Contract Resolution is signed and issued by an authorized official of the City of Nixa, a binding contract shall exist between the bidder and the City of Nixa.

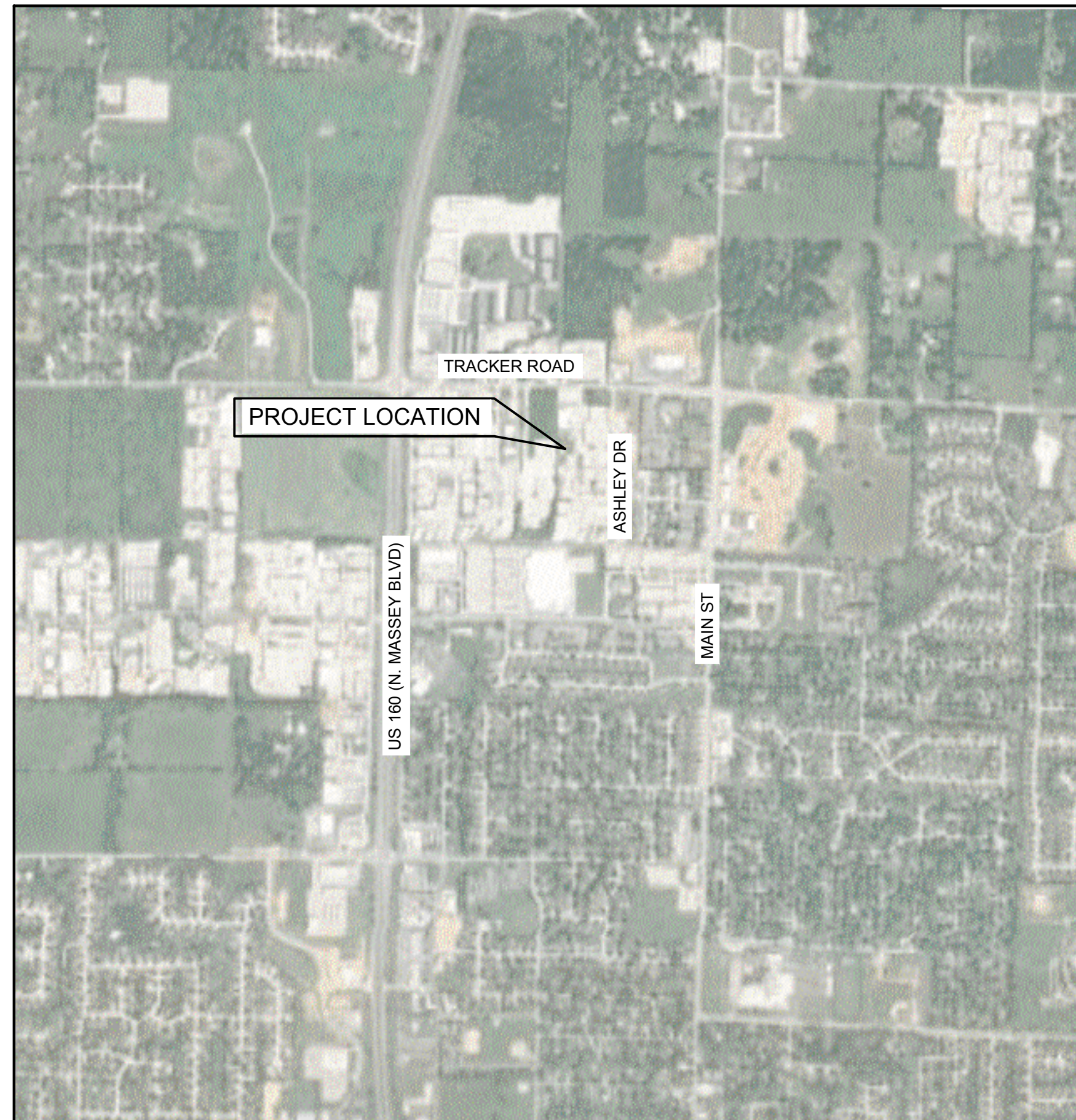
Print Name

Signature

ASHLEY DRIVE NEW 1-MGAL COMPOSITE ELEVATED TANK (CET) WATER TOWER

LOCATED IN THE WEST SIDE OF THE NORTHWEST CORNER OF SECTION 12,
TOWNSHIP 27 NORTH, RANGE 22 WEST, OF THE 6TH P.M. NIXA, MISSOURI

PROJECT TEAM & UTILITY CONTACT LIST	
OWNER CITY OF NIXA, MISSOURI 1111 KATHYRN STREET NIXA, MO 65714 CONTACT: TRAVIS COSSEY PHONE: 417.725.2353 EMAIL: TCOSSEY@NIXA.COM	WATER CITY OF NIXA, MISSOURI 1010 EAGLECREST STREET NIXA, MO 65714 CONTACT: JASON STUTESMUN PHONE: 417.725.2353 EMAIL: JSTUTESMUN@NIXA.COM
ENGINEER OLSSON, INC. 550 E. ST. LOUIS ST SPRINGFIELD, MO 65806 CONTACT: JERRY JESKY, PE PHONE: 417.885.1746 EMAIL: JJESKY@OLSSON.COM	ELECTRIC OZARK ELECTRIC CO-OP 2007 JAMES RIVER COURT NIXA, MO 65714 PHONE: 417.725.5160 CONTACT: KEN RAMING PHONE: 417.844.9644
SURVEYOR OLSSON, INC. 550 E. ST. LOUIS ST SPRINGFIELD, MO 65806 CONTACT: DAVID DRUMM, PLS PHONE: 417.885.1710 EMAIL: DDRUMM@OLSSON.COM	SEWER CITY OF NIXA, MISSOURI 1010 EAGLECREST STREET NIXA, MO 65714 CONTACT: JASON STUTESMUN PHONE: 417.725.2353 EMAIL: JSTUTESMUN@NIXA.COM
NIXA FIRE DEPARTMENT CONTACT: LLOYD WALLÉS, FIRE CHIEF, WHITNEY WEAVER, ASSISTANT CHIEF PHONE : 911	



VICINITY MAP
SCALE: 1"=1000'

SHEET INDEX	
NUMBER	TITLE
1	COVER SHEET
2	GENERAL NOTES AND LEGEND
3	1-MGAL CET WATER TOWER SITE PLAN
4	1-MGAL CET WATER TOWER FINISH GRADING PLAN
5	1-MGAL CET WATER TOWER ELEVATION VIEWS
6	1-MGAL CET WATER TOWER SECTIONS AND DETAILS
7	1-MGAL CET WATER TOWER SECTIONS AND DETAILS
8	1-MGAL WATER TOWER STANDARD DETAILS

BASIS OF BEARINGS
Grid North based on Missouri State Plane Coordinate System 1983 by use of MoDOT continuously operating GNSS RTK Network Central Zone

DATUM
Elevations based on NAVD 88 by use of MoDOT continuously operating GNSS RTK Network



TEMPORARY BENCHMARKS (TBM)

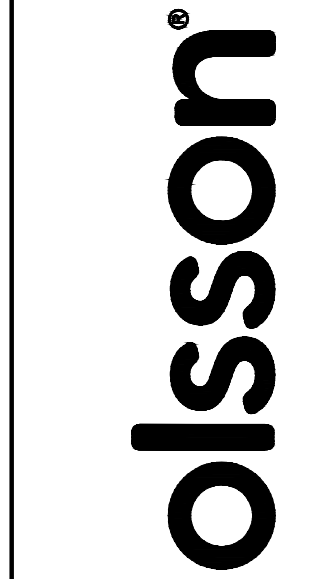
TEMPORARY BENCH MARK (TBM)
ELEV. 1284.12
RAILROAD SPIKE IN WEST FACE OF POWER POLE

PROJECT CONTROL

60D
CONTROL POINT 1 - 60D NAIL
(SURVEY PT. NO. 6)
N 449150.66
E 1407399.95

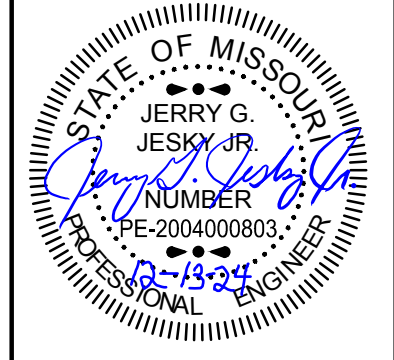
EXISTING IRON BAR
CONTROL POINT 2 - 1/2" I.B.
(SURVEY PT. NO. 626)
N 449161.40
E 1407582.54

EXISTING IRON BAR
CONTROL POINT 3 - 60D NAIL
(SURVEY PT. NO. 1)
N 449021.17
E 1407508.08



550 East St. Louis Street
Springfield, MO 65806

olsson.com
TEL 417.890.8802
FAX 417.890.8805
Olsson - Engineering
Missouri COA #001592



BY	DESCRIPTION	DATE	REV. NO.	REVISIONS

COVER SHEET
ASHLEY DRIVE NEW 1-MGAL CET WATER TOWER
CITY OF NIXA
NIXA, MO
2024



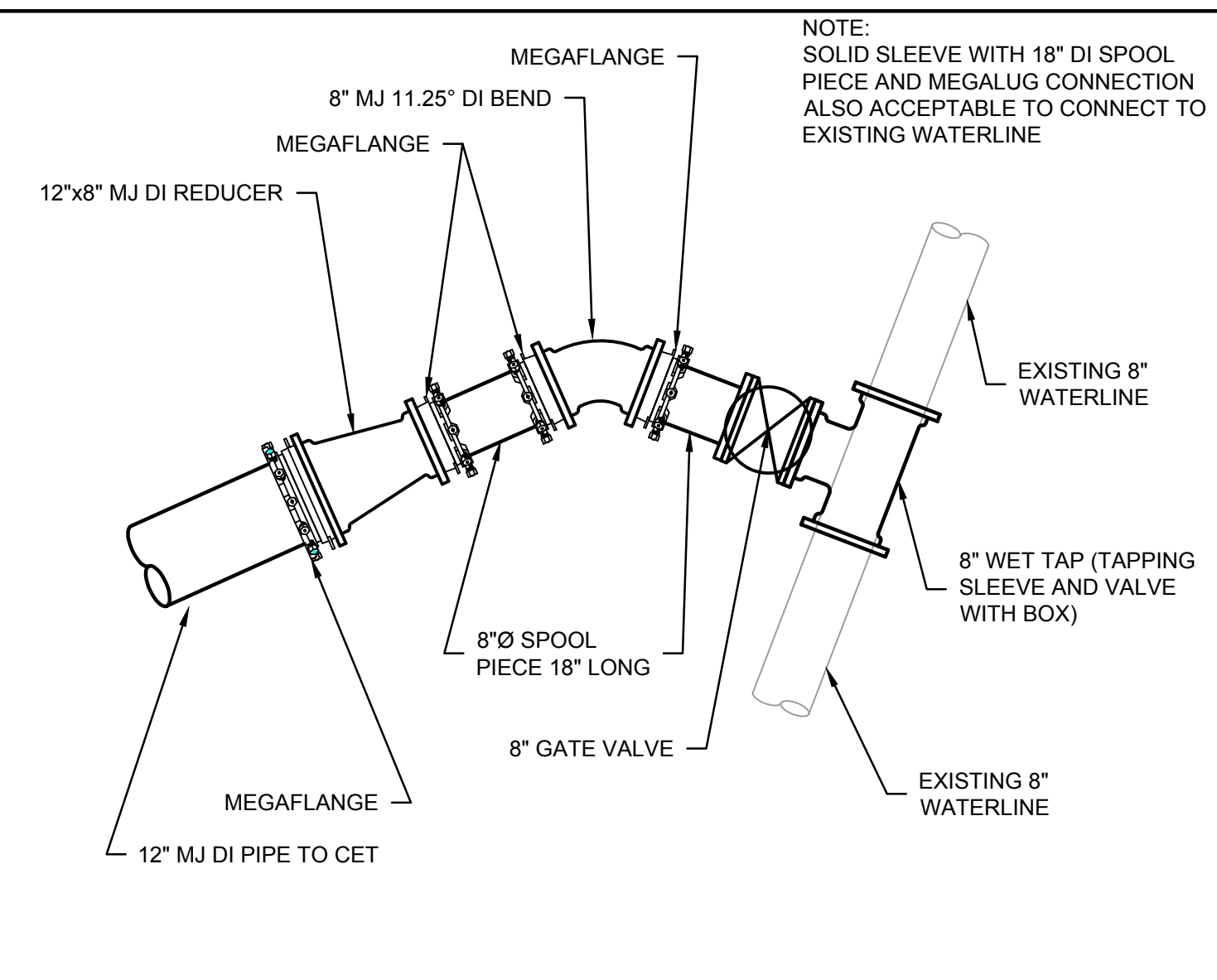
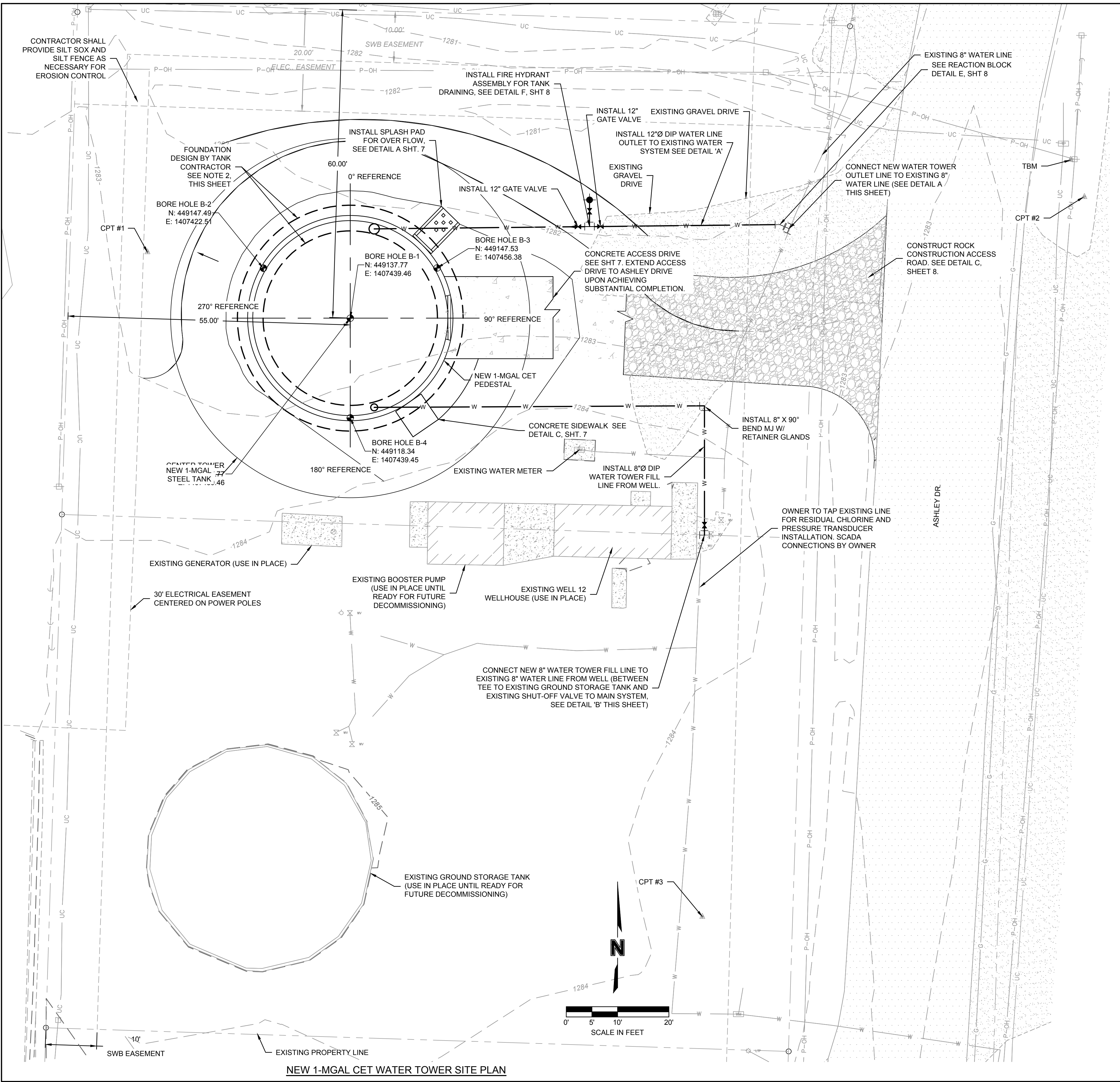
1-800-DIG-RITE or 811
www.mo1call.com

THE EXISTING UTILITY LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE AND MAY NOT INCLUDE ALL LINES PRESENT. THE CONTRACTOR SHALL BE RESPONSIBLE TO CALL "1-800-DIG-RITE", AND COORDINATE FIELD LOCATION OF EXISTING UNDERGROUND UTILITIES PRIOR TO BEGINNING GRADING ACTIVITIES. !!STOP!! CALL BEFORE YOU DIG!!

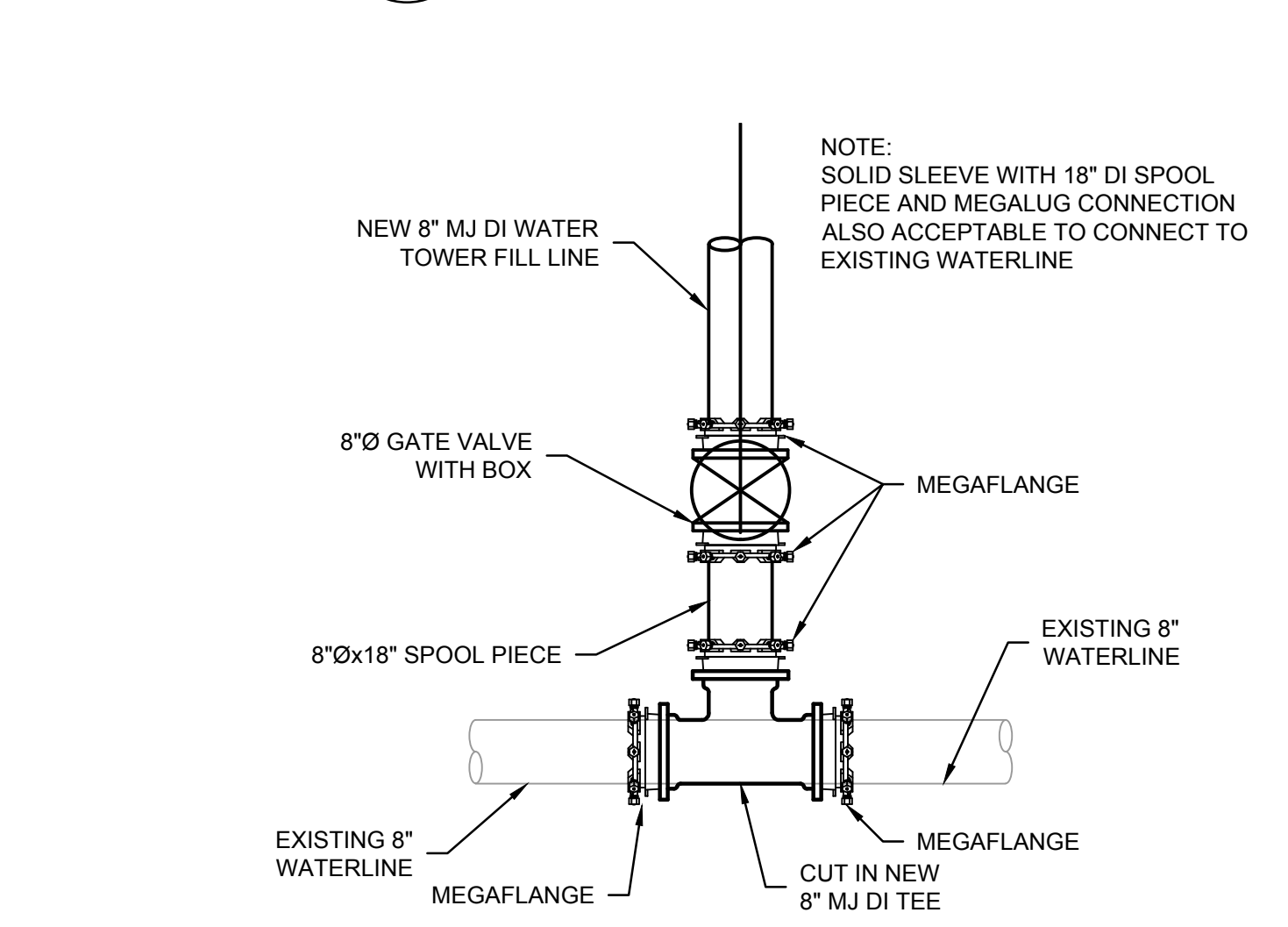
drawn by: _____ TH
designed by: _____ JJ
project no.: 024-02777
date: 8.20.2024

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DATE: Dec 13, 2024 11:27am USER: thll

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 DATE: Dec 13, 2024 11:29am USER: thill



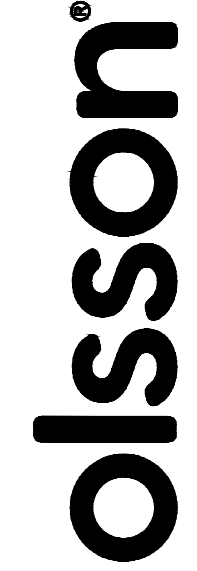
A
 TOWER OUTLET CONNECTION
 TO EXISTING WATERLINE
 SCALE: N.T.S.



B
 NEW WATER TOWER FILL
 LINE TO EXISTING WATERLINE
 SCALE: N.T.S.

- NOTE:
- BORE NUMBERING REFERENCES THE GEOTECHNICAL REPORT. SEE PROJECT MANUAL.
 - TANK PEDESTAL AND BOWL DIMENSIONS WERE OBTAINED FROM MANUFACTURER LITERATURE FOR TANKS OF A SIMILAR SIZE/CONSTRUCTION.

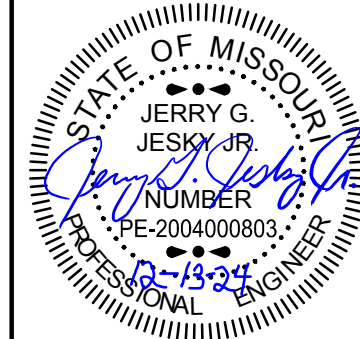
- GENERAL CONSTRUCTION NOTES:
- CONSTRUCTION & MATERIALS SHALL CONFORM TO THE CITY OF NIXA'S TECHNICAL SPECIFICATIONS AND THE LATEST REVISION OF AWWA AND ASTM STANDARDS.
 - PRIOR TO BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL ATTEND A PRECONSTRUCTION CONFERENCE WITH THE CONSULTING ENGINEER AND THE CITY OF NIXA.
 - IT SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR TO CONTACT THE UTILITY SUPPLIERS AND ARRANGE FOR ANY NECESSARY MODIFICATIONS REQUIRED TO FACILITATE CONSTRUCTION ACTIVITIES.
 - IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO KEEP ROCK, MUD, AND OTHER DEBRIS FROM ACCESS STREETS CAUSED BY CONSTRUCTION EQUIPMENT THROUGHOUT THE DAY AND AT THE END OF EACH WORK DAY.
 - ALL WATER METER PITS, FIRE HYDRANTS AND OTHER IMPROVEMENTS SHALL BE ADJUSTED TO FINISHED GRADE.
 - CONTRACTOR SHALL PROVIDE AT LEAST TWO WARNING SIGNS PROHIBITING UNAUTHORIZED ACCESS TO THE PROJECT SITE.



550 East St. Louis Street
 Springfield, MO 65806

olsson.com
 TEL 417.890.8802
 FAX 417.890.8805

Olsson - Engineering
 Missouri COA #001592



REV. NO.	DATE	DESCRIPTION	BY

1-MGAL CET WATER TOWER SITE PLAN

ASHLEY DRIVE NEW 1-MGAL CET WATER TOWER
 CITY OF NIXA

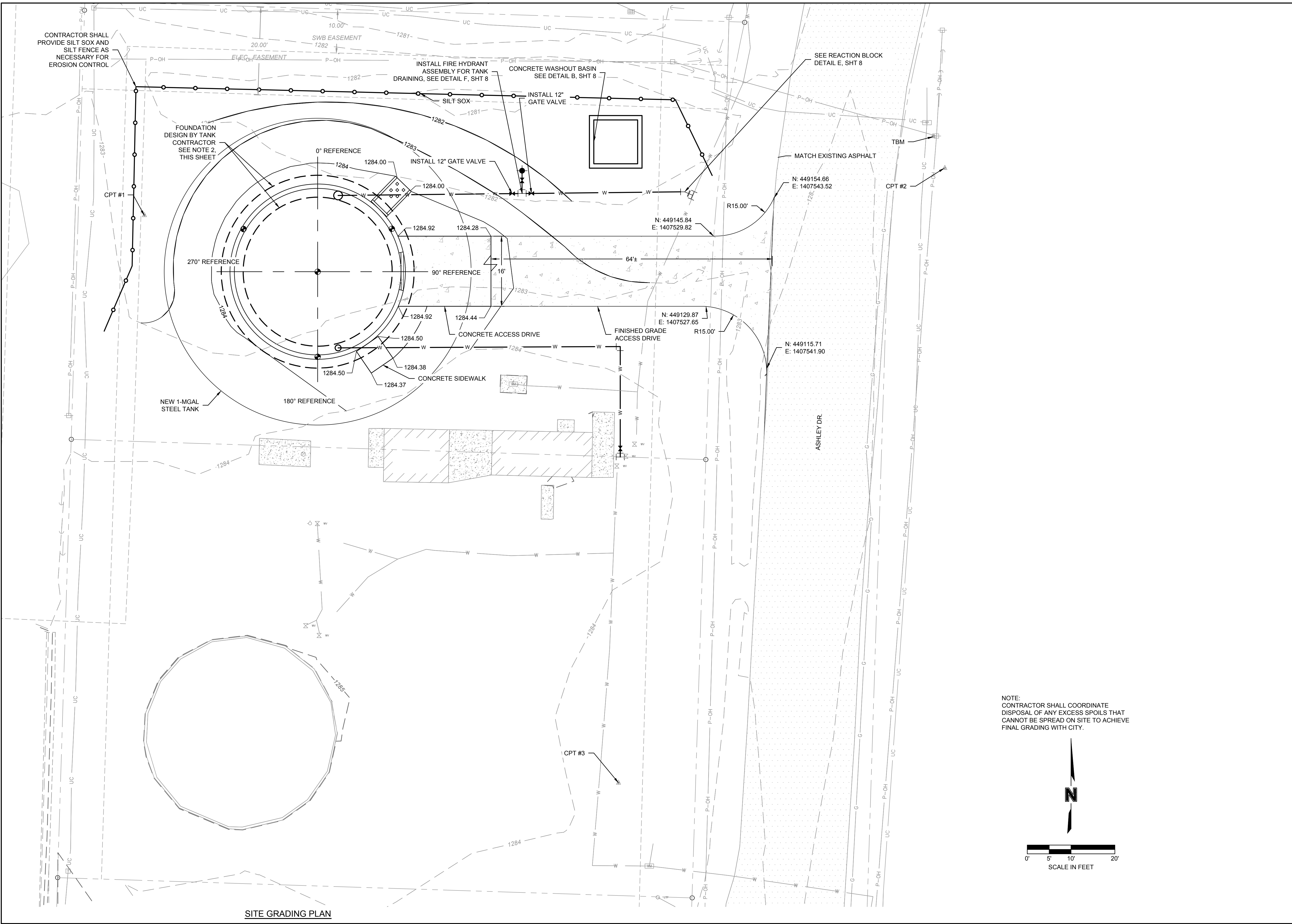
REVISIONS

drawn by: _____ TH
 designed by: _____ JJ
 project no.: 024-02777
 date: 8.20.2024

2024

SHEET
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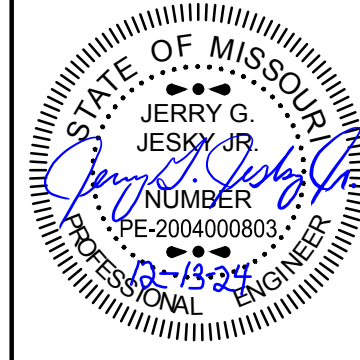


SITE GRADING PLAN

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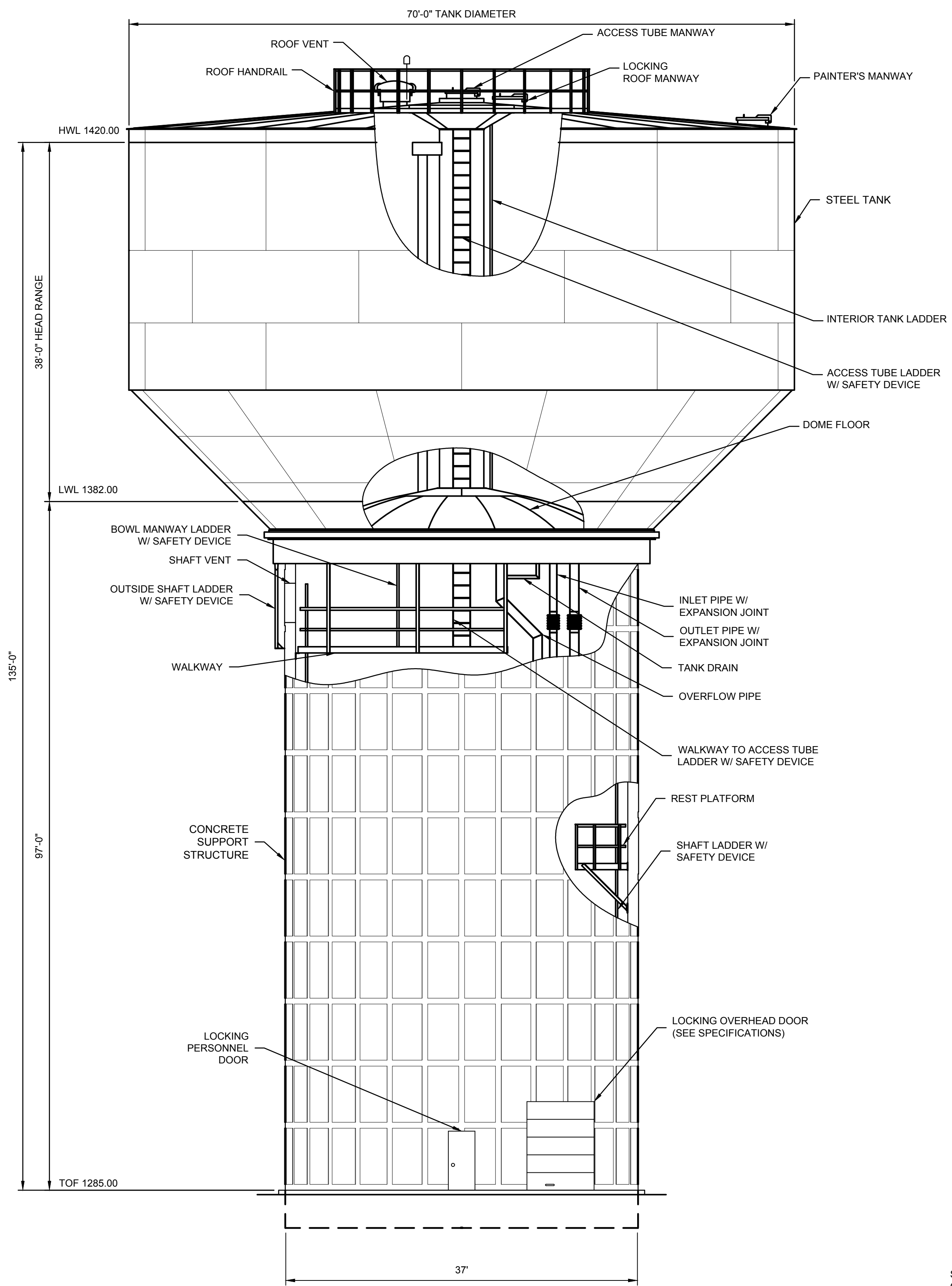


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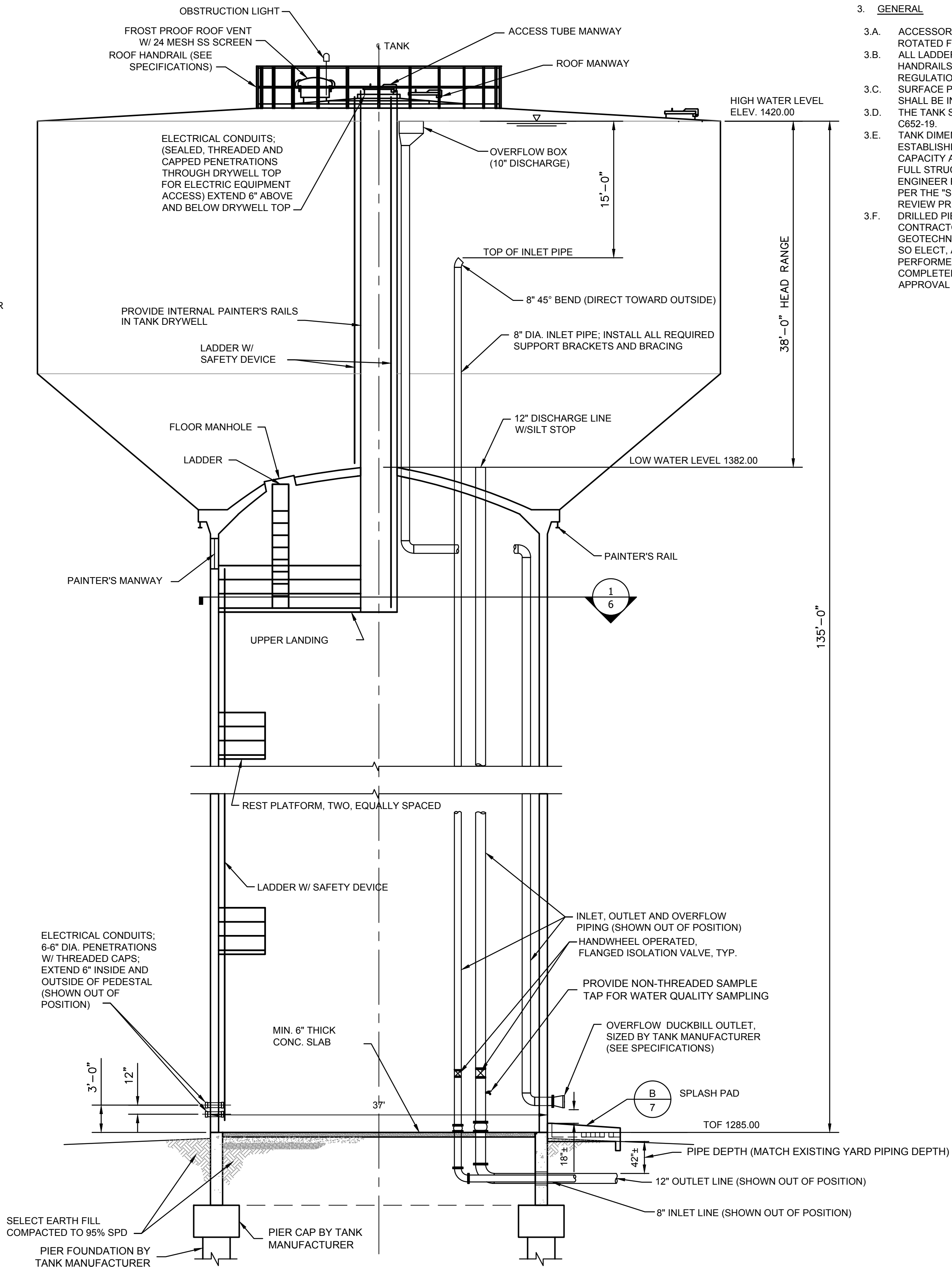
4 - 1-MGAL CET WATER TOWER FINISH GRADING PLAN
 ASHLEY DRIVE NEW 1-MGAL CET WATER TOWER
 CITY OF NIXA
 NIXA, MO
 2024

drawn by: TH
 designed by: JL
 project no.: 024-02777
 date: 8.20.2024

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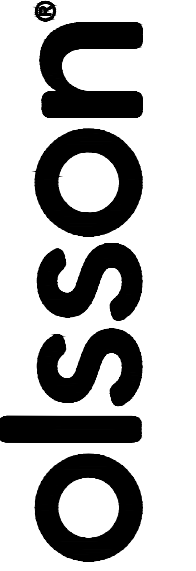


ELEVATION
Not To Scale



PARTIAL SECTIONAL ELEVATION
Not To Scale


1. **DESIGN CRITERIA**
 - 1.A. THE TANK AND SUPPORT STRUCTURE SHALL BE DESIGNED, FABRICATED, AND ERECTED IN ACCORDANCE WITH AWWA D107-16 AND THE PROJECT SPECIFICATIONS.
2. **MATERIALS**
 - 2.A. STEEL PLATE: ASTM A283 OR ASTM A36
 - 2.B. STRUCTURAL SHAPES: ASTM A36
 - 2.C. LADDER RUNGS: ASTM A706
3. **GENERAL**
 - 3.A. ACCESSORIES SHOWN ON THE ELEVATION DRAWING MAY BE ROTATED FOR CLARITY.
 - 3.B. ALL LADDERS, LADDER SAFETY DEVICES, PLATFORMS, HANDRAILS, ETC. SHALL CONFORM TO CURRENT OSHA REGULATIONS.
 - 3.C. SURFACE PREPARATION, LOGO AND COATING REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.
 - 3.D. THE TANK SHALL BE DISINFECTED IN ACCORDANCE WITH AWWA C652-19.
 - 3.E. TANK DIMENSIONS ARE PROVIDED FOR THE PURPOSES OF ESTABLISHING A BID PRICE, AND ARE TYPICAL OF A TANK OF THIS CAPACITY AND CONSTRUCTION. CONTRACTOR SHALL PROVIDE A FULL STRUCTURAL DESIGN, SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF MISSOURI, AND SUBMIT PER THE "SUBMITTALS" SECTION OF THE SPECIFICATIONS FOR REVIEW PRIOR TO COMMENCEMENT OF CONSTRUCTION. DRILLED PIER FOUNDATION SHALL BE DESIGNED BY TANK CONTRACTOR BASED UPON THE RECOMMENDATIONS OF THE GEOTECHNICAL REPORT PROVIDED. SHOULD THE CONTRACTOR SO ELECT, ADDITIONAL SOILS INVESTIGATIONS MAY BE PERFORMED AT THE CONTRACTOR'S SOLE EXPENSE, AND COMPLETED ONLY AFTER WRITTEN NOTIFICATION TO, AND APPROVAL BY, THE OWNER.



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REV. NO.	DATE	DESCRIPTION	BY

1-MGAL CET WATER TOWER ELEVATION VIEWS

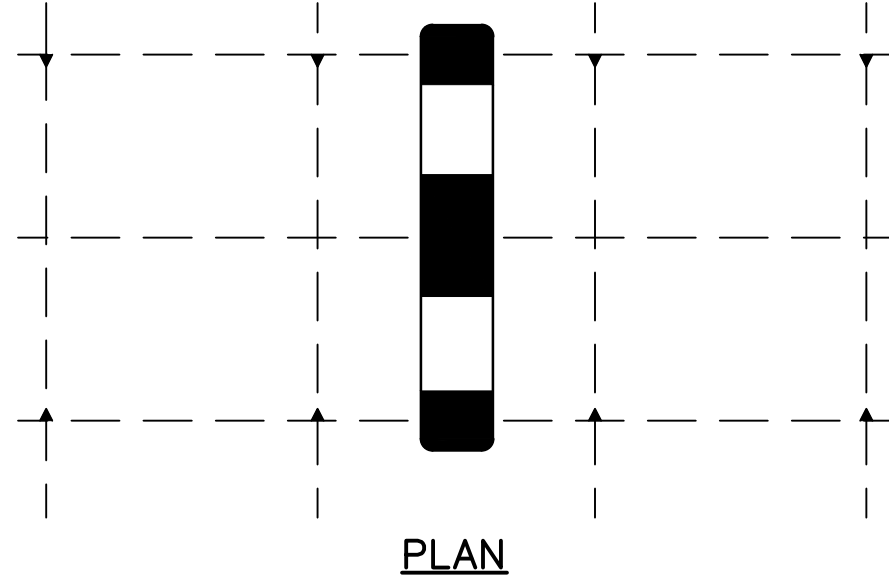
ASHLEY DRIVE NEW 1-MGAL CET WATER TOWER
CITY OF NIXA

NIXA, MO

2024

drawn by: _____ TH
 designed by: _____ JI
 project no.: 024-02777
 date: 8.20.2024

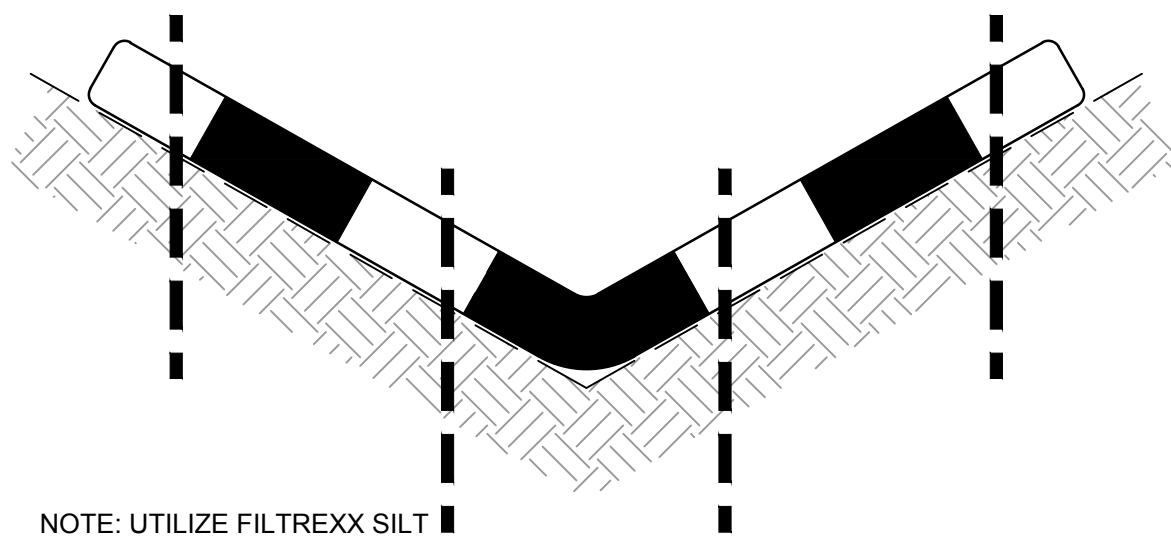
SHEET
5



PLAN

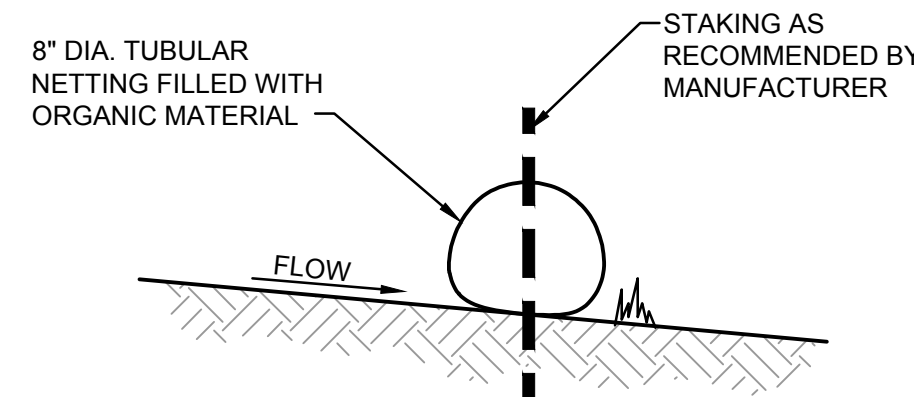
SEDIMENT BARRIER NOTES:

1. PLACE SEDIMENT BARRIER AT DOWNSLOPE LIMIT OF AREA TO BE GRADED AS NECESSARY.
2. FASTEN SEDIMENT BARRIER AS RECOMMENDED BY MANUFACTURER.
3. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
4. SEDIMENT BARRIER SHALL BE REMOVED WHEN IT HAS SERVED ITS USEFULNESS, SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
5. SEDIMENT TRAPPED BY THIS PRACTICE SHALL BE DISPOSED OF IN AN APPROVED SITE IN A MANNER THAT WILL NOT CONTRIBUTE TO ADDITIONAL SILTATION.
6. ACCUMULATED SILT SHALL BE REMOVED WHEN IT REACHES A DEPTH RECOMMENDED BY MANUFACTURER AND DISPOSED OF IN AN APPROVED SPOIL SITE OR AS IN NO. 5 ABOVE.
7. AT EACH END OF SEDIMENT BARRIER, TURN UPSLOPE AND EXTEND UNTIL GROUND SURFACE RISES 18".
8. LIMITS OF EROSION AND SEDIMENT CONTROL STRUCTURES SHOWN ARE SCHEMATIC. ANY ADDITIONAL STRUCTURES NOT SHOWN ON THIS PLAN THAT ARE NECESSARY TO PREVENT SEDIMENT FROM LEAVING THE SITE ARE THE CONTRACTOR'S RESPONSIBILITY.
9. CONSTRUCT EROSION CONTROL IMPROVEMENTS PRIOR TO BEGINNING OF ANY OTHER WORK, UNLESS OTHERWISE NOTED.



NOTE: UTILIZE FILTREXX SILT SOXX OR APPROVED EQUAL PRODUCT

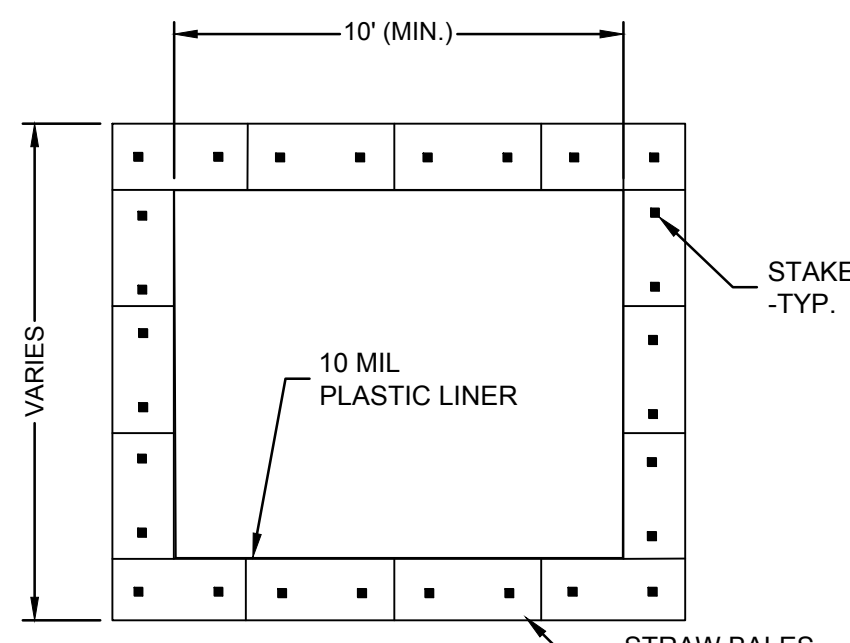
SECTION



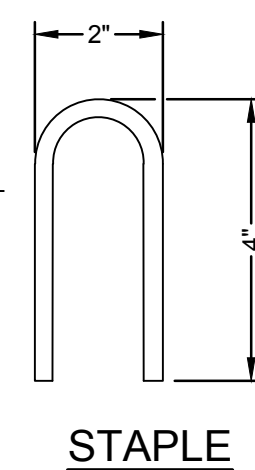
SLOPE

A
8 Not To Scale
SEDIMENT BARRIER DETAIL

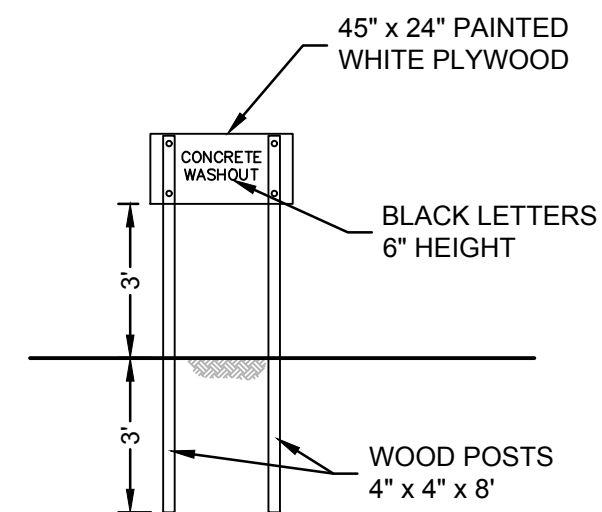
1. ACTUAL LAYOUT LOCATIONS & NUMBER OF WASH-OUTS TO BE DETERMINED BY CONTRACTOR IN FIELD.
2. THE CONCRETE WASH-OUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.
3. WASH-OUTS SHALL BE LOCATED A MINIMUM OF 50 FT. FROM STORM DRAINS, OPEN DRAINAGE FACILITIES AND WATER COURSES. AVOID MIXING EXCESS AMOUNTS OF FRESH CONCRETE.
4. INSTALL BEFORE THE START OF ANY CONCRETE ACTIVITIES OR DELIVERIES.
5. INSPECT EVERY WEEK AND AFTER 1/2" STORM EVENT. REMOVE AND DISPOSE OF HARDENED CONCRETE AND RETURN THE FACILITY TO A FUNCTIONAL CONDITION. WASH-OUT FACILITIES MUST BE CLEANED, OR NEW FACILITIES MUST BE CONSTRUCTED AND READY FOR USE ONCE THE WASH-OUT IS 75% FULL.
6. WHEN TEMPORARY CONCRETE WASH-OUT FACILITIES ARE NO LONGER REQUIRED FOR THE WORK, THE HARDENED CONCRETE SHOULD BE REMOVED AND DISPOSED. MATERIALS USED TO CONSTRUCT TEMPORARY CONCRETE WASH-OUT FACILITIES SHALL BE REMOVED FROM THE SITE AND DISPOSED. HOLES, DEPRESSIONS OR OTHER GROUND DISTURBANCE CAUSED BY THE REMOVAL OF THE WASH-OUT SHALL BE BACKFILLED AND REPAIRED.



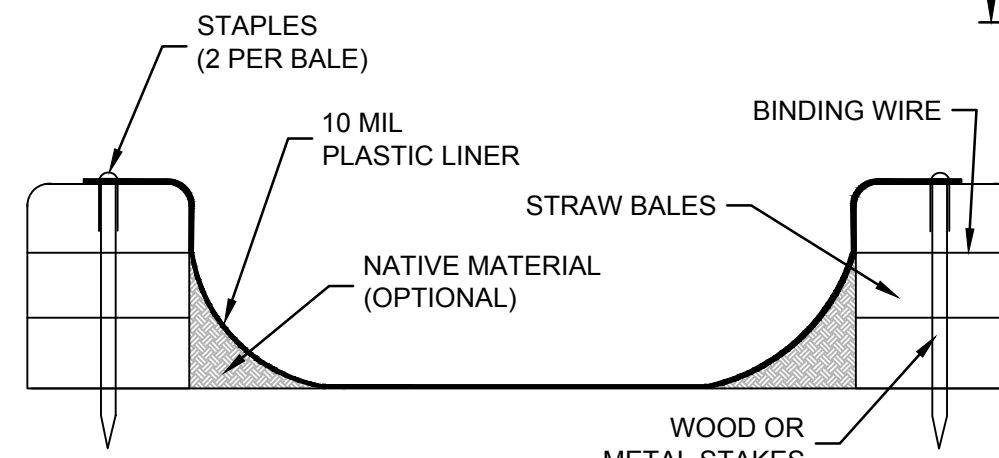
PLAN



STAPLE



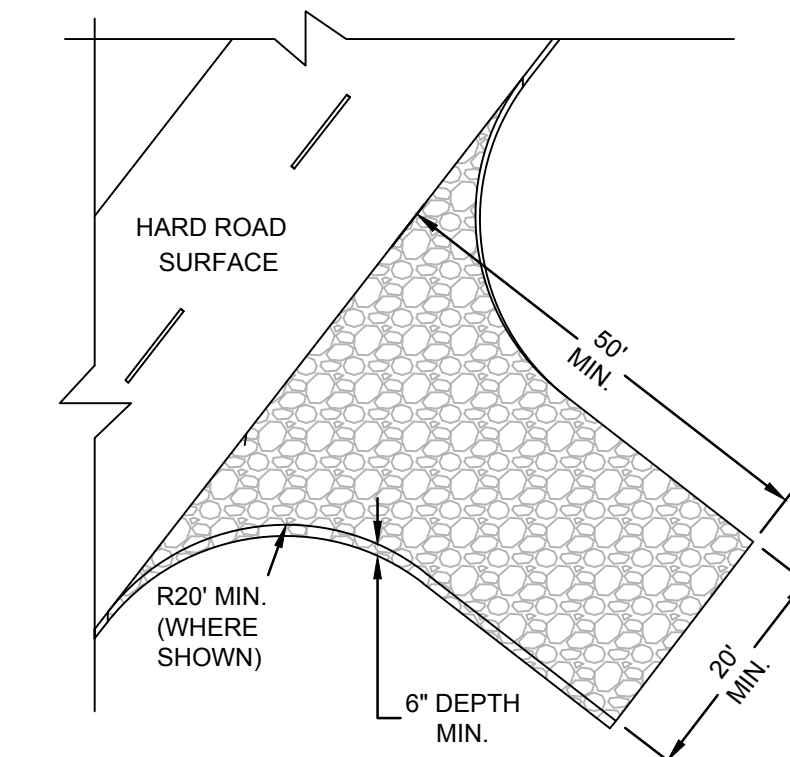
WASHOUT SIGN



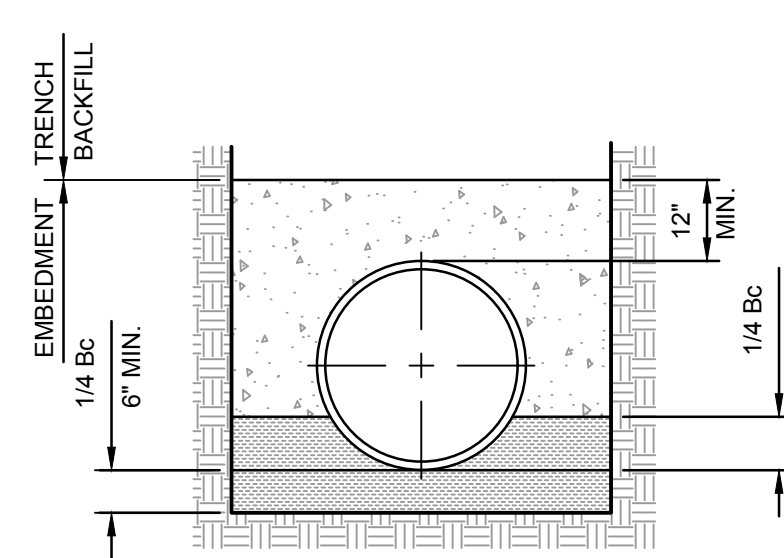
SECTION

B
8 Not To Scale
CONCRETE WASHOUT DETAILS

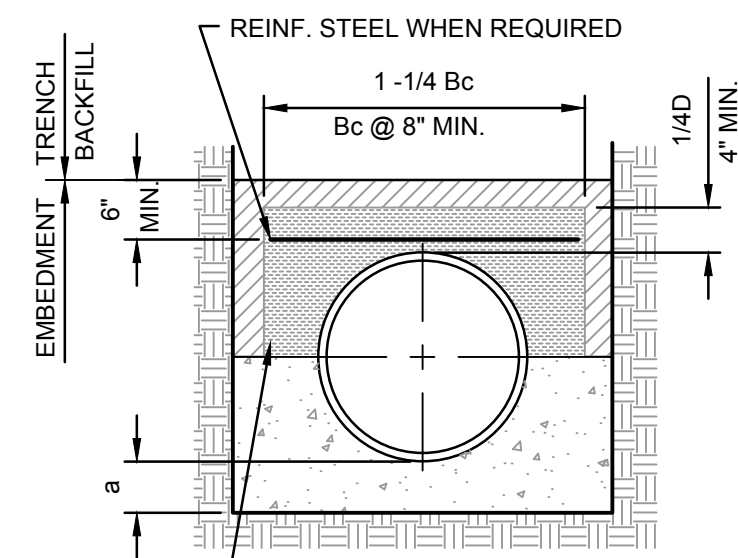
- NOTES:**
1. INSTALL AS SOON AS POSSIBLE BEFORE START OF GRADING
 2. PLACE FILTER FABRIC UNDER STONE
 3. USE 3/8" CLEAN CRUSHED LIMESTONE
 4. REPLACE AS NEEDED TO MAINTAIN 6" DEPTH AT ALL TIMES DURING CONSTRUCTION



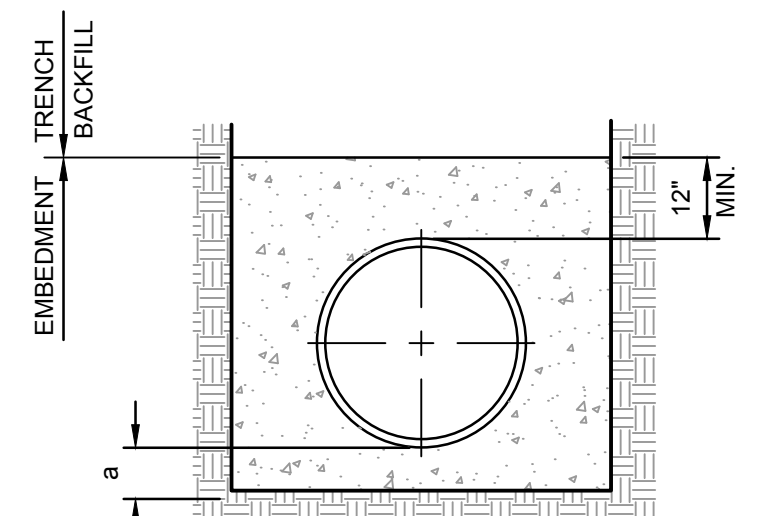
C
8 Not To Scale
GRAVEL CONSTRUCTION ENTRANCE/EXIT



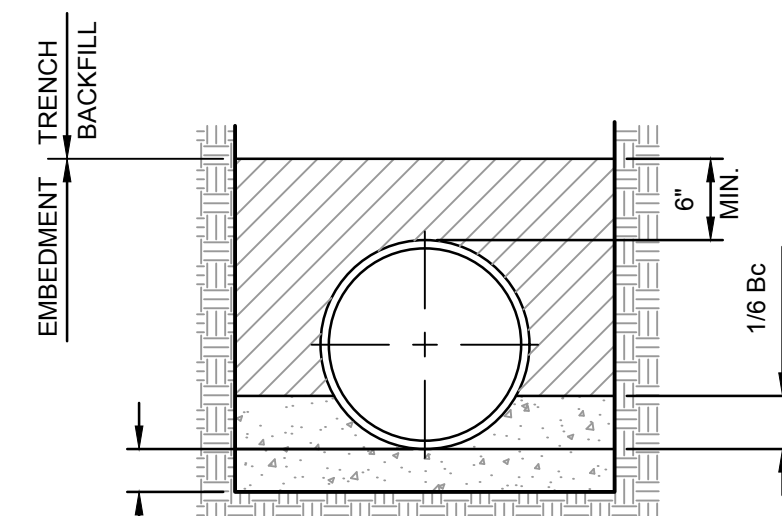
CLASS A
CONCRETE CRADLE



CLASS A
CONCRETE ARCH



CLASS B
FIRST CLASS BEDDING



CLASS C
ORDINARY BEDDING

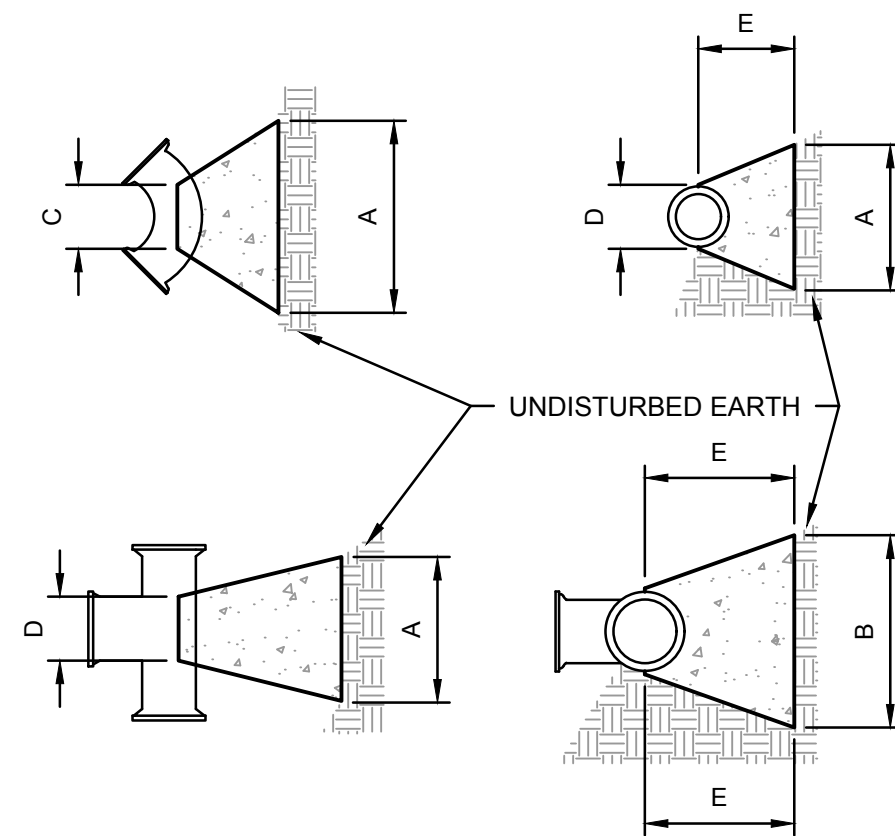
TABLE OF EMBEDMENT DEPTHS BELOW PIPE

SOIL TRENCH		
BEDDING CLASS	PIPE O.D.	a MIN.
A AND B	16" AND SMALLER	4"
A AND B	LARGER THAN 16"	1/4 O.D.
C	32" AND SMALLER	4"
C	LARGER THAN 32"	1/8 O.D.

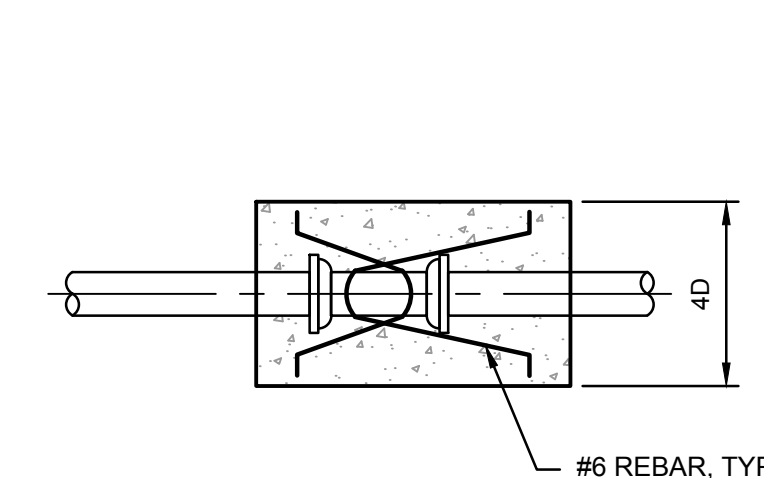
ROCK TRENCH		
BEDDING CLASS	PIPE O.D.	a MIN.
A AND B	24" AND SMALLER	6"
A AND B	LARGER THAN 24"	1/4 O.D.
C	48" AND SMALLER	6"
C	LARGER THAN 48"	1/8 O.D.

LEGEND

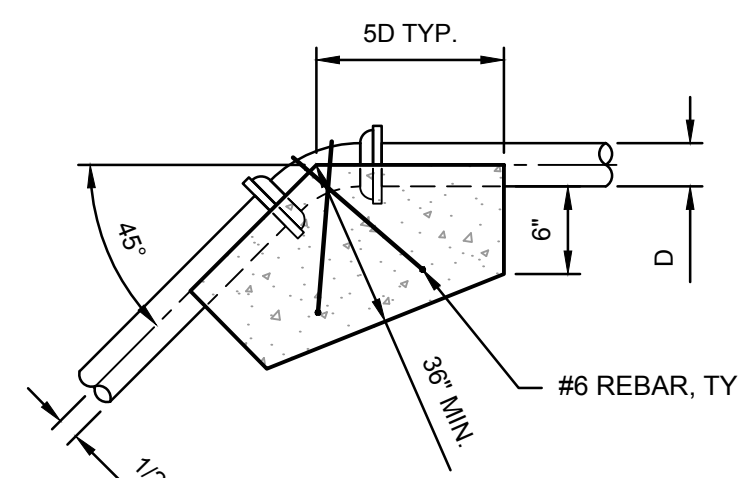
- Bc OUTSIDE DIA. OF PIPE
- d NOMINAL PIPE SIZE
- a EMBEDMENT BELOW PIPE
- Hand Placed Embedment
- Granular Embedment
- CONCRETE
- UNDISTURBED EARTH



HORIZONTAL THRUST BLOCK



SECTIONAL PLAN



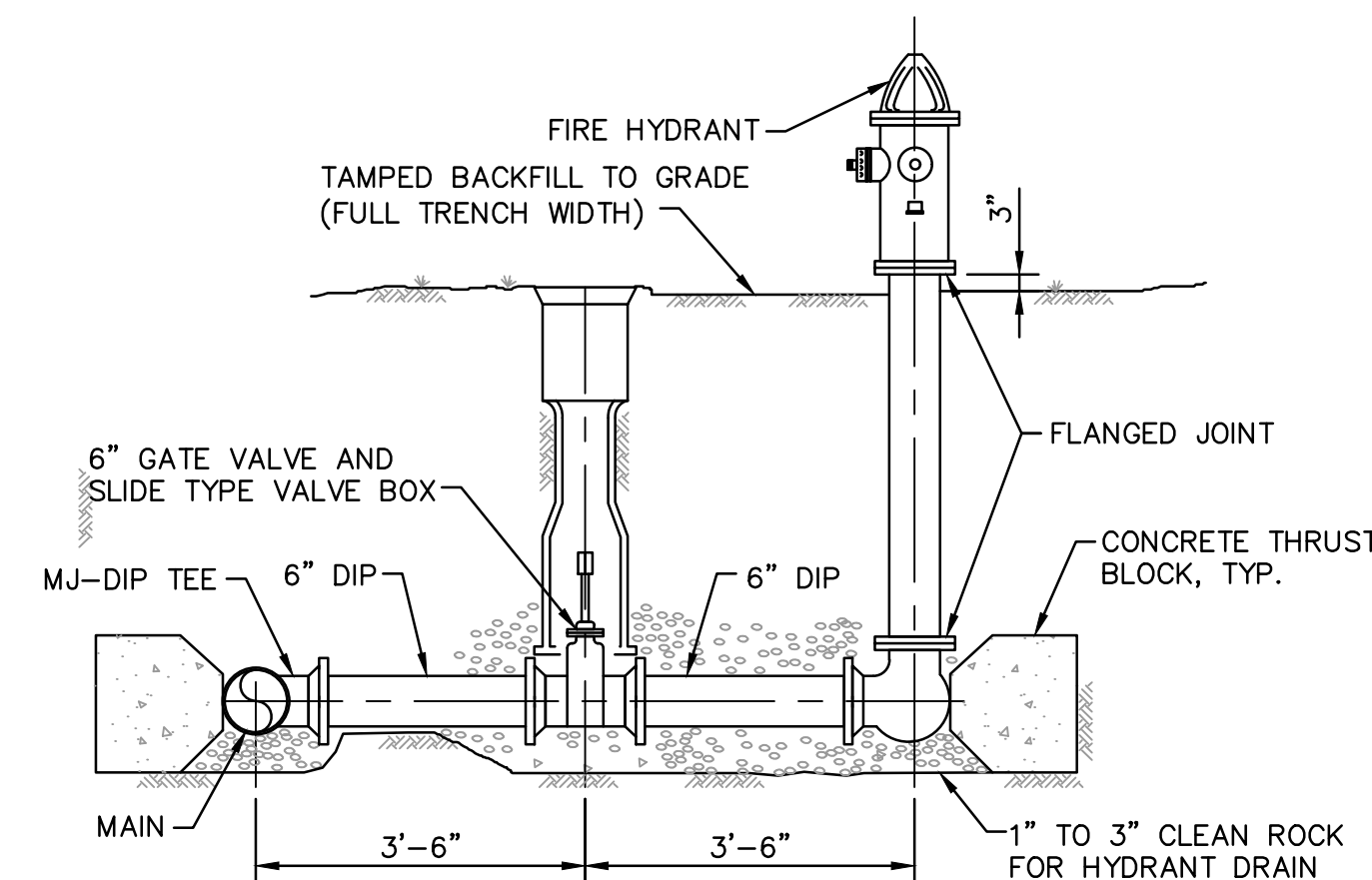
SECTIONAL ELEVATION

VERTICAL BEND BLOCKING DETAIL
PIPE SIZE CHART

PIPE SIZE	FITTING	DISTANCE IN INCHES				
		A	B	C	D	E
4" AND SMALLER	11.25 & 22.5°	32	28	3	7	14
	45°	32	28	4	7	14
	90°	34	28	6	7	14
	TEE/PLUG	36	28	7	7	14
6"	11.25 & 22.5°	35	29	4	9	15
	45°	36	29	6	9	15
	90°	38	29	7	9	15
	TEE/PLUG	40	29	9	9	15
8"	11.25 & 22.5°	38	31	5	11	17
	45°	40	31	6	11	17
	90°	52	34	9	11	22
	TEE/PLUG	44	31	11	11	17
10" & 12"	11.25 & 22.5°	44	34	7	15	19
	45°	47/59	37	10	15	24
	90°	70/91	38/44	13	15	30/39
	TEE/PLUG	57/71	35/39	15	15	22/28

- CONCRETE THRUST BLOCK NOTES:**
1. THRUST BLOCKS ARE BASED ON A WORKING PRESSURE OF 200 P.S.I. 36" COVER, AND 2000 P.S.F. ALLOWABLE SOIL BEARING PRESSURE.
 2. FOR PIPE SIZES NOT SHOWN USE DIMENSIONS FOR NEXT LARGER SIZE.
 3. USE 3/8" PLYWOOD SEPARATOR BETWEEN BLOCKS AND PLUGS TO ALLOW FOR FUTURE REMOVAL.
 4. MJ FITTING WITH RETAINER GLANDS REQUIRED FOR ALL VERTICAL BENDS

E
8 Not To Scale
CONCRETE THRUST BLOCK DETAILS



NOTES:

1. MJ RETAINER GLANDS AT EACH END, MAY BE SUBSTITUTED FOR CONCRETE THRUST BLOCKS.
2. WHERE HYDRANT IS LOCATED ON SAME SIDE OF STREET AS SIDEWALK, TOP OF VALVE BOX SHALL BE FLUSH WITH TOP OF SIDEWALK.

F
8 Not To Scale
TYPICAL FIRE HYDRANT ASSEMBLY

D
8 Not To Scale
EMBEDMENT OF PIPE - TYPICAL

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2024

1-MGAL WATER TOWER STANDARD DETAILS

ASHLEY DRIVE NEW 1-MGAL CET WATER TOWER
CITY OF NIXA

NIXA, MO

drawn by: _____ TH
designed by: _____ JJ
project no.: 024-02777
date: 8.20.2024

SHEET
8

Technical Specifications

**ASHLEY DRIVE NEW 1-MGAL
CET WATER TOWER
Nixa, Missouri
2024**

olsson[®]



JERRY G. JESKY JR.—CIVIL ENGINEER
PE—2004000803

Olsson Project No. 024-02777

December 2024

Missouri Certificate of Authorization No. 001592

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03 30 00	CAST-IN-PLACE CONCRETE
03 60 00	GROUTING

DIVISION 33 - UTILITIES

33 16 11	ELEVATED COMPOSITE WATER STORAGE TANK
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CITY OF NIXA, MO STANDARD WATER SPECIFICATIONS

CITY OF NIXA, MO STANDARD WATER DETAILS

GEOTECHNICAL ENGINEERING REPORT

SECTION 03 01 30 - MAINTENANCE OF CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Removal of deteriorated concrete and reinforcement and subsequent replacement and patching.
 - 2. Floor joint repair.
 - 3. Epoxy crack injection.
- B. Related Sections include the following:
 - 1. Division 07 Section "Water Repellents" for clear penetrating and film-forming water repellents applied to concrete.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.
- B. Samples: Cured Samples of patching materials.
- C. Material Certificates: For each type of product indicated, signed by manufacturers.

1.4 QUALITY ASSURANCE

- A. Mockups: Build mockups for epoxy crack injection to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with type and name of products and manufacturers.
- B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.
- C. Store cementitious materials off the ground, under cover, and in a dry location.
- D. Store aggregates, covered and in a dry location, where grading and other required characteristics can be maintained and contamination avoided.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.
 - 1. Use only Class A epoxies when substrate temperatures are below or are expected to go below 40 deg F within 8 hours.
 - 2. Use only Class A or B epoxies when substrate temperatures are below or are expected to go below 60 deg F within 8 hours.
 - 3. Use only Class C epoxies when substrate temperatures are above and are expected to stay above 60 deg F for 8 hours.

PART 2 - PRODUCTS

2.1 PATCHING MORTAR

- A. Patching Mortar, General:
 - 1. Unless otherwise indicated, use any of the products specified in this Article.
 - 2. Overhead Patching Mortar: For overhead repairs, use patching mortar recommended by manufacturer for overhead use and as specified in this Article.
 - 3. Coarse Aggregate for Adding to Patching Mortar: Washed aggregate complying with ASTM C 33, Size No. 8, Class 5S. Add only as permitted by patching mortar manufacturer.
- B. Job-Mixed Patching Mortar: 1 part portland cement complying with ASTM C 150, Type I, II, or III and 2-1/2 parts fine aggregate complying with ASTM C 144, except 100 percent passing a No. 16 sieve.
- C. Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cementitious Patching Mortar:
 - 1) Kaufman Products, Inc.; Hicap.
 - 2) Sonneborn, Div. of ChemRex; Deep Pour Mortar.
 - 3) Sto Corp., Concrete Restoration Division; Sto Full-Depth Repair Mortar.
 - 4) ThoRoc, Div. of ChemRex; LA Repair Mortar.

2.2 MISCELLANEOUS MATERIALS

- A. Epoxy Joint Filler: 2-component, semirigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of at least 80 per ASTM D 2240.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anti-Hydro International, Inc.; Groove & Crack Filler #250.
 - b. Kaufman Products, Inc.; Surepoxy Flexijoint.
 - c. MBT Protection and Repair, Div. of ChemRex; Masterfill 300i.
 - d. Meadows, W. R., Inc.; Sealtight Rezi-Weld Flex.

2.3 MIXES

- A. Mix products, in clean containers, according to manufacturer's written instructions.
 1. Add clean silica sand and coarse aggregates to products only as recommended by manufacturer.
 2. Do not add water, thinners, or additives unless recommended by manufacturer.
 3. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit of measure.
 4. Do not mix more materials than can be used within recommended open time. Discard materials that have begun to set.
- B. Grout for Use with Preplaced Aggregate: Proportion according to ASTM C 938. Add grout fluidifier to mixing water followed by cementitious materials and then fine aggregate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Notify Architect seven days in advance of dates when areas of deteriorated or delaminated concrete and deteriorated reinforcing bars will be located.

3.2 PREPARATION

- A. Protect people, motor vehicles, equipment, surrounding construction, Project site, plants, and surrounding buildings from injury resulting from concrete rehabilitation work.
 - 1. Erect and maintain temporary protective covers over pedestrian walkways and at points of entrance and exit for people and vehicles, unless such areas are made inaccessible during the course of concrete rehabilitation work. Construct covers of tightly fitted, 3/4-inch exterior-grade plywood supported at 16 inches o.c. and covered with asphalt roll roofing.
 - 2. Neutralize and collect alkaline and acid wastes according to requirements of authorities having jurisdiction, and dispose of by legal means off Owner's property.
 - 3. Dispose of runoff from wet operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
 - 4. Collect runoff from wet operations and dispose of by legal means off Owner's property.
- B. Shoring: Install temporary supports before beginning concrete removal.

3.3 APPLICATION

- A. General: Comply with manufacturer's written instructions and recommendations for application of products, including surface preparation.
- B. Patching Mortar: Unless otherwise recommended by manufacturer, apply as follows:
 - 1. Wet substrate thoroughly and then remove standing water. Scrub a slurry of neat patching mortar into substrate, filling pores and voids.
 - 2. Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.
 - 3. After each lift is placed, consolidate material and screed surface.
 - 4. Where multiple lifts are used, score surface of lifts to provide a rough surface for application of subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.
 - 5. Wet-cure cementitious patching materials, including polymer-modified, cementitious patching materials, for not less than seven days by water-fog spray or water-saturated absorptive cover.
- C. Joint Filler: Install in nonmoving floor joints where indicated.
 - 1. Install filler so that when cured, it is flush at top surface of adjacent concrete. If necessary, overfill joint and remove excess when filler has cured.

- D. Epoxy Crack Injection: Comply with manufacturer's written instructions and the following:
1. Clean areas to receive capping adhesive of oil, dirt, and other substances that would interfere with bond, and clean cracks with oil-free compressed air or low-pressure water to remove loose particles.
 2. Place injection ports as recommended by epoxy manufacturer, spacing no farther apart than thickness of member being injected. Seal injection ports in place with capping adhesive.
 3. Seal cracks at exposed surfaces with a ribbon of capping adhesive at least 1/4 inch thick by 1 inch wider than crack.
 4. Inject cracks wider than 0.003 inch to a depth of 8 inches or to a width of less than 0.003 inch, whichever is less.
 5. Inject epoxy adhesive, beginning at widest part of crack and working toward narrower parts. Inject adhesive into ports to refusal, capping adjacent ports when they extrude epoxy. Cap injected ports and inject through adjacent ports until crack is filled.
 6. After epoxy adhesive has set, remove injection ports and grind surfaces smooth.

END OF SECTION 03 01 30

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SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.
2. Shoring, bracing, and anchoring.

1.2 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Exposed surface form-facing material.
2. Concealed surface form-facing material.
3. Form ties.
4. Waterstops.
5. Form-release agent.

- B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.

1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.

- a. Location of construction joints is subject to approval of the Architect.

3. Indicate location of waterstops.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

2.2 FORM-FACING MATERIALS

- A. As-Cast Surface Form-Facing Material:
1. Provide continuous, true, and smooth concrete surfaces.
 2. Furnish in largest practicable sizes to minimize number of joints.
 3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete, and as follows:
 - a. Plywood, metal, or other approved panel materials.
 - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) APA HDO (high-density overlay).
 - 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
 - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
 - 4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.
- B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
1. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 WATERSTOPS

- A. Flexible Rubber Waterstops: U.S. Army Corps of Engineers CRD-C 513, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints, with factory fabricate corners, intersections, and directional changes.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Williams Products, Inc.
 - b. Insert manufacturer's name.
 2. Profile and Dimensions: As specified by Contractor's engineer.
- B. Flexible PVC Waterstops: U.S. Army Corps of Engineers CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints, with factory fabricate corners, intersections, and directional changes.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BoMetals, Inc.
 - b. Sika Corporation.
 - c. Vinylex Waterstop & Accessories.
 - d. Insert manufacturer's name.
 2. Profile and Dimensions: As specified by Contractor's engineer.
- C. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing Inc.
 - b. CETCO, a Minerals Technologies company.
 - c. Concrete Sealants Inc.
 - d. Henry Company.
 - e. JP Specialties, Inc.
 - f. Sika Corporation.
- D. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Adeka Corporation.
 - b. CETCO, a Minerals Technologies company.
 - c. GCP Applied Technologies Inc.
 - d. Kryton International Inc.
 - e. Sika Corporation.

2.4 RELATED MATERIALS

- A. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 - 2. Form release agent for form liners shall be acceptable to form liner manufacturer.
- F. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete".
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-1.0: ACI 117 Class D, 1 inch.
 - 2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
 - 3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.

- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips.
 - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 3. Place joints perpendicular to main reinforcement.
 - 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
 - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
 5. Clean embedded items immediately prior to concrete placement.

3.3 INSTALLATION OF WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm.
1. Install in longest lengths practicable.
 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
 3. Allow clearance between waterstop and reinforcing steel of not less than 2 times the largest concrete aggregate size specified in Section 03 30 00 "Cast-In-Place Concrete."
 4. Secure waterstops in correct position at 12 inches on center.
 5. Field fabricate joints in accordance with manufacturer's instructions using heat welding.

- a. Miter corners, intersections, and directional changes in waterstops.
 - b. Align center bulbs.
6. Clean waterstops immediately prior to placement of concrete.
 7. Support and protect exposed waterstops during progress of the Work.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.
1. Install in longest lengths practicable.
 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
 3. Protect exposed waterstops during progress of the Work.

3.4 SHORING AND RESHORING INSTALLATION

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
 2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION

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SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel reinforcement bars.
 - 2. Welded-wire reinforcement.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of steel reinforcement.
 - 2. Bar supports.
 - 3. Mechanical splice couplers.
- B. Shop Drawings: Comply with ACI SP-066:
 - 1. Include placing drawings that detail fabrication, bending, and placement.
 - 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1.3 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."
- B. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Steel Reinforcement:
 - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
 - 2. Mechanical splice couplers.
- C. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Headed-Steel Reinforcing Bars: ASTM A970/A970M.
- D. Galvanized Reinforcing Bars:
 - 1. Steel Bars: ASTM A615/A615M, Grade 60, deformed bars.
 - 2. Zinc Coating: ASTM A767/A767M, Class I zinc coated after fabrication and bending.
- E. Epoxy-Coated Reinforcing Bars:
 - 1. Steel Bars: ASTM A615/A615M, Grade 60, deformed bars.
 - 2. Epoxy Coating: ASTM A775/A775M or ASTM A934/A934M with less than 2 percent damaged coating in each 12-inch bar length.
- F. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- G. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.
- H. Galvanized-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.
- I. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A coated, Type 1, plain deformed steel.

2.2 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

- a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
 - b. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - c. For dual-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - d. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
 - e. For stainless steel reinforcement, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
- B. Mechanical Splice Couplers: ACI 318 , same material of reinforcing bar being spliced; .
- C. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
1. Finish: Galvanized ASTM A884/A884M, Class A, Type 1, epoxy coated, with less than 2 percent damaged coating in each 12-inch wire length.
- D. Stainless Steel Tie Wire: ASTM A1022/A1022M, not less than 0.0508 inch in diameter.

2.3 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
1. Do not cut or puncture vapor retarder.
 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 2. Do not tack weld crossing reinforcing bars.

- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
 - 2. Stagger splices in accordance with ACI 318.
 - 3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
 - 4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.
- G. Install welded-wire reinforcement in longest practicable lengths.
 - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches.
 - 2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
 - 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 - 4. Lace overlaps with wire.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
 - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel-reinforcement placement.
2. Steel-reinforcement mechanical splice couplers.
3. Steel-reinforcement welding.

END OF SECTION 03 20 00

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all materials and labor necessary to complete all concrete, plain and reinforced, as indicated on Drawings or as specified in these specifications and as required to complete the Project. Work, without limiting the generality thereof, includes:
1. Installation of concrete to provide pile caps, transfer beams, grade beams, footings, foundations, suspended slabs, building walls, elevator shaft walls, retaining walls, slabs on grade, electrical ductbanks, and other incidental concrete Work.
 2. Mass concrete foundations and related structures.
 3. Furnishing and installation of admixtures.
 4. Work of other trades required to be built into concrete, such as inserts for connections to steel members, waterstops, flashing reglets, anchors, embedded plates, and reinforcing dowels.
 5. Providing vapor retarder or waterproofing membrane below slabs on grade.
 6. Finishing of concrete as specified herein or as indicated on Drawings.
- B. Related Requirements:
1. Section 03 10 00 - Concrete Forming and Accessories: Formwork and accessories.
 2. Section 03 35 00 - Concrete Finishing: Finishing of concrete floor surfaces.
 3. Section 31 23 16 - Excavation.
 4. Section 31 23 23 - Fill.
 5. Section 31 63 29 - Drilled Concrete Piers and Shafts.
 6. Section 32 13 13 - Concrete Paving: Concrete pavement and walks.
 7. Section 32 16 23 - Sidewalks: Concrete paving for sidewalks.

1.2 DEFINITIONS

- A. Cementitious Materials: The materials that are subject to compliance with requirements, such as Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume.
- B. Conventional Concrete: A type of concrete that has a specified compressive strength of less than 8,000 psi.
- C. High-Strength Concrete (HSC): A type of concrete that has a specified compressive strength of 8,000 psi or greater.

- D. Water-Cementitious Materials Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M182 - Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats.

B. American Concrete Institute:

1. ACI 117 (117M) - Specification for Tolerances for Concrete Construction and Materials.
2. ACI 232.3R - Report on High-Volume Fly Ash Concrete for Structural Applications.
3. ACI 228.1R - Report on Methods for Estimating In-Place Concrete Strength.
4. ACI 239R - Ultra-High-Performance Concrete: An Emerging Technology Report.
5. ACI 301 (301M) - Specifications for Structural Concrete.
6. ACI 302.1R - Guide for Concrete Floor and Slab Construction.
7. ACI 305R - Guide to Hot Weather Concreting.
8. ACI 305.1 (305.1M) - Specification for Hot Weather Concreting.
9. ACI 306.1 - Standard Specification for Cold Weather Concreting.
10. ACI 306R - Guide to Cold Weather Concreting.
11. ACI 308.1 (308.1M) - Specification for Curing Concrete.
12. ACI 318 (318M) - Building Code Requirements for Structural Concrete.
13. ACI 350.5 (350.5M) - Specifications for Environmental Concrete Structures.
14. ACI 357.3R - Guide for Design and Construction of Waterfront and Coastal Concrete Marine Structures.
15. ACI 362.1R - Guide for the Design and Construction of Durable Concrete Parking Structures.
16. ACI 363.2R - Guide to Quality Control and Assurance of High-Strength Concrete.

C. ASTM International:

1. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
3. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
6. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
7. ASTM C150/C150M - Standard Specification for Portland Cement.
8. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
9. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete.
10. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

11. ASTM C231/C231M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
12. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.
13. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
14. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete.
15. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
16. ASTM C567/C567M - Standard Test Method for Determining Density of Structural Lightweight Concrete.
17. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements.
18. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
19. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
20. ASTM C845/C845M - Standard Specification for Expansive Hydraulic Cement.
21. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
22. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
23. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
24. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
25. ASTM C1074 - Standard Practice for Estimating Concrete Strength by the Maturity Method.
26. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
27. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
28. ASTM C1218/C1218M - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
29. ASTM C1260 - Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
30. ASTM C1293 - Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
31. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
32. ASTM C1567 - Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).
33. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
34. ASTM C1611/C1611M - Standard Test Method for Slump Flow of Self-Consolidating Concrete.
35. ASTM C1778 - Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete.
36. ASTM D994/D994M - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

37. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
38. ASTM D1752 - Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
39. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
40. .
41. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
42. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
43. ASTM E1155 (E1155M) - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
44. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
45. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
46. ASTM E1993/E1993M - Standard Specification for Bituminous Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

D. Canadian Standards Association (CSA):

1. CSA A23.1/A23.2 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

E. National Ready Mixed Concrete Association (NRMCA):

1. NRMCA - Certification of Ready Mixed Concrete Production Facilities.

F. National Sanitation Foundation (NSF):

1. NSF/ANSI Standard 61 - Drinking Water System Components - Health Effects.

G. U.S. Army Corps of Engineers:

1. CRD-C 48 - Standard Test Method for Water Permeability of Concrete.

1.4 COORDINATION

- A. Coordinate placement of control and expansion joint devices with erection of concrete formwork and placement of form accessories.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at City of Nixa Public Works office.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Independent testing agency responsible for field quality control.
 - d. Ready-mix concrete manufacturer.
 - e. Concrete Subcontractor.
 - f. Admixture manufacturer.
 - g. Concrete pumping Contractor.
 - h. Formwork Contractor.
 - i. Special concrete finish Subcontractor.

2. Review the following:
 - a. Special inspection and testing agency procedures for field quality control.
 - b. Construction joints, control joints, isolation joints, and joint-filler strips.
 - c. Semi-rigid joint fillers.
 - d. Vapor retarder or waterproofing installation.
 - e. Anchor rod and anchorage device installation tolerances.
 - f. Cold and hot weather concreting procedures.
 - g. Concrete finishes and finishing.
 - h. Curing procedures.
 - i. Forms and form-removal limitations.
 - j. Shoring and reshoring procedures.
 - k. Methods for achieving specified floor and slab flatness and levelness.
 - l. Floor and slab flatness and levelness measurements.
 - m. Concrete repair procedures.
 - n. Concrete protection.
 - o. Initial curing and field curing of field test cylinders in accordance with ASTM C31/C31M.
 - p. Protection of field-cured field test cylinders.

1.6 SUBMITTALS

A. Product Data: Submit data on the following:

1. Portland cement.
2. Fly ash.
3. Performance-based hydraulic cement.
4. Aggregates.
5. Admixtures:
 - a. Include limitations of use, such as restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
6. Vapor retarders or waterproof membranes.
7. Curing materials:

- a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.
 8. Joint fillers.
 9. Repair materials.
 - B. Design Mixtures: For each concrete mixture, include the following:
 1. Mixture identification.
 2. Minimum 28-day compressive strength.
 3. Durability exposure class.
 4. Maximum water-cementitious materials ratio.
 5. Calculated equilibrium unit weight for lightweight concrete.
 6. Slump limit.
 7. Air content.
 8. Nominal maximum aggregate size.
 9. Indicate amounts of mixing water to be withheld for later addition at Project Site, if permitted.
 10. Submit intended placement method.
 11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 12. Submit separate mix designs if admixtures are required for the following:
 - a. Hot and cold weather concrete Work.
 - b. Air-entrained concrete Work.
 - C. Qualification Data: Submit data for the following:
 1. Installer: Include copies of applicable ACI certificates.
 2. Ready-mixed concrete manufacturer.
 3. Testing agency: Include copies of applicable ACI certificates.
 - D. Shop Drawings:
 1. Construction Joint Layout:
 - a. Indicate proposed construction joints required to construct structure.
 - b. Location of construction joints is subject to approval of Architect/Engineer.
 - E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 - F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- 1.7 CLOSEOUT SUBMITTALS
- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

- B. Project Record Documents: Record actual locations of embedded utilities and components concealed from view in finished construction.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified Installer employing Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor certified as ACI Flatwork Concrete Finisher/Technician, or an ACI Concrete Flatwork Technician with experience installing and finishing concrete, and incorporating permeability-reducing admixtures.
 - 1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.
- B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.
 - 1. Personnel performing laboratory tests are required to be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisors are required to be ACI-certified Concrete Laboratory Testing Technician, Grade II.
- D. Alkali-Silica Reactivity Testing: Aggregates used in the concrete shall be tested by an independent testing agency for alkali-silica reactivity in accordance with ASTM C1260.
- E. Additional Testing and Inspection Services:
 - 1. If required, Owner's testing agency will perform additional testing and inspection services to verify conformance to Contract Documents as listed below:
 - a. Inspect concrete batching, mixing, and delivery operations.
 - b. Inspect forms, foundation preparation, reinforcement, embedded items, reinforcement placement, and concrete placing, finishing, and curing operations.
 - c. Sample concrete at point of placement and other locations as directed by Architect/Engineer and perform required tests.
 - d. Review manufacturer's report for shipment of cement, reinforcement, and prestressing tendons, and conduct laboratory tests or spot checks of materials received for compliance with specifications.
 - e. Other testing or inspection services as required by Architect/Engineer.

2. Provide Owner's testing agency with requested documentation and access to perform testing and inspection activities.

1.9 MOCKUPS

- A. Section 01 40 00 - Quality Requirements: Requirements for mockup.
- B. Size: Construct mockups as follows:
 1. Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
 2. Formed-Surface Panels: Build approximately 100 sq. ft. <_____> in the location indicated or, if not indicated, as directed by Engineer.

1.10 AMBIENT CONDITIONS

- A. Section 01 50 00 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
- B. Cold-Weather Placement: Comply with ACI 301, ACI 306.1, and as follows:
 1. Protect concrete Work from physical damage or reduced strength caused by frost, freezing actions, or low temperatures.
 2. When average high and low temperature is expected to fall below 40 deg. F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 3. Do not use frozen materials or materials containing ice or snow.
 4. Do not place concrete in contact with surfaces less than 35 deg. F, other than reinforcing steel.
 5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- C. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
 1. Maintain concrete temperature at time of discharge not to exceed 95 deg. F.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Concrete Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Concrete Components:

1. Cement:

- a. Comply with ASTM C150/C150M, Type I - Normal Type II - Moderate Sulfate Resistant.
- b. Type: Portland.

2. Fly Ash: Comply with ASTM C618, Class C or F.

3. Normal Weight Aggregates:

- a. Comply with ASTM C33/C33M coarse aggregate or better, graded. Provide aggregates from a single source.

1) Alkali-Silica Reaction: Comply with one of the following:

- a) Expansion Result of Aggregate: Not more than 0.04 percent at one year when tested in accordance with ASTM C1293.
- b) Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
- c) Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.

b. Coarse Aggregate Maximum Size: 1 inch nominal.

c. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

4. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.

a. Air-Entraining Admixture: ASTM C260/C260M.

b. Water-Reducing Admixture: ASTM C494/C494M, Type A.

c. Retarding Admixture: ASTM C494/C494M, Type B.

d. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.

- e. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 - f. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
 - g. Plasticizing and Retarding Admixture:
 - 1) Comply with ASTM C1017/C1017M.
 - 2) Type I, plasticizing or Type II, plasticizing and retarding.
5. Water and Water Used to Make Ice: ASTM C94/C94M, potable.
- C. Carbon-Steel Cut Sheet Fiber: ASTM A820/A820M, Type 2, cut sheet, deformed, minimum of [1.5 inches] [2 inches] [2.4 inches] <_____> long, and aspect ratio of [35 to 40] [45 to 50] [60 to 65] <_____>.
- 1. Manufacturers:
 - a. Concrete Fiber Solutions.
 - b. Fibercon International, Inc.
 - c. Sika Corporation.
- D. Synthetic Monofilament Micro-fiber: Monofilament polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C1116/C1116M, Type III, [1/2 to 1-1/2 inches] [1 to 2-1/4 inches] <_____> long.
- 1. Manufacturers:
 - a. ABC Polymer Industries.
 - b. BASF Corporation.
 - c. Euclid Chemical Company (The); an RPM company.
 - d. GCP Applied Technologies Inc.
 - e. Propex Operating Company, LLC.
 - f. Sika Corporation.
- E. Synthetic Fibrillated Micro-fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C1116/C1116M, Type III, [1/2 to 1-1/2 inches] [1 to 2-1/4 inches] <_____> long.
- 1. Manufacturers:
 - a. ABC Polymer Industries.
 - b. BASF Corporation.
 - c. Euclid Chemical Company (The); an RPM company.
 - d. GCP Applied Technologies Inc.
 - e. Propex Operating Company, LLC.
 - f. Sika Corporation.
- F. Synthetic Macro-fiber: Synthetic macro-fibers engineered and designed for use in concrete, complying with ASTM C1116/C1116M, Type III, [1 to 2-1/4 inches] <_____> long.
- 1. Manufacturers:

- a. ABC Polymer Industries.
- b. Euclid Chemical Company (The); an RPM company.
- c. GCP Applied Technologies Inc.
- d. Propex Operating Company, LLC.
- e. Sika Corporation.

2.3 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A[, **except with maximum water-vapor permeance of** <_____>]; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Manufacturers:

- a. Carlisle Coatings & Waterproofing Inc.
- b. Fortifiber Building Systems Group.
- c. GCP Applied Technologies Inc.
- d. ISI Building Products.
- e. Raven Industries, Inc.
- f. Reef Industries, Inc.
- g. Stego Industries, LLC.
- h. W.R. Meadows, Inc.

- B. Sheet Vapor Retarder, Class C: ASTM E1745, Class C[, **except with maximum water-vapor permeance of** <_____>]; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

1. Manufacturers:

- a. ISI Building Products.
- b. Stego Industries, LLC.
- c. Tex-Trude.

- C. Sheet Vapor Retarder/Termite Barrier: ASTM E1745, Class A, except with maximum water-vapor permeance of 0.03 perm; complying with ICC AC380. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Manufacturers:

- a. Polyguard Products, Inc.
- b. Stego Industries, LLC.
2. Low-Temperature Flexibility: Pass at minus 15 deg. F; ASTM D146/D146M.
3. Puncture Resistance: 224 lbf minimum; ASTM E154/E154M.
4. Water Absorption: 0.1 percent weight-gain maximum after 48-hour immersion at 70 deg. F; ASTM D570.
5. Hydrostatic-Head Resistance: 231 feet minimum; ASTM D5385.

- D. Bituminous Vapor Retarder: ASTM E1993/E1993M, 110-mil- thick, semiflexible, seven-ply sheet membrane, consisting of reinforced core and carrier sheet with fortified asphalt layers, protective weather coating, and removable plastic release liner. Furnish manufacturer's accessories, including bonding asphalt, pointing mastics, and self-adhering joint tape.
1. Manufacturers:
 - a. W.R. Meadows, Inc.
 2. Water-Vapor Permeance: 0.0011 grains/h x sq. ft. x inches Hg when tested in accordance with ASTM E154/E154M.
 3. Tensile Strength: 156 lbf/inch when tested in accordance with ASTM E154/E154M.
 4. Puncture Resistance: 140 lbf when tested in accordance with ASTM E154/E154M.

2.4 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Manufacturers:
 - a. BASF Corporation.
 - b. Bon Tool Co.
 - c. Brickform; a division of Solomon Colors.
 - d. Dayton Superior.
 - e. Euclid Chemical Company (The); an RPM company.
 - f. Kaufman Products, Inc.
 - g. Lambert Corporation.
 - h. Laticrete International, Inc.
 - i. Nox Crete products group.
 - j. Sika Corporation.
 - k. SpecChem, LLC.
 - l. TK Products.
 - m. Vexcon Chemicals Inc.
 - n. W.R. Meadows, Inc.
- B. Concrete Curing Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Concrete Curing Reusable Moisture-Retaining Covers, ASTM C171:
1. Burlap-polyethylene sheet.
 - a. 10 oz. burlap laminated onto 5 mil white coated polyethylene.
 - b. Reusable, natural burlap provides moisture absorption.
 - c. Coated white poly reflects sunlight and intense heat rays.
 - d. Quality lamination between the two fabrics.
 - e. Size: 10-by-100-foot roll.

2. Provide wet cure blankets comprised of a non-woven polypropylene fabric coated with a white-pigmented polyethylene, complying with ASTM C171; total thickness varies per manufacturer. Acceptable products are as follows
 - a. HydraCure reusable, reflective wet cure blankets as manufactured by PNA Construction Technologies, thickness 40 mils.
 - b. Transguard? 4000 as manufactured by Reef Industries, Inc., thickness 42 mils.
 - c. Conkure 80 as manufactured by Raven Industries, thickness 17 mils.

- D. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.
 1. Manufacturers:
 - a. Anti Hydro International.
 - b. ChemMasters, Inc.
 - c. Dayton Superior Specialty Chemicals.
 - d. Euclid Chemical Company (The); an RPM company.
 - e. Kaufman Products, Inc.
 - f. Lambert Corporation.
 - g. Laticrete International, Inc.
 - h. Nox Crete products group.
 - i. SpecChem, LLC.
 - j. TK Products.
 - k. Vexcon Chemicals Inc.
 - l. W.R. Meadows, Inc.

- E. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B[, **certified by curing compound manufacturer to not interfere with bonding of floor covering**].
 1. Manufacturers:
 - a. Anti-Hydro International, Inc.
 - b. ChemMasters, Inc.
 - c. Dayton Superior.
 - d. Euclid Chemical Company (The); an RPM company.
 - e. Kaufman Products, Inc.
 - f. Lambert Corporation.
 - g. Laticrete International, Inc.
 - h. Nox-Crete Products Group.
 - i. SpecChem, LLC.
 - j. TK Products.
 - k. Vexcon Chemicals Inc.
 - l. W.R. Meadows, Inc.

- F. Clear, Waterborne, Membrane-Forming, Curing Compound: ASTM C309, Type 1, Class B, 18 to 25 percent solids, nondissipating[, **certified by curing compound manufacturer to not interfere with bonding of floor covering**].

1. Manufacturers:

- a. BASF Corporation.
- b. ChemMasters, Inc.
- c. Dayton Superior Specialty Chemicals.
- d. Euclid Chemical Company (The); an RPM company.
- e. Kaufman Products, Inc.
- f. Lambert Corporation.
- g. Laticrete International, Inc.
- h. Metalcrete Industries.
- i. Nox Crete products group.
- j. SpecChem, LLC.
- k. Vexcon Chemicals Inc.
- l. V-Seal Concrete Sealers & Specialty Coatings.
- m. W.R. Meadows, Inc.

G. Clear, Solvent-Borne, Membrane-Forming, Curing and Sealing Compound:
ASTM C1315, Type 1, Class A.

1. Manufacturers:

- a. BASF Corporation.
- b. ChemMasters, Inc.
- c. Concrete Sealers USA.
- d. Dayton Superior Specialty Chemicals.
- e. Euclid Chemical Company (The); an RPM company.
- f. Kaufman Products, Inc.
- g. Lambert Corporation.
- h. Laticrete International, Inc.
- i. Metalcrete Industries.
- j. Nox Crete products group.
- k. Right Pointe.
- l. SpecChem, LLC.
- m. TK Products.
- n. Vexcon Chemicals Inc.
- o. W.R. Meadows, Inc.

2.5 AUTOMATIC CONCRETE CURING SYSTEM

A. Basis-of-Design Product: The Cure Tender USA Automatic Curing System automatically time releases water required for concrete curing onto the concrete and under the cure blankets, allowing the concrete to be unattended. This system is self-contained and solar powered, and can be used on both vertical and flat concrete. It consists of the following components:

1. 1,200-gallon water storage tank to provide 50-60 hours of constant supply.
2. Specially designed perforated watering hoses.
3. Solar-powered time release pump capable of running five days without recharging.
4. 2-inch gas-powered water pump for priming of soaking blankets.

5. Anti-theft devices (optional).

2.6 SMART CONCRETE SENSORS AND SOFTWARE

- A. Smart concrete sensor and software system consists of an integrated platform of embedded wireless sensors that automatically monitor the curing and hardening of concrete, combined with manufacturers' mobile apps and associated cloud software.
- B. Basis-of-Design Products: Subject to compliance with requirements, provide Wireless SmartRock and BlueRock Sensors, SmartRock mobile app, Giatec 360 cloud dashboard and SmartHub as manufactured by Giatec Scientific Inc., or comparable products by one of the following:
 1. Concrete Sensors, a subsidiary of Hilti, offers the following:
 - a. NovoConcrete - wireless sensors for automatic data collection.
 - b. NovoSyte - cloud software and analytics.
 - c. NovoHub - wireless gateway.
 - d. NovoDB - mix design database.
- C. SmartRock Sensor Technical Specifications:
 1. Reading Range: Minus 22 to plus 176 deg. F.
 2. Accuracy: Plus or minus 1 degree C.
 3. Measurement Frequency: Once every 15 minutes (for two months of data).
 4. Wireless Signal Range: Up to 26 feet.
 5. Dimensions: 1.5 x 1.5 x 0.5 inches.
 6. Temperature Cable Length: 16 in./10 ft.
 7. Battery Life: Up to four months after installation.
 8. Data Communication and Analysis: Android and iOS app, Giatec 360 Cloud Dashboard.
 9. Standards: ASTM C1074 (approved by ACI 318, CSA A23.1/A23.2, most of USDOT specifications).
- D. SmartRock System Attributes:
 1. Concrete Strength: Based on the maturity method in accordance with ASTM C1074. Smart concrete testing technologies and real-time data collection.
 2. Wireless Sensors: Rugged, waterproof, and designed to survive toughest conditions. Sensors are fully embedded and tied to rebar prior to concrete pour.
 3. Instant wireless connection to smartphones.
 4. User-friendly mobile app displays temperature, strength, maturity information, and more.
 5. Share full PDF or CSV reports instantly with all project stakeholders.
 6. Track and review all projects with Giatec 360 cloud dashboard.

2.7 RELATED MATERIALS

- A. Joint Devices and Filler:

1. Joint Filler, Type **[A]** <_____>:
 - a. Description: Asphalt-impregnated fiberboard or felt.
 - b. Comply with ASTM **[D1751]** **[D994/D994M]**.
 - c. Thickness: [1/4] <_____> inch.
 - d. Profile: Tongue-and-groove.
 - e. <_____>, as manufactured by <_____>.

2. Joint Filler, Type **[B]** <_____>:
 - a. Description: Recycled PVC.
 - b. **[Comply with ASTM D1752.]**
 - c. Thickness: <_____> inch.
 - d. <_____>, as manufactured by <_____>.

3. Joint Filler, Type **[C]** <_____>:
 - a. Description: Premolded sponge rubber.
 - b. **[Comply with ASTM D1752.]**
 - c. Thickness: <_____> inch.
 - d. <_____>, as manufactured by <_____>.

4. Construction Joint Devices:
 - a. Material: Integral **[galvanized steel]** **[extruded plastic]**.
 - b. Thickness: <_____> inch.
 - c. Profile: Tongue-and-groove with **[removable top strip exposing sealant trough and]** knockout holes spaced at [6] <_____> inches o.c.
 - d. Furnish ribbed steel spikes with tongue to fit top screed edge.
 - e. <_____>, as manufactured by <_____>.

5. Expansion **[and Contraction]** Joint Devices:
 - a. **[Comply with ASTM B221.]**
 - b. Material: Extruded aluminum.
 - c. Filler Strip: Resilient **[elastomeric]** **[vinyl]** **[neoprene]** with Shore A hardness of **[35]** <_____> to permit plus or minus **[25]** <_____> percent joint movement with full recovery.
 - d. Cover Plate: **[Extruded aluminum,]** **[Vinyl,]** of longest manufactured length at each location, and **[flush]** **[recessed]** mounted.
 - e. Color: **[As selected]** <_____>.
 - f. <_____>, as manufactured by <_____>.

6. Sealant and Primer: <_____> type, as specified in Section 07 90 00 - Joint Protection.
7. Sealant (Hot Applied):
 - a. Comply with ASTM D6690.
 - b. Type: **[I]** **[II]** **[III]** **[IV]**.
 - c. <_____>, as manufactured by <_____>.

8. Sealant:
 - a. Description: [**Cold-applied,**] [**two-part polyurethane**] <_____>.
 - b. <_____>, as manufactured by <_____>.

B. Nonshrink Grout:

1. Manufacturers:
 - a. CGM, Incorporated.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. Laticrete International, Inc.
 - d. QUIKRETE.
 - e. Sika Corporation.
2. Substitutions: [**As specified in Section 01 60 00 - Product Requirements**] [**Not permitted**].
3. Furnish materials according to <_____> standards.
4. Description: Premixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing agents.
5. Comply with ASTM C1107/C1107M.
6. Minimum Compressive Strength: [2,400] <_____> psi in 48 hours and [7,000] <_____> psi in 28 days.

C. Bonding Agent:

1. Manufacturers:
 - a. Euclid Chemical Company (The); an RPM company.
 - b. Metalcrete Industries.
 - c. QUIKRETE.
 - d. Sika Corporation.
 - e. W.R. Meadows, Inc.
2. Substitutions: [**As specified in Section 01 60 00 - Product Requirements**] [**Not permitted**].
3. Furnish materials according to <_____> standards.
4. Description: [**Polymer resin emulsion**] [**Polyvinyl acetate**] [**Latex emulsion complying with ASTM C1059**] or [**two-component modified epoxy resin,**] [**non-solvent two-component polysulfide epoxy,**] [**mineral-filled polysulfide polymer epoxy,**] [**mineral-filled polysulfide polymer epoxy resin,**] [**polyamide-cured epoxy**]. Provide epoxy resin base bonding systems complying with ASTM C881.

2.8 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
1. Fly Ash or Other Pozzolans: 15 percent by mass.
 2. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass, and silica fume not exceeding 10 percent by mass.
 3. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass, and silica fume not exceeding 10 percent by mass.
- C. Admixtures: Use in accordance with manufacturer's written instructions.
1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete.

2.9 CONCRETE MIXTURES

- A. Select proportions for normal weight concrete according to ACI 301, Method 1 .
- B. Select proportions for concrete ACI 318 field test data.
- C. Performance and Design Criteria:
1. Compressive Strength: 3000 psi at 7 days.
 2. Compressive Strength: 4000 psi at 28 days.
 3. Cement Type: ASTM C150/C150M .
 4. Minimum Cement Content: <564> lb./cu. yd.
 5. Aggregate Type: Normal weight.
 6. Maximum Water-Cementitious Materials Ratio: 0.42 by weight.
 7. Aggregate Size:
 - a. Maximum: 1.5 inch.
 8. Air Content: 5 percent, plus or minus 1.5 percent.
 9. Admixture Type(s): <_____>.
 10. Slump: 2 - 4 inches, plus or minus 1 inch.
- D. Ready-Mixed Concrete: Mix and deliver concrete according to ASTM C94/C94M.
- E. Site-Mixed Concrete: Mix concrete according to ACI 318.
- F. Mass Concrete: Comply with requirements of ACI 301 Section 8 - Mass Concrete.

- G. High Early Concrete Mix Proportions: Provide high early concrete as a pre-blended, prepackaged material requiring only the addition of water and stone aggregate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
 - 1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
 - 2. Do not proceed until unsatisfactory conditions have been corrected.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

- A. Previously Placed Concrete:
 - 1. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.
 - 2. Remove laitance, coatings, and unsound materials.
- B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with nonshrink grout.
- C. Remove debris and ice from formwork, reinforcement, and concrete substrates.
- D. Remove water from areas receiving concrete before concrete is placed.
- E. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
 - 1. Daily access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project Site during Site curing period for test samples.
 - 4. Security and protection for test samples and for testing and inspection equipment at Project Site.

3.3 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 2. Face laps away from exposed direction of concrete pour.
 3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
 4. Lap joints 6 inches and seal with manufacturer's recommended tape.
 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
 7. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.4 INSTALLATION

- A. Placing Concrete:
1. Place concrete according to ACI 318.
 2. Notify testing laboratory and Engineer, minimum 24 hours prior to commencement of operations.
 3. Ensure that reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.
 4. Deposit concrete at final position, preventing segregation of mix.
 5. Place concrete in continuous operation for each panel or section as determined by predetermined joints.
 6. Consolidate concrete.
 7. Maintain records of concrete placement, including date, location, quantity, air temperature, and test samples taken.
 8. Place concrete continuously between predetermined expansion, control, and construction joints.
 9. Do not interrupt successive placement and do not permit cold joints to occur.
 10. Saw-Cut Joints:
 - a. Saw-cut joints within 12 hours after placing.
 - b. Use 3/16 inch thick blade.
 - c. Cut into 1/4 depth of slab thickness.
 11. Screeding:
 - a. Screed floors and slabs on grade level.

B. Concrete Finishing:

1. Provide concrete floors with smooth-rubbed finish .
2. Finish concrete floor surfaces as specified in Section 033500 - Concrete Finishing.
3. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
 - a. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
 - b. Coordinate required final finish with Architect/Engineer before application.

C. Curing and Protection:

1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
2. Protect concrete footings from freezing for minimum of five days.
3. Maintain concrete with minimal moisture loss at relatively constant temperature for period as necessary for hydration of cement and hardening of concrete.
4. Cure concrete according to ACI 308.1 using addition of water method, wet absorptive cover method, moisture retaining cover method, or curing compound method.
5. Mass Concrete Curing: Cure mass concrete in accordance with ACI 301, Section 8. Use thermocouple sensors for monitoring temperature and maturity. Place sensors at center of largest portion of concrete placement and at 2 inches below concrete surface. Place a back-up sensor at each location. Provide data from sensors to Architect/Engineer **[and Owner] [and Construction Manager]** daily. Maximum temperature in concrete after placement should not exceed 160 deg. F.
6. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - a. Recoat areas subject to heavy rainfall within three hours after initial application.
 - b. Maintain continuity of coating and repair damage during curing period.

3.5 FIELD QUALITY CONTROL

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- B. Inspection and Testing: Performed by Owner's testing laboratory according to ACI 318.
- C. Provide unrestricted access to Work and cooperate with appointed testing and inspection firm.
- D. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
- E. Concrete Inspections:

1. Continuous Placement Inspection: Inspect for proper installation procedures.
2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

F. Strength Test Samples:

1. Sampling Procedures: Comply with ASTM C172.
2. Cylinder Molding and Curing Procedures:
 - a. Comply with ASTM C31/C31M).
 - b. Cylinder Specimens: Field cured.
3. Sample concrete and make one set of three cylinders for every 50 cu. yd. or less of each class of concrete placed each day, and for every 5,000 sq. ft. of surface area for slabs and walls.
4. If volume of concrete for a class of concrete would provide less than five sets of cylinders, take samples from five randomly selected batches, or from every batch if less than five batches are used.
5. Make one additional cylinder during cold weather concreting and field cure.

G. Concrete Maturity Testing Using Sensors:

1. Non-destructive Test: Gather information from wireless embedded sensors recording temperature and strength.
2. Data is logged and/or retrieved by external device in real-time.
3. Comply with sensor manufacturer's written instructions and ASTM C1074, CSA A23.1/A23.2, ACI 318, ACI 228.1R, and ACI 306R.

H. Field Testing:

1. Slump Test Method: Comply with ASTM C143/C143M.
2. Air Content Test Method: Comply with ASTM C231.
3. Temperature Test Method: Comply with ASTM C1064.
4. Compressive Strength Concrete:
 - a. Measure slump and temperature for each sample.
 - b. Measure air content in air-entrained concrete for each sample.

I. Cylinder Compressive Strength Testing:

1. Test Method: Comply with ASTM C39/C39M.
2. Test Acceptance: According to ACI 318.
3. Test one cylinder at seven days.
4. Test one cylinder at 28 days.
5. Retain one cylinder for <_____> days for testing when requested by Engineer.
6. Dispose of remaining cylinders if testing is not required.

J. Patching:

1. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

2. Honeycombing or Embedded Debris in Concrete:
 - a. Not acceptable.
 - b. Notify Architect/Engineer upon discovery.
3. Patch imperfections according to ACI 318.

K. Defective Concrete:

1. Description: Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.
2. Repair or replacement of defective concrete will be determined by Architect/Engineer.
3. Do not patch, fill, touch up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

END OF SECTION 03 30 00

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SECTION 03 60 00 - GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Portland cement grout.
2. Rapid-curing epoxy grout.
3. Nonshrink cementitious grout.

B. Related Requirements:

1. Section 03 10 00 - Concrete Forming and Accessories: Form materials, waterstops, and accessories as required to form cast-in-place concrete and maintain structural integrity until stripping.
2. Section 03 30 00 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frames, slabs on fill or grade, and other concrete components.

1.2 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete for Buildings.
2. ACI 301M - Specifications for Structural Concrete (Metric).
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 318M - Metric Building Code Requirements for Structural Concrete.

B. ASTM International:

1. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
2. ASTM C40/C40M - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
3. ASTM C150/C150M - Standard Specification for Portland Cement.
4. ASTM C191 - Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle.
5. ASTM C307 - Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
6. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
7. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
8. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.

C. U. S. Army Corps of Engineers Concrete Research Division (CRD):

1. CRD-C621 - Non-Shrink Grout.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information regarding grout.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Submit instructions for mixing, handling, surface preparation, and placing epoxy-type and nonshrink grouts.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- F. Qualifications Statement:
 1. Submit qualifications for manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Store materials according to manufacturer instructions.
- C. Protection:
 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT GROUT

- A. Portland Cement: Comply with ASTM C150/C150M, Type I and II.
- B. Water:
 1. Potable.
 2. No impurities, suspended particles, algae, or dissolved natural salts in quantities capable of causing:

- a. Corrosion of steel.
- b. Volume change increasing shrinkage cracking.
- c. Efflorescence.
- d. Excess air entraining.

C. Fine Aggregate:

1. Washed natural sand.
2. Gradation:
 - a. Comply with ASTM C33/C33M.
 - b. Represented by smooth granulometric curve within required limits.
3. Free from injurious amounts of organic impurities according to ASTM C40/C40M.

D. Mix:

1. Portland cement, sand, and water.
2. Do not use ferrous aggregate or staining ingredients in grout mixes.

2.2 RAPID-CURING EPOXY GROUT

A. Manufacturers:

1. Laticrete International, Inc.
2. Sika Corporation.
3. W.R. Meadows, Inc.

B. Description:

1. High-strength, three-component epoxy grout formulated with thermosetting resins and inert fillers.
2. Rapid-curing, high adhesion, and resistant to ordinary chemicals, acids, and alkalis.

C. Performance and Design Criteria:

1. Compressive Strength:
 - a. 12,000 psi at seven days.
 - b. Comply with ASTM C579.
2. Minimum Tensile Strength:
 - a. 2,000 psi.
 - b. Comply with ASTM C307.
3. Coefficient of Expansion:
 - a. 30×10^{-6} inch per degree F.
 - b. Comply with ASTM C531.

4. Shrinkage:
 - a. None.
 - b. Comply with ASTM C827/C827M.

2.3 NONSHRINK CEMENTITIOUS GROUT

A. Manufacturers:

1. CGM, Incorporated.
2. Euclid Chemical Company (The); an RPM company.
3. Laticrete International, Inc.
4. QUIKRETE.
5. Sika Corporation.

B. Description:

1. Pre-mixed and ready-for-use formulation requiring only addition of water.
2. Nonshrink, non-corrosive, nonmetallic, non-gas forming, and no chlorides.

C. Performance and Design Criteria:

1. Certified to maintain initial placement volume or expand after set, and to meet following minimum properties when tested according to CRD-C621 for Type D nonshrink grout:
 - a. Setting Time:
 - 1) Initial: Approximately two hours.
 - 2) Final: Approximately three hours.
 - 3) Comply with ASTM C191.
 - b. Maximum Expansion: 0.10 to 0.40 percent.
 - c. Compressive Strength:
 - 1) One-Day: 4,000 psi.
 - 2) Seven-Day: 7,000 psi.
 - 3) 28-Day: 10,000 to 10,800 psi.
 - 4) Comply with CRD-C621.

2.4 FORMWORK

- A. As specified in Section 03 10 00 - Concrete Forming and Accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify areas to receive grout.

3.2 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Remove defective concrete, laitance, dirt, oil, grease, and other foreign material from concrete surfaces by brushing, hammering, chipping, or other similar means until sound and clean concrete surface is achieved.
- C. Roughen concrete lightly, but not to interfere with placement of grout.
- D. Remove foreign materials from metal surfaces in contact with grout.
- E. Align, level, and maintain final positioning of components to be grouted.
- F. Saturate concrete surfaces with clean water, and then remove excess water.

3.3 INSTALLATION

- A. Formwork:
 - 1. Construct leakproof forms anchored and shored to withstand grout pressures.
 - 2. Install formwork with clearances to permit proper placement of grout.
 - 3. As specified in Section 03 10 00 - Concrete Forming and Accessories.
- B. Mixing:
 - 1. Portland Cement Grout:
 - a. Use proportions of two parts sand and one part cement, measured by volume.
 - b. Prepare grout with water to obtain consistency to permit placing and packing.
 - c. Mix water and grout in two steps:
 - 1) Premix using approximately 2/3 of water.
 - 2) After partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing two to three minutes.

- d. Mix only quantities of grout capable of being placed within 30 minutes after mixing.
 - e. Do not add additional water after grout has been mixed.
 - f. Minimum Compressive Strength: 2,400 psi in 48 hours and 7,000 psi in 28 days.
2. Rapid-Curing Epoxy Grout:
 - a. Mix and prepare according to manufacturer instructions.
 - b. Minimum Compressive Strength: 2,400 psi in 48 hours and 7,000 psi in 28 days.
 3. Nonshrink Cementitious Grout:
 - a. Mix and prepare according to manufacturer instructions.
 - b. Minimum Compressive Strength: 2,400 psi in 48 hours and 7,000 psi in 28 days.
 4. Mix grout components in proximity to Work area and transport mixture quickly and in manner not permitting segregation of materials.
- C. Placing of Grout:
1. Place grout material quickly and continuously.
 2. Do not use pneumatic-pressure or dry-packing methods.
 3. Apply grout from one side only to avoid entrapping air.
 4. Do not vibrate placed grout mixture or permit placement if area is being vibrated by nearby equipment.
 5. Thoroughly compact final installation and eliminate air pockets.
 6. Do not remove leveling shims for at least 48 hours after grout has been placed.
- D. Curing:
1. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or by using wet burlap method.
 2. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.
 3. After grout has attained its initial set, keep damp for minimum three days.

END OF SECTION 03 60 00

SECTION 33 16 11 - ELEVATED COMPOSITE WATER STORAGE TANK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work

1. The work to be performed under these specifications includes furnishing all labor, materials, tools and equipment necessary to design, fabricate, construct, inspect and test a 1,000,000-gallon welded steel elevated water storage tank supported on a concrete support structure, commonly referred to as a Composite Elevated Tank (CET), including the design and construction of the foundation and accessories as shown on the drawings and specified herein.

B. Related Work

1. The work shall also include all labor, materials and equipment necessary to construct the site improvements and site piping as shown on the drawings and specified herein. Existing water system infrastructure to remain in use and online throughout construction of the project.

C. Description

1. The tank and support structure shall be a composite tank style. The tank shall be of all welded steel design and have a dome roof, straight sides and a cone bottom. The support structure shall be of concrete design. The concrete support structure shall be configured so that a concrete tank floor with a steel liner plate supports the water inside the steel reservoir. Suspended steel tank floor configurations are not acceptable.

1.2 PRE-QUALIFICATION OF CONTRACTOR

- A. Bids will only be accepted from experienced Contractors who have successfully completed at least ten composite elevated tanks of equal or greater capacity in the last ten years. These projects shall have been constructed using the forming system required in this Specification.
- B. Each bidder shall provide a list of at least five such projects stating location, completion date, contact names and telephone numbers, if requested.

1.3 STANDARDS, CODES AND GUIDES

- A. The following standards and specifications are referenced. The latest edition shall be used if the edition is not specified.

1. AWWA D107: Standard for Composite Elevated Tanks for Water Storage

2. AWWA D100: Standard for Welded Carbon Steel Tanks for Water Storage
3. AWWA D102: Standard for Painting Steel Water Storage Tanks
4. AWWA C652: Standard for Disinfection of Water Storage Facilities
5. ASCE 7: Minimum Design Loads for Buildings and Other Structures
6. ACI 301: Specifications for Structural Concrete for Buildings
7. ACI 305: Hot Weather Concreting
8. ACI 306: Cold Weather Concreting
9. ACI 318: Building Code Requirements for Structural Concrete
10. NSF 61: Drinking Water System Components
11. NSF 600: Health Effects Evaluation and Criteria for Chemicals in Drinking Water
12. OSHA: Occupational Safety and Health Standards
13. SSPC: Steel Structures Painting Council

1.4 OWNER OR ENGINEER SUPPLIED INFORMATION

A. The following information is provided with the bid documents:

1. Soils investigation report that is specific to the project site and prepared by a qualified Geotechnical Engineer. The soils investigation report includes a determination of the Site Class in accordance with AWWA D107.
2. Summary of FAA requirements such as height restrictions, obstruction marking or obstruction lighting. The Owner or Engineer has filed Form 7460-1 with the FAA (<http://forms.faa.gov/>) to determine requirements. While no markings or lighting is required per FAA, the Owner has chosen to include obstruction lighting on this project to maintain consistency throughout the water system.

1.5 SUBMITTALS

- A. Each Contractor shall submit with its proposal a sketch of the composite elevated tank showing major dimensions and plate thicknesses. A sketch of the foundation showing preliminary dimensions and approximate quantities of concrete and reinforcing steel shall also be provided with the proposal.
- B. Prior to construction, the contractor shall furnish construction drawings of the tank, concrete support structure and foundation sealed by a Professional Engineer licensed in the State of Missouri. Construction drawings for the foundation shall show applicable design and construction standards, materials of construction, design loads and allowable soil bearing or pile capacity.
- C. A summary of the design for the foundation, support structure and the tank, shall be provided prior to construction. The design summary shall show applicable design and construction standards, materials of construction, design loads and results showing conformance with the specifications. The design shall be sealed by a Professional Engineer licensed in the State of Missouri.
- D. Welder's certifications shall be submitted in accordance with AWWA D107.

- E. Provide an operating and maintenance manual containing operating instructions, maintenance instructions, as-built construction drawings, cleaning and painting instructions, a gage table and catalog cuts of equipment supplied.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Furnish an elevated water storage tank as shown on the drawings and as specified in this section. The design, materials, fabrication, construction, testing and inspection of the tank, support structure and foundation shall comply with AWWA D107, except as modified herein. Tank capacity, head range, height to TCL and top of foundation elevation shall be as shown on the drawings. Tank net capacity shall be 1,000,000 gallons.

2.2 MATERIALS

- A. Materials and material tests for reinforced concrete shall conform to ACI 318 except as modified herein.
- B. The same brand and type of cement, and aggregate from a consistent source shall be used throughout the construction of the concrete support structure to maintain uniformity of color.
- C. The minimum specified compressive strength of concrete shall be 4000 psi. The specified compressive strength of concrete used for the design of the wall and dome shall not exceed 6000 psi and 5000 psi, respectively.
- D. Deformed bar reinforcing steel shall conform to ASTM A615 Grade 60 or ASTM A706 Grade 60. Plain welded wire reinforcement shall conform to ASTM A1064.
- E. Materials and material tests for the steel tank and all tank components shall comply with the latest edition of AWWA D107 except as modified herein.

2.3 DESIGN CRITERIA

- A. Design shall conform to the current International Building Code (IBC) including any revisions by the State of Missouri or by the City of Nixa.
- B. Loads shall be calculated using AWWA D107, ASCE 7, and the applicable Fire Prevention Code. The largest of these loads shall be used for design.
- C. Load combinations from ACI 318, ASCE 7, applicable Fire Prevention Code, and those following in this Specification shall be considered. The combinations which produce the greatest effect shall govern the design.

- D. Dead load shall be the estimated weight of all permanent construction and fittings. The unit weight of steel shall be considered as 490 pounds per cubic foot, the unit weight of concrete shall be taken as 150 pounds per cubic foot.
- E. Water load shall be the weight of all of the liquid when the tank is filled to the overflow. The unit weight of water shall be 62.4 pounds per cubic foot.
- F. Snow load shall be in accordance with AWWA D107 and based on 25 pounds per square foot.
- G. Wind load shall be in accordance with AWWA D107 and based on a basic wind speed V of 120 miles per hour and Exposure Category C in accordance with ASCE 7 for Category IV (essential facility) structures.
- H. Seismic design shall be in accordance with AWWA D107 and ASCE 7 based on the following parameters:
1. Risk Category: IV
 2. Site Class: D
 3. Tank center location: 37.064444 Latitude; -93.298611 Longitude
- I. The structural effects of the applied loads shall be considered with the loads defined according to ASCE 7. Load combinations used for allowable stress design and strength design shall conform with AWWA D107.
- J. Foundation:
1. The design of the foundation shall conform to ACI 318 except as modified herein.
 2. The foundation design shall be by the Contactor and shall conform to the recommendations given in the geotechnical report. The foundation depth shall be as required for the extreme frost penetration shown in AWWA D107.
 3. Earth cover shall be a minimum of 3 feet over the top of pipe in accordance with AWWA D107. Any pipe passing through the foundation which does not meet this minimum cover requirement shall be properly insulated until such minimum cover is achieved.
 4. Unless modified by the Geotechnical Engineer, the foundation shall be sized to provide a safety factor of 3.0 against the ultimate soil bearing capacity in accordance with AWWA D107. For driven pile the safety factor shall be at least 2.0. Safety factors may be reduced to 2.25 and 1.5 respectively when direct vertical loads are combined with wind or seismic.
 5. The foundation shall be sized such that there is a minimum safety factor of 1.5 against overturning for wind or seismic events using service load combinations.
 6. Foundation piling shall conform to the design and detailing requirements of International Building Code (IBC) Section 1810, including the supplemental design and detailing requirements based on the assigned Seismic Design Category (SDC).
- K. Concrete Support Structure:
1. The design of the concrete support structure shall conform to AWWA D107 and ACI 318 except as modified herein.

2. The minimum wall thickness shall not be less than 8 inches exclusive of rustications or other architectural relief.
3. The concrete support structure walls shall have a minimum reinforcement ratio in accordance with AWWA D107. Where the seismic design category determined in accordance with ASCE 7 is D, E or F, the minimum reinforcement ratio shall be 0.25% in the vertical and horizontal directions.
4. The concrete support structure walls shall have reinforcement placed in two layers in each direction with 50% of the minimum required steel in each layer.
5. The vertical load capacity for walls shall be determined using the procedures in AWWA D107 Section 6.3.
6. Horizontal reinforcement shall be provided to resist the ovaling of the wall due to wind pressure, using the procedures in AWWA D107 Section 6.3.
7. The concrete support structure walls shall be designed to resist in plane shear using the procedures in AWWA D107 Section 6.3. The effect of openings shall be considered in the shear design.
8. Openings in the concrete support structure walls that are less than or equal to 24 inches and are isolated do not require a beam and column analysis. Isolated openings shall have a clear distance between openings equal to 0.75 times the cumulative width of adjacent openings. Additional reinforcement having an area of not less than 1.2 times the area of interrupted reinforcement shall be distributed equally to either side of openings. Openings shall have a minimum of one No. 5 reinforcing bar placed diagonally in each corner. All reinforcing shall be fully developed beyond the opening.
9. Openings larger than 24 inches or combinations of openings that are not isolated shall be designed using an effective beam and column analysis as per AWWA D107 Section 6.3. Vertical and horizontal reinforcement shall be provided around the opening in accordance with the requirements of this section.
 - a. The corners of the openings shall be reinforced with diagonal bars. The area of bars provided shall be equal to the minimum horizontal reinforcement ratio times the column area. A minimum of two No. 5 reinforcing bars shall be placed diagonally in each corner.
 - b. Reinforcement provided around openings shall be fully developed. Column reinforcement shall extend the greater of half the opening height or the development length above and below the opening or be developed into the foundation. Horizontal reinforcement shall extend the greater of the development length past the midpoint of the column or a minimum of half a development length beyond the column.
10. Local effects at openings shall be considered when the opening is located less than half the opening width above the foundation. The foundation shall be designed to adequately develop the opening reinforcement and redistribute loads across the unsupported width.

L. Concrete to Tank Interface:

1. The concrete to tank interface region includes those portions of the concrete support structure and welded steel tank that are affected by the transfer of forces between the concrete tank floor, ringbeam, tank cone bottom and support structure wall. The design of the interface region shall be based on an analysis using finite element or similar analysis which can accurately model the interaction of the intersecting elements. The analysis shall provide results including the shear, moment and compression or tension caused by the intersecting elements in the interface region.
2. The analysis shall consider the transfer of forces from the intersecting elements under all anticipated load conditions. These conditions shall include the eccentricity of loads, restraint effects caused by shrinkage and temperature differentials, long term effects caused by concrete creep, and the effect of anchorage of the welded steel tank to the concrete.
3. The geometry of the interface region shall provide positive drainage at the top of the wall and ringbeam. Condensation or precipitation shall not be allowed to accumulate in this area.
4. The geometry of the tank shall be established such that the ringbeam provided at the top of the wall is a compression member with gravity loads acting alone (D + F). In this loading condition the compressive stress in the ringbeam shall be not less than 50 psi to minimize cracking in the interface region. No direct tension in the ringbeam under this loading condition will be allowed. The maximum compression in the ringbeam shall be no greater than 0.18f_c.
5. The ringbeam shall be reinforced as a compression member with a minimum longitudinal reinforcement ratio of 0.40%. Tie reinforcement shall be provided in accordance with ACI 318 for compression members as a minimum. Additional tie reinforcement shall be provided if required by the analysis of the interface region.
6. When a concrete dome supports the tank contents, it shall not be less than 9 inches thick, or less than the mean spherical radius of the dome divided by 50. The minimum reinforcement ratio shall be 0.36% in orthogonal directions. The reinforcement shall be placed in two layers with 50% of the minimum required steel in each layer.

M. Welded Steel Tank:

1. The design for all sections of the steel tank shall be per the unit tension/compression stresses allowed for material classes listed in the latest edition of AWWA D107.
2. The tank shall have a domed steel roof to minimize snow accumulating and water ponding on the roof plates. The dome roof also allows visual confirmation of roof accessories for tank security and structural integrity by allowing observation of the roof appurtenances. The roof radius shall be between 0.8 and 1.2 times the tank diameter. Roof plates and supporting structure shall be designed to support the full snow load or 15 psf as a minimum.
3. For areas of the steel tank where the water is supported by a steel cone, the cone plate thickness may be determined using a nonlinear buckling analysis. A nonlinear buckling analysis may only be performed for liquid filled cones with a thickness-to-radius ratio greater than 0.0010 and less than 0.0030. The angle of the cone measured from the axis of revolution to the plate surface shall not exceed 60 degrees. If a nonlinear buckling analysis is not performed, the cone plate thickness shall be determined in accordance with the shell stability formulas provided in AWWA D107.

- a. The nonlinear buckling analysis shall include the effects of material and geometric non-linearities, residual stresses and imperfections.
 - b. The imperfection considered in the analysis shall have a magnitude of not less than $0.04\sqrt{Rt}$, where R is the radius normal to the plate measured to the axis of revolution, and t is the corroded plate thickness. The length of the imperfection shall be equal to or less than $4\sqrt{RT}$ and be appropriate for the type of construction used for the cone. The location and shape of the imperfection shall produce the lowest critical buckling stress.
 - c. The minimum specified yield strength of the cone plate material shall be equal to or greater than 36 ksi. The yield strength used for the analysis shall be no greater than 40 ksi when the material of construction has a minimum specified yield strength greater than 40 ksi.
 - d. Plate thickness used for the cone plates shall be no less than 80% of that required by the shell stability formulas provided in AWWA D107 when the thickness to radius ratio is greater than or equal to 0.00143. Cone plate thickness shall be no less than 70% of that required by AWWA D107 when the thickness to radius ratio is less than 0.00143.
 - e. The nonlinear buckling analysis shall demonstrate that the provided cone plate thickness has a factor of safety of at least 2.0 against buckling in the corroded condition.
4. The concrete tank floor shall be covered with a welded steel liner to provide a water-tight boundary. The minimum thickness of the liner plate shall be 1/4-inch. Liner plates may be placed directly on the concrete when the liner plates are formed to match the shape of the tank floor. Liner plates that are not formed to match the shape of the tank floor shall have the space between the liner plates and the tank floor completely filled with a flowable grout.
 5. Unless otherwise noted, at junctions in plates where meridional forces are discontinuous such as cone to cylinder junctions, a tension or compression ring may be required to resist the radial forces generated. In these regions, the allowable stresses shall not exceed those referred to in AWWA D107.
 - a. Tension ring stresses shall not exceed the lesser of 15,000 psi or one half of the minimum specified yield of the plate material.
 - b. Compression ring stresses shall not exceed 15,000 psi.
 - c. To determine the stresses in the ring due to discontinuity forces, the tank plates immediately adjacent to the discontinuity may be assumed to participate for a distance of $0.78\sqrt{Rt}$.
 6. Minimum plate thickness of all tank parts shall be in accordance with AWWA D107.
 7. No corrosion allowance is required.

2.4 APPURTENANCES

A. Exterior Doors:

1. Provide a 36-inch by 84-inch commercial steel door. The door shall be 1 3/4 inches thick with 4 3/4-inch 16-gauge jambs, door holder and automatic boor bottom. Door to be AMWELD series 1500 Seamless door, with Series 400 Frame, or approved equal. Door shall be minimum 16-gauge and insulated with pre-formed polystyrene insulation. Doors shall be thoroughly cleaned, phosphated and finished with one coat of baked-on rust inhibiting prime paint in accordance with ASTM B117 and ASTM D1735. Provide three (3) full mortise, 5 knuckle hinges, 4 1/2 inches by 4 1/2 inches minimum. Hinges shall be steel, phosphated and primed coated for finish painting. Provide a complete and functional door lockset and tumbler-type lock, keyed to the owner's existing system. Provide Owner with a minimum of two keys no later than substantial completion of the tank. Door painting shall conform to the tank exterior paint system.
2. Provide one electrically operated 12-foot wide by 14-foot high overhead steel rolling door located in the base of the support structure. Door slats to be formed of 22-gauge steel with end locks and designed for a minimum 20-psf wind load. Steel curtain construction with high-grade zinc coating per ASTM A153 hot process, and phosphate coating for paint adhesion. Provide air baffle for entire upper barrel, curtain bottom bar with brush sealing, weather end lock on alternate slats and sealing strips for weather tightness. The door shall be equipped with slide bolt locks on both sides of interior bottom. Door painting shall conform to the tank exterior paint system. Overhead door location shall be as shown on the drawings. Provide minimum two remote door openers.
3. Provide two (2) eight-inch diameter steel safety posts outside of the opening to protect the door from vehicle impact. Safety posts shall be filled with concrete.

B. Piping and Pressure Relief:

1. Provide an 8-inch diameter inlet pipe that extends from the base of the support structure to an elevation approximately 15 feet below the high water level (HWL). Provide a 12-inch diameter outlet pipe that extends from the base of the support structure and extends a minimum of 12 inches above the steel tank bottom. Pipe material within the support structure shall be ASTM A240-304L material and have a minimum thickness of schedule 10S but not less than 1/8-inch. Piping below the grade slab shall be cement lined, restrained mechanical joint ductile iron.
2. The inlet and outlet pipes shall be designed to support all related static and dynamic loads. Suitable galvanized steel brackets, guides and hangers shall be provided on the support wall and tank floor at intervals not exceeding 20 feet.
3. The inlet and outlet pipes shall be designed and constructed to accommodate any differential movement caused by settlement and by thermal expansion and contraction over the range of extreme temperature differences expected for the support wall and pipe.
4. Provide insulated coating system to the inlet pipe as specified in Part 3, Paragraph 3.5 E.

5. Tank Manufacturer shall design the diameter of the overflow pipe. Overflow pipe shall be equipped with an anti-vortex entrance and shall be designed to accommodate the maximum inlet rates specified herein without excessive head buildup over the overflow entrance (<12"). The overflow pipe within the support structure shall be ASTM A240-304L material. Stainless steel piping shall conform to ASTM A778 and welded fittings shall conform to ASTM A774. The pipe shall have a minimum thickness of schedule 10S but not less than 1/8-inch. Inside the tank, the overflow pipe shall conform to ASTM A53 Grade B and have a minimum thickness of ¼-inch. All pipe-to-pipe joints shall be welded. The overflow shall be attached to the access tube and support structure. Discharge shall be as shown in the drawings. The attachment to the support structure shall be with galvanized steel brackets spaced no more than 20 feet apart. The overflow pipe discharge shall be equipped with a duckbill type check valve on the exterior of the tank, with an invert elevation between 12 and 24 inches above the splash pad.
6. A minimum of one aluminum pressure-vacuum vent near the center of the roof shall be provided. The vent(s) shall be sized to handle pressure differential caused by water entering or leaving the tank at a maximum rate. The maximum inlet rate is 1,500-gpm, the maximum withdrawal rate is 4,000-gpm. The open area of the overflow shall not be considered as a venting area. The vent(s) shall have stainless steel 18-mesh insect screens and shall be designed to relieve any pressure or vacuum in the event the screen frosts over or is otherwise clogged and shall be easily dismantled for cleaning. The vent(s) shall be self-correcting. The pressure-vacuum vent may be mounted on the exhaust hatch.

C. Access, Ladders, and Platforms:

1. All ladders shall have round, smooth, solid rungs.
2. Provide a galvanized steel interior ladder system attached to the support structure which extends from grade to the walkway and painters access manway. This ladder system shall consist of a continuous straight run ladder with galvanized climb thru rest platforms provided at no more than 50 feet intervals. This ladder shall be equipped with a ladder safety rail. A caution sign shall be provided at the lowest point of access to the ladder requiring safe climbing devices. The sign shall read "CAUTION – Safety Equipment Required When Climbing Ladder". The sign shall be secured to the wall.
3. Provide a painted steel ladder on the interior of the access tube from the walkway to the tank roof. This ladder shall be equipped with a ladder safety rail.
4. Provide a galvanized steel ladder from the walkway to the tank bottom manway. This ladder shall be equipped with ladder safety rail.
5. The ladder safety rail shall be an OSHA approved, galvanized system as manufactured by North Safety, or equal. Provide a removable extension for each ladder that does not extend 48 inches beyond the walkway level. The owner shall be supplied with two (2) harnesses and two (2) sleeves.
6. Provide a galvanized steel walkway immediately below the tank extending from the support structure to the access tube. The walkway shall be a minimum of 48 inches wide with 42-inch high handrails.

7. Provide an access tube located on the vertical centerline of the tank. The access tube shall have a minimum diameter of 60 inches. The access tube shall extend below the tank floor to the walkway level to provide continuous ladder access from the walkway to the tank roof.
8. Provide a circular roof handrail to encompass all centrally located roof appurtenances. The roof handrail shall be 42 inches high and shall include a top rail, intermediate rail and toeboard. The handrail shall be constructed in accordance with OSHA requirements.

D. Antenna Rail and Cable Details:

1. Provide all labor, materials, equipment and installation to make all necessary provisions for future antenna cable(s) routing. This work includes but is not limited to the following:
 - a. Six (6) 6-inch diameter pipe penetrations (with caps) in the support structure, located approximately two feet (2') above the top of foundation.
 - b. Six (6) 6-inch diameter pipe penetrations (with caps) in the access tube cover.
 - c. Suitable brackets welded to the inside of the support structure and access tube to safely secure future antenna cables. Bracket spacing shall not exceed 8 feet.
 - d. For safety considerations during antenna installation, and for maintenance, a 42" high handrail shall be furnished with a top rail, intermediate rail, and toeboard. Handrail shall be ~ 20' diameter and centered around the tank access tube roof hatch. The handrail shall also provide an attachment point for the antenna(s).

E. Manways, Hatches and Vents:

1. One 24-inch x 36-inch painter's access manway/ventilation louver opening shall be provided giving access to the exterior painter's rail located at the top of the concrete support structure. This opening shall have a removable aluminum rainproof louver with bird screen to provide ventilation for the concrete support structure. The louver shall be accessible from the walkway.
2. One 36-inch diameter tank bottom manway shall be provided in the tank floor with access by ladder from the walkway.
3. Two 36-inch diameter steel hatches shall be supplied. One shall be at the top of the access tube with spring assist, chain, hook, and inside handle. The other shall be adjacent to the access tube for entry into the tank and shall have a handle and hasp. The hatch openings shall have a curb four inches high and the cover shall have a downward overlap of two inches.
4. One 24-inch diameter painter's access manway shall be provided adjacent to the interior painter's rail giving access from the roof.

F. Painter's Rails:

1. Provide painters rails and an interior inspection rail as specified herein:

- a. Interior Painters Rails: The rails shall be attached to the underside of the roof. Provide one rail near the center of the tank and one rail approximately 18 inches from the tank shell. If the slope distance between these two rails exceeds 32 feet, provide a third rail.
- b. Exterior Painters Rail: The rail shall be located near the top of the support structure and be accessible from the walkway via the painter's access manway/ventilation louver.
- c. Interior Inspection Rail: The rail shall be located near the top of the support structure and be accessible from the walkway. The rail and support brackets shall be galvanized.

G. Electrical:

1. Interior waterproof light sockets with rigid conduit, wiring and switch shall be provided inside the support structure and access tube. There shall be one light located at the top of the access tube, one light at the lower end of the access tube above the walkway opening, one light at each of the support structure ladder rest platforms, and one light at the base of the support structure. Total number and location of lights shall be as shown on the drawings. All wiring shall be in conduit. The conduit and wiring shall terminate with a junction box in the base of the tower. Duplex outlets shall be installed as shown on the drawings. Electric service shall be provided and connected by others.
2. Exterior lighting above the access door(s) and/or overhead door(s) for added security.
3. A double obstruction light shall be provided on the roof of the tank near the apex. The lights shall be enclosed in aviation red obstruction light globes as approved by the FAA, complete with an automatic photo-electric cell type switch. The contractor shall install all conduit and wiring from the light to the electrical service panel.

H. Lightning Protection:

1. Provide a lightning protection system for the elevated tank structure and any roof mounted equipment that may be damaged by lightning.
2. Minimum requirements include two 28 strands by 14-gauge copper conductors bonded to the steel tank 180 degrees apart. The conductors shall be fastened to the interior support wall at 3 feet minimum spacing and shall terminate with buried 5/8-inch diameter by 8-foot-long copper clad ground rods.
3. Lightning protection for obstruction lights shall consist of an air terminal mounted on the support and formed to fit around the fixture. The 1/2-inch diameter copper air terminal shall extend a minimum of 10 inches above the light fixture and shall connect to a copper conductor that terminates in a bonding plate secured to the tank roof.

I. Galvanized Corrosion Protection:

1. Dissimilar metals inside the tank and below the TCL shall be electrically isolated from carbon steel tank components to which they attach. Painting of the dissimilar metals does not eliminate the requirement for isolation.

PART 3 - EXECUTION

3.1 GENERAL

- A. All concrete formwork, placement and consolidation shall comply with ACI 318 and ACI 301 except as modified herein. Concrete tolerances shall comply with ACI 117 except as modified herein.
- B. Concrete placed in cold weather conditions shall be protected to prevent damage in accordance with ACI 306. The cold weather protection shall continue until the concrete has attained 35% of the specified compression strength and the allowable temperature differential can be maintained.
- C. Concrete placed in hot weather conditions shall be protected to prevent damage in accordance with ACI 305.
- D. Concrete shall be cured in conformance with ACI 318. Curing methods shall be continued until the concrete has reached a compressive strength that will allow for safe jumping of forms without causing damage to previously placed concrete.
- E. Concrete strength tests shall be taken in accordance with ACI 318 except as modified herein. Strength test samples shall be taken as the concrete is delivered from the truck. At least one strength test sample shall be taken for every day that concrete is placed. Additional strength test samples shall be taken for every 50 CY of concrete placed when the total daily pour is less than or equal to 150 CY and for every 150 CY of concrete placed when the total daily pour is greater than 150 CY. Owner's representative will be responsible for taking samples and testing concrete.
- F. For the concrete pours associated with the foundation, each strength test sample shall include five 4" x 8" molded cylinders. Three cylinders will be used to establish the 28-day strength in accordance with ACI 318. One cylinder should be tested at 7 days to supplement the 28-day test. The fifth cylinder shall be a spare for the other cylinders.
- G. For the concrete pours associated with the support structure (shaft), strength test samples for each ring poured shall include eight 4" x 8" molded cylinders. Three cylinders will be used to establish the 28-day strength in accordance with ACI 318. One cylinder should be tested at 3 days, one at 7 days, and one at 14 days to supplement the 28-day test. The two remaining cylinders shall be spares for the other cylinders.
- H. Inspection and testing of the welded steel tank shall comply with AWWA D107 Section 9.
- I. Owner to provide non-destructive testing services for coating inspections.

3.2 CONCRETE FOUNDATION

- A. An inlet and outlet pipe extending a minimum of three feet outside the foundation wall shall be included as part of the foundation.

- B. All exposed formed surfaces shall receive a smooth as-cast form finish, and all unexposed formed surfaces shall receive a rough form finish. All exposed unformed surfaces shall receive a trowel finish, and all unexposed unformed surfaces shall receive a float finish.
- C. Provide a minimum 8-inch concrete slab at grade in the base of the support structure. The slab shall be placed over compacted structural backfill and shall be reinforced. Provide 1/2-inch expansion material at the slab to foundation intersection and at floor penetrations. Provide saw-cut control joints at 18 foot maximum spacing. The slab shall be sloped towards the floor drain. The slab shall be constructed in accordance with the latest edition of ACI 301.
- D. All concrete work shall comply with ACI 301.

3.3 CONCRETE SUPPORT STRUCTURE

- A. A mock-up panel shall be constructed using the proposed form work, concrete, and placement methods, as described in Division 3 of the specifications. The mock-up panel shall be inspected by Contractor, Owner, and Engineer to determine panel quality and if any adjustments need to be made in the materials or processes proposed for use. Contractor shall be prepared to construct additional mock-up panels as needed to obtain consensus from Owner and Engineer that the proposed support structure panel construction will meet the design intent of this project and reduce voids in the exterior of the concrete.
- B. The concrete support structure wall shall be constructed using a jump form process. The form system shall use curved, prefabricated form segments of the largest practical size to minimize panel joints. Concrete pour height shall be a minimum of 4 feet and a maximum of 8 feet. Form panels shall extend the full height of the concrete pour using only vertical panel joints. Formwork shall be secured using bolts through the wall prior to concrete placement. Working platforms that allow safe access for inspection and concrete placement shall be provided. Form facing material shall be metal, or plywood faced with plastic or fiberglass.
- C. The form system shall incorporate a uniform pattern of vertical and horizontal rustications to provide architectural relief to the exterior wall surface. Construction joints and formwork panel joints shall be located in rustications. Formwork panel joints shall be sealed using closures which combine with the form pattern to prevent grout leakage and panel joint lines. The top of each concrete placement shall be finished with a grade strip. The vertical and horizontal rustications shall be proportioned and combined to impart a symmetrical architectural pattern to the completed structure.
- D. Support wall forming system shall incorporate segmented concrete placement. Temporary vertical bulkheads shall divide the wall pour into segments that are less than a single batch of concrete. The bulkheads shall be located at rustications, braced rigid and tight to maintain vertical alignment under concrete load. Each segment shall be continuously placed with concrete to the full form height. Temporary bulkheads shall not be removed until adjacent concrete is placed.

- E. Formwork shall remain in place until the concrete has attained sufficient strength to support the form removal and subsequent loads without damage to the structure. The Contractor shall base formwork removal procedures and times on early-age test results. However, form movements and concrete placement shall be limited to a maximum of once per day.
- F. Dimensional tolerances for the concrete support structure shall be checked by the contractor prior to each pour and maintained as the structure is built. The tolerances for construction of the concrete support structure are:
1. Support Wall Variation:
 - a. Thickness -3%, +5%
 - b. Diameter $0.4\% \leq 3$ inch
 - c. Vertical Alignment:
 - 1) in any 10 feet of height $\frac{1}{2}$ inch
 - 2) in any 50 feet of height 1 inch
 - 3) over total height $1 \frac{1}{2}$ inch
 2. Tank Floor Variation:
 - a. Slab floor thickness -3%, +5%
 - b. Dome floor thickness -6%, +10%
 - c. Dome floor radius 1%
 - d. Local deviation from true $\frac{3}{4}$ inch
 - e. (Using a 5-foot sweep board)
 3. Level Alignment Variation:
 - a. From specified elevation 1 inch
 - b. From a horizontal plane $\frac{1}{2}$ inch
 4. Offset Between Formwork:
 - a. Exterior exposed surfaces $\frac{1}{8}$ inch
 - b. Interior exposed surfaces $\frac{1}{4}$ inch
- G. All exterior exposed surfaces shall receive a smooth as-cast form finish. All interior exposed surfaces shall receive a rough as-cast form finish. All exposed surfaces shall be cleaned to remove surface contamination. All tie holes and concrete voids larger than $\frac{3}{4}$ -inch diameter and/or $\frac{1}{2}$ -inch deep shall be filled with a color matching non-shrink grout. All exposed surfaces shall be cleaned to remove any concrete paste leakage from higher placed concrete shaft rings. No additional finish of the exterior exposed surface is required unless excessive form oil remains on the concrete surface.
- H. The top of the concrete tank floor shall receive a float finish.

3.4 WELDED STEEL TANK

- A. All welding shall comply with AWWA D107.
- B. All welding procedures, welders and welding operators shall be qualified in accordance with ASME Section IX for the processes and positions utilized.
- C. To minimize corrosion and rust staining on the underside of the roof, the roof plate laps, and rafter-to-roof plate seams shall be seal welded. The minimum thickness for seal welded roof plates shall be 1/4 inch.
- D. The edges or surfaces of the pieces to be joined by welding shall be prepared by flame cutting, plasma arc cutting, arc gouging, machining, shearing, grinding or chipping and shall be cleaned of detrimental oil, grease, scale and rust. The edges of the pieces may have a protective coating applied to them which need not be removed before they are welded unless specifically prohibited by the welding procedures.
- E. Field and shop welding may be done by the shielded metal arc welding process, the gas metal arc welding process, the flux core arc welding process and the submerged arc welding process.
- F. Plates and component members of the tank shall be assembled and welded following erection methods which result in a minimum of distortion from weld shrinkage. Surfaces to be welded shall be free from loose scale, slag, heavy rust, grease, paint and other foreign material.
- G. The Contractor shall remove weld of slag, spatter, burrs and other sharp or rough projections. The surface of the weld shall be suitable for subsequent cleaning and painting operations.
- H. Full penetration butt-welded joints shall be inspected using the radiographic examination method. The number and location of the radiographs and the acceptance criteria shall be as required by AWWA D107. Inspection by sectional segments is not allowed.
- I. All liner plate welds shall be tested using the vacuum box testing method before the tank is painted.
- J. When the cone plate thickness has been determined using a nonlinear buckling analysis, the contractor shall measure the actual imperfections of the cone plates after welding. The measurements shall be taken in the meridional direction. Measurements shall be taken at each meridional weld seam and midway between each meridional weld seam. Where the actual imperfections exceed the tolerances assumed in the analysis, further evaluation will be required and corrective action such as reworking the shell or adding stiffeners may be required.

- K. In order to assist in the maximization of the paint's lifecycle, all welds on the tank exterior shall be ground smooth and blended to a NACE-D profile. All welds on the tank interior shall be ground smooth and blended to a NACE-D profile. Welds on the interior dry support column can remain in an as-welded condition but must have a profile adequate for the specified paint system. Engineer/Owner reserves the right to provide third-party inspection to ensure compliance to this requirement.

3.5 COATINGS AND FINISHES

A. General:

1. All tank painting and paint testing shall be in accordance with AWWA D102, the Steel Structures Painting Council Specification SSPC-PA1, approved paint manufacturer specifications and as specified herein.
2. Each system shall be from a single manufacturer. The paint products specified are manufactured by Tnemec and the products of other manufacturers may be used subject to review and approval by the engineer. Local Tnemec Representative is Midwest Coating Consultants in Kansas City, Missouri, contact Taylor Buerky tbuerky@tnemec.com 816-590-5294.
3. Pre-construction primers may be utilized in the fabrication process to preserve the blast profile and cleanliness. In the field, weld seams and abraded areas will be cleaned on a spot basis. The remaining sound primer will be cleaned to remove dirt and other contaminants. After cleaning the specified coating system will be applied in its entirety in the field at the millages specified.
4. No paint shall be applied when the temperature of the surface to be painted is below the minimum temperature specified by the paint manufacturer, or less than 5 degrees above the dew point temperature. Paint shall not be applied to wet or damp surfaces or when the relative humidity exceeds 85% unless allowed by manufacturer's data sheets. Follow the paint manufacturer's recommendations for the specific paint system used.
5. After erection and before painting, remove slag, weld metal splatter and sharp edges by chipping or grinding. All surfaces that have been welded, abraded or otherwise damaged, shall be cleaned and primed in the field in accordance with the paint system requirements.
6. All areas blasted in the field shall be coated the same day before any rusting occurs.

B. Exterior Coating System (D102-17, OCS-4):

1. Shop Surface Preparation: Spot clean as required to remove all oil and grease from the surface prior to blast cleaning. All surfaces shall be abrasive blast cleaned to a commercial finish in accordance with the recommended methods outlined in the Steel Structures Painting Council Specification SSPC SP-6/NACE No. 3.
2. Shop Primer: Immediately after abrasive blasting and before any rusting occurs (within 12 hour maximum) apply one coat of aromatic urethane TNE MEC Series 94-H20 (Greenish-Gray) Hydro-Zinc or equal, to a dry film thickness (DFT) range of 2.5 to 3.5 mils.

3. Field Surface Preparation for Blast Cleaning: After erection and prior to field touch-up priming, all surfaces shall be cleaned to remove all surface contamination including oil, grease, dust, dirt and foreign matter. Weld slag, weld spatter and other sharp or rough projections shall be removed.
4. Field Blast Cleaning: All rusted, abraded and unpainted areas shall be blast cleaned to a commercial finish in accordance with SSPC SP-6/NACE No. 3. All shop primed areas shall be brush blasted to SSPC SP-7/NACE No.4.
5. Field Touch-Up: Spot prime with aromatic urethane TNEMEC 94-H2O (Greenish-Gray) Hydro-Zinc, or 91-H2O (Greenish-Gray) Hydro-Zinc, or equal, to a DFT range of 2.5 to 3.5 mils.
6. Field Intermediate Coat: Apply one coat of aliphatic acrylic polyurethane TNEMEC Series 1095 Endura-Shield, or equal, to a DFT range of 2.0 to 3.0 mils. The color shall be tinted to contrast the prime coat.
7. Field Finish Coat and Logo: Apply one coat of Advanced Thermoset Solution Fluoropolymer TNEMEC Series 700 Hydroflon or equal, to a DFT range of 2.0 to 3.0 mils. Finish color shall be selected by the Owner.
8. The total DFT range of the three coat Exterior Coating System shall be 6.5 to 9.5 mils.
9. Owner to provide awarded Contractor with vector file(s) of chosen logo. Contractor to plan on painting the same logo on two sides of the steel tank. Anticipated logo colors include 647C medium blue, 206C bright red, and 2417C green.

C. Interior Wet Coating System (D102-17, ICS-6):

1. Shop Surface Preparation: Spot clean as necessary to remove all oil and grease from the surface prior to blast cleaning. All surfaces shall be abrasive blast cleaned to a near-white finish in accordance with SSPC SP-10/NACE No. 2.
2. Shop Primer: Immediately after abrasive blasting and before any rusting occurs (within 12 hour maximum), apply one coat of aromatic urethane TNEMEC Series 94-H2O (Greenish-Gray) Hydro-Zinc or equal, to a DFT range of 2.5 to 3.5 mils.
3. Field Surface Preparation for Blast Cleaning: After erection and prior to field touch-up priming, all surfaces shall be spot cleaned as required to remove all surface contamination including oil, grease, dust, dirt and foreign matter. Weld slag, weld spatter and other sharp or rough projections shall be removed.
4. Field Blast Cleaning: All rusted, abraded and unpainted areas shall be blast cleaned to a near white finish in accordance with SSPC SP-10/NACE No. 2. All shop primed areas shall be brush blasted so SSPC SP-7/NACE No.4.
5. Field Touch-Up: Spot prime with aromatic urethane TNEMEC Series 94-H2O (Greenish-Gray) Hydro-Zinc, or equal, to a DFT range of 2.5 to 3.5 mils.
6. Irregular surfaces, including weld seams, bolt heads and nuts, corners and edges, shall be stripe coated by brush or roller after the field spot prime coat has been applied and prior to application of the first full field coat. Use Series N140/N140F-1255 (Beige) Pota-Pox Plus, to a DFT Range of 2.0 to 4.0 mils.
7. Field Finish Coat: Apply one coat of modified Phenalkamine Epoxy TNEMEC Series 21-WH16 (Off-White) Epoxoline or equal, to a DFT range of 16.0 to 18.0 mils.
8. The total DFT range of the Interior Wet Coating System shall be 18.5 to 21.5 mils.
9. Interior immersion surfaces shall be holiday tested per NACE SP0188.

D. Interior Dry Coating System (D102-17, ICS-5):

1. Shop Surface Preparation: Spot clean as necessary to remove all oil and grease from the surface prior to blast cleaning. All surfaces shall be abrasive blast cleaned to a commercial finish in accordance with SSPC SP-6/NACE No. 3.
2. Shop Primer: Immediately after abrasive blasting and before any rusting occurs (within 12 hour maximum), apply one coat of polyamide epoxy TNE MEC Series V140-1255 (Beige) Pota-Pox Plus or Series V140F-1255 (Beige) Pota-Pox Plus (fast cure) or equal, to a DFT range of 4.0 to 6.0 mils.
3. Field Surface Preparation for Blasting Cleaning: After erection and prior to field touch-up priming, all surfaces shall be spot cleaned as required to remove all surface contamination including oil, grease, dust, dirt and foreign matter. Weld slag, weld spatter and other sharp or rough projections shall be removed.
4. Field Blast Cleaning: All rusted, abraded and unpainted areas shall be blast cleaned to a commercial finish in accordance with SSPC SP-6/NACE No. 3. All shop primed areas shall be brush blasted to SSPC SP-7/NACE No.4.
5. Field Touch-Up: Spot prime with aromatic urethane TNE MEC Series 94-H2O (Greenish-Gray) Hydro-Zinc, or 91-H2O (Greenish-Gray) Hydro-Zinc, or equal, to a DFT range of 2.5 to 3.5 mils.
6. Field Intermediate Coat: Apply one coat of polyamidoamine epoxy TNE MEC Series N140-15BL (Tank White) Pota-Pox Plus or Series N140F-15BL (Tank White) Pota-Pox Plus (fast cure) or equal, to a DFT range of 3.0 to 5.0 mils.
7. Field Finish Coat: Apply one coat of polyamidoamine epoxy TNE MEC Series N140-15BL (Tank White) Pota-Pox Plus or Series N140F-15BL (Tank White) Pota-Pox Plus (fast cure) or equal, to a DFT range of 3.0 to 5.0 mils.
8. The total DFT range of the Interior Dry Coating System shall be 8.5 to 13.0 mils.

E. Interior Inlet and Outlet Pipe Coatings and Insulation:

1. Surface Preparation: All surfaces shall be abrasive blast cleaned to a commercial finish in accordance with SSPC SP-6/NACE No. 3.
2. Field Prime Coat: Tnemec Series 94-H2O Hydro-Zinc or equal, to a DFT of range 2.5 to 3.5 mils.
3. Field Intermediate Coat (inlet pipe only): Tnemec Series 971 Aerolon or equal, to a DFT range of 80.0 to 100.0 mils applied as two coats of 40.0 to 50.0 mils DFT per coat.
4. Field Intermediate Coat (outlet pipe only): One coat of polyamidoamine epoxy TNE MEC Series N140-15BL (Tank White) Pota-Pox Plus or Series N140F-15BL (Tank White) Pota-Pox Plus (fast cure) or equal, to a DFT range of 3.0 to 5.0 mils.
5. Field Finish Coat (inlet pipe only): None.
6. Field Finish Coat (outlet pipe only): One coat of polyamidoamine epoxy TNE MEC Series N140-15BL (Tank White) Pota-Pox Plus or Series N140F-15BL (Tank White) Pota-Pox Plus (fast cure) or equal, to a DFT range of 3.0 to 5.0 mils.
7. Foam Insulation with Jacketing: Within the concrete support structure, install on both inlet and outlet lines, including bends, a 2-inch thick pre-formed, closed-cell polyisocyanurate foam insulation, Trymer 2000XP or equal, encased in a smooth wrought aluminum alloy jacketing with a minimum thickness of 0.016". Utilize stainless steel banding, installed as recommended by the manufacturer.

3.6 TESTING AND STERILIZATION

- A. Sufficient cure, per the manufacturer's recommendations, of the final coat on the interior wet surface shall be allowed before the elevated tank is sterilized and filled with water.
- B. The tank shall be sterilized per the requirements of AWWA C652, Chlorination Method No. 2.
- C. All water for flushing, testing and disinfection shall be provided by the OWNER. Contractor shall make every effort to minimize over-use and/or wasting of water during the flushing, testing and disinfection procedures. The City of Nixa reserves the right to bill the Contractor at the current wholesale water rate plus applicable taxes for excessive overuse of water, and for water use due to failed or repeated water tests. Any leaks in the tank that are disclosed by these tests shall be repaired by gouging out defective areas and re-welding. No repair work shall be done on any joint unless the water in the tank is at least two feet below the joint being repaired. Any paint damaged by repairs shall be properly restored.

3.7 GUARANTEE

- A. General: The Contractor shall guarantee its work for a period of ONE YEAR from the date of substantial completion. Substantial completion is defined as the date when the tank is placed, or available to be placed, into service. Contractor to schedule an 11-month inspection of the tank with Owner to determine if any correction period actions are needed. The Contractor will repair any defects of which they are notified during that period which may appear because of faulty design, workmanship or materials furnished under the specifications.

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TECHNICAL SPECIFICATIONS

ARTICLE I GENERAL CONDITIONS

Section 1. City of Nixa Extension Policies.

A. REQUEST FOR CITY UTILITIES INSIDE THE CITY OF NIXA PLANNING AREA.

1. All properties within the designated planning area must be annexed into the City Limits of Nixa to access any City utility.
2. All properties within the designated planning area will be considered for annexation upon request if state statute requirements are fulfilled.
3. All existing structures annexed into the city limits of Nixa will be required to pay the fees for wastewater as per voter approved guidelines.
4. It will be the responsibility of the annexation petitioner to determine zoning requirements and fee structures.
5. The petitioner must be the legal representative for the property owner and the petitioner may withdraw the annexation by a written and notarized request up to the time of the passage of the annexation ordinance.
6. All building and development plans under consideration at the time of annexation must be submitted for City staff review. Staff will review the request within a 30-day time frame.
7. Any building and development that is underway at the time of annexation shall conform to all current City Codes.
8. The City may reimburse the developer for ~~any~~ requested increase in lift station or line capacity that is over the size required by the State Department of Natural Resources. Lift station capacity and line sizing shall be approved by the City and its consulting engineer. Provided reimbursement is considered, the amount will be determined by computing the difference between the bids for the required versus requested improvements. The City reserves the right to reject any or all bids.

9. All street, stormwater, electric, water and wastewater extensions, whether internal or external to development shall be the sole expense of the party requesting the street and/or utility unless otherwise approved by the Board of Aldermen.
10. Off-street improvements may be required by the City. City staff will review traffic and road conditions, change in classification and potential traffic hazards. Off-street road improvements and upgrades will meet City Street Specifications and will be the responsibility of the developer. When necessary, City may require the developer to supply a professional traffic study to determine offsite needs.
11. The City encourages the formation of neighborhood improvement districts to pay for infrastructure improvements within the planning area.

B. REQUEST FOR CITY UTILITIES OUTSIDE THE CITY OF NIXA PLANNING AREA

1. All developments must be built to City of Nixa Development Standards.
2. All developments must contractually agree to pay the fees for wastewater capacity as per voter approved guidelines.
3. All developments must be approved by the Department of Natural Resources before construction begins.
4. Request for utilities from outside of the Nixa Planning Area will be considered for residential purposes only. Outside utilities will only be given in instances when annexation is not possible. Prior to connection, the applicant must sign a "Consent to Annex" form, to be executed when State Statute requirements can be met.
5. All street, stormwater, electric, water and wastewater extensions shall be the sole expense of the party requesting the street and/or utility unless otherwise approved by the Board of Aldermen.
6. Off-street improvements may be required by the City. City staff will review traffic and road conditions, change in classification and potential traffic hazards. Off-street road improvements and upgrades will meet City Street Specifications and will be the responsibility of the developer. When necessary, City may require the developer to supply a professional traffic study to determine offsite needs.
7. All developments must have approval from the Christian County Planning and Zoning Authority before construction begins.

8. All requests require thirty (30) day staff review before permits are granted or hearing scheduled.

Section 2. City of Nixa Construction Discussion Items.

This list is presented as a typical construction check list, but may not include specific items pertaining to a particular project.

If in doubt concerning any of the City requirements or Ordinances, contact the appropriate City Department. Failure to comply with any discussion item may be cause for a stop work order, exposure of completed work or lack of willingness of the City's part to accept part or all of the work.

A. GENERAL:

1. Prior to approval of the Preliminary Plat, it will be the individual developer's responsibility to acquire all required off-site water, sewer, drainage, street and electric easements required by the City to serve the proposed development.
2. The City of Nixa requires that prior to beginning construction; the Owner will be responsible for convening a pre-construction conference to be held at City Hall between the Consulting Engineer(s), the Owner, the Contractor, City of Nixa personnel and all private utility providers.
3. All construction and materials shall conform to the City of Nixa General Development Regulations and Technical Specifications as adopted and revised from time to time by the City of Nixa.
4. It shall be the sole responsibility of the contractor to contact the utility suppliers and arrange for any necessary modifications required to facilitate construction activities.
5. It shall be contractor's responsibility to keep rock, mud and other debris from adjacent streets by construction equipment throughout the day and at the end of each work day. Contractors shall provide a construction traffic plan for approval at the pre-construction conference and be responsible to notify all related contractor agencies.
6. All buried pipe shall comply to the City of Nixa's bedding requirements. (See Detail Drawing B-1 and B-4 in the attached Appendix)

7. No pipe shall be backfilled until it has been approved by the City's Superintendent or City Inspector. It shall be the responsibility of the contractor to contact City Public Works at (417) 727-2353 and arrange for this inspection.
8. All City inspections shall be made during regular City business hours unless prior arrangements for inspections have been made. All costs (including overtime) associated with inspections outside normal hours will be charged to the contractor.
9. Testing of water and wastewater lines shall meet the City of Nixa specifications. It shall be the Contractor or Developer's responsibility to notify both the **Engineer and the City of Nixa**, a minimum of 24 hours prior to the scheduled testing. It shall also be the Contractor's responsibility to have all necessary equipment needed to perform the testing on site and ready to proceed with testing at the scheduled time. Failure to make these arrangements may necessitate rescheduling the test.
10. All utility road crossings shall be properly bedded and the trench backfilled with $\frac{3}{4}$ " base rock. Base Rock shall be installed in lifts no more than 6" thick and each lift shall be compacted individually to grade.
11. The City of Nixa will issue building permits only after all utilities, with the exception of street asphalt, are in place and all grading work has been completed.
12. Upon completion of the project, the Developer/Contractor will be responsible for furnishing a copy of redlined as-built drawings to the City. The as-built drawings shall indicate any deviations from the original City-approved drawings shall indicate dimensions from lot lines to sewer tees and shall locate water, sewer and buried electric by dimensions from the street right-of-way line. As-built drawings shall be submitted to the City prior to the issuance of building permits.
13. Prior to any changes to City approved specifications or approved construction plans, contractors shall be responsible for completing a Request for Plan Revision (Form found on Page 9 of this document.) all appropriate signatures will be required and copies distributed to all parties.

B. WATER:

1. Testing of waterlines shall meet the City of Nixa specifications. It shall be the

Contractor or Developer's responsibility to notify both the **Engineer** and **the City of Nixa** at least **24 hours** prior to the scheduled testing. It shall also be the Contractor's responsibility to have all necessary equipment to perform the testing on site and to be ready to proceed with testing at the scheduled time. A failure to do so could lead to rescheduling the testing.

2. All buried pipe shall comply to the City of Nixa bedding requirements. (See Detail Drawing B-1 and B-4 in the attached Appendix)
3. No cutting of concrete or asphalt surfaces shall be allowed unless prior City approval is obtained in writing. Crossing permits may be obtained from the Street Superintendent, 725-2353.
4. All utility road crossings shall be properly bedded and the trench backfilled with $\frac{3}{4}$ " base rock. Base Rock shall be installed in lifts no more than 6" thick and each lift shall be compacted individually to grade.
5. Upon completion of waterline construction, no existing water valves shall be operated unless City Personnel are notified and are present. Contractor shall notify City personnel prior to making connection to the City's water distribution system.
6. A metal fence post shall be placed by all meter pits to prevent damage to the meter after installed;. (See Detail Drawing A-1 in the attached Appendix)
7. Water Meter Box Lids shall be equivalent to a Crouch 104 lid, which is a 2-piece lid.
8. Damage to all individual lot utilities shall be the responsibility of the person named on the building permit.
9. Subdivisions that opt to construct underground electric shall install the water line at 4-foot and the gas line at 7-foot behind the curb on the same side of the street, underground electric shall be installed at 4-foot and the sewer line at 7-foot distance behind the curb on the opposite side of the street. The water meters shall be on every other lot line and the electric meters are to be placed on alternate lots. (See Detail Drawing A-1 in the attached Appendix)
10. An insulated copper tracer wire shall be placed on top of all water mains and at all meter boxes and valves. Tracer wires within meter boxes and valves shall be extended to the top of the box plus 12-inches and back to the main in a continuous run. Any necessary stripping or splicing of the tracer wire shall

be repaired by placing electrical tape over the un-installed area. (See Detail Drawing B-3 in the attached Appendix)

11. All water mains shall be Class 200 SDR 21 pipe.
12. The water meter lids and valve boxes shall be set at final grade elevation by the contractor. Should final grade elevation change due to yard work, the builder responsible for the yard work shall reset meter lids and valve boxes to the revised grade. The cost incurred for raising meter setters shall be the responsibility of the builder.
13. These requirements are not intended to include all waterline construction information. The Developer/Contractor shall refer to the Water Specifications in the City of Nixa Technical Specifications Book for additional information.
14. All water main construction shall comply with Missouri Department of Natural Resources "Design Guide for Community Public Water Supplies", and the City of Nixa Technical Specifications.
15. The Developer shall be solely responsible for making connection to the City's existing water main and shall meet all construction specifications and guidelines set forth in this document.
16. Typical Water Service: (See Detail Drawing B-9 in the attached Appendix.)

C. WATER CROSSINGS:

All water services shall be Type K Copper tubing.

D. SEWER:

1. All new sewer construction shall be completed and accepted by the City before final tie in to the City system. This may be completed by keeping the two systems physically separated or by plugging the new system at the City connection point until approval has been completed.
2. All testing of sewer lines shall meet the City of Nixa specifications. It shall be the Contractor's/Developer's responsibility to notify both the Engineer and the City of Nixa, a minimum of 24 hours prior to the scheduled testing. It shall also be the Contractor's responsibility to have all necessary equipment needed to perform the testing on site and ready to proceed with testing at the

scheduled time. Failure to make these arrangements may necessitate rescheduling the test.

3. All buried pipe shall comply with the City of Nixa bedding requirements. (See Detail Drawing B-1 and B-4 in the attached Appendix)
4. No cutting of concrete or asphalt surfaces shall be allowed unless City approval is obtained in writing. Crossing or street cut permits may be obtained from the Street Superintendent, 725-2353.
5. All utility road crossings shall be properly bedded and the trench backfilled with $\frac{3}{4}$ " base rock. Base Rock shall be installed in lifts no more than 6" thick and each lift shall be compacted individually to grade.
6. It shall be the responsibility of the Developer/Contractor to insure that all manholes on the street shoulders are at curb level at final grade.
7. All manholes placed within the street shall be flush with the final pavement and meet specification details in Drawing.
8. The City Inspector shall be contacted for inspection of any lateral crossings prior to backfilling.
9. Subdivisions that opt to construct underground electric shall install the water line at 4-foot and the gas line at 7-foot distance from the curb on the same side of street; underground electric shall be installed 4-foot and the sewer line at 7-foot behind the curb on the opposite side of the street. The water meters shall be on every other lot line and the electric meters are to be placed on alternate lots. (See Detail Drawing A-1 in the attached Appendix)
10. All sewer main lines shall be 8" or larger SCH 40 when the depth of sewer is less than 10 feet. Sewer mains greater than 10 feet in depth shall be SDR 21.
11. At the location of the sewer tees there shall be an "S" painted on the curb. A PVC pipe stake shall be set vertically to indicate the sewer tee location.
12. These requirements are not intended to include all sewer line construction

information. The Developer/Contractor shall refer to the Sewer Specification in the City of Nixa Technical Specifications Book for additional information.

E. STREETS:

1. All proposed street construction shall be placed on a suitable subgrade. Where over excavation is required, suitable, consistent material shall be placed to bring the excavation to subgrade elevations. (See Detail Drawing D-1 in the attached Appendix).
2. The City Inspector shall inspect the street sub-grade prior to base rock placement and after base rock placement. It shall be the responsibility of the Developer/Contractor to contact the City to arrange for these inspections.
3. At all locations where street construction terminates at a phase line, with construction to be continued in the future, a pavement construction joint shall be constructed by means of placing a 2"x4" board laterally across the roadway and paving flush with the board. The board shall remain in place.
4. Concrete lined ditches or suitable storm sewers shall be required at all locations where stormwater is conveyed from the streets or along back lot lines.
5. These requirements are not intended to include all street construction information. The Developer/Contractor shall refer to the Street Specifications in the City of Nixa Technical Specifications Book for additional information.

F. UNDERGROUND ELECTRIC AND STREET LIGHTS:

1. Street lights are to be placed every 200 feet on straight runs. At cul-de-sacs, lights shall be placed at the end of the cul-de-sac and spaced as indicated on straight runs.
2. Easements shall be provided for constructing buried and overhead electric lines to poles.
3. Subdivisions that opt to construct underground electric shall install the water line at 4-foot and the gas at 7-foot distance behind curb on the same side of street. Underground electric shall be installed 4-foot and the sewer line at 7-foot distance behind the curb on the opposite side. The water meters shall be on every other lot line and the electric meters are to be placed on alternate

lots. (See Detail Drawing A-1 in the attached Appendix)

4. The City does not stock maintenance or repair parts for street lighting other than standard lights included in this document. The developer shall contact the City Electric Superintendent to obtain pricing information for optional types of street lights if desired. Optional street lighting may require special agreement assuring future parts and materials necessary for maintenance as well as cost for same.

G. DRAINAGE/DETENTION:

1. All stormwater drainage shall be conveyed through concrete lined ditches or installed in pipe unless a grass lined ditch is allowed by the City of Nixa Development Department and a written approval is obtained.
2. The Contractor shall place sod on the entire floor of the ditch and shall be responsible for maintaining all sod through the first growing season after placement.
3. Contractor shall spray hydro mulch on interior and exterior sides and floors of all detention basins in areas where a 4 foot concrete trickle channel is constructed within the basin. Seeding and strawing shall be allowed within those basins where an 8 foot concrete low flow channel is constructed. (See Detail Drawing G-1 in the attached Appendix) The contractor/Developer shall be responsible for proper cover through the first full growing season.
4. Contractor shall provide erosion control by placing silt curtains at strategic locations within the project. Silt curtains shall consist of straw bales tied together and secured to any applicable drainage ways. (See Detail Drawing G-17 in the attached Appendix)
5. The Developer shall be responsible for maintenance of all required detention basins for a period of one year after City's acceptance of the work.
6. Building permits will normally be issued upon completion of all drainage and detention improvements. Permits may be issued on a case by case basis for those subdivisions with approved drainage plans and a letter of credit from the Developer's financial institution.

Section 3. Service Ownership/Responsibility.

Generally, after acceptance, all production, main distribution, service lines and other facilities such as transformers and meters are the responsibility of the City of Nixa. Customer's service lines include all piping and facilities from the outlet side of all meters is the responsibility of the customer. All customer lines shall be installed, maintained and repaired to meet currently adopted codes and ordinances of the City of Nixa. Transfer of commodity such as electricity and water also transfers ownership on the outlet side of the meter.

Customer's lines on the wastewater collection system include all building piping and yard piping from the structure to the City's main including the main tap or "Y" regardless of location. All customer lines shall be installed, maintained and repaired to meet currently adopted codes and ordinances of the City of Nixa.

Sections 4 thru 19 Reserved

ARTICLE II WATER AND SEWER SPECIFICATIONS

Section 20. Excavation and Trenching.

A. SCOPE: This section covers excavation and trenching work and shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching as required; the handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection work; preparation of subgrades; pumping and dewatering as necessary or required; protection of adjacent property; backfilling; pipe embedment; surfacing and grading; and other appurtenant work.

B. GENERAL REQUIREMENTS: Excavation work shall be performed in a safe and proper manner with appropriate precautions taken against all hazards. Excavations shall provide adequate work space and clearances for the work to be performed therein and for the installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

Subgrade surfaces shall be clean and free of any loose material when concrete is placed thereon.

Excavations for manholes and similar structures constructed of masonry units shall have horizontal dimensions with at least a 6-inch clearance provided for outside plastering.

Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the City or City's Engineer. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill or embankment.

C. BLASTING: The Contractor shall comply with all laws, ordinances, applicable safety codes, requirements, and regulations relative to the handling, storage, and use of explosives and the protection of life and property. The Contractor shall be responsible for all damage caused by any blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench.

The Contractor shall avoid excessive overbreak or damage to adjacent structures, equipment, utilities or buried pipeline. Blasting near utilities shall be subject to approval of the utility owner or City.

Before delivery of any explosives at the job site, the Contractor shall have blasting endorsement on his public liability and property damage insurance policy.

All rock which cannot be handled and compacted, as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed.

D. **UNAUTHORIZED EXCAVATION:** Except where otherwise authorized, shown, or specified, all material excavated below the bottom of concrete walls, footings, slabs on grade, and foundations shall be replaced, by and at the expense of the Contractor, with concrete placed at the same time and monolithic with the concrete above.

E. **DEWATERING:** The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed, therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

All excavations for concrete structures or trenches, which extend down to or below groundwater, shall be dewatered by lowering and keeping the ground water level beneath such excavations, 12 inches or more below the bottom of the excavation.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

The Contractor will be held responsible for the condition of any pipe or conduit which is used for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

F. **SHEETING AND SHORING:** Except where banks are cut back on a stable slope, excavation for structures and trenches shall be properly and substantially sheeted, braced, and shored, as necessary to prevent caving or sliding, for protection of workmen, work, existing structures and facilities. Sheet piling, bracing, and shoring shall be designed and built to withstand all loads that might be caused by earth movement or pressure, and shall be rigid, maintaining shape and position under all circumstances.

Trench sheet piling shall not be pulled before backfilling unless pipe strength is sufficient, in the opinion of the City or City's Engineer, to carry trench loads based on trench width to the back of sheet piling; nor shall sheet piling be pulled after backfilling.

Where trench sheet piling is left in place, such sheet piling shall not be braced against the pipe, but shall be supported in a manner, which will preclude concentrated loads or horizontal thrusts on the pipe. Cross bracing installed above the pipe to support sheet piling may be removed after pipe embedment has been completed.

G. **STABILIZATION:** Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen.

Subgrades for concrete structures or trench bottoms, which are otherwise solid but which become mucky on top due to construction operations, shall be reinforced with one or

more layers of crushed rock or gravel. No more than 1/2 inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding materials are placed thereon. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations shown on the drawings.

All stabilization work shall be performed by and at the expense of the Contractor.

- H. **TRENCH EXCAVATION:** The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. One block or 400 feet (whichever is the shorter) shall be the maximum length of open trench on any line under construction.

Except where tunneling is shown on the drawings, is specified, or is permitted by the Engineer, all trench excavation shall be open cut from the surface.

1. Alignment, Grade, and Minimum Cover: The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of Section 25-21 Installation of Mains.

Where pipe grades or elevations are not definitely fixed by the contract drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of 42-inch backfill cover over the top of the pipe. Greater pipe cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation.

2. Limiting Trench Widths: Trenches shall be excavated to a width, which will provide adequate working space and pipe clearances for proper pipe installation, jointing, and embedment. Unless otherwise shown on the drawings, the maximum trench widths, below an elevation of 6 inches above the top of the installed pipe, shall be no more than 24 inches greater than the outside diameter of the pipe. The minimum permissible clearances between the installed pipe and either trench wall shall be 6 inches.

Stipulated minimum clearances are not minimum average clearances, but are minimum clear distances that will be required.

Where necessary to reduce earth load on trench banks to prevent sliding and caving, banks may be cut back on slopes, not to extend lower than one foot above the top of the pipe.

3. Unauthorized Trench Widths: Where, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted, either pipe of adequate strength, special pipe embedment, or arch concrete encasement, as required

by loading conditions and as determined by the Engineer, shall be furnished and installed by and at the expense of the Contractor.

4. Mechanical Excavation: The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand-excavating methods shall be used. Mechanical equipment used for trench excavation shall be of a type, design, and construction, and shall be so operated that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalks are obtained at least from an elevation one foot (1') above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalks of the trench. Undercutting the trench sidewalk to obtain clearance will not be permitted.
5. Cutting Concrete and Asphalt Surface Construction: No cutting of concrete/asphalt surfaces shall be allowed unless City approval is obtained in writing. Cuts in concrete or asphalt pavement and base pavements shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be started with a concrete saw in a manner which will provide a clean groove at least 1 1/2 inch deep along each side of the trench and along the perimeter of cuts for structures.

Concrete and asphalt pavement and concrete base pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than 6 inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. Trench width at the bottom shall not be greater than the top width; no undercutting will be permitted.

Pavement cuts shall be made to and between straight or accurately marked curved lines, which unless required, shall be parallel to the centerline of the trench. Pavement removed for connection to existing lines or structures shall not be of greater extent than necessary for the installation as determined by the City or City's Engineer.

Where the trench parallels the length of concrete walks and trench location is all or partially under the walk, the entire walk shall be removed and replaced. Where the trench crosses drives, walks, curbs, or other surface construction, the surface construction shall be removed and replaced between existing joints or between saw cuts.

6. Excavation Below Pipe Subgrades: Except where otherwise required, pipe trenches shall be excavated below the underside of the pipe, to provide for the installation of either 3/4 inch crushed limestone embedment pipe foundation material or sand if in accordance with the material manufactures design specifications. (#1578 4/09)
7. Artificial Foundations in Trenches: Whenever so ordered by the City or City's

Engineer, the Contractor shall excavate to such depth below grade as directed and the trench bottom shall be brought to grade with such material as the City or City's Engineer may order installed.

8. **Bell Holes:** Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

Section 21. Installation of Mains.

- A. **STANDARDS:** Specifications shall incorporate the provisions of the AWWA standards and/or manufacturer's recommendations and Missouri Department of Natural Resources "Minimum Design Standards for Missouri Community Water Systems" effective December 10, 2013.
- B. **BEDDING, EMBEDMENT AND BACKFILL:** Bedding is the portion of the trench beneath the pipe and supporting the pipe to its spring line. Embedment is the material placed around the pipe to at least six inches above the top of the pipe. Backfill is the material placed into the trench above the embedment. Water main installation design shall meet the following requirements.
 - a. Trench construction, bedding, and embedment shall be appropriate for the type and size of the pipe installed.
 - b. Continuous, firm, stable, and uniform bedding shall be provided in the trench for all buried pipe. The bedding design shall insure that there is full support in the haunches of the pipe and be smooth and free of ridges, hollows, and lumps.
 - c. Bell holes should be excavated so that only the barrel of the pipe receives bearing from the trench bottom.
 - d. The weight of metallic fittings shall not be supported by the pipe. Metallic fittings shall be provided with proper support, such as crushed stone, concrete pads or a well compacted trench bottom.
 - e. Rocks and hard objects larger than one inch diameter found in the trench shall be removed at least four inches below and on each side of the pipe and the trench bottom should be filled with 4 to 6 inches of tamped bedding material.
 - f. When an unstable sub-grade condition which will provide inadequate pipe support is encountered, an alternative foundation shall be provided such as over digging and backfilling with tamped granular material.
 - g. The trench shall be kept free from water during pipe installation until the pipe has been installed, embedded and backfilled.
 - h. If the trench passes over another pipe or previous excavation, the trench bottom shall be filled with granular material and compacted.
 - i. Blocks shall not be used to change pipe grade or to intermittently support pipe across excavated sections.
 - j. All bedding and embedment material shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks or stones.

- k. Embedment material should be tamped in layers around the pipe, and to a sufficient height above the pipe that the pipe is adequately supported, stabilized, and protected. Shaped beddings perform essentially as well as full-contact embedment with select granular soil and are considered equal to full contact bedding.
- l. Bedding normally consists of free flowing material such as gravel, sand, silty sand, or clayey sand. If this material is not used, a chipper should be used on the trencher to prepare the soil removed from the trench as embedment and backfill.
- m. Embedment material diameter for plastic pipe shall be no greater than ½ inch for 4-inch diameter pipe, ¾ inch for 6 and 8-inch diameter pipes, and 1-inch for pipe diameters from 10 inches and greater.
- n. Sand or other non-acidic granular material shall be used for pipe bedding, embedment and backfill in high traffic areas and under paved roads.
- o. Backfill may consist of the excavated material, provided it is free from unsuitable matter such as large lumps of clay, frozen soil, organic material, boulders, or stones larger than 8 inches, or construction debris.
- p. Width of trenches shall be at least four inches larger than the pipe's diameter. The minimum clear width of a trench should be the pipe outside diameter plus twelve inches to be wide enough to accommodate the compaction equipment.

C. **BEDDING:** A continuous and uniform bedding shall be provided in the trench for all buried pipe; Backfill material shall be tamped in layers around the pipe, and to a sufficient height above the pipe that the pipe is adequately supported, stabilized and protected. Rocks and hard objects larger than one inch diameter found in the trench shall be removed for a depth of at least six inches below the bottom of the pipe.

D. **MATERIAL:** Material for bedding shall be ¾ inch clean crushed limestone or sand in accordance with the material manufactures design specifications. (#1578 4/09)

E. **TRENCH BACKFILL:** All trench backfill above pipe bedding shall conform to the following requirements.

1. Compacted Crushed Stone Backfill: Compacted backfill above the bedding shall consist of ¾ inches clean crushed limestone and will be required for the full depth in the following locations:

a. Beneath pavements, surfacing, driveways, curbs, gutters, walks, or other surface construction or structures.

b. In the street, road, or on highway shoulders or any paved roadways.

2. Other Backfill: A continuous and uniform material shall be provided in the trench for all buried pipe above the bedding and shall be free of brush, roots more than 2 inches in diameter, debris, and refuse, but may contain rubble and detritus from rock excavations and stones smaller than 2"; Compaction of trench backfill above pipe bedding in locations other than those specified will not be required except to the

extent necessary to prevent future settlement.

Uncompacted backfill material above bedding may be placed by any method, acceptable to the City or City's Engineer, which will not impose excessive concentrated or unbalanced loads, shock, or impact on, and which will not result in displacement of installed pipe.

F. LABORATORY TESTS: All laboratory tests to determine compliance of embedment and backfill materials with specified treatments and to determine compliance with specified compaction requirements will be paid for directly by the Contractor.

G. DRAINAGE MAINTENANCE: Trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or watercourses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the trafficway to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the Contractor.

Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed and the original section, grades, and contours of ditches or water courses shall be restored. Surface drainage shall not be obstructed longer than necessary.

H. PROTECTION OF TRENCH BACKFILL IN DRAINAGE COURSE: Where trenches are constructed in ditches or other water courses, backfill shall be protected from surface erosion. Where the grade of the ditch exceeds 1 percent, ditch checks shall be installed. Unless otherwise shown on the drawings or directed by the Engineer, ditch checks shall be concrete. Ditch checks shall extend no less than 2 feet below the original ditch or water course bottom for the full bottom width and at least 18 inches into the side slopes and shall be at least 12 inches thick.

I. DISPOSAL OF EXCESS EXCAVATED MATERIALS: Except as otherwise permitted, all excess excavated materials shall be disposed of away from the site of the work.

Broken concrete and other debris resulting from pavement or sidewalk removal, excavated rock in excess of the amount permitted to be and actually installed in trench backfill, refuse, and debris encountered in excavation work, and other similar waste materials shall be disposed of away from the site of the work.

Excess earth from excavations located in unimproved property shall be distributed over the pipe trench and within the pipeline right-of-way to a maximum depth of 6 inches above the original ground surface elevation at and across the trench and sloping uniformly each way. Material thus wasted shall be carefully finished with a drag, blade machine, or other suitable tool to a smooth, uniform surface without obstructing drainage at any point. Wasting of excess excavated material in the above manner will not be

permitted where the line of trench crosses or is within a railroad, public road, or highway right-of-way. The disposal of waste and excess excavated materials, including hauling, handling, grading, and surfacing shall be a subsidiary obligation of the Contractor.

- J. **SETTLEMENT:** The Contractor shall be responsible for all settlement of backfill, fills, and embankments that may occur within one year after final completion of the contract under which the work was performed.

The Contractor shall make or cause to be made all repairs or replacements made necessary by settlement within 30 days after notice from the City or City's Engineer.

- K. **SEEDING AND SODDING:** The work shall consist of furnishing all labor, equipment, and materials necessary for the preparation, fertilization, seeding, and mulching of the areas specified. All disturbed areas shall be seeded and mulched except for sodded areas, surfaced areas, and solid rock. Disturbed areas outside of authorized construction limits shall be seeded and mulched, or sodded at the contractor's expense.

1. **Topsoil:** Topsoil shall consist of a fertile, friable soil of loamy character, free of sub-soil, stumps, stones, refuse, and other foreign material. It shall contain a normal amount of natural humus and be reasonably free of roots, hard dirt, heavy or stiff clay, coarse sand, noxious weeds, noxious weed seeds, sticks, brush, and other litter. The topsoil shall be obtained from well-drained, arable land and be of even texture so that all the soil will pass a one-half (1/2) inch screen. The topsoil shall not be infested with nematodes or with any other noxious animal life or toxic substances. Sandy loam of low fertility, even though mixed with leaf mold, manure, or other fertilizers, will not be accepted.
2. **Seed:** Provide grass seed for established areas in a blend as specified below, unless directed otherwise by the landowner or City.
 - a. 75% by weight of a three-way blend (equal parts) of turf fescues, consisting of any three of the following varieties: Olympic, Falcon, Bonanza, Rebel, Hound Dog, Astro 2000, Eldorado, Wrangle, FineLawn One, Anthem, or Apache.
 - b. 15% by weight of Perennial Rye, consisting of one or more of the following varieties: Affinity, Derby, Regal, Manhattan, or Chateau.
 - c. 10% by weight of Bluegrass, consisting of either Kentucky Bluegrass, Park Bluegrass, or both.
 - d. Purity of seed shall be 98%.
 - e. Germination shall be 85%.
3. **Fertilizer:** Provide a mixture containing 13 pounds each of soluble nitrogen, phosphate, and potash per 100 pounds.

4. Mulch for Hydraulically Seeded Areas: Provide a mixture of 50% recycled slick paper mulch and 50% ground corrugated paper mulch by weight. The recycled slick paper mulch shall be produced from printer's slick paper containing wood cellulose and kaolin clay. Newsprint is not allowed. The slick paper mulch shall have a maximum moisture content of 8% by weight, and shall have a pH of 4.5 to 6.5. The corrugated paper mulch shall have a moisture capacity of 700 grams water per 100 grams dry mulch minimum, a dry moisture content of 12% maximum, and a pH of 5.0 to 8.0. All mulch materials must be free of any germination or growth-inhibiting substances, green in color, and have the property of being evenly dispersed and suspended when agitated in water.

Clean wheat straw shall be material applied over the hydraulic mulch.

5. Seed for Pasture and Cropland Areas: Match as nearly as possible the species in existence prior to disturbance. Alfalfa or other exotic grasses will not be replaced but will be compensated if the land is privately owned.
 6. Replacement of Plants, Trees, Shrubs, Sod: Plants, trees, shrubs and sod shall be replaced with the same strain as removed and approximately the same size and dimensions as those removed including trees up to 4 inches in diameter.
 7. Sod: Machine cut, strongly rooted, certified turf-grass sod, at least 2 years old, and be relatively free of weeds or other undesirable native grasses. Provide sod capable of vigorous growth and development when planted (viable, not dormant). Composed primarily of Kentucky bluegrass. Moisten sod to depth at which it is to be cut when stripped during dry periods. Provide sod in uniform thickness of 5/8-inch, plus or minus 1/4-inch, measured at time of cutting and excluding top growth and thatch. Strips shall be of supplier's standard size of uniform length and width with maximum 5% allowable deviation in either length or width. Broken or torn pads, or pads with uneven ends are not acceptable. Sod pads shall be capable of supporting their own weight and retaining size and shape when pad is suspended vertically from a firm grasp on upper 10% of pad. Handle sod with care to prevent loss of native soil from roots.
 8. Liming Material: Shall consist of agricultural liming materials conforming to the Missouri Agricultural Liming Materials Act of 1976.
- L. **STRUCTURE BACKFILL**: Backfill around structures shall be compacted, to the extent necessary to prevent future settlement, by tamping or other means acceptable to the City or City's Engineer. Water settlement will be permitted only where no damage would be caused to the work.

Material for backfill shall be composed of earth only and shall contain no wood, grass, roots, broken concrete, stones, trash, or debris of any kind. No tamped or otherwise mechanically compacted backfill shall be deposited or compacted in water.

- M. CLASSIFICATION OF EXCAVATED MATERIALS: No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work, regardless of the type, character, composition, or condition thereof.

Section 22. PVC Water Piping.

This section covers Polyvinyl Chloride Piping (PVC). PVC pipe shall be furnished complete with all fittings, jointing materials, anchors, blocking encasement, and other necessary appurtenances. Waterline construction shall be in accordance with the "Missouri Department of Natural Resources Minimum Design Standards for Missouri Community Water Systems" effective December 10, 2013.

- A. STANDARDS OF MATERIALS SELECTION: Unless otherwise required by the drawings or specified herein, all fittings shall be D.I.P. mechanical joint.

Pipes shall conform to the latest edition of the AWWA, ASTM, Plastic Pipe Institute (PPI), or UniBell Plastic Pipe Association standards or recommendations. Fittings, valves and fire hydrants shall conform to the latest standards issues by the AWWA and, where applicable, shall be certified by NSF or Underwriters Laboratories for use in drinking water. Special attention shall be given to selecting pipe materials that will protect against both internal and external pipe corrosion. PVC pipes must be at least Class 200 and conform to SDR-21. Pipes, fittings and appurtenances containing more than 0.25 percent lead calculated by weighted average shall not be used. Fittings shall have at least the same pressure rating as the pipe.

High Density Polyethylene (HDPE) Pipe

Anchored or end restrained pipe such as connections between HDPE pipe and other types of pipe will develop longitudinal stresses or thrust instead of undergoing a change in length. Restraining structures must be designed to resist these anticipated loads. The Plastic Pipe Institute technical guidelines for connecting HDPE pipe to other types of pipe shall be used. Heat fusion joining by butt fusion using certified methods is the preferred method of connecting lengths of HDPE pipe and of installing fittings in HDPE pipe. Any mechanical methods of joining HDPE pipe or of installing fittings shall be specifically designed for use with HDPE pipe. HDPE pipe with scrapes or gouges exceeding 10 percent of the wall thickness shall not be used. The damaged sections shall be removed and replaced. Kinked pipe shall not be installed and shall be removed and replaced. High density polyethylene plastic (HDPE) pipe shall meet the appropriate ANSI/AWWA standard and working pressure rating for the pipe size, PE code designation, and expected working pressures of the installation. All HDPE pipe shall be pressure tested in accordance with the recommended practice of the Plastic Pipe Institute for this pipe. Any leaks discovered shall be repaired.

- B. PERMEATION OF PIPE WALLS: In areas that are contaminated with organic chemicals,

permeation of organic chemicals into the water system shall be prevented by using non-permeable materials for all portions of the water system including pipe, fittings, service connections and hydrant leads.

- C. **USED MATERIALS:** Only water mains that have been used previously for conveying potable water may be reused, and must meet the above standards and have been practically restored to their original condition.
- D. **JOINTS:** Packing and joining materials used in the joints of pipe shall conform to the latest edition of the AWWA standards. Pipe having mechanical joints or slip-on joints with nylon or synthetic rubber gaskets is preferred. Natural rubber shall not be used.
- E. **HANDLING:** Pipe, fittings, and accessories shall be handled in a manner that will insure installation in sound, undamaged condition. Equipment, tools, and methods used in unloading, reloading, hauling, and laying pipe and fittings shall be such that the pipe and fittings are not damaged. Hooks inserted in ends of pipe shall have broad, well-padded contact surfaces.
- F. **CUTTING PIPE:** Cutting shall be done in a neat manner, without damage to the pipe. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed with a file to remove all roughness and sharp corners.
- G. **CLEANING:** The interior of all pipe and fittings shall be thoroughly cleaned for foreign matter before being installed and shall be kept clean until the work has been accepted. Before jointing, all joint contact surfaces shall be wire brushed, if necessary, wiped clean, and kept clean until jointing is completed.

Every precaution shall be taken to prevent foreign material from entering the pipe during installation. No debris, tools, clothing, or other materials shall be placed in the pipe.

The end of the pipe must be protected from contamination when construction is terminated at the close of each day or for any extended period of discontinuation of construction activities. The pipe end must be sufficiently sealed with a cap or plug so is no foreign material may enter the line/pipe and maintained clean in accordance with all applicable specifications.

- H. **INSPECTION:** Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. Spigot ends shall be examined with particular care since they are vulnerable to damage from handling. All defective pipe and fittings shall be removed from the site of the work.
- I. **ALIGNMENT:** Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not be permitted. Either shorter pipe sections or fittings shall be installed where the alignment or grade requires them.
- J. **LAYING PIPE:** Pipe shall be protected from lateral displacement by placing the specified

pipe embedment material. Under no circumstances shall pipe be laid in water and no pipe shall be laid under unsuitable weather or trench conditions. Pipe shall be laid with the bell ends facing the direction of laying except when reverse laying is specifically authorized by the City or City's Engineer.

- K. **PUSH-ON JOINTS:** All instructions and recommendations of the pipe manufacturer, relative to gasket installation and other jointing operations shall be followed by the Contractor. All joint surfaces shall be lubricated with heavy vegetable soap solution immediately before the joint is completed. Lubricant shall be suitable for use in potable water, shall be stored in closed containers, and shall be kept clean. Each spigot end shall be suitably beveled to facilitate assembly.
- L. **MECHANICAL JOINTS:** Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Over tightening bolts to compensate for poor installation practice will not be permitted.
- M. **FLANGED JOINTS:** Whenever screwed-on flanges are used, the pipe shall extend completely through the flange. The pipe end and flange face shall be finish machined in a single operation. Flange faces shall be flat and perpendicular to the pipe centerline.

When bolting flanged joints, care shall be taken to insure that there is no restraint on the opposite end of the pipe or fitting which would prevent uniform gasket compression or which would cause unnecessary stress in the flanges. One flange shall be free to move in any direction while the flange bolts are being tightened. Bell and spigot joints shall not be packed or assembled until all flanged joints affected thereby have been tightened. Bolts shall be tightened gradually and at a uniform rate so that gasket compression is uniform.

- N. **WALL CASTINGS:** Unless otherwise shown on the drawings, wall castings shall be provided where cast iron pipes pass through concrete or masonry walls.
- O. **CONNECTIONS WITH EXISTING PIPELINES:** Where connections are made between new work and existing piping, such connections shall be made using suitable fittings for the conditions encountered. All live taps will be required. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers, and as authorized by the City or City's Engineer. Facilities shall be provided for proper dewatering and for disposal of all water removed from the dewatered lines and excavations without damage to adjacent property.

Special care shall be taken to prevent contamination when dewatering, cutting into, and making connections with existing pipe. No trench water, mud, or other contaminating substances shall be permitted to enter the lines. The interior of all pipe, fittings, and valves installed in such connections shall be thoroughly cleaned and then swabbed with, or dipped in, chlorine solution having chlorine content of 200 milligrams per liter.

- P. **REACTION ANCHORAGE AND BLOCKING:** All unplugged bell and spigot or all-bell

tees, Y-branches, bends deflecting 11 degrees or more, and plugs which are installed in piping subjected to internal hydrostatic heads in excess of 30 feet shall be provided with suitable reaction blocking, anchors, joint harness or other acceptable means for preventing movements of the pipe caused by internal pressure.

1. Concrete Blocking: Concrete blocking shall extend from the fitting to solid undisturbed earth and shall be installed so that all joints are accessible for repair. The bearing area of concrete reaction blocking shall be as shown on the drawings or as determined by the Engineer. If adequate support against undisturbed ground cannot be obtained, metal harness anchorages consisting of steel rods across the joint and securely anchored to pipe and fitting or other adequate anchorage facilities shall be installed to provide the necessary support. Should the lack of a solid vertical excavation face be due to improper trench excavation, the entire cost of furnishing and installing metal harness anchorages in excess of the contract value of the concrete blocking replaced by such anchorages shall be borne by the Contractor.
2. For Other Locations: Reaction blocking, anchorages, or other supports for fittings installed in fills or other unstable ground, above grade, or exposed within structures, shall be provided as required by the drawings or as necessary to prevent movement.
3. Protection of Metal Surfaces: All steel clamps, rods, bolts, and other metal accessories used in reaction anchorages or joint harness subject to submergence or contact with earth or other fill material and not encased in concrete shall be protected from corrosion by two coats of coal tar paint applied to clean, dry metal surface. The first coat shall be dry and hard before the second coat is applied. Metal surface exposed above grade or within structures shall be painted with two coats (in addition to a prime coat) of paint acceptable to the City or City's Engineer.

All joints shall be watertight and free from leaks. Each leak which is discovered within one year after final acceptance of the work by the City shall be repaired by and at the expense of the Contractor.

- Q. TRACER WIRE: All PVC waterlines shall be buried with a 12 gauge (solid) coated copper wire for future location efforts. Wire is to lie on top of pipe and shall extend up into all meter boxes and valves. (See Detailed Drawing B-3 and the General Discussion Notes)

Section 23. Water Main Design.

- A. PRESSURE: All water mains shall be sized in accordance with a hydraulic analysis based on flow demands and pressure requirements. The system shall be designed to maintain a minimum pressure of 35 psi at ground level at all points on the distribution system under all conditions of design flow not including fire flow, except that the department may approve a minimum design pressure of 20 psi in areas served by rural water districts that are isolated from the City's distribution system or on a case-by-case basis in accordance with the "Minimum Design Standards for Missouri Community Water Systems" effective December 10, 2013. The normal working pressure in the distribution system should be

approximately 60 psi.

B. DIAMETER:

1. The minimum size of a water main for providing fire protection and serving fire hydrants shall be six inches in diameter. Larger mains shall be required to allow withdrawal of the required fire flow while maintaining the minimum residual pressure of 20 psi throughout the distribution system.
2. For public water systems not providing fire protection, no water main shall be smaller than 2 inches in diameter. Water lines serving more than one service connection shall be considered a water main.

C. FIRE PROTECTION: Fire protection shall be provided for all waterline extensions. The system design should be such that fire flows and facilities meet the classification criteria of the state Insurance Service Offices (ISO). Systems that cannot provide a minimum fire flow of 250 gpm for a two hour duration are not designed to provide fire protection. All water mains shall be designed to carry fire flows and shall have fire hydrants connected to them.

D. FLUSHING:

1. Flushing devices and valving shall be provided to allow every main in the distribution system to be flushed. Flushing devices should be sized to provide flows that will give velocity of at least 2.5 feet per second on the water main being flushed.
2. In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-in wherever practical.
3. Where dead-end mains occur, they shall be provided with an approved flushing device.
4. No flushing device shall be directly connected to any sewer.

E. ISOLATION VALVES: Sufficient valves shall be provided on water mains so that inconvenience and sanitary hazards to customers will be minimized during repairs. Valves should be located at not more than 500 foot intervals in commercial districts and at not more than one block (or 800 foot) intervals in residential or other districts. Where systems serve widely scattered customers and where future development is not expected, the valve spacing should be at every water main branch on both the feeder main and the branch line.

Section 24. Fire Hydrants.

A. LOCATION AND SPACING: Fire Hydrants shall be provided at each street intersection and at intermediate points between intersections to meet the current

classification criteria of the Insurance Services Office (ISO). Generally, the fire hydrant spacing may range from 500 feet to 600 feet in residential areas or 300 feet to 350 feet in commercial areas. The number of hydrants required shall be based on use/occupancy type, required fire flow, along with distance and access considerations. The maximum distance from any structure's access point to a hydrant in a commercial area shall not exceed 200 feet, as measured along the required access. Final approval of fire hydrant spacing shall be by the Nixa Fire Protection District. (1701 9/2011)

- B. VALVES AND NOZZLES: Fire hydrants should have a minimum bottom valve opening of at least 5 1/4 inches and one 4 1/2 inch pumper nozzle and two 2 1/2 inch nozzles.
- C. HYDRANT LEADS: The hydrant lead shall be a minimum of six inches in diameter and contain a shutoff valve.
- D. DRAINAGE: A gravel pocket or dry well shall be provided unless the natural soils will provide adequate drainage for the hydrant barrel. Hydrant drains shall not be connected to or located within ten feet of sanitary sewers or storm drains.
- E. INSTALLATION: Installation of fire hydrants shall meet the following requirements.
 - a. The weight of the hydrant shall not be carried by the pipe. Hydrants, lead valves, fittings, and branch connections shall be provided with proper support, such as crushed stone, concrete pads or a well compacted trench bottom.
 - b. Drainage shall be provided for dry barrel hydrants. This is generally washed stone extending at least one foot on all sides of the hydrant.
 - c. Hydrants shall be plumb.
 - d. The center of a hose outlet shall be not less than 18 inches above final grade and so that the final hydrant installation is compatible with the final grade elevation.
 - e. As a rule, hydrants are either oriented with the pumper outlet perpendicular to the curb which faces the street, or with the pumper outlet set at a 45-degree angle to the street.
 - f. Hydrants shall be protected if subject to mechanical damage. The means of protection shall be arranged in a manner that will not interfere with the connection to, or operation of, hydrants.
 - g. A clearance space of at least three feet (3 ft.) surrounding the hydrant body should be provided around every hydrant.
 - h. Utility poles, vaults, walls, plants and other landscape materials should be kept outside the hydrant's clearance space.
 - i. In poor load-bearing soil, special construction such as support collars may be required.

Section 25. Air Relief Valves; Valve, Meter and Blow-off Chambers.

- A. LOCATION: At high points in water mains where air can accumulate, provisions shall be made to remove air by means of manually operated hydrants or automatic air relief valves. Automatic air relief valves shall not be used in situations where flooding of the

manhole or chamber may occur.

- B. PIPING: The open end of an air relief pipe from automatic valves shall be extended to at least one foot above grade and terminate in a downturned position with the opening covered with an 18-mesh, corrosion resistant screen. The pipe from a manually operated valve shall be capped with a threaded removable cap or plug and should be extended to the top of the pit. Vaults or wells housing automatic air relief valves shall be drained to daylight with drains sized to carry the maximum output of the air relief valve.
- C. CHAMBER DRAINAGE: Chambers, pits or manholes containing valves, blow-offs, meters, or other such appurtenances to a distribution system shall not be connected directly to any storm drain or sanitary sewer, nor shall blow-offs or air relief valves be connected to any sanitary sewer. Such chambers or pits shall be drained to the surface of the ground or provided with a sump
- D. INSTALLATION STANDARDS: Specifications shall incorporate the provisions of the AWWA C-605 standards and/or manufacturer's recommended installation procedures.

Section 26. Crossings:

- A. GENERAL: The following factors shall be considered in providing adequate separation.
 - a. Materials and type of joints for water and sewer pipes.
 - b. Soil conditions.
 - c. Service and branch connections into the water main and sewer line.
 - d. Compensating variations in the horizontal and vertical separations.
 - e. Space for repair and alterations of water and sewer pipes.
 - f. Off-setting of water mains around manholes.
- B. PARALLEL INSTALLATION: Water main shall be located at least ten feet horizontally from any existing or proposed line carrying non-potable fluids such as, but not limited to drains, storm sewers, sanitary sewers, combined sewers, sewer service connections, and process waste or product lines. The distance shall be measured edge to edge.

In cases where it is not practical to maintain a ten-foot separation, the City may allow deviation on a case by case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a non-potable fluid line, provided that the water main is laid in a separate trench located as far away from the non-potable line as feasible and meets other specific construction requirements. Locating a water main on an undisturbed earth shelf located on one side of the non-potable line as feasible and meets other specific construction requirements. Locating a water main on an undisturbed earth shelf located on one side of the non-potable line is not recommended and requires justification by the engineer and specific case-by-case approval of the department. In either case, an elevation shall be maintained such that the bottom of the water main is at least 18 inches above the top of the non-potable line while meeting minimum cover requirements.

In areas where the recommended separations cannot be obtained, either the waterline or the non-potable line shall be constructed of mechanical or manufactured restrained joint pipe, fusion welded pipe, or cased in a continuous casing. Casing pipe must be a material that is approved for use as water main. Conventional poured concrete is not an acceptable encasement.

- C. **LINE CROSSINGS:** Water mains crossing sewers, or any other lines carrying non-potable fluids shall be laid to provide a minimum vertical clear distance of 18 inches between the outside of the water main and the outside of the non-potable pipeline. This shall be the case where the water main is either above or below the non-potable pipeline. An 18-inch separation is a structural protection measure to prevent the sewer or water main from settling and breaking the other pipe. At crossings, the full length of water pipe shall be located so both joints will be as far from the non-potable pipeline as possible but in no case less than ten feet or centered on a 20-foot pipe. In areas where the recommended separations cannot be obtained either the waterline or the non-potable pipeline shall be constructed of mechanical or manufactured restrained joint pipe, fusion welded pipe, or cased in a continuous casing that extends no less than ten feet on both sides of the crossing. Special structural support for the water and sewer pipes may be required. Casing pipe must be a material that is approved for use as water main. Conventional poured concrete is not an acceptable encasement.
- D. **EXCEPTIONS:** Any exceptions from the specified separation distances in paragraphs B and C must be submitted to the City for approval.
- E. **FORCE MAINS:** There shall be at least a ten-foot horizontal separation between water mains and sanitary sewer force mains or other force mains carrying non-potable fluids and they shall be in separate trenches. In areas where the recommended separations cannot be obtained, either the waterline or the non-potable line shall be constructed of mechanical joint pipe or cased in a continuous casing, be constructed of mechanical joint pipe, or be jointless or fusion welded pipe. Where possible, the waterline shall also be at such an elevation that the bottom of the water main is at least 18 inches above the top of the non-potable line. Casing pipe must be a material that is approved for use as water main. Conventional poured concrete is not an acceptable encasement.
- F. **SEWER MANHOLES:** No waterline shall be located closer than ten feet to any part of a sanitary or combined sewer manhole. Where the separation cannot be obtained, the waterline shall be constructed of mechanical or manufactured restrained joint pipe, fusion welded pipe, or cased in a continuous casing. Casing pipe must be a material that is approved for use as water main. The full length of water pipe shall be located so both joints will be as far from the manhole as possible, but in no case less than ten feet or centered on a 20-foot pipe. No water pipe shall pass through or come into contact with any part of a sanitary or combined sewer manhole.
- G. **DISPOSAL FACILITIES:** No water main shall be located closer than 25 feet to any wastewater disposal facility, agricultural waste disposal facility, or landfill. Water mains shall be separated by a minimum of 25 feet from septic tanks and wastewater disposal

areas such as cesspools, subsurface disposal fields, pit privies, land application fields, and seepage beds.

H. ABOVE WATER CROSSINGS: The pipe shall be adequately supported and anchored, protected from damage and freezing and accessible for repair or replacement.

I. UNDERWATER CROSSINGS:

- a. Flowing streams and water body crossings five hundred feet or less in length shall have a minimum cover of four feet over the pipe. When crossing water courses greater than 15 feet in width, the following shall be provided:
 - i. The pipe shall be of special construction, having flexible watertight joints. Steel or ductile iron ball-joint river pipe shall be used for open cut crossings. Mechanical or restrained joint or fusion welded pipe may be used for open cut crossings, provided it is encased in a welded steel casing. Mechanical or restrained joint or fusion weld pipe shall be used for bored crossings.
 - ii. Adequate support and anchorage shall be provided on both sides of the stream.
 - iii. Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible and should not be subject to flooding.
 - iv. The valve closest to the supply source shall be in an accessible location and installed in a vault, manhole, or meter pit sized to allow the installation of leak detection equipment.
 - v. Permanent taps shall be provided on each side of the valve within the manhole, vault, or meter pit to allow insertion of a small meter to determine leakage and for sampling purposes.
 - vi. Bank erosion is a major cause of stream crossing failures, and erosion protection measures such as rip rap have limited success. Stream movement and the history of bank erosion must be considered when choosing the length that the crossing pipe or casing shall extend beyond the upper edge of the stream channel. The stream crossing pipe or casing shall extend at least 15 feet beyond the upper edge of the stream channel on each side of the stream.
 - vii. Large river crossings such as those crossing the Missouri or Mississippi River require specialized design and shall be considered on a case-by-case basis.
- b. For lake, waterbody, and flood plain crossings greater than 500 feet in length, the design shall consider the ability to access and repair or replace the pipe in these crossings. Consideration shall also be given to the ability to continue service to areas served by the crossing in the event of a submerged leak or pipe break.
 - i. Submerged portions of pipe crossing proposed lakes shall not be buried when the submerged pipe is greater than 500 feet in length except for the transition from water to land.

- ii. Steel or ductile iron ball-joint river pipe or fusion welded pipe shall be used under water during normal flow conditions. Mechanical, restrained joint, or fusion welded pipe shall be used in flood plains.
 - iii. Underwater installations shall be tested for leaks prior to installation.
 - iv. Valves above the high water level shall be provided at both ends of water crossings so that the section can be isolated for testing or repair.
 - v. The valve closest to the supply source shall be in an accessible location and installed in a vault, manhole, or meter pit sized to allow the installation of leak detection equipment.
 - vi. Permanent taps shall be provided on each side of the valve within the manhole, vault, or meter pit to allow insertion of a small meter to determine leakage and for sampling purposes.
- c. Intermittent flowing streams
- i. Restrained joint or thermal welded pipe shall be used for all stream crossings.
 - ii. The pipe shall extend at least 15 feet beyond the upper edge of the stream channel on each side of the stream.
 - iii. Adequate support and anchorage shall be provided on both sides of the waterway.

J. **STREET CROSSINGS:** No cutting of concrete/asphalt surface shall be allowed unless prior City approval is obtained in writing. At all locations where water lines are placed within the street, water trench shall be backfilled with 3/4 inch clean crushed limestone to the subgrade of the proposed pavement.

K. **WATER SERVICES:** All water services shall be made with 200 psi High Density Polyethylene (HDPE) pipe equal to copper tubing size (CTS) SDR 9 potable water pipe. Service pipe shall meet the requirements of ASTM 2737, AWWA C901 and NSF Standards 14 and 61.

1. Typical Water Service: (See Detail Drawing B-9 in the City of Nixa's Technical Specifications Book)

- a. Crossings Serving Single Lot: Water service crossing shall be made using 1 inch diameter High Density Polyethylene (HDPE) pipe.

Water services on same side as water main shall be High Density Polyethylene (HDPE) pipe.

- b. Crossings serving Twin lots: Water service crossing shall be made using a single 2 inch diameter or 2 - 1" diameter High Density Polyethylene (HDPE) pipes. Dual Services on same side as water main shall be High Density Polyethylene (HDPE) pipe.

2. Typical Water Meter Box: (See Detail Drawing B-7 in the City of Nixa's Technical Specifications Book)

- L. PROTECTION OF WATER METER BOXES: It shall be the responsibility of the contractor to place a metal fence post at each meter box to prevent damage to the meter after installation.

Section 27. Waterline Acceptance Testing.

- A. GENERAL: This section covers simultaneous hydrostatic pressure testing and leakage testing of the waterline. The pipelines shall be tested as specified herein.

It shall be the responsibility of the contractor to notify the City of Nixa personnel at least 24 hours in advance of the time and place at which testing work will be done. All defects shall be repaired to the satisfaction of the City of Nixa. (#1578 4/09)

Temporary discharge piping shall be provided for wasting test water at a suitable remote location where such water will drain away from the work.

- B. PRESSURE/LEAKAGE TEST: The pipelines shall be subjected to a simultaneous hydrostatic pressure and leakage testing. The test shall be conducted prior to connection of the pipeline to the existing water lines. All shutoff valves shall be open during testing. Anchored or blocked test plugs shall be provided as necessary.
- C. FILLING AND VENTING THE LINE: The pipelines shall be slowly filled with water and all air expelled from the pipe. Vents shall be provided where necessary. A suitable plug shall be provided for the tapped vents.
- D. TESTING EQUIPMENT FACILITIES: The Contractor shall furnish the gauges and measuring device for the hydrostatic and leakage tests, pump, pipe, connections, and all other necessary apparatuses, unless otherwise specified, and shall furnish the necessary assistance to conduct the test.
- E. TEST PRESSURE: During the test the pipeline shall be subjected to 150 percent of the working pressure at the point of the test, but not less than 125 percent of normal working pressure at the highest elevation in the pipeline. Working pressure is defined as the maximum anticipated sustained operating pressure.
- F. TEST DURATION: The test pressure shall be maintained for at least 2 hours or for whatever longer period is necessary for the City Inspector to inspect the pipeline.
(#1578 4/09)
- G. LEAKAGE MEASUREMENT: Leakage shall be defined as the quantity of water that must be supplied into the pipe section being tested to maintain a pressure within 5 psi of the specified leakage-test pressure after the pipe has been filled with water and the air in the pipeline has been expelled.
- H. ALLOWABLE LEAKAGE: No installation will be accepted if the leakage is greater than

that determined by the formula:

$$L = \frac{ND(P)^{1/2}}{7,400}$$

WHERE:

L = Allowable leakage (gal/hr)

N = Number of joints in the length of pipeline tested

D = Nominal diameter of pipe (inches)

P = Average test pressure during the leakage test (psi-gauge)

- I. DEFECTS: It is the intent of these specifications and the contract based thereon that all joints in piping shall be watertight and free from visible leaks during the prescribed leakage test and each and every leak which may be discovered at any time prior to the expiration of one year from and after the date of final acceptance of the work by the City shall be located and repaired by and at the expense of the Contractor, regardless of any amount that the total line leakage rate during the specified leakage test may be below the specified maximum rate.

If the specified leakage test is made after the pipeline has been backfilled and the joints covered, and such test shows a leakage rate in excess of the permissible maximum, the Contractor shall make all necessary surveys in connection with the location and repair of leaking joints to the extent required to reduce the total leakage to an acceptable amount. Where evidence of leaking joints does not appear on the ground surface above or near the leaks, the Contractor shall prospect the line by sinking a hole, with an auger or otherwise, at the location of each joint and determine any undue saturation of the soil which would indicate a leak at such joint; such prospecting shall be done after pressure has been maintained in the line a sufficient time to provide adequate soil saturation for locating leaks by this method.

Leaks in mechanical joints shall be repaired by dismantling, cleaning, realigning gland and gasket, and rebolting. Under no circumstances shall gland bolts be tightened beyond the specified and allowable torque limits in an attempt to reduce or stop leakage from a defective joint or for any other purpose.

- J. REPETITION: Materials shall be replaced as necessary and the pressure test shall then be repeated until the line and all parts thereof withstand the test in a satisfactory manner.

Section 28. Waterline Disinfection.

- A. GENERAL: The waterline shall be disinfected with a strong chlorine solution. Disinfecting may be done concurrently with pressure and leakage testing or after pressure and leakage testing at the option of the Contractor. All necessary disinfection equipment and materials shall be provided by the Contractor. Disinfection work shall conform to the requirements of AWWA C651-99, "Standard for Disinfecting Water Mains" as modified or supplemented herein.

B. **DISINFECTANTS:** The forms of chlorine that may be used in the disinfection operations are liquid chlorine, sodium hypochlorite solution, and calcium hypochlorite granules or tablets.

1. **Liquid Chlorine:** Liquid chlorine conforming to ANSI/AWWA B301 contains 100% available chlorine and is packaged in steel containers usually of 100-lb, 150-lb, or 1-ton net chlorine weight. Liquid chlorine shall be used only: (1) in combination with appropriate gas-flow chlorinators and ejectors to provide a controlled high-concentration solution feed to the water to be chlorinated; (2) under the direct supervision of someone familiar with the physiological, chemical, and physical properties of liquid chlorine who is trained and equipped to handle any emergency that may arise; and (3) when appropriate safety practices are observed to protect working personnel and the public.
2. **Sodium Hypochlorite:** Sodium hypochlorite conforming to ANSI/AWWAB300 is available in liquid form in glass, rubber-lined, or plastic containers typically ranging in size from 1 qt. to 5 gal. Containers of 30 gal. or larger may be available in some areas. Sodium hypochlorite contains approximately 5% to 15% available chlorine, and the storage conditions and time must be controlled to minimize its deterioration.
3. **Calcium Hypochlorite:** Calcium hypochlorite conforming to ANSI/AWWA B300 is available in granular form or in 5-g tablets, and must contain approximately 65% available chlorine by weight. The material should be stored in a cool, dry, and dark environment to minimize its deterioration. Minimum contact time to allow tablets to dissolve shall be 7 hours.

C. **FEEDING:** Pipelines shall be disinfected by the tablet method, the continuous feed method or the slug method in accordance with ANSI/AWWA C651-99.

1. **Tablet Method:** The tablet method consists of placing calcium hypochlorite granules or tablets in the water main as it is being installed and then filling the main with potable water when installation is completed. This method shall be used only if the pipes and appurtenances are kept clean and dry during construction.
2. **Continuous Feed Method:** The continuous feed method consists of placing calcium hypochlorite granules in the main during construction (optional), completely filling the main to remove all air pockets, flushing the completed main to remove particulates, and filling the main with potable water. The potable water shall be chlorinated so that after a 24 hour period in the main there will be a free chlorine residual of not less than 10 mg/l.
3. **Slug Method:** The slug method consists of placing calcium hypochlorite granules in the main during construction; completely filling the main to eliminate all air pockets; flushing the main to remove particulates; and slowly flowing through the main a slug of water dosed with chlorine to a concentration of 100 mg/l. The slow rate of flow ensures that all parts of the main and its appurtenances will be exposed to the highly

chlorinated water for a period of not less than 3 hours.

During disinfection all valves shall be operated to insure that all appurtenances are disinfected.

- D. **BACTERIOLOGICAL TESTS:** After the chlorine solution is flushed out of the line and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected from the new main. At least one set of samples shall be collected from every 1,200 ft of the new water main, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological quality in accordance with Standard Methods for the Examination of Water and Wastewater; and shall show the absence of coliform organisms; and, if required, the presence of a chlorine residual. Turbidity, pH, and a standard heterotrophic plate count or test may be required at the option of the purchaser, because new material does not typically contain coliform but does typically contain HPC bacteria.

Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate as required by Standard Methods for the Examination of Water and Wastewater. No hose or fire hydrant shall be used in the collection of samples. The record of compliance shall be the bacteriological test results certifying that the water sampled from the new water main is free of coliform bacteria contamination and is equal to or better than the bacteriologic water quality in the distribution system.

- E. **REDISINFECTION:** If initial disinfection fails to produce satisfactory bacteriological results or if other water quality is affected, the new main may be reflashed and shall be resampled. If check samples also fail to produce acceptable results, the main shall be rechlorinated by the continuous-feed or slug method until satisfactory results are obtained.

Section 29. Protection of Potable Water Supply.

The Contractor shall be solely responsible for assuring protection of the City's potable water supply by means of providing backflow prevention as indicated in these specifications.

- A. **PROTECTION OF POTABLE WATER OUTLETS:** All potable water openings and outlets shall be protected against backflow, in accordance with one of the following.
1. **Air Gap:** Openings and outlets shall be protected by an air gap between the opening and the fixture flood level rim. Openings and outlets equipped for hose connection shall be protected by means other than an air gap.
 2. **Hose Connections:** Sillcocks, hose bibs, wall hydrants and other openings with a hose connection shall be protected by an atmospheric-type or pressure type vacuum breaker or a permanently attached hose connection vacuum breaker.

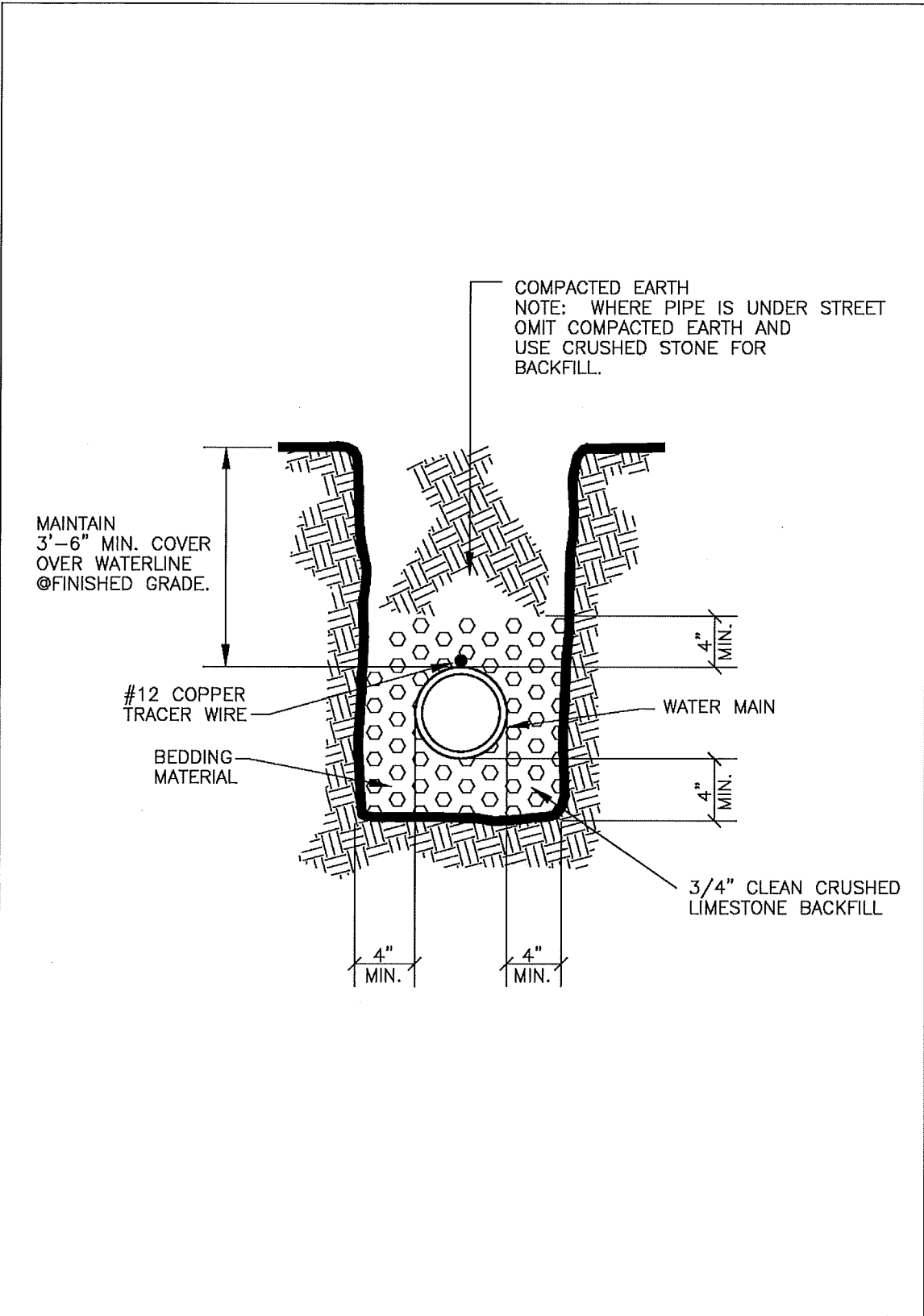
3. Reduced Pressure Principle Backflow Preventer: Openings and outlets shall be protected by a reduced pressure principle backflow preventer.

B. CONNECTIONS:

1. Automatic Fire Sprinkler Systems and Standpipe Systems: The potable water supply to automatic fire sprinkler and standpipe systems shall be protected against backflow by a double check-valve assembly or a reduced pressure principle backflow preventer.

The exception is where systems are installed as a portion of the water distribution system in accordance with the requirements of this code and are not provided with a fire department connection, isolation of the water system shall not be required

2. Additive or Non-potable Source: Where systems contain chemical additives or antifreeze, or where systems are connected to a non-potable secondary water supply, the potable water supply shall be protected against backflow by a reduced pressure principle backflow preventer. Where chemical additive or antifreeze is added to only a portion of an automatic fire sprinkler or standpipe system, the reduced pressure principle backflow preventer shall be permitted to be located so as to isolate that portion of the system.
3. Subject to Back Pressure: Where a potable water connection is made to a non-potable line, fixture, tank, vat, pump or other equipment subject to backflow pressure, the potable water connection shall be protected by a reduced pressure principle backflow preventer.
4. Lawn Irrigation Systems: The potable water supply to lawn irrigation systems shall be protected against backflow by a double check valve back flow preventer or a reduced pressure principle backflow preventer. Where chemicals are introduced into the system, the potable water supply shall be protected against backflow by a reduced pressure principle backflow preventer.

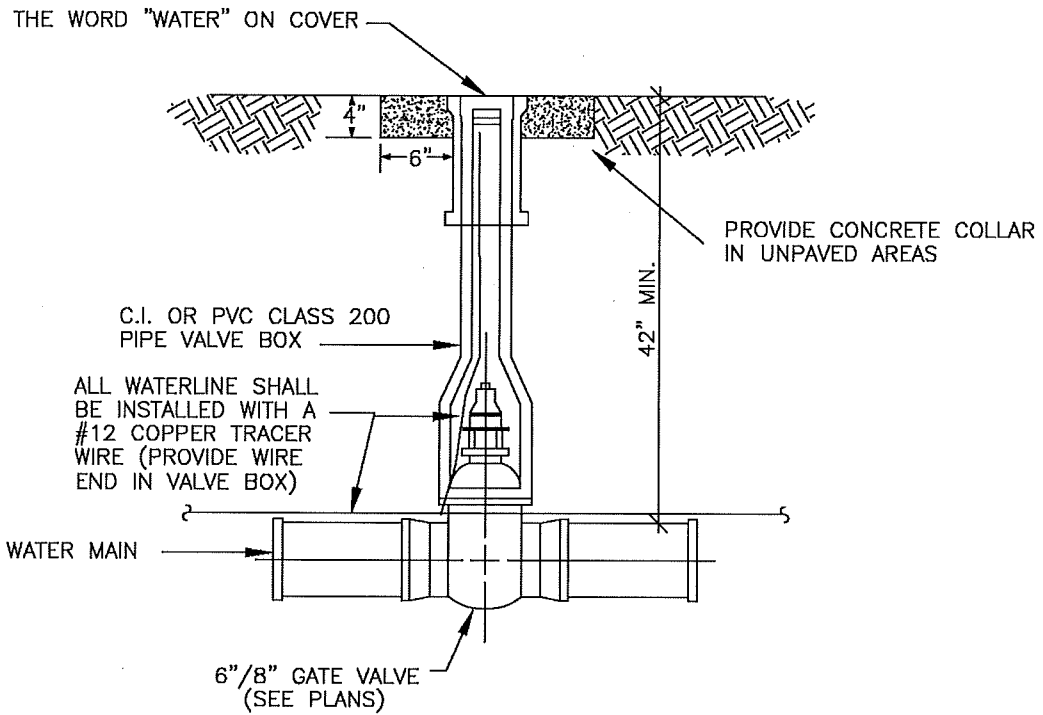


TYPICAL WATERLINE
EMBEDMENT DETAIL

DATE:
01/31/99

DWG:
B1

NOTE:
IN LIEU OF C.I. VALVE BOX SHOWN AN
ALTERNATIVE PVC VALVE BOX ACCEPTABLE
TO THE CITY WILL BE ALLOWED.



GENERAL NOTE: ALL WATERLINE FITTINGS
ARE TO BE D.I.P. M.J. FITTINGS.



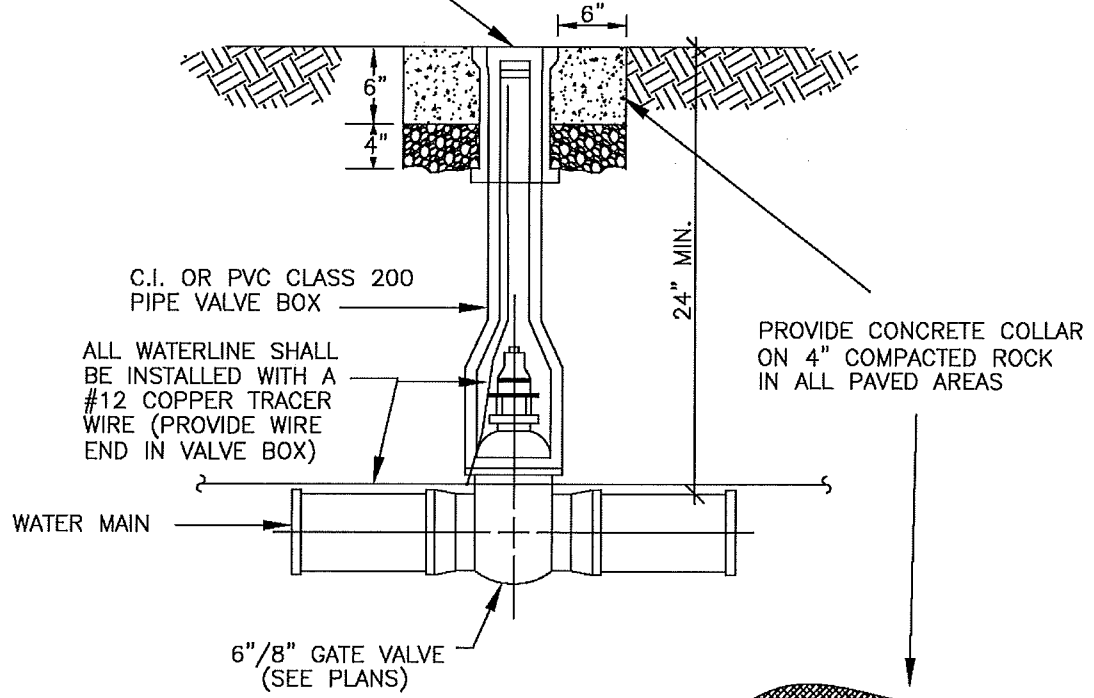
TYPICAL VALVE DETAIL

DATE:
10/26/06

DWG:
B2

NOTE:
 IN LIEU OF C.I. VALVE BOX SHOWN AN
 ALTERNATIVE PVC VALVE BOX ACCEPTABLE
 TO THE CITY WILL BE ALLOWED.

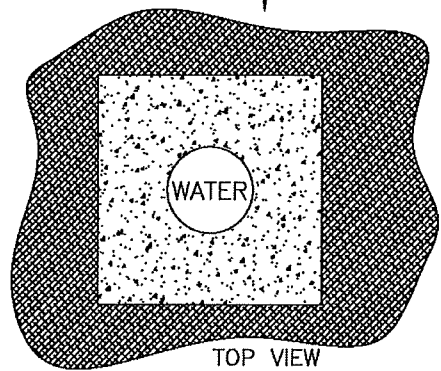
THE WORD "WATER" ON COVER



ALL WATERLINE SHALL
 BE INSTALLED WITH A
 #12 COPPER TRACER
 WIRE (PROVIDE WIRE
 END IN VALVE BOX)

PROVIDE CONCRETE COLLAR
 ON 4" COMPACTED ROCK
 IN ALL PAVED AREAS

GENERAL NOTE: ALL WATERLINE FITTINGS
 ARE TO BE D.I.P. M.J. FITTINGS.



TOP VIEW

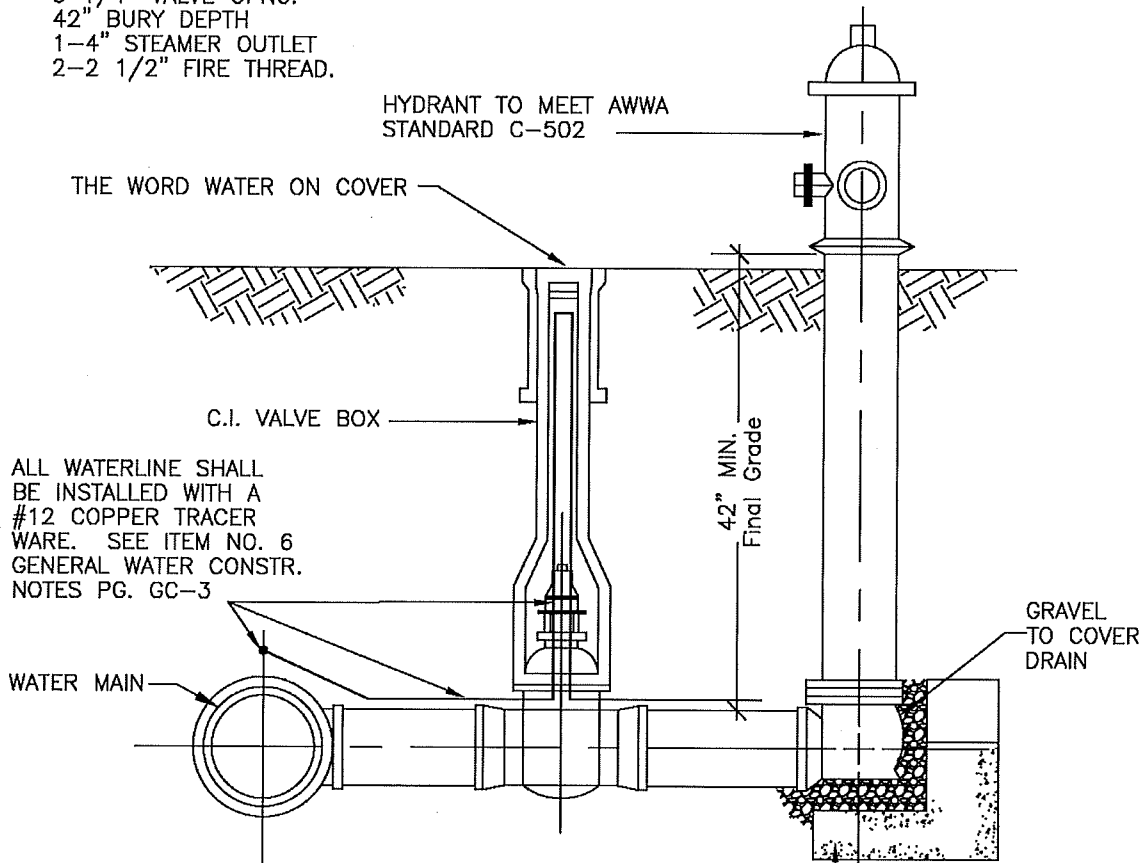


TYPICAL VALVE DETAIL

DATE: 09/16/04
 DWG: B2a

HYDRANT TO BE 3-WAY
 6" SHOE TRAFFIC MODEL
 5 1/4" VALVE OPNG.
 42" BURY DEPTH
 1-4" STEAMER OUTLET
 2-2 1/2" FIRE THREAD.

HYDRANT TO BE PLACED WITH
 NOZZLES FACING STREET



ALL WATERLINE SHALL
 BE INSTALLED WITH A
 #12 COPPER TRACER
 WARE. SEE ITEM NO. 6
 GENERAL WATER CONSTR.
 NOTES PG. GC-3

ALL FIRE HYDRANTS WILL BE INSTALLED WITH
 8" x 6" MJ x SWIVEL TEE AND 6" x 13"
 MJ x SWIVEL COUPLING. NO DUC LUGS, STAR
 BOLTS, ALL THREAD ROD, MEGA-LUGS OR
 RETAINER GLANDS WILL BE ALLOWED.

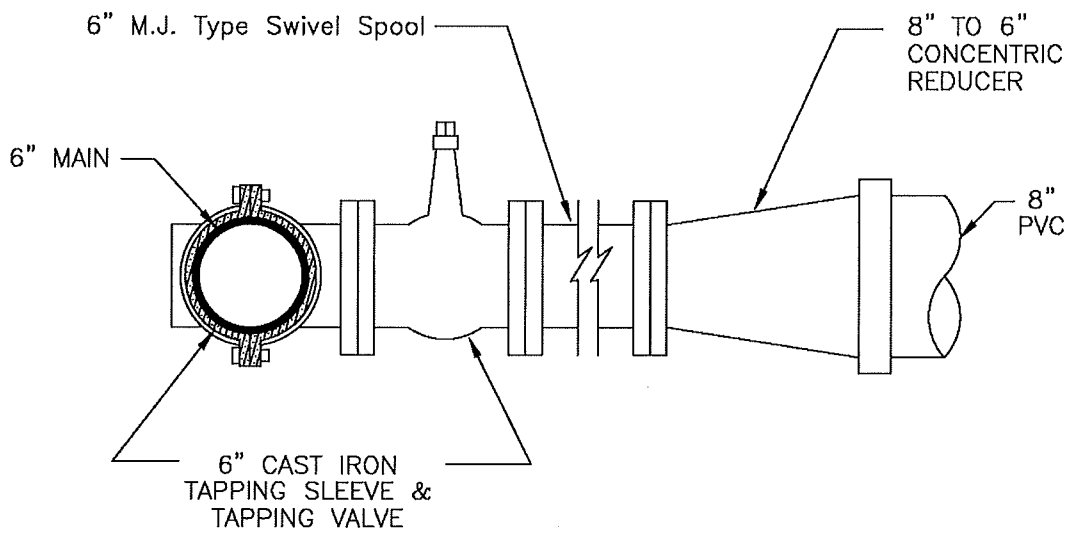
GENERAL NOTE: ALL WATERLINE FITTINGS
 ARE TO BE D.I.P. M.J. FITTINGS.



HYDRANT DETAIL

DATE:
 10/31/06
 DWG:
 B3

ALL WATERLINE SHALL
BE INSTALLED WITH A
#12 COPPER TRACER
WIRE

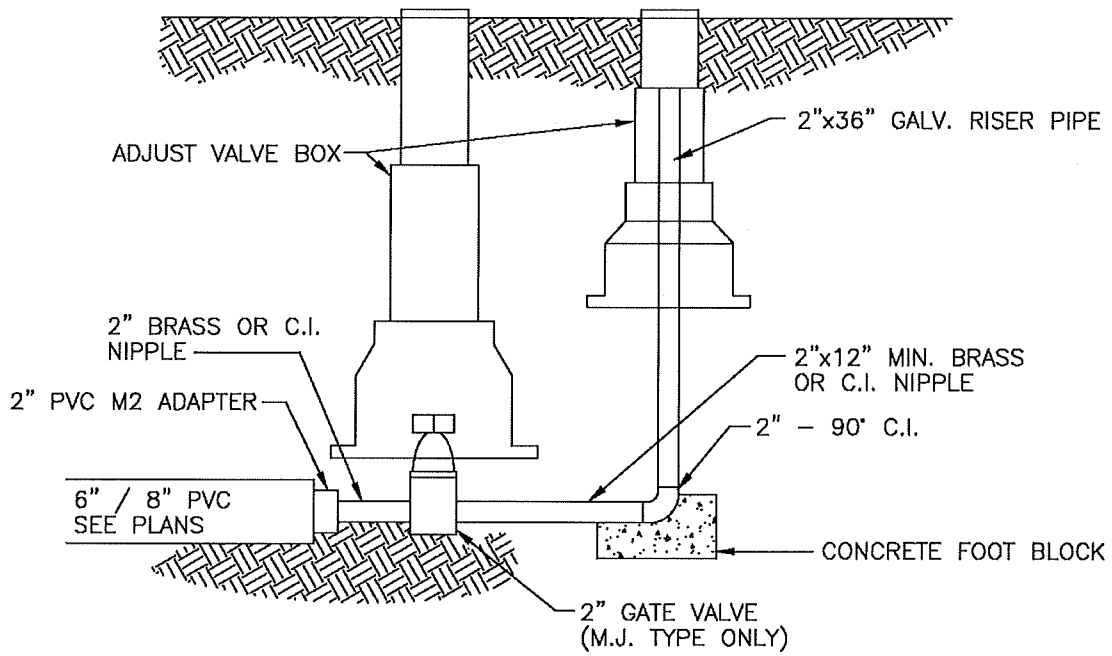


GENERAL NOTE: ALL WATERLINE FITTINGS
ARE TO BE D.I.P. M.J. FITTINGS



6" LIVE-TAP DETAIL

DATE:
10/31/06
DWG:
B5



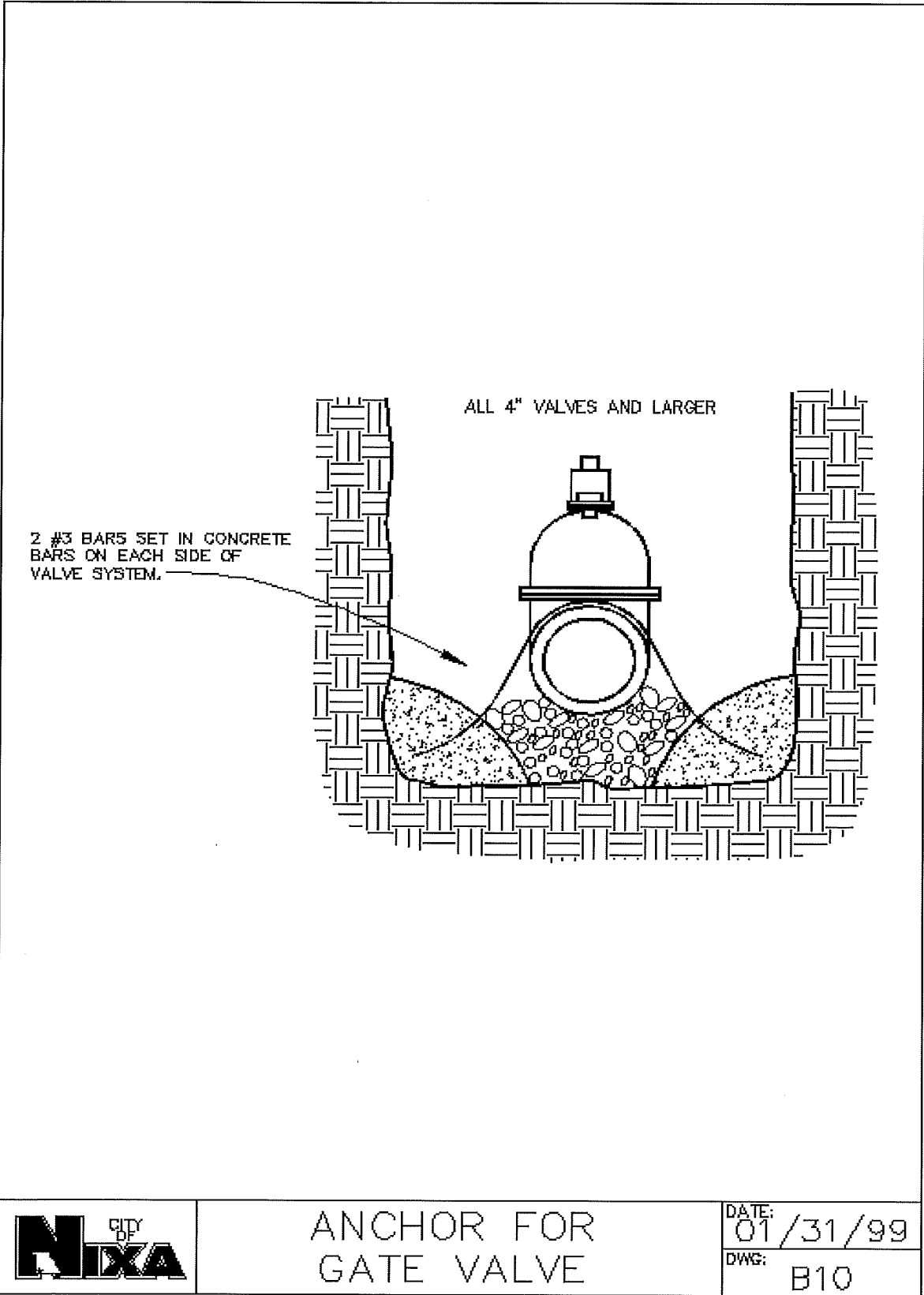
NOTE:
 IN LIEU OF FLUSH HYDRANT SHOWN
 AN ALTERNATE FROST PROOF FLUSH
 HYDRANT ACCEPTABLE TO THE CITY
 MAY BE CONSIDERED.

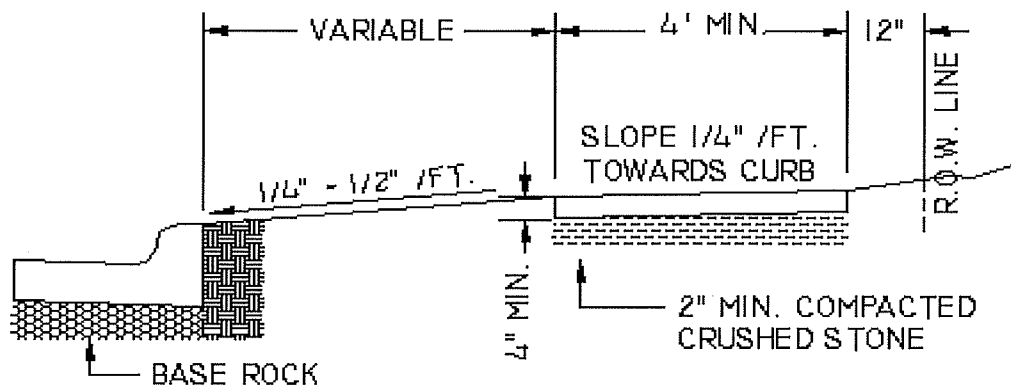


TYP. 2" FLUSH
 VALVE DETAIL

DATE:
 10/31/06

DWG:
 B6





NOTES:

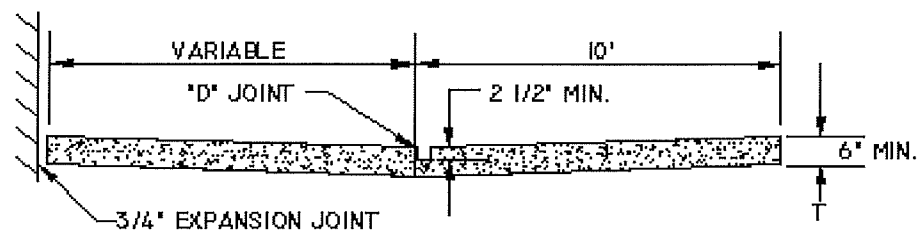
1. JOINTS SHALL BE FORMED AT RIGHT ANGLES TO THE ALIGNMENT OF THE SIDEWALK.
2. THE SIDEWALK SHALL BE MARKED OFF INTO SQUARE STONES BY CONTRACTION JOINTS. CONTRACTION JOINTS SHALL BE ONE-EIGHT (1/8) INCH WIDE (MIN.) BY ONE (1) INCH DEEP AND SHALL BE FORMED BY TOOLING.
3. EXPANSION JOINTS SHALL BE FORMED BY A ONE-HALF (1/2) INCH THICK PREFORMED JOINT FILLER, EXTENDING THE FULL DEPTH OF THE SLAB, AND SECURED SO THAT THE JOINT FILLER IS NOT MOVED BY DEPOSITING AND COMPACTING THE CONCRETE AT THESE JOINTS.
4. EXPANSION JOINTS SHALL BE PLACED WHERE SIDEWALK ABUTS TO OTHER STRUCTURES AND SHALL NOT BE SPACED MORE THAN 50 FEET APART ON STRAIGHT RUNS FOR HAND LAID SIDEWALK AND NOT MORE THAN 100 FEET APART ON STRAIGHT RUNS FOR MACHINE LAID SIDEWALKS.



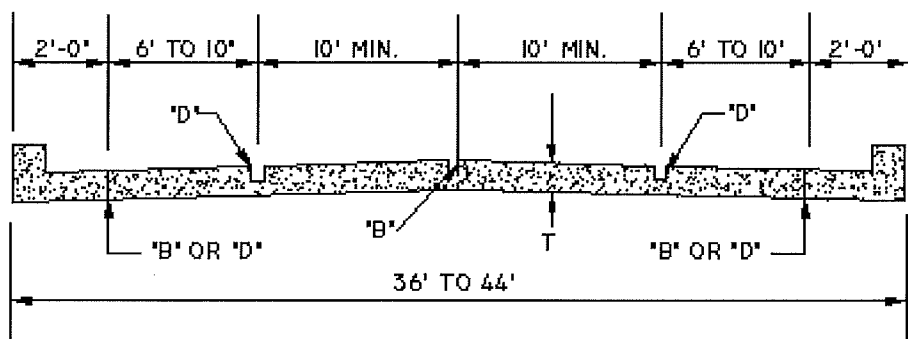
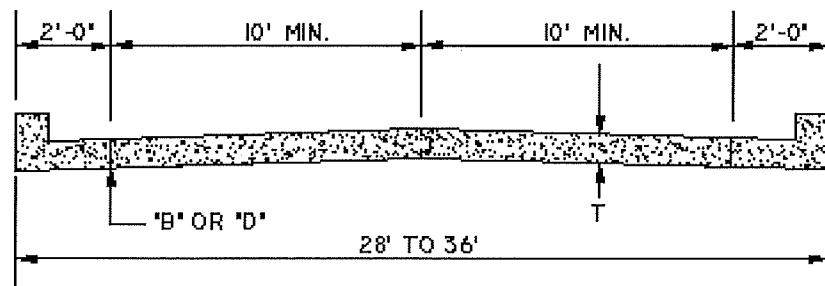
CONCRETE SIDEWALK
DETAIL

DATE:
01/31/99

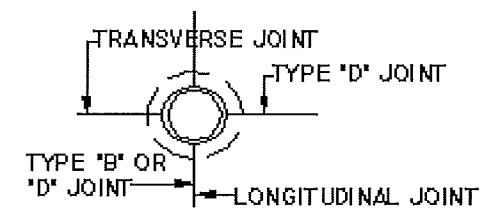
DWG:
D3



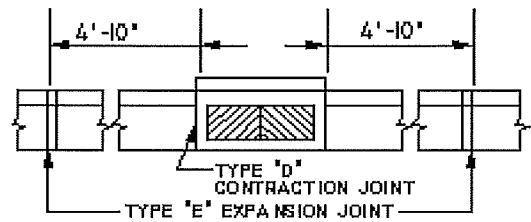
TYPICAL ALLEY SECTION



CONCRETE PAVEMENT - JOINT LOCATIONS



JOINT LOCATION AT INLETS



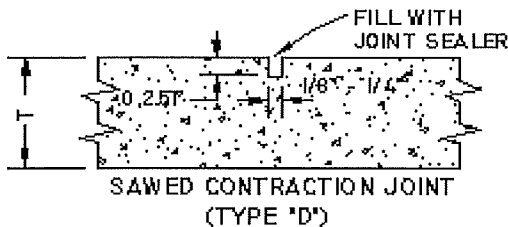
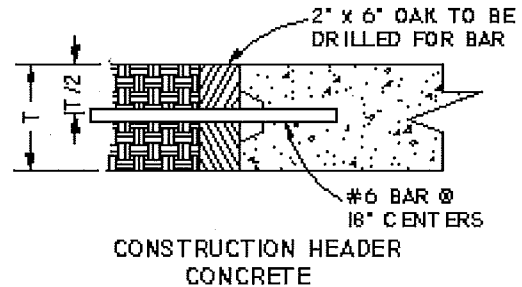
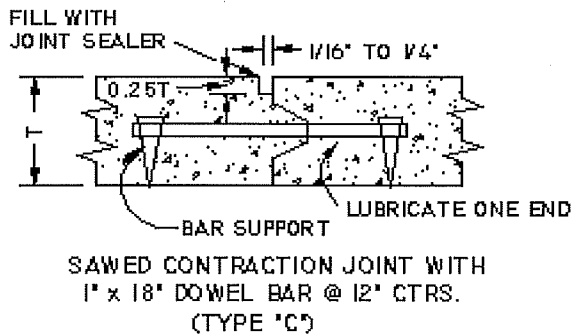
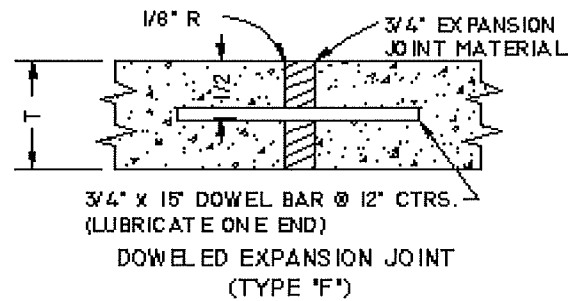
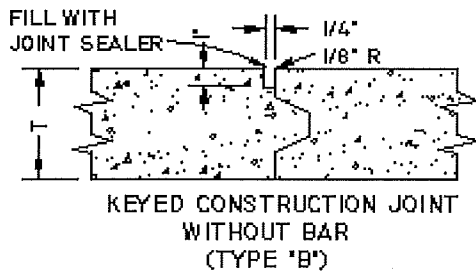
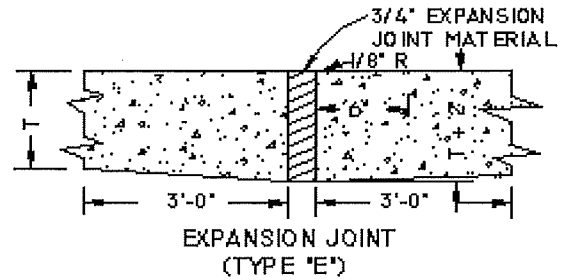
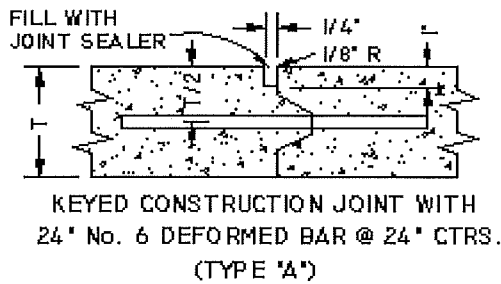
JOINT LOCATION AT INLETS



CONCRETE PAVEMENT
JOINT DETAILS

DATE: 01/31/99

DWG: D7

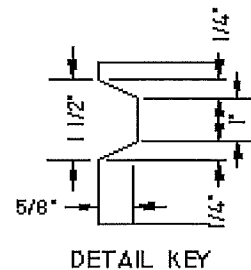


DEPT OF SAW JOINT

6" PAV. = 1 1/2"

7" PAV. = 1 3/4"

8" PAV. = 2"



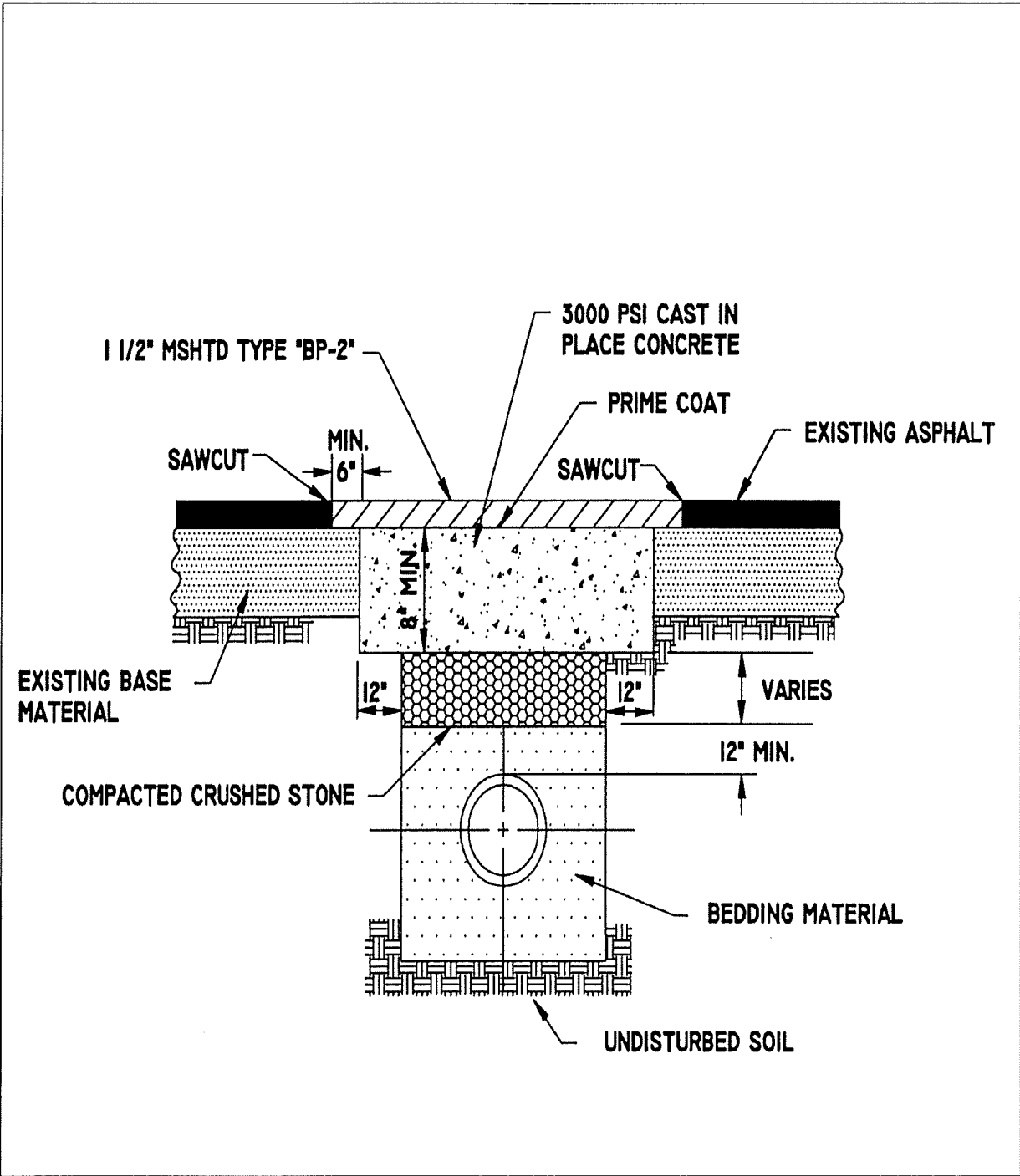
KEYWAY FORMED BY FASTENING KEY TO FORM



CONCRETE PAVEMENT
JOINT DETAILS

DATE:
01/31/99

DWG:
D9



	ASPHALT STREET REPAIR	01/31/99
		D13

SEEDING RATES

BROADCAST

DRILLED SODDED

Tall Fescue	30 lbs./acre	25 lbs./acre solid
Kentucky Bluegrass	3 lbs./acre	2 lbs./acre solid
Red Fescue	10 lbs./acre	7 lbs./acre
Wheat or Rye	120 lbs./acre	100 lbs./acre
Annual Ryegrass	100 lbs./acre	100 lbs./acre

SEEDING DATES

Perennial Grasses:	March 1 to May 15 or August 15 to October 15
Temporary Cover:	May 15 to November 15
Overseeding:	November 15 to March 1

MULCH RATES

Wheat straw: 100 lbs. Per 1000 square feet (4,500 lbs./acres)

FERTILIZER RATES

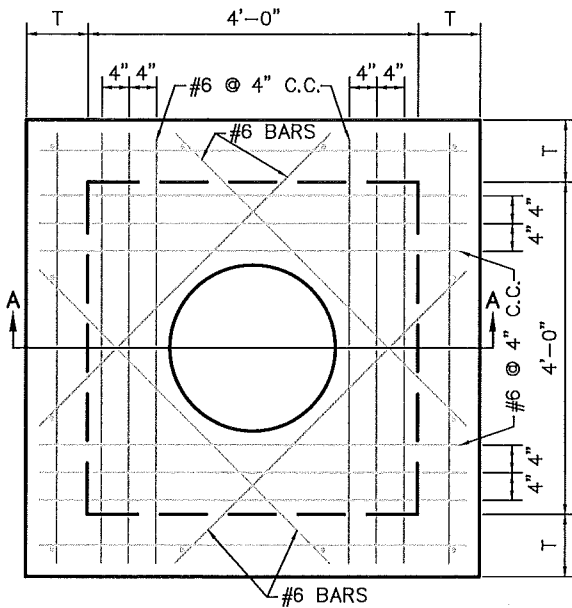
Nitrogen:	90 lbs./acre
Phosphate:	90 lbs./acre
Potassium:	90 lbs./acre
Lime:	1500 lbs./acre ENM*

*ENM-Effective Neutralizing Material as per State evaluation of quarried rock.



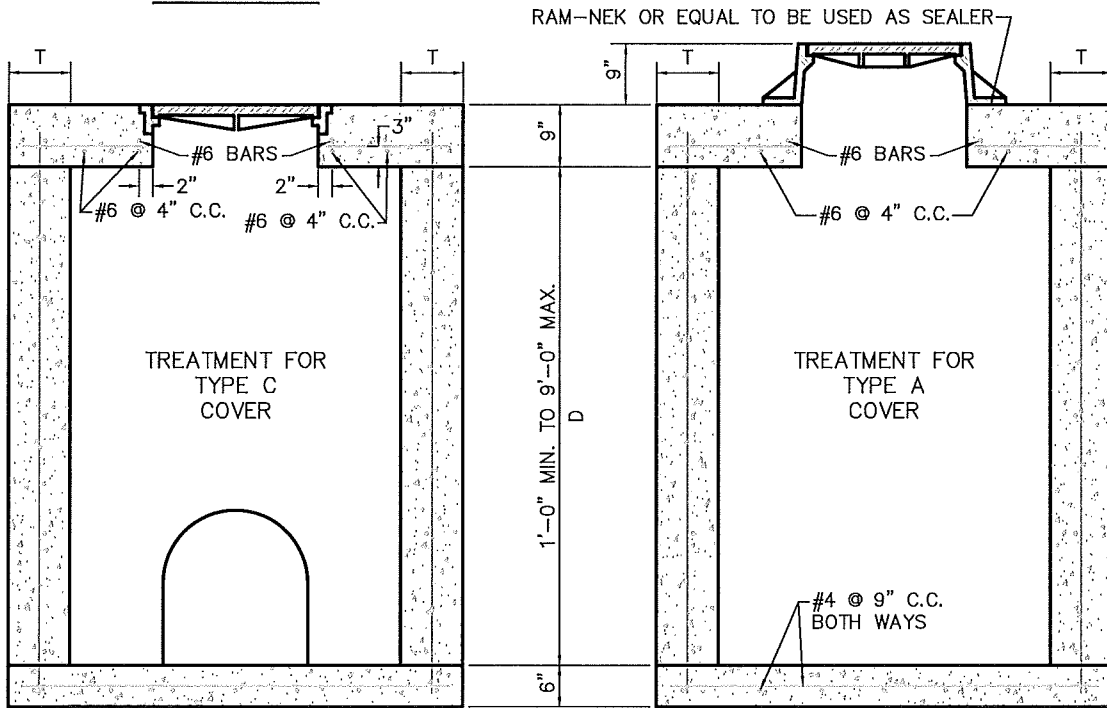
**SEEDING, MULCH &
FERTILIZER**

DATE: 7 / 8 / 15
DWG: G1



PLAN

STANDARD JUNCTION BOX					
TABLE OF REINFORCEMENT				WALL THICK. "T"	CONC. CU. YDS.
"D"	VERT. BARS	HOR. BARS			
1'-0"	NONE	NONE		9"	1.93
2'-0"	"	"		9"	2.45
3'-0"	"	"		9"	2.98
4'-0"	"	"		9"	3.50
5'-0"	12 #5 @ 18" C.C. 5'-11" EACH	20 #4 @ 14" C.C. 5'-2" EACH		9"	4.03
6'-0"	12 #5 @ 18" C.C. 6'-11" EACH	20 #4 @ 17" C.C. 5'-2" EACH		9"	4.55
7'-0"	20 #5 @ 12" C.C. 7'-11" EACH	24 #4 @ 16" C.C. 5'-2" EACH		9"	5.08
8'-0"	20 #5 @ 12" C.C. 8'-11" EACH	28 #4 @ 15" C.C. 5'-2" EACH		9"	5.61
9'-0"	20 #5 @ 12" C.C. 9'-11" EACH	28 #4 @ 17" C.C. 5'-2" EACH		9"	6.14
STEEL IN TOP SLAB		16 #6	5'-2" EACH		
		4 #6	5'-0" EACH		
STEEL IN BOTTOM		14 #4	5'-2" EACH		
SEE DRAWINGS FOR STEEL PLACEMENT					



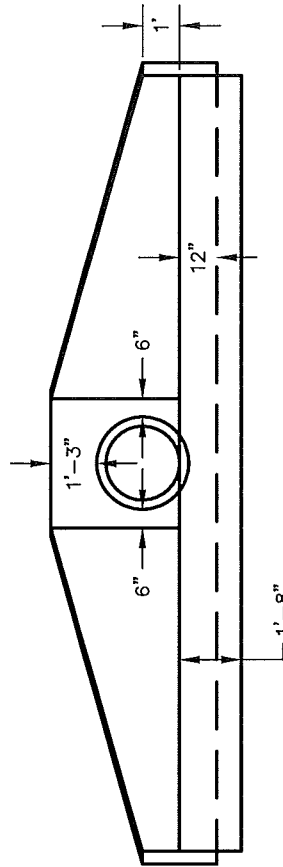
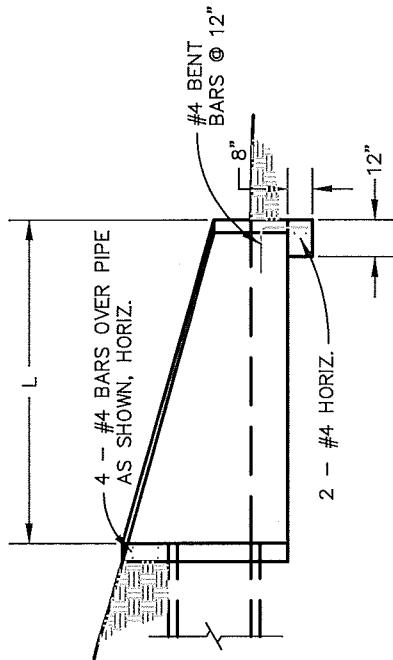
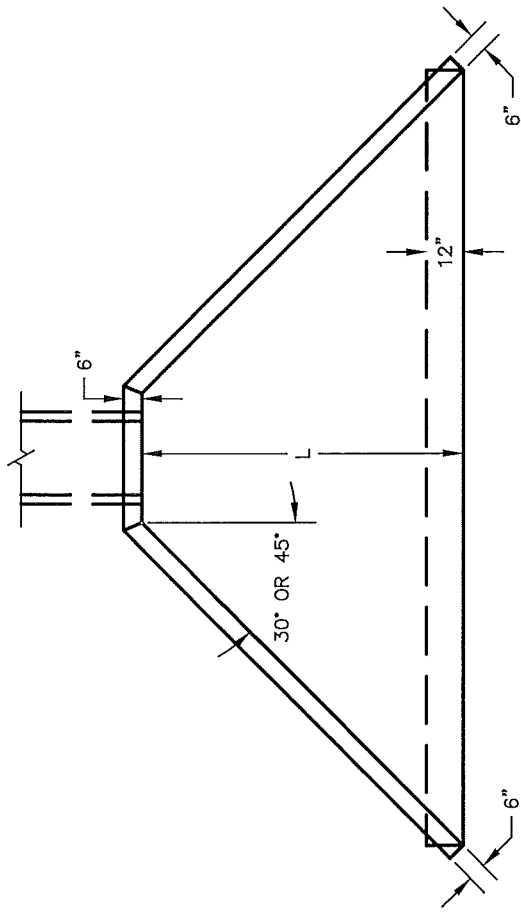
SECTION AA

- DIAGONAL BARS IN TOP SLAB PLACED NEAR BOTTOM OF SLAB.
- REINFORCING BARS SHALL BE CUT OR BENT AT PIPE OPENINGS.
- ALL PIPES SHALL FIT FLUSH WITH INSIDE FACE OF BOX.
- MAXIMUM PIPE SIZE FOR BOX IS 42". FOR LARGER PIPES INCREASE INSIDE BOX DIMENSIONS TO THE INSIDE PIPE DIAMETER PLUS 6". USE GIVEN BAR SPACING FOR LARGER BOXES. MAXIMUM ALLOWABLE BOX SIZE IS 72".
- BOTTOM OF BOX TO BE FILLED WITH CONCRETE TO MID-DEPTH OF PIPE FORMING CHANNELS TOWARD OUTLET PIPE FROM ALL INLET PIPES.
- ALL CONCRETE SHALL HAVE 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI
- ALL REINFORCING BARS TO BE DEFORMED BARS AND MEET REQUIREMENTS OF ASTM A-615 MIN. GRADE 40.
- 4" BEDDING MATERIAL TO BE USED UNDER BOX.
- IF BOX IS GREATER THAN 9' DEEP, MUST BE SPECIAL DESIGN.



JUNCTION BOX

DATE: 7/8/15
 DWG: G7



HEADWALL AND WINGWALLS TO BE CAST IN PLACE AROUND END OF RCP PIPE. STEEL IN HEADWALL TO BE #4 BARS @ 12" O.C. EACH WAY.

L IS BASED ON A 2.5:1 SLOPE

CULVERT HEIGHT OR DIAMETER	L
15"	6'-9"
18"	7'-6"
21"	8'-3"
24"	8'-9"
27"	9'-3"
30"	10'-3"
36"	11'-6"
42"	13'-0"
48"	14'-3"



PIPE HEADWALL AND WINGWALLS

30° & 45°

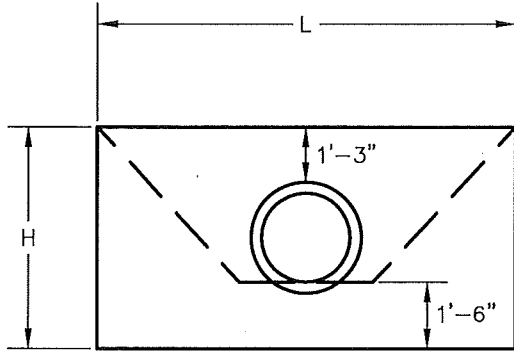
DATE:

7/8/15

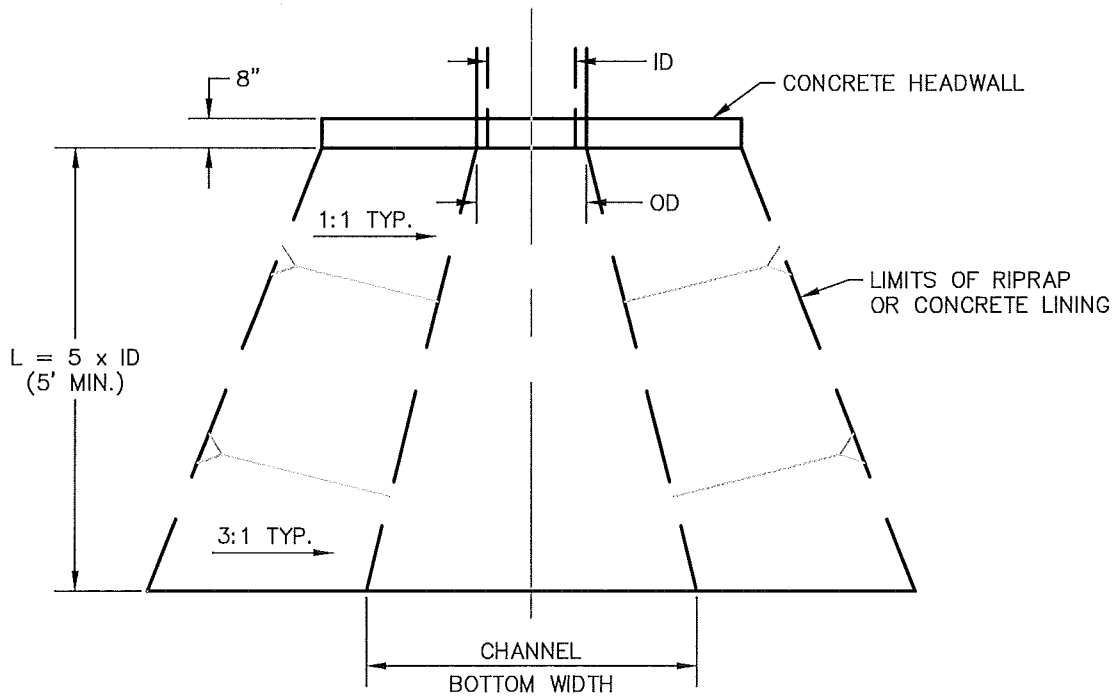
DWG:

G11

PIPE DIAMETER	L	H
15"	7'-0"	4'-3"
18"	8'-0"	4'-6"
21"	8'-9"	4'-9"
24"	9'-6"	5'-0"
27"	10'-6"	5'-3"
30"	11'-6"	5'-6"
36"	13'-0"	6'-0"
42"	14'-6"	6'-6"
48"	16'-0"	7'-3"



REINFORCEMENT: #4's @ 12", EACH WAY

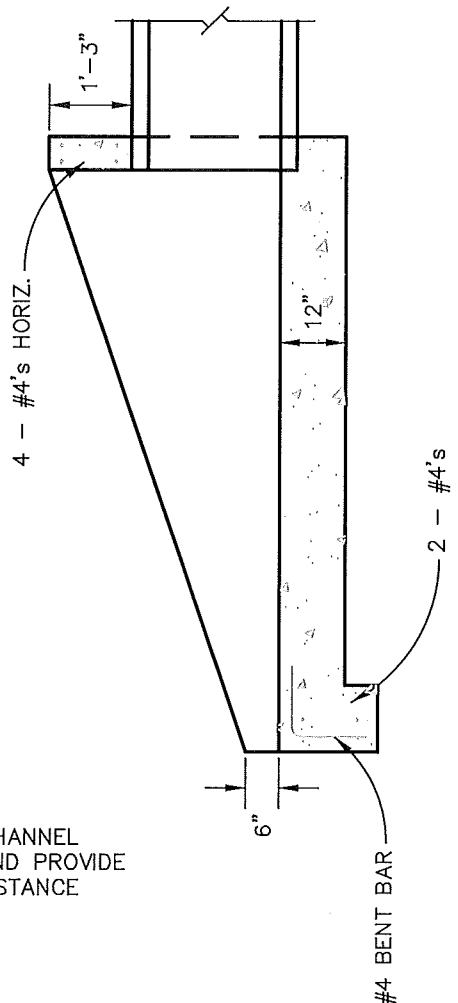
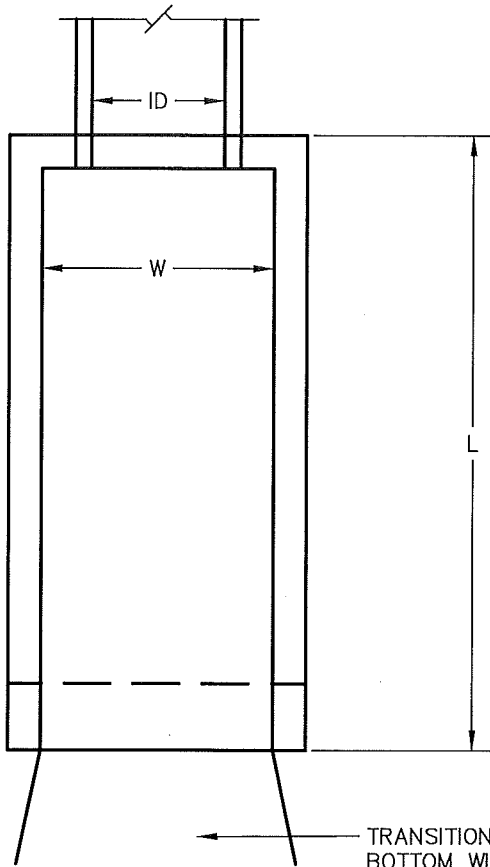


NOMINAL RIP RAP SIZE SHALL BE DESIGNED BY THE ENGINEER ACCORDING TO THE MAXIMUM OUTLET VELOCITIES AND SHEAR STRESSES. GEOTEXTILE FABRIC SHALL BE INSTALLED UNDERNEATH RIP RAP PAD.

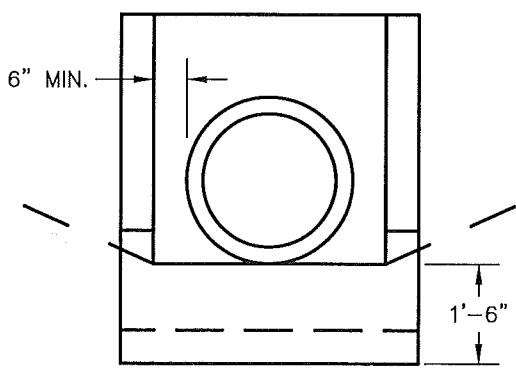


STRAIGHT HEADWALL & RIP RAP PROTECTION

DATE: 7/8/15
DWG: G12



TRANSITION TO CHANNEL
BOTTOM WIDTH AND PROVIDE
RIPRAP FOR A DISTANCE
OF 5 x ID.

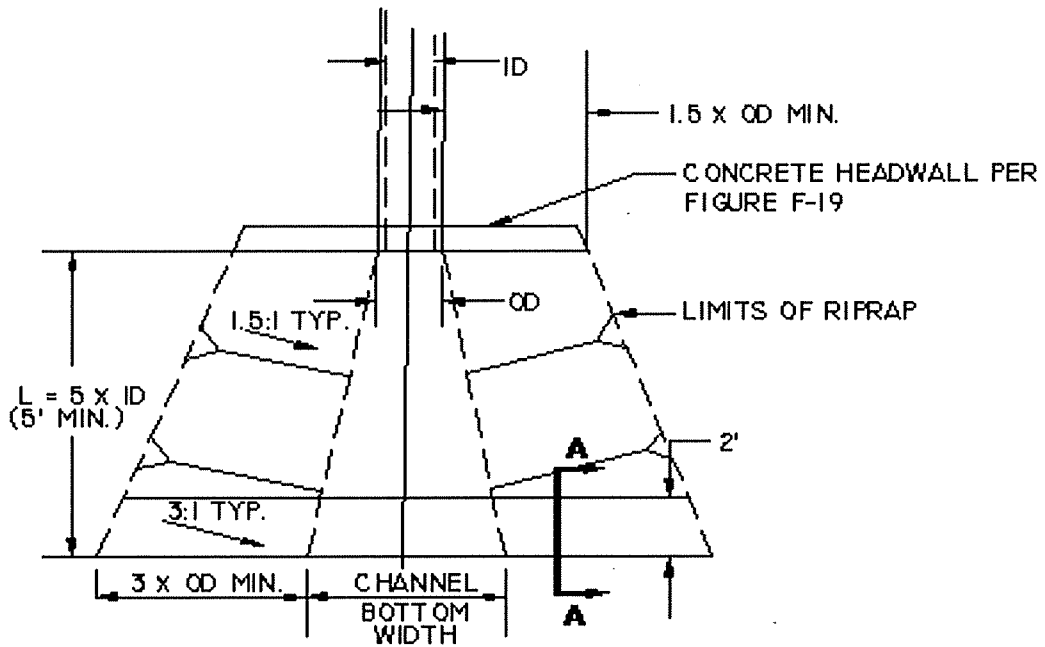


PIPE DIAMETER	L	H
15"	6'-9"	2'-9"
18"	7'-6"	3'-0"
21"	8'-3"	3'-3"
24"	8'-9"	3'-6"
27"	9'-3"	3'-9"
30"	10'-3"	4'-3"
36"	11'-6"	4'-9"
42"	13'-0"	5'-3"
48"	14'-3"	6'-0"



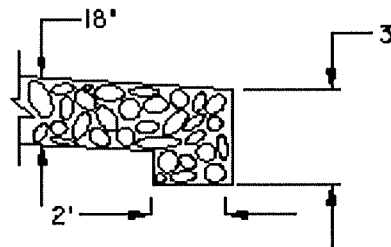
STANDARD U-SHAPED CONCRETE HEADWALL

DATE: 7/8/15
DWG: G13



PIPE I.D. L
(INCHES) (FEET)

12	5.0
15	6.5
18	7.5
24	10.0
30	12.5
36	15.0
42	17.5
48	20.0
54	22.5
60	25.0



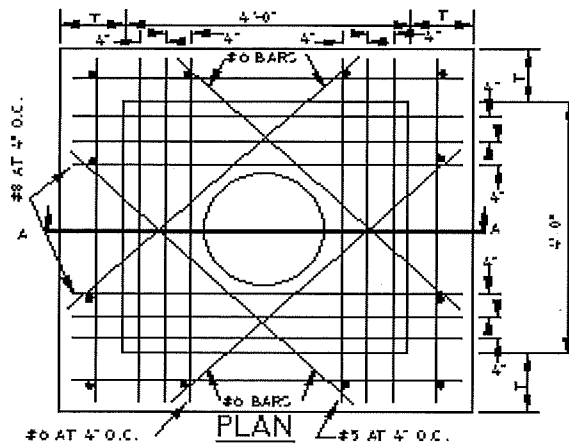
**SECTION A-A
TOE WALL**



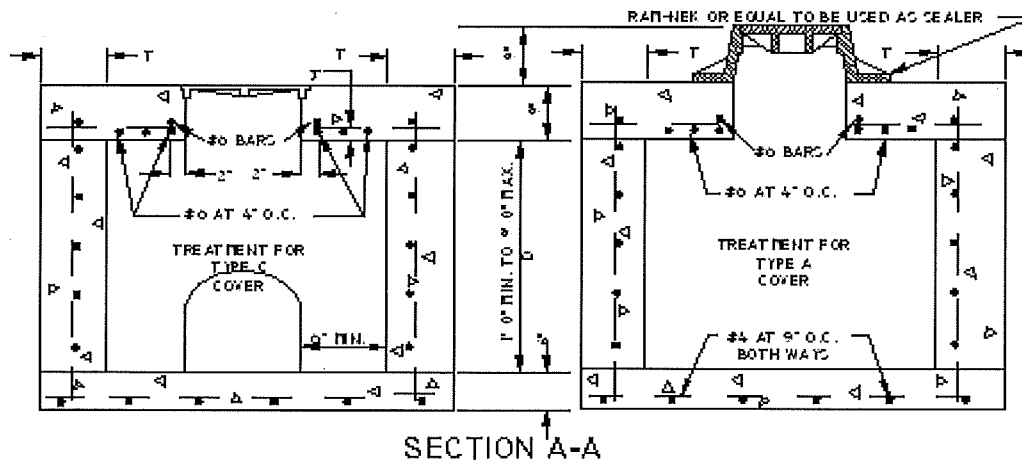
**OUTLET EROSION PROTECTION
CULVERT & STORM SEWER OUTLETS**

DATE: 01/31/99

DWG: G18



STANDARD JUNCTION BOX			
TABLE OF REINFORCEMENT			WALL THICK 'I'
'D'	VERT. BARS	HOR. BARS	
1'-4"	NONE	NONE	0"
1'-8"	NONE	NONE	0"
2'-4"	NONE	NONE	0"
2'-8"	NONE	NONE	0"
3'-4"	12 #5 AT 18" O.C.	24 #4 AT 18" O.C.	0"
3'-8"	5'-4" EACH	5'-2" EACH	0"
4'-4"	12 #5 AT 18" O.C.	24 #4 AT 18" O.C.	0"
4'-8"	6'-4" EACH	5'-2" EACH	0"
5'-4"	24 #5 AT 12" O.C.	24 #4 AT 18" O.C.	0"
5'-8"	7'-4" EACH	5'-2" EACH	0"
6'-4"	24 #5 AT 12" O.C.	24 #4 AT 18" O.C.	0"
6'-8"	1'-4" EACH	5'-2" EACH	0"
7'-4"	24 #5 AT 12" O.C.	24 #4 AT 18" O.C.	0"
7'-8"	0'-4" EACH	5'-2" EACH	0"
STEEL IN TOP SLAB		16 #5 - 5'-2" EACH	
STEEL IN BOTTOM		4 #6 - 5'-8" EACH	
SEE DRAWINGS FOR STEEL PLACEMENT			



1. DIAGONAL BARS IN TOP SLAB PLACED NEAR BOTTOM OF SLAB.
2. REINFORCING BARS SHALL BE CUT OR BENT AT PIPE OPENINGS.
3. ALL PIPES SHALL FIT FLUSH WITH INSIDE FACE OF BOX.
4. MAXIMUM PIPE SIZE FOR BOX IS 36". FOR LARGER PIPES INCREASE INSIDE BOX DIMENSIONS TO THE INSIDE PIPE DIAMETER PLUS 12". USE GIVEN BAR SPACING FOR LARGER BOXES. MAXIMUM ALLOWABLE BOX SIZE IS 72".
5. BOTTOM OF BOX TO BE FILLED WITH CONCRETE TO MID DEPTH OF PIPE FORMING CHANNELS TOWARD OUTLET PIPE FROM ALL INLET PIPES.
6. IF BOX IS GREATER THAN 9', MUST BE SPECIAL DESIGN.
7. MUST MAINTAIN 6" CLEARANCE BETWEEN THE PIPE AND ALL WALLS (SLAB) FOR PRECAST BOXES.



STANDARD JUNCTION BOX

DATE: 01/31/99
DWG: G22

GEOTECHNICAL ENGINEERING REPORT

Ashley Drive New 1-MGal Composite Water Tower
Nixa, Missouri

Prepared for:
City of Nixa, Missouri



10/3/2024
October 2024

Olsson Project No. 024-02777

Missouri Certificate
of Authorization #: 001592





October 3, 2024

City of Nixa, Missouri
Attn: Mr. Travis Cossey
1111 Kathryn Street
Nixa, Missouri 65714

RE: Geotechnical Engineering Report
Ashley Drive New 1-MGal Composite Water Tower
Ashley Drive and W Tracker Road
Nixa, Missouri
Olsson Project No. 024-02777

Dear Mr. Cossey,

Olsson, Inc. has completed the authorized geotechnical exploration for the new 1-MGal Composite Water Tower. This report presents the findings of the field exploration and laboratory testing programs, discusses the observed subsurface conditions, and based on our interpretation of the logs, provides deep foundation design recommendations for the new water tower. A boring location map, boring logs, and a description of our exploration program are provided in **Appendix A**. Laboratory test results are in **Appendix B**. Rock core photographs are in **Appendix C**.

We appreciate the opportunity to provide our geotechnical engineering services for this project and are prepared to provide the recommended foundation observation services as well. If you have any questions or need further assistance, please contact us at your convenience.

Respectfully submitted,
Olsson, Inc.
Missouri Certificate of Authority No. 001592

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- Appendix A Exploration Maps, Logs, and Information
- Appendix B Laboratory Test Results
- Appendix C Rock Core Photographs

EXECUTIVE SUMMARY

This Executive Summary provides a limited overview of the report and is subject to any and all clarifications, conditions, contingencies, limitations and/or qualifications that may exist in the body of the report.

Project Description	
Project Description	The proposed 1-MGal composite water tower will have a height of about 140 feet and a diameter of about 70 feet. The total load for the tank is expected to be about 11,000 kips. The magnitude of the overturning moments are anticipated to be in the range of 13,200 kip-feet due to wind and 37,000 kip-feet due to earthquake loading.
Subsurface Conditions	
On-Site Fill	Fill was encountered to depths ranging from 13 feet to 18 feet. The fill consisted of clay soils intermixed with silt, sand and gravel.
Native Clay Soils	The native clay soils were generally silty, moist and contained variable amounts of chert gravel. The clays were stiff in the upper 10 to 15 feet. As the borings progressed deeper into the clay mantel, the clay soils became soft to very soft, and moist to very moist. Weathered limestone seams were noted within the clay mantel.
Limestone Bedrock	The Burlington-Keokuk limestone formation was encountered at the base of each boring at depths of 28 to 76 feet. Significant variation in the depth to bedrock should be anticipated at this site.
Subsurface Water Conditions	Water was not encountered during auger drilling operations. As the borings were advanced with rotary wash and rock coring techniques, water level readings could not be obtained upon completion of the borings.
Geotechnical Considerations	
Deep Foundations	The proposed water tower should be supported on drilled shafts bearing at least 12 inches into competent limestone bedrock, which was encountered at our borings at depths ranging from 28 feet to 76 feet. The depth to top of bedrock varried signifacntly across relatively short distances. The bearing elevations of the drilled shafts should be expected to vary across the site. Weathered limestone seams were also present within the clay mantel. Hard rock removal techniques (core barrels and rock augers) should be anticipated to advance the drilled shafts. The base of the drilled shafts should be observed by the Geotechnical Engineer of Record to evlaute the bedrock before concrete placement.

Figure 2. Project Site Location



2. SUBSURFACE CONDITIONS

2.1 Subsurface Profile

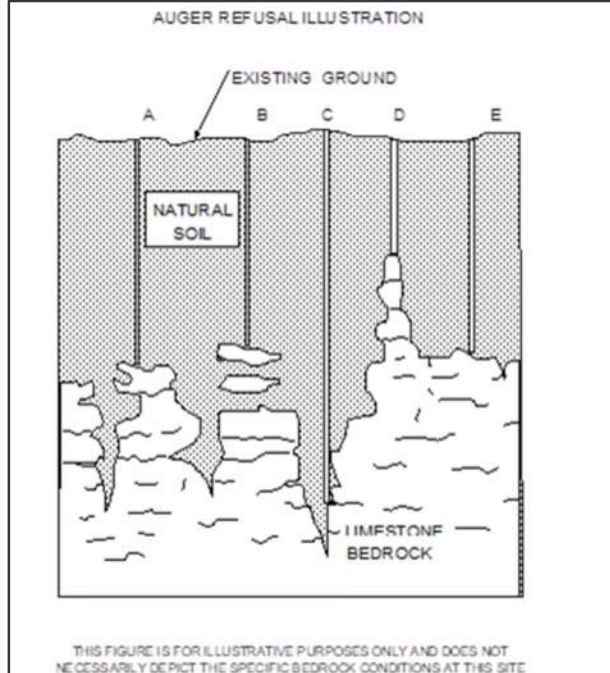
The appended borehole reports represent subsurface conditions at the specific boring locations at the time of our field exploration; variations may occur between or beyond the borings. The stratification lines shown on the logs represent the approximate boundary between material types. However, the transition between layers may be gradual.

Underlying the relatively thin organic rootzone layer, previously placed fill extended to depths ranging from 13 feet to 18 feet at the boring locations. The fill we encountered generally consisted of clay soils intermixed with variable amounts of gravel, sand, and silt, although other materials, including rock fragments and debris, could be present in the fill. Any records regarding placement of the fill, if available, should be made available to **Olsson** for review.

Below the fill, native highly plastic (fat) clay soils extended to depths ranging from 28 feet to 76 feet below the existing ground surface. The native soils were generally silty, moist to very moist, and contained varying amounts of chert gravel. The upper 10 to 15 feet of the native clay soils were generally stiff, but the soils tended to soften with increasing depth.

Limestone bedrock, belonging to the Burlington-Keokuk formation, was encountered below the native clay soils. The approximate depth to auger refusal on the limestone varied greatly between the borings, ranging from 28 feet to 76 feet. The drill crew did note weathered limestone seams within the clay soils in the borings that encountered deeper bedrock. The variation in bedrock depth, in conjunction with the limestone seams noted at the borings, suggests that the bedrock at this site is pinnacled, as shown in **Figure 3**. At the boring locations, the drill crew obtained rock core samples of the bedrock. The rock core samples obtained exhibited Rock Quality Designations (RQD) generally ranging from 66 percent to 100 percent. The upper limestone at boring B-2 was noted to have an RQD of 0 in the upper 6 inches. RQD is the percent of total length cored consisting only of sound pieces at least 4 inches or more in length and is a measure of the integrity of the rock mass in-situ. Based on RQD, rock quality can be generally described as excellent to fair.

Figure 3. Pinnacled Bedrock



2.2 Water Level Observations

The drill crew observed the boreholes for free water while auger drilling, but prior to rotary wash drilling and rock coring. These techniques introduce water into the boreholes, masking actual water levels. Although water was not observed in the borings, this does not mean the borings terminated above water. Water levels will fluctuate over time with variations in precipitation, site grading, drainage, fill, and adjacent land use. Perched subsurface water conditions can also develop at the interface between cohesive soils and limestone bedrock. Long-term monitoring with piezometers generally provides a more representative indication of the potential range of subsurface water conditions. Such monitoring was not completed as part of this exploration.

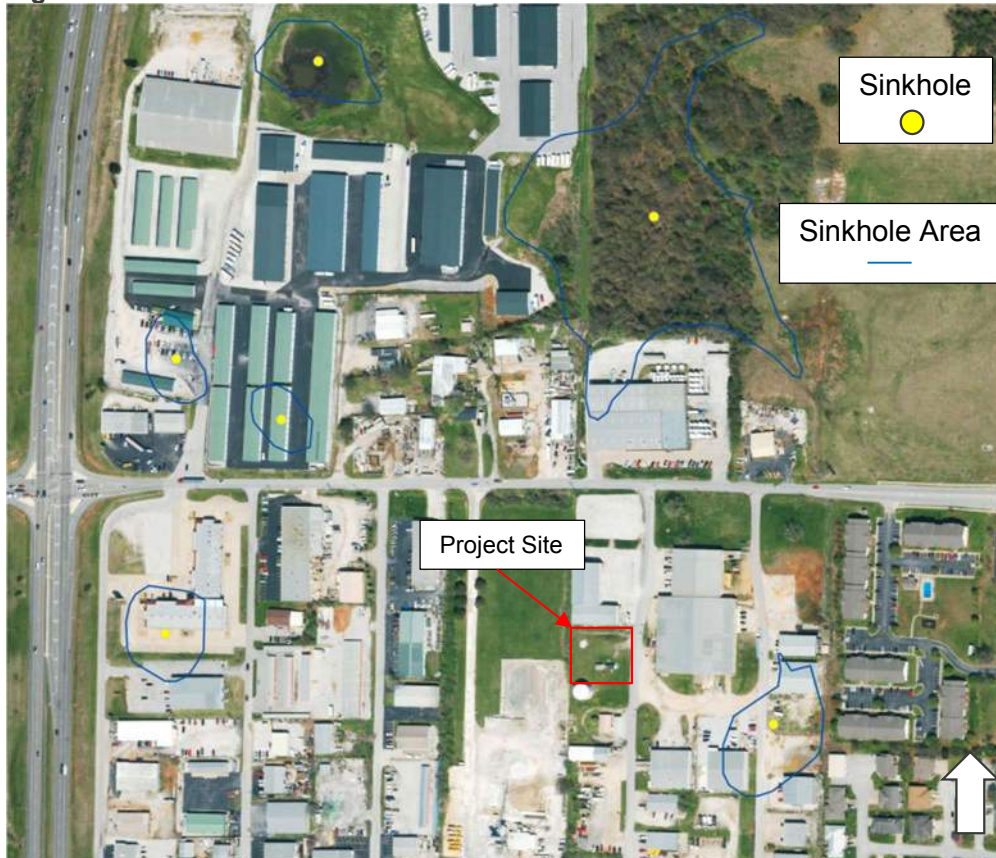
Olsson can provide additional monitoring upon written request of the Owner and/or **Olsson's** client.

3. GEOTECHNICAL CONSIDERATIONS

In our opinion and based on the soil conditions observed at the borings, the 1-MGal composite water tower should be supported on drilled shafts that extend to limestone bedrock. The bedrock surface was irregular, and weathered limestone seams were noted in the clay soil mantel at a few boring locations. These conditions and differences in top of rock elevations are indicative of pinnacled bedrock. Although limestone seams were noted at the borings, slabs of un-weathered bedrock could be suspended in the residual soil matrix ("floaters"). In addition, rock "pinnacles" rising above the surrounding bedrock surface and widened joints that may extend well below the surrounding bedrock surface should be expected at this site. The drilled shaft foundations supporting the water tower will need to extend and bear on competent limestone bedrock. The depths of the drilled shafts will likely vary over short distances and may need to extend through any limestone floaters and/or weathered limestone seams, and bear on suitable limestone. We suggest that the project budget allow for a sufficient contingency in the event that the drilled shafts bear at greater depths than can be inferred from the borings alone.

This exploration was performed to sample and characterize the near surface soil and bedrock conditions that would be impacted by the new water tower. The field exploration was not scoped to explore for the presence of underground caves, or solution cavities, that sometimes occur with the bedrock at greater depth. Karst features, including a sinkhole and sinks, are located in the project area. Based on a cursory review of Missouri Department of Natural Resources (MoDNR) karst maps, **Figure 4** shows several sinkholes around the site. Although our borings did not encounter any voids within the limestone at the depths explored, air filled voids could be present between the borings, or at greater depths than explored. Any construction in karst topography is accompanied by some degree of risk. To determine the likelihood of karst activity at this site, additional studies should be undertaken.

Figure 4. MoDNR Known Karst Features



The borings encountered existing fill to depths of up to 18 feet. As the four small diameter borings provide only a limited amount of data regarding the existing fill, the fill may contain soft zones, debris or significantly greater amounts of unsuitable materials than could be reasonably inferred from the boring information. Debris and fragments within the fill may not be discovered until installing the drilled shafts. Any records regarding the existing fill should be provided to **Olsson** to review, if available.

4. FOUNDATION RECOMMENDATIONS

4.1 Drilled Shaft Foundations

In our opinion, the new water tower should be supported on drilled shafts bearing at least 12 inches into competent limestone bedrock. Drilled shafts bearing on competent bedrock at this site can be designed and proportioned using an allowable end bearing pressure of 40 kips per square foot (ksf). Drilled shafts at this site should have a minimum diameter of 30 inches and a length to diameter ratio greater than 3.

As previously discussed, the top of the competent limestone bedrock varied greatly over a relatively short distance. The borings encountered weathered limestone seams within the clay mantel at significantly shallower levels than the associated top of bedrock at a couple of the borings. The bearing elevations of the drilled shafts should be expected to vary across the site. Installation of the drilled shafts could encounter limestone floaters, limestone seams, or be located partially within joints in the limestone. In addition, debris or rubble could be encountered within the portion of the drilled shafts that extend through the fill. The drilled shafts may also encounter soft and/or wet soils at greater depths. Rock augers and/or core barrels may be necessary to advance the drilled shafts through un-weathered limestone floaters and limestone seams. Although not observed at our borings, water could be encountered during installation of the drilled shaft foundations requiring temporary casing and/or dewatering.

The bearing conditions at the base of each drilled shaft should be carefully observed by **Olsson**. If evidence of voids or other karst features are encountered during installation of the drilled shafts, **Olsson** should be contacted, and additional exploration may be necessary.

The bottom of the shaft excavation should be cleared of water and loose material before placing concrete. Concrete should be placed as soon as possible, following drilled shaft excavation to minimize bearing surface disturbance. Any water accumulating in the drilled shaft excavation should be pumped from the excavation.

Drilled shaft foundations designed and constructed as recommended above would be expected to experience total and differential settlements on the order of ½ inch.

4.2 L-Pile Parameters

Recommended soil and rock parameters for the analysis of lateral deflection of drilled shaft elements under lateral loading conditions using the computer program, L-Pile, are presented in **Table 1**.

Table 1. L-Pile Parameters

Material	p-γ Curve Type	Unit Weight, pcf	Undrained Shear Strength, (c _u) psf	Strain Factor, E ₅₀	Static Soil Modulus, (K _s) pci	Uniaxial Compressive Strength, psi
On-Site Fill	Stiff Clay Above Watertable	120	500	0.01	100	--
Firm to Stiff Native Clay Soils	Stiff Clay Above Watertable	120	1,000	0.007	500	--
Soft Clay Soils	Stiff Clay Above Watertable	120	500	0.01	100	--
Limestone Bedrock	Vuggy Limestone	130	--	0.001	--	1,000

4.3 Seismic Site Classification

For this project site, the soil conditions encountered at the boring are consistent with Site Class “D” as defined by ASCE 7-16.

5. REPORT LIMITATIONS

The conclusions and recommendations presented in this report are based on the information available regarding the proposed construction, geotechnical information obtained from our field exploration and laboratory testing, as well as our experience with similar projects. Our borings and testing represent a limited statistical sampling of the subsurface. Conditions may be encountered during construction that are substantially different from those encountered in this exploration and adjustments to design and construction may be necessary.

In the event of any changes in the nature of the proposed project as outlined in this report, the opinions in this report cannot be considered valid unless **Olsson** reviews the changes, and the opinions of this report are modified or affirmed by **Olsson**.

The scope of this exploration did not include any environmental assessment for the presence of wetlands and/or hazardous or toxic materials in the soil or groundwater on or near the site. Any statements in this report regarding odors, discoloration, or suspicious conditions are strictly for the information of our client.

This report is based on generally accepted professional geotechnical engineering practice at the time of this report, within this geographic area. No warranty, express or implied, is intended or made. This report has been prepared for the exclusive use of **City of Nixa, Missouri** and their authorized representatives for specific application to the discussed project.

APPENDIX A

Exploration Maps, Logs, and Information

Field Exploration

Our drill crew advanced the borings with an all-terrain mounted drill rig using continuous-flight augers, wet rotary and rock coring techniques. Boring locations were located in the field by the drill crew using a hand-held GPS unit. The approximate locations of the borings are shown on the Boring Location Map. The boring elevations presented on the appended Borehole Reports were obtained by plotting the approximate boring locations on a site topographic map, dated August 20, 2024, and interpolating between the contour lines. These interpolated elevations are reported to the nearest foot on the logs. True surface elevations at these locations could differ due to interpolation, and other differences could occur from superposing approximate boring locations on the topographic plan. The boring locations and elevations should be considered accurate only to the degree implied by the means and methods used to define them.

Samples were obtained using the methods and at the depths shown on the logs. Recovered samples were sealed in containers, labeled, and protected for transportation to the laboratory for testing.

The drill crew prepared field boring logs during drilling operations. The field logs include drilling and sampling methods, sampling intervals, groundwater measurements, and general descriptions of the observed soil conditions. The final boring logs represent our engineering interpretation of the field logs based on visual classification and laboratory testing of the collected samples.



Boring Location Map

Ashley Drive 1-MGal Composite Water Tower
Nixa, Missouri

Olsson Project No: 024-02777

Client: City of Nixa

Last Revision Date: 9/30/2024

Engineer: JD Putnam, EI

SYMBOLS AND NOMENCLATURE

DRILLING NOTES

DRILLING AND SAMPLING SYMBOLS

SS: Split-Spoon Sample (1.375" ID, 2.0" OD)	HSA: Hollow Stem Auger	NE: Not Encountered
U: Thin-Walled Tube Sample (3.0" OD)	CFA: Continuous Flight Auger	NP: Not Performed
CS: Continuous Sample	HA: Hand Auger	NA: Not Applicable
BS: Bulk Sample	CPT: Cone Penetration Test	% Rec: Percent of Recovery
MC: Modified California Sampler	WB: Wash Bore	WD: While Drilling
GB: Grab Sample	FT: Fish Tail Bit	IAD: Immediately After Drilling
SPT: Standard Penetration Test Blows per 6.0"	RB: Rock Bit	AD: After Drilling
	PP: Pocket Penetrometer	CI: Cave In

DRILLING PROCEDURES

Soil samples designated as "U" samples on the boring logs were obtained in using Thin-Walled Tube Sampling techniques. Soil samples designated as "SS" samples were obtained during Penetration Test using a Split-Spoon Barrel sampler. The standard penetration resistance 'N' value is the number of blows of a 140 pound hammer falling 30 inches to drive the Split-Spoon sampler one foot. Soil samples designated as "MC" were obtained in using Thick-Walled, Ring-Lined, Split-Barrel Drive sampling techniques. Recovered samples were sealed in containers, labeled, and protected for transportation to the laboratory for testing.

WATER LEVEL MEASUREMENTS

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In relatively high permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels is not possible with only short-term observations.

SOIL PROPERTIES & DESCRIPTIONS

Descriptions of the soils encountered in the soil test borings were prepared using Visual-Manual Procedures for Descriptions and Identification of Soils.

PARTICLE SIZE

Boulders	12 in. +	Coarse Sand	4.75mm-2.0mm	Silt	0.075mm-0.005mm
Cobbles	12 in.-3 in.	Medium Sand	2.0mm-0.425mm	Clay	<0.005mm
Gravel	3 in.-4.75mm	Fine Sand	0.425mm-0.075mm		

COHESIVE SOILS

<u>Consistency</u>	<u>Unconfined Compressive Strength (Qu) (tsf)</u>	
Very Soft	<0.25	
Soft	0.25 – 0.5	
Firm	0.5 – 1.0	
Stiff	1.0 – 2.0	
Very Stiff	2.0 – 4.0	
Hard	> 4.0	

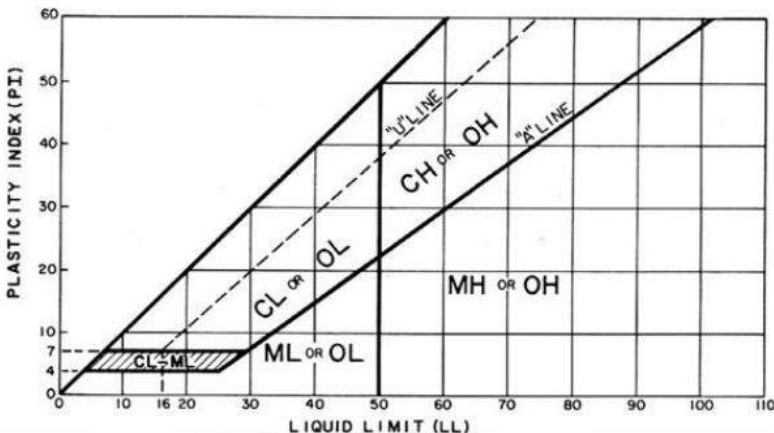
COHESIONLESS SOILS

<u>Relative Density</u>	<u>'N' Value</u>
Very Loose	0 – 3
Loose	4 – 9
Medium Dense	10 – 29
Dense	30 – 49
Very Dense	≥ 50

COMPONENT %

<u>Description</u>	<u>Percent (%)</u>
Trace	<5
Few	5 - 10
Little	15 - 25
Some	30 - 45
Mostly	50 - 100

PLASTICITY CHART



ROCK QUALITY DESIGNATION (RQD)

<u>Description</u>	<u>RQD (%)</u>
Very Poor	0 – 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 – 100

olsson

PROJECT NAME: **Ashley Drive New 1-MGal Composite Water Tower** CLIENT: **City of Nixa, Missouri**

PROJECT NUMBER: **024-02777** LOCATION: **Nixa, Missouri**

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
	<p>APPROX. SURFACE ELEV. (ft): 1282.6</p> <p>ROOT ZONE FILL</p> <p><i>Reddish brown with light brown and gray clay, silt, sand, gravel</i></p>		0								
1280											
			5	SS 1		6-9-10 N=19		18.3			
1275											
			10	U 2			2.6	19.9	101.9		
1270											
			15	SS 3	CH	5-8-9 N=17		20.3		59/39	
1265											
	<p>FAT CLAY</p> <p><i>Very stiff, red with brown, silty, chert gravel, moist</i></p>		20	SS 4		10-8-12 N=20		25.1			

CONTINUED NEXT PAGE

WATER LEVEL OBSERVATIONS		<p>OLSSON, INC. 1700 E. 123RD STREET OLATHE, KANSAS 66061</p>	STARTED: 8/29/24	FINISHED: 8/29/24
WD	∇ Not Encountered		DRILL CO.: SUB-DRILLER	DRILL RIG: CME 550X
IAD	∇ Not Performed		DRILLER: D.A.	LOGGED BY: J.D./D.S.
AD	∇ Not Performed		METHOD: C.F.A / ROTARY WASH / ROCK CORE	

PROJECT NAME Ashley Drive New 1-MGal Composite Water Tower	CLIENT City of Nixa, Missouri
--	---

PROJECT NUMBER 024-02777	LOCATION Nixa, Missouri
------------------------------------	-----------------------------------

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
1260	FAT CLAY <i>Very stiff, red with brown, silty, chert gravel, moist (continued)</i>		20								
				25	SS 5		4-6-10 N=16		45.7		
1255	<i>Switched to Wet Rotary - 28.5 feet</i>										
				30	SS 6		50/1"		45.9		
1250	Firm, red with brown, silty, chert gravel, very moist										
				35	SS 7		2-3-3 N=6		32.8		
1245	Soft, red with brown, silty, chert gravel, very moist										
				40	SS 8		3-2-2 N=4		45.7		

CONTINUED NEXT PAGE

WATER LEVEL OBSERVATIONS WD Not Encountered IAD Not Performed AD Not Performed	OLSSON, INC. 1700 E. 123RD STREET OLATHE, KANSAS 66061	STARTED: 8/29/24 FINISHED: 8/29/24 DRILL CO.: SUB-DRILLER DRILL RIG: CME 550X DRILLER: D.A. LOGGED BY: J.D./D.S. METHOD: C.F.A / ROTARY WASH / ROCK CORE
--	---	--

PROJECT NAME Ashley Drive New 1-MGal Composite Water Tower	CLIENT City of Nixa, Missouri
--	---

PROJECT NUMBER 024-02777	LOCATION Nixa, Missouri
------------------------------------	-----------------------------------

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
1240	<i>Soft, red with brown, silty, chert gravel, very moist (continued)</i>		40								
			45	SS 9		9-3-2 N=5		53.9			
1235			50	SS 10		0-0-0 N=0		52.9			
1230			55								
1225	LIMESTONE <i>Light gray to light blue gray, Burlington-Keokuk Limestone</i>		57.0'	RC 1							Recovery 100.0% RQD 58.3%
	CONTINUED NEXT PAGE										

WATER LEVEL OBSERVATIONS WD Not Encountered IAD Not Performed AD Not Performed	OLSSON, INC. 1700 E. 123RD STREET OLATHE, KANSAS 66061	STARTED: 8/29/24 FINISHED: 8/29/24 DRILL CO.: SUB-DRILLER DRILL RIG: CME 550X DRILLER: D.A. LOGGED BY: J.D./D.S. METHOD: C.F.A / ROTARY WASH / ROCK CORE
--	---	--

PROJECT NAME Ashley Drive New 1-MGal Composite Water Tower	CLIENT City of Nixa, Missouri
--	---

PROJECT NUMBER 024-02777	LOCATION Nixa, Missouri
------------------------------------	-----------------------------------

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
1220	LIMESTONE <i>Light gray to light blue gray, Burlington-Keokuk Limestone (continued)</i>		60	RC 2							100% <u>RQD</u> 100.0%
1215	<i>Unconfined Compressive Strength - 1,222 ksf</i>		65	RC 3							<u>Recovery</u> 98.3% <u>RQD</u> 88.3%
			70	RC 4							<u>Recovery</u> 100% <u>RQD</u> 100.0%
BASE OF BORING AT 72.0 FEET											

WATER LEVEL OBSERVATIONS	OLSSON, INC. 1700 E. 123RD STREET OLATHE, KANSAS 66061	STARTED: 8/29/24	FINISHED: 8/29/24	
WD Not Encountered		DRILL CO.: SUB-DRILLER	DRILL RIG: CME 550X	
IAD Not Performed		DRILLER: D.A.	LOGGED BY: J.D./D.S.	
AD Not Performed		METHOD: C.F.A / ROTARY WASH / ROCK CORE		

PROJECT NAME Ashley Drive New 1-MGal Composite Water Tower	CLIENT City of Nixa, Missouri
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PROJECT NUMBER 024-02777	LOCATION Nixa, Missouri
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="border: 1px solid black; padding: 2px;"> Split Spoon </div> <div style="border: 1px solid black; padding: 2px;"> Rock Core </div> </div> <p>APPROX. SURFACE ELEV. (ft): 1282.6</p> <p>ROOT ZONE FILL <i>Reddish brown clay, gravel, silt, sand, moist to very moist</i></p>		0								
1280			5	SS 1	CH	3-5-6 N=11				73/48	
1275			10	SS 2		6-8-9 N=17		29.4			P-200 = 50.2%
1270			15	SS 3		3-5-7 N=12		31.5			
	<p>FAT CLAY <i>Stiff, red, silty, chert gravel, very moist</i></p>		20	SS 4		4-4-4 N=8		35.5			
1265			20								
	<p>CONTINUED NEXT PAGE</p>										

WATER LEVEL OBSERVATIONS WD Not Encountered IAD Not Performed AD Not Performed	OLSSON, INC. 1700 E. 123RD STREET OLATHE, KANSAS 66061	STARTED: 8/27/24 FINISHED: 8/28/24 DRILL CO.: SUB-DRILLER DRILL RIG: CME 550X DRILLER: D.A. LOGGED BY: J.D./D.S. METHOD: C.F.A / ROTARY WASH / ROCK CORE
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PROJECT NAME Ashley Drive New 1-MGal Composite Water Tower	CLIENT City of Nixa, Missouri
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PROJECT NUMBER 024-02777	LOCATION Nixa, Missouri
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
1260	<i>Firm, red, silty, chert gravel, very moist (continued)</i>		20								
			25	SS 5		3-3-4 N=7		37.5			
1255			29.2'	SS 6		7-4-5 N=9		18.9			P-200 = 59.2%
	<i>Stiff to firm, red, silty, chert gravel, moist</i>		35	SS 7		3-2-3 N=5		29.8			
1245			38.5'	SS 8		0-1-2 N=3		33.2			P-200 = 85.9%

CONTINUED NEXT PAGE

WATER LEVEL OBSERVATIONS WD Not Encountered IAD Not Performed AD Not Performed	OLSSON, INC. 1700 E. 123RD STREET OLATHE, KANSAS 66061	STARTED: 8/27/24 FINISHED: 8/28/24 DRILL CO.: SUB-DRILLER DRILL RIG: CME 550X DRILLER: D.A. LOGGED BY: J.D./D.S. METHOD: C.F.A / ROTARY WASH / ROCK CORE
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PROJECT NAME: **Ashley Drive New 1-MGal Composite Water Tower** CLIENT: **City of Nixa, Missouri**

PROJECT NUMBER: **024-02777** LOCATION: **Nixa, Missouri**

ELEVATION (ft)	Split Spoon Rock Core MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
1240	<i>Soft, red, silty, chert gravel, very moist (continued)</i>		40								
			45	SS 9		0-2-2 N=4		41.0			
1235			50	SS 10		1-1-2 N=3		50.1			
1230			55	SS 11		0-4-2 N=6		57.5			
	<i>Firm, red, silty, chert gravel, very moist to wet</i>		53.5'								
	<i>Firm, red, silty, chert gravel, weathered limestone seams, very moist</i>		55.0'								
1225	<i>Switched to Wet Rotary - 55 feet</i>										
	CONTINUED NEXT PAGE										

WATER LEVEL OBSERVATIONS		OLSSON, INC. 1700 E. 123RD STREET OLATHE, KANSAS 66061	STARTED: 8/27/24	FINISHED: 8/28/24
WD	Not Encountered		DRILL CO.: SUB-DRILLER	DRILL RIG: CME 550X
IAD	Not Performed		DRILLER: D.A.	LOGGED BY: J.D./D.S.
AD	Not Performed		METHOD: C.F.A / ROTARY WASH / ROCK CORE	

PROJECT NAME: **Ashley Drive New 1-MGal Composite Water Tower** CLIENT: **City of Nixa, Missouri**

PROJECT NUMBER: **024-02777** LOCATION: **Nixa, Missouri**

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
1220	<i>Firm, red, silty, chert gravel, weathered limestone seams, very moist (continued)</i>		60								
			65.0'	SS 12		5-3-3 N=6		48.6			
1215	<i>Soft, red, silty, chert gravel, wet</i>		65								
			70								
1210			75	SS 13		4-2-1 N=3		68.3			
			75.9'								
1205	LIMESTONE <i>Light blue gray to light gray, Burlington-Keokuk Limestone</i>		80	RC 1							Recovery 50.0%
				RC							Recovery 100.0%
CONTINUED NEXT PAGE											

WATER LEVEL OBSERVATIONS		OLSSON, INC. 1700 E. 123RD STREET OLATHE, KANSAS 66061	STARTED: 8/27/24	FINISHED: 8/28/24
WD	∇ Not Encountered		DRILL CO.: SUB-DRILLER	DRILL RIG: CME 550X
IAD	∇ Not Performed		DRILLER: D.A.	LOGGED BY: J.D./D.S.
AD	∇ Not Performed		METHOD: C.F.A / ROTARY WASH / ROCK CORE	

PROJECT NAME Ashley Drive New 1-MGal Composite Water Tower	CLIENT City of Nixa, Missouri
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PROJECT NUMBER 024-02777	LOCATION Nixa, Missouri
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
1200	LIMESTONE <i>Light blue gray to light gray, Burlington-Keokuk Limestone (continued)</i> <i>Unconfined Compressive Strength - 710 ksf</i>		80	2							<u>RQD</u> 66.7%
1195	<i>Unconfined Compressive Strength - 992 ksf</i>		85	RC 3							<u>Recovery</u> 100.0% <u>RQD</u> 83.3%
	<i>Unconfined Compressive Strength - 1,350 ksf</i>		90	RC 4							<u>Recovery</u> 100.0% <u>RQD</u> 100.0%
BASE OF BORING AT 92.5 FEET											

WATER LEVEL OBSERVATIONS	OLSSON, INC. 1700 E. 123RD STREET OLATHE, KANSAS 66061	STARTED: 8/27/24	FINISHED: 8/28/24	
WD Not Encountered		DRILL CO.: SUB-DRILLER	DRILL RIG: CME 550X	
IAD Not Performed		DRILLER: D.A.	LOGGED BY: J.D./D.S.	
AD Not Performed		METHOD: C.F.A / ROTARY WASH / ROCK CORE		

PROJECT NAME: **Ashley Drive New 1-MGal Composite Water Tower** CLIENT: **City of Nixa, Missouri**

PROJECT NUMBER: **024-02777** LOCATION: **Nixa, Missouri**

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
	<p>APPROX. SURFACE ELEV. (ft): 1282.5</p> <p>ROOT ZONE FILL</p> <p><i>Reddish brown with gray and light brown clay, gravel, silt, sand, moist to very moist</i></p>	0.3'	0								
1280		0.3'		U 1			3.5	17.4	107.0		
1275			5								
		13.5'	10	SS 2		4-10-8 N=18		32.8			
1270			15	SS 3		4-6-9 N=15		40.4			
	<p>FAT CLAY</p> <p><i>Stiff, reddish brown, silty, gravel, moist to very moist</i></p>	13.5'	20	SS 4		8-12-12 N=24		26.9			P-200 = 70.5%

CONTINUED NEXT PAGE

WATER LEVEL OBSERVATIONS		<p>OLSSON, INC. 1700 E. 123RD STREET OLATHE, KANSAS 66061</p>	STARTED: 8/26/24	FINISHED: 8/30/24
WD	∇ Not Encountered		DRILL CO.: SUB-DRILLER	DRILL RIG: CME 550X
IAD	∇ Not Performed		DRILLER: J.D.	LOGGED BY: D.A./E.M.
AD	∇ Not Performed		METHOD: C.F.A / ROTARY WASH / ROCK CORE	

PROJECT NAME: **Ashley Drive New 1-MGal Composite Water Tower** CLIENT: **City of Nixa, Missouri**

PROJECT NUMBER: **024-02777** LOCATION: **Nixa, Missouri**

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
1260	FAT CLAY <i>Stiff, reddish brown, silty, gravel, moist to very moist (continued)</i>		20								
			25	SS 5	CH	12-7-5 N=12		39.8		84/51	
1255			28.2'								
	LIMESTONE <i>Light blue gray to light gray, Burlington-Keokuk Limestone</i> <i>Unconfined Compressive Strength - 1,118 ksf</i>		30	RC 1							<u>Recovery</u> 100.0% <u>RQD</u> 100.0%
1250			35	RC 2							<u>Recovery</u> 98.3% <u>RQD</u> 90.0%
1245	<i>Unconfined Compressive Strength - 750 ksf</i>		40								<u>Recovery</u>
	<i>Unconfined Compressive Strength - 752 ksf</i>										

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WATER LEVEL OBSERVATIONS	OLSSON, INC. 1700 E. 123RD STREET OLATHE, KANSAS 66061	STARTED: 8/26/24	FINISHED: 8/30/24
WD Not Encountered		DRILL CO.: SUB-DRILLER	DRILL RIG: CME 550X
IAD Not Performed		DRILLER: J.D.	LOGGED BY: D.A./E.M.
AD Not Performed		METHOD: C.F.A / ROTARY WASH / ROCK CORE	

PROJECT NAME Ashley Drive New 1-MGal Composite Water Tower	CLIENT City of Nixa, Missouri
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PROJECT NUMBER 024-02777	LOCATION Nixa, Missouri
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
1240	LIMESTONE <i>Light blue gray to light gray, Burlington-Keokuk Limestone (continued)</i>		40	RC 3							100.0% <u>RQD</u> 100.0%
			43.9'	RC 4							Recovery 100.0%

BASE OF BORING AT 43.9 FEET

RQD
100.0%

WATER LEVEL OBSERVATIONS	OLSSON, INC. 1700 E. 123RD STREET OLATHE, KANSAS 66061	STARTED: 8/26/24	FINISHED: 8/30/24
WD Not Encountered		DRILL CO.: SUB-DRILLER	DRILL RIG: CME 550X
IAD Not Performed		DRILLER: J.D.	LOGGED BY: D.A./E.M.
AD Not Performed		METHOD: C.F.A / ROTARY WASH / ROCK CORE	

PROJECT NAME: **Ashley Drive New 1-MGal Composite Water Tower** CLIENT: **City of Nixa, Missouri**

PROJECT NUMBER: **024-02777** LOCATION: **Nixa, Missouri**

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
	<p>APPROX. SURFACE ELEV. (ft): 1283.1</p> <p>ROOT ZONE FILL</p> <p><i>Reddish brown with light brown and gray clay, gravel, sand, silt, moist to very moist</i></p>		0								
1280											
			5	SS 1		6-7-13 N=20		28.8			P-200 = 77.4%
1275											
			10	SS 2		5-9-10 N=19		30.2			
1270											
			15	SS 3		10-5-17 N=22		28.5			P-200 = 86.3%
1265											
	<p>FAT CLAY</p> <p><i>Stiff, red, chert gravel, silty, moist to very moist</i></p>		20	SS 4	CH	3-5-5 N=10		38.6		79/47	

CONTINUED NEXT PAGE

WATER LEVEL OBSERVATIONS		OLSSON, INC. 1700 E. 123RD STREET OLATHE, KANSAS 66061	STARTED: 8/29/24	FINISHED: 8/29/24
WD	∇ Not Performed		DRILL CO.: SUB-DRILLER	DRILL RIG: CME 550X
IAD	∇ Not Performed		DRILLER: D.A.	LOGGED BY: J.D.
AD	∇ Not Performed		METHOD: C.F.A / ROTARY WASH / ROCK CORE	

PROJECT NAME: **Ashley Drive New 1-MGal Composite Water Tower** CLIENT: **City of Nixa, Missouri**

PROJECT NUMBER: **024-02777** LOCATION: **Nixa, Missouri**

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
	FAT CLAY <i>Stiff, red, chert gravel, silty, moist to very moist (continued)</i>		20								
1260											
	<i>Switched to Wet Rotary - 25 feet</i>		25	SS 5		3-4-5 N=9		47.1			
1255											
			30	SS 6		2-2-3 N=5		53.5			
1250											
			35	SS 7		4-5-5 N=10					
1245											
	LIMESTONE <i>Light blue gray to light gray, Burlington-Keokuk Limestone</i>		38.0'								
			40								Recovery

CONTINUED NEXT PAGE

WATER LEVEL OBSERVATIONS

WD Not Performed
 IAD Not Performed
 AD Not Performed

OLSSON, INC.
 1700 E. 123RD STREET
 OLATHE, KANSAS 66061

STARTED: 8/29/24 FINISHED: 8/29/24
 DRILL CO.: SUB-DRILLER DRILL RIG: CME 550X
 DRILLER: D.A. LOGGED BY: J.D.
 METHOD: C.F.A / ROTARY WASH / ROCK CORE

PROJECT NAME Ashley Drive New 1-MGal Composite Water Tower	CLIENT City of Nixa, Missouri
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PROJECT NUMBER 024-02777	LOCATION Nixa, Missouri
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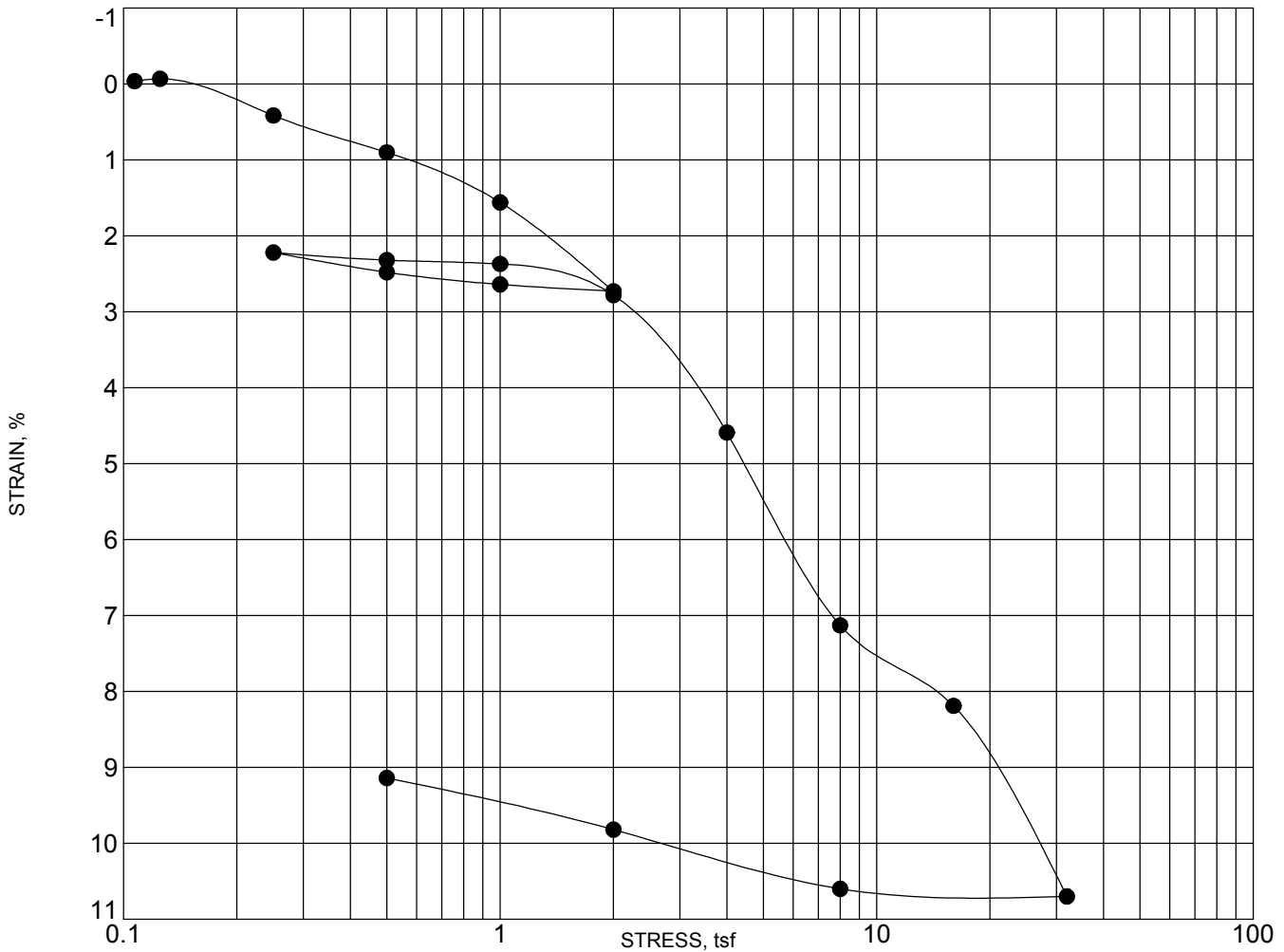
ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
1240	Unconfined Compressive Strength - 856 ksf LIMESTONE Light blue gray to light gray, Burlington-Keokuk Limestone (continued) Unconfined Compressive Strength - 868 ksf		40	RC 1							100.0% <u>RQD</u> 100.0%
1235	Unconfined Compressive Strength - 362 ksf		45	RC 2							<u>Recovery</u> 96.7% <u>RQD</u> 96.7%
	Unconfined Compressive Strength - 362 ksf		50	RC 3							<u>Recovery</u> 100.0% <u>RQD</u> 100.0%
BASE OF BORING AT 53.0 FEET											

WATER LEVEL OBSERVATIONS WD <input type="checkbox"/> Not Performed IAD <input type="checkbox"/> Not Performed AD <input type="checkbox"/> Not Performed	OLSSON, INC. 1700 E. 123RD STREET OLATHE, KANSAS 66061	STARTED: 8/29/24 DRILL CO.: SUB-DRILLER DRILLER: D.A. METHOD: C.F.A / ROTARY WASH / ROCK CORE	FINISHED: 8/29/24 DRILL RIG: CME 550X LOGGED BY: J.D.
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APPENDIX B

Laboratory Test Results

PROJECT NAME: Ashley Drive New 1-MGal Composite Water Tower CLIENT: City of Nixa, Missouri
 PROJECT NUMBER: 024-02777 PROJECT LOCATION: Nixa, Missouri



Boring No: B-1 Initial Water Content (%): 19.9 Est. Preconsolidation Stress (tsf): _____

Sample ID: U-2 Final Water Content (%): 16.3 Laboratory Water Type: Distilled Water

Sample Depth: 8.0 - 10.0' Initial Dry Density (pcf): 108.7 Test Procedure Method: NA

Start Date: 09/18/2024 Initial Void Ratio: 0.551 Interpretation Procedure: NA

Technician: W. Rogers Final Void Ratio: 0.399 Stress at Inundation (tsf): _____

Apparatus: FT II - 31 Initial Degree of Saturation (%): 96.5 Specimen Trimming Method: Ring Sampler

Specific Gravity: 2.7 Final Degree of Saturation (%): 131.4

ATTERBERG LIMITS
LL PL PI Classification

Sample Description: Reddish brown fat clay Notes: _____

APPENDIX C

Rock Core Photographs

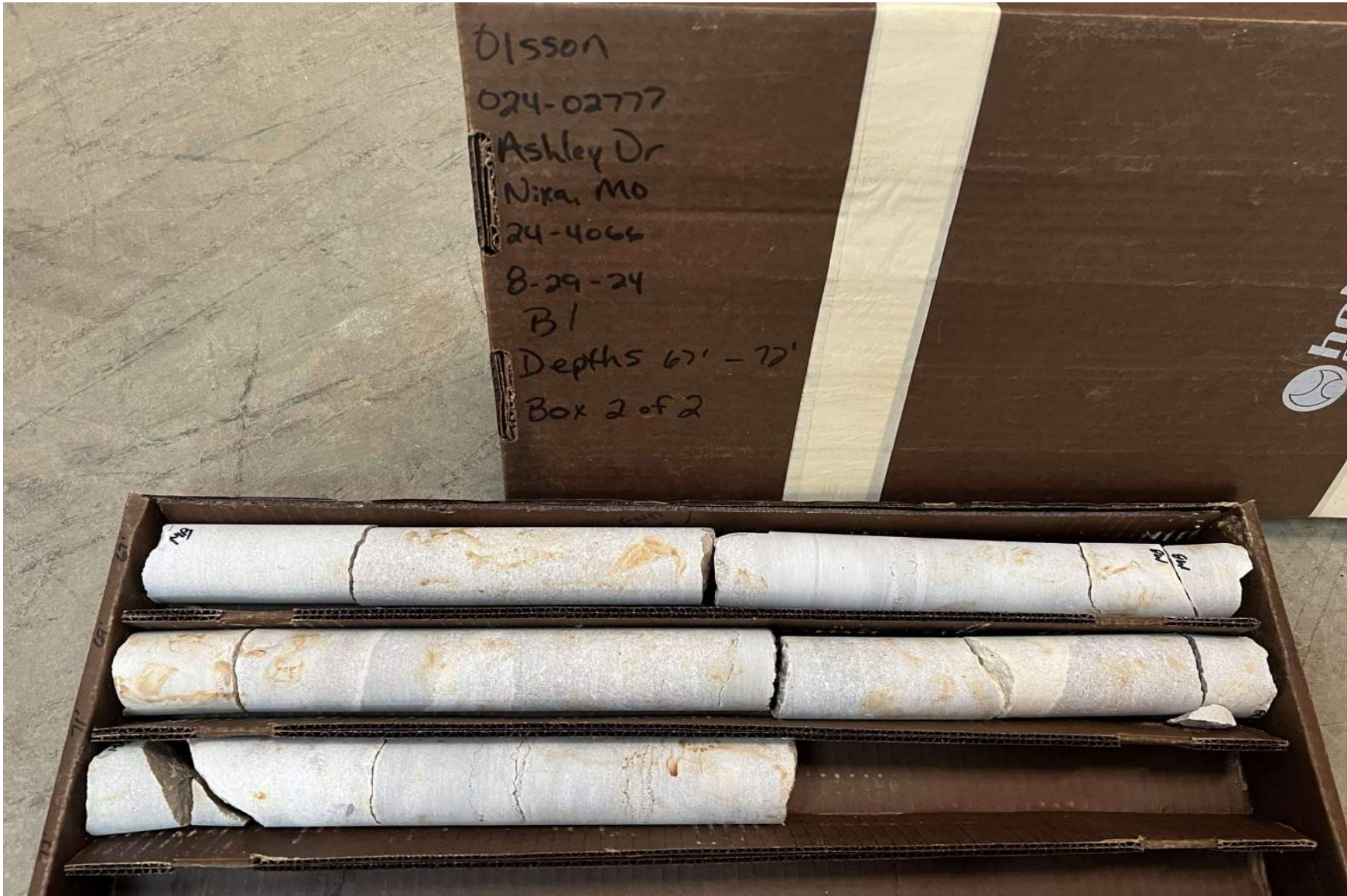


olsson

B-1: Box 1 of 2 (57'-67')

Nixa 1-MGal Water Tower
Nixa, Missouri

Olsson Project No:	024-02777
Client:	City of Nixa, Missouri
Last Revision Date:	9/9/2024
Engineer:	JD Putnam, EI



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B-1: Box 2 of 2 (67'-72')

Nixa 1-MGal Water Tower
Nixa, Missouri

Olsson Project No:	024-02777
Client:	City of Nixa, Missouri
Last Revision Date:	9/9/2024
Engineer:	JD Putnam, EI




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B-2: Box 1 of 2 (77'-87')

Nixa 1-MGal Water Tower
Nixa, Missouri

Olsson Project No:	024-02777
Client:	City of Nixa, Missouri
Last Revision Date:	9/9/2024
Engineer:	JD Putnam, EI



	B-2: Box 2 of 2 (87'-92')	Olsson Project No: 024-02777
	Nixa 1-MGal Water Tower Nixa, Missouri	Client: City of Nixa, Missouri
		Last Revision Date: 9/9/2024
		Engineer: JD Putnam, EI



olsson

B-3: Box 1 of 2 (28.2'-38.2)

Nixa 1-MGal Water Tower
Nixa, Missouri

Olsson Project No:	024-02777
Client:	City of Nixa, Missouri
Last Revision Date:	9/9/2024
Engineer:	JD Putnam, EI

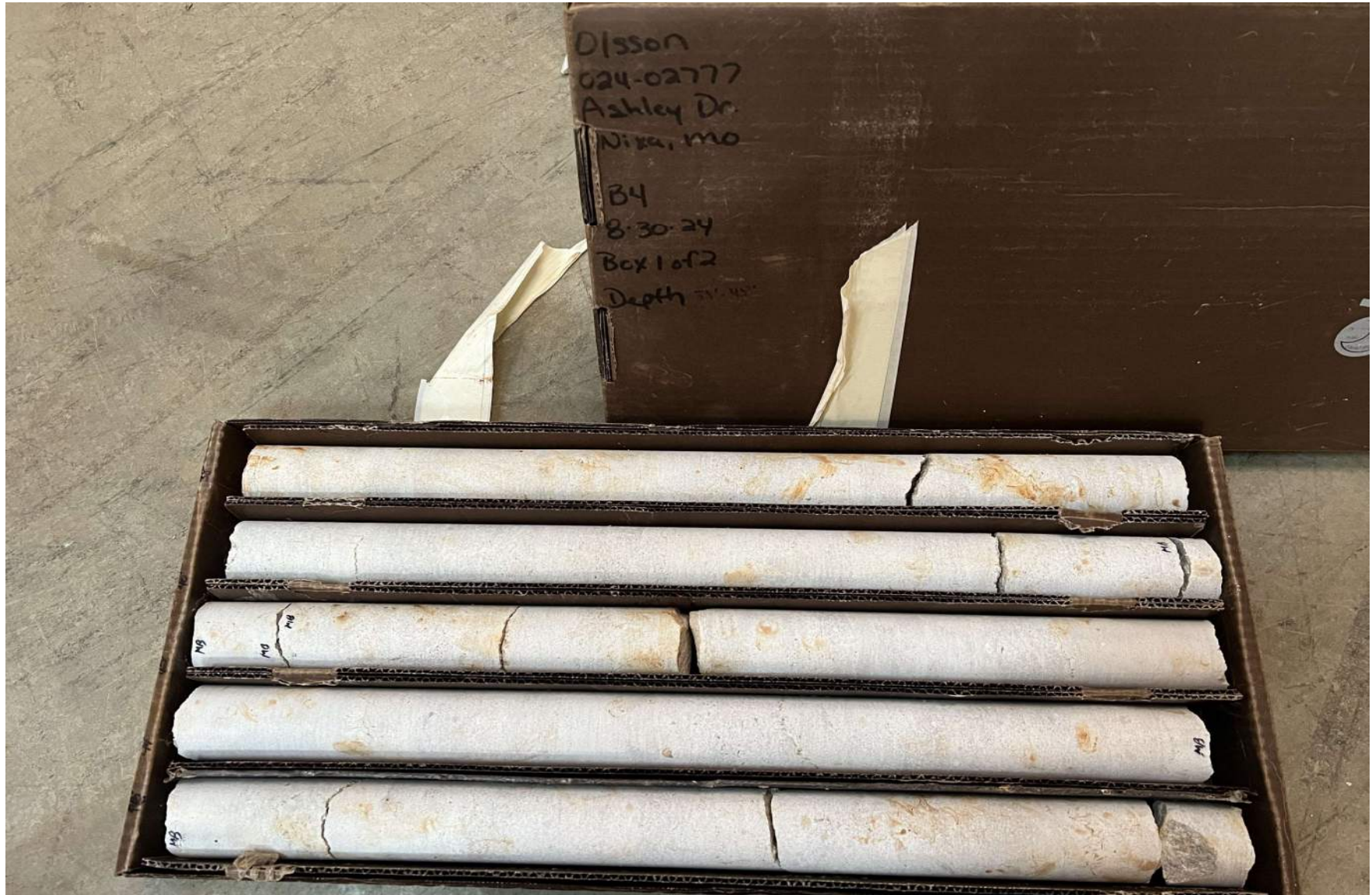


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B-3: Box 2 of 2 (38.2'-43.2')

Nixa 1-MGal Water Tower
Nixa, Missouri

Olsson Project No:	024-02777
Client:	City of Nixa, Missouri
Last Revision Date:	9/9/2024
Engineer:	JD Putnam, EI



Olsson
024-02777
Ashley Dr.
Nixa, MO
B4
8-30-24
Box 1 of 2
Depth

olsson

B-4: Box 1 of 2 (38'-48')

Nixa 1-MGal Water Tower
Nixa, Missouri

Olsson Project No:	024-02777
Client:	City of Nixa, Missouri
Last Revision Date:	9/9/2024
Engineer:	JD Putnam, EI



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B-4: Box 2 of 2 (48'-53')

Nixa 1-MGal Water Tower
Nixa, Missouri

Olsson Project No:	024-02777
Client:	City of Nixa, Missouri
Last Revision Date:	9/9/2024
Engineer:	JD Putnam, EI

ASHLEY DRIVE NEW 1-MGAL COMPOSITE WATER TOWER

Nixa, Missouri

October 2024

Olsson Project No. 024-02777

EFFECTIVE DATE:		TERMINATION DATE:		CONTRACT NUMBER:	
<input type="checkbox"/> NEW CONTRACT			<input type="checkbox"/> ADDENDUM NUMBER:		
CITY			CONTRACTOR		
Name:	City of Nixa, Missouri		Name:		
Address:	715 W. Mt. Vernon St. PO Box 395 Nixa, MO 65714		Address:		
Phone:	417.725.3785		Phone:		
Email:	tcossey@nixa.com		Email:		
Attn:	Travis Cossey		Attn:		

**CONSTRUCTION CONTRACT FOR
ASHLEY DRIVE 1-MGALLON COMPOSITE ELEVATED WATER TOWER**

THIS CONSTRUCTION CONTRACT FOR ASHLEY DRIVE 1-MGALLON COMPOSITE ELEVATED WATER TOWER ("Contract") is made and entered into upon its execution by the City of Nixa, Missouri, a constitutional charter city organized under the laws of the State of Missouri ("City") and _____, a _____ ("Contractor").

WHEREAS the City, after conducting a Request for Bid solicitation process, referenced as RFB-004-2025/Water desires to engage Contractor to perform Construction of a 1,000,000-gallon composite style elevated water storage tank, 135 feet to high water level. Work includes design, fabrication, erection, painting and disinfection of the tank, construction of a concrete foundation, installation of required internal and yard piping, electrical items, water system interconnection yard piping, site restoration, and all other appurtenant work; and

WHEREAS Contractor submitted one of the selected bids; and

WHEREAS the City desires to engage Contractor to perform such work under the terms and conditions of this Contract; and

WHEREAS the Contractor desires to perform such work under the terms and conditions of this Contract.

NOW, THEREFORE, for the considerations herein expressed, it is mutually agreed by and between the City and the Contractor as follows:

1. Manner and Time for Completion. The Contractor agrees to perform and undertake the work described herein. The Contractor shall perform said work in accordance with the standard of care, skill, and expertise ordinarily used by members of the Contractor's profession in the performance of similar work. The work is described in Exhibit A, which is attached hereto and incorporated herein by this reference ("Services"). Contractor shall furnish all supervision, labor, tools, equipment, materials, and supplies necessary to perform the Services at Contractor's own expense in accordance with the contract documents, any applicable City ordinances, and any applicable state or federal laws within 450 calendar days from the date Contractor is ordered to proceed, which order shall be issued by the City, within 30 days after the date of execution of this Contract. If such order is not issued within 30 days after execution of this Contract, then this Contract shall terminate.

2. Addition to Services. The City may add to the Services or delete therefrom services, provided that the total cost of such work does not exceed the total cost authorized herein. The Contractor shall undertake such changed activities only upon the written direction of the City. All such directives and

changes shall be in written form and shall be accepted and countersigned by the Contractor.

3. Payment.

3.1. Progress Payments. Provided that Contractor performs the Services in the manner set forth herein, the City shall pay the Contractor in accordance with the provisions set forth in Exhibit B, which shall constitute full and complete compensation for the Contractor's work. Such compensation shall be paid in progress payments, as established by the City, subject to receipt of a requisition for payment and a statement of the work provided by the Contractor for the period covered by the requisition. Such requisition shall include an acknowledgement signed by both the City and the Contractor that the Contractor has fully performed the work to be paid for in such progress payments in conformance with the Contract. If applicable, the City shall provide notice to the Contractor of any payment amount withheld and the reason for such withheld payment. The acceptance of any payment under this Contract expressly constitutes a release of the City by the Contractor and its subcontractors from any and all claims which were made or could have been made by the Contractor and its subcontractors against the City which may arise out of or are related to this Contract prior to the date of payment by City.

3.2. Retainage. City shall withhold 5% from each progress payment as retainage to ensure performance and completion of the Contract. Retainage amounts shall be paid as part of City's Final Payment to Contractor.

3.3. Payment Conditioned on Acceptable Performance. No payment shall be made by City unless the Contractor's performance for work which it seeks payment was completed in compliance with the provisions of this Contract. No partial payment to the Contractor shall operate as approval or acceptance of all work completed by Contractor prior to the date of payment.

3.4. Total compensation not to exceed. It is expressly understood that in no event shall the total compensation and reimbursement to be paid to the Contractor under the terms of this Contract exceed the sum of **[INSERT AMOUNT]** unless specifically and mutually agreed to in writing by both the City and the Contractor.

3.5. Final Completion and Final Payment.

3.5.1. Final Completion is the point at which all work under this Contract has been completed by the Contractor in strict compliance with the terms of this Contract and the Contractor is ready to receive its Final Payment. Final Completion will only occur when all of the following conditions, unless waived in writing by the City, have been satisfied:

3.5.1.1. All work is complete and in compliance with this Contract.

3.5.1.2. Contractor has submitted to the City a Final Payment Application for all funds remaining due under the Contract.

3.5.1.3. Contractor has completed all of its obligations under this Contract, including, without limitation, provided all manufacturer's warranties or any other warranties which are part of the project, provided any manuals for the operation and maintenance of equipment and systems which are part of the project, provided any as-builts or other drawings, any documentation transferring to City ownership of all equipment and materials which are part of the project, and any other close-

out requirements reasonably required by the City.

3.5.1.4. Contractor has delivered to the City a final claim statement setting forth in detail all claims of any kind pending against the City or any indemnitee connected with or arising out of this Contract that are pending but not yet resolved. Any claim not specified by the Contractor, whether on behalf of itself or of its subcontractors, shall be deemed waived.

3.5.2. The Contractor shall notify the City, in writing, when it considers Final Completion achieved. After receiving such notice, the City shall, within a reasonable time, thereafter, schedule an inspection of the work to determine if Final Completion has been achieved. If the City determines that Final Completion has not been achieved, the City shall promptly provide the Contractor with a list of items to be completed or corrected to enable City to certify that Final Completion has been achieved. The Contractor shall promptly perform such work and notify the City upon completion so another inspection can be scheduled. If the City determines that Final Completion has been achieved, the City shall promptly notify the Contractor that all requirements have been met.

3.5.3. The acceptance of Final Payment under this Contract expressly constitutes a release of the City by the Contractor and its subcontractors from any and all claims which were made or could have been made by the Contractor and its subcontractors against the City which may arise out of or are related to this Contract.

3.6. Liquidated Damages. The parties mutually and expressly agree that time of completion of work by the Contractor is of the essence due to the fact that _____. Should Contractor, or in the case of default, the surety, fail to substantially complete the work within the time specified in this Contract, or within such extra time as may be allowed, Contractor (or surety) shall be liable to the City in the amount of \$500 per day for each and every calendar day that the performance of this Contract remains uncompleted after the time allowed for substantial completion, as liquidated damages, and not as a penalty, it being stipulated that actual damages to the City and the public arising from Contractor's failure to timely complete the work would be difficult, if not impossible, to ascertain. The amount assessed as liquidated damages may be withheld from any funds otherwise due to Contractor from the City. The Services are not considered complete until final acceptance by the City.

4. Exchange of Data and Cooperation. All information, data, and reports in the City's possession and necessary for the carrying out of the Services, shall be furnished to the Contractor without charge, and the parties shall reasonably cooperate with each other in every possible way in the carrying out of the Services.

5. Personnel. The Contractor represents that Contractor shall secure at Contractor's own expense all personnel required to perform the Services. Such personnel shall not be considered employees of the City. All the Services required hereunder shall be performed by the Contractor or under Contractor's direct supervision and all personnel engaged in the work shall be fully qualified and shall be authorized under state and local law to perform such Services. None of the Services covered by this contract shall be subcontracted without the prior written approval of the City.

6. Term. This Contract shall commence upon its full execution by the Parties and shall continue until the completion and acceptance by the City of the Services, unless sooner terminated pursuant to Paragraph 7.

7. Termination.

7.1. Termination for breach. Failure of Contractor to fulfill Contractor's obligations under this Contract in a timely and satisfactory manner in accordance with the terms of this Contract shall constitute a breach of the Contract, and the City shall thereupon have the right to immediately terminate the Contract. The City shall give written notice of termination to the Contractor. In the event of any litigation arising from breach of this Contract, the City shall be entitled to recover from the Contractor all reasonable costs incurred for such litigation, including staff time, court costs, attorney fees, and all other related expenses incurred in such litigation.

8. City's Right to Proceed. In the event this Contract is terminated, the City may take over the work and prosecute the same to completion, by contract or otherwise, and Contractor and its sureties shall be liable to the City for any costs over the amount of this Contract thereby occasioned by the City. In any such case, the City may take possession of, and utilize in completing the work, such materials, appliances and structures as may be on the work site and are necessary for completion of the work. The foregoing provisions are in addition to, and not in limitation of, the rights of the City under any other provisions of the contract, city ordinances, and state and federal laws.

9. Confidentiality. Any reports, data, or similar information given to, prepared or assembled by the Contractor under this Contract shall be considered the property of the City and shall not be made available to any individual or organization by the Contractor without prior written approval of the City. The provisions of this Paragraph shall survive the termination or expiration of this Contract.

10. Conflict of Interest. Contractor certifies that no member or officer of its firm or organization is an officer or employee of the City of Nixa, Missouri, or any of its boards or agencies, and further that no officer or employee of the City has any financial interest in this Contract which would violate any applicable federal regulations or the provisions of RSMo. Section 105.450 et seq or the provisions of Nixa City Charter Section 13.1.

11. Assignment. Neither party may assign, transfer, or delegate any or all of its rights or obligations under this Contract, including by operation of law, change of control, or merger, without the prior written consent of the other party. No assignment shall relieve the assigning party of any of its obligations hereunder. Any attempted assignment, transfer, or other conveyance in violation of the foregoing shall be null and void. This Contract shall be binding upon and shall inure to the benefit of the parties hereto and their respective successors and permitted assigns.

12. Nondiscrimination. The Contractor agrees in the performance of this contract not to discriminate on the ground or because of race, creed, color, national origin or ancestry, sex, religion, handicap, age, status as a protected veteran or status as a qualified individual with a disability, or political opinion or affiliation, against any employee of Contractor or applicant for employment and shall include a similar provision in all subcontracts let or awarded hereunder. The parties hereby incorporate the requirements of 41 C.F.R. §§ 60-1.4(a)(7), 29 C.F.R. Part 471, Appendix A to Subpart A, 41 C.F.R. § 60-300.5(a) and 41 C.F.R. § 60-741.5(a), if applicable.

12.1. This Contractor and subcontractor shall abide by the requirements of 41 C.F.R. § 60-300.5(a). This regulation prohibits discrimination against qualified protected veterans and requires affirmative action by covered prime contractors and subcontractors to employ and advance in employment qualified protected veterans.

12.2. This Contractor and subcontractor shall abide by the requirements of 41 C.F.R. § 60-741.5(a). This regulation prohibits discrimination against qualified individuals on the basis of

disability and requires affirmative action by covered prime contractors and subcontractors to employ and advance in employment qualified individuals with disabilities.

13. Occupational License. The Contractor shall obtain and maintain an occupational license or business registration with the City of Nixa, Missouri, if required by city code and any required state or federal requirement. The cost for this occupational license shall be borne by the Contractor.

14. Insurance Requirements.

14.1. Without limiting any of the other obligations or liabilities of the Contractor, Contractor shall at all times during the Term of this Contract, and for a period of three years thereafter, unless waived in writing by the City, at Contractor's sole cost and expense, at least the following types and amounts of insurance:

14.1.1. Commercial General Liability Insurance with limits no less than \$517,306.00 per occurrence and \$3,448,710.00 in the aggregate, including bodily injury and property damage, which policy shall include contractual liability covering insuring the activities of Contractor under this Contract;

14.1.2. Worker's Compensation Insurance with statutory coverage as provided for in RSMo. 287.010 et seq.;

14.1.3. Employers Liability Insurance with limits no less than \$517,306.00 per occurrence and \$3,448,710.00 in the aggregate;

14.1.4. Commercial Automobile Liability with limits no less than \$517,306.00 per occurrence and \$3,448,710.00 in the aggregate; and

14.1.5. Owner's and Contractor's Protective Liability Insurance. To protect the City, its agents, servants, and employees from claims which may arise from the performance of this Contract, with limits of at least \$3,448,710.00 for all claims arising out of a single accident or occurrence and at least \$517,306.00 with respect to injuries and/or death of any one person in a single accident or occurrence. The Owner's and Contractor's Protective Liability Insurance must:

14.1.5.1. Be a separate policy with the named insured being: The City of Nixa, Missouri; and

14.1.5.2. Be with the same insurance company with which the Contractor carries its Commercial General Liability Insurance and Automotive Liability Insurance; and

14.1.5.3. Contain an endorsement that disclaims coverage for any claim barred by the doctrines of sovereign immunity or official immunity, except attorney's fees and other litigation costs incurred in defending a claim. Nothing contained in this policy (or this endorsement thereto) shall constitute any waiver of whatever kind of these defenses or sovereign immunity or official immunity for any monetary amount whatsoever.

14.2. All insurance policies required pursuant to Paragraph 14 shall:

14.2.1. Be issued by insurance companies reasonably accepted by the City, able to transact business within the State of Missouri, and with an A.M. Best Rating of no less than B+ Rating;

14.2.2. Provide that such insurance carriers give the City at least 30 days' prior written notice of cancellation or non-renewal of policy coverage; provided that, prior to such cancellation, the Contractor shall have new insurance policies in place that meet the requirements of this Paragraph 14;

14.2.3. Waive any right of subrogation of the insurers against the City or any of its officials, employees, or agents;

14.2.4. Provide that such insurance be primary insurance and any similar insurance in the name of and/or for the benefit of the City shall be excess and non-contributory;

14.2.5. Name the City and its officials, employees, and agents, as additional insured;

14.2.6. Not be met by the use of a single limit policy.

14.3. Contractor shall provide the City with copies of the certificates of insurance and policy endorsements for all insurance coverage required by this Paragraph 14 at the time of execution of this Contract and shall not do anything to invalidate such insurance.

14.4. Failure of the Contractor to maintain the coverages set out in this Paragraph 14 shall not relieve it of any contractual responsibility or obligation or liability in general or under this Contract.

14.5. This Paragraph 14 shall not be construed in any manner as waiving, restricting, or limiting the liability of the Contractor for any obligations imposed under this Contract (including but not limited to, any provisions requiring a party hereto to indemnify, defend, and hold harmless under this Contract).

14.6. Subcontracts. In case any or all the performance of this Contract is sublet, the Contractor shall require the subcontractor to procure and maintain all insurance required in this Paragraph 14. Contractor shall provide evidence of such insurance from said subcontractor.

14.7. Changes in policy limits. In the event the scope or extent of the City's tort liability as a governmental entity as described in Section 537.600 through 537.650 RSMo. is broadened or increased during the term of this Contract by legislative or judicial action or in the event that the Sovereign Immunity limits for a given calendar year, as published annually on the Missouri Register by the Missouri Department of Insurance are increased during the term of this Contract, the City may require Contractor, upon 10 days written notice, to execute a contract addendum whereby the Contractor agrees to provide, at a price not exceeding Contractor's actual increased premium cost, additional liability insurance coverage as the City may require to protect the City from increased exposure as the result of increase. Any such additional insurance coverage shall be evidenced by an appropriate certificate of insurance and shall take effect within the time set forth in the addendum.

14.8. Survival. The provisions of this Paragraph shall survive the termination or expiration of this Contract.

15. Contractor's responsibility for subcontractors. The Contractor shall be fully responsible to

the City for the acts and omissions of its subcontractors, and of persons either directly or indirectly employed by them, as Contractor is for the acts and omissions of persons it directly employs. Contractor shall cause appropriate provisions to be inserted in all subcontracts relating to this Contract, to bind all subcontractors to Contractor by all the terms herein set forth, and insofar as applicable to the work of subcontractors and to give Contractor the same power regarding termination of any subcontract as the City may exercise over Contractor under any provisions of this contract. Nothing contained in this contract shall create any contractual relation between the subcontractor and the City.

16. Independent Contractor Clause. This Contract does not create an employee/employer relationship between the parties. It is the parties' intention that the Contractor shall be an independent contractor and not the City's employee for all purposes, including, but not limited to, the application of the Fair Labor Standards Act, minimum wage and overtime payments, Federal Insurance Contribution Act, the Social Security Act, the Federal Unemployment Tax Act, the provisions of the Internal Revenue Code, Missouri revenue and taxation laws, Missouri workers' compensation, and unemployment insurance laws. The Contractor shall retain sole and absolute discretion as to the judgment and manner and means of carrying out the Contractor's activities and responsibilities hereunder. The Contractor agrees that it is a separate and independent enterprise from the public employer, that it has a full opportunity to find other business, that it has made its own investment in its business, and that it will utilize a high level of skill necessary to perform the work. This Contract shall not be construed as creating any joint employment relationship between the Contractor and the City, and the City shall not be liable for any obligation incurred by the Contractor, including but not limited to unpaid minimum wages and/or overtime premiums.

17. Liability and Indemnity.

17.1. In no event shall the City be liable to the Contractor for special, indirect, or consequential damages, except those caused by the City's gross negligence or willful or wanton misconduct arising out of or in any way connected with a breach of this contract. The maximum liability of the City shall be limited to the amount of money to be paid or received by the Contractor under this contract.

17.2. The Contractor shall defend, indemnify and save harmless the City, its elected or appointed officials, agents and employees from and against any and all liability, suits, damages, costs (including attorney fees), losses, outlays and expenses from claims in any manner caused by, or allegedly caused by, or arising out of, or connected with, this contract, or the work or any subcontract thereunder (the Contractor hereby assuming full responsibility for relations with subcontractors), including, but not limited to, claims for personal injuries, death, property damage, or for damages from the award of this contract to Contractor, notwithstanding any possible negligence, whether sole or concurrent, on the part of the City, its officials, agents and employees.

17.3. The Contractor shall indemnify and hold the City harmless from all wages or overtime compensation due any employees in rendering services pursuant to this Contract or any subcontract, including payment of reasonable attorneys' fees and costs in the defense of any claim made under the Fair Labor Standards Act, the Missouri Prevailing Wage Law or any other federal or state law.

17.4. The indemnification obligations of Contractor hereunder shall not be limited by any limitations as to the amount or type of damages, compensation or benefits payable by or for the Contractor, under any federal or state law, to any person asserting the claim against City, its elected or appointed officials, agents, and employees, for which indemnification is sought.

17.5. The indemnification obligations herein shall not negate, abridge or reduce in any way any additional indemnification rights of the City, its elected or appointed officials, agents and employees, which are otherwise available under statute, or in law or equity.

17.6. Contractor affirms that it has had the opportunity to recover the costs of the liability insurance required in this Contract in its contract price. Contractor's obligation under this Contract to defend, indemnify, and hold harmless any person from that person's own negligence or wrongdoing is limited to the coverage and limits of the applicable insurance required of the Contractor under this Contract.

17.7. The Contractor shall indemnify and hold the City harmless for any penalties, fines, fees or costs, including costs of defense, which are charged or assessed by any Federal, state or local agency including, but not limited to, Environmental Protection Agency or Department of Natural Resources.

17.8. The provisions of this Paragraph shall survive the termination or expiration of this Contract.

18. Contract Documents.

18.1. The entire Contract of the parties shall consist of the following documents:

18.1.1. This Contract;

18.1.2. _____ (Exhibit A); and

18.1.3. _____ (Exhibit B).

18.2. The above listed documents are attached hereto and incorporated by their reference herein as though fully set forth herein.

18.3. No modification, amendment, or waiver of any of the provisions of this Contract shall be effective unless in writing specifically referring hereto and signed by both parties.

18.4. In the event of a conflict between terms, the terms of this Contract, exclusive of its Exhibits, Attachments, or Schedules, shall control over the terms of any Exhibit, Attachment, or Schedule.

19. Nonresident/Foreign Contractors. The Contractor shall procure and maintain during the life of this Contract:

19.1. If the Contractor is a foreign corporation, a certificate of authority to transact business in the State of Missouri from the Secretary of State, unless exempt pursuant to the provisions of Section 351.570 RSMo.

19.2. A certificate from the Missouri Director of Revenue evidencing compliance with the transient employer financial assurance law, unless exempt pursuant to the provisions of Section 285.230 RSMo.

20. Notices.

20.1. All notices required or permitted hereinunder and required to be in writing may be given by Electronic Mail or by first class mail addressed to City and Contractor at the addresses shown below:

To City:

Name: City of Nixa, Missouri
Address: 715 W. Mt. Vernon St., PO Box 395, Nixa MO 65714
Phone: 417.725.3785
Email: tcossey@nixa.com
Attn: Travis Cossey
Dept: Water

To Contractor:

Name:
Address:
Phone:
Email:
Attn:

20.2. The date of delivery of any notice given by mail shall be the date falling on the second full day after the day of its mailing. The date of delivery of notice by Electronic Mail transmission shall be deemed to be the date transmission occurs, except where the transmission is not completed by 5:00 p.m. on a regular business day at the terminal of the receiving party, in which case the date of delivery shall be deemed to fall on the next regular business day for the receiving party.

20.3. Notice information may be updated by the respective party upon reasonable notice of such change to the other party.

21. Right to Audit. Contractor agrees to furnish sufficient supporting details as may be required by the City to support any charges or invoices submitted to the City for payment under this Contract. Contractor shall make available for the City's inspection all records covering or relating charges submitted to the City for payment. Contractor shall make appropriate adjustments in the event that discrepancies are found. The City shall have the right to audit the Contractor's records pertaining to the work/product for a period of three (3) years after final payment. The provisions of this Paragraph shall survive the termination or expiration of this Contract.

22. Compliance with Laws. Contractor agrees to comply with all applicable federal, state and local laws or rules and regulations applicable to the provision of services and products hereunder. Contractor affirmatively states that payment of all local, state, and federal taxes and assessments owed by Contractor is current.

23. City Benefits. The Contractor shall not be entitled to any of the benefits established for the employees of the City nor be covered by the Worker's Compensation Program of the City.

24. No Third-Party Beneficiaries. This Contract is for the sole benefit of the parties hereto and their respective successors and permitted assigns and nothing herein, express or implied, is intended to or shall confer upon any other person any legal or equitable right, benefit, or remedy of any nature

whatsoever, under or by reason of this Contract.

25. Jurisdiction. This Contract and every question arising hereunder shall be construed or determined according to the laws of the State of Missouri, without giving effect to any choice or conflict of law provision or rule which would cause the application of the laws of any jurisdiction other than those of the State of Missouri. Should any part of this Contract be litigated, venue shall be proper only in the Courts of Christian County, Missouri. The provisions of this Paragraph shall survive the termination or expiration of this Contract.

26. Waiver of Jury Trial. Each party irrevocably and unconditional waives any right it may have to a trial by a jury in respect to any legal action arising out of or relating to this Contract or the transaction contemplated thereby. The provisions of this Paragraph shall survive the termination or expiration of this Contract.

27. Severability. If any term or provision of this Contract is held to be invalid, illegal, or unenforceable, such invalidity, illegality, or unenforceability shall not affect any other term or provision of this Contract or invalidate or render unenforceable such term or provision.

28. Headings. The headings in this Contract are for reference only and shall not affect the interpretation of this Contract.

29. Interpretation. This Contract shall be construed without regard to any presumption or rule requiring construction or interpretation against the party drafting an instrument or causing any instrument to be drafted.

30. Payment for Labor and Materials. The Contractor shall pay for all labor and materials used in the provision of the Services.

31. Performance and Payment Bonds.

31.1. The Contractor shall furnish a Performance Bond and a Labor and Materials Payment Bond with surety approved by the City and on forms approved by the City, each bond shall be in the amount of **\$INSERT CONTRACT AMOUNT (full amount of contract)** conditioned upon the full and faithful performance of all terms and conditions of this Contract and payment of all labor and material suppliers.

31.2. It is further mutually agreed between the parties that if at any time after the execution of this Contract the City deems the surety or sureties upon such bond(s) to be unsatisfactory, or if, for any reason, such bond(s) ceases to be adequate to cover the performance of the work, the Contractor shall, at its expense, within 5 days after the receipt of notice from the City to do so, furnish an additional bond or bonds, in such form and amount, and with such surety or sureties as shall be satisfactory to the City. In such event no further payment to the Contractor shall be deemed to be due under this Contract until such new or additional security for the faithful performance of the work and the payment of labor and material suppliers shall be furnished in a manner and form satisfactory to the City.

31.3. The corporate surety on any performance or payment bond must be licensed by the State of Missouri and if the required bond exceeds \$25,000.00 must be listed in United States Treasury Circular 570.

32. Prevailing Wage. In compliance with sections 290.210 through 290.340 RSMo, all workers

performing work under this Contract shall be paid a wage of no less than the "prevailing hourly rate of wages" for work of a similar character in this locality or the public works contracting minimum wage, whichever is applicable, as set out in the Wage Order. If at any time the Contractor is found to not have paid prevailing wages, the Contractor shall forfeit as a penalty to the City \$100.00 for each calendar day or portion of a calendar day for each worker paid less than the stipulated required rates for any work done under this Contract by the Contractor or by any subcontractor under the Contractor. Notwithstanding the foregoing, if the engineer's estimate of the total project cost or the bid accepted by the City is \$75,000.00 or less, then all labor utilized in the construction of the improvements shall not be required to pay the "prevailing rate of wages" or the public works minimum wage. However, if the project becomes subject to a change order that increases the total project cost to more than \$75,000.00, a "prevailing hourly rate of wages" or the public works contracting minimum wage, whichever is applicable, shall be paid for all labor utilized in the construction of the improvements but only for that portion of the project which exceeds \$75,000.00.

33. Safety Training. Pursuant to Missouri Revised Statute Section 292.675, Contractors and subcontractors who sign a contract to work on public works projects must provide a 10-hour OSHA construction safety program, or similar program approved by the Department of Labor and Industrial Relations, to be completed by their on-site employees within sixty (60) days of beginning work on the construction project. The Contractor shall provide an acceptable notarized affidavit stating that Contractor has verified the completion of a 10-hour constructions safety program with respect to the employees working in connection with the contracted services. Contractors and subcontractors in violation of this provision will forfeit to the public body \$2,500.00 plus \$100 a day for each employee who is employed without training. Public bodies and contractors may withhold assessed penalties from the payment due to those Contractors and subcontractors. The penalties shall not begin to accrue until the time periods in the statute have elapsed (60 days after notice to proceed and 20 days to produce documentation for employees found in violation).

34. Affidavit for Contracts Over \$5,000.00. That pursuant to Missouri Revised Statute Sections 285.525 through 285.550, if this contract exceeds the amount of \$5,000.00 and Contractor is associated with a business entity, Contractor shall provide an acceptable notarized affidavit stating that the associated business entity is enrolled in and participates in a federal work authorization program with respect to the employees working in connection with the contracted services, and that said business entity does not knowingly employ any person who is an unauthorized alien in connection with the contracted services. Additionally, Contractor must provide documentation for said business entity evidencing current enrollment in a federal work authorization program.

35. Compliance with Anti-Discrimination against Israel Act. Pursuant to Section 34.600 RSMo, if this Contract exceeds the amount of \$100,000 for Contractors with ten or more employees, Contractor, by executing this Contract, certifies that the Contractor is not currently engaged in and shall not for the duration of the contract, engage in a boycott of goods or services from the State of Israel; is not currently engaged in and shall not, for the duration of the contract, engage in a boycott of goods or services from companies doing business in or with Israel or authorized by, licensed by, or organized under the laws of the State of Israel; or is not currently engaged in and shall not for the duration of this contract, engage in a boycott of goods or services from persons or entities doing business in the state of Israel.

[Remainder of page intentionally left blank. Signatures follow on next page.]

