Standard Specifications and Construction Drawings

February 2, 2023

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STANDARD SPECIFICATIONS AND CONSTRUCTION DRAWINGS

SECTION 1000 GENERAL INFORMATION

1001 PURPOSE

The purpose of these specifications is to establish, where applicable, minimum acceptable standards or a range of acceptable results for construction of public improvements in the City of Norman. The Contractor shall be solely responsible for producing an acceptable end product and exercising control of the project. The City of Norman personnel, except as specifically provided for in these specifications, will perform inspections for the City to determine if an acceptable product is being produced.

1002 INTERPRETATION

These specifications will be interpreted in such a manner as to allow the contractor to control the project in order to produce an acceptable end product. These specifications will not be interpreted in a manner that allows a contractor to produce an unacceptable end product or endanger the public. When disputes arise over interpretation of the specifications, the General Conditions of the Contract will govern. Only projects in substantial conformance with plans and specifications will be accepted by the City of Norman.

1003 APPLICABILITY

1003.1 CONTRACTORS WORKING FOR THE CITY OF NORMAN

All applicable portions of these specifications will apply to all contractors working for the City of Norman.

1003.2 CITY OF NORMAN CONSTRUCTION

Unless otherwise noted in the contract documents, these specifications will apply to all projects constructed by the Public Works, , Utilities, and Parks and Recreation Departments of the City of Norman.

1003.3 PRIVATE CONTRACTORS CONSTRUCTING ANY CAPITAL PROJECT THAT WILL BE TRANSFERRED TO THE CITY OF NORMAN

Except for method of measurement and basis of payment paragraphs, these specifications will apply to all projects constructed by a private contractor that will be transferred to the City of Norman. At the discretion of the developer, the method of measurement and basis of payment may be used.

1004 MATERIALS NOT LISTED IN THESE SPECIFICATIONS

Materials listed in these specifications are those materials normally used by the City of Norman. All materials shall be new (not re-conditioned), recently manufactured and subject to approval by the City of Norman Engineering staff. Any construction materials not approved will be replaced at the expense of the private contractor and/or supplier. This does not preclude the use of other materials by developers, engineers, or contractors. When a material not listed in these specifications is to be used in a project,

the engineer designing the project will provide a draft specification for review. If the draft specification is accepted, the material may be used in the project. The Engineer will approve the material and provide written approval per project.

1004.1 HAZARDOUS MATERIALS

A. Hazardous Chemicals: Anytime and outside contractor brings a hazardous substance(s) into the workplace as outlined by the City of Norman safety manual, the Safety Manager and the construction inspector must receive a CIL (chemical inventory list) and MSDS(s) (material safety data sheet) for those substance(s). Similarly, a CIL and MSDS(s) for all hazardous substances in the area that the contractor will be working must be provided to the contractor. This exchange will be coordinated by whomever is granting the contract.

Service contractors whose work or material pose a health hazard to employees shall be responsible for the training and education requirements outlined under the policy provided by the city of Norman Safety Manager. The training must be documented and the Safety Manager must retain the record of this training in the manner that in-house safety training is cataloged.

Outside contractors must comply with all the provisions of the hazard Communication Standard while working for the City of Norman. Periodic oversight visits from the Safety Manager may be performed to assure compliance.

1005 INSPECTION OF PUBLIC WORKS PROJECTS

All inspections of public works projects will be conducted in accordance with City of Norman Administrative Regulations and Code and good engineering practices.

1006 TESTING REQUIREMENTS

1006.1 APPLICATION OF TEST REQUIREMENTS

A. **General:** Unless otherwise specified, testing of projects constructed using these specifications will be tested in accordance with this section. Unless otherwise specified, the contractor will provide the equipment, materials, and labor necessary to conduct the required tests. The contractor will coordinate with the Project Inspector for appropriate test dates and the Inspector will observe tests as required. When tests are conducted off site or by a testing laboratory, the Contractor will provide certified copies of the test results. If a project or portion of a project fails to meet the required test results, the contractor will take appropriate corrective action and the test shall be conducted again on the corrected work. Corrections to work and additional testing shall be at the contractor's expense.

B. **Test Specimens:** It shall be the responsibility of the Contractor to furnish evidence to the City that the quality of the materials and workmanship entering in to the work complies with the plans and specifications in order to accomplish this. The minimum schedule of satisfactory tests listed herein shall be performed by a testing laboratory approved by the City. When tests reveal that the quality of materials or workmanship does not meet the requirements of the specifications, additional tests shall be made as directed by the City Engineer or designee until the number of satisfactory tests called for in the schedule have been made. The City will pay the cost of all initial testing of work which passes the requirements. The Contractor will pay for two (2) passing tests for each failed test. This cost will be deducted from the Contractor's Pay Estimate. The developer of a

subdivision which requires public improvements shall pay the cost of all testing, including subgrade densities, paving densities, concrete strength tests, paving thickness cores, etc.

C. **Test results:** All test results shall be provided to the City of Norman within 5 working days of the test sample being taken in the field.

1006.2 PAVING, CONCRETE AND COMPACTION TESTING

A. Concrete Test Schedule:

Description	***Test Method***	***Quantity Represented One Test***
Concrete Cylinder	AASHT O T-23	50 CY Concrete
Entrained Air Content	AASH TO T-152	50 CY Concrete
Slump	AASH TO T-119	50 CY Concrete

1. One test for concrete cylinders shall be construed to mean that at least four test specimens shall be taken in accordance with the above schedule. Two shall be tested at an age of seven days, and two shall be tested at an age of twenty-eight days, and the strength determined from the average of these pairs of test specimens. A minimum of one test (four specimens) shall be taken for each day's work. Beam and cylinder specimens taken in the field shall be made and cured in accordance with AASHTO T-23. One test for entrained air content shall be made for each set of four concrete cylinder specimens taken.

2. ***Job-Mix Design***. The Contractor shall provide the City with a complete job-mix design performed by a laboratory, approved by the City. A design need not be performed for each project, but the design for each project must have been accomplished not longer than six months before the commencement of the project. The Contractor will be responsible for the cost of this testing, unless otherwise stated in the Special Conditions. A new job-mix design will be performed if the sources of is changed during the project.

B. Asphalt Testing Schedule:

1. ***General.*** The following testing will be required on asphalt mixes produced under these specifications.

2. ***Job-Mix Design.*** The Contractor shall provide the City with a complete job-mix design performed by a laboratory, approved by the City. A design need not be performed for each project, but the design for each project must have been accomplished not longer than six months before the commencement of the project. The Contractor will be responsible for the cost of this testing, unless otherwise stated in the Special Conditions. A new job-mix design will be performed if materials sources are changed during the project.

3. ***Aggregates.*** The Contractor shall, upon request, provide the City with copies of the tests required by ODOT 708.02 for each aggregate to be used on this project.

4. ***Asphalt.*** The Contractor shall obtain from his asphalt supplier, and furnish the City with a Certificate of Analysis of each different type and grade of asphalt used on the project. All asphalt products will be required to meet the provisions of Section 708-3 of the latest edition of Standard Specifications for Highway Construction of the Oklahoma Department of Transportation.

5. Schedule:

Description	***Method of Test***	***Quantity of Item Represented by One Test***
Roadway & Lab Molded Core Density See Note # 1, 2 & 3	Roadway Density OHDL-14 METHOD "A" Lab molded Density OHDL-14 method "B" & OHDL-8	3 Cores per days run up to 875 T
Extraction & Gradation See Note # 1, 2 & 3	AASHTO T-11 AASHTO T-27 AASHTO T-30 AASHTO T-164 AASHTO T-308 or OHDL 26	l test per days run up to 875 T
Rice Test See Note # 1, 2 & 3	AASHTO T-209	1 test minimum per type of mix per project.

Notes

1) Additional tests will be required when the same type of mix is not placed in consecutive days, a change in the mix design or plant failure.
2) Definition of a lot: A lot is the tons of asphalt placed in one day up to 875 T.
3) Test results are to be recorded on ODOT Asphalt Plant Inspector's Work Sheet.

C. Subgrade Test Schedule

Description	***Method of Test***	***Quantity of Item Represented by One Test***
Standard Proctor Density	AASHTO T-99	As differing soil conditions require.
P.I.	AASHTO T-89 AASHTO T-90	As differing soil conditions require.
Field Density: Subgrade and/or sand bedding	AASHTO T-238	575 SY of subgrade or 200' for 26' street
C.B.R. Lab Test Field Test	ASTM D-1883 ASTM D-4429	Min. 1 per Soil Type or as required by the City Engineer

D. Trench Backfill Test Schedule

Description	***Method of Test***	***Quantity of Item Represented by One Test***
Standard Proctor Density	AASHTO T-99	As differing soil conditions require
Field Density	AASHTO T-238	1 test every 300' of trench for each 4' lift. 1 test every 200' of Bedding Material.

E. Surface Coring Schedule

1. Schedule:

Street Classification	***Core Interval***
Residential	300'
Collector	230'
Arterial	
- Full Width	150'
- Half Width	300'

2. Core hole shall be patched immediately with the following material:

(a) Concrete Paving: PCC grout, Class A

(b) Asphalt Paving: PCC grout, Class A; Hot mix, cold laid asphalt per ODOT 708.04, or approved equal.

1006.3 WATER LINE TESTING

Conduct testing as stipulated in Specification Section 2403.9

1006.4 SANITARY SEWER FORCE MAIN PRESSURE TESTING

A. **Preparation:** Prior to starting the pressure test the Contractor will flush the line of all dirt and debris. The Contractor will also evacuate all air from the line. This work will be coordinated with the Utilities Inspector and the Line Maintenance Division of the Utilities Department.

B. Procedure:

1. The Contractor will bring the line up to test pressure of 100 psi or 1.5 times the design pressure (whichever is greater) and the line must maintain that pressure for a period of 120 minutes with not more than a 5 psi drop.If the line does not pass the pressure test, then the contractor must repair the lines so that it will meet the test requirements.

C. **Required Results:** Hold 1.5 times the working pressure of the line for 120 minutes with a drop of 5 psi or less.

D. **Inspection Requirements:** Contractor cannot begin or complete any testing without permission from the Project Inspector.

1006.5 SANITARY SEWER LINES MANDREL AND PRESSURE TESTING

A. **Preparation:** The Contractor will ensure that the line is clean and all debris has been removed from manholes. The Contractor will coordinate with the Project Inspector to have the lines tested with a mandrel prior to pressure testing.

B. Procedure:

1. Mandrel Test (Required on flexible pipe only): The contractor will have personnel pull the required size mandrel through the line while the Project Inspector observes. This test will be conducted at least 30 days after the line has been installed.

   (a) The mandrel shall have a diameter equal to 95% of the inside diameter of the pipe.

   (b) The test shall be performed without mechanical pulling devices.

   (c) If the line does not meet test requirements, the contractor will make necessary repairs and retest.

2. Pressure Test:

   (a) The Contractor will plug both ends of the line and pressure the line to 4 psi.

   (b) When the line is at pressure the Project Inspector will observe the pressure gage for 7 minutes.

   (c) If the line does not meet test requirements, the contractor will make necessary repairs and retest.

   (d) When the test is completed, the contractor will remove all plugs and ensure the line is clear.

C. Required Results:

1. The Mandrel must pass through the line and no pipe shall exceed a deflection of 5%.

2. The line must hold 4 psi of air pressure for 7 minutes.

D. **Inspection Requirements:** Contractor cannot begin or complete any testing without permission from the Project Inspector.

E. **Alternative Inspections:** In special circumstances and with acceptance by the Engineer, the following alternative tests may be substituted for the pressure test detailed above.

1. **Joint Testing:** On 24" and larger diameter lines.
2. **Exfiltration Test:** Conducted in accordance with standard industry practices.
3. **Infiltration Test:** Conducted in accordance with standard industry practices.

1006.6 SANITARY SEWER LINES DYE TESTING

A. **Required For:** Gravity sanitary sewer line replacement projects. Normally this will be a City Contract or work performed by Utilities Department crews.

B. **Preparation:** The Contractor will ensure that the line is clean and all debris has been removed from manholes. The contractor will prepare the water source with sufficient sewer line marking dye, to give the water a highly visible color.

C. Procedure:

1. A rigid pipe connected to a water source will be used to inject dye colored water, under pressure, into the material surrounding the gravity sewer.

2. The dye injection will start 10' upstream of the lowest manhole and will

proceed upstream in 10' increments. The dye will be injected until, in the opinion of the Utility Inspector, the area is saturated.

3. Dye will be injected in the vicinity of all service taps.

4. The Utility Inspector will observe the down stream manhole and if dye appears in the manhole, the line has failed the test. If the line fails the test, the contractor will make necessary repairs and retest.

D. **Required Results:** No dye to enter the line.

E. **Inspection Requirements**: Contractor cannot begin or complete any testing without permission from the Project Inspector.

1006.7 MANHOLE INSPECTION/TESTING

A. **Required For:** In accordance with ODEQ 252:656-5-4(g)(5) a manhole leakage test must be performed.

1. Manholes that are concrete and poured monolithically; and subsequent to all pipe connections in place to the manhole (normal lateral, lineal, or drop connection); and all connections having water stop gaskets cast within the manhole; and cast-in-place manhole barrel sections in a continuous pour without seams or joints shall be tested in accordance with the procedure outlined below.

2. For pre-cast manholes, a list of acceptable manhole manufacturers must be provided with each manufacturer providing written certification of satisfactory manufacturer manhole leakage testing. Any pre-cast manhole apparently damaged during the construction process must be tested for leakage in accordance with the procedure outlined below, and repaired, if required by the Engineer

B. **Preparation:** The contractor will ensure that the manholes to be inspected are clean, properly grouted, and that the appropriate rings and lids have been installed.

C. **Procedure**:

1. Test manholes for leakage separately and independently of the wastewater lines by vacuum testing. Test manholes after installation with all connections (existing and /or proposed) in place. Plug lift holes with an approved non-shrink grout prior to testing. Install drop-connections and gas sealing connections prior to testing.

2. **Vacuum Test:** Temporarily plug lines entering the manhole with the plugs braced to prevent them from being drawn into the manhole. Install plugs in the lines beyond drop-connections, gas sealing connections, etc. Place the test head inside the frame at the top of the manhole and inflate in accordance with the manufacturer's recommendations. Draw a vacuum of 10 inches of mercury, then turn off the vacuum pump. Read the level of vacuum after the required test time with the valve closed. The manhole will pass the test if the drop in the level is less than 1 inch of mercury (final vacuum greater than 9 inches of mercury). The required test time for 48-, 60-, and 72-inch manholes with depths up to 30 feet is 2 minutes. Test times for manholes of greater size and depths will be determined by the Engineer.

3. **Visual Inspection:** For manholes that fail the vacuum test a visual inspection will be conducted to try and determine the source of the leakage.

4. **Dye Test:** If a visual inspection is unsuccessful in identifying the source of the leakage a dye test shall be conducted. The procedure for the dye test will be as follows:

   (a) The dye injection will be at 4 equally spaced locations around the manhole.

   (b) Dye will be injected until, in the opinion of the Project Inspector, the area is saturated.

   (c) The Project Inspector will observe the manhole for 30 minutes and if dye appears on the walls of the manhole, the manhole has failed the test. If the manhole fails the test, the contractor will make necessary repairs and retest.

5. **Manhole Repairs:** Repair any manhole which fails the leakage testing process with non-shrink grout or other suitable material as determined for the material from which the manhole is constructed. Retest the manhole as described above until a successful test is achieved. Remove all temporary plugs and grout after a successful test.

D. **Inspection Requirements:** Contractor cannot begin or complete any testing without permission from the Project Inspector.

1006.8 STORM SEWER PIPE INSPECTION/TESTING

A. **Preparation:** The Contractor will ensure that the line is clean and all debris has been removed from manholes and drop inlets.

B. **Frequency:** Each line from manhole to manhole or drop inlet will be tested. If the inspector suspects a portion of the line was not properly installed, a dye test of that portion of the line may be required.

C. **Procedure:**

1. If a dye test is required, it will be prepared in the same manner as a sewer line test except:

   (a) The dye injection will be at equally spaced locations around the section in question.

   (b) Dye will be injected until, in the opinion of the Project Inspector, the area is saturated. The Project Inspector will observe the line for 30 minutes and if dye appears in the line, the line has failed the test. If the line fails the test, the contractor will make necessary repairs and retest.

D. **Inspection Requirements:** The Utilities Inspector will be on site to observe all mandrel and dye testing, if required.

1006.9 STORM SEWER DROP INLETS AND JUNCTION BOXES INSPECTION/TESTING

A. **Preparation:** The contractor will ensure that the drop inlets and junction boxes to be inspected are clean, properly grouted, and that the grates or rings and lids have been installed.

B. **Frequency:** The Utilities Inspector may request that a drop inlet or junction box that does not appear to meet specifications be tested by dye testing.

C. **Procedure:**

1. The Inspector will visually inspect each drop inlet and junction box for compliance with the specifications.

2. If a dye test is required it will be prepared in the same manner as a line test except:

   (a) The dye injection will be at 4 equally spaced locations around the drop inlet or junction box.

   (b) Dye will be injected until, in the opinion of the Project Inspector, the area is saturated.

   (c) The Project Inspector will observe the drop inlet or junction box for 30 minutes and if dye appears on the walls of the drop inlet or junction box, the drop inlet or junction box has failed the test. If the drop inlet or junction box fails the test, the contractor will make necessary repairs and retest.

D. **Required Results:** The drop inlet or junction box must meet specifications and if dye testing is required then no dye shall enter the drop inlet or junction box.

E. **Inspection Requirements:** The Utilities Inspector will be on site to observe all testing.

1007 SUBMITTALS

Submittals will be provided to the Design Engineer or Utilities Engineer as required by the specifications or during the pre-construction conference. The submittals will be reviewed and accepted or returned for additional information within two weeks after receipt. The following guidelines will apply unless the contractor is notified otherwise:

1007.1 MATERIALS

Material submittals will be made and approved by the engineer or his authorized representatives before the material is installed. If the material manufacturer's installation recommendations are more restrictive than the city's, then the manufacturer's recommendations shall govern.

1007.2 WORKING DRAWINGS

Working drawings shall be provided prior to starting work on the items covered by the drawings.

1008 ABBREVIATIONS

Wherever the following abbreviations are used in Contracts, Proposals, these Specifications or on Plans, they are to be construed the same as the respective expressions represented:

AASHTO American Association of State Highway and Transportation Officials

AIA American Institute of Architects

ANSI American National Standards Institute (United States of America Standards Institute)

ASA American Standards Association

ASCE American Society of Civil Engineers

ASTM American Society of Testing and Materials

AWPA American Wood Preservers Association

AWWA	American Water Works Association
AWS	American Welding Society
CIL	Chemical Inventory List
ITE	Institute of Transportation Engineers
MSDS	Material Safety Data Sheet
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
ODEQ	Oklahoma Department of Environmental Quality
ODOT	Oklahoma Department of Transportation
OSHA	Occupational Safety and Health Administration
UL	Underwriter's Laboratory
WEF	Water Environment Federation

1009 DEFINITIONS

ADVERTISEMENT: All of the legal publications pertaining to the work contemplated or under Contract.

AWARD: The decision of the Owner to accept the proposal of the lowest and best bidder for the work, subject to the execution and approval of a satisfactory contract and the required bonds therefor, and to such other conditions as may be specified or otherwise required by law.

BIDDER: Any person or persons, partnership, company, firm or corporation acting directly through a duly authorized representative submitting a proposal for the work contemplated.

BASE COURSE: The layers of selected material of a designated thickness placed on a subbase or a subgrade to support a surface course.

CALENDAR DAY: Any day shown on the calendar beginning and ending at midnight.

CHANGE ORDER: A written order issued by the City to the Contractor, covering changes within the scope of the Contract and establishing the basis of payment and time adjustments for the work affected by the changes.

CHANNEL: A natural or artificial water course.

CITY: The City of Norman, Oklahoma, a Municipal Corporation, acting through its duly authorized assistants or agents.

CITY ATTORNEY: The City Attorney of the City of Norman, Oklahoma, or his duly authorized assistants or agents.

CITY CLERK: The City Clerk of the City of Norman, Oklahoma, or her duly authorized assistants or agents.

CITY CONTROLLER: The City Controller of the City of Norman, Oklahoma, or his duly authorized assistants or agents.

CITY MANAGER: The Manager of the City of Norman, Oklahoma

COMPLETION DATE: The date on which the Contract work is completed.

CONSTRUCTION: Any alteration of land for the purpose of achieving its development or changed used, including particularly any preparation for, building of, or erection of a structure.

CONTRACT: The written agreement between the City and the Contractor setting forth the obligations of the parties thereunder, including, but not limited to, the performance of the work, the furnishing of labor and materials, and the basis of payment. The contract includes the Invitation for Bids, Proposal, Contract Form,

all Contract Bonds, Specifications, Supplemental Specifications, Special Provisions, all Plans, and the Work Order, also any Change Orders and Supplemental Agreements that are required to complete the construction of the work in an acceptable manner, including authorized extensions.

CONTRACT ADMINISTRATOR: The contract administrator is the City employee assigned responsibility for coordination with the contractor and administration of the contract.

CONTRACT ITEM (PAY ITEM): A specifically described unit of work for which a price is provided in the Contract.

CONTRACT TIME: The number of workdays or calendar days allowed for completion of the Contract, including authorized time extensions.

CONTRACTOR: The individual, partnership, joint venture, firm or corporation contracting with the City or other public entity for performance of prescribed work. This includes a private contractor constructing improvements for a developer that will be transferred to the City of Norman. This also includes a contractor working for Oklahoma Department of Transportation.

COUNCIL: The Council of the City of Norman, Oklahoma.

CULVERT: Any structure under the roadway with a clear opening of twenty (20) feet or less measured along the center of the roadway.

DETENTION: A temporary storage of a determined quantity of water for a specified period of time with a release rate that is either fixed or variable.

DEVELOPER: Any person, persons, corporation, or other entity who in his or her own behalf, or as an agent of another, engages in development, subdivision, construction of structures, or alteration of land in preparation there of.

DRAINAGE DITCH: An open excavation or ditch constructed for the purpose of carrying off surface water.

DRAINAGE MASTER PLAN: The City of Norman Drainage Plan for the Canadian River and Little River Drainage Basin and all drainage systems related thereto.

DRAINAGE SYSTEM: The surface and subsurface system for the removal of water from the land, including both the natural elements of streams, marshes, swales, and ponds, whether of an intermittent or continuous nature, and the man-made element which includes culverts, ditches, channels, retention facilities, detention facilities, gutters, streets, and storm sewer systems.

EARTH CHANGE: Excavation, grading, regrading landfilling, berming or diking of land.

EARTH CHANGE PERMIT: Written permission issued by the City Engineer authorizing any person, firm or corporation to an earth change in conformance with an approved plan within the City of Norman.

EASEMENT: A grant of the right of use of property of an owner for a certain purpose at the will of the grantee.

ENGINEER: The City Engineer and such Assistants or Representatives as authorized by the City Manager while acting within the scope of their assigned duties or vested authority.

EQUIPMENT: All machinery, tools and apparatus necessary for the proper construction and acceptable completion of work.

EXTRA WORK: Any work performed by the Contractor not provided for by the plans.

FINAL ACCEPTANCE DATE: The date upon which the completed work is accepted by the City without exception or reservation.

FURNISH: To supply.

GUARANTY: Furnished by the bidder as a guarantee of good faith to enter into a contract with the City and to execute the required bonds for the work contemplated after the work is awarded to him and as liquidated damages in event of failure to do so.

HOLIDAYS: Any day proclaimed a holiday by the City.

HVEEM STABILITY TEST: Asphaltic concrete test that measures the asphaltic concrete mix's resistance to lateral displacement under vertical loading.

LABORATORY: The official testing laboratory of the City or any other testing laboratory which may be designated by the City Engineer.

MAINTENANCE BOND: The approved form of security furnished by the Contractor and his Surety as a guarantee that he will maintain the work constructed by him in good condition for the period of time required.

MATERIALS: Any substances used in the construction of the project and its appurtenances.

MAYOR: The Mayor of the City of Norman, Oklahoma.

NATURAL DRAINAGE: The dispersal of surface waters through ground absorption and by drainage channels formed by the existing surface topography which exists at the time of adoption of this document or formed by any natural or approved man-made changes in the surface topography.

NOTICE TO PROCEED: Written notice to the Contractor to proceed with the Contract work not later than the date specified.

OWNER: City of Norman, a Municipal Corporation, acting through its duly authorized representatives or agents.

PAVEMENT STRUCTURE: The combined subbase, base and surface courses placed on the subgrade to support the traffic load and distribute it to the roadbed.

PERFORMANCE BOND: The approved form of security furnished by the Contractor as a guarantee of good faith on the part of the Contractor to execute the work in accordance with the plans and specifications and terms of the Contract.

PIPE BEDDING: Material placed in the bottom of the excavation which serves as the base for the pipeline.

PLANS: The accepted plans, profiles, typical sections, cross sections, working drawings and supplemental drawings, or exact reproductions thereof, which show the location, character, dimensions, and details of the work to be done.

PROJECT INSPECTOR: An authorized Representative of the City assigned to make detailed inspections of Contract performance.

PROJECT: The specific pipelines, facilities, and all appurtenances and construction to be performed under the Contract.

PROPOSAL: The written statement or statements duly filed with the City of the person or persons, partnership, company, firm or corporation proposing to do the work contemplated. The term "Bid" as used herein shall refer to and mean "Proposal".

PROPOSAL FORM: The approved form on which the formal bids for the work are to be prepared and submitted.

PROPOSAL GUARANTY: The security, designated in the "proposal form" and in the "Advertisement," to be furnished by the bidder as a guarantee of good faith to enter into a contract with the City and to execute the required bonds for the work contemplated after the work is awarded to him and as liquidated damages in event of failure to do so.

PROVIDE: To furnish and erect or install.

RIGHT-OF-WAY: A general term denoting land, property, or an interest therein, acquired for highway purposes.

SIDEWALK: That portion of the Right-of-Way constructed for the use of pedestrians.

SPECIAL CONDITIONS: The special clauses setting forth conditions or requirements peculiar to the specific project involved, supplementing the General Conditions and taking precedence over any conditions or requirements of the General Conditions with which they are in conflict.

SPECIFICATIONS: The compilation of provisions and requirements for the performance of prescribed

work.

STANDARD SPECIFICATIONS: The book of Specifications approved for general application and repetitive use.

STATUTORY BOND: The approved form of surety set up and furnished by the Contractor and his Surety as a guarantee that he will pay, in full, all bills and accounts for material and labor used in the construction of the work, as provided by law.

STRUCTURE: Bridge, culvert, catch basin, drop inlet, retaining wall, cribbing, manhole, endwall, headwall, building, sewer, service pipe, underdrain, and foundation drain and other features which may be encountered in the work and not otherwise Classified.

SUBBASE: The layer or layers of selected material of a designed thickness placed on a subgrade to support a base course.

SUBGRADE: The top surface of a roadbed upon which the pavement structure and shoulders are constructed.

SUBMITTALS: Those items which must be submitted and reviewed by the City prior to work on an item or during work on an item. This may include working drawings, supplier certifications, test results, and other types of information.

SUPERINTENDENT: The representative of the Contractor present at all times during progress of the work, capable of supervising the work effectively and authorized to make binding decisions for the Contractor.

SURETY OR SURETIES: The corporate body which is bound by such bonds as are required with and for the Contractor and engages to be responsible for the entire and satisfactory fulfillment of the contract, and for any and all requirements as set out in the specifications, contract or plans.

SURFACE COURSE: One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called the "Wearing Course."

WORK: Work shall mean the furnishing of all labor, materials, equipment, and other incidentals necessary to the successful completion of the project and the carrying out of all the duties and obligations imposed by the Contract.

WORKING DRAWINGS: Stress sheets, shop drawings, erection plans, false-work plans, framework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data which the Contractor is required to submit to the Engineer for review.

END OF SECTION 1000

City of Norman

STANDARD SPECIFICATIONS AND CONSTRUCTION DRAWINGS

SECTION 1100 GENERAL CONDITIONS

SECTION 1100 GENERAL CONDITIONS

1101 DEFINITION OF TERMS

1101.1 DEFINITIONS

Wherever the words, forms, or phrases herein defined or pronouns used in their stead occur in these specifications, in the contract or in the Advertisement of any document or instrument herein contemplated or to which these specifications apply, the intent and mean shall be interpreted as defined in Sections 1008 and 1009.

1102 INFORMATION AND REQUIREMENTS FOR BIDDERS

1102.1 CONTENT OF PROPOSAL FORMS

The City will furnish bidders with proposal forms which will state the general location and description of the contemplated work and will contain a list of the items of work to be done and upon which bid prices are asked. The PROPOSAL form will state the time limits for commencing and for completing the work and will provide for entering the amount of the proposal guaranty. The PROPOSAL form will contain a Non collusion Affidavit. In addition to the Non collusion affidavit, bidders must complete, sign and have notarized such additional affidavits as are included in the Proposal.

1102.2 INTERPRETATION OF PLANS AND SPECIFICATIONS

If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the plans, specifications or other proposed contract documents, he may submit to the Engineer a written request for an interpretation thereof. The person submitting such request will be responsible for its prompt delivery. An interpretation of the proposed documents will be made only by addendum, duly issued, and a copy of such addendum will be mailed or delivered to each person receiving a set of such documents. The City will not be responsible for any other explanations or interpretations of the proposed documents.

1102.3 EXAMINATION OF DOCUMENTS AND SITE OF THE WORK

Bidders are advised that the plans and specifications of the Engineer on file with the City shall constitute all the information which the City will furnish. No other information given by the City or any official thereof prior to the execution of the contract shall ever become a part of or change the contract, plans or specifications, or be binding on the City. Bidders are required, prior to submitting any proposal, to read carefully the specifications, the proposal, contract and bond forms; to examine carefully all plans on file; to visit the site of the work; to examine carefully local conditions; to inform themselves by their independent research of the difficulties to be encountered and judge for themselves of the accessibility of the work and all attending circumstances affecting the cost of doing the work or the time required for its completion, and obtain all information required to make an intelligent proposal. Bidders shall rely exclusively upon their own estimates, investigations and other data which are necessary for full information

upon which the proposal may be based. Submission of a proposal will be evidence that the Bidder has made the examinations and investigations required herein.

1102.4 PREPARATION OF PROPOSAL

The bidder shall submit his proposal and non-collusion affidavit on the forms furnished- All blank spaces in the proposal form shall be correctly filled in and the bidder shall state the prices, written in ink, both in words and numerals, for which he proposes to do the work contemplated or furnish the materials required. Such prices shall be written distinctly legibly. In case of conflict between words and numerals, the words shall govern. If the proposal is submitted by a firm or partnership, the name and post office box address of each member must be given, and the proposal signed by a member of the firm or partnership who is a person duly authorized to act for the partnership in the submission of the proposal. If the proposal is made by a company or corporation, the company or corporate name and the state under the laws of which said company or corporation is chartered and the business address must be given, and the proposal signed by an official or agent who is a person duly authorized to act for the company or corporation in the submission of the proposal. Powers of attorney, authorizing agents or others to sign proposals must be properly certified and must be in writing and on file with the City Clerk or submitted with the proposal.

1102.5 PROPOSAL AFFIDAVIT

Each proposal shall be accompanied by a sworn statement in writing that the person signing the proposal executed said proposal in behalf of the bidder therein named, and that he had lawful authority to do so, and that said bidder has not directly or indirectly entered into any agreement, express or implied, with any other bidder or bidders having for its object the controlling of the amount of such bid or any bids, the limiting of the bids or bidders, the parceling or farming out to any bidder or bidders or other persons of any part of the contract or any bid, or the subject matter of the bid or the profits thereof, and that he has not and will not divulge said sealed bid to any person whatever except those having a partnership or other financial interest with him in said bid, until after the said sealed bids are opened.

1102.6 PROPOSAL GUARANTY

Proposals will not be considered unless the original filed with the Purchasing Agent is accompanied by a Bidder's Bond, or certified or cashier's check in the required amount, made payable to the "City of Norman." The check shall be in the amount as designated in the Advertisement. The Proposal Guaranty is required as evidence of good faith and as a guarantee that, if awarded the Contract, the Bidder will execute the Contract and furnish the required bonds within the required time.

1102.7 FILING OF PROPOSALS

File proposals in a manner and within the time limit for receiving proposals, as stated in the Advertisement. Hard copy proposals shall be plainly marked on the envelope with the word "Proposal" and the name of the project.

1102.8 WITHDRAWAL OF PROPOSALS

Permission will not be granted to withdraw or modify any proposal after it has been filed and before the time set for opening proposals. Request for non-consideration of proposals must be made in writing, addressed to the City Council, and filed with the Purchasing Agent before the time set for opening proposals. After other proposals are opened and

read, the proposal for which withdrawal is properly requested will be returned unopened.

1102.9 OPENING OF PROPOSALS

The proposals filed with the Purchasing Agent will be opened at the time stated in the Advertisement and shall thereafter remain on file in the Office of the Purchasing Agent two (2) days before any Contract will be entered into, based on such proposals. Bidders are invited to attend the opening of the proposals.

1102.10 IRREGULAR PROPOSALS

Proposals will be considered irregular if they show any omissions, alterations of forms, additions or conditions not called for, unauthorized alternate bids, or irregularities of any kind. However, the City reserves the right to waive technicalities as to changes, alterations or reservations, and make the award in the best interest of the City.

1102.11 REJECTION OF PROPOSALS

The City reserves the right to reject any or all proposals, and all proposals submitted are subject to this reservation. Proposals may be rejected for any of the following specific reasons:

A. Proposals/bids received after the time limit for receiving proposals/bids as stated in the Advertisement.

B. Proposal/bid prices obviously unbalanced.

C. Summation of proposal/bid prices on any one project above the Engineer's estimate of cost for such project.

D. Proposals/bids containing any irregularities.

E. Proposals/bids received more than ninety-six (96) hours, excluding Saturday, Sunday, and Holidays, before the time set for the opening of bids.

1102.12 DISQUALIFICATION OF BIDDERS

Bidders may be disqualified, and their proposals not considered for any of the following specific reasons:

A. Where more than one proposal for an individual, firm, partnership or corporation is filed under the same or different names, and where such proposals are not identical in every respect.

B. Reasonable grounds for believing that any Bidder is interested in more than one proposal for the work contemplated or materials to be furnished.

C. Reason for believing that collusion exists among the Bidders.

D. The bidder being in arrears on any existing contracts, interested in any litigation against the City, or having defaulted on a previous contract.

E. Lack of competency as revealed by the Financial Statement, Experience and Equipment Questionnaire, etc.

F. Uncompleted work, which, in the judgment of the City, will hinder or prevent the prompt completion of additional work if awarded.

1103 AWARD AND EXECUTION OF CONTRACT

1103.1 CONSIDERATION OF PROPOSALS

After the proposals are opened, those proposals containing unit prices will be tabulated for comparison on the basis of the quantities shown in the approximate estimate. Until the execution of the contract with the successful bidder, the City reserves the right to reject any or all proposals, to waive technicalities, and to advertise for new proposals, or proceed to do the work otherwise when the best interest of the City will be promoted thereby.

1103.2 AWARD OF CONTRACT

The City reserves the right to withhold the award of the contract for a reasonable period of time from the date of opening the proposals, and no award will be made until the necessary investigations are made as to the responsibility of the low bidder.. The awarding of the contract shall give the bidder no right of action or claim against the City upon such contract until the execution of the contract shall have been completed and the contract delivered to the Contractor. The City reserves the right to award all or any portion or portions of the work.

1103.3 RETURN OF PROPOSAL GUARANTY

As soon as the proposal prices have been compared, the City may, at its discretion, return the proposal guaranties accompanying those proposals, which in its judgment would not be considered in making the award. Should the awarding of the contract be delayed more than thirty (30) days, all Bidders' checks will be returned, unless such delay is from causes beyond the control of the City, and in such event, the proposal and Bidder's Check of any Bidder will be returned at the Bidder's option.

1103.4 BONDS - PERFORMANCE, STATUTORY, AND MAINTENANCE

A. With the execution and delivery of the Contract, the Contractor shall furnish and file with the City, in the amounts required, the following surety bonds:

1. A good and sufficient Performance Bond in an amount equal to one hundred (100) percent of the approximate total amount of the Contract, guaranteeing the full and faithful execution of the work and performance of the Contract and for the protection of the City and all property owners interested, against any damage by reason of negligence of the Contractor, or the improper execution of the work or the use of inferior materials.

2. A good and sufficient Statutory Bond in an amount equal to one hundred (100) percent of the approximate total amount of the Contract, guaranteeing payment for all labor, materials, and equipment used in the construction of the improvements.

3. A good and sufficient Maintenance Bond in an amount equal to (see below) percent of the total amount of the Contract, guaranteeing the maintenance in good condition of such improvement for a period of (see below) year(s)' from and after the time of the completion and acceptance by the City of said improvements.

Type of Construction	Publicly Financed Projects		Privately Financed Projects	
	% of Contract	Maintenance Bond Period (years)	% of Contract	Maintenance Bond Period (years)
Water	100 1st year 15 2nd year	2	50 1st year 15 2nd year	2
Sanitary Sewer	100 1st year 15 2nd year	2	50 1st year 15 2nd year	2
Street and Storm Sewer	100 1st year 15 2nd to 5th years	5	25	3

Should repairs on the project be necessary during the maintenance bond period, the repairs made shall also be bonded for an additional 1-year period from the date of completion and acceptance of the repair work by the City.

B. No Surety will be accepted who is now in default or delinquent on any bond or who is interested in any litigation against the City. All bonds shall be made on forms furnished by the City and shall be executed by surety companies licensed to do business in the State of Oklahoma and acceptable to the City. Each bond shall be executed by the Contractor and the Surety. Should any Surety on the Contract be determined unsatisfactory at any time by the City, notice will be given to the Contractor to that effect, and the Contractor shall forthwith substitute a new Surety or Sureties satisfactory to the City. No payment will be made under the Contract until the new Surety or Sureties, as required, have qualified and been accepted by the City. The Contract shall not be operative nor shall any payments be due until acceptance of the bonds by the City.

C. All bonds shall be in the forms prescribed by Law or Regulation or by the Contract Documents and be executed by such sureties as are named in the current list of "Companies on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department. All Bonds signed by an agent must be accompanied by a certified copy of the authority to act.

1103.5 EXECUTION OF CONTRACT

The person or persons, partnerships, company, firm or corporation to whom a contract is awarded shall, within the time set forth in the proposal, sign the necessary agreements entering into the required contract with the City, and execute and deliver the required bonds.

A. No contract shall be binding on the City until it has been reviewed by the City Council, executed by the City, and delivered to the Contractor.

1103.6 FAILURE TO EXECUTE CONTRACT

Upon failure of the Bidder to execute the required bonds or to sign the required contract within fifteen (15) days after the contract is transmitted to the Contractor, he will be considered to have abandoned his proposal. By reason of the uncertainty of market prices of the materials and labor and it being impracticable and extremely difficult to fix the amount of damages to which the City would be put by reasons of said Bidder's failure to execute said Bonds and Contract, the proposal guaranty accompanying the proposal shall be the agreed amount of damages which the City will suffer by reason of such failure on the part of the Bidder and shall thereupon be retained by the City as liquidated damages. The filing of a proposal will be considered as an acceptance of this provision.

1104 SCOPE OF WORK

1104.1 MEANING AND INTENT OF PLANS AND SPECIFICATIONS

A. It is the intent of these plans and specifications to prescribe a complete work or improvement, which the Contractor undertakes to do in full compliance with the plans, specifications, special provisions, proposal and contract. The Contractor shall do all work as provided in the plans, special provisions, specifications, proposal and contract, and shall do such additional, extra and incidental work as may be considered necessary to complete the work in a satisfactory and acceptable manner. He shall furnish all labor, materials, tools, equipment and incidentals necessary to the prosecution of the work, unless otherwise specified.

B. The Contractor shall examine all drawings prior to bidding, and shall require his various subcontractors and materials suppliers to provide items of work shown on any of the plans and to provide necessary utility connections.

C. The Engineer shall decide the meaning and intent of any portion of the specifications, and of any plans or drawings where same may be found obscure or be in dispute.

D. It is the intent that this be a complete project as far as the Contract Documents (contract, drawings and specifications) set forth. It is not the intent that different phases of the work on- this project be delegated to various trades and subcontractors by the Contract Documents. The Contractor must make his own contracts with the various subcontractors, setting forth the work these subcontractors will be held responsible for. The Contractor, alone, will be held responsible by Engineer and City for the complete project.

E. Where the words "furnish", "provide", and/or "install" are used, it shall be interpreted to mean that the Contractor is responsible for furnishing, providing and installing, ready for successful and continuous use, all items of work, whether by his own men or his subcontractors and suppliers. The words "Contractor shall" in most instances have been omitted and simple directive statements have been made. These omitted words shall be supplied by inference. Omission of these words shall not release the Contractor from any work called for on this project. The Contractor shall provide all items, articles, materials, operations or methods listed, mentioned or scheduled, either on the drawings or in the specifications, or both, including all labor, materials, equipment and incidentals necessary and required for completion.

1104.2 SPECIAL PROVISIONS

Should any work or any conditions which are not thoroughly or satisfactorily stipulated or

covered by the general or standard conditions be anticipated on any proposed work, "Special Conditions" for such work shall be prepared and shall be considered as a part of the specifications and contract.

1104.3 INCREASED OR DECREASED QUANTITIES OF WORK

A. The City reserves the right to alter the quantities of the work to be performed or to extend or shorten the improvement at any time when and as found necessary and the Contractor shall perform the work as altered, increased or decreased, at the contract unit prices. No allowance will be made for any change in anticipated profits, nor shall such changes be considered as waiving or invalidating any condition or provision of the contract.

B. This provision shall not be construed as to permit the Contractor to perform additional work not included or contemplated in the original proposal.

1104.4 ALTERATIONS OF PLANS AND SPECIFICATIONS

The City reserves the right to make such changes in the plans and in the character of the work as may be necessary or desirable to insure completion of the work in the most satisfactory manner, provided such changes do not materially alter the original plans and specifications or change the general nature of the work as a whole. Such changes shall not be considered as waiving or invalidating any condition or provision of the contract.

1104.5 EXTRA WORK

When any work is necessary to the proper completion of the project for which no prices are provided in the proposal or contract, the Contractor shall do such work but only when and as ordered in writing by the Engineer and with the prior review by the City.

1104.6 FINAL CLEANING UP

Upon completion of the work, and before acceptance and final payment will be made, the Contractor shall clean and remove from the site of the work surplus and discarded materials, temporary structures, and debris of any kind. He shall leave the site of the work in a neat and orderly condition. Waste materials removed from the site of the work shall be disposed of at locations satisfactory to the Engineer.

1105 CONTROL OF WORK AND MATERIALS

1105.1 AUTHORITY OF ENGINEER

All work shall be done under the supervision of the Engineer and to his satisfaction. He shall decide all questions which arise as to the quality and acceptability of materials furnished, work performed, manner of performance, rate of progress of the work, interpretation of the plans and specifications, acceptable fulfillment of the contract, compensation mutual rights between contractors under these specifications, and suspension of work. The Engineer shall have the right to establish any sequence or priority of operation in the interest of desirable cooperation with other work. He shall determine the amount and quality of work performed and materials furnished, and his decision and estimates shall be final and binding on the Contractor. His estimate in such event shall be a condition precedent to the right of the Contractor to receive money due him under the contract.

1105.2 CONFORMITY WITH PLANS, ALLOWABLE DEVIATIONS

All deviations from the specifications will be accomplished by Change Orders prepared by the Engineer. All Change Orders shall be in writing and shall be reviewed by the City before the work is commenced. Change Orders submitted to the City for review shall bear the signature of the Engineer, and shall be provided hereinafter.

1105.3 DETAIL SHOP AND WORKING DRAWINGS FURNISHED BY CONTRACTOR

The Contractor shall submit to the Engineer for review, such additional shop and working drawings of structures or equipment as may be required and, prior to the acceptance of such drawings by the Engineer, any work done or materials ordered shall be at the Contractor's risk. The Contract price shall include the cost of furnishing such drawings.

1105.4 COORDINATION OF PLANS, SPECIFICATIONS, PROPOSAL AND SPECIAL PROVISIONS

The plans, these specifications, the Proposal, Special Conditions and all supplementary documents are intended to describe a complete work, and are essential parts of the contract. A requirement occurring in any of them is binding. In case of discrepancies, figured dimensions shall govern over scaled dimensions; Specifications shall govern over Plans; Special Conditions shall govern over General Conditions and the quantities shown in the Proposal shall govern over those shown on the Plans. The Contractor shall take no advantage of any apparent error or omission in the plans and specifications, and the Engineer shall be permitted to make such corrections or interpretations as may be deemed necessary for the fulfillment of the intent of the plans and specifications. In the event the Contractor discovers any apparent error or discrepancy, he shall immediately call such error or discrepancy to the attention of the Engineer.

1105.5 COOPERATION OF CONTRACTOR

A. Plans and Specifications will be provided to the contractor in electronic format (pdf). **The Contractor, however, shall have plans and specifications available at each work site during the execution of the contract.**

B. The Contractor shall give to the work the consistent attention necessary to facilitate the program thereof, and he shall cooperate with the Engineer and his inspectors and with other contractors in every way possible. The Contractor shall always provide a competent Superintendent on the work site who is fully authorized as his agent on the work. Such Superintendent shall be capable of reading and thoroughly understanding the plans and specifications and shall receive and fulfill instructions from the Engineer or his representative. The Contractor and his Superintendent shall provide all reasonable facilities to enable the Engineer and his inspectors to inspect the workmanship and materials entering into the work.

1105.6 MEASUREMENTS

Before ordering any material or doing any work, the Contractor shall verify all measurements involved, and shall be responsible for the correctness of same. No extra charge or compensation will be allowed on account of difference between actual dimensions and the measurements indicated on the drawings, and any differences which may be found shall be submitted to the Engineer for consideration before proceeding with the work.

1105.7 SOURCE OF SUPPLY AND QUALITY OF MATERIALS

The Contractor shall not start delivery of materials until the Engineer has reviewed the source

of supply. Only materials conforming to the requirements of these specifications shall be used in the work, and such materials shall be used only after written acceptance by the Engineer, and only so long as the quality of said material remains equal to the requirements of the specifications. The Contractor shall furnish accepted materials from other sources, if for any reason the product from any source at any time before commencing or during the prosecution of the work proves unacceptable. After acceptance, any material which has become mixed with or coated by dirt or any other foreign substance during its delivery and handling shall not be used in the work.

1105.8 APPROVAL OF MATERIALS

Before ordering materials, the Contractor shall make written request to the Engineer for review and acceptance of, the use of any materials, construction, etc., other than those mentioned as standard in the specifications or so indicated on the drawings, and obtain his acceptance of materials, construction, etc., proposed for use when "accepted" materials or work are specified without mentioning any standard by name. The terms "accepted" or "accepted equal" shall mean accepted by the Engineer.

1105.9 SAMPLES AND TESTS OF MATERIALS

The Contractor shall submit samples of materials, finish appliances, etc., when required by the Engineer; all such samples must be accepted by the Engineer in writing before work is executed, and all work shall conform in all respects to accepted samples. Work not conforming to accepted samples will be rejected and the Contractor shall remove such nonconforming work and replace it with work that does conform. If submittals are not accepted, others shall be submitted until satisfactory samples have been accepted. Where, in the opinion of the Engineer or called for in the specifications, tests of materials are necessary, the City will pay the cost of all initial testing of which passes the requirements. The Contractor will pay for two (2) passing tests for each failed test. This cost will be deducted from the Contractor's Pay Estimate. The developer of a subdivision which requires public improvements shall pay the cost of all testing. Tests, unless otherwise specified, are to be made in accordance with the latest standard methods of the American Society for Testing Materials. All tests shall be made by a laboratory acceptable to the Engineer and the City. The Contractor shall provide such facilities as may be required for collecting and forwarding samples, and shall not use the materials represented by the samples until tests have been made and reviewed by the Engineer. All field tests shall be made by a representative of an approved testing laboratory. Testing shall be performed as specified in the Special Conditions or Specifications unless otherwise required by the City.

1105.10 GUARANTY

Unless otherwise specified in the Special Conditions, the Contractor shall guarantee the work for two (2) years from date to acceptance by Engineer and City. Neither the final certificate, nor payment, nor any provisions in the contract documents, shall relieve him of responsibility for negligence or faulty materials or workmanship within the extent and period provided; and upon written notice from the Engineer or the City, he shall remedy any defects due thereto and pay all expenses for any damages to other work resulting therefrom.

1105.11 STORAGE OF MATERIALS

Materials shall be stored so as to insure the preservation of their quality and fitness for the work. When directed by the Engineer, they shall be placed on wooden platforms or other hard, clean surfaces and not on the ground, and shall be placed under cover when directed. Stored materials shall be located so as to facilitate prompt inspection.

1105.12 INSPECTION

A . The Contractor shall ensure the Engineer has the opportunity to ascertain whether or not the work as performed is in accordance with the requirements and intent of the plans and specifications. Ample advanced notice will be provided by the Contractor to the Engineer of the need to cover over any uninspected work by a certain date in order to not delay the project.

B. If the Engineer requires, the Contractor shall, at any time before acceptance of the work, remove and uncover such portions of the finished work as may be directed for inspection. After inspection, the Contractor shall restore said portion of the work to the condition required by the specifications.

C. Should the work thus exposed at the direction of the Engineer prove acceptable, the cost of uncovering or removing and the replacing of covering or making good the parts removed will be paid for as "Extra Work. However, if ample notice was not provided by the Contractor to the Engineer of the intent to cover over the work, then the cost of the uncovering or removing and the replacing of the covering or making good of the parts removed shall be borne by the Contractor, regardless of whether or not the work examined proved acceptable or unacceptable. Should the work so exposed or examined prove unacceptable, the cost of covering or removing and the replacing of the covering or

making good of the parts removed shall be at the Contractor's expense,. Any work done or materials used without suitable supervision or inspection by the Engineer may be ordered removed and replaced at the Contractor's expense.

1105.13 REMOVAL OF DEFECTIVE AND UNAUTHORIZED WORK

A. All work which has been rejected or condemned shall be repaired, or if it cannot be satisfactorily repaired it shall be removed and replaced, at the Contractor's expense. Defective materials shall be removed immediately from the site of the work.

B. Work done without proper inspection or any extra or unclassified work done without written authority and prior to agreement in writing as to prices, will be done at the Contractor's risk and will be considered unauthorized, and, at the option of the Engineer may not be measured and paid for and may be ordered removed at the Contractor's expense.

C. Upon the failure of the Contractor to satisfactorily repair or to remove and replace, if so directed, any rejected, unauthorized or condemned work and materials immediately after receiving notice from the Engineer, the Engineer shall, after giving written notice to the Contractor, have the authority to cause defective work to be remedied or removed and replaced, or to cause unauthorized work to be removed and to deduct the cost thereof from any compensation due or to become due to the Contractor. If the Engineer and City deem it inexpedient to correct work injured or done not in accordance with the contract, an equitable deduction from the contract price shall be made therefor.

1105.14 FINAL INSPECTION

The Engineer shall make final inspection of all work included in the contract or any portion thereof as soon as practicable after the work is completed and ready for acceptance. If the work is not acceptable to the Engineer at the time of such inspection, he shall inform the Contractor as to the particular defects to be remedied before final acceptance can be made.

1106 LEGAL RELATION AND RESPONSIBILITY TO THE PUBLIC

1106.1 LAWS TO BE OBSERVED

The Contractor shall, at all times, observe and comply with all Federal and State laws and City ordinances and regulations which in any manner affect the conduct of the work and shall observe and comply with all orders and decrees which exist at the present or which may be enacted later, or bodies or tribunals having jurisdiction or authority over the work.

1106.2 CONTRACTOR TO DEFEND, INDEMNIFY, AND SAVE HARMLESS - VIOLATIONS

The Contractor and his Surety shall defend, indemnify, and save harmless the City and all its officers, agents, and employees against any claims or liabilities arising from or based on the violation of any such law, ordinance, regulation, order, or decree whether by himself or his employees.

1106.3 PERMITS AND LICENSES

The Contractor shall procure all permits and licenses, pay all charges or fees, and give all notices necessary and incidental to the due and lawful prosecution of the work. The expense of all permits required by the City shall be paid by the City.

1106.4 PATENTED DEVICES, MATERIALS AND PROCESSES

If the Contractor is required or desires to use any design, device, material or process covered by letters, patent or copyright, he shall provide for such use by suitable legal agreement with the patentee or City. It is mutually understood and agreed that without exception the contract prices shall include all royalties or costs arising from patents, trademarks and rights-of-way involved in the work.

1106.5 SANITARY PROVISIONS

The Contractor shall establish and enforce among his employees such regulations in regard to cleanliness and the disposal of garbage and waste as will tend to prevent the inception and spread of contagious or infectious diseases and to effectively prevent the creation of a nuisance about the work or any property, either public or private. The necessary sanitary conveniences for the use of laborers on the work properly secluded from public observation shall be constructed and maintained by the Contractor, and their use shall be strictly enforced by the Contractor. All sanitary laws and regulations of the City and of the State of Oklahoma shall be strictly complied with.

1106.6 PUBLIC CONVENIENCE AND SAFETY

A. Materials stored about the work shall be so placed, and the work shall at all times be so conducted to provide for public safety and convenience, and to cause no greater inconvenience for the traveling public than is considered necessary by the Engineer. A work zone traffic control plan shall be provided and accepted by the City Engineer prior to commencing any work. The Contractor shall make provisions, bridges or otherwise at all cross streets, highways, sidewalks and private driveways, for the free passage of vehicles and pedestrians, provided that where bridging is impracticable or unnecessary in the opinion of the Engineer, the Contractor may make arrangements satisfactory to the Engineer and City for the diversion of traffic; and shall, at

his own expense, provide all materials and perform all work necessary for the construction and maintenance of roadways and bridges for the diversion of traffic. Sidewalks must not be obstructed unless by special permission of the Engineer, subject to review by the City.

B. Neither the materials excavated nor the construction materials excavated nor the construction materials or plant used in the construction of the work, shall be placed so as to endanger the work or prevent free access to all fire hydrants, water valves, gas valves, manholes for electric, telephone, telegraph or traffic signal conduits, sewers or fire alarm or police call boxes in the vicinity. The City reserves the right to remedy any neglect on the part of its attention after twenty-four (24) hours notice in writing to the Contractor, save in cases of emergency, when it shall have the right to remedy any neglect without notice; and in either case, the cost of such work done by the City shall be deducted from monies due or to become due the Contractor.

C. When the Contractor is required to construct temporary culverts or bridges, or make other arrangements for crossing over ditches or streams, his responsibility for accidents shall include the roadway approaches as well as the structures of such crossings.

1106.7 PRIVILEGES OF CONTRACTOR IN STREETS, ALLEYS OR RIGHTS-OF-WAY

For the performance of the Contract, the Contractor will be permitted to occupy such portions of streets or alleys, other public places or other rights-of-way as provided for in the ordinances of the City, as shown on the plans, or as permitted by the Engineer. A reasonable amount of tools, materials and equipment for construction may be stored in such space, but not more than is necessary to avoid delay in the construction. Excavated and waste materials shall be piled or stacked in such a way as not to interfere with spaces that may be designated to be left free and unobstructed, nor inconvenience occupants of adjoining property. Any additional grounds desired by the Contractor for his use shall be provided at his own expense.

1106.8 PROTECTION OF PROPERTY

The Contractor shall protect the work and adjacent property from damage resulting from carelessness or other causes or by reason of the action of the elements until the entire work is completed and accepted. The work shall be entirely at the Contractor's risk, and the City assumes no responsibility whatever for damage or loss to any of the work or adjacent property by reason of the Contractor's judgment.

1106.9 CONTRACTOR'S CLAIM FOR DAMAGES

Should the Contractor claim compensation for any alleged damage by reason of the acts or omissions of the City, he shall within ten (10) days after the sustaining of such damage, make a written statement to the Engineer setting out in detail the nature of the alleged damage. On or before the twenty-fifth (25th) day of the month succeeding that in which any such damage is claimed to have been sustained, the Contractor shall file with the Engineer an itemized statement of the details and amount of such damage, and upon request shall give the Engineer access to all books of account, receipts, vouchers, bills of lading and other books or papers containing any evidence as to the amount of such damage. Unless such statement shall be filed as thus required, the Contractor's claim for compensation shall be waived, and he shall not be entitled to payment on account of any such damage.

1106.10 PUBLIC UTILITIES AND PUBLIC PROPERTY TO BE CHANGED

In case it is necessary to change or move the property of any owner of a public utility, such owner will, upon proper application by the Contractor, be notified by the Engineer to change or move such property within a specified time, and the Contractor shall not interfere with such property until ordered to do so by the Engineer. The right is reserved to the owner of public utilities to enter upon the limits of the Contract for the purpose of making such repairs or changes of their property that may be necessary by performance of the Contract for the purpose of repairing or relaying sewer and water lines and appurtenances, repairing culverts or storm drains, and for making other repairs, changes, or extensions to any City property.

1106.11 DELAYS AND EXTENSIONS OF TIME

A. If the Contractor is delayed at any time in the progress of the Work by any act or neglect of the City or the Engineer, or by any employee of either, or by any separate contractor employed by the City, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in transportation, adverse weather conditions not reasonably anticipatable, unavoidable casualties, or any causes beyond the Contractor's control, or by delay authorized by the City pending arbitration, or by any other cause which the Engineer determines may justify the delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Engineer may determine.

B. Any claim for extension of time shall be made in writing to the Engineer not more than twenty (20) days after the commencement of the delay, otherwise it shall be waived. In the case of continuing delay only one claim is necessary. The Contractor shall provide an estimate of the probable effect of such delay on the progress of the Work.

1106.12 USE OF FIRE HYDRANTS

The Contractor or his employees shall not open, turn off, interfere with, attach pipe or hose to or connect anything with any fire hydrant, stop valve or stop cock, or tap any water main belonging to the City, unless duly authorized to do so by the City.

1106.13 USE OF A SECTION OR PORTION OF THE WORK

Whenever, in the opinion of the Engineer, any portion of the work or any structure is in suitable condition, it may be put into use by the written order of the Engineer, and such usage shall not be held to be in any way an acceptance of said work or structure or any part thereof, or as a waiver of any of the provisions of these specifications or contract. Pending final completion and acceptance of the work, all necessary repairs and renewals on any section of the work so put into use, due to defective materials or workmanship, to natural causes other than ordinary wear and tear, or to the operations of the Contractor, shall be performed by and at the expense of the Contractor.

1106.14 CONTRACTOR'S RESPONSIBILITY FOR THE WORK

Until written acceptance by the Engineer as provided for in these specifications, the work shall be under the charge and care of the Contractor, and he shall take every necessary precaution to prevent injury or damage to the work or any part thereof by the action of the elements or from any other of the cause whatsoever, whether arising from the execution or from the nonexecution of the work. The Contractor shall rebuild, repair, restore and make good at his own expense all injuries or damage to any portion of the work occasioned by any of the above causes before acceptance.

1106.15 PERSONAL RESPONSIBILITY OF PUBLIC OFFICIALS

In carrying out any of the provisions contained herein or in exercising any power or authority granted to him by the Contract, there shall be no liability upon the Engineer or his authorized assistants, either personal or as officials of the City, it being understood that in such matters he acts as the agent and representative of the City.

1106.16 WAIVER OF LEGAL RIGHTS

Inspection by the Engineer or by any of his duly-authorized representatives, any order, measurement or certificate by the Engineer, any order by City for the payment of money, any payment for or acceptance of any work, or any extension of time or any possession taken by the City, shall not operate as a waiver of any provisions of the contract or any power therein provided. Any waiver of any breach of contract shall not be held to be a waiver of any other or subsequent breach. The City reserves the right to correct any error that may be discovered in any estimate that may have been paid and to adjust the same to meet the requirements of the contract and specifications. The City reserves the right to claim and recover by process of law sums as may be sufficient to correct. any error or errors, or make good any deficiency in the work resulting from such error or deficiency, dishonesty or collusion discovered in the work after the final payment has been made.

1106.17 CONTRACTOR'S INDEMNIFICATION

A. The Contractor shall not commence work under this contract until he has obtained all insurance required under this specification, and such insurance has been reviewed by the City, nor shall the Contractor allow any subcontractor to commence work on his subcontract until all similar insurance required of the subcontractor has been so obtained and accepted.

B. The Contractor shall indemnity and hold harmless the City and the Engineer and their agents and employees from and against all claims, damages, losses and expenses; including attorney's fees arising out of or resulting from the performance of the work, provided that any such claim, damage, loss or expense (a) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself) including the loss of use resulting therefrom; and (b) is caused in whole or in part by any negligent act or omission of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

C. In any and all claims against the City or the Engineer or any of their agents or employees, by any employee of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any subcontractor under Workmen's Compensation acts, disability benefit acts, or any other employee benefit acts.

D. The obligation of the Contractor shall not extend to the liability of the Engineer, his agents or employees, arising out of (1) the preparation of approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications; or (2) giving of or the failure to give directions of instructions by the Engineer, his agents or employees, provided such giving or failure to give is the primary cause of the injury or damage.

1106.18 INSURANCE

A. The Contractor shall not commence work under this contract until he has obtained all insurance required under this Specification and such insurance has been reviewed and accepted by the City, nor shall the Contractor allow any subcontractor to commence work on his subcontract until all similar insurance required of the subcontractor has been so obtained and reviewed. The limits of liability under this section shall provide coverage for not less than the following amounts or greater where required by law.

1. ***Compensation and Death Liability Insurance*** The Contractor shall furnish and maintain during the life of this Contract, Workmen's Compensation Insurance as prescribed by the laws of the State of Oklahoma and Employer's Death Liability Insurance in an amount not less than one hundred thousand ($100,000) Dollars for all his employees employed at the site of the project, and, in case any work is sublet, the Contractor shall require the subcontractor similarly to provide Workmen's Compensation and Employer's Death Liability Insurance for all the latter's employees, unless such employees are covered by the protection afforded by the Contractor. In case any class of employees engaged in hazardous work, work under this Contract at the site of the project which is not protected under the insurance heretofore mentioned, the Contractor shall provide, and shall cause each subcontractor to provide adequate insurance for the protection of his employees not otherwise protected.

2. Public Liability and Property Damage Insurance

   (a) Contractor's Insurance. The Contractor and/or Subcontractor shall maintain during the life of this contract such Public Liability and Property Damage Insurance as will protect him from claims for damages for bodily injury, including accidental death, as well as from claims from property damages which may arise from operations under this contract whether such operations by himself or by his subcontractor or by anyone directly or indirectly employed by either of them and the amounts of such insurance shall be as follows:

      (1) Bodily Injury Liability in the amount of not less than $100,000.00 for injuries including accidental death, to any one person, and subject to the same limit for each person, in an amount not less than $300,000.00 for one accident.

      (2) Property Damage Liability Limits shall be carried in the amounts of not less than $100,000.00 for any one accident and an aggregate limit of $100,000.

   (b) Owner's Insurance. Contractor shall provide Owner's Protective Liability Insurance with this City as the name insured, and the engineers as additional insured, to protect the City and engineers against claims arising out of operations of Contractors and other independent Contractors,

as well as omissions of supervisory acts of the City and engineers in connection with the performance of the contract covered by these specifications in the following minimum amounts.

(1) Bodily Injury Liability in the amount of not less than $1,000,000 for injuries including accidental death, to any one person, and subject to the same limit for each person, in an amount not less than $2,000,000. for one accident.

(2) Property Damage Liability shall be carried in the amounts of not less than $100,000.00 for any one accident and an aggregate limit of $100,000.00.

(c) Comprehensive General Liability Insurance. The Contractor shall procure and maintain during the life of this Project Comprehensive General Liability Insurance to protect from claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees, including claims insured by personal injury during liability coverage and from claims for injury or destruction of tangible property, including loss of use resulting therefrom, any and all of which may arise out of or as a result from the Contractor's operations under the Contract, whether such operations be by himself or by any Sub-Contractor or anyone directly or indirectly employed by any of them, or for whose acts any of them may be legally liable. Such insurance shall include coverage for:

(1) Operation and Premises

(2) Independent Contractor Protective Liability

(3) Contractual Liability

(4) Explosion, Collapse, or Underground Damage

(d) Liability Limits. The limits of Liability for property damage, including accidental death, shall be $2,000,000.00 per occurrence and a total limit of $2,000,000.00 for all Completed Operations - Products bodily injury claims during a single policy year. The limits of liability for property damage shall be $2,000,000.00 per occurrence and $2,000,000.00 aggregate limit individually each for operations, Independent Contractor Protective, and Contractual for each project, and $2,000,000.00 aggregate limit for Completed Operation - Product damage during a single policy year.

(e) Comprehensive Automobile Liability. This insurance shall cover owned, hired, or other non-owned automobiles and shall protect the contractor from claims for bodily injury or property damage which may arise from the use of motor vehicles engaged in various operations under this Contract. The automobile insurance shall provide minimum limits of

liability for bodily injury of $1,000,000 for each person and $2,000,000 each occurrence, and $500,000 of property damage each occurrence

B. The policies of insurance shall be executed by an insurance or indemnity carrier authorized to do business in the State of Oklahoma.

C. Before awarding a contract, the City will be furnished a binder or certificate of insurance showing the coverage to be in effect.

1106.19 LIENS

Neither the final payment nor any part of the retained percentage shall become due until the Contractor, if required, shall deliver to the City a complete release of all liens arising out of this contract, or receipts in full in lieu thereof, and if required in either case an affidavit that so far as he has knowledge or information, the releases and receipts include all the labor and material for which a lien could be filed; both the Contractor may, if any subcontractor refuses to furnish a release or receipt in full, furnish a bond satisfactory to the City to indemnity him against any lien. If any lien remains unsatisfied after all payments are made, the Contractor shall refund to the City all monies that the latter may be compelled to pay in discharging such a lien, including all costs and a reasonable attorney's fee.

1106.20 TRANSPORTATION TAX

A. Under provisions of Section 3475 (b) of the Internal Revenue Code, as amended, the State of Oklahoma, its agencies and political subdivisions are exempt from payment of the three per centum (3%) transportation tax levied by Subsection (a) of Section 3475, in either of the following cases:

1. When the property (equipment, goods, materials, etc.) is consigned to the State, its agencies, or political subdivisions, or,

2. When such property is consigned to the State, its agency, or political subdivision in care of the Contractor.

B. It is the policy of the City to take advantage of the savings afforded by the above mentioned exemption. To this end, the Contractor agrees to comply with the following:

1. "In determining cost of material and computing freight charges, do not include a 3% Federal Transportation of Property Tax. Section 3475 (b) of the Internal Revenue Code, as amended, exempts the City from this tax. The successful Bidder will be furnished an appropriate exemption certificate form by the contracting authority, and will be authorized to have all shipments of construction materials and equipment entering into this Contract consigned to the City in care of himself, thereby enabling him to take advantage of the above- mentioned exemption."

   NOTE: Said exemption will not apply to shipments of fuel, lubricants, spare parts, or items of construction equipment belonging to the Contractor which will not become the property of the City.

1106.21 CONSTRUCTION AND MAINTENANCE SIGNING

A. Work Zone Traffic Control Plan (WZTCP) shall be prepared and submitted. The WZTCP shall show devices and shall reflect the contractor's plan of work on the project. Installation and removal times of devices shall be

provided. The WZTCP shall include any sidewalks that are inside the work area. The plan shall include barricades and detours for sidewalk closures. Submittal of a traffic control plan shall not be considered notice of closure of a roadway.

B. Signing shall be in accordance with Part VI - Traffic Controls for Street and Highway Construction and Maintenance Operations of the current *Manual on Uniform Traffic Control Devices* (MUTCD). The Contractor shall, at his own expense, design, provide, and maintain the appropriate traffic control devices, to be reviewed by Norman's City Traffic Engineer prior to signing. Maintenance shall mean that the contractor shall check the traffic control devices daily (Including holidays, Saturdays, Sundays and days the contractor is not actively working on the project) to ensure they are properly installed and in proper working order.

C. The Contractor must have a certified Workzone Traffic Technician (WTT) responsible for the installation and maintenance of all traffic control devices required by latest revision of the (MUTCD) for the protection of traffic in and around the construction work sites. The WTT may be an employee of the Contractor or the Contractor may hire an outside firm to perform this service.

D. The WTT must be certified by a recognized public agency such as the Oklahoma Department of Transportation, OSU Technical Institute, American Traffic Safety Services Association, etc.

E. Sandbags shall be used for ballasting portable signs and barricades. Sandbags shall be placed on the lower parts of the frame. Application and number of sandbags shall be sufficient to withstand the force of wind gusts on the traffic control device.

F. The Contractor shall provide the Traffic Control Division and the City Engineer or designed with 72 hours notice prior to the closure of any roadway. Each separate closure requires a separate notice which includes specific dates, times and durations. The notice shall also include a traffic Control Plan as described above, which has been approved 72 hours prior to the road closure.

G. The Contractor shall either furnish watchmen at the point of closure to protect any freshly installed pavement or install impenetrable barriers at the points of closures. The Contractor will be held responsible for all damage to the work due to failure of barricades, signs, lights, and watchmen to protect it, and whenever evidence of such damage is found prior to acceptance, the City may order the damaged portion immediately removed and replaced by the Contractor at his expense, if, in the opinion of the Superintendent such action is justified. The Contractor's responsibility for the maintenance of barricades, sign, and lights and for providing watchmen shall not cease until the project shall have been accepted by the City.

H. Where traffic control signs, devices, flagmen, etc., are required by law in conjunction with this work through other utility, railroad, or Governmental Agencies, all necessary traffic control shall be provided by and at the expense of the Contractor to the extent as affected by this project.

1106.22 PROTECTION AND RESTORATION OF PROPERTY

A. The Contractor shall not enter upon private property, whether the property has an easement or not, for any purpose without first giving twenty-four (24) hour

advance notice to property owner, and shall use reasonable caution necessary to prevent damage to landscaping, fences, culverts, bridges, pavements, driveways, sidewalks, etc., to all water, sewer, gas or electric lines or appurtenances thereof, and to all other public or private property along or adjacent to the work. The Contractor shall notify the proper representatives of any public service corporation, any company or individual, not less than twenty-four (24) hours in advance of any work which might damage or interfere with the operation of their or his property, along or adjacent to the work.

B. Contractor shall be responsible for all damage or injury to property of any character resulting from any neglect or misconduct in the manner or method of executing the work or materials, and said responsibility shall not be released until the work shall have been completed and accepted. When and where any direct or indirect damage or injury is done to public or private property on account of any neglect or misconduct in the execution of the work in consequence of the nonexecution thereof on the part of the Contractor, he shall repair at his expense such damage to a condition similar or equal to that existing before such damage or injury was done; by repairing, rebuilding or otherwise.

C. In case of the failure on the part of the Contractor to repair such damage or make good such damage or injury, the Engineer may, upon forty-eight (48) hours written notice, under ordinary circumstances and without notice when a nuisance or hazardous condition results, proceed to repair, rebuild or otherwise restore such property as may be determined necessary, and the cost thereof will be deducted from any monies due or to become due the Contractor under his contract.

1106.23 PROTECTION AND PRESERVATION OF LAND MONUMENTS AND PROPERTY LINE MARKS

The Contractor shall protect carefully from disturbances or damages all land monuments and iron pins or other markers which establish property or street lines, provided that where such monuments or markers must, of necessity, be disturbed or removed in the performance of the Contract, the Contractor shall first give ample notice to the City, so that he may witness or reference in such monuments or markers. Should the Contractor disturb, remove, or damage any established land monument or property or street line mark without first giving the City ample notice, the City may deduct the cost of re-establishing such monument or marks from any monies due or to become due the Contractor.

1107 PROSECUTION AND PROGRESS

1107.1 SUBLETTING OF WORK

A. The Contractor shall not employ any subcontractor on the work without prior written acceptance of the Engineer and the City.

B. Subcontractors proposed for any part of the work and all subcontractors must be accepted by the City in writing within thirty (30) days after the award of the contract.

C. The City will not recognize any subcontractor on the work. The Contractor shall at all times when work is in operation be represented either in person or by a qualified superintendent or other designated representative. If the Contractor sublets the whole or any part of the work to be done under this

contract, he will not under any circumstances be relieved of his responsibility and obligations. The Contractor shall not subcontract more than 40% after excluding the cost of all materials without written permission of the City of Norman. Failure to comply with this provision will constitute breach of Contract, and the City shall take appropriate action to dismiss the Contractor. In this event, the Contractor will have no claims (such as lost profit, etc.), due to his breach of this provision. All transactions of the Engineer shall be with the Contractor. Subcontractors will be considered only in the capacity of the employees or workmen and shall be subject to the same requirements as to character and competency.

1107.2 ASSIGNMENT OF CONTRACT

The Contractor shall not assign, transfer, convey, or otherwise dispose of the Contract or his right, title, or interest in or to the same or any part thereof, without the previous consent of the Engineer in writing, accepted by the City Council, and concurred in by the Surety. If the Contractor does without such previous consent, assign, transfer, convey, sublet, or otherwise dispose of the Contract or his right, title, or interest therein, or any part thereof, to any person or persons, partnership, firm or corporation, or by bankruptcy, voluntary or involuntary, or by assignment under the insolvency laws of any state, attempt to dispose of the Contract or make default in or abandon said Contract, then the Contract may, at the option of the City, be revoked and annulled unless the Surety shall successfully complete said Contract and any monies due or to become due under said Contract shall be retained by the City as liquidated damages for the reason that it would be impracticable and extremely difficult to fix the actual damages.

1107.3 PROSECUTION OF WORK

The Contractor shall begin the work to be performed under the contract within the time limit stated in the Advertisement, Proposal and Contract, and shall conduct the work in such a manner and with sufficient equipment, materials and labor as necessary to insure its completion within the time limit sat forth in the Advertisement, Proposal and Contract. The sequence of all construction operations shall at all times be as directed by the Engineer. Should the prosecution of the work for any reason be discontinued by the Contractor, he shall notify the Engineer at least twenty-four (24) hours in advance of resuming operations.

1107.4 LIMITATION OF OPERATIONS

The Contractor shall conduct his work so as to create a minimum amount of inconvenience to the public. At any time when the Contractor, in the judgment of the Engineer, has obstructed or closed or is carrying on operations on a greater portion of the street or public way than is necessary for the proper execution of the work, the Engineer may require the Contractor to finish the section on which work is in progress before work is started on any additional section.

1107.5 CHARACTER OF WORKMEN AND EQUIPMENT

A. The Contractor shall employ such superintendents, foremen and workmen as are careful and competent, and the Engineer may demand the dismissal of any person or persons employed by the Contractor in, about or on the work who shall misconduct himself or be incompetent or negligent in the proper performance of his or their duties, or neglect or refuse to comply with the directions of the Engineer, and such person or persons shall not be employed again thereon without the written consent of the Engineer. Should the Contractor continue to employ or again employ such person or persons without the written consent of the Engineer, then the Engineer may withhold

all estimates which are, or may become due, or may suspend the work, until compliance with such orders is accomplished.

B. All workmen shall have sufficient skill and experience to properly perform the work assigned them. All workmen engaged on special work or skilled work, or in any trade, shall have sufficient experience in such work to properly and satisfactorily perform it and operate the equipment involved, and shall make due and proper effort to execute the work in the manner prescribed in these Specifications; otherwise, the Engineer may take action as above prescribed.

C. The Contractor shall furnish such equipment as is considered necessary for the prosecution of the work in an acceptable manner and at a satisfactory rate of progress. All equipment, tools and machinery used for handling materials and executing any part of the work shall be subject to review by the Engineer, and shall be maintained in a satisfactory working condition. Equipment on any portion of the work shall be such that no injury to the work or adjacent property will result from its use. Equipment shall meet applicable safety and environmental standards.

1107.6 DAY'S WORK: WORKING HOURS

Work shall be done only during regular and commonly accepted and prescribed working hours. No work shall be done nights, Saturdays, Sundays or regular holidays unless a special order or permit is given by the Engineer to do so. Eight (8) hours shall constitute a days work, and the Contractor shall observe all State Laws and City Ordinances governing the hours of work.

1107.7 TIME OF COMMENCEMENT AND COMPLETION

The Contractor shall commence work within the time specified in the Contract and the rate of progress shall be such that the whole work will be performed and the premises cleaned up in accordance with the Contract, Plans, and Specifications within the time limit, where such time is stated in the Contract, unless an extension of time be made in the manner hereinafter specified.

1107.8 EXTENSION OF TIME OF COMPLETION

The Contractor shall be entitled to an extension of time, as provided herein only when claim for such extension is submitted to the Engineer in writing by the Contractor within seven (7) days from and after the time when any alleged cause of delay shall occur and then only when such claim is accepted by the Engineer and the City Council. In adjusting the Contract time for the completion of the project, all strikes, lockouts, unusual delays in transportation, or any condition over which the Contractor has no control, unusual adverse weather conditions above normal for the contract period, and also any suspensions ordered by the Engineer for causes not the fault of the Contractor, shall be excluded from the computation of the Contract time for completion of the work. If the satisfactory execution and completion of the Contract should require work or materials in greater amounts or quantities than those set forth in the Contract, then the Contract time shall automatically be increased in the same proportion as the cost of the additional work relates to the cost of the original contracted work. No allowance shall be made for delays or suspension of the prosecution of the work due to the fault of the Contractor.

1107.9 FAILURE TO COMPLETE WORK ON TIME

A. The time of completion is of the essence of the Contract. For each calendar day that any work shall remain uncompleted after the time agreed upon in the Proposal and the Contract, or as automatically increased by additional

work or materials ordered after the Contract is signed, or the increased time granted by the City for the completion of said work, the sum per day given in **APPENDIX D Fee Schedule** of the Engineering Design Criteria Manual, unless otherwise specified in the Proposal or Special Conditions, will be deducted from the monies due the Contractor, not as a penalty but as liquidated damages.

1107.10 TEMPORARY SUSPENSIONS

A. The Engineer shall have the authority to suspend the work, wholly or in part, for such period or periods as he may deem necessary due to unsuitable weather or such other conditions as are considered unfavorable for the suitable prosecution of the work.

B. If it should become necessary to stop work for an indefinite period, the Contractor shall store all materials in such manner that they will not obstruct or impede the traveling public unnecessarily, nor become damaged in any way, and he shall take every precaution to prevent damage or deterioration of the work performed, and shall provide suitable drainage about the work and erect temporary structures where necessary.

C. The Contractor shall not suspend work without written authority from the Engineer, and shall proceed with the work promptly when notified by the Engineer to resume operations.

1107.11 SUSPENSION OF WORK AND ANNULMENT OF CONTRACT

A. The work or any portion of the work under contract shall be suspended immediately on written order of the Engineer or the City, a copy of such notice to be served upon the Contractor's Surety, or the contract may be annulled by the City for any good cause or causes, among others of which special reference is made to the following:

1. Failure of the Contractor to start work within the time limit specified.
2. Substantial evidence that the progress being made by the Contractor is insufficient to complete the work within the specified time.
3. Failure of the Contractor to provide sufficient and proper equipment for properly executing the work.
4. Deliberate failure on the part of the Contractor to observe any requirements of these specifications, or to comply with any orders given by the Engineer, as provided for in these specifications.
5. Failure of the Contractor to promptly make good any defects in materials or workmanship or any other nature, the correction of which has been directed in writing by the Engineer.
6. Substantial evidence of collusion for the purpose of illegally procuring a contractor perpetrating fraud on the City in the construction of work under contract.

B. When work is suspended for any one of the causes itemized above, or for any other cause or causes, the Contractor shall discontinue the work or any part thereof as the City shall designate, whereupon the Surety may at its option

assume the contract or that portion thereof which the City has ordered the Contractor to discontinue, and may perform the same; or may, with the written consent of the Engineer, accepted by the City, sublet the work or portion of the work so taken over; provided, however, that the Surety shall exercise its option (if at all) within two (2) weeks after the written notice to discontinue work has been served upon the Contractor and upon the Surety or its authorized agent. The surety, in such event, shall assume the Contractor's place in all respects and shall be paid by the City for all work performed by it in accordance with the terms of the contract; and if the Surety, under the provisions hereof, shall assume said entire contract, all monies remaining due the Contractor at the time of his default, shall thereupon become due and payable to the Surety as the work progresses, subject to all the terms of the contract.

C. In the event the Surety does not, within the time hereinbefore specified, exercise its rights and option to assume the contract or that portion thereof which the City has ordered the Contractor to discontinue then the City shall have the power to complete, by contract or otherwise as it may determine, the work herein described or such part thereof as it may deem necessary, and the Contractor hereby agrees that the City shall have the right to take possession of and use any of the materials, plant, tools, equipment, supplies and property of every kind provided by the Contractor for the purpose of his work, and to procure other tools, equipment and materials for the completion of the same, and to charge to the account of the Contractor the expenses of said contract for labor, materials, tools, equipment and expenses incident thereto. The expense so charged shall be deducted by the City out of such monies as may be due or may at anytime thereafter become due the Contractor under any by virtue of the contract or any part thereof. The City shall not be required to obtain the lowest bid for the work of completing the contract, but the expense to be deducted shall be the actual cost of the work. In case such expense is less than the sum which would have been payable under the contract if the same had been completed by the Contractor, the balance shall operate at liquidated damages as hereinabove set out. In case such expense shall exceed the amount which would have been payable under the contract if the same had been completed by the Contractor, then the Contractor and his Surety shall pay the amount of such excess to the City on notice from the City of the excess so due. When any particular part of the work is being carried on by the City by contract or otherwise under the provisions of this section, the Contractor shall continue the remainder of the work in conformity with the terms of the contract, and in such manner as in no wise to hinder or interfere with the performance of workman employed as above provided by the City.

1107.12 TERMINATION OF CONTRACT

The contract will be considered fulfilled, save as provided in any bond or bonds or by law, when all the work has been completed, the final inspection made by Engineer, and final acceptance and final payment made by the City.

1108 MEASUREMENT AND PAYMENT

1108.1 MEASUREMENT OF QUANTITIES

The determination of quantities of work acceptably completed under the terms of the contract, or as directed by the Engineer, in writing, will be made by the Engineer, based on measurements taken by him or his assistants. These measurements of quantities will be taken according to the

plan units. When materials are measured in the vehicle, the measurement will be taken at the point of delivery. When required by the Engineer, the capacity of all vehicles shall be plainly marked on each vehicle, and the capacity or marking shall not be changed without the permission of the Engineer.

1108.2 APPLICATION FOR PROGRESS PAYMENT

A. At least twenty days before each progress payment is scheduled (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. Application must be submitted on the form provided herein. Payment may be delayed or not processed without use of the proper application form. Non-standard forms not provided by the City may be rejected at City's Discretion. It shall be the Contractor's responsibility to make copies for his use from the form provided herein. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that City has received the materials and equipment free and clear of all liens, charges, security interests and and encumbrances (which are hereinafter in these General Conditions referred to as "Liens") and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect City's interest therein, all of which will be satisfactory to City. The amount of retainage with respect to progress payments will be as stipulated herein.

B. **Contractor's Warranty of Title:** Contractor warrants and guarantees that title to all work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to City no later than the time of payment free and clear of all liens.

C. **Review of Applications for Progress Payment:** Engineer will, within ten (10) days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to City, or return the Application to the Contractor, indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application for payment at a later date.

1108.3 SCOPE OF PAYMENT

A. The Contractor shall receive and accept the compensation as herein provided in full payment for furnishing all labor, materials, tools, equipment, and incidentals; for performing all work contemplated and embraced under the Contract; for all loss of damage arising out of the nature of the work or from the action of the elements; for any unforeseen defects or obstruction which may arise or be encountered during the prosecution of the work and before its final acceptance by the Engineer; for all risks of every description connected with the prosecution of the work; for all expenses incurred by or in consequence of suspension or discontinuance of such prosecution of the work as herein specified; for any infringement of patents, trademarks, or copyrights and for completing the work in an acceptable manner according to the Specifications.

B. The payment of any current or partial estimate prior to final acceptance of the work by the City shall in no way constitute an acknowledgment of the acceptance of the work, nor in any way prejudice or affect the obligation of the Contractor to repair, correct, renew, or replace at his expense any defects or imperfections in the construction or in the strength or quality of the material used in or about the constructions due to or attributable to such defects, which defects, imperfections, or damage shall have been discovered on or before the final inspection and acceptance of the work. The Engineer shall be the sole judge of such defects, imperfections, or damage and the Contractor shall be liable to the City for failure to correct the same as provided herein.

1108.4 PAYMENT FOR EXTRA WORK

A. The extra work completed by the Contractor as authorized and accepted by the Engineer and the City Council, will be paid for in the manner hereinafter described and the compensation thus provided shall be accepted by the Contractor as payment in full for all labor, materials, tools, equipment, and incidentals, and all superintendents' and timekeeper's services, all insurance, and all other overhead expense incurred in the prosecution of the extra work.

B. Payments for extra work will be made by one or more of the following methods:

1. Unit prices agreed on in writing by the Engineer and the Contractor and accepted by the City Council before said work is commenced, subject to all other conditions of the Contract. (For Contracts over $1,000,000, the maximum amount will be 10%.)

2. A lump sum price agreed on in writing by the Engineer and the Contractor and accepted by the City Council before said work is commenced, subject to all other conditions of the Contract.

3. The actual costs including labor, materials, tools, equipment, and field supervision of such extra work plus fifteen percent (15%), which fifteen percent (15%) is hereby understood and agreed to include all overhead expense and profits, when agreed upon in writing by the Engineer and the Contractor, and accepted by the City Council before said work is commenced; subject to all other conditions of the Contract. For Contracts in excess of $1,000,000, overhead expense and profit is limited to 10%.

C. The Contractor shall, on or before the tenth (10) day of the month succeeding that in which any extra work shall have been performed, file with the Engineer his claim and an account giving the itemized cost of such work and shall give the Engineer access to all accounts, bills, and vouchers relating thereto. If the estimate exceeds one hundred dollars ($100) in amount, ninety percent (90%) of such estimated sum will be paid if approved.

1108.5 PARTIAL ESTIMATES

Between the 25th day and the last day of each month, the Engineer will make an approximate estimate of the value of the work done and/or materials furnished during that month under these Specifications. Whenever the said estimate or estimates of work done and/or materials furnished since the last previous estimate exceed One Hundred Dollars ($100) in amount, less retainage of such estimated sum will be paid when accepted.

1108.6 PAYMENTS WITHHELD

Should any defective work or material be discovered, or should a reasonable doubt arise as to the integrity of any part of the work completed prior to the final acceptance and payment, there will be deducted from the first estimate rendered after the discovery of such work an amount equal in value to the defective or questioned work and this work will not be included in the subsequent estimate until the defects have been remedied or the cause for doubt removed.

1108.7 ACCEPTANCE AND FINAL PAYMENT

Upon completion of any Contract and before final acceptance, a final inspection must be made by the Engineer to determine whether the work has been completed in accordance with the Contract and Specifications. All prior partial estimates and payments shall be subject to correction in the final estimate and payment. When the work has been so completed and certified to the Council, the work will be considered accepted and the final acceptance shall be executed and submitted.

END OF SECTION 1100

City of Norman
STANDARD SPECIFICATIONS AND CONSTRUCTION DRAWINGS
SECTION 2100 SITE DEVELOPMENT AND EARTHWORK

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2101 SITE CLEARING AND RESTORING

2101.1 DESCRIPTION

This work shall consist of the removal and reconstruction or replacement of all obstructions (Obstructions include, but are not limited to trees, brush, fences, retaining walls, patios, trash burners, signs, mail boxes, outbuildings, landscaping, etc.) affected by the construction of the project, with the exception of sidewalk, curb, street, parking lot, road, alley surfacing, gravel and oiled surfaces which will be removed and repaired under Section for Pavement Cut and Repair. Any obstructions which are not to be reconstructed are so designated on the plans.

2101.2 MATERIALS

A. Waste Material: All waste material and debris resulting from the cleaning operation or occurring within the right-of-way shall be disposed of in such a manner that air pollution regulations and solid waste disposal regulations are not violated and private or public property is not injured or endangered. Permission in writing from the property owner must be obtained by the contractor if waste material is placed on private property. A copy of this permission shall be furnished to the Engineer before the final estimate will be paid. In no case will debris or extra material be left in the right-of-way.

B. Plant Material to be Replaced: Shrubs or trees in the right-of way that are to be replaced will be replaced with like type shrubs or trees. When these items are encountered they shall be removed, preserved, replaced or the contractor may make arrangements with the property owner to replace them. Arrangements with property owners shall be in writing and the Engineer shall be furnished a copy prior to payment of the final estimate.

C. Salvaged Material: Material such as bricks, signs, manhole frames and covers, etc., which may, in the opinion of the Engineer be suitable for use by the City shall be the property of the City, and shall be neatly stacked or removed to such places along the site of the work as the Engineer may direct. This will be done at no additional cost to the City.

2101.3 CONSTRUCTION METHODS

A. **General:** The contractor shall clear and remove from the construction site all trees marked for removal, brush, roots, stumps, hedges, fences, rock, rubbish, and any other objectionable materials within or over-hanging the right of way as directed by the Engineer.

B. **Clearing:**

1. Tree Removal/Protection: No trees shall be removed, even though listed for removal until specifically marked by the Engineer. Trees to be removed shall be felled in such a manner as not to injure other trees which are to remain, either on the right-of-way or adjacent thereto. Trees or plants which are to remain in place and which may be in danger of injury by construction operations or equipment shall be suitably boxed, fenced or otherwise protected. Boxing and fencing shall be constructed and removed at the direction of the Engineer. The contractor shall

repair all injuries to bark, trunk limbs, and roots of remaining trees and shrubs by proper dressing, cutting and painting according to accepted methods, using only accepted tools and materials.

2. Obstruction *Removal:* All obstructions in the designated right-of- way shall be removed and disposed of by the Contractor in a method that is suitable for the obstruction.

C. **Maintaining Access:** Passable surfaces across or along the construction site shall be maintained at all times with gravel, steel mat or plate, or temporary bituminous surfacing material where a sidewalk, driveway, parking lot, street, road, or alley previously existed.

D. **Maintaining Streets:** The contractor will be responsible for preventing his trucks from scattering debris, mud, and/or soil on public roads. If this occurs the contractor will clean-up debris as required by the Engineer.

E. **Reconstruction:**

1. *General:* All obstructions to be replaced or reconstructed shall be restored to substantially the same condition as existed prior to the construction. The contractor shall remove and dispose of all debris, restore the surface of the earth to the grade existing prior to construction and upon completion of the work shall leave the site in a neat clean and orderly condition, as nearly as it was prior to construction as may reasonably be done.

2. *Sodding:* When the area being worked crosses the front or side yard of an existing residence or commercial establishment, the disturbed area will be sodded upon completion of other restoration activities. When sodding is required in backyards it will be called for on the plans.

3. *Seeding:* This will include seeding all disturbed areas with grass and establishing an initial growth on the seeded areas. During the normal growing season the areas will be seeded with grasses that match the surrounding grasses. During the winter months either rye or winter wheat will be used to establish ground cover.

2101.4 SPECIAL REQUIREMENTS

A. Notification of Landowners:

1. *Privately Held Land:* It shall be the contractor's responsibility to notify all landowners prior to entering onto their property. If an owner has an obstruction that will be affected, they will be notified sufficiently in advance of construction operations so that they may make such arrangements as they may desire for the protection, removal or relocation of property in advance of construction.

2. *Public Owned Land or Utilities:* If an obstruction is of public ownership, the Contractor shall notify the appropriate agency, and obtain any necessary permit or license, forty-eight hours before beginning any operations affecting the obstruction. All work shall conform to the current standard and specifications of the agency, and shall be reviewed by the agency before the work is started.

At the contractor's request, the Engineer will furnish information as to what licenses or permits are required.

B. **Clearing Limits:** The contractor shall limit the clearing operation to not over one mile ahead of the construction operation and shall follow up with restoration immediately after completion of construction.

C. **Protection of Areas Outside of Construction:** Areas outside of the construction area shall be preserved in their natural state. If the contractor damages an area outside of the construction area, the damage will be repaired to its original condition at no additional cost to the City.

D. **Compliance with Easements:** A copy of all easements associated with this contract are included in the Special Provisions to the contract. The contractor shall take all actions necessary to comply with the requirements of these easements and the cost of this compliance shall be included in this item.

2102 EARTHWORK

2102.1 SCOPE

This section governs the performance of all work required to excavate, remove, dispose or compact all materials encountered within the limits of the project, at the locations shown on the plans, in accordance with the requirements of applicable Sections of the General Conditions and Covenants, and as provided for in the Special Conditions.

2102.2 DEFINITIONS:

A. **Grading:** Grading as used herein shall mean the performance of all excavation, embankment, and backfill in connection with the construction of all improvements.

B. **Excavation:** Excavation is defined as the removal of materials from the construction area to the lines and grades shown on the plans.

1. *Unclassified Excavation:* Unclassified excavation is defined as the removal of all material encountered regardless of its nature. All material excavated will be considered as-Unclassified Excavation unless the Special Conditions specify Classified Materials.

2. *Rock Excavation:* Rock excavation is defined as the removal of all rock materials which cannot be excavated with a backhoe, trenching machine, drag line, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers or jackhammers.

3. *Earth Excavation:* Earth excavation is defined as the removal of all material not defined as rock.

C. **Embankment or Backfill:** Embankment or backfill is defined as the placing and compacting of material in the construction area to the lines and grades shown on the plans.

1. *Unsuitable Material:* Unsuitable material is defined as muck, frozen material, organic material, top soil, rubbish, and rock with a maximum dimension greater than 24".

2. *Suitable Material:* Suitable material is defined as entirely imperishable with that portion passing the No. 40 Sieve having a liquid limit not exceeding 40 and a plastic index not exceeding 25, when tested in accordance with ASTM D423 and D-424, respectively.

3. *Rock Embankment:* Material for rock embankment shall be free of unsuitable material and shall contain,-by volume, greater than 10 percent rock or gravel having a maximum dimension greater than 3" but not greater than 24".

4. *Earth Embankment*: Material for earth embankment shall be free of unsuitable material and shall, contain by volume, less than 10 percent rock or gravel having a maximum dimension greater than 3".

D. **Borrow:** Borrow is defined as accepted material excavated from an area outside of the project limits and required for the construction of the embankment.

E. **Waste:** Waste is defined as excavation material not used in the embankment and disposed of outside of the embankment areas.

F. **Structures:** Structures as used herein refers to bridges, culverts, storm sewer and/or sanitary appurtenances, retaining walls and similar construction.

2102.3 GENERAL CONSTRUCTION METHODS:

A. The Contractor shall adhere to any and all statutes regarding the notification of utilities prior to beginning any work within public right-of- way. Relocation or protection of any existing utilities located in street right-of-way shall be governed by the General Conditions and Covenants. The relocation and/or protection of any utility that is shown on the plans, that lies within a utility easement and is endangered by this construction shall be the responsibility of the Contractor.

B. The Contractor shall make every reasonable effort to protect private facilities. These facilities may not be shown on the plans. When these facilities are disturbed or damaged by the work, the Contractor shall make necessary arrangements for repairs to the facilities for continuous service prior to the close of that work day.

C. It shall be the responsibility of the Contractor to protect all property lot corners and control monumentation. Should it be necessary to disturb any such monument, whether stake, pin, bar, disk, box, or other, it remains the responsibility of the Contractor' to reference such markers prior to removal, reset, them, and file such relocations or monumentation documents as the law may require. Any such references, removal, replacement and certification of monuments shall be performed by, a registered licensed surveyor. A copy of all such certification documents shall be provided to the Engineer prior to final payment. Any monument destroyed or improperly reset by the Contractor may be replaced by the Engineer to the standards required by law at the expense of the Contractor.

D. Grading, excavation and backfilling for all improvements, shall be made to the lines, grades and cross sections indicated by the plans.

E. In addition, to any erosion control measures shown on the plans, the Contractor shall schedule and conduct his operations in such a manner and shall provide any necessary control facilities to protect downstream and adjacent properties from pollution, sedimentation or erosion caused by the grading operations. Any pollution or damage occurring shall be the responsibility of the developer, property owner and/or contractor that has day to day operational control of the site.

F. During construction, the graded area shall be maintained by the Contractor in such condition that it will be well drained at all times. Roadway ditches, channel changes, inlet and outlet ditches and other ditches in connection with the roadway shall be cut and maintained to the required cross section. All drainage work shall be performed in proper sequence with other operations. All ditches and channels shall be kept free of debris or obstructions.

2102.4 EXCAVATION

A. All suitable material removed by excavation shall be used as far as practicable in the formation of embankment as required to complete the work. The Contractor shall sort all excavated material and stockpile when necessary, so as to provide suitable materials for embankments.

B. All excavated material which is suitable for top soil shall be used before any top soil is obtained from a borrow source. Top soil material secured from excavations shall be stockpiled at locations acceptable to Owner.

C. After removal of the roadway excavation material to the required section, all material between lines 12" outside of the curbs and within the top 6" of the subgrade shall be compacted to 95 percent of maximum density for the material.

D. Rock encountered within the full width of the roadway, toe of slope to toe of slope, shall be undergraded to an elevation of 6" below the finished subgrade elevation. Care shall be taken to avoid overshooting when blasting. Rock shall be removed in such a manner as to leave no excessive water pockets in the surface.

E. Areas of undergrading or overbreak in rock between lines 1' outside of - the curbs shall be backfilled with spalls, rock fragments or a granular type material. Backfill materials shall have a plasticity index not to exceed 14 and a gradation such that at least 50 percent of the material will be retained on the No. 4 sieve.

2102.5 UNDERGRADING

Where materials are encountered which are deemed as unsuitable by the Engineer for use in the work, they shall be removed to the depth and limits as ordered, by the Engineer.

Areas undergraded shall be backfilled with one of the following materials:

A. Rock fragments or spalls.

B. A granular type material having a plasticity index not to exceed 10 and a gradation such that at least 50 percent of the material will be retained on the No. 4 sieve and not more than 40 percent will pass the No. 10 Sieve.

C. A material meeting the requirements of ASTM D448, Size No. 67.

2102.6 EMBANKMENT

A. **General:** The embankments shall be constructed using suitable materials, as herein defined, procured from excavations made on the project site or from borrow areas as required to complete the grading work.

B. **Starting the Embankment:**

1. Where embankments, regardless of height, are placed against hillsides or existing embankments, either of which have a slope steeper than 1 vertical to 4 horizontal, the existing slope shall be- benched or stepped in approximately 12" rises as the new fill is brought up in a maximum of 6" layers or lifts. The material bladed out, the bottom of the area cut into, and the embankment material being placed, shall be compacted to the required density. Material cut out, bladed into place and compacted shall not be measured and paid for directly but will be considered as incidental work. The existing surface upon which embankment material is to be placed shall have all unstable and unsuitable material removed before starting the embankment work.

2. Where embankments 24" or less in depth are to be placed on areas covered by existing pavement, the existing pavement shall be removed and the cleared ground surface shall be compacted to the specified density. Where embankments greater than 24" in depth are to be placed on areas covered by existing pavement, the existing pavement shall be broken into pieces not larger than 12" maximum dimension, left in place and the embankment started thereon.

C. **Placing Earth Embankment:** Earth shall be placed in successive horizontal layers distributed uniformly over the full width of the embankment area. Each layer of material shall not exceed 6" in thickness (loose state) and shall be compacted to not less than the required density before the next layer is placed thereon. Contractor may request placement of layers thicker than 6" if he can demonstrate the ability to obtain proper compaction for the full layer thickness. As the compaction of each layer progresses, continuous blading, or dozing will be required to level the surface and to insure uniform compaction. Embankment construction shall not be performed when material contains frost, is frozen or is snow covered.

D. **Placing Earth and Rock Embankment:** When earth and scone or rock fragments are mixed in the embankment, all stones or rock fragments exceeding the thickness of the compacted lift shall be disposed of by being incorporated into the embankment outside the limits of the proposed surfaced areas. The thickness of the layer in these areas may be increased if necessary to accommodate the rocks, but shall nor exceed 15" in thickness (loose state). The stones or rock fragments are to be placed so there will be no nesting.

E. **Consolidated Rock Embankment:**

1. When the excavated material consists predominantly of stone or rock fragments of such size that the material cannot be placed in layers of the thickness prescribed, such material shall be placed in the embankment in layers having a thickness of the approximate average size of the larger rocks but not to exceed 24". Rocks or boulders too large to permit placing in a 24" layer shall be reduced in size as necessary to permit placement. Rock shall not be dumped in place but shall be distributed by blading or dozing in a manner to insure proper placement in final position in the embankment. The spalls and smaller scone fragments shall be left on the surface of each layer as formed. Each layer shall be thoroughly consolidated before the next layer is placed.

2. The top 12" of the embankment shall not contain material having a maximum dimension greater than 3". The rock fragments or crushed stone shall be well graded to form a dense mass when compacted.

F. **Compacting the Embankment:**

1. Before placing any embankment, the surface of the existing ground shall be prepared as heretofore specified, moistened as required, and the top 6" compacted to a density of 90 percent.

2. All embankment shall be compacted to a density of at least 90 percent of the maximum density for the material used as determined by AASHTO T-99. In addition to the above required compaction, the subgrade between lines 12" outside of the curbs and within the top 6" of the subgrade shall be compacted to a density of at least 95 percent of the maximum density for material used as determined by AASHTO T-99. All compaction shall be within a tolerance of □ 2% of the optimum

moisture at maximum density as determined by the Moisture Density Curve obtained. For example, if the optimum moisture is 15%, then the range will be 17% to 13% .

3. All the work involved in either adding moisture to or removing moisture from embankment materials to within these moisture limits shall be considered incidental to the completion of the grading operation.

G. **Moisture - Density Determination:** In-place density and moisture content of the embankment will be determined by AASHTO T-238.

2102.7 FINISHING

A. In areas where sodding or seeding is proposed, the upper 12" of the surface area shall be earth material. The top 6" shall be suitable for sustaining grass.

B. Except where other permit or utility work is in progress, the graded surface shall be made free of rock, concrete, and brick, or fragments thereof, or rubbish and shall be finished to the lines, grades, and cross- section indicated on the plans, including shoulder, berm and sidewalk spaces.

C. The Contractor shall repair any damaged surface, and shall not use any finishing equipment that will leave a marred surface. When the subgrade preparation is included as a part of the finishing, the work shall be accomplished according to the requirements of Section 2201 entitled "Subgrade Preparation," and shall be considered incidental to finishing the grading work.

2102.8 CLEANUP

Cleanup shall follow the work progressively and final clean-up shall follow immediately upon the completion of work. The contractor shall remove from the site of the work all equipment, tools and discarded materials, and other construction items. The entire right-of-way or easement shall be left in a finished and neat condition. Cleanup shall be considered as incidental to the completion of the grading work.

2103 TEMPORARY EROSION AND SEDIMENT CONTROL

2103.1 DESCRIPTION

This item shall consist of temporary soil erosion sediment and water pollution control measures in accordance with the City of Norman's Engineering Design Criteria for the duration of the contract. The temporary pollution control provisions contained herein shall be coordinated with the permanent soil erosion control features specified elsewhere in the contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction and post construction period. These control measures shall at no time be used as a substitute for the permanent control measures unless otherwise directed by the Engineer and they shall not include measures taken by the Contractor at his expense under Subsections 2103.3 (A) through (E) to control conditions created by his construction operations. The temporary measures shall include dikes, dams, berms, sediment basins, fiber mats, jute netting, temporary seeding, straw mulch, asphalt mulch, plastic liners, rubble liners, dikes, slope drains and other devices specified by the Engineer.

2103.2 PRECONSTRUCTION CONFERENCE

Prior to the start of the applicable construction, the Contractor shall submit for review his schedules for accomplishment of soil-erosion control work and his plan to keep the area of erodible earth material to a minimum. He shall also submit for acceptance his proposed method of soil erosion control on

construction and haul roads and material sources and his plan for disposal of waste materials. No work shall be started until the soil erosion control schedules and methods of operations have been reviewed and accepted by the Engineer.

2103.3 CONSTRUCTION REQUIREMENTS

A. The Engineer has the authority to define erodible earth and the authority to limit the surface area of erodible earth material exposed by preparing right-of-way, clearing and grubbing, the surface area of erodible earth material exposed by excavation, borrow and embankment construction operations (except for commercial operations) and to direct the Contractor to provide temporary pollution control measures to prevent contamination of adjacent streams, other water courses, lakes, ponds or other areas of water impoundment. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains and use of temporary mulches, mats seeding or other control devices or methods accepted by the Engineer as necessary to control soil erosion.

B. The Contractor will be required to incorporate all permanent soil erosion control features into the project at the earliest practicable time as outlined in his acceptable schedule. Temporary pollution control measures shall be used to prevent or correct erosion that may develop during construction prior to installation of permanent pollution-control features, but are not associated with permanent control features on the project.

C. The Engineer will limit the area of preparing right of way, clearing and grubbing, excavation, borrow and embankment operations (other than in commercially operated sources) to be proportional to the Contractor's capability and progress in keeping the finish grading, mulching, seeding, sodding, and other such permanent pollution control measures current in accordance with the accepted schedule. Should seasonal conditions make such limitations unrealistic, temporary soil erosion control measures shall be performed. The amount of surface area of erodible-earth material exposed at one time shall not exceed 750,000 ft^2 for each excavation operation, 750,000 ft^2 for each material source operation (other than from commercially-operated sources), 750,000 ft^2 for each preparing of right-of-way operation or 750,000 ft^2 for each clearing and grubbing operation, unless otherwise shown on the plans or with prior acceptance by the Engineer in writing.

D. The Contractor shall maintain the top of the earthwork in all roadway sections through all construction stages in such a manner as to permit the runoff of precipitation to the outer edges. When directed by the Engineer, earth berms shall be constructed along the top and/or bottom edges of embankment or cuts to intercept the runoff water at the close of the day's grading operations. Earth berms shall be compacted to the satisfaction of the Engineer. Temporary slope drain facilities shall be provided to carry the runoff to the bottom of the slopes. The slope drains may be of flexible or rigid construction, but shall be capable of being readily shortened or extended as the cut or fill progresses. Pipe and/or sheeting shall be provided at the entrance to the temporary slope drains, and where necessary, energy dissipaters shall be provided at the outlet. Open drains shall be stabilized as necessary to prevent erosion. On embankments with flat slopes where slope drains are impractical, temporary grasses and/or mulch stabilization shall be constructed concurrently with the embankment formation.

E. Should preventive measures fail to function effectively, the Engineer will require. the Contractor to act immediately to bring the erosion and siltation under control by whatever additional temporary means are necessary.

F. The Contractor shall also conform to the following practices and controls. All labor, tools, equipment and incidentals to complete the work will not be paid for directly but shall be considered as subsidiary work to the various items included in the contract.

1. Waste or disposal areas and construction roads shall be located and constructed in a manner that will minimize the amount of sediment entering streams.

2. Frequent fordings of live streams will not be permitted; therefore, temporary bridges or other structures shall be used wherever an appreciable number of stream crossings are necessary. Unless permission is granted in writing by the Engineer, mechanized equipment shall not be operated in live streams.

3. When work areas or material sources are located in or adjacent to live streams, such areas shall be separated from the stream by a dike or other barrier to keep sediment from entering a flowing stream. Care shall be taken during the construction and removal of such barriers to minimize the muddying of a stream.

4. All waterways shall be cleared as soon as practicable of falsework, piling, debris or other obstructions placed during construction operations that are not a part of the finished work.

5. The Contractor shall take sufficient precautions to prevent pollution of streams, lakes and reservoirs with fuels, oils, bitumens, calcium chloride or other harmful materials. He shall conduct and schedule his operations so as to avoid or minimize siltation of streams, lakes and reservoirs and to avoid interference with movement of migratory fish.

6. The contractor shall take sufficient precautions to prevent airborne pollution. Should these precautions fail, the Engineer shall require the Contractor to act immediately to bring the airborne pollution under control by whatever additional means are necessary. If the airborne pollution cannot be prevented, the contractor shall stop whatever construction activity is causing the pollution. When the wind velocity is greater than 15 mph, the contractor is strongly advised to not start any construction activity which shall cause airborne pollution.

7. The Contractor shall take sufficient precautions to prevent any pollutant such as discarded building materials, litter, chemicals, fuels, fluids or sediment from entering the municipal separate storm sewer system (MS4).

2104 SODDING AND SEEDING

2104.1 SCOPE

The work covered under this item includes all supervision, labor, materials and equipment needed for establishing a permanent, erosion preventing vegetation cover. All areas disturbed by the construction of this project shall be sodded as specified herein and where noted on the Drawings. Seeding shall only be used if approved as an acceptable alternative by the Engineer.

2104.2 PRODUCTS

Sod:

1. Bermuda grass sod to be used as source material shall be a thick stand of common Bermuda grass growing on fertile topsoil. Types of Bermuda grass other than "Common" may not be used unless accepted by the Engineer. The vegetative parts (rhizomes, stolons, and roots) of Bermuda grass shall be viable as indicated by a dense, deep rooted stand.

2. The source for sod shall be free of reproducing parts of weeds classified as "Prohibited Noxious" and shall be as free of other legally "Restricted Noxious" plant materials as required by the Oklahoma Department of Agriculture Seed Law. The proposed source of sod will be accepted by the Engineer before the beginning of sodding operations. Prior to acceptance, the area shall not be tilled or mowed. However, all vegetative growth exceeding 3" height shall be mowed and the residue removed prior to harvesting the sod or sprigs.

3. The sod shall be moist when excavated from the source and shall be kept moist until planted. Sod in storage which becomes dry shall not be remoistened and used, but shall be discarded.

4. Sod material shall consist of vegetative parts (rhizomes, stolons, and roots) of Bermuda grass with an appreciable quantity of adhering soil.

5. Solid Slab Sod shall be rectangular slabs of Bermuda grass. Bermuda grass vegetative parts shall exist throughout the slab, and shall be obtained from soils with a minimum P.I. of 3. The slab must have a dense vegetative growth and be capable of being transported in a condition closely resembling its original state.

B. **Seed:**

1. Seed labeled in accordance with the applicable portions of U.S. Dept. of Agriculture Rules and Regulations under the Federal Seed Act shall be furnished. Seed shall be furnished in sealed, standard containers unless written exception is granted. Seed that is wet or moldy or that has been otherwise damaged in transit or storage will not be acceptable.

2. The kind and quantity of seed to be furnished and planted shall be as follows:

Type	*Lbs. per 1,000 Sq. Ft.*	*Lbs. per Acre*
Bermuda Grass, hulled	*0.5*	22
Bermuda Grass, unhulled	*0.75*	33
Fescue KY31	1.0	44
Old World Blue Stem	0.14	6.1

C. **Fertilizer:** Fertilizer of 10-20-10 grade and ammonium nitrate (33.5% N), uniform in composition, free flowing, and suitable for application with accepted equipment, shall be provided. The fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable State fertilizer laws, and bearing the name, trade name or trademark, and warranty of the producer.

D. **Vegetative Mulch:** Vegetative mulch shall be native prairie hay, slough grass hay, or other grass-like material that may be accepted. Hay from leguminous plants and straw from threshed cereal grains will not be acceptable. While the grade of the hay is unimportant, it shall not be of such a brittle nature that it cannot be anchored in the soil satisfactorily, nor shall it be so rotten or moldy that it will deteriorate rapidly. The hay shall not exist in, or be broken into, lengths that are too short to be adequately held in place on the soil. Hay cut with a rotary-type cutter will not be accepted. The hay shall have been baled dry, in bales of uniform size and relative weight, and shall be dry when used. The hay shall be suitable for spreading with standard mulch blower equipment. The material shall be free from the seeds and other reproductive parts of weeds whose seeds are classed as "prohibited" by the Oklahoma State Board of Agriculture; shall contain no Johnson grass and other weeds on said Board's noxious weed list, and shall be practically free of any plants that could interfere with roadside turf or increase the cost of maintenance.

All vegetative mulching material in storage shall be fully protected against wet weather.

2104.3 CONSTRUCTION METHODS

A. **Preparation:** Unless otherwise specified, the entire construction area and other disturbed areas (including borrow areas) shall be spread with a minimum 3" thick layer on topsoil which is free of trash, shrubs, trees and other foreign matter. Grubbed and scarified material earlier removed and stockpiled may be used as topsoil material if sufficiently free of such foreign matter.

B. **Application:**

1. Seed:

(a) The area shall be seeded with Bermuda or Fescue grass seed at a rate as shown above. Seed shall be mixed with an equal amount of fertilizer at least 12 hours prior to seeding. The admixture shall be seeded by mechanical hand seeder or accepted power equipment. Whenever grass begins to sprout, an application of 200 lbs. of 10-20- 10 commercial fertilizer shall be applied to the area, preferably after the ground has been thoroughly saturated. After two or three months of planting, the seeded site shall be top dressed with 8 lbs. per 1,000 so. ft. or 350 lbs per acre of 33-00.

(b) The Contractor shall rewater or reseed the areas as often as necessary until the grass appears live over the entire area. After the grass appears live over the entire area and when, in the opinion of the Engineer, the grass is living and growing, it shall be the Contractor's responsibility to water the grass until completion and final acceptance of the project. Established growth must be over 95% of the entire area.

2. Sod:

(a) The slabs of sod shall be placed soil side down. They shall be placed in rows, which on slopes shall run perpendicular to the flow of water. Each slab shall fit tightly against the edge of adjoining slabs and shall be placed so that the vertical joints are not continuous across adjoining horizontal rows. Voids shall be filled with additional sod. All slabs shall have firm contact with the soil underneath.

(b) After the slabs have been placed, the sodded area shall be thoroughly watered. When sufficiently dry, additional voids shall be filled with good soil and watered again. The area shall then be thoroughly watered daily for a period of at least seven days after placement.

(c) Soil moisture shall exist throughout the zone from 1 inch below the surface to at least 5 inches below the surface at the time of planting. The required moisture content of the soil may be estimated and judged closely by the hand- squeeze test. The soil should readily form a tight cast when squeezed in the hand. The cast should break into two pieces without crumbling and without leaving excess water on the hand after casting.

(d) Fertilizer shall not be placed on hard or glazed surfaces. Fertilizer shall be applied at the rates shown on the Plans.

(e) When satisfactory results can be obtained, disking for soil preparation, weed removal, and incorporation of fertilizer may be accomplished in one operation.

(f) If a fertilizer containing phosphorous is specified, one half of the fertilizer shall be applied before placement of solid slab sod and shall then be incorporated into the soil by disking. After placement and compaction of the sod, the remaining half of the fertilizer shall be applied and immediately incorporated into the soil with water.

(g) Fertilizer containing nitrogen only shall be applied after the sodding and sprigging operations have been completed.

C. **Season:** If the Construction work is not completed during the normal planting season (April 15 through September 1) for Bermuda and/or Fescue, the Contractor shall seed the entire area with an accepted temporary vegetative cover, such as wheat, oats or rye grass to prevent erosion until the following spring at which time the Contractor will be required to return and prepare the area to be seeded as specified above and seed the entire area with Bermuda grass as specified above at no additional cost to the Owner. All areas which have eroded will at this time be brought back to original line and grade as directed by the Engineer.

D. **Water Supply:** Water used in the sodding and/or seeding operation will not be furnished by the Owner. The Contractor must make provisions to obtain water for this operation at his own expense. It will be the Contractor's responsibility to transport the water to the area where it is needed.

2105 BIOFILTRATION MEDIUM

2105.1 GENERAL REQUIREMENTS

A. SCOPE:

This item shall govern mixing and placing medium for a biofiltration basin intended to treat storm runoff. This specification is applicable for projects or work involving either inch-pound or SI units. Within the text inch-pound units are given preference followed by SI units shown within parentheses.

B. ABBREVIATIONS:

Wherever the words, forms, or phrases herein defined, or pronouns used in their stead occur in these specifications, in the contract or in the Advertisement of any document or instrument herein contemplated or to which these specifications apply, the intent and meaning shall be as defined in Sections 1008 and 1009.

C. CODES, SPECIFICATIONS, AND STANDARDS:

Codes, specifications, and standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise specified.

D. QUALITY ASSURANCE

1. Field tests shall be completed as specified in this Section.

E. SUBMITTALS

The submittal requirements of this specification item include:

1. A signed statement provided by the Contractor that:

   (a) A laboratory analysis has been conducted of the actual mixture being proposed and has been verified as meeting the specifications below. The date of the laboratory analysis must be no more than six months prior to the date of installation of the biofiltration medium. A copy of the laboratory results must be provided.

   (b) No "sandy loam" (aka "red death") fill material is included in the mixture.

   (c) Reports the source of organic matter.

   (d) Laboratory reports of analyses results documenting that the mixture meets the following specifications: Particle size distribution performed per ASTM D-422:

      (1) • Coarse fragments + sand content of 70 - 90% by weight

      (2) • Clay content of 3 - 10% by weight

      (3) • Silt + clay content ≤ 27% by weight

   (e) Percent organic matter of 0.5 - 5% by weight per ASTM

2. Contractor's statement, along with lab results showing,that the biofiltration medium has been tested by a laboratory using approved procedures and meets the criteria as noted in Table 1 below:

Table 1 - Biofiltration Medium Characteristics

Parameter	Results*	Criteria	Criteria Met?*
Percent Sand + Coarse Fragments (ASTMD-422)		70 - 90%	
Percent Clay (< 0.002 mm)		3 - 10%	
Percent Silt + Clay (< 0.05 mm)		≤ 27%	
Percent Organic Matter (ASTM D-2974)		0.5 - 5%	
Is any "Red Death" included in medium?		None allowed	
Is the mixture free of trash, stones, weeds, or other undesirable material?		None allowed	
Is the medium well-mixed and homogenous?		Must be homogenous	

* Laboratory Must Fill In These Cells

Table 2 - Biofiltration Medium Testing and Installation Dates

Date of Laboratory Analysis (earliest)*	
Date of Medium Installation*	
Time between Dates (months)*	
Criteria for Time Between Dates (months)	6
Is Criteria Met?*	

* Contractor Must Fill In These Cells

2105.2 PRODUCTS

A. ACCEPTABLE MATERIALS

The following mixture (% by volume) should create an appropriate biofiltration medium, subject to specific characteristics of the topsoil, which may exhibit considerable variability:

1. 70-80% concrete sand per ASTM C33 and/or screened decomposed granite sand

2. 20-30% screened bulk topsoil (chocolate loam is also acceptable)

3. The source materials must be free of stones, roots, or other similar objects larger than two inches. Additionally, it should be free of trash, other undesirable material, and should not contain weeds or weed seeds.

4. The ingredients shall be well-mixed to create a homogenous medium.

B. UNACCEPTABLE MATERIALS

A commercially available fill material that should not be used is typically marketed as "sandy loam." This product is often referred to by landscapers as "red death", which refers to the color of material, and is an infertile fill material that has poor drainage characteristics. All materials shall be free of Bermuda grass, Quackgrass, Johnson grass, or other noxious weeds, their roots or seeds.

C. MEASUREMENT

Biofiltration medium will be measured by the cubic yard (cubic meters: 1 cubic meter is equal to 1.196 cubic yards) in its final position based upon the average end areas, calculated from pre-construction cross sections and plan grades. The plan quantities for biofiltration medium will be used as the measurement for payment of this item.

D. PAYMENT

All work performed as required herein and measured as provided under "Measurement" will be paid for at the unit bid price. The bid prices shall include full compensation for furnishing all labor; all materials; all royalty and freight involved; all hauling and delivering on the road; and all tools, equipment, and incidentals necessary to complete the work. Payment will not be made for unauthorized work.

2105.3 CONSTRUCTION METHODS

A. EROSION CONTROL

Prior to commencing this work, all required erosion control and environmental measures shall be in place as indicated on the approved site plan and/or modified.

B. SCHEDULING, DELIVERY, STORAGE, AND SIGNAGE

The biofiltration medium must be delivered to, or mixed at, the site prior to the mid- construction conference. The medium must be certified as meeting the required specifications by the Engineer and approved by the Project Inspector. The medium must be stored on-site separate from other materials and covered to prevent erosion of the mixture by rainfall and runoff. The medium must have a prominent tag affixed that reads "BIOFILTRATION MEDIUM FOR WATER QUALITY POND."

C. PLACEMENT

After construction is complete, stabilize all areas draining to the biofiltration basin. Permanent controls will be cleaned out and filter medium will be installed after stabilization of the site. Install geotextile fabric per the Biofiltration Bed detail provided in EDC Figure 7004-3.
Biofiltration medium shall be placed in lifts of 12 to 18 inches without using heavy operating equipment or compaction. Lifts should be lightly watered to

encourage soil settling. The final surface must be raked flat. The Engineer must be notified 24 hours prior to installation of the biofiltration medium and must approve and certify the installation.

D. SHRINKAGE

Some shrinkage of the medium is to be expected after installation, in the range of 5-15%. As a general recommendation about 20 inches of medium should be installed to achieve a depth of 18 inches.

2106 BASIN LINERS

2106.1 GENERAL REQUIREMENTS

A. SCOPE:

This specification is to govern the furnishing of all materials, labor, equipment, tools, and other services to wet pond basin liners as specified in this section and as shown on the drawings.

All wet ponds require an impermeable liner. Impermeable liners are also required where hazardous material is present. If a liner is required and there are multiple controls in series, liners are only required for the first control in series. Impermeable liners may be clay, concrete, geosynthetic clay liner (GCL), geomembrane, or other approved liner, depending on the application.

B. ABBREVIATIONS:

Wherever the words, forms, or phrases herein defined or pronouns used in their stead occur in these specifications, in the contract or in the Advertisement of any document or instrument herein contemplated or to which these specifications apply, the intent and meaning shall be as defined in Sections 1008 and 1009.

C. CODES, SPECIFICATIONS, AND STANDARDS:

Codes, specifications, and standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise specified.

D. QUALITY ASSURANCE:

A construction Quality Assurance/Quality Control (QA/QC) Plan must be prepared by the engineer for the purpose of providing a basis for all construction/installation and testing of the liner system during the liner construction process. The QA/QC plan must be approved by the City prior to liner construction.

1. For clay liners, the QA/QC plan must include, but not be limited to, the following items: recordkeeping documents, including daily construction reports, inspection and test data sheets, non- conformance and corrective measure reports, design and specification changes, and all other documentation accumulated by inspection personnel during construction; pre-construction soil sampling, testing and documentation protocol, including the type of information to be documented for each sample, and the test procedures to be used; protocol during construction, including the monitoring of the subgrade, as well as material placement (including items such as density testing and moisture content, lift thickness and bonding, processing of soil and reduction of clods, footed compaction equipment, and number of passes of compaction equipment), sampling and testing procedures, frequencies and other

requirements. Also, the handling of any liner perforations as a result of various types of testing must be addressed along with guidance on how to address any deficiencies that may be discovered, including corrective measures to be taken.

2. For geomembrane and GCL liners, the QA/QC plan must include, but not be limited to, the following items: geomembrane/GCL manufacturing and delivery data requirements, including raw materials properties, roll and production quality assurance and control data requirements, along with transportation, handling and storage requirements, and conformance testing; installer qualifications requirements; installation requirements, including surface preparation, system anchorage, geomembrane/GCL placement (including, but not limited to panel identification, placement and installation schedule), seaming information (including, as applicable to geomembrane or GCL, seam layout, preparation, equipment, weather conditions, trial welds, general procedures, non-destructive testing and destructive testing), identification of defects and repair procedures, and geomembrane/GCL acceptance procedures.

3. All liner construction and QA/QC activities must be under the supervision of an independent licensed engineer with experience in geotechnical engineering. The engineer or designated representative must be on site during all significant liner construction activities, including but not limited to:

   (a) At the beginning of liner construction to inspect subgrade acceptability;

   (b) During the processing of clay liner material for placement to ensure adequate moisture conditioning and particle size reduction;

   (c) During placement of clay liner lifts to ensure 6 inch maximum lift depth is not exceeded and compaction is sufficient;

   (d) During all geomembrane and GCL installation;

   (e) During clay and geomembrane liner testing;

   (f) Prior to placement of successive clay lifts to verify acceptability of prior lift surface;

   (g) During construction of penetrations and any other construction that will affect the integrity of the liner (access ramps, pump pads, etc.).

   (h) During placement of protective soil layer.

E. SUBMITTALS

Following completion of the liner construction, a report must be prepared under the direction of and sealed by the engineer and submitted to the City. The report is intended to provide documentation of all installation methods and testing procedures conducted during the installation of the liner and to provide evidence that the liner was constructed in accordance with the construction plans, technical specifications and QA/QC plan.

F. PRODUCT DELIVERY, STORAGE, AND HANDLING

1. Transportation:

   Provide geomembrane liners in rolls wrapped with protective covering to protect the geomembrane from mud, dirt, dust, and debris. The geomembrane shall be free of defects or flaws which significantly affect its physical properties. Label each roll of fabric in the shipment with a number or symbol to identify the thickness, length, and manufacturer's roll number. Folded sections of panels are not acceptable and shall not be used in High Density Polyethelene (HDPE) liner construction. Creased sections of panels (which are not a normal part of the manufacturing process for some HDPE manufacturers) are not acceptable and shall not be used in the geomembrane liner construction. The geomembrane rolls shall be packaged and shipped by appropriate means so that no damage is caused. Transportation shall be the responsibility of the installer.

2. Delivery:

   Off-loading and storage of the geomembrane is the responsibility of the installer. The installer shall be responsible for replacing any damaged or unacceptable material at no cost to the Owner. No off-loading shall be done unless the Engineer is present. Damage during off-loading shall be documented by the Engineer. All damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined by the Engineer. The Engineer will be the final authority on determination of damage.

3. On-Site Storage:

   The geomembrane shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat, or other damage. A sacrificial cover must be used to protect the HDPE if stored on site more than 6 months. The rolls shall be stored in such a manner as to avoid shifting, abrasion, or other adverse movements that can damage the geomembrane liner material. The rolls shall be stored on a prepared surface (not wooden pallets) and should not be stacked more than three rolls high.

2106.2 SAMPLING AND COMPLIANCE REQUIREMENTS

A. A competent laboratory must be maintained by the producer of the geomembrane at the point of manufacture to ensure quality control in accordance with ASTM testing procedures. The laboratory shall maintain records of its quality control results and provide a manufacturer's certificate to the Engineer prior to shipment. The certificate shall include:

   1. Name of manufacturer.
   2. Chemical composition. Product description.
   3. Roll numbers if a geomembrane.
   4. Date of Production.
   5. Statement of compliance to specification requirements.
   6. Signature of legally authorized official attesting to the information required.

B. WARRANTY

The membrane manufacturer shall provide warranty coverage on the membrane for a period of 5 years from date of installation. The manufacturer shall replace or repair any defective materials and workmanship including significant leakage, abnormal aging, deterioration of materials, and other defects of the membrane liner which fail within the warranty period.

The Contractor shall furnish the Owner with a written warranty covering the requirements of this paragraph.

2106.3 GENERAL DESIGN GUIDELINES

A. SITE

The analysis and design should entail a comprehensive review of the site specific conditions to determine the most appropriate type of liner for the site, and should include a stability assessment of the pond side slope. The criteria in item 7102.2-7102.12 is applicable to any size basin or pond, while the criteria in item 7102.13 may be applied to sedimentation basins, filtration basins and retention ponds that are less than 1,000 square feet in area.

When required for sedimentation/filtration basins, the liner must underlie both the sedimentation basin and filtration basin and any gabion wall areas.

B. LINER SUBGRADE

1. A stable subgrade is very important in the construction of the pond or basin. Careful evaluation must be conducted to ensure the liner will be placed on a suitable base. If any voids are encountered, proper geotechnical analysis must be performed to ensure that the integrity of the liner can be maintained. Proof rolling must be conducted as necessary to determine the suitability of the subgrade, and any suspect areas must be reworked and recompacted, or the weak soils removed and replaced with suitable fill material. The subgrade for geomembrane or GCL must be smooth and contain no particles greater than 0.375 inch diameter.

C. LINER CHARACTERISTICS

At least three types of liners can be considered, including a clay liner of appropriate thickness and permeability, a geomembrane liner, and GCL. Alternative liner designs may also be considered.

1. If geomembrane is used, it must be a HDPE liner, have a minimum thickness of forty (40) mils and be ultraviolet resistant. Liners on side slopes may need to be textured depending on slope angle and type of protective cover over the liner. The liner requirements for a smooth HDPE geomembrane shall meet the following minimum average roll values (MARV): Tensile Strength at Break = 150 lb/in-width; Tensile Strength at Yield = 80 lb/in-width; Elongation at Break = 700%; Elongation at Yield = 13%; Tear Resistance = 25 lb; Puncture Resistance = 70 lb; Carbon Black Content = 2-3%; Notched Constant Tensile Load – 300 hr; Oxidative Induction Time = >100 mins. The liner requirements for a textured HDPE geomembrane shall include the following MARVs: Tensile Strength at Break = 55 lb/in-width; Tensile Strength at Yield = 80 lb/in- width; Elongation at Break = 100%; Elongation at Yield = 12%; Tear Resistance = 25 lb; Puncture Resistance = 55 lb; Carbon Black Content = 2-3%; Notched Constant Tensile Load – 300 hr; Oxidative Induction Time = >100 mins. Use of a

geomembrane also requires that a suitable geotextile fabric be placed on the top and bottom of the membrane for puncture protection if any particles with diameters greater than 0.375 inch are present in the cover soil or subgrade surface, respectively. The geotextile requirements shall meet the following MARVs: Grab Tensile Strength = 220 lbs; Puncture Resistance = 125 lbs; Trapezoidal Tear Strength = 95 lbs; Mullen Burst = 450 psi; Apparent Opening Size (AOS) = 80 Sieve. The designer must demonstrate the liner's impermeability, and the method of liner protection to be used during maintenance and sediment removal operations. Equivalent methods for protection of the geomembrane liner will be considered by the Public Works Director, or designee on a case by case basis.

Equivalency will be judged on the basis of ability to protect the geomembrane from puncture, tearing and abrasion. Individuals installing geomembrane liners must be trained and/or certified by the liner manufacturer.

2. If a GCL is used, it must meet the manufacturer's minimum property values. The designer must demonstrate the GCL's low permeability, and the method of GCL protection to be used during maintenance and sediment removal operations. Equivalent methods for protection of the GCL will be considered by the Engineer on a case by case basis. Equivalency will be judged on the basis of ability to protect the GCL from puncture, tearing and abrasion. Individuals installing GCL's must be trained and/or certified by the GCL manufacturer.

3. If a clay liner is used, it must be designed for the site-specific conditions by a geotechnical engineer and must have a minimum thickness of twenty four (24) inches or greater. Coefficient of permeability must be 1x10-7 cm/sec or less. Other parameters must be as follows: plasticity index of not less than 15; liquid limit of not less than 30; and at least 30% clay particles passing the No. 200 sieve, with a maximum particle size of 1 inch. Soil must be processed to reduce clod size as much as possible prior to compaction and compaction of the lifts must be done using footed rollers. Clay compaction must be no less than 95% of Standard Proctor Density with a moisture content range at or a maximum 4 percentage points above optimum moisture content or 90% of Modified Proctor Density at a moisture content between 1% dry and 3% wet of optimum moisture content. Soil sampling and testing must be conducted on the borrow source and installed liner samples as applicable. Liner material verification sampling and testing should occur at frequencies which must be in accordance with the QA/QC plan. In-situ materials may be used if it can be demonstrated that all required liner parameters will be met. If the clay liner is to be overlain by a drainage layer, a suitable geotextile fabric must be placed on the surface of the liner prior to placement of the drainage layer to limit clogging of the drainage layer by the clay liner.

4. Geomembrane or GCL liner placement over excavated rock requires installation of protective material to prevent damage to the liner. Examples of protective material include spray-on fiberglass, additional clay liner material, or placement of a thick enough geotextile suitable to prevent liner damage.

5. An alternative liner design may be approved by the Engineer if it can be

demonstrated by the responsible party that the liner is equivalent to or exceeds the above requirements.

D. HANDLING OF LINER PENETRATIONS

Liner penetrations are one of the areas of the pond or basin that are most susceptible to leakage. It is critical that the design and construction of these areas pay special attention to liner continuity around these interface points. Detailed analysis must be performed related to the handling of all areas of liner penetrations including but not limited to pipe inlet and outlet structures, headwalls, and areas where concrete access ramps, maintenance pads, and pump pads interface with the liner. Penetrations for wet ponds should be placed to minimize the hydraulic head over the penetration. Consideration must be given to the need for special applications such as gaskets, clay or bentonite plugs, filter diaphragms, special backfill and compaction, and other measures to prevent leakage around all these areas.

E. PROTECTING THE LINER FROM EROSION

1. The integrity of the liner, particularly a clay liner, can be severely compromised by any erosion that may occur at the surface of the liner. The design must provide appropriate mechanisms to prevent erosion of the liner at all areas, including the inlet structure and the separation berm between the forebay and main pool of wet ponds. Additionally, the liner must be continuous under wet pond separation berms to minimize the potential for leakage at the equalization/inter-basin pipe.

F. EARTHWORK

1. Earthwork shall be in accordance with Standard Specification 2102. All surfaces to be lined shall be smooth, free of all foreign and organic material, sharp objects, , or debris of any kind. These surfaces shall provide a firm, unyielding foundation with no sharp changes or abrupt breaks in grade. Standing water or excessive moisture shall not be allowed.
2. The installer, on a daily basis, shall certify that the surface on which the geomembrane will be installed is acceptable. After the supporting soil surface has been accepted, it shall be the Contractor's responsibility to indicate to the Owner any change to its condition due to natural causes or occurrences that may require repair work.

G. PROTECTING THE LINER AGAINST DAMAGE AND LOSS OF MOISTURE

It is imperative that the clay liner be kept moist during construction and prior to the time the basin is filled. Otherwise, cracks can develop in the clay, particularly during the hotter months of the year, thereby rendering it susceptible to leakage. For wet ponds, provisions must be included in the construction documents that require the contractor to protect the liner against loss of moisture until the basin is completely filled. For all ponds, damage to unprotected clay, GCL, or geomembrane liners can also occur due to passage of equipment during construction or during future sediment removal and maintenance operations. To minimize the possibility of damage and drying, all liner designs should include a protective soil layer over the liner with a minimum thickness of 12 inches for clay liners, and 24 inches for GCL and geomembrane (the 24-inch thickness can be reduced for liners which are never to undergo traffic by heavy equipment or are otherwise protected from heavy equipment).

H. LINER PLANS AND SPECIFICATIONS

The Contractor's/Developer's engineer must prepare the necessary plans and specifications to provide clear direction for the construction of the liner and all related components. Construction details must be included for all liner cross-sections, penetrations, and any other areas requiring special attention and/or guidance to ensure proper construction. A scale drawing of the area to be lined, including a grid established across the base and side slopes of the pond or basin with target elevations shown, must also be prepared by the Contractor's/Developer's engineer. This grid will provide a basis for verification of liner thickness during construction and will be used for the purpose of recording elevation data prior to placement of the initial lift and following placement of the final lift. All required testing, standards, procedures, and material properties must be spelled out in detail in the documents. Parties who are responsible for any surveying, sampling, testing and other verification requirements must be identified in the documents.

I. GROUNDWATER CONTROL

Liners constructed below groundwater will require dewatering as necessary to allow construction of the liner. To prevent damage to the liner due to uplift pressures after termination of dewatering or during future maintenance, the liner must include placement of sufficient soil ballast or additional thickness of clay liner to resist any uplift pressures.
Alternative designs to relieve liner uplift pressure (French drain, etc.) will be considered and must be approved by the Engineer.

J. SUBMERGED INLETS AND STORM SEWERS

Due to excessive leakage issues submerged inlets and storm sewers connections to Stormwater Control Measures (SCM) are to be avoided whenever possible. In situations where site conditions require a submerged inlet or storm sewer then the portion of the inlet pipe that is placed below the water quality elevation must be designed to store water, not simply convey it. In these situations the pond liner must extend and surround the portion of the inlet pipe or storm sewer that is designed to be under water and all structural elements and piping below the water quality elevation shall be watertight. Acceptable watertight piping includes gasketed RCP, PVC, and wastewater grade HDPE. Leak testing of the system will be performed to verify that the system is watertight and able to perform as designed.

K. POND WATER LOSSES, PERFORMANCE CRITERIA AND SUPPLEMENTAL WATER REQUIREMENTS

While fluctuation of the permanent pool level is to be expected due to climatic conditions, type and extent of vegetation, phased developments and other factors, the minimum level acceptable at any time is 12" below the permanent pool (the lower limit of the marsh zone). A nearby source for make-up (supplemental) water is recommended as a way to maintain an adequate permanent pool level should the level drop. A water balance based on local data must be performed in order to demonstrate compliance with these performance criteria. The water balance should use a daily time step and account for all significant inflows (rainfall, runoff, supplemental water) and outflows (evaporation of open water, evapo-transpiration of wetland vegetation/vegetated bench, seepage, water withdrawals). A range of climatic conditions should be modeled, including but not limited to, average and dry years. The water balance serves two purposes. First, it is necessary to provide information for determining pond sizing

requirements and any supplemental (makeup) water requirements, as applicable. A minimum water level is necessary for both aquatic plant survival and, if the liner material is clay, to keep the clay moist to prevent cracking. Wet ponds that are operated and/or maintained by the City must meet the performance criteria assuming that no supplemental water is provided, unless approved by the Engineer. Second, a water balance is necessary in order to determine if the pond is experiencing a water loss in excess of normal anticipated losses. It must be performed in order to develop performance criteria for the pond to be measured against upon completion of the pond construction. The engineer must specify criteria for acceptance testing of the pond over a specified period of time, using actual daily water level measurements, actual daily precipitation data, and other required data to determine whether the pond is losing water in excess of anticipated losses.

One reason the permanent pool may stabilize lower than the design level is if development in the contributing watershed is phased in over a long period of time, such that the impervious cover and runoff coefficient at the early phases of construction are less than the final, build-out values. In this case the amount of water available to fill the wet pond may be lower at the earlier development phase, which would strand the vegetated bench below the permanent pool level, an unacceptable situation. The designer and Contractor must ensure that the vegetated bench is submerged per the above criteria for wetland plant survival and to maintain liner integrity. It is unacceptable for the water level to remain low for an extended period of time, such that the health of the wetlands plants is threatened due to lack of moisture.

L. GEOMEMBRANES AND GCL'S

1. The geomembrane or GCL shall only be placed on prepared [subgrade/clay liner/geonet composite]. The deployment (including equipment used in the handling of the geomembrane or GCL) shall not damage the sub-liner.

2. No vehicular traffic shall be allowed on the geomembrane or GCL. Only low-ground-pressure supporting equipment may be allowed to traverse across the geomembrane or GCL. If such supporting equipment is operating on the geomembrane or GCL it must be placed on a sacrificial surface or rub sheet in order to help protect the geomembrane liner or GCL.

3. Only those geomembrane liner sections that are to be placed and seamed (or overlapped for GCL's) in 1 day should be unrolled.

4. No equipment or tools shall damage the geomembrane or GCL by handling, trafficking, or other means.

5. No personnel working on the geomembrane or GCL shall smoke, wear damaging shoes, or engage in other activities that could damage the geomembrane.

6. Wrinkles for geomembrane shall be identified as to proper location and compensation shall be identified on the Contractor's and Engineer's drawings. Ballast shall be used to prevent relocation of the compensating wrinkles by wind. [Applicable for exposed liner systems only.]

7. Adequate loading (e.g. sand bags or similar items that will not damage the geomembrane or GCL) shall be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of

panels to minimize risk of wind flow under the panels).

8. Weather Conditions: Geomembrane or GCL deployment shall proceed between ambient temperatures of 40 F to 104 F. Placement can proceed below 40 F only after it has been verified by the Engineer that the material can be seamed according to the Specifications and is approved by the Engineer. Geomembrane or GCL placement shall not be done during any precipitation, in the presence of excessive moisture (e.g. fog, rain, dew) or in the presence of excessive winds, as determined by the installation supervisor.

M. SEDIMENTATION BASINS, FILTRATION BASINS AND RETENTION PONDS LESS THAN 1,000 SQUARE FEET IN AREA

Concrete liners may be used for sedimentation basins, filtration basins and retention ponds less than one thousand (1,000) square feet in area. Concrete must be five (5) inch thick with a 28 day minimum strength of 3000 psi and a 7 day minimum strength of 2100 psi or better and must be reinforced by steel wire mesh. The steel wire mesh must be six (6) gauge wire or larger and six (6) inch by six (6) inch mesh or smaller. Concrete surface finish must comply with Standard Specification 2201.3.H. When the underlying soil is clay or has an unconfined compressive strength of one-quarter (0.25) ton per square foot or less, the concrete must have a minimum six (6) inch compacted aggregate base consisting of coarse sand and river stone, crushed stone or equivalent with diameter of three-quarters (0.75) to one (1) inch. Where visible, the concrete must be inspected annually and all cracks must be sealed.

2106.4 CONSTRUCTION

A. INSPECTION

All HDPE geomembrane liners or GCL's shall be inspected by the Engineer prior to installation in the Project. Damaged or unsuitable products shall be removed promptly from the job site and replaced with new, undamaged and suitable products. GCL's shall be installed in accordance with the manufacturer's recommendations depending on the type of GCL. The following paragraphs apply to HDPE geomembrane installation.

B. FIELD SEAMING

1. Seams shall be oriented parallel to the line of maximum slope, i.e., oriented down, not across the slope. In corners and odd-shaped geometric locations, the number of field seams shall be minimized, and outside the corners.

2. Seam jointing of the sidewalls and bottom sections must be located in the bottom and at least 5 feet from the sidewall. No folds, large wrinkles, or fish-mouths shall be allowed in the seamed area. Where wrinkles or folds occur, the materials shall be cut and overlapped, and an extrusion weld applied. During wrinkle or fold repairs, adjacent geomembranes may not necessarily be required to meet the 3- to 4-inch minimum overlap if approved by the Engineer. All complete seams shall be tightly bonded and sealed.

C. SEAM OVERLAP

1. Panels of geomembrane must have a finished overlap of a minimum of 4 inches for hot shoe fusion welding and 3 inches for extrusion welding, but in any event sufficient overlap shall be provided to allow

peel tests to be performed on the seam.

2. No solvent or adhesive may be used unless the product is approved by the Engineer.

3. The procedure used to temporarily bond adjacent panels together shall not damage the geomembrane; in particular, the temperature of hot air at the nozzle of any spot welding apparatus shall be controlled such that the geomembrane is not damaged.

D. SEAMING EQUIPMENT AND ACCESSORIES

Equipment for field seaming is hot shoe fusion welders and extrusion welders in accordance with manufacturer's guidelines.

E. TRIAL SEAMS

1. The Engineer should observe all test seam procedures and all seam testing. All seam testing of the geomembrane should follow these specifications.

2. Each day, prior to commencing field seaming, test seams shall be made on fragment pieces of geomembrane to verify that seaming conditions are adequate.

3. Each trial test seam shall be at least 3 feet long by 1 foot wide. Four (six when possible if using dual track fusion welding) adjoining 1-inch wide specimens will be die-cut from the test seam sample. Two specimens will be tested in the field for shear and two for peel (four when possible if testing both inner and outer welds for dual track fusion welding).

4. The failure criteria are the same as that for destructive seam testing as described in Section 7103.7, Destructive Seam Testing, of this Section. These test specimens must exhibit a Film Tear Bond "FTB" (ASTM D6392). If the seam does not delaminate, but fails in the adjacent sheet material on either side of the seam, it is an FTB or an acceptable failure mode. If one test seam fails, the trial seam will be repeated. If this trial seam also fails, then two more trial seams must be constructed and tested. This process must continue and no welding can begin for the machine or welder (if applicable) until all test seams are passing.

5. Additional trial seams shall be made for all of the following:

   (a) At the beginning of each seaming period for each seaming apparatus used that day (The beginning of each seaming period is considered to be the morning, and immediately after a break).

   (b) Each occurrence of significantly different environmental conditions (i.e., temperature, humidity, dust, etc.).

   (c) Any time the machine is turned off for more than thirty minutes.

   (d) When seaming different geomembranes (tie-ins and smooth to textured).

6. Both the welder and the machine must be tested for each new trial seam when extrusion welding. Only the machine needs to be tested for each new trial seam when fusion welding since the machine is not as operator dependent. Each welder shall make at least one test seam each day he/she actually performs seaming.

F. NON-DESTRUCTIVE SEAM TESTING

The installer shall non-destructively test all field seams over their full length. All test equipment, including but not limited to the following shall be furnished by the installer:

1. Vacuum Box Testing (ASTM D5820):

   (a) A suction value of approximately 3 to 5 inches of gauge vacuum must be applied to all extrusion welded seams tested in this manner.

   (b) Equipment for testing single wedge fusion seams and extrusion seams shall be comprised of the following:

   - A vacuum box assembly consisting of: rigid housing, transparent viewing window, soft rubber gasket attached to the bottom, port hole or valve assembly, and vacuum gauge.
   - A steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections.
   - A rubber pressure/vacuum hose with fittings and connections.
   - A plastic bucket and wide paint brush.
   - A soapy solution.

2. The following procedures shall be followed by the installer:

   (a) Excess sheet overlap shall be trimmed away.

   (b) Clean the window andgasket surfaces and check for leaks.

   (c) Energize the vacuum pump and reduce the tank pressure to approximately 5 psi.

   (d) Wet a strip of geomembrane approximately 12 by 48 inches (length of box) with the soapy solution.

   (e) Place the box over the wetted area and compress.

   (f) Close the bleed valve and open the vacuum valve.

   (g) Ensure that a leak tight seal is created.

   (h) For a period of approximately 15 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.

   (i) If no bubbles appear after 15 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3-inch overlap and repeat the process. The Engineer must observe 100 percent of this testing.

   (j) All areas where soap bubbles appear shall be marked and repaired and then retested.

3. The following procedures shall apply to locations where seams cannot be non-destructively tested, as determined by the Engineer:

   (a) If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation.

   (b) If the seam cannot be tested prior to final installation, the

seaming operations shall be observed by the Engineer for uniformity and completeness.

4. Air Pressure Testing (ASTM D5820):

   (a) The following procedures are applicable to those processes which produce a double seam with an enclosed space.

   (b) Equipment for testing double fusion seams shall be comprised of the following:

   - An air pump equipped with pressure gauge capable of generating and sustaining a pressure of approximately 30 psi and mounted on a cushion to protect the geomembrane.
   - A manometer equipped with a sharp hollow needle, or other approved pressure feed devise.

5. The following procedures shall be followed by the installer:

   (a) Seal both ends of the seam to be tested.

   (b) Insert needle or other approved pressure devise into the tunnel created by the double wedge fusion weld.

   (c) Energize the air pump to a pressure of approximately 30 psi, if possible. The air pump must then be shut off and the air pressure observed after 5 minutes.

   (d) A loss of less than 4 psi is acceptable if it is determined that the air channel is not blocked between the sealed ends. A loss of more than 4 psi indicates the presence of a seam leak which must then be isolated and repaired by following appropriate repair procedures. The Engineer must observe and record all pressure gauge readings.

   (e) Remove needle or other approved pressure feed devise and seal.

G. DESTRUCTIVE SEAM TESTING

The installer shall provide the Engineer with a minimum of one destructive test sample per 500 feet of seam length from a location specified by the Engineer. The installer shall not be informed in advance of the sample location. At a minimum, a destructive test must be performed for each welding machine used for seaming or repairs.

1. Sample Procedure: In order to obtain test results prior to completion of liner installation, samples shall be cut by the installer as the seaming progresses. Sampling items and locations shall be determined by the Engineer. The Engineer must witness the obtainment of all field test samples and the installer shall mark all samples with their location roll and seam number. The installer shall also record in written form the date, time, location, roll seam number, ambient temperatures, and pass or fail description. A copy of the information must be attached to each sample portion. All holes in the geomembrane resulting from obtaining the seam samples shall be immediately repaired. All patches shall be vacuum tested.

2. Size and Disposition of Samples: The samples shall be 12 inches wide by 24 inches long with the seam centered lengthwise. The sample shall be cut into two equal length pieces, half to be given to the Engineer and

the other half to be given to the Owner's representative. If the installer desires a sample the size should be increased to 12 inches wide by 36 inches long.

3. Field Laboratory Testing: The Engineer shall cut ten 1-inch wide replicate specimens from his sample and these shall be tested by the Engineer. The Engineer shall test at least two specimens for peel strength (ASTM D4437). To be acceptable, all test specimens must pass the minimum specified value (and exhibit an FTB failure).

4. Independent Laboratory Testing: The Engineer shall witness all field tests and see that proper identification and details accompany the test results. Details required include:

   (a) Date and time.

   (b) Ambient temperature.

   (c) Identification of seaming unit, group or machine.

   (d) Name of master seamer.

   (e) Welding apparatus temperature and pressure.

5. Pass or fail description.The Engineer shall properly mark, package and ship at least five specimens received from the installer to a laboratory for the determination of shear and peel strengths (ten when possible for both tracks of dual-track fusion welded seams). The test method and procedures to be used by the independent laboratory shall be the same used in field testing, where seam samples are 1 inch wide, and the grip separation rate is 2 ipm. All specimens tested in the peel mode must fail in FTB. At least four of five specimens from each peel and shear determination must meet the minimum specified value The average value from all five specimens from each peel and shear determination must meet the minimum specified value.

6. Procedures for Destructive Test Failure: The following procedures shall apply whenever a sample fails the field destructive test:

   (a) The installer shall reconstruct the seam between the failed location and any passed test location.

   (b) Additional samples shall be taken 10 feet on either side of the failed test for an additional field test. Should the sample pass the field test, duplicate samples shall be submitted for laboratory testing. If these laboratory samples pass the tests, then the seam is reconstructed between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

   (c) A maximum of two attempts will be made per 100 linear feet of seam before the section is determined failed and repair is to be affixed to the entire seam.

   (d) Over the length of seam failure, the Contractor shall either cut out the old seam, reposition the panel and reseam, or add a cap strip, as required by the Engineer.

   (e) After reseaming or placement of the cap strip, additional destructive field test(s) shall be taken within the reseamed area. The reseamed sample shall be found acceptable if test results

are approved by the Engineer. If test results are not acceptable, this process shall be repeated until the reseamed length is judged satisfactory by the Engineer.

7. In the event that a sample fails a laboratory destructive test, then the above procedures shall be followed, considering laboratory tests exclusively.

8. The Engineer will document all actions taken in conjunction with destructive test failures.

H. DEFECTS AND REPAIRS

1. All seams and non-seam areas of the geomembrane shall be inspected by the Engineer for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane shall be clean at the time of inspection. The geomembrane surface shall be brushed, blown, or washed by the installer if the amount of dust or mud inhibits inspection. The Engineer shall decide if cleaning of the geomembrane is needed to facilitate inspection.

(a) Evaluation:

- Each suspect location in seam and non- seam areas shall be non-destructively tested as appropriate in the presence of the Engineer. Each location that fails the non- destructive testing shall be marked by the Engineer, and repaired accordingly.

(b) Repair Procedures:

- Defective seams shall be restarted/reseamed as described in these specifications.
- All holes shall be patched.
- Tears shall be repaired by patching. Where the seam is on a slope or an area of stress and has a sharp end, it must be rounded prior to patching.
- Blisters, large holes, undispersed raw materials, and contamination by foreign matter shall be repaired by patches.
- Surfaces of HDPE which are to be patched shall be abraded and cleaned no more than 15 minutes prior to the repair. No more than 10 percent of the thickness shall be removed.

2. Patches shall be round or oval in shape, made of the same geomembrane, and extend a minimum of 6 inches beyond the edge of defects. All patches shall be of the same compound and thickness as the geomembrane specified. All patches shall have their top edge beveled with an angle grinder prior to placement of the geomembrane. Patches shall be applied using approved methods only.

3. Restart/Reseaming for Extrusion Welding Procedures: The welding process shall restart by grinding the existing seam and rewelding a new seam. Welding shall commence where the grinding started and must overlap the previous seam by at least 2 inches. Reseaming over an existing seam without regrinding shall not be permitted.

4. Verification of Repairs:

(a) Each repair shall be non-destructively tested except when the Engineer requires a destructive seam sample obtained from a

repaired seam. Repairs that pass the non- destructive test shall be taken as an indication of an adequate repair. Failed tests indicate that the repair shall be repeated and retested until passing test results are achieved.

(b) Daily documentation of all non-destructive and destructive testing shall be provided to the Engineer by the installer. The documentation shall identify all seams that initially failed the test and include evidence that these seams were repaired and successfully retested.

5. Geomembrane Acceptance: The installer shall retain all ownership and responsibility for the geomembrane until acceptance by the Owner. The geomembrane liner shall be accepted by the Owner when all of the following conditions are met:

(a) Installation is finished.

(b) Verification of the adequacy of all field seams and repairs, including associated testing, is complete.

(c) Certification, including "as-built" drawing(s), is provided by the installer to the City's representative.

I. PRE-CONSTRUCTION REQUIREMENTS (CLAY LINER)

Before construction when using a clay liner, classify and test all liner material and submit the following with the industrial wastewater treatment permit application:

1. Soil classification name(s) for all soils used to construct the surface impoundment and a list of source(s) of any imported soil;

2. Particle size distribution, Atterberg limits, and shrink/swell potential, according to ASTM test methods;

3. Compaction curves indicating the moisture/density relationship with saturated hydraulic conductivity for a practical range of density and moisture values;

4. Optimum moisture content of the soil at various compaction densities; and

5. Saturated hydraulic conductivity of a representative compacted sample using water and actual or synthetic wastewater.

J. CONSTRUCTION REQUIREMENTS (CLAY LINER)

Clay liner systems should be constructed:

1. With a water content-density range to assure a maximum saturated hydraulic conductivity of 1 x 10-7cm/sec, verified by an independent soil testing laboratory;

2. In lifts that are not more than nine inches thick uncompacted, and six inches thick compacted. Examine each lift before compaction and remove rocks, debris, or foreign matter greater than one inch in diameter. Also remove and repair lenses, cracks, channels and root holes that could adversely affect hydraulic conductivity;

3. With bottom seal and dike cores relatively incompressible and compacted at a water content up to 4 percent above the optimum and to at least 90% Standard Proctor Density.

4. By scarring the soils between lifts for good bonding;

5. By performing one test per lift per 3,000 square feet or a minimum two tests per lift to monitor the lift thickness, the water content, the compaction density and the saturated hydraulic conductivity of the liner;

6. At least two feet thick with at least four lifts. Depending on the wastewater class, impoundment purpose, groundwater depth, and other criteria, the Oklahoma Department of Environmental Quality may require a thicker liner.

7. By protecting the soil liner from cracking during and after construction due to desiccation or freezing, and document the procedures; and

8. By protecting the liner with at least 12 inches of soil.

K. PRE-CONSTRUCTION REQUIREMENTS (CONCRETE LINER)

Before construction when using a concrete liner, classify and test all liner material and submit the following with the industrial wastewater treatment permit application:

1. Test the concrete liner material for both chemical and physical properties that show the concrete is compatible with the wastewater by using actual or synthetic wastewater; and

2. Determine an appropriate water-cement ratio based on maximum strength requirements and operational conditions.

L. CONSTRUCTION REQUIREMENTS (CONCRETE LINER)

Construct a concrete liner as follows:

1. Prepare the subgrade to prevent differential settling under maximum operational conditions;

2. Mix the concrete with water free of oil, grease, acids and alkalis, and under 2000 ppm turbidity with minimal sulfates;

3. Pour concrete liners monolithically, at least six inches thick and reinforced for impoundment stability and to prevent cracking or fracturing during maximum operating conditions; and

4. Construct concrete liners with 3000 pounds per square inch compressive strength concrete as determined after 28 days curing time by standard concrete compression test.

M. WATER LEVEL MONITORING FOR LINER INTEGRITY VERIFICATION IN WET PONDS

After the filling and installation of aquatic vegetation in a wet pond, the water level of the permanent pool shall be measured monitored for a minimum of eight weeks. The engineer Cishall specify the method and frequency of monitoring, and the responsible party for conducting water level monitoring. The engineer shall perform a water balance, as specified in EDC 7004.3.C.3, to determine that the water loss does not exceed anticipated losses from calculated liner leakage, evaporation, plant transpiration and discharge. All monitoring data and calculations must be documented and submitted to the City of Norman for review

2107 MEASUREMENT AND PAYMENT

2107.1 SCOPE

This section covers the methods of measurement, and the basis of payment, for the furnishing of all labor, equipment, tools and materials, and for the performance of all related work necessary to complete any construction covered in Section 2100.

2107.2 GENERAL

Unless specifically altered by the contract Special Conditions, the methods of measurement and payment will be specified herein.

2107.3 ITEMS NOT LISTED IN THE PROPOSAL

There will be no measurement or separate payment for any items of work not specifically identified and listed in the Proposal and all costs pertaining thereto will be included in the contract unit prices for other items listed in the Proposal.

2107.4 MEASUREMENT AND PAYMENT

Payment for the quantities of accepted work will be made as follows:

A. **Site Clearing:** Site clearing, right-of-way clearing, and site restoration for pipelines shall all be paid for at the lump sum price provided in the proposal. The contract lump sum price shall be the total compensation for furnishing all material, labor, equipment, tools and incidentals necessary to complete the work, in accordance with the plans and these specifications. When not listed as a separate contract pay item, site clearing and right-of-way clearing and restoring shall be considered as incidental work, and the cost thereof shall be included in such contract pay items as are provided for in the proposal contract.

B. **Excavation:** All authorized excavation shall be measured, unless lump sum method is included in the proposal, in its original position and the volume in cubic yards determined by the average end area method. All work performed as prescribed by this item shall be paid for at the contract bid price per cubic yard or lump sum for unclassified excavation, or rock excavation, which price shall constitute payment in full for excavation, placing excavated material in embankment, loading and hauling, and for satisfactory disposal of unsuitable and excess materials; finishing slopes, ditches and parkways; for all maintenance blading or scarifying the ground surface; and for furnishing all labor, tools, materials, equipment, and incidentals necessary to complete the work. Dragging, pushing, or scraping of material along or across the surface of the complete concrete improvements or pavements shall not be permitted.

C. **Borrow:** Borrow shall be measured in a compacted condition in its final position and the volume computed in cubic yards by the method of average end areas; or as specified otherwise. All work performed as required herein and as "Embankment," and measured as provided in this item shall be paid for at the unit price bid. The unit price bid shall be full compensation for furnishing all labor, for all royalties, materials, tools, equipment, hauling and incidentals necessary to complete the work.

D. **Embankment:** Embankment shall not be measured or paid for as a separate contract pay item, but the cost of construction of the embankment complete in place shall be included in such contract pay items as "Excavation" or "Borrow." The contract pay items provided shall be full compensation for the furnishing of all labor, material, tools, equipment, and incidentals necessary to complete the embankment, including cost of water, sprinkling or wetting, rolling, etc., in accordance with the plans and specifications.

E. **Topsoil:**

1. Topsoil secured from borrow sources shall be measured by the square meter (square yard) in place on the project site. Measurement for payment shall be made only on topsoils secured from borrow sources. All work performed as ordered and measured as provided under this item shall be paid for at the unit price bid for topsoil. The price shall be full compensation for excavating, loading, hauling, placing, and furnishing all labor, equipment, tools, supplies and incidentals necessary to complete the work.

2. All labor, equipment, tools, and incidentals necessary to place salvage topsoil as specified shall be included in the unit price bid for "Unclassified Excavation." All excavation required by this item in cut sections shall be measured in accordance with provisions for the various excavation items involved with the provision that excavation shall be measured and paid for once only, regardless of the manipulations involved.

F. **Sodding:** Spot sodding and block sodding shall be measured and paid for at the unit price per square yards of sodded area complete in place in accordance with the plans and specifications. The contract unit price shall be the total compensation for furnishing and placing all sod; for all rolling and tamping; for all water; for disposal of all surplus material; and for all material, labor, equipment, tools and incidentals necessary to complete the work, all in accordance with the plans and these specifications.

G. **Seeding:** Acceptable material for broadcast seeding, disked seeding, asphalt mulch seeding, and hydro mulching shall be measured and paid for at the unit price per square yard or by the acre, complete in place. The price shall be full compensation for furnishing of all materials, including water, for seed-fertilizer slurry, hydraulic mulching, and sprinkling; and for performing all operations necessary to complete the work except as follows: all fertilizer shall be measured and paid for separately.

H. **Fertilizer:** Fertilizer shall be considered as incidental work, and the cost thereof shall be included in such contract pay items as are provided for in the proposal contract.

I. **Temporary Erosion and Sediment Control:**

1. Temporary erosion, sediment, and water pollution control measures installed according to the specifications as required for earthwork, clearing, and grading, not attributed to the Contractor's negligence, shall be measured and paid for in accordance with appropriate specifications for the type of control measure installed, or by a lump sum for the entire item of work. Should the work not be comparable to the work included under the applicable bid items, the work will be paid for as "Extra Work" in accordance with Section 1104.5 of the General Conditions. Unit contract price paid shall be full compensation for all materials, labor, equipment, and incidentals to complete the work as specified.

    (a) Temporary Slope Drains: Slope drains will be measured and paid for by the linear foot in place. Measurements will be taken only on the completed cut or fill slope when to grade. Inlets, outlets, and diversion dikes will be considered as an integral part of the drain.

    (b) Temporary Siltation Screen: Siltation screens approved by the Engineer will be measured and paid for by the linear foot in place.

    (c) Temporary Sediment Filter: Sediment filters will be measured and paid for by each unit accepted in place.

    (d) Temporary Sediment Basin: Accepted sediment basins will be measured and paid for by each unit constructed as specified. Inlets and outlets will be considered an integral part of the basin.

2. In the event that temporary erosion, sediment, and water pollution control measures required on projects are due to Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled, and are ordered by the Engineer, such work shall not be measured for payment but shall be performed by the Contractor at his own expense.

3. Temporary pollution control may include construction work outside the right-of-way.. Contractor shall perform temporary pollution control work outside the right-of-way as needed without a separate itemization or measurement for payment beyond the proposed project cost.

END OF SECTION 2100

City of Norman

STANDARD SPECIFICATIONS AND CONSTRUCTION DRAWINGS

SECTION 2200 MISCELLANEOUS CONSTRUCTION

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SECTION 2200 MISCELLANEOUS CONSTRUCTION

2201 CONCRETE FOR STRUCTURES

2201.1 GENERAL REQUIREMENTS

A. Description: This section shall govern the performance of all work necessary for construction of cast-in-place concrete structures for inlets, manholes, junction boxes, headwalls, and incidental structures.

B. Responsibility for Strength: It is the intent of these specifications that the Contractor shall guarantee that concrete of the specified compressive strength is incorporated in the structures and that the responsibility for producing the required grades of concrete is assumed by the Contractor. Should the average strengths shown by test cylinders fall below the strengths required, the Engineer will require any or all of the following changes: amount of cement; grading of aggregate, or ratio of the water to the cement used. If the tests disclose that the strength of the concrete is insufficient for the structure as built, the Engineer may condemn the part of any structure in which concrete of insufficient strength has been placed and the Contractor, at his cost, shall remove and replace such concrete with concrete meeting these specifications.

2201.2 MATERIALS

A. Fly Ash: Concrete materials shall conform to ODOT Specification Section 701, except that fly ash shall not be used to replace cement in the mix design.

B. Concrete Mixes: All concrete shall be in accordance with Sections 509 and 701, of the latest edition of the ODOT "Standard Specifications for Highway Construction."

C. Reinforcing Steel: Reinforcing bars shall conform to ASTM A615 Grade 60. Welded wire fabric shall conform to ASTM A185.

2201.3 CONSTRUCTION METHODS

A. **Experimental Concrete Mixes:** The Contractor shall make experimental mixes prior to the placing of the concrete and at any time during the progress of the work when necessary to demonstrate that the concrete will meet these specifications. Materials for making experimental mixes shall be furnished by the contractor and these materials shall be identical with those intended for use in the work. The cost of the materials, as well as the costs of crushing test specimens made from the experimental mix, shall be borne by the Contractor and shall be included in the price bid for concrete.

B. **Mixing:** The concrete shall be mixed in an accepted batch machine or mixer. The ingredients shall be accurately measured by weight, unless measurement by

volume is permitted by the Engineer, before being placed in the mixer. Measuring boxes or other accepted measuring apparatus shall be such that the proportions can be accurately determined. The quantity of water to be added, which will vary with the degree of dryness of the material and with the weather conditions, shall be accurately measured for each batch of concrete. Means shall be provided by which a measured quantity of water can be introduced at any stage of the process. The mixing shall be done in a thorough and satisfactory manner and shall continue until every particle of aggregate is completely covered with mortar. The mixing time for each batch of two yards or less shall be not less than one and one half (1½) minutes after the materials are in the mixer. The mixing time shall be increased fifteen (15) seconds for each additional cubic yard or fraction thereof. The entire contents of the drum shall be discharged before recharging. Re-tamping of concrete which has partly hardened will not be permitted.

C. **Ready Mixed Concrete:** Ready-mixed concrete may be used on the work, when the mix design is accepted during the submittal process. The contractor must demonstrate that the concrete can be furnished in accordance with these specifications and that delivery can be made at a rate that will ensure the continuity of any pour. All mixer trucks shall be equipped with water meters. Additional water shall be added at the job site only with the specific permission of the Engineer.

D. **Consistency:** All reinforced concrete which is required to be spaded or puddled in forms or around reinforcing steel shall be of such consistency that:

1. All aggregates will float uniformly throughout the mass without settling or segregation;
2. When dropped directly from the discharge chute of the mixer, it will flatten out at the center of the pile but will stand up at the edges, the piling spreading from internal expansion and not by flowing;
3. It will flow sluggishly when tamped or spaded;
4. It can be readily puddled into corners and angles of forms and around reinforcing steel;
5. It can be readily spaded to the bottom of the pour or to a depth of several feet at any time within thirty (30) minutes after placing.
6. A desirable consistency is one which results in a very slight accumulation of water at the top of a layer several feet in thickness, but with out segregation or accumulation of laitance. If, through accident, intention or error in mixing, any concrete shall, in the opinion of the Engineer, very materially from the consistency specified, such concrete shall not be incorporated in the work but shall be discharged as waste material.

E. **Placing Concrete:** Before beginning a run of concrete, surfaces of the forms, reinforcing steel and concrete previously placed shall be thoroughly wetted or oiled. Sub-grades shall be sprinkled or sealed in a manner that will prevent the removal of water from the concrete.

Concrete shall be placed in the forms immediately after mixing. It shall be so deposited that the aggregates are not separated. Dropping the concrete any considerable distance, generally in excess of 5' depositing large quantities any point and running or working it along the forms, or any other practice tending to cause segregation of the ingredients will not be allowed. It shall be compacted

by vibration or continuous tamping, spading or slicing. Care shall be taken to fill every part of the forms, to work the coarser aggregate back from the face, and to force the concrete under and around the reinforcement without displacing it. All concrete shall be thoroughly vibrated, except where specifically excepted in the specifications. The concrete shall be deposited in continuous horizontal layers and whenever practicable, concrete in structure shall be deposited continuously for each monolithic section of the work. Chutes and tremmies used for conveying concrete shall be mortar-tight. Work shall be arranged in order that each part of the work shall be placed as a unit if this is possible. Where necessary to stop placing concrete, the work shall be brought up in level courses and against a vertical stop board. The placing of concrete under water, where permitted, must be done by special accepted methods. No concrete shall be placed without providing advanced notification to, and receiving acknowledgment from, the Project Inspector.

F. **Placing Concrete in Cold Weather:** No concrete shall be placed without the specific permission of the Engineer when the air temperature is at or below 35 degrees F. If concreting in freezing weather is permitted by the Engineer, care shall be taken to prevent the use of any frozen material. In addition to adequate provisions for protecting the concrete against chilling or freezing, the Contractor shall heat the water and aggregate in order that when deposited in the forms, the concrete will have a temperature of not less than 55 degrees F, nor more than 70 degrees F. Heated water and aggregate shall be combined in the mixer before cement is added. Cement shall not be added to mixtures of water and aggregate when the temperature of the mixture is greater than 100 degrees F. The concrete shall be adequately protected in order to maintain a minimum concrete temperature of □□ degrees F for a minimum period of seventy two (72) hours [for "High Early Strength" concrete, a minimum period of forty-eight (48) hours] after it has been placed and a temperature above 32 degrees F for a period of two additional days. The work shall be done entirely at the Contractor's risk; if the concrete is damaged then the Contractor shall replace it. No chemicals or other foreign matter shall be added to the concrete for the purpose of preventing freezing, and concrete shall not be placed on frozen ground.

G. **Construction Joints:** Construction joints shall be located as shown on the plans and at other points as may be necessary during construction provided that the location and nature of additional joints shall be accepted by the Engineer. In general, joints shall be located at points of minimum shear, shall be perpendicular to the principal lines of stress, and shall have suitable keys having areas of approximately one-third (1/3) of the area of the joints. When placing against a construction joint, the surface of the concrete previously placed shall be thoroughly cleaned of dirt, scum, laitance or other soft material, and shall be roughened. The surface shall then be thoroughly washed with clean water and covered with at least 1/2" of cement mortar, after which concreting may proceed. Mortar shall be placed in a manner that will not splatter forms and reinforcing steel.

H. **Finish of Concrete Surfaces:** All surfaces exposed to view shall be free from conspicuous lines, affects or other irregularities caused by defects in the forms. If for any reason this requirement is not met, or if there are any conspicuous honeycombs, the Engineer may require a correction of the defects by rubbing with carborundum bricks and water until a satisfactory finish is obtained. Immediately after removing the forms, all wires or other exposed metal shall be cut back off the concrete surface and the depressions thus made and all honeycombing and other defects shall be painted with mortar and then rubbed

smooth. If the Engineer deems any honeycombing or other defect to require such treatment, the defective concrete shall be cut out to a depth sufficient to expose the reinforcement and to afford a key for the concrete replacing the cut out.

I. **Curing Concrete:** Exposed surfaces of concrete shall be protected by accepted methods from premature drying for a period of at least seven (7) days. Curing compounds, when accepted by the Engineer, shall be applied according to the manufacturer's recommendations and shall not be used on any surface against which additional concrete is to be bonded, nor on surfaces which will be painted. In dry, hot weather, forms shall be removed as early as practicable and curing started immediately. The Engineer may require the frequent wetting of the concrete and the use of means to protect it from the direct rays of the sun.

J. **Placing Reinforcement:** All reinforcement, when placed, shall be free from mill scale, loose or thick rust, dirt, paint, oil or grease, and shall present a clean surface. Bends and splices shall be accurately and neatly done, and shall conform to the American Concrete Institute Manual of Standard Practice for Detailing Reinforced Concrete Structures. All reinforcing shall be placed in the exact position shown on the plans and shall be held firmly in position by means of accepted spacers and supports, by wiring to the forms, and by wiring the bars together at intersections with accepted wire ties in order that the reinforcement will not be displaced during the depositing and compacting of the concrete. When the concrete surface will be exposed to the weather in the finished structure or where rust would impair the appearance, the portions of all accessories in contact with the form work shall be galvanized steel or plastic. The placing and fastening of reinforcement in each section of the work shall be accepted by the Engineer before any concrete is deposited in the section. Care shall be taken not to disturb the reinforcement after the concrete has taken its initial set.

K. **Forms:** Forms shall be so designed and constructed that they may be removed without injuring the concrete. The material to be used in the forms for exposed surfaces shall be sized and dressed lumber or metal in which all bolt and rivet heads are countersunk. In either case, a plain, smooth surface of the desired contour must be obtained. Undressed lumber may be used for backing or other unexposed surfaces, except inside faces of conduits. The forms shall be built true to line and braced in a substantial and unyielding manner. They shall be mortar tight and, if necessary to close cracks due to shrinkage, shall be thoroughly soaked in water. Forms for re-entrant angles shall be filleted and for corners shall be chamfered. Dimensions affecting the construction of subsequent portions of the work shall be carefully checked after the forms are erected and before any concrete is placed. The interior surfaces of the forms shall be adequately oiled with a non-staining mineral oil to ensure the non-adhesion of mortar. Form lumber which is to be used a second time shall be free from bulge or warp and shall be thoroughly cleaned. The forms shall be inspected immediately preceding the placing of concrete; any building or warping shall be remedied and all dirt, sawdust, shavings or other debris within the form shall be removed. No wood device of any kind used to separate forms will be permitted to remain in the finished work. Temporary openings shall be placed at the bottom of the column and wall forms and at other points where necessary to facilitate cleaning and inspection immediately before depositing concrete.

L. **Removal of Forms:** Forms shall be removed in such manner as to ensure the complete safety of the structure. No forms shall be removed except with the express permission of the Engineer. In general, acceptance will be based on

the following:

1. Forms on ornamental work, railings, parapets and vertical surfaces which do not carry loads and which will be exposed in the finished work shall be removed within twenty-four (24) hours to forty-eight (48) hours after placing, depending upon weather conditions.

2. Girder, beam and joist sides only, column, pier, abutment and wall forms may be removed within twenty-four (24) hours to forty-eight (48) hours after placing, depending upon weather conditions. No backfill shall be placed against wall, piers or abutments unless they are adequately supported or have reached the required strength.

3. Girder, beam and joint soffit forms shall remain in place with adequate shoring underneath, and no construction load shall be supported upon nor any shoring removed from any part of the structure under construction until that portion of the structure has attained sufficient strength to support safely its weight and the loads placed thereon.

4. *Concrete Thrust Blocks:* Thrust blocks or other restraint devices shall be adequate to prevent movement of the line at 150 psipressure, unless otherwise specified. Thrust blocks shall be placed against undisturbed soil in the trench. The thrust block shall have sufficient surface area to transmit the thrust to the undisturbed soil. The thickness, width, and length shall be sufficient to carry the required load. The minimum thickness, width, and length for thrust blocks shall be 12". Concrete placed for thrust blocks shall be consolidated to ensure that no voids remain in the block. Thrust blocks will be of unreinforced 3500 psi concrete unless otherwise specified.

M. Concrete Encasement of Pipelines:

1. *General*: Concrete encasement of pipelines shall be a minimum of 6" thick at the thinnest point. Encasement shall be plain concrete with no reinforcement, unless otherwise specified. All encasement will be placed as a monolithic placement.

2. *Water Lines:* Water lines shall be encased where the cover over the line is not sufficient to spread surface loading where trench widths are more than the maximum as shown on the Standard Details.

3. *Sanitary Sewer Lines*: Sanitary sewers shall be encased when the depth of cut from the original ground elevation to the flow line of the pipe is 4' or less. Sanitary sewer lines will be encased where they cross water lines, as shown on the plans. Flowable fill encasement necessitated by trench widths more than the maximum as shown on the Standard Details shall be placed as directed by the Engineer. All flowable fill encasement required because of excessive trench width shall be placed at the expense of the contractor.

4. *Other Utility Lines*: Where other utility lines require concrete encasement, the owner of the utility shall specify the method and thickness of encasement.

N. **Concrete Slab Protection for Pipelines:** This item will be installed only as shown on the plans or at the direction of the Engineer. Where pipelines are within 24" of the surface or 24" of another pipeline, they will be covered with a 12" reinforced concrete slab. This slab will be placed in such a manner as to prevent accidental excavation into the pipeline. This slab shall be placed on a (2" thick rock bed over the pipeline. The excavation shall then be filled to ground level.

O. **Concrete Cradle for Pipelines:** Concrete cradle of pipelines shall be a minimum of 6 inches thick at the thinnest point on the sides and bottom of the pipe. Cradle shall be plain concrete with no reinforcement, unless otherwise specified. All cradle will be placed as a monolithic placement. For sanitary sewers, a standard concrete cradle is required at any location where the depth of cut to the flow line of the pipe is 16' or more. Concrete cradle necessitated by trench width more than the maximum as shown on the Standard Details shall be placed as directed by the Engineer. All concrete cradle required because of excessive trench width shall be placed at the expense of the contractor.

P. **Reinforced Concrete Piers for Pipelines:** Piers shall be located and constructed as shown on the plans and Standard Details. Forms shall be made to conform to the shape of the pier and securely braced. Reinforcing steel shall be bent as detailed and securely tied in place. Bearing area for the pipe shall be made to fit the outside diameter of the pipe and shall support the pipe at the proper grade. Steel strapping and bolts shall be galvanized or stainless with a neoprene or felt bond breaker between the steel casing and the straps. Any honeycomb or other unevenness in the concrete shall be patched with cement mortar immediately after form removal.

2202 BORE AND CONDUIT

2202.1 DESCRIPTION

This section governs the furnishing of all materials, labor, equipment, tools and other services to construct conduit (casing) pipes beneath streets, highways, and railroads and perform related work necessary to complete the work shown on the plans or specified.

2202.2 PERMITS

The permits for crossings shall be obtained by the City of Norman. The Contractor shall give notification to the Oklahoma Department of Transportation (ODOT) or railroad company prior to the start of the work. Work shall not commence until all arrangements are completed and permission is given by the City to start the work. For development projects, all required information and fees for permitting shall be submitted by the Developer.

2202.3 SUBMITTALS

Submittals shall be as specified in the General Conditions.

A. Submit the following:

1. Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.
2. Certified copies of reports of factory tests specified in this Section and required by the referenced standards.
3. Plans and details describing materials and methods proposed by the Contractor for use in special crossings.

4. Detailed design calculations and drawings of support systems proposed for tunnel construction.

2202.4 GENERAL PROCEDURES

A. The Contractor shall be prepared to attend all meetings and provide any necessary data, reports, information, details, and construction schedules as requested by the Owner.

B. The Engineer shall review and modify as necessary the scheduling of any or all construction activities under the highway or railroad right-of-way in order to prevent interruption to traffic. The Contractor shall include the cost for such procedures in his bid and shall not be entitled to any change in contract amount on account of such procedures.

C. All work shall be done in a careful, workmanlike manner to the satisfaction of the proper officials, as well as the Engineer.

2202.5 PRODUCTS

A. Steel Conduit

1. The conduit pipe and joints shall be of steel construction. The conduit pipe and joints shall be capable of withstanding the load of railroad roadbed, track, and traffic or the load of pavement, subgrade, and traffic, as applicable. The conduit pipe and joints shall be constructed to prevent leakage of any matter from the conduit throughout its entire length, except at the ends of the conduit.

2. The conduit pipe shall be welded steel pipe, new and unused material in accordance with current ASTM Specifications A-139 Grade B for "Electric Fusion of Welded Steel Pipe" with a minimum yield of 35,000 psi. The inside diameter shall be at least 4” greater than the largest diameter of the carrier pipe’s main joint or exterior restrained joint, whichever is greater.

3. The minimum wall thickness of the conduit pipe shall be as shown in the following table:

Diameter	***Minimum Wall Thickness***	
of Casing	***Under Highway***	***Under Railroad***
in.	***in.***	***in.***
Under 14	0.25	0.188
14	0.25	0.219
16	0.25	0.219
18	0.25	0.25
20	0.375	0.281
22	0.375	0.312
24	0.375	0.344
26	0.375	0.375
28	0.5	0.406

Diameter of Casing	*Minimum Wall Thickness*	
	Under Highway	*Under Railroad*
in.	*in.*	*in.*
30	0.5	0.406
32	0.5	0.438
34	0.5	0.469
36	0.5	0.469
38	0.5	0.5
40	0.5	0.5
42	0.5	0.5

4. The exterior walls of conduit shall be treated on a tiered system as indicated below:

   - Tier 1 (non-critical crossings of minor roadways and drainage channels) – casing pipe without an epoxy coating.
   - Tier 2 (critical crossings of major roadways and highways) – casing pipe with exterior walls fusion bonded epoxy coated in accordance with AWWA C213 or approved equal.
   - Tier 3 (railroad crossings) – casing pipe with exterior walls fusion bonded epoxy coated in accordance with AWWA C213 or approved equal. Additionally, conduit under railroads shall have a compatible abrasion resistant overlay with a minimum 20 mil thickness. Abrasion resistant overlay shall be applied over the fusion bonded epoxy coating. After conduit is welded, exterior coating shall be repaired in accordance with AWWA C210 or approved equal.

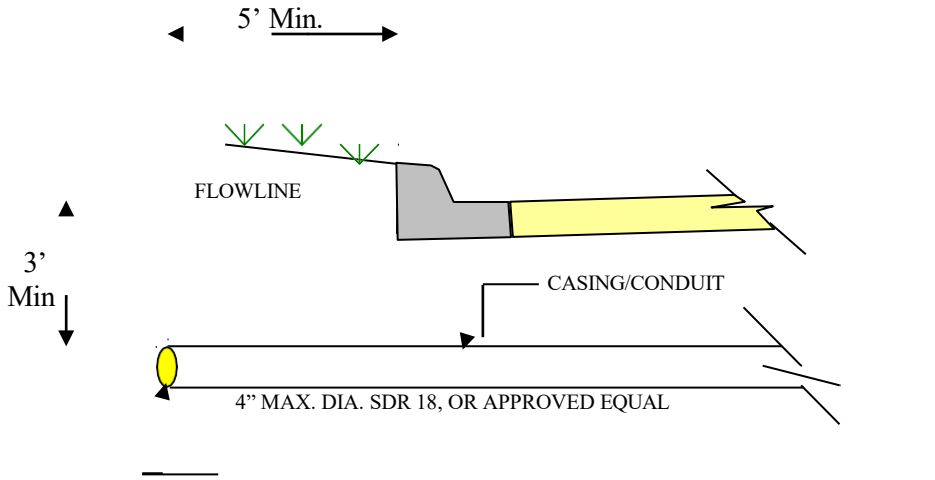
B. Plastic Conduit

1. Utility boring casing 4 inches or less in diameter in public Rights- of-Way, may consist of PVC, SDR 18, or equal and be at least 3 feet below gutter. The colors of plastic casings shall be consistent with standard color convention for buried utilities:

   - Red or red stripes: Electric lines
   - Orange or orange stripes: Telecommunications or alarm lines
   - Yellow or yellow stripes: Natural gas and petroleum
   - Green or green stripes: Sewer lines
   - Blue or blue stripes: Potable Water

2. If the annular space between the surrounding soil and the outside of the casing or conduit exceeds ½" at any point, then said space must be pressure grouted.
3. The conduit pipe and joints shall be constructed to prevent leakage of any matter from the conduit throughout its entire length.

Figure 2200 – 1



SECTION AT EDGE OF ROADWAY

2202.6 CONSTRUCTION OF CONDUIT PIPE

A. Installation of the conduit shall proceed from a pit, be excavated at a safe distance from the edge of the highway or railroad and outside of the right-of-way unless approved by the Engineer for construction within the right-of-way, and shall be constructed without interruption to highway or railroad traffic.

B. The carrier pipe shall be installed inside a conduit pipe of the length shown on the plans. Except as otherwise permitted, the conduit pipe shall be dry bored or jacked into place to satisfactory alignment and grade for its entire length.

C. The jacking pipe shall be constructed to provide not less than 25’ clearance between the side of the pit adjacent to the road and the centerline of the track or road measured at right angles. Open trenches shall be properly sheeted and braced when and where necessary to provide safe working conditions and protection for highway, roads, structures, and utilities.

D. Provide and maintain during conduit installation and backfill, pits at locations shown on plans or as directed by the Engineer. Excavation for pits shall be sheeted as necessary.

E. Remove all excavated material and replace or change existing structures or utilities encountered to the satisfaction of the Engineer.

F. The ends of the conduit shall be filled with concrete mortar to protect against the entrance of foreign material which might prevent ready removal of the conduit.

G. For street/roadway crossings, minimum clearance between bottom of pavement base and top of conduit shall not be less than 18".

2202.7 CONSTRUCTION OF CASING PIPE BY METHODS OTHER THAN JACKING OR BORING

The installation of the conduit pipe by methods other than the jacking method must be performed in a manner which meets with prior approval of the authorities. Any expense incurred in connection with the construction of the crossing, removal, replacement, or maintenance resulting from the construction of the conduit and carrier pipe shall be at the expense of the Contractor.

2202.8 INSTALLATION OF CARRIER PIPE

A. The carrier pipe designated on the drawings shall be as specified in other Sections for the type of pipe, whether water main, gravity sanitary sewer, storm sewer, force main, or electrical conduit.

B. Jointing of the carrier pipe shall be restrained joints for the type of pipe material and fittings used unless a variance from this requirement is approved by the Engineer.

C. Carrier pipe shall be placed into and through the tunnel liner or steel conduit at locations shown on plans using casing insulators or spacers designed to adequately support and electrically isolate the carrier pipe within the casing pipe under all conditions. Insulators or spacers shall consist of pre-manufactured steel bands with plastic lining and plastic runners. Insulators shall fit snug over the carrier pipe and position the carrier pipe approximately in the center of the casing pipe, to provide adequate clearance between the carrier pipe bell and the casing pipe. Fasteners for insulators shall be stainless steel or cadmium plated. The number and location of casing insulators of spacers shall be determined by the manufacturer to protect carrier pipe from damage. Manufacturers of casign insulators or spacers shall be:

- Advance Products & Systems, LLC (http://www.apsonline.com).
- Cascade Waterworks Manufacturing Company (http://www.cascademfg.com)
- CCI Piping Systems (http://www.ccipipe.com)
- Approved equal .

Wood skids are not acceptable for this use. Methods of pipe installation shall be used to maintain tight joints, to the satisfaction of the Engineer.

2203 MATERIALS FURNISHED BY CONTRACTOR, INSTALLED BY CITY

2203.1 DESCRIPTION

This specification governs materials to be provided to the City for installation by the City.

2203.2 MATERIALS

Materials shall be provided to the City in accordance with the specifications and as described in the Special Conditions and/or Contract proposal.

2203.3 CONSTRUCTION METHODS

The Contractor will provide materials to be installed by the City to the location specified by the City.

2204 MATERIALS FURNISHED BY CITY, INSTALLED BY CONTRACTOR

2204.1 DESCRIPTION

This specification governs the installation of materials furnished by the City as included in the Contract proposal.

2204.2 MATERIALS

Materials furnished by the City shall be as described in the Special Conditions and/or included in the proposal.

2204.3 CONSTRUCTION METHODS

A. The City will provide the materials to be installed by the Contractor to the location specified by the Contractor.

B. Materials shall be installed in accordance with the City's and/or manufacturer's specifications.

2205 PAVEMENT REMOVAL AND REPLACEMENT

2205.1 DESCRIPTION

This section governs all work involved in the repair and replacement of existing streets, roads, highways, drives, parking areas, curbs, gutters, sidewalks, and other paved areas damaged or destroyed during construction of the work included in this Contract.

2205.2 DEFINITIONS

A. **Abbreviations**

1. *ODOT* - Oklahoma Department of Highways' Standard Specifications.
2. *AASHTO* - American Association of State Highway & Transportation Officials.
3. *ACI* - American Concrete Institute.
4. *ASTM* - American Society for Testing & Materials.
5. *NRMCA* - National Ready Mix Concrete Association.

B. **Rock***:* A natural aggregate of mineral particles connected by strong and permanent cohesive forces. Rock includes limestone, sandstone, dolomite, granite, marble, and lava.

C. **Subgrade***:* The prepared and compacted soil immediately below the pavement or walk system and extending to such depth as will affect the structural design.

D. **Subbase*:*** The layer of specified or selected material of designed thickness placed on a subgrade to support a base course and surface course.

E. **Base Course:** The layer of specified or selected material of designed thickness placed on a subbase to support a binder or surface course.

F. **Binder Course***:* The layer of specified or selected material of designed thickness placed on a base course to support a surface course.

G. **Surface Course***:* The layer of specified or selected material of designed thickness placed on a subbase or base course to support the traffic load.

2205.3 QUALITY ASSURANCE

A. **Mixing Plant:** Prior to placing any hot asphalt concrete pavement or Portland cement concrete pavement, the Contractor shall provide the Engineer the name and location of the bituminous mixing or concrete mixing plant and the type and composition of mixes the Contractor proposes to use in the work.

B. **Tolerances:** Paving and surfacing shall comply with the tolerances specified in ODOT Section 401.04.

2205.4 JOB CONDITIONS / CONSTRUCTION METHODS

A. Paving and surfacing materials shall not be placed on a wet surface or when weather conditions would prevent the proper construction of paving and surfacing.

B. Aggregate base shall not be placed on frozen subgrade or when air temperature is below 35 degrees F

C. Bituminous prime coat or tack coat shall not be placed when air temperature is below 50 degrees F

D. Bituminous mixtures shall be placed in accordance with Section 411.04, of the latest edition of the ODOT "*Standard Specifications for Highway Construction*." and per the following tables. Bituminous mixtures shall not be placed on any existing concrete or bituminous surface where temperature is 25 degrees F or lower.

COMPACTED LIFT THICKNESS	**SURFACE TEMPERATURE** (Minimum)
More than 3 inches	40 degrees F
1 ½ inches3 inches	45 degrees F
1 ½ inches	50 degrees F

Note: If wind speed is 10 mph or greater, then 5 degrees F will be added to minimum temperature.

Hveem Equivalent Type	**Superpave Type**	**Nominal Size (in.)**	**Compacted Lift thickness Range (in.)**	**Optimum Lift Thickness (in.)**
*	S1	1-1/2	4-1/2 to 9	6
AH	S2	1	3 to 6	4
A	S3	3/4	2-1/4 to 4-1/2	3
B, BH	S4	1/2	1-1/2 to 3	2
C	S5	3/8	1-1/4 to 2-1/4	1-1/2
D	S6	No. 4	1/2 to 1	3/4

E. **Placing Concrete in Cold Weather:** No concrete shall be placed without the specific permission of the Engineer when the air temperature is at or below 35

degrees F. If concreting in freezing weather is permitted by the Engineer, care shall be taken to prevent the use of any frozen material. In addition to adequate provisions for protecting the concrete against chilling or freezing, the Contractor shall heat the water and aggregate in order that when deposited in the forms, the concrete will have a temperature of not less than 55 degrees F, nor more than 70 degrees F. Heated water and aggregate shall be combined in the mixer before cement is added. Cement shall not be added to mixtures of water and aggregate when the temperature of the mixture is greater than 100 degrees F. The concrete shall be adequately protected in order to maintain a minimum concrete temperature of 55 degrees F for a minimum period of seventy two (72) hours [for "High Early Strength" concrete, a minimum period of forty-eight (48) hours] after it has been placed and a temperature above 32 degrees F for a period of two additional days. The work shall be done entirely at the Contractor's risk; if the concrete is damaged then the Contractor shall replace it. No chemicals or other foreign matter shall be added to the concrete for the purpose of preventing freezing, and concrete shall not be placed on frozen ground.

F. Paving and surfacing materials shall not be placed when natural light is not sufficient to properly observe work or operations.

2205.5 MATERIALS

A. **Aggregate:** Mineral aggregates shall be in accordance with ODOT Sections 701 or 703, , depending on the intended use.

B. **Bituminous Materials:**

1. *Petroleum asphalt cement:* Petroleum asphalt cement shall be Grade AP-5, AP-4, or AP-3 and shall be homogeneous, free from water, and shall not foam when heated to 347 degrees F.

2. *Viscosity Asphalt Cement:* Viscosity graded asphalt cement shall meet the requirements of AASHTO M 320 and shall be performance graded asphalt.

3. *Cut-Back Asphalt***:** Cut-back asphalt shall be composed of an intimate homogeneous mixture of an asphalt base and a suitable distillate designed for rapid, medium, or slow curing. Cut-back asphalt may also contain an additive as an aid in uniformly coating wet, damp, or dry aggregates used in patching mixtures or bituminous pavements. The asphalt shall not contain more than 0.5% water as determined by AASHTO T55, shall not separate when allowed to stand, and shall not foam when heated to permissible temperatures. When an additive is used, it shall be incorporated homogeneously in the asphalt at the point of manufacture.

4. *Prime Coat Materials:* Bituminous materials for prime coat shall conform to ODOT Section 708.03 for Cut-back asphalt - MC-70; or MC-30, or Asphalt emulsion - AE-P, AE-PL

5. *Tack Coat Materials:* Bituminous materials for tack coat shall conform to ODOT Section 708.03 for Asphalt Emulsion - AE-T, SS1 and CSS1.

6. *Seal Coat Materials***:** Bituminous materials for seal coat shall conform to ODOT section 708.03 for Asphalt Emulsion - RS-2, AE-90, AE-150.

C. Hot Asphalt Concrete Mixes

1. Hot asphalt concrete (HAC) mixture shall consist of an intimate mixture of coarse aggregate, fine aggregate including mineral filler if required, and asphalt cement combined in portions specified in this Section. The mixture proportions have been prepared on the basis of using rock or gravel aggregate.

2. When the use of one kind and size of aggregate is started, the use of that same kind and size shall be continued for the entire lift being constructed, unless otherwise directed by the Engineer.

3. Hot asphalt concrete mixtures shall comply with the following, unless otherwise shown or specified:

	ODOT	
Course	***Type***	***Specifications***
Base	S3	411 and 708-3
Surface	S4 & S5	411 and 708-3\

D. Portland Cement Concrete

1. *Cement* shall be Portland cement and shall meet the requirements of ASTM Specification C 150, ACI 301, and ACI 318. Cement shall be Type 1 for normal use, Type 1A where air-entrainment is desired, or Type III or Type IIIA where high early strength is desired and authorized by the Engineer. Blended hydraulic cements which meet the requirements of ASTM Specification C 595 Type 1-P Portland-pozzolan cement may be used where a more watertight concrete is required. Cement shall meet the requirements of ODOT Section 414.

2. *Aggregate:* Regular fine and coarse aggregates shall meet the requirements of ASTM Specification C 33. Aggregate shall be crushed limestone with a maximum size of 3/4 inch, except in mass concrete the maximum size may be 1-1/2 inches.

3. *Water* shall be potable, clean, and free from injurious amounts of oils, acids, alkalis, organic materials, or other substances that may be deleterious to concrete or steel. A maximum of 500 mg/L of chloride ion may be present in the water.

E. Admixtures:

1. Air-entraining admixtures shall meet the requirements of AASHTO Specification M154.

2. Water-reducing and retarding admixtures shall meet the requirements of AASHTO Specification M194 and ODOT Section 701.03. The amount of admixture added to the concrete shall be in accordance with the manufacturer's requirements. Furnish a compliance statement that the admixture used satisfies all requirements of this specification.

3. Fly ash shall meet the chemical and physical requirements of ASTM C 618 for mineral admixture Class F, except loss on ignition shall not exceed 6%. Fly ash shall be sampled and tested in accordance with ASTM C 311 prior to use.

F. Reinforcement:

1. Reinforcing steel shall meet the requirements of ASTM

Specification A 615, Grade 60.

2. Welded wire fabric or wire mesh shall meet the requirements of ASTM A 185.

G. Joint Filler:

1. Preformed expansion joint filler shall meet the requirements of ASTM Specification D 1752, Type III.

2. Hot-poured rubberized asphalt joint filler shall meet the requirements of ASTM Specification D-3405.

3. Waterproof expansion joint filler shall meet the requirements of ASTM Specification D 1850.

H. **Materials for Curing Concrete Pavement:** Concrete pavement shall be wet cured by using burlap, waterproof blankets, or ponding; or by using a membrane compound. If the membrane method is used, the compound shall be Type 2, complying with AASHTO M148 for white pigmented compound. A pressure sprayer capable of applying a continuous uniform film to the pavement surfaces will be required.

1. Concrete pavement shall meet the requirements of ODOT Section 414.

2. Concrete sidewalks and steps shall meet the requirements of ODOT Section 610.

3. Reinforced concrete for curbing shall meet the requirements of ODOT Section 609.

2205.6 CONSTRUCTION METHODS

A. Preparation for Paving and Surfacing

1. Areas to be paved or surfaced shall be clean with temporary pavement materials which are not a part of the permanent pavement, cold-mix asphalt, deleterious or unsuitable materials removed and disposed of.

2. Any existing pavement, surfaces, or walks which are not broken or cut along straight lines shall be cut along straight lines prior to pavement or walk replacement.

B. **Subbase Preparation:** Subbase 6” thick shall be provided in locations where pavement is to be placed on a material other than Special Backfill. Subbase shall meet the requirements of ODOT Section 310.

1. **Pavement Replacement:** All pavements encountered with respect to base courses, surface courses, and thicknesses shall be replaced in kind. Finish elevations, lines, and grades of replacement pavement shall be the same as elevations, lines, and grades of pavement removed, unless otherwise shown on the drawings.

2. *Bituminous Pavements:*

(a) Unless otherwise shown on the drawings, the minimum section (excluding subbase) of any bituminous pavement shall be 8” compacted aggregate base (ODOT 703.01, Type A Aggregate Base), 3” hot asphalt concrete (HAC) base, and 2” HAC surface Type B.

(b) Alternate Section - Pavements with pavement thicker than 4”:

Unless otherwise shown on the drawings, the pavement shall be a full-depth section with a minimum of 4" HAC base plus additional depth to make up full-depth, plus 2" of HAC binder and 2" of HAC surface Type B.

3. *Brick Pavements:* In a brick surfaced street, unless specifically excepted and pending the structural adequacy of any remaining brick, the Contractor may remove all brick and enough base material to allow full width repaving using either a bituminous or concrete pavement; or of providing a HAC base or binder for the full depth of the brick across the trench and then replace the entire street with 2" of HAC surface Type B.

4. *Brick Base and Asphalt Surface:* Unless otherwise shown on the drawings, for a street with a brick base and an asphalt surface, the replacement section shall be full depth asphalt from the bottom of the brick base to the top of the asphalt surface. The top 2" shall be HAC surface Type B.

5. *Concrete Base and Asphalt Surface:* Unless otherwise shown on the drawings, for a street with a concrete base and an asphalt surface, the replacement section shall be a new concrete base, not less than 6" thick with HAC base to within 50 2" of the existing grade and then 2" of HAC surface Type B.

6. *Chip and Seal Pavement:* Unless otherwise shown on the drawings, chip and seal pavements shall have 8" of compacted aggregate base and a processed bituminous coated aggregate pavement placed and rolled as specified in ODOT Section 402.

7. *Gravel Pavement:* Unless otherwise shown on the drawings, gravel pavement shall be replaced with 6" of compacted stone or gravel aggregate as specified in ODOT Section 403.

C. RESERVED

1. CurbsThe construction of curbs, combination curb and gutter, and integral curb and gutter shall be in accordance with these specifications and as shown on the plans and shall be in reasonably close conformance with the lines and grades shown on the plans or as directed by the Engineer.

2. Excavation for curbs shall be made to the required depth, and the subgrade or base upon which the curb is constructed shall be compacted to a firm, even surface to not less than 95% of maximum dry density as determined in accordance with AASHTO T-99.

3. All curb and gutter shall consist of concrete (ODOT Class A, 6 sack, 3000 psi, water/cement ratio of 0.48, 1" to 3" Slump).

4. The curbs shall be constructed by the use of wood or metal forms; or, if accepted by the Engineer, the curb may be constructed using a curb slipform machine. Forms, if used, shall be straight, free from warped or bent sections, and shall extend for the entire depth of the curb and shall be securely held in place so that no deviation from alignment and grade will occur during placement of concrete. The concrete shall be consolidated by vibration or other acceptable methods. The top of the curb shall be floated smooth and the top outer corner rounded to a $^1/_4$" radius.

5. The face, top, and gutter of curbs shall not have deviations or

irregularities of more than $^1/_4$" when checked with a 10-foot straightedge.

6. Construction joints shall be placed at 10-foot intervals, unless otherwise shown or directed by the Engineer. The joint shall be uniform, of $^1/_8$" to $^1/_4$" in width, and to a depth of approximately $2^1/_2$". The joint may be saw cut or formed by accepted removable strips providing a straight joint at right angles to the length of curb. Joints shall be filled with specified bituminous joint filler material. Construction joints shall be formed around all abutting structures such as inlets and shall be as specified previously.

7. As soon as possible after placing and finishing of concrete, the curbing shall be moistened and kept moist for three days, or cured with the use of a specified membrane compound.

8. If existing curb is to be removed and replaced with new curb or new curb extended from existing curb, the existing curb shall be removed to the nearest joint of suitable existing curb or as directed by the Engineer.

D. **Lane Striping:** Contractor shall stripe new paving with standard road paint. Stripe width and spacing to match that of paving restored or replaced.

E. **Protection:**

1. Compacted aggregate subbase and surface shall be compacted true to line and grade and required density. Subbase quality, compaction, and moisture shall be maintained until prime coat is placed. Surface shall be maintained until job is complete.

2. Vehicular traffic of any kind shall not be permitted on any bituminous course until the bituminous mixture has hardened sufficiently not to be distorted beyond specified tolerances. Foreign material which is on the surface of any course shall be removed before the course is rolled or any subsequent course is placed.

3. Traffic on concrete pavement or walks shall not be permitted until concrete has developed sufficient strength not to be marked or damaged. Vehicular traffic shall not be permitted on concrete until it has reached a compressive strength of 3,000 psi.

4. Damaged pavement and walks shall be repaired or replaced to the satisfaction of the Engineer.

F. **Clean-up:** Job site shall be cleaned up following pavement and surfacing restoration. All rubbish, excess materials, temporary structures, and equipment shall be removed the work left in a neat and presentable condition.

2206 RIPRAP

2206.1 DESCRIPTION

This section shall govern the furnishing and installation of riprap upon a prepared surface to a grade and thickness shown or established by the Engineer.

2206.2 DEFINITIONS

A. **Riprap**: Placed protective material consisting of broken stone or concrete.

B. **Dumped Riprap**: Riprap emptied out of a vehicle unloaded or dropped in a large mass.

C. **Revetment Riprap**: Riprap placed to retain a wall of earth with a layer of stone.

D. **Hand-laid Riprap**: Riprap placed by hand rather than by mechanical means.

2206.3 MATERIALS

A. **Dumped Riprap**: Dumped riprap shall consist of broken concrete, masonry, or stone removed from an old structure; broken pieces removed from concrete pavement, base, or monolithic brick pavement; and broken rock from a fragmented stone or a solid rock excavation.

B. **Revetment Riprap**

1. The gradation of the riprap shall be such that:

   (a) No individual piece weighs more than 120 pounds.

   (b) 90-100% of the material passes a 12" sieve.

   (c) 20-60% of the material passes a 6" sieve.

C. Not more than 10% of the material passes a 1½" sieve.

D. **Hand-laid Riprap**: Hand-laid riprap aggregate shall consist of pieces, except spalls, no less than 10 ft^3 in volume and no less than 3" in the least dimension. The width of these pieces shall be no less than 6" for 6" hand-laid nor less than 12" for 12" hand-laid riprap.

E. **Filter Fabric**: A special fabric usually used in drainage applications to allow water flow without clogging or binding by soil particles.

1. The fabric consists exclusively of manmade thermoplastic fibers, is a non-woven geotextile fabric, and forms a mat of uniform quality.

2. Fabric fibers are continuous and random throughout the fabric.

3. The fabric is mildew resistant and rot-proof, and it is satisfactory for use in a wet soil and aggregate environment.

2206.4 CONSTRUCTION METHODS

A. Dumped Riprap

1. Dumped riprap shall be placed at locations shown on the plans or as directed.

2. Material shall be placed to produce a surface of approximate regularity but need not necessarily be hand placed.

3. The finished surface shall vary no more than nine inches from true plane. The thickness perpendicular to its surface shall be no more than two feet nor less than one foot, unless otherwise directed.

B. **Revetment Riprap**: Revetment riprap may be placed by dumping and shall be placed to the required thickness at the locations shown on the plans or at such other designated locations.

C. **Hand-laid Riprap**

1. Hand-laid riprap shall be placed by hand and shall be no less than the thickness shown on the plans or as specified. For 6" hand-laid riprap, the

thickness shall be no less than 6” and for 12” no less than 12”.

2. The slope upon which hand-laid riprap is to be placed shall conform with the cross section shown on the plans. Laying shall begin in a trench below the toe of the slope. It shall progress upward with each piece being laid by hand perpendicular to the slope. It shall be firmly embedded against the slope and the adjoining piece with the sides in contact with well broken joints. The spaces between the larger pieces shall be filled with spalls of suitable size which shall be thoroughly rammed into place.

3. The finished surface shall present an even, tight surface true to line, grade, and section.

4. When broken concrete pavement is used for 6” hand-laid riprap, it shall be laid with the smooth sides up.

D. Filter Fabric

1. Filter Fabric shall be installed in accordance with the manufacturer's recommendations, as indicated on the Drawings or as directed by the Engineer or designated representative. When lapping is required, it shall be in accordance with the manufacturer's recommendations. Backfilling around the Filter Fabric shall be done in such a manner that the Filter Fabric material will not be damaged during the placement.

2207 MEASUREMENT AND PAYMENT

2207.1 SCOPE

This section covers the methods of measurements, and the basis of payment, for the furnishing of all labor, equipment, tools, and materials and for the performance of all related work necessary to complete any construction covered in Section 2200.

2207.2 GENERAL

Unless specifically altered by the Special Conditions, the methods of measurement and payment will be as specified herein, and as listed in the Proposal (Bid Schedule).

2207.3 ITEMS NOT LISTED IN THE PROPOSAL

There will be no measurement or separate payment for any items of work not specifically identified and listed in the Proposal and all costs pertaining thereto will be included in the Contract Unit Prices for other items listed in the proposal.

2207.4 MEASUREMENT AND PAYMENT

The quantities of accepted work will be measured and paid for on a unit price basis determined as follows:

A. **Concrete Structures:** Measurement and payment for concrete structures shall be on a per each basis, complete in place with all accessories and shall include appurtenant work including excavation and backfill, unless specified otherwise in the Special Conditions and/or Contract Proposal.

B. **Conduit:** Measurement and payment for conduit, including the carrier pipe, shall be at the contract unit price per linear (oot, measured along the centerline of the conduit for the size, type, and installation method included in the Contract Proposal and placed as shown on the plans. All carrier pipe shall be paid for

under other items. Payment for excavation, backfilling, boring, and/or tunneling shall be included in the unit prices included in the Proposal and shall be full compensation for all equipment, materials, tools, labor, and incidentals for a complete installation. No additional payment shall be made for dewatering, skids, or plugging end of conduit.

C. **Materials Furnished by the City, Installed by the Contractor:** Materials furnished by the City and installed by the Contractor shall be paid for as a lump sum or at the Contract unit price for each unit as described in the Special Conditions or Contract Proposal. Such payment shall be full compensation for all equipment, tools, labor, and incidentals for a complete installation.

D. **Materials Furnished by the Contractor, Installed by the City:** Materials furnished by the Contractor and installed by the City shall be paid for as a lump sum or at the Contract unit price for each unit as described in the Special Conditions or Contract Proposal. Such payment shall be full compensation for all materials furnished to the site.

E. **Pavement Replacement:**

1. The replacement of concrete pavement, concrete base, rock for flexible base, and gravel for flexible base shall be paid for at the contract unit price per cubic yard complete in place.

2. Asphaltic concrete pavement shall be paid for at the contract unit price per square yard, complete in place.

3. The replacement of one or two course surface treatment or penetration type pavement surface shall be paid at the contract unit price per square yard complete in place.

4. Curb and curb and gutter shall be paid at the contract unit price per linear foot, complete in place.

5. Sidewalks shall be paid for at the contract unit price per square foot or square yard, complete in place.

6. The contract unit price shall be total compensation for furnishing and placing all materials, including rolling and finishing, for disposal of all surplus material, and for all labor, tools, equipment, and incidentals necessary to complete the work, all in accordance with the plans and specifications.

F. **Riprap:** Riprap shall be measured and paid for at the unit contract price for square yards of the specified minimum thickness or in cubic yards, based on the dimensions shown on the plans and described in the proposal, or by ton of material in place. The contract unit price shall be the total compensation for preparing the subgrade, including excavation; for furnishing and placing all materials; for furnishing, placing, shaping, and tamping backfill; for disposal of all surplus materials; and for all labor, tools, equipment and incidentals necessary to complete the work, all in accordance with the plans and these specifications.

END OF SECTION 2200

City of Norman
STANDARD SPECIFICATION AND CONSTRUCTION DRAWINGS
SECTION 2300 STREETS AND DRAINAGE

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2301 ADOPTION OF ODOT STANDARD SPECIFICATIONS

2301.1 SCOPE

The latest edition of the *Oklahoma Standard Specifications for Highway Construction*, as published by the Oklahoma Department of Transportation (ODOT), are hereby adopted as the standard specifications for grading, street, road and drainage construction for the City, except as amended herein. In the event of any conflict between any of the provisions of the *Oklahoma Standard Specifications for Highway Construction* and the specific provisions set forth herein, then in such event the specific provisions set forth herein shall control.

2302 DEFINITIONS

2302.1 TERMS

Certain terms included in the adopted specifications referenced in Section 2301 shall incorporate the following substitution of definitions in their use thereof:

A. Commission means the duly authorized officers or agents of the City of Norman, Oklahoma constituted by law to administer the affairs of the City.

B. Department means the City of Norman, Oklahoma, a municipal corporation, acting through its duly authorized officers or agents.

C. Director means the duly authorized officer of the City in whom executive or administrative powers are vested or his duly authorized representative.

D. Engineer means the City Engineer of the City of Norman or their duly authorized representative.

E. Materials Division means the Public Works Department of the City of Norman.

2303 PROCEDURE FOR USING ODOT STANDARD SPECIFICATIONS IN CITY CONTRACTS

2303.1 REVISIONS, AMENDMENTS, AND CLARIFICATIONS

Revisions, amendments, and clarifications to ODOT Standard Specifications shall be included in the Special Conditions of the Contract. The ODOT section shall be referenced by number and description, followed by the required information.

2304 SPECIAL CITY REQUIREMENTS

2304.1 TESTING REQUIREMENTS

A. **Materials Testing:** Materials testing shall be as specified in the ODOT Standard Specifications.

B. **Construction Testing:** Testing of completed construction shall be as specified in the ODOT Standard Specifications and Section 1006 of these specifications.

C. **Tolerances:** Tolerances shall be according to ODOT Standard Specifications except as modified herein.

1. Pavement Surface Thickness: Average test thickness shall not be less than the plan thickness, and no individual test thickness shall be deficient by more than 1/4". Maximum thickness to be averaged shall be no more than 1/2" greater than the design thickness. The asphalt pavement core thickness shall be measured according to ASTM D-3549-93a.

2. Concrete Compressive Strength: No individual test cylinder for 28-day compressive strength shall be less than the specified strength.

2304.2 SUBGRADE

A. Preparation:

1. When preparing the subgrade, all roots and plant material shall be removed, and the excavation refilled with suitable backfill.

2. When working the subgrade all soft, yielding, or other unsuitable materials, shall either be removed and replaced, or stabilized in place.

3. The subgrade shall be constructed to grade by use of *"blue tops"*. *"Blue tops"* shall be placed every 50 ft at both the center line and at the back of curb and gutter. If lime, fly ash, cement etc. is added to the subgrade, the subgrade shall be *"blue topped"* before and after placement of the added material.

4. Dowels are required at all longitudinal and transverse contraction joints in concrete pavement which is 8" thick or greater. Dowel size shall be reviewed and accepted by the City Engineer.

5. The entire subgrade shall be constructed to the required grade, density tests performed and reviewed, and proof rolling completed and reviewed, before construction of the curb and gutter or any other paving.

6. Except where specified elsewhere, the subgrade shall be compacted to 95% standard proctor density at ±2% of optimum moisture.

B. Stability Testing:

1. When preparing subgrades, the subgrade shall be checked for stability, even though it may meet the compaction requirements.

2. The check for stability shall be proof rolling with a large roller or loaded scraper and visual observation to insure that there is no pumping of the subgrade.

C. Correction of Unstable Subgrade:

1. A pumping or otherwise unstable subgrade shall be treated or replaced until it is stable, as determined by the City Engineer.

2. Subgrade drainage shall be considered when a subgrade pumping problem is encountered that is attributed to groundwater. When subgrade drainage is not installed, the engineer shall inform the City Engineer, in writing, of the reasons for not installing subgrade drainage.

3. *Fly Ash*: When used for subgrade stabilization, fly ash shall conform to ODOT 702.01.

4. When Subgrade modification is required, such as lime, kiln dust, or fly ash, it shall be mixed and processed according to the appropriate section of the latest edition of the Oklahoma Standard Specifications for Highway Construction as published by the Oklahoma Department of Transportation (ODOT). When lime is used, 6% will be the minimum percentage provided.

2304.3 BASE

A. **Base Drainage:** Where groundwater or ponding surface water present a threat to base stability a drainage system as shown in Standard Drawing No. ST 22 is required.

2304.4 CONCRETE PAVING

A. Concrete Street General:

1. Curb and gutter may be placed separate of the pavement, if variance is requested and granted.

2. Concrete shall be cured with white curing compound.

3. Joint layouts shall be reviewed by the City Engineer prior to placement of paving. If possible, longitudinal contraction and construction joints shall present logical traffic lanes to the driver.

4. Dowels are required at all longitudinal and transverse contraction joints in concrete pavement which is 8" thick or greater. Dowels shall be 1¼" in diameter, 18" long spaced at 12" center to center.

B. Longitudinal Joints:

1. Longitudinal cracking joints shall be placed at intervals equaling two (2) times the pavement thickness in inches converted to feet (i.e. 2 X 6" = 12" which converts to a 12 foot spacing of longitudinal cracking joints) but, not to exceed every 15 feet.

2. Longitudinal construction joints on residential and residential collector streets may, at the option of the design engineer, be butt type joints with a tiebar or keyway type without a tiebar.

3. Longitudinal construction joints on all other streets shall be keyway type with a tiebar.

4. Longitudinal contraction joints shall be made to a minimum depth of one fourth (1/4) the thickness of the pavement.

C. Transverse Joints:

1. Transverse contraction joints shall be placed at intervals equaling two (2) times the pavement thickness in inches converted to feet (i.e. 2 X 6" = 12" which converts to a 12 foot spacing of transverse contraction joints) but, not to exceed every 15 feet.

2. Transverse construction joints on residential collector streets may, at the option of the design engineer, be butt type joints with a tiebar or keyway type without a tiebar.

3. Transverse construction joints on arterial streets shall be keyway type with a tiebar.

4. Transverse contraction joints shall be made to a minimum depth of one fourth (1/4) the thickness of the pavement.

D. Expansion Joints:

1. Expansion joints shall be placed at all street intersection radius and at the last joint before a cul-de-sac.

2. Expansion joints shall have a tiebar when the street being constructed requires a tiebar or keyway for a construction joint.

2304.5 JOINT SEALING

A. Materials:

1. Sealant*:* Joint sealer shall be of the rubber-asphalt hot-poured type which readily bonds to concrete surfaces type conforming to the following specifications.

2. Pavement: ASTM D6690, Type II

3. Vertical Face of Curb Joints: Federal Specifications TT-S-001543

4. Class A or Polyurethane Sealant: ASTM C-920, Type M, Grade NS, Class 25, Use T.M.

5. Primers: The use of primers when recommended by the manufacturer of the proposed sealant and accepted by the City Engineer, is authorized in accordance with the manufacturer's instructions.

6. Backer Rod: Backer rod shall be made of compressible, closed-cell polyethylene foam, be compatible with the joint sealant, and have the physical properties shown in the following table.

Backer Rod Physical Properties

Density, lbs/cu. ft.	2.0	ASTM D 1622
Tensile Strength, psi	25	ASTM D 1623
Water Absorption by Volume, §	0.5	ASTM C 509
Compression Deflection @ 25§, psi	6	AET Method*
Temperature Resistance, degrees F.	-45 to 410	AET Method

* AET methods are included in pending ASTM specifications for backer material.

B. Equipment:

All necessary equipment shall be furnished by the contractor in accordance with requirements of subsection 108.06 (Methods and Equipment) in the latest version of the ODOT Standard Specifications. The minimum requirements for construction equipment as required to complete the work are specified herein.

108.06 Methods and Equipment (from ODOT Standard Specifications)

It is the intent of the plans and the Contract that, except when specifically provided, methods and equipment used shall be those generally accepted by the industry, and which produce the quality of work expected.

If the contractor desires to use an unusual or experimental method or type of equipment, they shall notify the engineer in writing. The notice shall include a full description of the methods and equipment proposed to be used and an explanation of the reasons for desiring to use that method or equipment before he begins work. If the Engineer concurs, it is specifically agreed and understood that the Contractor will be fully responsible for producing construction work in conformity with Contract requirements.

If after use, the proposed methods or equipment fails to produce work meeting the requirements of the plans and the Contract, the Contractor shall discontinue the use of that method of equipment and complete the remaining work with conventional methods and equipment in a manner acceptable to the engineer. The contractor shall remove the deficient work and replace it with work meeting the requirements of the plans and Contract. No change will be made in the basis of payment for the construction items involved or in the contract time as a result of a change in methods or requirements under these provisions.

The engineer shall have the final authority to reject any method that cannot produce the required results or equipment, which cannot be properly calibrated or controlled. Rejected equipment shall be removed and replaced with approved equipment.

1. *Concrete Saw:* A self-propelled power saw with water cooled diamond or abrasive saw blades shall be provided for cutting joints to the widths and depths specified, or for refacing joints where surface films of old sealant cannot be readily removed by sandblasting. (See Table 2304.5.1)

2. *High pressure water pumping system*: High pressure water pumping system capable of delivering sufficient pressure and volume of water to thoroughly flush concrete slurry from saw joints.

3. *Sand Blasting Unit:* compressed air pressure type sandblasting equipment of proper size and capacity to clean joint surfaces as specified. The unit shall be equipped for removal of all free water and

oil from the compressed air.

4. *Air compressors*: The air compressor shall deliver air at a minimum of 120 cubic feet per minute, have suitable traps for the removal of all free water and oil from the compressed air and develop at least 0.621 Mpa (90 psi) nozzle pressure.

5. *Sealing Equipment*: The unit applicators used for heating and installing hot-poured sealing materials shall be mobile and shall be equipped with a double boiler agitator-type kettle with an oil medium in the outer space for heat transfer, and a direct-connection pressure-type extruding device with a nozzle or nozzles shaped for insertion in the joints to be filled, positive devices for controlling the temperature of the oil and the sealant, and a recording type thermometer for indicating the temperature of the sealer. The applicator shall be so designed that the sealant will circulate through the delivery hose and return to the inner kettle when not sealing a joint.

6. *Injection Tool*: A mechanical injection device as required for applying the sealer into the joint.

C. Construction Methods:

1. Sawing joints: The existing contraction joints shall be cut to the width and depth shown on the saw table below. Sawing shall be done in such a manner as to produce a new joint having a cut face on both sides and be uniform in width along its full length. Only sawing will be allowed for joints, no routering is allowed.

Table 2304.5.1
Existing Contraction Joints
Widths and Depths

Joint Width, (Inches)	***Joint Depth, Min (Inches)***	***Sealant Bead Thickness (Inches)***	***Backer Rod Placement Depth (Inches)***
3/8	1 5/8)	3/8	5/8
1/2	1 3/4)	1/2	3/4
5/8	2	5/8	7/8
3/4	2 1/4	3/4	1
7/8	2 1/2	7/8	1 1/8
1	2 3/4	1	1 1/4

2. Random Cracks: Cracks are to be sawed by a pushed power saw with abrasive or water-cooled diamond saw blades to the width and depths specified (See Table 2304.5.2 Below). No backer rod will be required for random cracks.

NOTE: Routering and or plowing will be allowed prior to sawing and sand blasting. The Contractor must clean the joint face by sawing and sand blasting **after** the joint has been plowed or routered. V-shaped plows are not allowed, only rectangular.

Table 2304.5.2
Random Cracks
Table of Widths and Depths

Joint Width	***Joint Depth, Min***	***Sealant Bead Thickness*** *(bottom of joint to within ¼" of the surface)*	***Backer Rod Placement Depth***
(Inches)	***(Inches)***	***(Inches)***	***(Inches)***
3/8	3/4 Min.	1/2	N/A
1/2	"	"	N/A
5/8	"	"	N/A
3/4	1	"	N/A
7/8	1	"	N/A
1	1	"	N/A

3. Preparation of Cracks: The specifications, which apply to joints, shall also apply to cracks. Hairline cracks shall not be routed and sealed. The construction inspector shall define a hairline crack on the job site.

   The minimum joint width of all joints or cracks to be sealed shall be 3/8".

4. Flushing Joints: Within 5 minutes after sawing, the resulting slurry shall be removed from the joint and immediate area by flushing with a high-pressure water system and other equipment necessary to thoroughly remove the slurry.

5. Cleaning Joint Faces:

   (a) **General:** The cut faces of the joints shall be thoroughly cleaned of all foreign materials, as may be required for proper installation and bonding of the joint sealer or filler, including old sealant or any residue from water flushing operations, by sandblasting as required. The use of portable hand-saws will not be permitted for cleaning joint faces.

   (b) The cut faces of the joint shall be thoroughly air dried for a minimum of 48 hours after flushing the water. Blow drying of the joints with compressed air will not be permitted.

   (c) **Sandblasting**: After complete drying, the joint shall be sandblasted. The sandblasted nozzle shall be attached to a mechanical aiming device so as to direct the sandblast at approximately a 45 degree angle and at a maximum of 2 inches from the faces of the joint. Both joint faces shall receive sandblasting. After sandblasting the joints shall be blown out using filtered oil free and moisture free air at a minimum of 90 psi and 120 cfm. Blowing out of the joint shall be accomplished by using a blow tube which will fit into the joint.

(d) Joint Contamination: In the event the open joints prepared for installation of joint sealing materials become contaminated by traffic, or the result of weather conditions, they shall be re-cleaned as specified above as approved by the Engineer.

(e) Subdivision Development: The contractor for the developer shall assure that all concrete joints are clean, dry and the proper width before the sealant is installed and that the bond breaker rod as specified below has been installed per these specifications. The City's construction inspector shall approve all joints before the sealant is installed. The sealant, as specified in these specifications, shall be used. The sealant shall be installed per these specifications.

6. Bond Breaker Rod: When shown on the plans or recommended by the sealant manufacturer, a bond breaker rod shall be installed prior to application of the joint sealant. The bond breaker rod shall be of the type recommended by the manufacturer of the sealant material. The bond breaker rod shall be installed in a manner that will produce the dimensions (width and depth) described on the Plans.

7. Sealing Joints:

(a) ***Approval of Joints for Sealing***: The Department's inspectors will examine joints prepared for sealing just prior to installation of the joint filler or sealer. Joints will not be approved for sealing if contaminated or not adequately dry as required for bonding of sealing materials.

(b) ***Installation of Joint Sealers and Fillers***:

(c) ***General*****:** A representative of the joint filler and/or joint sealer manufacturer shall be on the job site at the beginning of the joint sealing operation to demonstrate to the Contractor and to the Department's inspectors the manufacturer's acceptable standards for installation of the joint sealant materials.

(d) ***Application of Joint Sealers:***

(1) ***Joint Sealers:*** *The joint sealer shall be applied, using a mechanical injection tool approved by the Engineer. Application of the joint sealer will not be permitted when the joint temperature is less than 40°F (4°C). Joints shall not be sealed unless they are thoroughly clean and dry. Sealers to fill the joint shall be injected into the joint and applied in a manner which causes it to bond to the joint face surfaces. The surfaces of sealers requiring tooling shall be tooled, using an approved mechanical device to produce a slightly concave surface approximately 0.25 inches below the pavement surface. Tooling shall be accomplished before a skin forms on the surface of the sealer. The use of soap or oil as a tooling aid will not be*

permitted. Tooling will not be required if the sealer is self-leveling.

(e) ***Bonding Failures***: Failure of the sealant to bond to sawed surfaces of the concrete joint will be cause for rejection and shall be at the Contractor's expense to replace the sealant.

8. Traffic: Traffic shall not be allowed on the fresh applied sealant until it becomes tack free.

D. Rate of Progress of Joint and Crack Preparation:

E. The work required for the removal of existing joint sealant including widening and/or deepening of joint openings if required, and refacing of joint walls shall proceed at an appropriate rate of progress determined acceptable to the Engineer. The final stages of joint preparation, including sandblasting of the joint faces, air pressure cleaning of joints, and placement of backer rod shall be limited to only that lineal footage of joint that can be resealed during the same workday.

F. Installation of Backer Rod:

1. After the existing sealant has been removed to the required depth, the backer rod shall be installed at the depth recommended by the sealant manufacturer. The backer may be installed by hand using a blunt tool or a roller device. The size of the backer road for each joint shall be in accordance with the following table (2304.5.3).

Table 2304.5.3
Backer Rod Size

Joint Width (inches)	*Rod Diameter (inches)*
3/8	1/2
½	5/8
5/8	3/4
¾	7/8
7/8	1
1	1-1/4

G. Sealant Preparation:

1. Hot-poured sealing material shall not be heated in excess of the safe heating temperature recommended by the manufacturer as shown on sealant containers. Sealant that has been overheated or subjected to heating for over three hours or that has remained in the applicator at the end of the day's operation shall be removed and disposed of. Material may be added to the melter as the sealant is withdrawn during the sealing operation.

H. Sealant Installation: *(See Standard No. ST-29)*

1. Time of Application (New Pavement and Concrete Patches):

(a) Joints shall be sealed immediately following the concrete-curing period or as soon thereafter as weather conditions permit. The concrete walls of the joint shall be surface dry, and atmospheric and pavement temperatures shall be above 40°F (4°C) at the time of application of the sealant. Open joints that cannot be sealed under the conditions specified herein shall be sealed with an approved temporary seal to prevent infiltration of foreign particles. When rain interrupts sealing operations, joint shall be recleaned prior to installing sealant.

2. Time of Application: (Existing Joints to be Resealed):

(a) Joints shall be sealed immediately following the sandblast cleaning of the joint walls and following placement of the backer rod. The concrete walls of the joint shall be surface dry, and the atmospheric and pavement temperatures shall be above 40°F (4°C) at the time of application of the sealant. Open joints ready for resealing that cannot be sealed under the conditions specified herein, or when rains interrupt sealing operations, shall be recleaned prior to installing of the sealant.

(b) Sealing Joints: No joint sealant shall be installed until the cleaned joints have been inspected and approved by the City of Norman's construction inspector. Excess of spilled sealant shall be removed from the pavement by approved methods and discarded. In no cases shall the sealant extend above the surface and if inadvertently so placed, shall be removed. When a primer is supplied by the manufacturer, it shall be applied evenly to the joint faces in accordance with the manufacturer's recommendations. The joint shall be checked frequently to insure that the newly installed sealant is cured to a tack-free condition within 3 hours.

(c) Final Acceptance: In place sealant which is not completely bonded to the concrete surfaces of the joint walls, or develops cohesive failures within the sealant, or contains voids or entrapped air, or fails to set to a tack-free condition within 24 hours will be rejected. Sealant may be rejected at any time prior to final acceptance of the project. Sealant which is rejected shall be removed from the joint, wasted and replaced in a manner satisfactory to the City Engineer at no additional cost to the City

(d) Installation of sealant in vertical face of curb and top of curb: Contractor shall use a polyurethane sealant in this area which meets the following specifications: ASTM C-920, Type M, Grade NS, Class 25, use T.M. or Federal Specification TT-S-001543. This work will be paid at the same unit price per lineal foot as the rubberized asphalt.

I. Measurement:

1. Field Measurements, in lineal feet shall be made as necessary to determine the actual quantity placed. The City of Norman's construction inspector shall make the measurements. The contractor may have personnel present when measurements are made if he so desires.

J. Payment:

1. The quantity of cleaning and sealing to be paid will be determined by the actual measurement of the number of lineal feet of sealed joints and cracks in place rounded off to the nearest lineal foot. Payment will be made at the contract unit bid prices per lineal foot for the cleaning and sealing item. The unit bid price shall include the cost of all labor and materials and the use of all equipment and tools.

2304.6 CURB AND GUTTER

A. General:

1. Curb and gutter may be placed separate of the pavement, if variance is requested and granted.

2. Concrete shall be cured with white curing compound.

B. Transverse Joints:

1. Transverse cracking joints shall be placed at intervals equaling the spacing used for the street.

2. Transverse construction joints on curb and gutter shall match the type of joint required for the type of street being constructed.

C. Expansion Joints:

1. Expansion joints shall be placed at all street intersection radius and at the last joint before a cul-de-sac.

2. Expansion joints shall have a tiebar when the street being constructed requires a tiebar or keyway for a construction joint.

D. Joint Sealing: The joints in the gutter up to 1" above the flow line will be sealed with rubberized asphalt sealer conforming to ASTM D-3405. Vertical face of curb joints shall be cleaned and sealed with silicone conforming to ODOT 701.08(e) or polyurethane sealant conforming to ASTM C-920, Type M, Grade NS, Class 25, use T.M.

2304.7 SIDEWALKS

A. Sidewalk Base Preparation:

1. When constructing sidewalks, the concrete shall be laid on a firm, smooth surface at an average depth below finish grade equal to the thickness of the sidewalk.

2. All soft and yielding or other unsuitable materials shall be removed and replaced with suitable material before construction of the sidewalk.

3. The sidewalk shall be constructed on leveling bed of 2” of compacted crushed aggregate base or recycled aggregate base.

4. All sidewalks shall consist of concrete (ODOT Class A, 6 sack, 3000 psi, water/cement ratio of 0.48, 1” to 3” Slump).

5. There shall be an initial inspection of forms and a final inspection upon completion.

B. Finish and Joints:

1. Sidewalks shall have a non-slip broomed surface.

2. Expansion joints shall be placed at all intersections with curbs.

3. Transverse cracking joints will normally be tooled or sawed into the finished sidewalk to a depth of 1".

4. Transverse cracking joints shall be placed at intervals not to exceed every 5'.

5. The cross slope shall be 2% or less at all locations and be constructed in compliance with the most current version of the 2010 ADA Standards for Accessible Design, as noted in the City of Norman Engineering Design Criteria.

6. Edge all outside edges of walk and all joints with 0.25” radius edging tool.

7. Form construction joints around all abutting structures and appurtenances such as manhole, utility poles, hatches, and fire hydrants. Install 0.5” thick premolded expansion joint filler in construction joints. Expansion joint material shall extend for the full depth of the walk.

8. When connecting a new sidewalk to an existing 4” sidewalk, excavate an additional 2” below the existing sidewalk and place a 6” thickened edge.

9. At the beginning and the end of the days pour and at a construction joint, a 6” thickened edge is required with either (2) #3 x 12” rebar or a 2” x 2” keyway.

10. Sidewalk and driveways are to be backfilled and compacted immediately after forms are removed.

11. Curing Concrete: Exposed surfaces of concrete shall be protected by accepted methods from premature drying for a period of at least seven (7) days. Curing compounds, when accepted by the Engineer, shall be applied according to the manufacturer’s recommendations, and shall not be used on any surface against which additional concrete is to be bonded, nor on surfaces which will be painted. In dry, hot weather, forms shall be removed as early as practicable, and curing started immediately. The Engineer may require the frequent wetting of the concrete and the use of means to protect it from the direct rays of the sun.

12. Expansion joints shall be placed at curbs, driveways, or abutting structures. All expansion joints shall be constructed with a 6" thickened edge and 3/8" diameter smooth dowels at 24" spacing as shown on drawing Standard No. ST-14. Expansion joints shall be required at intervals of 50 feet.

13. Upon completion of the work and before the final inspection, the site shall be clean of any work surplus, discarded material, temporary structures, and debris of any kind.

2304.8 STRIPING:

A. Striping shall be Thermoplastic or Paint (Multipolymer) based on the roadway's material type and volume, in vehicles per day. See the Engineering Design Criteria for selection and use of striping.

1. **Thermoplastic:** Hot applied thermoplastic traffic stripe shall meet the requirements of ODOT 711.01 and shall be applied in accordance with ODOT 855.04.

2. **Paint (Multipolymer):** Traffic stripe paint shall conform to and be applied in accordance with ODOT 856.

2304.9 STORM SEWER

A. Storm Sewer Pipe Permitted:

	Description	***AASHTO Specification***	***ASTM Specification***
1.	Reinforced Concrete Round Culvert, Storm Drain and Sewer Pipe	M170	C76
2.	Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe	M207	C507
3.	Joints for Concrete Pipe, Manholes and Precast Box	M198	C443
4.	Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe	M206	C506
5.	Pre-Cast Concrete Manholes	M199	C478
6.	Pre-Cast Reinforced Concrete Box Culvert	M259/273	C789/850
7.	Polyvinyl Chloride (PVC) Pipe		D3034
8.	Corrugated Polypropylene Pipe	M330	F2881

B. Concrete Storm Sewer Pipe Joint Seals:

1. For zero internal head storm applications use AASHTO M170, M206, or M207 concrete products with Omni-Flex seals or butyl rope (Ram-neck), installed according to the manufacturer's recommended external joint openings. Use manufacturer's gap sheet.

2. For concrete storm sewers with low internal head (30'), use AASHTO M242 concrete products with ASTM C443 confined O-ring or Forsheda gaskets.

C. Removal of Water: All dewatering shall be incidental to other items of work and shall be provided at no cost to the City.

D. Testing:

1. Paved areas: One density test (AASHTO T-238) per street crossing

2. Non-paved areas: One density test per 300 lineal feet of trench in the haunching for all pipe except concrete.

2304.10 ASPHALT PAVING

A. Tack Coat:

1. A tack coat shall be required between lifts of asphalt.

2. The face of the gutter on the concrete curb and gutter shall have a tack coat before asphalt is placed on the subgrade.

B. Asphalt Testing:

1. Target density of asphalt pavement will be 94% of maximum theoretical as determined by AASHTO T 209, with the acceptable range being 92% to 97%. Densities of 91.99% to 88.10% shall be subject to a penalty as described on table 3 below and in Section 411.04 of the latest edition of the Oklahoma Department of Transportation "Standard Specifications for Highway Construction". The penalties shall be paid to the City of Norman for future pavement maintenance costs and shall be paid before final acceptance of the development by City Council. The penalty shall be based on the documented original contract price of the asphalt pavement between the contractor and developer. The City Engineer shall calculate the penalty to be paid. Densities above 97% and below 88.1% shall be considered unacceptable and shall be, as determined by the City Engineer, either removed and replaced by the contractor at no cost to the developer or left in place with a 100% penalty being paid to the City of Norman.

2. If the No. 200 sieve mixture or percent AC soluble in solvent of the constructed asphalt pavement does not meet the approved job mix formula, then a penalty shall be paid to the City of Norman. The penalties shall be calculated using the following tables. If the above test results fall in the unacceptable range, the asphalt pavement will be, as determined by

the City Engineer, either removed and replaced or left in-place with a 100% penalty being paid to the City of Norman. The penalty shall be as stated in Paragraph 1 above.

Table 1

Percent AC Soluble in Solvent

+-% Deviation beyond tolerance based on job mix formula	% of contract price to be paid contractor
0.01 - 0.14	94.00
0.15 – 0.24	93.00
0.25 - 0.34	92.00
0.35 - 0.44	91.00
0.45 - 0.54	90.00
Greater than 0.54	Unacceptable

Table 2

NO. 200 Sieve Mixture

+-% Deviation beyond tolerance based on job mix formula	% of contract price to be paid contractor
0.01 - 0.14	98.00
0.15 – 0.24	95.00
0.25 - 0.34	91.00
0.35 - 0.44	87.00
0.45 - 0.54	83.00
0.55 - 0.64	78.00
0.65 - 0.74	72.00
0.75 - 0.84	66.00
0.85 - 0.94	60.00
0.95 - 1.04	53.00
Greater than 1.04	Unacceptable

3. A minimum of three (3) roadway cores are to be taken per days run, up to 875 tons. For tonnage less than 725 tons, the contractor must submit a written request to cut less than three (3) cores before cutting cores.

4. All core densities below 92% and above 96% shall be re-cored within three (3) feet of the failing core. Only one re-core of the original core locations shall be allowed. The City's construction inspector shall observe the re-cores. If the re-cores densities fail, the contractor will be penalized per section 2304.10 B 1. Re-rolling asphalt will not be allowed once the asphalt temperature falls below 180° F (82.2° C).

5. The thickness of asphalt cores shall be measured according to ASTM D 3549-93a.

6. The penalty for the asphalt density test, AC content test and No. 200 sieve mixture test, shall be assessed only on the test failure that produces the greatest penalty.

NOTE: A minimum of 3 core densities will be required per type of mix per project.

EXAMPLE:

		Required Tests
Project Length	800'	3 Full Depth Cores
Width of Asphalt	24'	* 3 " S3" mix cores density
Type "S3" Asphalt	470 Ton	* 3 " S4 & S5" mix cores density
Type "S4 & S5" Asphalt	235 Ton	1 "S3" extraction & gradation
		1 "S4 & S5" extraction & gradation
		2 Rice Tests "S3" & "S4 & S5"

* NOTE: Each lift of asphalt is to be cored before placement of the next lift.

Acceptance and pay adjustments will be based on a test by the City of Norman and in accordance with the following schedule:

Table 3

Target density of asphalt pavement

Average Lot Density *% of Maximum Theoretical Density* ***(ALD)***	Pay Adjustment Factor (**PAF**)
Above 97	Unacceptable *
92 – 97	1.00
91 – 92	1.00-(0.07)(92-ALD)
88.1 – 91	0.93-(0.15)(91-ALD)
Below 88.1	Unacceptable *
Adjustment Payment = PAF x Contract Unit Price	

* Unless otherwise directed by the Engineer, products testing in this range are unacceptable and shall be removed and replaced at no additional cost to the City of Norman.

C. Header Curb:

1. Asphalt streets with temporary end-of-pavement sections shall be completed with either a 6" wide by 12" deep concrete header curb, or the asphalt pavement shall be extended 10-feet beyond the design pavement section. When extending the asphalt pavement, the asphalt shall be saw cut and a butt joint used.

END OF SECTION 2300

City of Norman
STANDARD SPECIFICATION AND CONSTRUCTION DRAWINGS
SECTION 2400 WATER LINES

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STANDARD SPECIFICATION AND CONSTRUCTION DRAWINGS
SECTION 2400 WATER LINES

2401 GENERAL REQUIREMENTS

2401.1 SCOPE

This specification is to govern the furnishing of all materials, labor, equipment, tools, superintendence, and other services necessary to construct water mains, complete with appurtenances including extensions and relocations at the locations shown on the plans or specified. This section governs materials for water mains having a diameter of 4" through 64" and water service lines less than 4" .

2401.2 ABBREVIATIONS

Wherever the words, forms, or phrases herein defined, or pronouns used in their stead occur in these specifications, in the contract or in the Advertisement of any document or instrument herein contemplated or to which these specifications apply, the intent and mean shall be interpreted as defined in Sections 1008 and 1009.

2401.3 CODES, SPECIFICATIONS, AND STANDARDS

Codes, specifications, and standards referred to by title or number shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply in all cases. Specific reference standards include:

A. Title 252. Oklahoma Administrative Code, Chapter 626, Public Water Supply Construction Standards, ODEQ
B. Water System Operations, AWWA
C. Standards and Manuals of Practice, AWWA
D. Backflow and Cross-Connection Manual, AWWA
E. Code of Ordinances, City of Norman

2401.4 QUALITY ASSURANCE

A. The Contractor shall test and disinfect water mains as specified in Section 2403.9.

2401.5 SUBMITTALS

A. Submittals shall be as specified in the General Conditions.

B. Submit the following:

1. Manufacturer's Certificate of Compliance certifying compliance with the applicable specifications and standards.

2. Certified copies of test reports of factory tests required by the applicable standards.

3. Shop drawings with performance data, physical characteristics, and dimensional layouts for piping, fittings, valves, hydrants, and precast concrete units.

2402 PRODUCTS

2402.1 PIPE AND FITTINGS

A. Polyvinyl Chloride Pipe (PVC)

1. Pipe

- Polyvinyl chloride pipe shall meet the requirements of AWWA C900 DR-18 (235 psi) for all pipe sizes.
- Polyvinyl chloride pipe shall have ductile-iron-pipe-equivalent outside diameter.
- Pipe joints shall be push-on type, meeting the requirements of AWWA C900.
- Mark each length of pipe in accordance with AWWA C900.

2. Fittings and Glands

- Fittings and glands shall be ductile iron. Fittings shall meet the requirements of ANSI A21.10/AWWA C110 or ANSI A21.53/AWWA C153. Design and manufacture fittings for a pressure rating compatible with that of the pipe.
- Fitting joints shall be mechanical joints. Mechanical joints shall meet the requirements of ANSI A21.11/AWWA C111.
- Mark each fitting. Marking shall meet the requirements of ANSI A21.10/AWWA C110.
- All ductile iron pipe fittings and glands shall be factory applied fusion bonded epoxy coated which meets AWWA C116.

3. Adapters

- Adapters from polyvinyl chloride water mains to flanged valves or fittings shall be ductile iron. Adapters shall meet the requirements of ANSI A21.10/AWWA C110. Design and manufacturer adapters for a pressure rating compatible with that of the pipe.
- EBAA Megalug restraints, or approved equal, shall be used for all sizes which are available and shall be fusion bonded epoxy coated per AWWA C116.
- Adapter ends connecting to polyvinyl chloride water mains shall have plain ends or mechanical joints. Mechanical joints shall meet the requirements of AWWA C111 and C153.
- Adapter ends connecting to flanged valves or fittings shall have joints complying with the specifications for the applicable valves or fittings.

4. Gaskets:

- Gaskets for polyvinyl chloride push-on joints shall meet the requirements of AWWA C900.
- Gaskets for mechanical joints shall meet the requirements of AWWA C111 and AWWA C153.

5. ***Nuts and Bolts****:* Nuts and bolts for mechanical joints shall be 304 Stainless Steel. Nuts shall be hexagon nuts and Teflon coated. Bolts shall be tee head bolts. Nuts and bolts shall meet the requirements of ANSI A21.11/AWWA C111.

B. High density polyethylene pipe (HDPE)

1. Pipe:

- High density polyethylene pipe (HDPE) shall be only used for trenchless directional drilling applications where no service connections are proposed. Additionally. HDPE wall thickness shall be considered when selecting the appropriate pipe size for hydraulic conditions.
- High density polyethylene pipe (HDPE) shall meet the requirements of AWWA C906, SDR-11.
- High density polyethylene pipe (HDPE) shall have ductile iron pipe equivalent outside diameter.
- Pipe joints shall be by thermal butt-fusion, flange assemblies, or mechanical methods as may be recommended by the pipe supplier. Polyethylene piping shall not be joined by solvent methods, adhesives, or threaded-type connections.
- Mark each pipe in accordance with AWWA C906.

2. Fittings:

- Fittings and glands shall be ductile iron and selected in accordance with AWWA C906 and utilize Ductile Iron Pipe Sizing (DIPS).
- Transition between HDPE and other pipe materials shall utilize mechanical fittings specifically designed for use with HDPE Pipe. Stainless steel internal stiffeners shall be installed in the end of the HDPE pipe when HDPE pipe is connected to a non-HDPE pipe, valve, fitting, or into the hub of a bolted coupling. Stiffener will be rated for DR and ID of pipe and 304 or 316 stainless steel. For welded-on HDPE adapters, the stiffener may be integral to the adapter.

C. Ductile-Iron Pipe:

1. Pipe

- Ductile iron pipe shall meet the requirements of ANSI A21.51/AWWA C151 and only used upon approval by the Utilities Engineer. Design and manufacture pipe for a working pressure of 150 psi plus 100 psi surge and a safety factor of 2. Minimum pressure class shall be as follows:

Size Range	***Pressure Class***
12" and smaller	350
14" through 24"	250
30" and larger	150

- Pipe joints shall be push-on type. Joints shall meet the requirements of ANSI A21.11/AWWA C111.
- Each length of pipe shall be marked with pipe class, casting period, manufacturer's name or trademark, and year of manufacturer. Marking shall meet the requirements of ANSI A21.51/AWWA C151.

2. Fittings and Glands

- Fittings and glands shall be ductile iron. Fittings for standard size fittings shall meet the requirements of ANSI A21.11/AWWA C110. Compact or short body fittings 3" through 16" shall meet the requirements of ANSI A21.53/AWWA C153. Design and manufacture fittings for a pressure rating compatible with pipe used.
- Fitting joints shall be mechanical joints or restrained push-on joints. Joints shall meet the requirements of ANSI A21.11/AWWA C111. Provide restrained mechanical joints as indicated on the drawings and specified in this Section. Restrained joints may be used instead of mechanical joints and thrust blocking. Restrained joints shall be Lok-Ring, Lok-Fast, Lok-Tyte, Megalug, or equal. Pipe connecting to restrained joint fittings shall also have restrained joints as indicated on the drawings and specified in this Section.
- Mark each fitting. Marking shall meet the requirements of ANSI A21.10/AWWA C110.
- Accepted manufacturers of ductile iron pipe include: U.S. Pipe and Foundry, American Cast Iron Pipe Co., and Griffin Pipe Company.
- All ductile iron pipe fittings and glands shall be factory applied fusion bonded epoxy coated (interior and exterior) which meets AWWA C116. The epoxy coating shall be installed per the coating manufacturers specifications. A Certificate of Compliance shall be required from the coating manufacturer stating that the coating meets all requirements mentioned herein. Holiday testing shall be required per ASTM G 62. The epoxy coating and the factory that applies the coating shall be approved by the Utilities Engineer. Fittings shall not be cement lined.

D. Pipe and Fittings Smaller than 3-Inch

1. ***Pipe*****:** Pipe shall be HDPE SDR9 – blue, CTS. Copper tubing, Type K, Class 1, conforming to ASTM B88 may be used for areas contaminated with or located near possible hydrocarbon contaminants. Tubing shall be

suitable for use with compression-type fittings.

2. Fittings and Couplings:
   - Fittings shall be brass conforming to ASTM B62 (Table 1) or ASTM B584. Brass shall have a tensile strength of not less than 30,000 psi when tested according to ASTM B208. Fittings shall be designed for 200 psi working pressure.
   - All castings shall be smooth, free from burrs, scales, sand holes and defects of every nature which would make them unfit for the use for which they are intended.
   - Nuts shall be smooth cast and shall have symmetrical hexagonal wrench flats.
   - All thread fittings, of all types, shall have N.P.T. threads, and male threaded ends shall be protected in shipment by a plastic coating or other equally satisfactory means.
   - Compression tube fittings shall have a Buna-N beveled gasket or equal.

E. Water Services:

1. **Controlling Brass Specifications** - All brass fittings and valved shall be manufactured in accordance with the AWWA Standard C800, latest version as further specified; any brass part of the fitting or valve in contact with potable water shall be made of a "No-Lead Brass", defined for the specification as UNS Copper Alloy C89520 in accordance with the chemical and mechanical requirements of ASTM B 584, or copper alloy CDA No. C 89833, and shall be certified by an ASNI accredited test lab per ASNI/NSF Standard 61/600. Permitted manufacturers: Mueller Company, Ford Meter Box Company and A.Y. McDonald Company.

2. **Service Saddle** – All Stainless Steel, 304 (18-8) per ASTM A420, with CC thread – ¾" through 2", single strap for ¾" – 1", double strap for 1 ½" – 2".

3. **Corporation Stops** – CC thread with pack joint (PJ) compression fitting for copper tube size pipe (CTS). Taps shall be at an angle of 45 degrees off the horizontal – never vertical. Multiple taps (two or more) shall be staggered around pipe circumference, and a minimum of 12" apart.

4. **Inserts for High Density Polyethylene Pipe (HDPE) Tubing** – Number 51 stainless steel for copper tube size pipe (CTS).

5. **High Density Polyethylene (HDPE) Pipe** – SDR 9 copper tube size (CTS); blue in color.

6. **Meter Valve / Straight Valve** – Brass valve shall be full port and pack joint compression connections for the following approved valves: 1" by 2/4" meter nut, 1" by 1" meter nut, 1.5" by meter flange, and 2" by meter flange.

7. **Coupling Connections** – PJ CTS compression by PJ CTS compression.

8. **Meter Boxes** – The listed meter boxes shall be made of High Density Polyethylene (HDPE), Carson-Brooks model 2200-18 with cast iron lid or approved equal by the Utilities Engineer for water meters in size from ¾" to 1". For 1.5" water meter installation Cason-Brooks 1324 with cast iron meter reader lid or approved equal by the utilities Engineer, and for 2"

water meter installations Carson-Brooks 1730 1730 with cast iron meter reader lid of approved equal by the Utilities Engineer.

9. **Tracer Wire** – #12 AWG solid copper wire with 30 mil HDPE coatings, installed with watertight connections on all service lines, short of long, from corporation stop to meter valve.

10. **Meter Setters** – Meter Setters shall be Ford Meter Box Company, Inc Series 70 copper setters with inlet ball valve and outlet cartridge dual check valve (VBHC) with minimum 9" high setter height, or approved equal.

F. Stops and Cocks:

1. Stops and cocks shall be brass conforming to ASTM B62 (Table 1) and shall be full size throughout the size specified.

2. Seating surfaces of the ground key type shall be tapered and shall be accurately fitted together by turning the key and reaming the body. Seating surfaces shall be lapped together using suitable abrasives to insure accurate fit. The large end to the tapered surface of the key shall be reduced in diameter for a distance that shall bring the largest end of the seating surface of the key into the largest diameter of the seating surface of the body, and the taper seat in the body shall be relieved on the small end, so that the small end of the key may extend through, to prevent wearing of a shoulder and to facilitate proper seating of the key. The stem end of the key, key nut and washer shall be so designed that if the key nut is tightened to the failure point, the stem of the key shall not fracture. The nut and the stem shall withstand a torque on the nut of at least three times the necessary effort to properly seat the key without failure in any manner.

3. The ball stop shall have a full-size round-way opening with straight-through flow, Teflon coated bronze ball with a minimum of .5 mil thickness coating. The stop must be so constructed that it may be disassembled and the ball removed without special tools.

4. Plug type stop shall have full size round way opening with straight-through flow. Seating surfaces shall be brass (or Teflon coated brass) to rubber O-rings, providing positive pressure seal without mechanical means. The stop must be so constructed that the plug may be removed without special tools. Material for rubber O-rings should conform to requirements of ASTM D 450 (test method shall be Rubber O-Rings, ASTM D 1414).

5. Inlet and outlet threads, of the types specified, shall conform to the applicable tables of AWWA C300, and inlet threads shall be protected in shipment by a plastic coating or other equally satisfactory means. If used, coupling nuts shall have a bearing skirt machined to fit the outside diameter of the pipe for a length at least equal to the outside of the pipe.

6. Corporation stops shall be designed as to rotate about the axis of the flow passageway within a circle of rotation small enough to properly clear the inside of any standard tapping machine of appropriate size.

G. Adapters:

1. Adapters from ductile iron water mains to flange joint valves or fittings shall be ductile iron. Adapters shall meet the requirements of ANSI

A21.10/AWWA C110, or ANSI A21.53/AWWA C153. Design and manufacture adapters for a pressure rating compatible with pipe used.

2. Adapter ends connecting to ductile iron water mains shall have plain ends, push-on joints, mechanical joints, or restrained push-on joints. Adapters with plain ends, push-on joints, or mechanical joints may be used where restrained joints are not required. Adapters shall have restrained push-on joints where restrained joint piping is required as indicated on the drawings and specified in this Section. Mechanical joints and push-on joints shall meet the requirements of ANSI A21.11/AWWA C111. Restrained joints shall be Lok-Ring, Lok-Fast, Lok-Tyte, Megalug, or equal.

3. Adapter ends connecting to flange joint valves or fittings shall have joints complying with the specifications for the applicable valves or fittings.

4. ***Lining and Coating:*** Line the inside surfaces of all pipe with double cement mortar lining and bituminous seal coat. Cement mortar lining and bituminous seal coat shall meet the requirements of ANSI A21.4/AWWA C104. Coat the exterior of the pipe and fittings with a 1 mil bituminous coating in accordance with AWWA C110 and AWWA C151, unless specified otherwise. All ductile iron pipe and fittings shall be coated with a layer of arcsprayed zinc per ISO 8179 before applying the bituminous coating asphaltic top coating in accordance with the pipe manufacturer's recommendations.

5. ***Gaskets:*** Gaskets for mechanical joints and push-on joints shall meet the requirements of ANSI A21.11/AWWA C111.

6. Nuts and Bolts:
   - Nuts and bolts for mechanical joints shall be 304 Stainless Steel. Nuts shall be hexagon nuts and Teflon coated. Bolts shall be tee head bolts. Nuts and bolts shall meet the requirements of ANSI A21.11/AWWA C111.
   - Nuts and bolts for restrained push-on joints shall meet the requirements of the joint manufacturer.

7. ***Tapping Sleeves*****:** Tapping sleeves shall be standard mechanical joint type for iron pipe and shall comply with all applicable requirements of ANSI A21.10/AWWA C110 for iron fittings. Tapping sleeves shall be furnished with a flanged outlet conforming in dimensions and drilling to ANSI B16.1, Class 125. Tapping sleeves shall be stainless steel full circle with 304 stainless steel flange, bolts and nuts with a mechanical joint outlet. Tapping sleeves shall be a used for connections to pipe sizes 24" and larger.

8. ***Polyethylene Encasement:***
   - Polyethylene tube wrap shall be furnished for all Ductile Iron Pipe. In addition to the factory applied asphaltic and zinc coating, all buried ductile iron pipe and fittings shall have a tube-type polyethylene encasement in accordance with AWWA C105. Polyethylene encasement shall be 4 mils thick and cross-laminated. Both ends of the pipe shall be thoroughly sealed with adhesive tape or plastic tie straps at the joint overlap. Place circumferential wraps of tape at 2-foot intervals along the barrel of the pipe to minimize the space between the encasement and the

pipe. Pipe shall be wrapped with V-BIO Enhanced Polyethylene Encasement in accordance with manufacturers recommendation.

- Tape of polyethylene tube shall be plastic backed adhesive tape, Polykan #900 or Scotchrap #50 or equal, 2" in width.

2402.2 VALVES

All valves and valve appurtenances shall be factory applied fusion bonded epoxy coated which meets AWWA C550 and bolts shall meet ASTM F-593-95 and nuts ASTM F-594-91.

A. **Gate Valves:** Buried gate valves shall be iron body, non-rising stem resilient seat gate valves. Valves shall meet the requirements of AWWA C509 or AWWA C515**,** shall be fusion bonded epoxy coated per AWWA C550 and shall have mechanical joint or flanged ends. Valve opening direction shall be consistent with operation of existing valves in the waterworks in which the valves are installed, unless otherwise directed by the Engineer. The following manufacturers will be permitted: Mueller Company, U.S. Pipe Company, American Pipe Company, Clow Valve, and M&H Valve Company. All body bolts to be stainless steel.

B. **Butterfly Valves:**

1. Butterfly valves shall be of the tight-closing, rubber-seat type, shall have a rated pressure of 200 psi. and shall be bubble-tight at this pressure with flow in either direction. Valves and operators shall meet the requirements of ANSI A21.11/AWWA C504 for "Rubber-Seated Butterfly Valves." The following manufacturers are permitted: Henry Pratt Company and Mueller Company.

2. Buried butterfly valves shall have mechanical joints or flanged. Mechanical joints shall meet the requirements of ANSI A21.11/AWWA C111. Butterfly valves installed above ground or in structures shall have flange joints as specified in AWWA C504. Nuts, bolts, and gaskets for flange joints shall meet the requirements of ANSI A21.10/C110. Nuts and bolts for mechanical joints shall be 304 Stainless Steel. Nuts shall be hexagon nuts and Teflon coated. Bolts shall be tee-head bolts. Nuts and bolts shall meet the requirements of ANSI A21.11/AWWA C111. Gaskets shall be full face and shall be red rubber, or equal.

3. Each buried butterfly valve or valve in a vault shall have a manual operator and a 2-inch operating nut. Valve opening direction shall be consistent with operation of existing valves in the waterworks in which the valves are installed, unless otherwise directed by the Utilities Engineer.

4. Each butterfly valve installed above ground shall have a manual operator and handwheel.

C. **Pressure-Reducing Valves:** Pressure-reducing valves shall be designed to provide tight shutoff under conditions of no flow and shall not "hunt" under ordinary flow conditions. Pressure-reducing valves shall be suitable for operation under the pressure and flow conditions as shown on the plans.

D. **Combination Air Valves:** Combination air-release and vacuum-relief valves shall be installed at the locations indicated on the plans. Each valve assembly shall be installed complete with appropriate piping and valves as shown on the plans. All piping and isolation valves shall be brass except for the air outlet from the valve which shall be brass or copper tubing. The following valves, or

approved equal, shall be used Valmatic Model 101S, 102S,103S or Cla-Val 36 Series, or approved equal.

E. **Tapping Valves:** Tapping valves shall be 200 psi, iron body, resilient-seated gate valves with nonrising stems conforming with all applicable requirements of ANSI/AWWA C500 and C509, except that the outlet and inlet end shall be standard mechanical joint end conforming to ANSI A21.11/AWWA C111.

F. Check Valves:

1. Swing check valves 3" and larger shall conform to and be tested in accordance with the AWWA Standard for Swing-Check Valves for Ordinary Water Works Service, AWWA C508. They shall be horizontally mounted, single disc, swing type with a full diameter passage providing minimum pressure loss. Valves shall be non-slamming with an outside lever and weight or a spring loaded lever. Disc faces and seat rings shall be bronze. Ends shall fit the pipe or fitting to which attached (push-on, mechanical, bell and spigot, or flanged). The following makes will be permitted: Crane, Darling, Mueller, or equal.

2. Check valves 2.5" in size and smaller for irrigation systems shall conform to the requirements of Federal Specification WW-V-51a for Class "A" 125 Pound Bronze Check Valves (for land use), Type IV.

G. Valve Appurtenances:

1. Valve Ends:
   - Valve ends of the mechanical joint type shall conform to ANSI A21.11/AWWA C111.
   - The end flanges of flanged valves shall conform in dimensions and drilling to ANSI B16.1 for cast-iron flanges and flanged fittings, Class 125. The laying lengths of the flanged valves shall conform to the dimensions of ANSI B16.10.

2. Valve Operation:
   - Gate valves shall be equipped with a 2" square wrench nut and the direction of rotation to open the valve shall be to the left (counterclockwise) unless otherwise noted in the Special Conditions.
   - Operators for non-buried service butterfly valves shall be of the enclosed gear-type furnished with a handwheel and 2" operating nut. Operators for buried service shall be equipped with mechanical stop-limiting devices to prevent over travel of the disc in the open and closed positions.
   - Valve position indicators shall be furnished for buried butterfly valves. The valve indicator shall be water-tight for installation inside a cast-iron valve box and shall show valve-disc position, direction of rotation, and number of turns from full-open to full-close. All working parts must be constructed of non-metallic and indestructible materials with a clear see-through cover.

H. ***2-Inch and Smaller Valves*:** Buried valves 2" and smaller valves for private water services shall meet the applicable requirements of AWWA C800, ASTM B-62 for 85-5-5-5 composition bronze, and USAS B2.1. Valves shall be Mueller H-10283N or equal.

2402.3 VALVE BOXES

Valve boxes for butterfly valves and gate valves shall be cast iron. Valve boxes shall be two piece or three piece type. Each two piece box shall be complete with bottom section, top section, and cover. Each three piece box shall be complete with base, center section, top section, and cover. Valve boxes shall be extension type with slide or screw type adjustment. Each base and bottom section shall be the proper size for the valve served. Each valve box assembly shall be the proper length for the valve served. The minimum thickness of metal shall be 3/16". Cast the word "WATER" in each valve box cover.

2402.4 FIRE HYDRANTS

A. **General:** Fire hydrants shall be dry barrel, standard compression, two-piece standpipe, break-away design conforming to AWWA C502 and shall comply with the following:

1. Two 2½" hose nozzles and one 4½" steamer nozzle, 5¼" minimum mechanical valve opening left and a 6" inlet connection.

2. Hydrants shall be equipped with two drainholes and provided with an automatic and positively operating noncorrodible drain or dip valve so as to drain the hydrant completely when the main valve is shut.

3. Harnessing lugs shall be furnished with the hydrants.

4. Hydrant models permitted are Mueller A423, American Darling B62B or B84B, Clow Valve Medallion, and East Jordan Model 5CD250.

5. Hydrants shall be painted red.

6. Nuts and bolts for hydrants shall be 304 Stainless Steel. Nuts shall be hexagon nuts and Teflon coated. Bolts shall be tee head bolts. Nuts and bolts shall meet the requirements of ANSI A21.11/AWWA C111. The fire hydrant shoe shall be fusion-bonded epoxy coated and lined which meets AWWA C550.

B. **Nut Dimensions:** Operating stem and nozzle cap nuts shall be 1½" point to flat pentagon.

C. **Nozzle Threads and Caps:** Hydrant nozzles shall meet NFPA standard thread requirements. All nozzle caps shall be equipped with chains attached to the hydrants and shall be furnished with long life rubber gaskets meeting rubber products in automotive application, ASTM D2000 requirements.

D. **Bury Depth:** The bury length of hydrant barrel shall be 4' finish grade to the invert of the connecting pipe. Extensions may be used to accommodate pipes at greater depths.

2402.5 VALVE VAULTS

A. Air release, meter, and pressure-reducing valve vaults shall be precast concrete conforming to ASTM C478. Access lid castings shall be as shown on the Standard Drawings.

B. Vaults which, by their special nature, must be cast in place shall conform to the plans and specifications in Section 2201.

2402.6 TRENCHING MATERIAL

A. The trench design for pipe shall be in accordance with these specifications and Norman's Standard Construction Drawings, unless approved by the Utilities

Engineer.

1. *Bedding* – The bedding shall be at least 4 inches thick immediately below the pipe. If trench is dry, bedding shall be 4 inches of sand. If wet, material shall be 4 inches of coarse aggregate No. 57 or 67 per ODOT 701.06.

2. *Haunching* - The Haunching layer shall extend from the bedding layer to 50% of the diameter of the pipe, or the spring line. The material shall be sand.

3. *Initial Backfill* – The Initial Backfill layer shall extend from the Haunching Layer to 12 inches above the top of the pipe. The material shall be sand.

4. *Select Backfill* – The Select Backfill layer shall extend to 12 inches above the Initial Backfill. In non-paved areas, the material shall consist of Select Fill. In areas under existing or proposed paved areas, the material shall be Standard Backfill Material.

5. *Final Backfill* – The Final Backfill layer shall extend from the Select Backfill layer to the final grade.

B. **Standard Backfill Material** – Material shall conform to Coarse Aggregate Type A per ODOT 703.01 or recycled concrete meeting the same gradation requirements.

C. **Sand** – Material shall conform to Class C Bedding Material per ODOT 703.06 B(2) Filter Sand or ODOT Table 703.11.

D. **Coarse Aggregate** – Material shall conform to No. 57 or 67 per ODOT 701.06.

E. **Select Fill** – Material shall consist of excavated materials screened to contain no rocks larger than 2-inches.

F. **Flowable Fill** (Controlled Low-Strength Material or CLSM) – Material shall be in accordance with ODOT 701.19 with at least 20lb/yd^3 of Portland cement in the mix design.

2402.7 CONCRETE

Cast-in-Place concrete used for thrust blocks, encasements, and structures shall conform to the requirements of Section 2201.

2402.8 CONDUIT PIPE

Conduit (casing) pipe shall be used where required at railroad or highway crossings or as specified on the plans. The conduit pipe shall be in accordance with Section 2202 and meet the requirements of the railroad or highway authority with regard to type of material, wall thickness, and coating. No conduit will be installed without the approval of the involved highway or railroad authority.

2402.9 TRACER WIRE AND WEATHERHEAD

A. Tracer wire shall be #12 AWG solid copper wire with 30 mil HDPE coating; DurAtrace \DT-B3021-(500), or approved equal. For directional drilling installation, the contractor hall use #8 Copper Head Solo Shot Extra-High Strength Tracer Wire or approved equal.

B. All underground splices shall include waterproof connectors; Dryconn #22 - #6 AWG Direct Bury Silicon Filled Tub w/Strain Relief (DBSR) or approved equal, with silicon sealant.

C. Contractor shall test installed tracer wire to demonstrate the integrity of the installation to allow for future used of the system for maintenance staff to locate the line. Contractor shall use 512 Hs (or similar) line locating equipment for testing.

D. Contractor shall place all weatherheads at valve boxes, fire hydrants, meters, and blow off valves.

E. Tracer system shall be properly grounded utilizing a magnesium anode per manufacturer's requirements.

2403 CONSTRUCTION DETAILS

2403.1 GRADING AND EXCAVATION

A. **Scope:** Excavation and trenching work 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; and other appurtenant work.

B. General:

1. Excavation and trenching work shall be performed in a safe and proper manner according to OSHA regulations and suitable precautions being taken against all hazards.

2. The Contractor shall explore and expose any and all obstructions in advance of excavation so that minor changes in grade and alignment may be made.

3. In paralleling present water and gas mains, the Contractor shall protect all service connections and shall arrange to furnish service to the consumers without interruption. When necessary, Contractor shall notify customers at least 48 hours advance of any anticipated interruption. All outages must be coordinated and approved by the Utilities Engineer.

4. All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions made for street drainage.

C. **Classification of Excavated Material:** 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.

D. **Blasting:** Blasting is not permitted.

E. **Unauthorized Excavation:** Any part of the trench excavated below grade shall be corrected with material accepted by the Engineer, placed and compacted by the Contractor.

F. Removal of Water:

1. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and groundwater 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.

2. All excavations for concrete structures or trenches which extend down to or below static groundwater elevations shall be dewatered by lowering and maintaining the groundwater surface beneath such excavations a distance of not less than 12" below the bottom of the excavation.

3. 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.

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

5. All dewatering shall be incidental to other items of work and shall be provided at no cost to the City.

G. **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, or shored per OSHA requirements as necessary to prevent caving or sliding, to provide protection for workmen and the work, and to provide protection for existing structures and facilities. Sheeting, 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.

H. **Stabilization:** 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. 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 stone or gravel. Not more than ½" depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon.

I. Trench Excavation:

1. The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. One block, or 300', whichever is shorter, shall be the maximum length of open trench ahead of pipe laying unless by written permission of the Engineer. Contractor shall not have open trench od more than 100’ behind pipe laying or one block, whichever is less. Paving and surface restoration shall commence a maximum of one month after initial trenching activities begin.

2. Except where tunneling or boring and jacking is specified and shown on the plans by the Engineer, all trench excavations shall be open cut.

3. Stones found in the trench shall be removed for a depth of a least 6” below the bottom of the pipe.

J. **Alignment and Grade:** The alignment and grade or elevation of the pipeline shall be as shown on the plans. The Contractor must maintain a constant check on the pipe alignment and trench depth and will be held responsible for any deviations therefrom.

K. Minimum Cover:

1. Except where otherwise shown, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover of 30” over the top of the pipe or with sufficient insulation to prevent freezing. Greater pipe cover depths may be necessary on existing pipe, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades.

2. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finish grade or pavement surface elevations.

L. **Unauthorized Trench Widths:** When, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted in the Standard Details, 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 Contractor's expense.

M. **Trench Bottom in Earth:** The trench in earth shall have a flat bottom the full width of the trench and shall be excavated to the grade to which the pipe is to be laid. The surface shall be graded to provide a uniform bearing and continuous support for each pipe at every point along its entire length. Pipe shall not be laid on trench bottom unless otherwise indicated by the Engineer.

N. **Bedding:** The Contractor shall use granular material (Class I or Class II bedding) in the trench bottom which shall be spread and the surface graded to provide a uniform bearing with continuous support along each section of pipe.

O. Rock Exploration:

1. Unless shown otherwise shown on the plans or noted in the Special Conditions, no rock exploration has been made. On those projects where rock exploration has been made, test holes have been drilled at locations and intervals as shown on the plans or subsurface information report to determine the approximate location and depth of rock. Resistance to penetration was assumed to be "solid rock."

2. This information is furnished for general reference purposes only. The Contractor must form his own opinion as to the character of materials which will be encountered from an inspection in the ground, from his own investigation of the test hole information, or from such other investigations of the test hole information, or from such other investigations as he may desire.

P. **Trench Bottoms in Rock:** All rock excavation shall be carried to a minimum of 4" below the bottom of the pipe. Standard bedding material shall be used to restore the trench bottom to the desired elevation and grade and to provide a uniform bearing and continuous support for the pipe along its entire length. Care shall be exercised to prevent any portion of the pipe from coming to bear on solid rock or boulders.

Q. Mechanical Excavation:

1. The use of mechanical equipment will not be permitted in locations where its operations 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.

2. Mechanical equipment used for trench excavation shall be of the 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 sidewalls are obtained at least from the bottom of the trench, and that trench alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

3. All mechanical trenching equipment, its operating conditions, and the manner of its operations shall be subject at all times to the approval of the Engineer.

R. **Stream Crossings:** Stream crossings shall be made in accordance with these specifications and as shown on the plans. The trench width shall be as required for proper pipe installation and the trench depth shall be as required to give minimum cover shown on the plans. Pipe encasement, where required, shall be in accordance with the specifications and placed as indicated on the plans. The construction of grouted riprap for erosion prevention of ditch slopes will be required at locations shown or designated on the plans.

1. *Above water crossings*: The pipe shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement in accordance with OAC specifications.

2. *Underwater Crossings:* A minimum cover of 4' shall be provided over the pipe. The restraint length shall begin and end at least 10-feet horizontally from the top of the creek bank or the next pipe joint, whichever is greater. When crossing water courses which are greater than 15' in width, the following shall be provided:
   - The pipe shall be of special construction, having flexible watertight joints.
   - 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 not subject flooding; and the valve closest to the supply source shall be a manhole.

S. Highway and Railroad Crossings:

1. The Contractor shall make highway and railroad crossing in accordance with these specifications, the Special Conditions, and as shown on the plans.

2. All construction or work performed and all operations of the Contractor, his employees, or his subcontractors within the limits of highway or railroad right-of-ways shall be in conformity with all the requirements and regulations, and be under the control (through the Engineer) of the authority owning or having jurisdiction over and control of the right-of-way.

2403.2 PIPE INSTALLATION

A. General:

1. Laying of pipe; installation of valves and hydrants; and embedment and backfill shall conform to the following specifications and the details as shown on the plans.

2. Whenever pipe laying is stopped, the open end of the line shall be sealed

with a watertight plug which will prevent trench water from entering the pipe.

3. Where the pipe is to be installed inside a conduit (casing) pipe, casing insulators or spacers shall be specifically designed to adequately support and electrically isolate the carrier pipe withing the casing pipe under all conditions. Insulators or spacers shall consist of pre-manufactured stainless steel bands with plastic lining and plastic runners. Insulators shall fit snug over the carrier pipe and position the carrier pipe approximately in the center of the casing pipe, to provide adequate clearance between the carrier pipe bell and the casing pipe. Fasteners for insulators shall be stainless steel or cadmium plated. The number and location of casing insulators or spacers shall be determined by the manufacturer to protect carrier pipe from damage.

4. The Contractor must make every effort to prevent entry of foreign matter into the pipeline during construction.

5. A solid clay dam (trench plug) is required every 400 feet along water line, per the Standard Detail.

B. Polyvinyl Chloride (PVC) Pipe:

1. *Handling:* Pipe, fittings, and other accessories shall at all times be handled with care to avoid damage. Under no circumstances shall they be dropped. Pipe fittings shall be handled as specified for ductile-iron pipe. Any damaged pipe shall be rejected.

2. *Cutting Pipe:* All pipe shall be cut with a saw or special cutting tool. 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 and beveled. Beveling shall be done with a specifically designed beveling tool. Hand beveling will not be allowed. When cutting pipe with couplings, mark the field cut pipe end the same distance in as the mark appeared on the original full-length pipe section.

3. *Cleaning:* The interior of all pipe and fittings shall be thoroughly cleaned of foreign matter before being installed and shall be kept clean until the work has been accepted.

4. *Pipe Laying:* PVC pipe shall be installed in strict accordance with the requirements and instructions of the pipe manufacturer. It shall be protected from lateral displacement and deflection by pipe embedment material installed as specified for pipe embedment and as shown on the Standard Drawings. No pipe shall be laid under unsuitable trench conditions. Pipe shall be joined in the ditch. Whenever pipe laying is stopped, the open end of the line shall be sealed with a watertight plug which will prevent trench water from entering the pipe.

5. *Tracer Wire:* Install tracer wire and weatherhead on PVC pipe in accordance with City's Standard Details.

C. Ductile Iron Pipe:

1. *Handling:* Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in a sound, undamaged condition. Equipment,

tools, and methods used in unloading, reloading, hauling, and laying pipe and fittings shall be such that the pipe, pipe coatings, and fittings are not damaged. Hooks shall not be used. Under no circumstances shall pipe or accessories be dropped or dumped. Pipe on which the cement lining has been broken or loosened shall be replaced by the Contractor.

2. *Cutting Pipe:* Ductile iron pipe shall be cut with either a saw or an abrasive wheel. Cutting of existing cast iron pipe shall be done with either a saw or abrasive wheel, or when there is a free end, with mechanical pipe cutters. The cutting of pipe with a torch will not be permitted. Cutting shall be done in a neat manner without damage to the pipe, or the cement lining. 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.

3. *Cleaning:* The interior of all pipe and fittings shall be thoroughly cleaned of foreign matter before being installed and shall be kept clean until the work has been accepted. Such surfaces shall be wire brushed, if necessary, wiped clean, and kept clean until jointing is completed.

4. *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, damaged, or unsound pipe and fittings shall be rejected and marked as such and removed from the site of the work.

5. *Alignment of Bell-and-Spigot Pipe:* Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the 50% of allowed joint deflection as indicated in ANSI/AWWA C600.

6. *Pipe Laying:* Pipe shall be protected from lateral displacement by pipe embedment material installed as specified. Under no circumstances shall the pipe be laid in water, and no pipe shall be laid under unsuitable trench conditions. Pipe shall be joined in the ditch. Whenever pipe laying is stopped, the open end of the line shall be sealed with a watertight plug which will prevent trench water from entering the pipe.

2403.3 JOINTING

A. Push-on Joints:

1. The gasket seat in the bell shall be wiped clean after which the gasket shall be placed. A thick film of lubricant shall be applied to all of the inner surface of the gasket and on the spigot end of the pipe. The lubricant and the gaskets shall be as recommended and supplied by the manufacturer of the pipe being used. The lubricant shall be odorless, tasteless, nontoxic, and suitable for use in potable water.

2. Field-cut pipe shall be bevel filed to remove any sharp or rough edges which might otherwise damage the gasket.

B. **Mechanical Joints:** The mechanical joint shall be used only when shown on the plans.

C. **Flanged Joints:** When bolting flanged joints, care shall be taken to ensure 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.

D. **Restrained Joints:** Restrained joints and anchoring joints shall be installed in strict accordance with the pipe manufacturer's recommendations.

2403.4 CONNECTION TO EXISTING MAINS

A. The Contractor shall furnish and install all fittings necessary to join the existing and new water mains as shown on the plans and/or call for in the Proposal. Service connections will not be allowed to any mains larger than 12" unless approved by the Utilities Engineer.

B. The City shall be given at least 24 hours notice prior to turning off any water supply mains. The Contractor shall coordinate tie-ins with the City to minimize down time. Fire hydrants that are temporarily out of service must be either bagged and labeled to indicate they are not in use. In addition, the Contractor shall hang door knockers in the work area to advise citizens of work to be performed.

2403.5 POLYETHYLENE ENCASEMENT

A. **General:** Polyethylene encasement shall be installed on ductile iron pipe and fittings when indicated on the plans and/or called for in the Proposal.

B. **Installation:** The polyethylene encasement shall be installed as specified in "Method A" or "Method B" below.

1. *Method A:* Polyethylene tubing shall be approximately 24" longer than the length of the pipe section to provide a 12" overlap on each adjacent pipe section. Tube ends shall be taped in place.

2. *Method B:* Polyethylene tubing shall be 12" shorter than the length of the pipe section with a 36" length of polyethylene tube centered over pipe joint and lapped over pipe section and its tubing. Tube ends shall be taped in place.

3. *Repairs:* Any rips, punctures, or other damages to the polyethylene shall be repaired with adhesive tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured with adhesive tape.

2403.6 SETTING VALVES, FITTINGS, AND HYDRANTS

A. Valves and Fittings:

1. All valves, fittings, plugs, and caps shall be set and joined to the pipe in the manner heretofore specified for cleaning, laying, and joining pipe, except that large valves may require special support so that the pipe will not be required to support the valve weight.

2. Each valve shall be inspected before installation to ensure that all foreign substances have been removed from within the valve body, and shall be opened and closed to see that all parts are in first-class working condition. Gate valves shall be set vertical in the horizontal pipeline. Valves and pipe shall be supported in such as a manner as to prevent stress in either with no deflection in the valve/pipe joint.

3. Valve boxes and lids shall be installed at each valve and shall be supported and maintained centered and plumb over the operating nut of the valve. The valve box shaft shall not transmit shock or stress to the valve. Install valve box covers flush with the surface of the finished area.

4. All bends and tees shall be provided with thrust blocks of plain concrete, as specified. All dead ends on new mains shall be closed with plugs or caps suitably restrained to prevent blowing off under test pressure.

B. Hydrants:

1. All new hydrant installations shall be as shown on the plans or Standard Drawings and shall include all necessary excavation and backfill to make the installation complete.

2. Each hydrant shall be inspected before installation for direction of opening, nozzle size and threading, nozzle caps and chains, operating nut, and cap nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow and weep hole openings, and handling damage and cracks. Defective hydrants shall be corrected or replaced.

3. All hydrants shall stand plumb. The weep holes of the hydrant shall be kept clear and free to drain. The areas around each hydrant and hydrant valve shall be thoroughly compacted to prevent settlement of these areas. Weep holes shall be surrounded by $1^1/_2$" washed rock as shown on Standard Drawing W 09.

4. Hydrants shall be set to a grade that allows their proper operation. Traffic hydrants with breakaway joint must be set with the joint above the ground line. Hydrants behind curbs shall be placed with the hydrant centerline at least 3' from the back of curb of fire lanes and streets. Hydrants shall be rotated so as to have the pumper nozzle facing the street or rotated to face any direction as required by the Engineer.

2403.7 THRUST RESTRAINT

A. **Hydrants:** Restrained joints shall be utilized with a valve and hydrant tee as shown on the Standard Drawings. Concrete thrust blocking is not required, unless anchored couplings cannot be used.

B. **Fittings:** All plugs, caps, tees, bends, and other fittings, unless otherwise specified, shall be provided with reaction blocking or suitably restrained joints as shown on the plans or Standard Drawings.

C. **Thrust Blocks:** Vertical and horizontal reaction blocking shall be 2500 psi concrete as specified herein. Thrust blocks shall be installed between solid ground and the fitting to be restrained. Concrete shall be located to contain the resultant thrust force and permit access to pipe and fitting joints for repairs.

D. **Restrained Joints:** Restrained push-on or mechanical joints, mechanical joint anchoring fittings (Megalug) or approved equal and mechanical joints utilizing set screw ductile iron retainer glands may be used in lieu of concrete thrust blocking if so indicated on the plans or accepted by the Engineer. Megalug or approved equal restrained joints shall be used on all sizes which are available and shall be fusion bonded epoxy in accordance with AWWA C116.

E. All thread, when used in thrust restraint, shall be stainless steel conforming to ASTM F-593-95.

2403.8 EMBEDMENT AND BACKFILLING

A. **Pipe Embedment:** Embedment for pipe shall be in accordance with these specifications and details of the laying condition as indicated on the plans or Standard Drawing W01.

B. **Trench Fill:** Backfill for the entire length of the pipeline shall be compacted full depth of the trench above the embedment.

1. Compacted backfill shall be finely divided job-excavated material free from debris, organic material, frozen materials, and stones larger than 6" in greatest dimension. Masses of moist, stiff clay shall not be used.

2. Whenever, in the opinion of the Engineer, the material excavated from the trenches is not suitable for backfilling, or there is a deficiency of material suitable for backfilling, the Contractor shall provide suitable material. The Contractor shall remove all excess excavated materials and shall dispose of them at locations provided by the Contractor.

3. At the option of the Contractor, compacted backfill may be either job-excavated material or standard bedding material.

4. Backfill in streets and driveways shall be accomplished entirely with granular bedding or flowable fill as shown on the Standard Drawings.

C. Placement and Compaction:

- Job-excavated materials shall be placed in uniform layers not exceeding 8" in uncompacted thickness. Increased layer thickness may be permitted for noncohesive material if the Contractor demonstrates to the satisfaction of the Engineer that the specified compacted density will be obtained. The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.
- Granular bedding used for backfill shall be placed in uniform layers not exceeding 6" and compacted by slicing with a shovel or vibrating.
- Compaction of trench backfill shall be the following percent of maximum density at optimum moisture content as determined by the Standard Proctor Test, ASTM D698:

Area	Cohesive Materials	Cohesionless Materials
Non-paved	85%	90%
Paved	Not Allowed (Refer to Standard Drawings)	95%

D. Backfill failing to meet required densities shall be removed or scarified and recompacted as necessary to achieve specified results.

E. Special backfilling will be allowed in new residential subdivisions or other development approved by the City Engineer. If trench settlement occurs within the maintenance bond period, the contractor shall fill and compact the settlement area, and repair property damaged by the settlement to the satisfaction of the City Engineer.

F. Warning tape shall be installed above all new and rehabilitated underground piping after placement of select backfill as detailed on Standard Drawing W-01.

The tape shall be installed approximately 24 inches above the top of pipe. The tape shall be 2 to 3 inches wide and made of materials not subject to decay or breakdown in the environment where it is installed. Tape shall be colored "blue" for water lines and shall be permanently marked "**CAUTION: BURIED WATER LINE BELOW**".

2403.9 DISINFECTION AND TESTING

The Contractor shall cause all new waterlines and appurtenances to be flushed, pressure tested, and disinfected with safe bacteriological samples obtained prior to placing the improvements into service. The order of completion for initial flushing and disinfection may vary dependent upon the disinfection methodology chosen.

A. **Initial Flushing:** After installation, the Contractor shall flush the constructed improvements by obtaining a water velocity of a least 3.0 ft/sec. Flushing shall be carried out long enough to remove a minimum of 2.5 times the volume of the pipeline being flushed, or longer as necessary to obtain turbidity-free water from all discharge points along the main. The following table specifies the minimum blow-off diameter for typical water line sizes. For water lines sizes not included in the table, the Contractor is to provide the calculations demonstrating that the minimum velocity is achieved.
Water line blow-off minimum flushing diameter, see table below.

Pipe Diameter	Minimum Blow-Off Diameter
8-inch or smaller	FH unless approved by Engineer
12-inch	FH unless approved by Engineer
16-inch and larger	16-inch open ended pipe

B. **Subsequent Flushing:** If the water line needs to be flushed more than once, the contractor shall be charged for the cost of the water, labor and additional testing used after the first flushing. The City will calculate said cost, which shall be paid before the project is accepted by the city. Costs will be based on current water rates. This applies to capital projects and subdivision development water lines.

C. Disinfection:

1. The Contractor must make every effort to prevent entry of foreign matter into the pipeline during construction.

2. The Contractor shall disinfect the constructed improvements in a manner acceptable to the City and in conformance with the requirements of the ODEQ and AWWA C651. The improvements may be disinfected by introducing a chlorine solution into the water line after initial flushing or by placing granular calcium hypochlorite (intended for use in water pipes only) into the water line as it is constructed. The new water line shall be disinfected by using a concentration of free chlorine not be less than 50 mg/l nor more than 100 mg/l.

3. The following table provides the approximate amount of granular calcium hypochlorite (typically 65% free chlorine) needed to produce a concentration of 50 mg/l per 100 feet for common diameters of water line. The Contractor must comply with the requirements of initial flushing after disinfection of the water line.

Approx. Granular Calcium Hypochlorite Required to Produce
50 mg/l Concentration in 100' of Pipe

Pipe Diameter (inches)	100 % Chlorine (pounds)	65% Chlorine (pounds)
4	0.027	0.042
6	0.061	0.094
8	0.108	0.168
12	0.240	0.377
16	0.436	0.670
24	0.875	1.507

(adapted from Table 6-6, Handbook of Chlorination, Clifford White, 1999)

4. When the Contractor chooses to disinfect by introducing a sodium hypochlorite solution into the water line, the solution shall be fed after initial flushing at a constant rate until the entire water line is filled with highly chlorinated water. The following table provides the approximate amount of 1% chlorine solution needed to produce a concentration of 50 mg/l per 100 feet for common diameters of water line.

Approximate Sodium Hypochlorite Solution Required to Produce
50 mg/l Concentration in 100' of Pipe

Pipe Diameter (inches)	One Percent Chlorine Solution (Gallons)
4	0.33
6	0.73
8	1.30
12	2.93
16	5.22
24	11.75

(adapted from Table 6-6, Handbook of Chlorination, Clifford White, 1999)

5. The highly chlorinated water shall be retained in the water line and appurtenances for at least 24 hours. All valves, hydrants and other appurtenances in the section treated shall be operated in order to disinfect the appurtenances.

6. The Contractor will provide suitable locations for bacteriological sampling. The City will collect water samples after the initial 24 hour disinfection period on two (2) consecutive days and have the samples tested by ODEQ or other ODEQ certified laboratory.

7. At the end of the disinfection periods, the treated water in all portions of the waterline shall have a residual of not less than 10 mg/l free chlorine. A residual of less than 10 mg/l shall cause the disinfection procedure to be repeated for that section of line.

8. Water line and appurtenances shall be flushed of all highly chlorinated water prior to placing in service. The highly chlorinated water shall be dechlorinated or disposed of by the Contractor in accordance with applicable Federal or State regulations without damage to public or private property.

9. The disinfection procedure shall be repeated should the initial treatment fail to yield satisfactory results.

D. Hydrostatic Testing:

1. The Contractor will complete the hydrostatic pressure and leakage testing. In the event of a test failure, the Contractor is responsible to locate and make any and all repairs to the water line improvements to achieve an acceptable test result.

2. Preparation: The distribution line may be tested without the taps installed. Prior to starting the test, the Contractor will flush the line of all dirt and debris. The Contractor will also evacuate all air from the water line. This will be coordinated with the Project Inspector and the Line Maintenance Division of the Utilities Department. Potable water to perform hydrostatic testing will be made available by the City at no charge to Contractor. All other water for construction shall be the responsibility of the Contractor.

3. The City, with Contractor assistance, shall perform hydrostatic pressure and leakage tests in accordance with AWWA C600 procedures. Where practicable, mains shall be tested in lengths between line valves or plugs of no more than 1,500 feet in length unless approved by the Utilities Engineer.

4. Conduct test at a pressure of 150 psi measured at the highest point of the water line. Duration of the test shall be not less than two hours. Maintain test pressure ± 5 psi throughout the duration of the test.

5. All visible leaks at exposed joints and all leaks evident on the shall be repaired by the Contractor regardless of leakage test results. All pipe, fittings, valves, and other appurtenances found to be defective shall be removed and replaced at the Contractor's expense.

6. Water lines which fail to meet test requirements shall be repaired until the test requirements are met.

E. Inspection Requirements: The Contractor is responsible to ensure the Project Inspector is on site to observe and document all required testing.

2403.10 SURFACE RESTORATION

A. **Seeding and Sodding:** If noted on drawings, all unpaved areas disturbed or damaged during the work shall be sodded by the Contractor, in accordance with Section 2104. Seeding may be allowed as approved by the Engineer.

B. **Sidewalks and Driveways:** All paved sidewalk and driveway areas damaged during the work shall be replaced by the Contractor. Repairs shall conform to the lines and grades of the original pavement and shall be equal to, or better than, the quality, thickness, and appearance of that removed. Sidewalk and driveway replacement shall conform to the requirements of Section 2205.

C. **Streets and Curbing:** All paved street, shoulder, and curbing areas cut by the line of trench or excavation or damaged during the work shall be replaced by the Contractor. Repairs shall conform to the lines and grades of the original pavement and shall be equal to or better than, the quality, thickness, and appearance of that removed. Paving and curb replacement shall conform to the requirements of Section 2205.

2403.11 FIRE LINES

A. Water lines providing fire protection or fire suppression capabilities shall be constructed in accordance with the requirements of Section 2400 and applicable sections of National Fire Protection Association (NFPA). Where these requirements are contradictory, the more restrictive requirement will apply.

B. All water lines to be dedicated to the City shall be installed in a dedicated right-of-way or utility easement. Utility easements for water lines shall have a minimum width of 15 feet and will be granted by the property owner, accepted by the City of Norman and filed at the county court house prior to acceptance of the work.

C. The diameter of the water line shall be determined by the design engineer and shall accommodate the proposed project needs as well as existing fire protection needs in the area where the connection is made. Dedicated fire lines shall be at least 6 inches in diameter unless otherwise approved by the City. Fire flows shall not cause the line pressure in the surrounding area to be less than 25 psi. If determined necessary by the Engineer, the developer shall install any additional off-site improvements to ensure a minimum pressure of 25 psi is maintained during fire flows.

D. A check valve and appurtenances with valve vault, in accordance with the Fire Line Standard Drawing, shall be installed in close proximity to the point where the fire line connects to the domestic water system. The vault will be oriented outside of the right-of-way or any utility easements. Representatives of Line Maintenance and the Fire Department must approve, in writing, drawings showing the layout and location of all fire line vaults prior to construction. For dead end fire line connections and privately owned looped fire lines the Contractor shall provide vaults, valves, and piping in accordance with the City's Standard Details.

E. Fire lines shall not be tapped for domestic or irrigation water use after the check valve.

2404 WATER MAINS NEAR SEWERS

2404.1 HORIZONTAL SEPARATION

A. Water mains shall be located at least 10 feet horizontally from any existing or proposed sewer lines, storm sewers, raw water lines, oil and gas lines, and buried electric lines. In cases where it is not practical to maintain a 10 foot separation, the ODEQ 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 line closer to a sewer line, provided that the water main is in a separate trench.

B. PVC water lines shall be located at least 50 feet horizontally from any gasoline storage tank. Wherever a 50 foot separation cannot be maintained for water lines, ductile iron pipe must be used for the water line but in no case shall be closer than 10 feet to the storage tank. The distance shall be measured edge to edge.

C. Water lines shall be located at least 50 feet from all parts of septic tanks and adsorption fields, or other sewage treatment and disposal systems. In cases where the 50 foot separation cannot be maintained, written approval from the Utilities Engineer shall be obtained. A minimum of the 15 feet shall be always maintained. ODEQ may allow deviation on a case-by-case basis.

2404.2 CROSSINGS

Sewers crossing water lines shall be laid to provide a minimum vertical distance of 24 inches between the outside of the water main and the outside of the sewer. This shall be the case where the water main is

either above or below the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far away as possible from the water main joints. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer to prevent damage to the water main and so sewer line joint shall be less than 9 feet from water lines.

2404.3 SPECIAL CONDITIONS

When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the sewer shall be designed and constructed equal to water pipe and shall be pressure tested to assure water tightness prior to backfilling. The sewer shall be designed and constructed in accordance with ODEQ 252:656.

2404.5 SEWER MANHOLES

No water line shall pass through, or come in contact with, any part of a sewer or a sewer manhole.

2405 MEASUREMENT AND PAYMENT

2405.1 SCOPE

This section covers the methods of measurements, and the basis of payment, for the furnishing of all labor, equipment, tools, and materials and for the performance of all related work necessary to complete any construction covered in Section 2400.

2405.2 GENERAL

Unless specifically altered by the Special Conditions, the methods of measurement and payment will be as specified herein, and as listed in the Proposal (Bid Schedule).

2405.3 ITEMS NOT LISTED IN THE PROPOSAL

There will be no measurement or separate payment for any items of work not specifically identified and listed in the Proposal and all costs pertaining thereto will be included in the Contract Unit Prices for other items listed in the proposal.

2405.4 MEASUREMENT AND PAYMENT

The quantities of accepted work will be measured and paid for on a unit price basis determined as follows:

A. **Pipe:** Payment shall be made at the unit price bid per linear foot of pipe of the size and type specified in the Proposal and placed as shown on the drawings. Total footage shall be the actual measurement along the centerline of the pipe. No additional payment shall be made for trench excavation, backfilling, including embedment and backfill material as specified, right-of-way clearing and restoring, polyethylene wrap if called out by the Engineer, vertical pipe or for fittings or specials included as pipe for concrete blocking or thrust restraint.

B. **Fittings:** Payment shall be made at the unit price bid per fitting type specified in the Proposal, installed in accordance with the plans, and shall include cost of concrete thrust blocking.

C. **Conduit (casing):** Measurement will be made in linear feet for the applicable size and type of conduit, bored or trenched, as called for in the Proposal and/or as shown on the plans, based on actual field-measured lengths of acceptably installed conduit (casing), including insulation spray foam, carrier pipe, thrust restraint system, spacers, vent piping, and other subsidiary items per Norman Standard Construction Drawings.

D. **Valves:** Payment for valves shall be made at the unit price bid per valve, of the type specified on the Proposal, and placed as shown on the Drawings. The unit price bid for air relief, blow off, and check valves shall include the valve vault. No additional payment shall be made for: excavation, backfilling, concrete

blocking, crushed rock for drains, valve boxes, or air relief valve piping in vaults.

E. **Fire Hydrants:** Payment for fire hydrants and stem extensions of the types specified in the Bid Schedule shall be made at the unit price bid per hydrant and per each different length of extension used. No additional payment shall be made for the pipe length between the existing water line and the fire hydrant except where the pipe is shown on the Drawings in separate profile, valves included in fire hydrant assemble, tee for assembly, backfill or thrust restraint.

F. **Tapping Sleeve and Valve:** Payment for tapping sleeve and valve shall be made at the unit price per tapping sleeve and valve, of the type and size specified on the Proposal, and placed as shown on the Drawings. The cost of pipe, valve, fittings, closure pieces, hardware, thrust restraint, and all other incidentals necessary for a complete and workable installation are included in this pay item.

G. **Wet Connection:** Payment for a wet connection shall be made at the unit price per wet connection. The cost of the pipe, fittings, closure pieces, hardware, thrust restraint, and all other incidental items necessary for a complete and workable installation are included in this pay item.

H. **Short Service:** Payment for a short service shall be made at the unit price per service connection. Short service is defined as a service line that does not cross a roadway between the main and the meter connection. The cost of furnishing all materials, labor, equipment, tools, and all other incidentals necessary for a complete and workable installation are included in this pay item.

I. **Long Service:** Payment for a short service shall be made at the unit price per service connection. Long service is defined as a service line that crosses a roadway between the main and the meter connection. The cost of furnishing all materials, labor, equipment, tools, and all other incidentals necessary for a complete and workable installation are included in this pay item.

J. **Specials (Vaults, Special Structures, etc)**: Measurement for these type items will be made based on the actual number of units installed, as called for on the plans and as identified in the Proposal.

END OF SECTION 2400

SECTION 2500 SANITARY SEWERS

SECTION 2500 SANITARY SEWERS

2501 GENERAL REQUIREMENTS

2501.1 SCOPE

This specification is to govern all work, materials, and testing for the installation of gravity sanitary sewers and pressure pipelines and related items complete, including manholes, junction chambers, diversion chambers, services, and miscellaneous concrete structures.

2501.2 ABBREVIATIONS

Wherever the words, forms, or phrases herein defined or pronouns used in their stead occur in these specifications, in the contract or in the Advertisement of any document or instrument herein contemplated or to which these specifications apply, the intent and mean shall be interpreted as defined in Sections 1008 and 1009.

2501.3 CODES, SPECIFICATIONS, AND STANDARDS

Codes, specifications, and standards referred to by title or number shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply in all cases. Specific reference standards include:

A. Title 252. Oklahoma Administrative Code, Chapter 656, Water Pollution Control Facility Construction Standards, ODEQ

B. Wastewater Collection Systems Management, MOP 7, WEF

C. Code of Ordinances, City of Norman

2501.4 SUBMITTALS

Before construction and preferably before fabrication, the Contractor shall submit to the Design Engineer for review calculations on the thickness or strength class and drawings showing pipe lengths, joints, and other construction and installation details. All pipe, fittings, coatings, materials, and structures furnished under this Contract shall be fabricated only in accordance with the drawings and these specifications.

2501.5 QUALITY ASSURANCE

A. **Performance Tests:** The Contractor shall test all gravity sewers constructed under the Contract. The Contractor shall constantly check horizontal and vertical alignment. Testing for vertical deflection in the case of non-rigid pipe and sewer watertightness testing in the case of all gravity sewers and hydrostatic testing of pressure (force main) pipe shall be as specified in Section 1006. If one or more sections of the sanitary sewer as-built information reflect that the slope does not meet ODEQ standards for minimum grade, the pipe must be replaced, or a variance must be requested by Utilities Engineer and approved by ODEQ before the City of Norman will accept the improvements.

B. **Line and Grade Requirements:** The Contractor shall provide assurance to the Utilities Engineer that the sewer is laid accurately to the required line and grade as shown on the drawings. The Contractor shall utilize a laser beam instrument to lay and check the alignment and grade between manholes. Before proceeding with the next section of sewer, the last section shall be checked for proper line and grade. Variations from a uniform line and grade as shown on the drawings and described below shall be cause for the line to be rejected.

C. Over-sizing sanitary sewer lines for purpose of complying with minimum grade requirements is not allowed unless documentation of compliance with minimum velocity of 2 feet per second at design average daily flow for sewer segment in question is provided and approved by the Utilities Engineer.

2501.6 RELATION TO WATER MAIN

A. See Section 2404.1.A and 2402.1.C. Sewers must be located at least 10 feet horizontally from any existing or proposed water main. The distance is to be measured from wall to wall.

B. **Crossings:** See Section 2404.2

C. **Special Conditions:** See Section 2404.3. Should specific conditions prevent this separation, the Contractor shall notify both the Design Engineer and Utilities Engineer for specific instructions regarding the treatment of the separation. Special conditions may allow installation of the sewer closer to a water main, provided that the water main is in a separate trench. It may be necessary to install 150 psi pressure rated pipe and joints as gravity sewer pipe for the congested areas.

2502 PRODUCTS

2502.1 GRAVITY SEWERS 18 INCHES AND LARGER

A. Polyvinyl Chloride (PVC) Pipe

1. Polyvinyl chloride pipe shall be closed profile pipe and conform to ASTM F679 or ASTM F949 requirements for flattening, impact resistance, stiffness, joint tightness, and extrusion quality.

2. The pipe shall be made of PVC plastic having cell classification of 12454 or 12364.

3. Joints shall be the integral bell type gasketed joint designed so that when assembled, the elastomeric gasket inside the bell is compressed radially on the pipe spigot to form a positive seal. The joint shall be so designed to avoid displacement of the gasket when installed in accordance with manufacturer's recommendations.

4. Pipe entering a manhole shall have a manhole waterstop gasket as supplied by the manufacturer firmly clamped around the pipe at the manhole. If flexible entry type manhole system is used, the waterstop gasket is not required.

B. High Density Polyethylene Pipe (HDPE)

1. Solid wall High density polyethylene pipe (HDPE) shall meet the requirements of ASTM -F-714 and Ductile Iron Pipe Sizing (DIPS).

2. Solid wall High density polyethylene pipe (HDPE) may be used for slip-lining or pipe bursting installations only in sizes from 18 inches to 48 inches in diameter.

3. Pipe joints shall be by heating and butt-fusion method in strict conformance with the manufacturer’s printed instructions and be made by qualified personnel using proper jigs and tools per standard procedures outlined by the pipe manufacturer.

C. Fiberglass Gravity Pipe

1. Glass-Fiber-Reinforced Thermosetting-Resin Pipe shall be in accordance with ASTM D3262, D4161, and D3567. The minimum pipe stiffness is 46 psi (SN 46) in accordance with ASTM D2412.

2. Pipes must be Type 1, Liner 1 or 2, Grade 1 or 3 per ASTM D3262.

3. Coupling joints must meet the requirements of ASTM D4161.

4. The pipe shall be field connected with flush fiberglass sleeve couplings or flush bell-spigot joints that utilize elastomeric sealing gaskets made of EPDM rubber compound as the sole means to maintain water tightness. The joints must meet the performance requirements of ASTM D4161. Joints at tie-ins may utilize a fiberglass, gasket-sealed coupling.

5. The pipe interior surface must have a glass reinforced liner system or be manufactured using a resin with a minimum 50% elongation when tested in accordance with ASTM D638.

6. Determine the maximum allowable leakage or infiltration by the following formula:

   L=CxDxS/126,720

   Where L is the allowable leakage in gallons per hour; S is the length of pipe tested in feet; D is the nominal diameter of the pipe in inches; C is infiltration/exfiltration rate. Use 50 for C outside of 25-year floodplain, and 10 for C within 25-year floodplain.

7. The pipes shall be installed per the manufacturer's recommendations.

8. Approved manufacturers are Hobas USA or Thompson Pipe Group FRP.

2502.2 GRAVITY SEWERS 15 INCHES OR SMALLER:

A. Polyvinyl Chloride Pipe.

1. Polyvinyl chloride pipe shall conform to ASTM D3034 SDR 35 or better, Type PSM.

2. Joints on PVC sewer pipe shall be the integral bell type gasketed joint designed so that when assembled the elastomeric gasket inside the bell is compressed radially on the pipe spigot to form a positive seal. The joint shall be so designed to avoid displacement of the gasket when installed in accordance with manufacturer's recommendations. The joint shall comply with the physical requirements of ASTM D3212, and the gasket shall be the only element depended upon to make the joint flexible and watertight.

3. All PVC Pipe entering a manhole shall have a manhole waterstop gasket as supplied by the manufacturer firmly clamped around the pipe at the manhole. If flexible entry type manhole system is used, the waterstop gasket is not required.

2502.3 FITTINGS:

Fittings such as wyes, tees, and bends shall be made in such a manner as will provide strength and watertightness at least equal to the class of the adjacent main line pipe to which they are jointed and shall conform to all other requirements specified for pipe of corresponding class and internal diameter. Joints shall be of the same type as used on the adjoining pipe. Fittings for sewer taps shall be SDR 26 tees per

the latest revision of ASTM D3034 or Norman Standard Drawings. A stainless steel repair band with a minimum length of 12-inches shall be used for connections. No flexible couplings will be allowed.

2502.4 FORCE MAINS

A. Force mains shall be PVC meeting the requirements of AWWA C900, DR-25 (165 psi), unless otherwise required by the Design Engineer. All PVC force mains shall be colored green and have a tracer wire and warning tape per Norman Standard Drawings.

B. Contractor shall install a line marking post (supplied by the contractor) every 400 linear feet. Contractor shall install a tracer wire weatherhead (see Section 2502.4.E below) fastened to the line marking post or inside a manhole. Spacing to be approved by Utilities Engineer.

C. All fittings must be ductile iron and shall have factory applied fusion bonded epoxy coated (interior and exterior) which meets AWWA C116. The epoxy coating shall be installed per the coating manufacturers specifications. A Certificate of Compliance shall be required from the coating manufacturer stating that the coating meets all requirements mentioned herein. Holiday testing shall be required per ASTM G 62. The epoxy coating and the factory that applies the coating shall be approved by the Utilities Engineer.

D. Valves

1. ***Eccentric Type Plug Valves***: Plug valves shall be nonlubricated eccentric type with resilient faced plugs having mechanical joint or flanged ends.

2. Port areas of valves shall be 100% of full pipe area.

3. Valve seats, valve plug stem sleeves and plug stem bushings shall be fabricated of materials which are corrosion and abrasive resistant. The corrosion resistance shall be such that exposure over a period of five years to domestic wastewater, industrial wastewater, domestic sludges or industrial sludges containing sulfuric acid, hydrochloric acid, acetic acid, mineral oils, vegetable oils, polymers, esters, or acetones shall not result in sufficient corrosion to interfere with the serviceability of the plug valve.

4. Seals shall be capable of being replaced while the line and valve remain in service, if under submerged conditions, thereby eliminating the need to take process units out of service.

5. All exposed nuts, bolts, springs, and washers shall be stainless steel. Means of actuation shall be by lever, gear actuator, tee wrench, extension stem, or floor stand, as indicated.

6. All plug valves shall be equipped with an underground operator.

7. Plug valves 10-inch and larger shall be equipped with gear actuators. All gearing shall be enclosed and lubricated with seals provided on all shafts to prevent entry of dirt and fluid into the actuator. All shaft bearings shall be furnished with permanently lubricated bronze bearing bushings. Actuator shall clearly indicate valve positions, and an adjustable stop shall be provided to set closing torque. Valve stop shall be positive and shall not move due to repeated operation of the valve.

8. Plug valves shall be DeZurik Series 100, Henry Pratt Ballcentric, Crispin Style 800, or approved equal.

9. ***Gate Valves***: Buried gate valves 4-inch and larger shall be iron body, non-rising stem gate valves. Valves shall meet the requirements of ANSI/AWWA C509 and shall have mechanical joint ends. Mechanical joints and joint accessories shall meet the requirements of ANSI/AWWA A21.11/C111. Valve opening direction shall be consistent with operation of existing valves in the utility in which the valves are installed, unless otherwise directed by the Utilities Engineer. The following manufacturers will be permitted: Mueller Company, U.S. Pipe Company, American Pipe Company, Clow Valve, and M&H Valve Company.

10. Check Valves:

- Where swing check valves are specified, they shall conform to and be tested in accordance with the AWWA Standard for Swing-Check Valves for Ordinary Water Works Service, AWWA Designation C508. They shall be horizontally mounted, single disc, swing type with a full diameter passage providing minimum pressure loss. Valves shall be of the non-slamming type designed for the future installation of outside lever and weight. Disc faces and seat rings shall be bronze. Ends shall fit the pipe or fitting to which attached (push-on, mechanical, bell and spigot, or flanged). The following makes will be permitted: Crane, Darling, Mueller, or equal.

- Where ball type check valves are specified, the valve shall consist of just three components: body, cover and ball - one moving part. The design of the valve shall be such that it keeps solids, stringy material, grit, rags, etc., moving without the need for back flushing. The ball shall clear the water way providing "full flow" equal to the nominal size. It shall be non-clog. The ball shall be hollow steel with an exterior of nitrile rubber, it shall be resistant to grease, petroleum products, animal and vegetable fats, diluted concentrations of acids or alkalis (pH 4-10), tearing and abrasion. The body and cover shall be of gray cast iron, Class 35. Flange drilling shall be according to ANSI B16.1, Class 125.

- Check valves 2-1/2 inches in size and smaller shall conform to the requirements of Federal Specification WW-V-51a for Class "A" 125-pound Bronze Check Valve (for land use), Type IV.

11. Sewage Air and Vacuum Valves
Sewage combination air and vacuum valves shall be as follows:

SIZE SPECIFICATION

2" x 1"	Apco No. 401 SC, Val-Matic Co. No. 301 BWA, or equal
2" x 2"	Apco No. 402 SC, Val-Matic Co. No. 302 BWA, or equal
3" x 3"	Apco No. 403 SC, Val-Matic Co. No. 303 BWA, or equal
4" x 4"	Apco No. 404 SC

E. **Valve Boxes:** Valve boxes for plug valves and gate valves shall be cast iron. Valve boxes shall be two piece or three piece type. Each two piece box shall be complete with bottom section, top section, and cover. Each three piece box shall be complete with base, center section, top section, and cover. Valve boxes shall be extension type with slide or screw type adjustment. Each base and bottom section shall be the proper size for the valve served. Each valve box assembly shall be the proper length for the valve served. The minimum thickness of metal shall be 3/16 inch. Valve box cover shall have wording "Sewer" cast in it.

F. Air and Vacuum Valve Chambers

1. Air and vacuum valve chambers shall be 6 foot diameter precast concrete manhole barrels with precast concrete flat slab tops. Precast manhole barrels shall meet the requirements of ASTM C478.

2. Air and vacuum valve chamber access frames and cover shall be in accordance with as Norman Standard Drawings

G. **Tracer Wire:** The tracer wire shall be one #12 AWG solid copper wire with 30 mil HDPE coating; DurAtrace \DT-B3021-(500), or approved equal. For directional drilling installation, the contractor hall use #8 Copper Head Solo Shot Extra-High Strength Tracer Wire or approved equal.

1. All underground splices shall include waterproof connectors; Dryconn #22 - #6 AWG Direct Bury Silicon Filled Tub w/Strain Relief (DBSR) or approved equal, with silicon sealant.

2. Contractor shall test installed tracer wire to demonstrate the integrity of the installation to allow for future used of the system for maintenance staff to locate the line. Contractor shall use 512 Hs (or similar) line locating equipment for testing.

3. Contractor shall attach tracer wire to weatherhead or manhole/vault ring.

2502.5 MANHOLES AND OTHER STRUCTURES:

A. MATERIALS:

1. Materials for manholes, junction chambers, diversion chambers, and miscellaneous concrete structures shall comply with the following:

2. Precast manhole sections shall conform to requirements of ASTM C478.

3. Concrete for precast manhole sections shall be 3,500 psi concrete. Monolithic manholes shall use 4,000 psi concrete. Ready-mix concrete shall conform to ASTM C94 Alternate 2. Maximum size of aggregate shall be 1½ inches. Slump shall be between 2 inches and 4 inches.

4. Forms for chamber and structures shall be plywood or other accepted material. Steel forms shall be used for the inside face of monolithic concrete manholes.

5. Reinforcing steel shall conform to ASTM A615, Grade 40 deformed bars, or ASTM A616, Grade 40 deformed bars.

6. Mortar Materials
   - Sand - ASTM C144, passing a No. 8 sieve.
   - Cement - ASTM C150, Type 1.
   - Water - shall be potable.

7. All joints shall be fully sealed and waterproofed. Rubber gaskets for precast concrete manhole sections shall meet the requirements of ASTM C443. The gasket shall be the sole element depended upon to make the joint flexible and watertight.

8. The manufacturer of the precast manholes shall provide core-drilled openings to produce a smooth, uniform, cylindrical hole of the proper size

to accommodate a resilient connector meeting the requirements of ASTM C923 for all sewer pipes entering and leaving the manhole. The approved connectors are Press-Seal Gasket Corp. (PSX gasket or Press Wedge II), Kor-N-Seal by NPG Systems, Inc., Z-LOK Connector by A-LOK Products, or approved equal.

9. All manhole casting shall comply with Section 2502.5A.1(i) of the Norman Standard Specifications and shall be ASTM A48 ductile iron and be made in the USA. Covers shall be solid with two (2) pickbars; vents or pick holes are not allowed. Manufacturer shall certify that all castings are manufactured and proof load tested in accordance with AASHTO M306 (latest version). Weight of the ring and cover shall be approximately 375 lbs. Additionally, rings and covers shall have the foundry name and production date (mm/dd/yy). Manhole covers shall include the lettering "CITY OF NORMAN", "SANITARY SEWER", and "DANGER – CONFINED SPACE" permanently cast into the street side surface. Castings without proper markings shall be rejected. Castings shall be EJ Model 2100, or Neenah R-1682 (Deeter 1159), or equal approved prior to bid.

10. Bolted ring and cover, where required, shall include at least three (3) one-inch (1") openings equally spaced around the rings. Furnish and install one-half inch (1/2") stainless steel (SST) anchor bolts and nuts in openings. Cover shall also have machined groove with one-quarter inch (1/4") diameter Neoprene Gasket.

11. Any other special manholes, junction chambers, diversion chambers, and miscellaneous concrete structures shall be constructed as detailed on the drawings.

12. Manhole Inverts shall be constructed as to provide a minimum drop of 0.1 feet from the incoming pipe invert to the outgoing pipe invert, unless otherwise approved by the Utilities Engineer.

2502.6 PIPE EMBEDMENT MATERIALS

A. Standard bedding material shall consist of 4-inches of Type A aggregate base per Norman Standard Drawings. If the trench is wet or directed by the Utilities Engineer, the material shall be 4-inches of No. 57 or 67 rock per ODOT Section 701.06.

B. Flowable fill shall be as specified in Section 2402.6.B.

C. Concrete for embedment and encasement shall have a compressive strength of 3,500 psi at 28 days.

D. One (1) clay plug or water dam is required between each manhole. The plug or dam shall be the full width of the trench, five (5) feet long, and extend a minimum of 24 inches above the top of the pipe.

2502.7 CONDUIT PIPE

Conduit (casing) pipe shall be used at railroad or highway crossings or where required by the Utilities Engineer. The conduit pipe shall be in accordance with Section 2202 and meet the requirements of the railroad or highway authority with regard to type of material, wall thickness, and coating. No conduit will be installed without the approval of the involved highway or railroad authority.

2503 SITE PREPARATION

2503.1 GENERAL

A. Contractor shall do all cleaning necessary for performance of his work and shall confine his operations to that area provided through easements, licenses, agreements, and rights-of-way. The Contractor's entrance upon any lands outside of that area provided by easements, licenses, agreements or public rights-of-way, shall be at the Contractor's sole liability.

B. The Contractor shall not occupy any portion of the Project Site prior to the date established in the Notice to Proceed without prior permission of the Utilities Engineer.

2503.2 OBSTRUCTIONS

A. **General:** Natural obstructions, existing facilities and improvements encountered during site preparation shall be removed, relocated, reconstructed or worked around as herein specified. Care shall be used while performing site preparation work adjacent to any facilities intended to remain in place. Except as otherwise specified, the Contractor shall be responsible for any damage to existing facilities and improvements and any repairs required shall be promptly made at the Contractor's expense. Waste materials shall be disposed of in a satisfactory manner off the work site. Restoration of utilities damaged by the Contractor shall be restored as directed by the utility company at no additional cost to the Owner. Unless otherwise provided in the Special Conditions or Proposal, no separate or additional payment will be made for any work in connection with removal, relocation or restoration of obstructions and existing facilities.

B. Surface Obstructions

1. Sidewalks, curb and gutter, drainage structures and similar obstructions shall be tunneled under if tunneling is best suited, otherwise the obstruction shall be, cut- in straight lines or removed to the nearest construction joint if located within five feet of the centerline of the trench. In no case shall the joint or line of cut be less than one foot outside the edge of the trench. Surface obstructions removed to permit construction shall be reconstructed as specified and to the dimensions, lines and grades of original construction.

2. Mailboxes shall be maintained in the manner that the Postal Service requires to prevent interruption of mail delivery.

3. Site preparation shall include where necessary and permitted the removal of trees, shrubs, brush, crops, and other vegetation within the limits of the easements (right-of-way) or as may be provided for in licenses, permits and agreements. The following procedures for protection of existing greenery are required.
   - Trees:
     - All reasonable effort shall be made to save as many trees as possible. Trees are defined as six inches in diameter and greater when measured at a point three feet above the ground surface. If trees can be saved by trimming, this shall be done in accordance with acceptable pruning practices.
     - All trees within easements or right-of-way provided, which are specifically to be removed or saved have been marked on the plans.

Trees to be removed shall be completely removed, including stump and large roots, unless such removal may result in damage to existing pipelines. In that event, trees shall be sawn off not more than 4 inches above the ground and the stump shall be removed to 12 inches below finish grade. Any tree replaced shall be outside the right-of-way or sewer easement and shall be like species of nursery stock.

- *Small Plants and Flowers*: At least two weeks prior to the start of construction, property owners shall be notified by the contractor of the proposed starting date. The purpose of this notification is so that the property owners can remove any small plants or flowers that they, the property owners, desire to save.

4. Fences interfering with construction and located within public rights-of-way or as may be allowed for in permits or agreements, may be removed by the Contractor only if the opening is provided with a temporary gate that will be maintained in a closed position except to permit passage of equipment and vehicles unless otherwise herein specified. Fences within temporary construction easements may be removed by the Contractor provided that temporary fencing is installed in such a manner as to serve the purpose of the fencing removed. The contractor shall locate and record all fence corners prior to removal. All fencing removed shall be restored by the Contractor to the condition existing prior to construction unless otherwise specified in the Special Conditions. The Contractor is and shall be solely liable for the straying of any animals protected or corralled or other damage caused by any fence so removed.

5. The Contractor shall preserve all property corners, pins or markers. In the event any property corners, pins, or markers are removed by the Contractor, such property points shall be replaced at the Contractor's expense and shall be reset by competent surveyors properly licensed to do such work. In the event such points are section corners or Federal land corners, they shall be referenced and filed with the appropriate authority.

6. Sodded and/or landscaped thoroughfares and areas on or adjacent to improved property shall be disturbed only to the extent required to permit construction. Such areas shall not be used as storage sites for construction supplies and insofar as practicable shall be kept free from stockpiles or excavated materials.

C. Subsurface Obstruction:

1. Where existing utilities and service lines are to be encountered, the Owner thereof shall be notified by the Contractor at least 48 hours (not including weekends and/or holidays) in advance of performing any work in the vicinity. All excavation, pipeline installation and backfilling work in the vicinity of such utilities shall be accomplished in the manner required by the respective Owner and, if requested, under their direct supervision. The Contractor shall be responsible for any and all damages to a public or private utility that may occur as the result of the construction.

2. The Contractor shall make a reasonable effort to ascertain the existence of obstructions and shall locate obstructions by digging in advance of machine excavation where definite information is not available as to their exact location. Where such facilities are unexpectedly encountered and damaged, responsible officials and other affected parties shall be notified

and arrangements made for the prompt repair and restoration of service.

3. The Contractor shall make every reasonable effort to protect private sewer facilities. They are not shown on the Plans. When these facilities are disturbed or damaged by the work, the Contractor shall make necessary repairs to the facilities for continuous service prior to the close of the workday.

2504 EXCAVATION

2504.1 SCOPE

Excavation and trenching work 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; preparation of subgrades; pumping and dewatering as necessary or required; protection of adjacent property; and other appurtenant work.

2504.2 GENERAL:

A. All pipeline excavation work shall be accomplished under supervision of a person experienced with the materials and procedures which will provide protection to existing improvements, including utilities and the proposed pipeline.

B. The alignment, depth, and pipe subgrades of all sewer trenches shall be determined by laser beam or other electronic equipment.

C. When pipe is to be installed in embankment or fill, the embankment shall be constructed and completed in accordance with Section 2100. Once the embankment or fill is complete and stabilized, the pipe may be installed. The top of the embankment or fill shall be built up to a plane at least 18 inches above the top of the proposed pipe prior to the excavation of the sewer trench.

D. The Contractor shall not open more trench in advance of pipe laying than is necessary. The maximum length of open trench allowed on any line under construction shall be 300 feet. All open trenches shall be adequately protected.

E. The Contractor shall remove surplus pipeline materials, tools, rubbish and temporary structures and leave the construction site clean, to the satisfaction of the Construction Inspector.

F. In the event hazardous wastes as defined by the Resource Conservation and Recovery Act of 1976 (PL94-580) are encountered, work shall be halted, and the Utilities Engineer shall be notified. Work shall be resumed only after the Utilities Engineer notifies the Contractor. Regulation of removal, handling and disposal of hazardous wastes is the responsibility of Federal and State agencies.

2504.3 CLASSIFICATION OF EXCAVATED MATERIAL

No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling regardless of the type, character, composition, or condition thereof.

2504.4 REMOVAL OF WATER

A. The Contractor shall remove any water that may accumulate or be found in the trenches and other excavations made under the Contract.

B. The Contractor shall form all dams, flumes or other works necessary to keep the excavation clear of water while the sewers and their foundations, and other foundation works, are being constructed. All water shall be removed from such

excavation in a manner that will not damage property.

C. All dewatering shall be incidental to other items of work and shall be provided at no cost to the City.

2504.5 BLASTING

Blasting is not permitted.

2504.6 TRENCH EXCAVATION

A. Excavations for pipelines, except where boring or jacking is specified, shall be accomplished by the open-cut method (trenching) except as specified or accepted by the Utilities Engineer. Trenching shall be with a minimum inconvenience and disturbance to the general public. One block, or 300 feet whichever is shorter, shall be the maximum length of open trench ahead of pipe laying unless otherwise accepted by the Utilities Engineer. The Contractor shall sort and stockpile the excavated material, so the proper material is available for backfill.

B. All trenches shall be excavated to depths required for proper pipe embedment. Over-depth excavation shall be required when the subgrade is unstable. Over-depth excavations shall be backfilled with granular pipe embedment material unless otherwise directed by the Utilities Engineer.

C. Undercutting of trench walls is not permitted.

2505 INSTALLATION OF PIPE

2505.1 SCOPE

This section governs construction methods and procedures for the installation of gravity and pressure pipelines and appurtenances.

2505.2 GOVERNMENTAL REQUIREMENTS

Sanitary sewer line installation shall comply with applicable Federal, State, and County Environmental Quality Departments requirements.

2505.3 TRENCH DEWATERING:

A. Contractor shall maintain a dry and stable trench, obtain necessary permits, and provide for the proper method of discharging such water from the work site at all times until pipeline installation is completed to the extent that hydrostatic pressure flotation or other adverse effects will not result in damage to the pipeline.

B. Proper dewatering techniques are the Contractor's responsibility. All work performed by the Contractor which is adversely affected by his failure to adequately dewater trenches will be subject to rejection by the Utilities Engineer. The Contractor shall repair and/or replace the affected pipeline without additional compensation.

2505.4 DRAINAGE COURSE CROSSING ENCASEMENT

Any pipeline crossing a well-defined drainage course having less than 3 feet of cover over the pipe shall be encased in concrete. The length of encasement shall be as shown on the Plans or if not shown as specified by the Design Engineer.

2505.5 TRENCH SHORING AND BRACING

A. All shoring, bracing or blocking shall be furnished and installed as necessary to preserve and maintain exposed excavation faces, to protect existing improvements, to protect the proposed pipeline and to provide for safety.

B. Shoring or other methods for support of trench walls is the responsibility of the Contractor and shall be accomplished by methods that will not adversely affect pipeline alignment, grade and/or structural integrity.

C. All bracing, sheeting and/or shoring installed below a horizontal plane 6 inches above top of proposed pipe shall not be disturbed or removed after pipe and/or pipe embedment has been installed unless otherwise specified. The bottom skids of a trench shield shall not extend lower than 6 inches above top of proposed pipe.

2505.6 PIPE EMBEDMENT:

A. All concrete embedment for rigid pipe shall begin and end at a pipe joint.

B. Pipe shall be embedded with standard bedding materials in accordance with Section 2502.6.

2505.7 BEDDING INSTALLATION:

A. The trench subgrade shall be prepared to provide a uniform and continuous pipe support between pipe bells and joints.

B. Place and densify embedment material by shovel slicing or vibrating and prepare embedment material so that the pipe will be true to line and grade after installation.

C. After each pipe has been brought to grade, aligned, and placed in final position, deposit and densify by shovel slicing sufficient bedding material under the pipe haunches and on each side of the pipe to hold the pipe in proper position during subsequent pipe, jointing, bedding, and backfilling operations. Place bedding material uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

D. Place pipe that is to be bedded in concrete embedment in proper position on temporary supports consisting of wood blocks or bricks with wood wedges. When necessary, anchor or weight the pipe to prevent flotation when the concrete is placed.

E. Place concrete for embedment or encasement uniformly on each side of the pipe and deposit at approximately its final position. Do not move concrete more than 5 feet from its point of placement.

F. If unstable subgrade conditions are encountered and it is determined by the Utilities Engineer that the bedding specified will not provide suitable support for the pipe, additional excavation to the limits determined by the Utilities Engineer will be required. This additional excavation shall be backfilled with material accepted by the Utilities Engineer.

2505.8 BEDDING MATERIAL:

A. **Concrete Cradle or Encasement**: Concrete for embedment shall have a minimum 28-day strength of 3,500 psi except as otherwise specified. After initial set of concrete, 12 inches of backfill material should be placed over the conduit or concrete. The backfill above this point shall not be placed nor sheeting removed until at least forty-eight (48) hours after placement of the concrete. Time requirements may be adjusted by the Utilities Engineer to obtain structural integrity.

B. **Granular Embedment**: The pipe shall be bedded in granular material, as shown as per Norman Standard Drawings.

C. **Flowable Fill:** Flowable Fill shall be a sand-cement slurry consisting of 2,970 lbs

of sand, 100 lbs of cement, and approximately 458 lbs of water per cubic yard. The slurry will be mixed to a pourable soupy mix in a ready mix truck. When the flowable fill is to be a Quick-Set flowable fill, the cement shall be replaced with a rapid set cement and the slurry shall have a strength of 65 to 75 psi in 1 to 1.5 hours.

2505.9 TEES, WYES AND BUILDING SERVICE LINES:

A. Building service lines from the main to the building shall be considered private.

B. Tees, wyes and saddles shall be installed at forty-five (45) degrees with pipe springline for pipe sizes 8 inches through 15 inches diameter. Tees, wyes and saddles shall not be installed in pipe sizes greater than or equal to 18 inches diameter. Saddles shall be DFW Flexible Saddle or approved equal.

C. Building service lines of 4 inches or less shall be installed with a straight alignment and at a uniform grade not less than one (1) percent unless otherwise specified and shall be embedded with granular bedding material. Service line depth shall be based on service line stub out 0.5 feet below surface, 1% minimum grade and a minimum of 26 inches from finished floor elevation to top of service line. When a building service line grade exceeds twenty (20) percent, pipeline anchors shall be installed with the first anchor not more than 12 feet nor less than 7 feet upstream of the tee or wye.

D. The Contractor shall maintain an accurate record for submittal to the Utilities Engineer of location, size and direction of each tee, wye, saddle and/or location, size and length of each building service line. Locations shall use the pipeline stationing as shown on the Plans or the distance from the first downstream manhole. If the City provides video of the tap location, the Contractor will be responsible for the City's cost to televise the sewer, in which the fee is to be assessed by the City.

E. Service lines shall be terminated and capped as shown as per Norman Standard Drawings.

2505.10 GRAVITY SEWERS:

A. All gravity sewers shall be installed to the alignment, elevation, slope, and with pipe embedment as specified and/or shown on the Plans. Maintain the following tolerances from true alignment and grade between adjacent manholes:

Alignment	6 inches
Grade	1 inch

B. Gravity pipe must be laid straight and to the grade specified. No joint deflection will be allowed. For Force Mains, joint deflection requirements shall conform with Section 2403.2.

2505.11 PRESSURE SEWERS (FORCE MAIN):

A. All pressure sewers shall be installed with required pipe embedment to depths shown on the Plans and in accordance with as per Norman Standard Drawings. The pipe shall be installed at a continuous slope unless indicated otherwise on the Plans

B. Accepted air relief valves shall be installed at all locations shown on the Plans or where required by the Utilities Engineer.

C. The Contractor shall block and anchor the pipeline or use restrained joints to

accommodate thrust and testing forces at pipe deflections, bends, tees, and plugs in accordance with as per Norman Standard Drawings.

2505.12 ANCHORS

A. Pipelines shall be anchored every 16 feet when the slope is greater than 20%.

B. The anchor shall be of concrete or other material accepted by the Utilities Engineer. Concrete anchors shall have a minimum thickness of 12 inches. The anchor shall extend not less than 12 inches into undisturbed earth on the sides and bottom and (12 inches) above top of pipe. In incompressible material, the above dimensions may be 6 inches each side and bottom. The anchor shall support a joint fitting.

2505.13 PIPE LAYING:

A. All pipe shall be installed in accordance with the pipe manufacturer's recommendations, except as modified herein.

B. Pipe laying shall not proceed if the trench width as measured at the top of pipe exceeds the maximum allowable trench width. If this occurs, the Contractor shall submit to the Utilities Engineer for review a better bedding for the pipe or pipe of sufficient strength to provide safe supporting strength.

C. All pipe and fittings shall be stored and handled with care to prevent damage thereto. Hooks shall not be used to transport or handle pipe or fittings. Pipe or fittings shall not be dropped.

D. Rejected pipe and fittings shall be marked and removed from the Project Site at no cost to the Owner. All pipe and fittings shall be examined for soundness and specification compliance prior to placement in the trench and rejected pipe or fittings shall not be incorporated into the pipeline. Pipe class or strength shall be checked to assure that proper pipe is installed.

E. Joint contact surfaces shall be cleaned prior to jointing. Lubricants, primers, or adhesives shall be used as recommended by the pipe or joint manufacturer.

F. Pipe laying normally shall begin at the lowest point. A minimum earth cover of 30 inches shall be provided for all sewers.

G. Unless otherwise required, all pipes shall be laid straight vertically and horizontally between manholes, excavating bell holes for each pipe joint. When jointed, the pipe shall form a true and smooth pipeline.

H. Pipe connecting to a structure shall be supported with concrete embedment, cradle or encasement to the first joint outside the structure excavation. If flexible wall connections are used, standard bedding may be used in lieu of concrete embedment provided the height of backfill does not exceed the covers depths, which would result in loads exceeding the pipe's safe supporting strength.

I. All pipelines shall be plugged at the end of each day's progress. Plugs or other positive methods of sealing shall be utilized at all times to protect any existing, system from entrance of stormwater or other foreign matter.

J. When a sanitary sewer line crosses an existing pipeline and the clearance is less than 2 feet, special embedment may be required.

2505.13 CONNECTION OF PIPES OF DISSIMILAR MATERIALS:

The connection of pipes of different materials shall be made using a non-shear stainless steel band or approved equal and shall provide a permanent and watertight connection that will withstand the hydrostatic test pressure.

2506 BACKFILL

2506.1 GENERAL:

A. All trash and debris shall be removed from the pipeline excavation prior to backfilling.

B. Unless otherwise specified, all sewer trenches and excavation around structures shall be backfilled to the original surface of the ground with suitable earth or earth and rock. When an earth and rock mixture is used, it shall be placed and thoroughly consolidated with sufficient earth to completely fill all voids between the rocks.

C. The backfill material shall be placed in lifts not to exceed 4 feet in depth. Each lift shall be compacted to the required density prior to the next lift being placed.

D. Sand backfill shall not be used for gravity sewer lines.

E. In areas marked "garden" or "flower garden," the original topsoil shall be replaced to original elevation and depth. Minimum depth shall be 12 inches.

F. Backfill material shall be carefully placed to avoid damage to or displacement of the pipe and other exposed utilities or structures.

G. Backfill shall not be placed when material contains frost, is frozen, or a blanket of snow prevents proper compaction. Contractor shall remove waste material, trees, organic material, rubbish, or other deleterious substances.

H. No rock whose greatest dimension exceeds six inches shall be placed within 4 feet of the top of the pipe in any excavation as backfill. No rock greater than one foot in its largest axis shall be placed in any trench excavation as backfill.

I. Special backfilling procedures will be allowed in new residential subdivisions or other development and will not be under a proposed driving surface, with approval of the Utilities Engineer. The select fill and final backfill can be backfilled in one lift. The backfill shall be compacted from the top of the trench by driving acceptable heavy equipment over the trench. If trench settlement occurs within the maintenance bond period the contractor shall fill and compact the settled area with acceptable material and repair the area with sod if necessary.

J. Warning tape shall be installed above all new and rehabilitated underground piping installed by open trench after placement of select backfill as detailed on Norman Standard Drawings. The tape shall be installed approximately 18 inches above the top of pipe. The tape shall be 2 to 3 inches wide and made of materials not subject to decay or breakdown in the environment where it is installed. Tape shall be colored “green” for both gravity sewers and pressure force mains and shall be permanently marked “CAUTION: BURIED SEWER LINE BELOW.”

2506.2 BACKFILLING UNDER PAVEMENT

Under areas to be paved, the backfill materials (ODOT 703.01, Type A Aggregate) from the top of the pipe embedment shall be compacted in such a manner so as to obtain 95% of maximum density as determined by ASTM D698. The backfill material shall extend a minimum of 2-feet behind the back of curb, or the edge of pavement where no curb exists. Required compaction and percentage of maximum density must be obtained before pavement is placed.

2506.3 BACKFILLING IN UNPAVED AREAS

From the top of the pipe embedment to a point at grade the backfill material shall be compacted to no less than 90% of maximum density for cohesionless and 85% for cohesive soils, per Norman Standard Drawings as determined by ASTM D698.

2506.4 BACKFILL AROUND STRUCTURES

A. No backfill shall be placed over or around any structure until the concrete or mortar has attained a minimum strength of 3,500 psi and can sufficiently support the loads imposed by the backfill without damage.

B. The Contractor shall use utmost care to avoid any wedging action between the side of the excavation and the structure that would cause any movement of the structure. Any damage caused by premature or unbalanced backfill or by the use of equipment on or near a structure will be the responsibility of the Contractor.

C. No rock larger than 4 inches maximum dimension shall be placed within 12 inches of the exterior surface of any structure.

2507 RESTORATION

2507.1 GENERAL

The Contractor shall restore the project site to conditions equal to or better than those existing prior to entry unless otherwise specified.

A. Maintain adequate safety signs, barricades and lights until final restoration of work area is completed.

B. Public property shall be restored to the requirements of the public body having jurisdiction.

2507.2 CLEAN-UP

The Contractor, upon completion of installation and backfill operations, shall prepare the area for final grading including but not limited to the following items:

A. Clean-up shall follow the backfilling operations as closely as possible.

B. Excess material shall be removed from the site including material that has washed into the stream beds, storm water facilities, streets, etc.

C. Tools, equipment, and construction material shall be removed except for in designated storage areas along the pipeline route.

D. Restore surface and sub-surface drainage and provide temporary wash checks where necessary.

2507.3 FINISHED GRADING:

The Contractor shall finish grade the area to lines and grades shown on the Plans or if not shown to those that existed prior to the area being disturbed. Special attention shall be directed to ensure surface drainage. The area shall be smoothed by raking or dragging.

2507.4 SURFACE RESTORATION:

A. **Seeding and Sodding:** All unpaved areas cut by the line of trench or excavation or damaged during the work shall be sodded when specifically indicated on the plans. Seeding may be installed upon authorization by the Utilities Engineer. Seeding and sodding shall conform to the requirements of Section 2104.

B. **Sidewalks and Driveways:** all paved sidewalk and driveway areas cut by the line of trench or excavation or damaged during the work shall be replaced. Sidewalk and driveway replacement shall conform to the requirements of Section 2205 and 2304.7.

C. **Streets and Curbing:** All paved street, shoulder, and curbing areas cut by the line of trench or excavation or damaged during the work shall be replaced to

conform to the lines and grades of the original pavement and shall be of equal quality, thickness, and appearance to that removed. Paving and curb replacement shall conform to the requirements of Section 2205 and 2304.

2507.5 FENCES

All fencing damaged and/or removed existing prior to construction shall be restored to a condition not less than that which existed prior to construction.

2507.6 WALLS

Retaining and architectural walls, if disturbed or damaged, shall be restored architecturally and structurally to conditions not less than that which existed prior to construction.

2507.7 TREES, SHRUBS AND BUSHES

Any tree, shrub or bush replaced shall be planted outside the permanent sanitary sewer right-of-way and shall be of the same species as the removed tree, shrub or bush. Any tree, shrub or bush species that is prohibited by local restrictions shall be substituted with a related species. The contractor shall notify the property owners at least two weeks prior to the start of construction so property owners can remove small plants and flowers.

2507.8 MANHOLE EXCAVATION

A. **Excavation**: Excavation for manholes and special structures shall be governed by this Section and Section 2504. It shall be achieved in a suitable and orderly manner providing a minimum disturbance to the general public.

B. **Depth of Excavation**: Depth of excavation shall be to that required for proper installation of the manhole or structure. Over-depth excavation may be required by the Utilities Engineer if the subgrade is unstable. Over-depth excavation due to unstable subgrade shall be backfilled as required by the Utilities Engineer. Over-depth excavation occurring through an oversight by the Contractor shall be backfilled as required by the Utilities Engineer at no additional cost to the Owner.

C. **Side Clearances**: Side clearances outside the manhole and/or structures shall be no greater than to allow for forming, connection of piping, proper application of special coatings, if required, and to permit inspection. When concrete is to be placed directly against excavated faces, excavation shall be sufficiently outside of the manhole or structure to provide not less than 3 inches of concrete cover over the steel reinforcement.

2507.9 MANHOLE INSTALLATION:

Manhole installation shall be governed by this Section and Section 2505. It shall be performed by the Contractor on a schedule that will provide an orderly progression of the work.

A. Bases:

1. Precast bases shall be reinforced in accordance with ASTM C478.

2. If precast bases are not used, poured concrete bases shall be used. Precast bases shall be installed on 6 inches of crushed rock. Depths exceeding this amount shall be filled with concrete.

3. Poured-in-place bases shall have a minimum thickness of 8 inches. When poured-in-place bases are used, the invert shall be poured monolithically with the base. The bottom wall sections shall be embedded in the base section a minimum of 3 inches. The bottom precast wall section shall not be set upon a previously poured base. Solid concrete blocks shall be used for supporting and leveling the wall section prior to pouring the base.

B. **Inside Dimensions**: The minimum horizontal clear distance in the barrel of the manholes shall not be less than four feet unless otherwise specified on the Plans.

C. Precast Manholes:

1. Delivery: Precast concrete components shall not be delivered to the job until representative concrete control cylinders have attained at least 80 percent of the specified minimum design strength.

2. Inspection: Precast concrete shall be inspected when delivered. Rejection of defective or cracked precast concrete components shall be in accordance with ASTM C478.

3. Construction: Precast sections shall be cleaned of all dirt, grass, and other deleterious matter. Seal each joint (including adjustment rings and castings) with a double bead of preformed bitumastic joint sealant. Lift holes shall be patched with non-shrink grout.

D. Cast-In-Place Manholes:

1. Wall thickness: Wall thickness shall conform to the dimensions as shown on the drawings.

2. Construction: Reinforcement steel shall be placed as shown on the drawing. Tie-holes shall be patched with non-shrink grout. Wall sleeves, where required, shall be installed as shown on the drawings. Water stops shall be installed at the wall and slab connection and shall be of the size, thickness and material as shown on the drawings.

3. Top Slabs: Thickness shall conform to the dimensions and reinforcement steel shall be placed as shown on the drawings.

4. Pipe Stubs: Stubs shall be installed at the locations, angles, elevations and of the materials as shown on the drawings. A water-tight removable stopper shall be installed in each pipe stub. Pipe stubs shall be installed so that a pipe joint will be 2 feet or less from the outside manhole wall.

5. Inverts: Inverts shall be structural concrete and steel-troweled to produce a dense, smooth finish. The invert channel shall be "U" shaped in cross section and extend upward one-half of the inside pipe diameter. Smooth transitions shall be formed for pipes of different sizes, elevation and bends. The invert bench shall be sloped to drain.

6. Top Elevation: The finished top elevation of manhole castings shall conform to the following unless otherwise shown on the plans or directed by the Utilities Engineer.

7. In paved or future paved areas, the top of the casting shall conform to the slope of the pavement and be 1/8 inch below the finished pavement elevation.

8. In non-pavement areas, the top of the casting shall be not more than 6 inches above the surrounding ground nor less than 0.2 feet above the surrounding ground. The final elevation shall be at a point where storm water will drain away from the manhole cover.

9. Manhole Adjustment: All new manholes will be provided with adjustment ring(s) underneath the casting as shown on the Norman Standard Drawings. The joints shall be sealed with preformed bitumastic sealant.

The maximum allowable adjustment distance between the top of the cone and the bottom of the casting shall be 24 inches. If the top of an existing manhole is required to be raised to an elevation that will exceed the maximum adjustment distance or lowered more than the adjustment rings will allow, all vertical adjustments shall be made to the barrel of the manhole.

10. Castings: Castings shall be installed with the mud ring inserted inside the manhole opening and resting on a minimum of two rows of preformed bitumastic sealer. Bolt-down castings shall be held in place as shown on the Plans.

E. **Waterproofing:** Exterior protective coating may be required where water infiltration through the concrete is expected and/or if required by the interior lining being provided.

F. **Liners and Coatings:** Interior protective coating or liner is required on all exposed concrete surfaces on the interior of the manhole, including concrete grade rings. The liner system shall be approved by the Utilities Engineer.

G. **Manhole Backfilling**: Manhole backfilling shall be governed by Section 2506.

H. **Restoration**: Restoration shall be governed by Section 2507.4.

I. **Manhole Testing**: Manholes shall be tested in accordance with Section 1006.7.

2508 MEASUREMENT AND PAYMENT

2508.1 SCOPE

This section covers the methods of measurements, and the basis of payment, for the furnishing of all labor, equipment, tools, and materials for the performance of all related work necessary to complete any construction covered in Section 2500.

2508.2 GENERAL

Unless specifically altered by the Special Conditions, the methods of measurement and payment will be as specified herein, and as listed in the Proposal (Bid Schedule).

2508.3 ITEMS NOT LISTED IN THE PROPOSAL

There will be no measurement or separate payment for any items of work not specifically identified and listed in the Proposal and all costs pertaining thereto will be included in the Contract Unit Prices for other items listed in the Proposal.

2508.4 MEASUREMENT AND PAYMENT

A. The quantities of accepted work will be measured and paid for on a unit price basis as determined as follows:

1. **Pipe:** Payment shall be made at the unit price bid per linear foot of pipe of the size and type specified in the Bid Schedule and placed as shown on the drawings. Total footage shall be the actual measurement along the centerline of the pipe to the inside face of connecting structures. No deduction will be made for laying lengths of valves or fittings. No additional payment shall be made for vertical pipe or for fittings or specials included as pipe, joint restraint, right-of-way clearing and restoring, testing, cleanup, or other operations unless identified in the Proposal.

2. **Polyethylene Wrap:** If called for separately in the Proposal, polyethylene tube shall be furnished and shall be paid for at the unit price bid per linear

foot installed.

3. **Standard Backfill Material (SBM):** If called for separately in the Proposal, payment shall be made at the unit price bid for cubic yards of SBM specified in the Proposal and placed as shown on the drawings. SBM volume estimate is computed on the basis of the length of pipe, trench width, and depth of SBM, less the volume of the pipe installed in the SBM based on the outside diameter (O.D.). Payment will not be made for extra width or depth of trench due to Contractor's workmanship.

4. **Trench Excavation:** If called for separately in the Proposal, payment shall be made at the unit price bid per cubic yard of trench excavation completed according to the Plans and Specifications. Volume will be computed as follows: Standard trench width as given per Norman Standard Drawings; length of line as of the actual horizontal measurement along the centerline of the ditch; depth of excavation in increments of 0-10 feet, 10-15 feet, 15+ feet below ground surface as the actual depth of ditch from the original ground surface to the flow line of the pipe as shown in the construction plans. Average end-area method of computing volume will be used. No measurement for excavation will be made for material excavated outside the neat lines of the standard trench width as given as per Norman Standard Drawings unless included in the Special Conditions or Proposal.

5. **Fittings:** Payment shall be made at the unit price bid per fitting type specified in the Proposal, installed in accordance with the plans, and shall include cost of concrete thrust blocking. This item shall include fittings required for service connections.

6. **Conduit (casing):** Measurement will be made in linear feet for the applicable size and type of conduit, bored or trenched, as called for in the Proposal and/or as shown on the plans, based on actual field-measured lengths of acceptably installed conduit (casing), including insulation spray foam, carrier pipe, thrust restraint system, spacers, vent piping, and other subsidiary items per Norman Standard Construction Drawings.

7. **Valves:** Payment for valves shall be made at the unit price bid per valve, of the type specified on the Proposal, and placed as shown on the Drawings. The unit price bid for air relief and check valves shall include the valve vault and box. If valve box extensions are required, they shall be paid for at the unit price bid per extension if identified separately in the Proposal. No additional payment shall be made for: excavation, backfilling, concrete blocking, crushed rock for drains, air relief valve piping in vaults, or for setting of the valve box or extension.

8. **Manholes:** Payment for manholes shall be made on the basis of units installed and accepted. If the manhole depth, measured from the invert to the top of the cover exceeds 6 feet, the additional depth shall be paid for at the unit price bid per vertical foot of manhole depth over 6 feet.

9. **Specials (Vaults, Special Structures, etc.):** Measurement for these type items will be made based on the actual number of units installed, as called for on the plans and as identified in the Proposal.

10. **Concrete Encasement:** Concrete encasement will be measured by the lineal foot of each size and type.

11. **Seeding:** Measurement and payment will be made in accordance with Section 2105.4.G.

12. **Sodding:** Measurement and payment will be made in accordance with Section 2105.4.F.

13. **Pavement Removal and Replacement:** Measurement will be made in accordance with Section 2207.4.E.

END OF SECTION 2500

City of Norman
STANDARD SPECIFICATIONS AND CONSTRUCTION DRAWINGS
SECTION 3000 PUBLIC WORKS ADMINISTRATION

SECTION 3000 PUBLIC WORKS ADMINISTRATION

3001 ADMINISTRATION BY THE PUBLIC WORKS DEPARTMENT

3001.1 INTRODUCTION

This sub-section defines the powers and duties of the Public Works Department and its inspectors, the requirements of permits, the establishment of fee schedules, and penalty provisions for violating City code.

3001.2 CONFLICTING PROVISIONS

When any provision of this Chapter conflicts with any other provision of the Code of the City of Norman, the provisions of this Chapter shall control.

3001.3 DUTIES OF THE PUBLIC WORKS DEPARTMENT

A. The Public Works Department, under the supervision of the Public Works Director, shall:

1. Make engineering plans and specifications for the physical facilities of the City, and supervise the construction of those facilities,

2. Establish a schedule of inspection and re-inspection fees for those items constructed or installed to adequately reflect not less than the actual costs of the City, and such schedules to be certified by the Public Works Director and filed with the City Clerk.

3. Specifically enforce the provisions of Chapter 16, Chapter 19, Chapter 21, and Chapter 22 of the Code of the City.

4. Promulgate and enforce such rules, regulations, and procedures for the efficient administration of those duties required by this section.

3002 POWERS OF PUBLIC WORKS INSPECTOR

3002.1 INSPECTORS OF THE PUBLIC WORKS DEPARTMENT SHALL HAVE THE POWER AND AUTHORITY TO:

A. Order the stopping of construction of any installation of storm, sanitary sewer, water or paving improvements if earth change permit or other applicable permits have not been obtained or, if such construction is being done in a careless or reckless manner, or in violation of the provisions of the Code of the City.

B. Call upon the police and fire departments in enforcing violations of the Code of the City.

C. Revoke any permit where it is found that there has been a misrepresentation of facts or a violation of the Code of the City.

D. Order the closing of any streets and the rerouting of traffic when the City of Norman has contracted with any person for the improvement of such street, or that period of time necessary to permit the proper completion of that improvement.

3002.2 APPEALS FROM INSPECTOR'S DECISIONS

A. Any person aggrieved by an inspector exercising his power and authority pursuant to Section 3001.3, must, before instituting suit, appeal to a Public Works Appeal Board, which shall consist of the Public Works Director, the City Attorney, and a designee of the City Manager.

B. Any such appeal shall be made within 5 days after the decision of the inspector, and shall be in writing, stating the reasons for the appeal. The date and place of all hearings shall be fixed by the appeal board, and all interested parties shall be given written notice of the hearings.

C. The appeal board shall give a written decision within 10 days of the hearings, and if accepted by the appealing party, the board shall take such necessary steps as to give effect thereto.

3002.3 INSPECTIONS

A. Public Works inspectors may enter upon property under development.

B. All work found to be faulty or incorrectly or defectively installed shall be corrected before any approval shall be given by an inspector, and when such has been corrected, notification for a re-inspection shall then be given to the Public Works Department.

C. All inspections shall be made by the Public Works Department within two (2) working days from the receipt of the notification for the inspection or re-inspection.

D. No work which is required to be inspected shall be covered over or covered up prior to that particular inspection, and any covering in place shall be removed upon the order of the inspector.

3002.4 NOTICE

A. Whenever an inspector exercises his power and authority pursuant to this Section 3001.3 in ordering compliance with the Code of the City, notice shall personally be given to the responsible person or his agent, or sent by certified mail to such person's last known address. If such persons are not personally located and no address is known, the notice shall be posted in a conspicuous place on the premises.

B. Such notice and order shall:

1. Be in writing

2. List the specific non-compliance with the Code of the City.

3. Specify the action to be taken.

4. Provide a reasonable time for compliance with the Code of the City.

3002.5 PERMITS REQUIRED, EXCEPTIONS

A. Except as otherwise provided in Subsection B of this Section, no person shall engage in the following acts without having first obtained the necessary permits from the Public Works Department:

1. The construction, alteration, cutting, mutilation, or changing in any manner for any purpose, any paved or traveled portion of any street or alley or drainage right-of-way, any easement, any curb, gutter, catch basin or other appurtenance of a street or alley, or any sidewalk.

2. The construction or repair of any off-site improvement.

3. Any earth disturbing construction activities including developing, grading, excavating, paving, landfilling, berming or diking.

B. No permit is required under the following circumstances:

1. Where a public utility corporation installs electrical conductors or equipment in the generation, transmission, sale, or use of electrical energy as outlined in their franchises with the City.

2. Where the construction, alteration, cutting, and changing of a portion of any street or alley or drainage right-of-way, any easement, any curb, gutter, catch basin or other appurtenance of a street or alley is under the direct supervision of the City Manager or the Public Works Department.

3. Where such cutting, or changing of a sidewalk is only for the repair of that sidewalk.

4. Where an emergency construction or repair of an off-site improvement is necessary, to protect the health and safety of the City inhabitants, and such construction or repair is made by a public utility or public service company. However, a permit is required after the commencement of that work.

3002.6 PERMIT FEE SCHEDULE

A. Refer to **APPENDIX D Fee Schedule** of the Engineering Design Criteria Manual.

3002.7 PENALTIES

A. Any person convicted of violating the provisions of the City's *Standard Specifications and Construction Drawings* and/or *Engineering Design Criteria* or material referenced in them, or of failing to act or comply with the provisions of them shall be punished by a fine of not to exceed $200 for each such violation or failure to comply.

B. Each day that a violation or failure to comply exists shall constitute a separate

and distinct offense, and any one or more of such offenses may be set out in any complaint or information filed.

C. Any person found in violation of the provisions of the City's *Standard Specifications and Construction Drawings* and/or *Engineering Design Criteria* will be denied issuance of any other City permits, approvals or inspections until the violation(s) are corrected or until written arrangements to correct the violation are submitted to, and accepted by, the City.

3003 STREET AND UTILITY INSPECTION CHECKLIST

3003.1 INTRODUCTION

This section is designed to provide the developer and his contractor with an overview of requirements for construction and inspection of subdivision utilities. Detailed information on utility design and construction is contained in the City's *Engineering Design Criteria*, *Standard Specifications and Construction Drawings*, and the City Code. Together these documents provide a basic outline for the construction of utilities in a subdivision. Should there be a perceived conflict between this document and the aforementioned documents, the user is requested to bring this conflict to the attention of the City Engineer. The Engineer will clarify these conflicts as quickly as possible. Any suggestions for additions to or improvements in this section will be accepted and acted on by the Engineer.

3003.2 ORGANIZATION

This section is organized around the basic utilities common to most subdivisions. Under the utility heading the section is further subdivided into the following topics:

A. Submittals/Permits Required Prior to Construction

B. Submittals Required During Construction

C. Required Inspections

D. Key Items Checked by Inspectors

3003.3 SITE PREPARATION

A. **Submittals/Permits Required Prior to Construction:**

1. Accepted Preliminary Plat
2. Site Grading Plans
3. Earth Change Permit
4. Burning Permit (If Required, from Fire Department)
5. Fill Material (If Required)

B. **Submittals Required During Construction:**

1. Documentation of proper disposal of any hazardous items removed from site.
2. Compaction tests on any fill areas under future roads.

C. **Required Inspections:**

1. Pre-work inspection to locate potential future problems such as ponds, gullies to be filled in, drainage channels, and existing utilities.
2. Completion of site work.

D. **Key Items Checked by Inspectors:**

1. Are utilities flagged prior to starting excavation?
2. Is brush and refuse being disposed of properly?
3. Is cut and fill work in compliance with the accepted plan?
4. Are proper fill and compaction procedures being used?
5. Are measures being taken to prevent erosion?
6. Is excess fill being disposed of properly?

3003.4 STREETS

A. Submittals/Permits Required Prior to Construction:

1. Accepted Plans for Grading, Streets, Drainage, Water, and Sewer.
2. Earth Change Permit
3. Concrete Mix Design
4. Asphalt Mix Design (If Required)
5. Testing Laboratory

B. **Submittals Required During Construction:**

1. Stabilization Reports on Subgrade
2. Compaction Reports on Subgrade
3. Compaction Reports on Base
4. Documentation of Concrete Mix
5. Documentation of Asphalt Mix (If Required)
6. Concrete test results
7. Asphalt test results (If Required)
8. Construction Staking

A. **Required Inspections:**

1. Subgrade prior to base work.
2. Street base prior to paving.
3. Form work for curb and gutters.

4. During start of paving operations.

5. Finished roadway to include core samples.

6. Final Inspection.

C. **Key Items Checked by Inspectors:**

1. Are all soil tests and compactions tests within prescribed limits?
2. When proof rolled with a loaded scraper or dump truck does the subgrade pump?
3. Has all unsuitable material been removed from the subgrade?
4. Has all vegetable matter been removed from the subgrade?
5. Have all utility lines been properly compacted?
6. Are all manholes, valves, and inlets at the proper elevation?
7. Do all water valve boxes have a 2' x 2' x 6" concrete pad (Asphalt Streets Only)?
8. Are curb forms a minimum of 6" high and 6" wide?
9. Is the street in the location and at the grade shown on the plans? And is the backside of the curb at least 12" deep?
10. Is the gutter at least 18" wide and the required thickness?
11. Are required wheelchair ramps formed into the curbs?
12. Does the concrete or asphalt delivered to the site conform to the accepted mix?
13. Is the concrete being placed at the thickness required on the plans?
14. Is the type of asphalt being placed at the thickness required on the plans?
15. Are expansion joints being placed at all intersections and radius points?
16. Are dowel bars and reinforcement placed as required by the plans?
17. Is the ground and air temperature within the limits for paving?
18. Is the asphalt above 225 degrees Fahrenheit and below 300 degrees Fahrenheit when placed?
19. Are proper placement procedures being followed?
20. Are there any areas on the finished street that do not properly drain?
21. Are saw joints placed at less than the maximum allowed for the paving thickness in the curb and gutter and the street?
22. Were all required cylinders pulled, checked by the accepted laboratory, and results of the tests given to the inspector?
23. Were required slump tests taken and results given to the inspector?

3003.5 STORM SEWERS

A. Submittals/Permits Required Prior to Construction:

1. Accepted Plans for Grading, Streets, Drainage, Water, and Sewer.
2. Earth Change Permit
3. Submittal for Piping, Manholes, Manhole Covers, Curb Inlets andGrates.
4. Concrete Mix Design
5. Testing Laboratory

B. Submittals Required During Construction:

1. Compaction Reports on Cuts in Street
2. Documentation on Materials Used
3. Construction Staking

C. **Required Inspections:**

1. Materials Prior to Installation
2. Location and Elevation
3. Backfilling Procedures
4. Manhole and Inlet Construction and Connections
5. Forms and Rebar Prior to Concrete Placement
6. Final Inspection

D. **Key Items Checked by Inspectors:**

1. Do materials have any cracks or broken parts?
2. Do materials comply with submittals?
3. Are storm drains located properly and on grade?
4. Is standard bedding material placed according to the Standard Drawings?
5. Is the pipe backfilled with required material over top of pipe?
6. Is standard bedding material used in streets and compacted to 95% density?
7. Are manhole joints properly sealed?
8. Are pipe joints properly sealed?
9. Are pipes properly grouted at manholes and inlets?
10. Are lift pin holes properly grouted?
11. Is the manhole lid ring properly grouted inside and out?
12. Are the curb inlets properly positioned and attached?
13. Is reinforcing steel properly sized and placed?
14. Are all grates and manhole lids in place?

15. Are all lines clean?

16. Do all lines flow properly?

17. Is there any ponding in the lines?

3003.6 IMPROVED DRAINAGE CHANNELS

A. Submittals/Permits Required Prior to Construction:

1. Accepted Plans for Grading, Streets, Drainage, Water, and Sewer.

2. Earth Change Permit

3. Concrete Mix (If Required)

4. Vegetative Cover

5. Erosion Control Plan

B. Submittals Required During Construction:

1. Concrete Mix Used

2. Construction Staking

C. Required Inspections:

1. Form Work Prior to Concrete Placement

2. Final Inspection

D. Key Items Checked by Inspectors:

1. Does the work comply with accepted plans?

2. Does the ditch conform to planned slope?

3. Are side slopes 3 to 1 or flatter?

4. Was reinforcement placed as called for in the plans?

5. Were side channels properly tied into the ditch?

6. Was rip-rap placed at under street structures (if required)?

7. Was the work area, that was not paved, properly seeded?

8. Was erosion control placed as required?

9. Does the ditch drain properly?

10. Are there areas where water ponds?

11. Were fill areas properly compacted?

3003.7 DETENTION FACILITIES

A. Submittals/Permits Required Prior to Construction:

1. Accepted Plans for Grading, Streets, Drainage, Water, and Sewer.
2. Environmental Impact Statement (if required)
3. Section 404 Permit from Corps of Engineers (if required)
4. Concrete Mix
5. Materials Used in Structure
6. Vegetative Control
7. Erosion Control
8. Earth Change Permit

B. Submittals Required During Construction:

1. Compaction Reports
2. Documentation on Materials Used
3. Construction Staking

C. Required Inspections:

1. Location and Elevation of Facility
2. Materials Prior to Installation
3. Backfilling Procedures
4. Forms and Reinforcement Prior to Concrete Placement
5. Final Inspection

D. Key Items Checked by Inspectors:

1. Do materials have any cracks or broken parts?
2. Do materials comply with submittals?
3. Is the drainage structure located properly and on grade?
4. Are proper backfilling and compaction procedures being used around the drainage structure?
5. Are pipe joints properly sealed?
6. Is reinforcing steel properly sized and placed?
7. Does the drainage structure flow properly?
8. Is the drainage structure clean, and is there any ponding inside the drainage structure?

9. Does the trickle channel flow properly?

10. Is the trickle channel properly located, and on the proper slope?

11. Does the work comply with accepted plans?

12. Was the work area, that was not paved, properly seeded?

13. Was erosion control placed as required?

14. Were fill areas properly compacted?

3003.8 GREENBELTS AND RESERVE AREAS

A. Submittals/Permits Required Prior to Construction:

1. Accepted Plans for Grading, Streets, Drainage, Water, and Sewer.

2. Drainage Construction Permit.

B. Submittals Required During Construction:

1. Landscape plans.

2. Landscape license agreement (If Required).

C. Required Inspections:

1. Preconstruction site inspection for tree size and condition and ground cover.

2. Final Inspection

D. **Key Items Checked by Inspectors:**

1. Is there trash or cut brush in the greenbelt or reserve area?

2. Is there vegetative cover over the ground surface of the greenbelt or reserve area?

3. Are there any drainage problems inside the greenbelt or reserve area?

4. Inspect for any specific improvements outlined on the plans for the subdivision.

3003.9 WATER LINES

A. Submittals/Permits Required Prior to Construction:

1. Accepted Plans for Grading, Streets, Drainage, Water, and Sewer.

2. Submittals for Pipe, Valves, Fire Hydrants, Valve Boxes, and Fittings.

3. Concrete Mix Design for Thrust Blocks

4. Testing Laboratory

5. Construction Permit from the City of Norman

6. Construction Permit for the State of Oklahoma

B. Submittals Required During Construction:

1. Documentation on Materials Used

2. Compaction Reports on Cuts in the Streets

3. Construction Staking

C. Required Inspections:

1. Materials Prior to Installation

2. Location and Elevation

3. Backfilling Procedures

4. Visual Inspection of All Valves, Fire Hydrants, Taps, and Bends Prior to Backfilling

5. Pressure and Testing and Sampling of the Completed Line: The steps below will be followed for pressure testing and sampling of a new water distribution line:

(a) City must flush the line of all dirt and air.

(b) The Contractor must add chlorine to sanitize the line.

(c) The City will bring the line up to a pressure of 150 PSI and the line must maintain that pressure for a period of 30 minutes with not more than a 5 PSI drop. If the line does not make the pressure test, then the contractor must repair the lines so that is will meet the test requirements. Following completion of the pressure test the Contractor should add additional chlorine if necessary to sanitize the line.

(d) City must flush the chlorine out of the line. Once the line is flushed the City will check the chlorine count to insure that it is in the range from 0 to 2.0 parts per million.

(e) The line will be allowed to set for a period of 48 hours without adding additional chlorine or flushing water through the system.

(f) The City will take water samples after the 48 hour period for two (2) consecutive days and turn in the samples for testing.

(g) If the samples from the line do not pass the City must flush the line and Contractor must add additional chlorine. Once this is done, the process of checking the line will start again at Paragraph 3001.9.C.5(d).

(h) If the samples in the line pass then the City will flush the line

completely and make sure that all valves area open.

D. Key Items Checked by Inspectors:

1. Does the pipe used in the project match the size and class in the submittals?

2. Do the fittings and fire hydrants match the materials accepted in the submittals?

3. Are the water lines being laid in the easement and at the required elevations?

4. Is standard bedding material or sand being placed according to Standard Drawing W 01?

5. Is a #12 copper wire being placed on the top of the PVC water pipe and connected to fire hydrants?

6. Are concrete thrust blocks being placed behind tees, fire hydrants, and bends (if required)?

7. Is ductile iron pipe, valves, and fittings being polywrapped properly?

8. Is the backfill in street areas being properly compacted and tested?

9. Are casings being placed under roads as required by the plans?

10. Are fire hydrants oil filled as required by City Specifications?

11. Are fire hydrants being placed at a height of 450 mm (18") minimum to 600 mm (24") maximum from ground level to the 113 mm ($4^1/_2$") steamer cap?

12. Can a meter wrench be placed on the valve, and is the valve box properly positioned?

13. Are all valves open?

14. Is a 2' x 2' x 6" concrete pad placed around all valve boxes?

15. Did the water line meet the pressure test requirements?

16. Were all sample points removed and backfilled?

17. Was the backfill of the water line in easement areas completed properly.

3003.10 SANITARY SEWERS

A. Submittals/Permits Required Prior to Construction:

1. Accepted Plans for Grading, Streets, Drainage, Water, and Sewer.

2. Submittals for Pipe, Manholes, Manhole Rings and Lids.

3. Concrete Mix

4. Construction Permit from City of Norman

5. Construction Permit from State of Oklahoma

B. Submittals Required During Construction:

1. Documentation on Materials Used

2. Compaction Reports on Cuts in Streets

3. Construction Staking

C. Required Inspections:

1. Material Prior to Installation

2. Location and Elevation

3. Backfilling Procedures

4. Mandrel

5. Pressure Test

(a) The Contractor must perform a pressure test on the line with the Inspector watching.

(b) The line must hold 4 PSI of air pressure for 7 minutes.

(c) Upon completion of the test the Contractor must remove all plugs from the line and replace the manhole covers.

6. Manhole Grouting Before Backfill

7. Taps Before Backfilling (If Required)

8. Grouting of Pipe flow lines inside Manholes

9. Final Inspection

D. Key Items Checked by Inspectors:

1. Does the pipe size and class match the submittals?

2. Are pipes broken or cracked?

3. Are the lines being laid at the proper elevation and in the easement?

4. Is pipe bedding and backfill per SS 01?

5. Is the line at least 3' below ground level?

6. Is the backfill in street cuts being properly compacted and tested?

7. In asphalt streets, is 4' x 4' x 8" concrete collar around manholes?

8. Are service taps stubbed to the surface and located accurately on as-builts?

9. Is cast iron or a brass plug placed on the stub out and fence or pipe post marker in place?

10. Are manholes, rings, and lids as specified in submittals?

11. Are manhole joints properly sealed?

12. Are lift pin holes properly grouted?

13. Are manhole lid rings properly grouted inside and out?

14. Are pipes properly grouted at flowline inside manholes?

15. Do manhole bottoms provide for free flow?

16. Are all lines and manholes clean?

17. Do all lines flow properly without ponding?

3003.11 LIFT STATIONS

A. Submittals/Permits Required Prior to Construction:

1. Accepted Plans for Grading, Streets, Drainage, Water, and Sewer.
2. Submittals for Pipe, Valves, and Fittings
3. Submittals for Electrical Gear and Pumps
4. Concrete Mix
5. Submittals for Structural Materials
6. Submittals for Force Main Pipe
7. Construction Permit from City of Norman
8. Construction Permit from State of Oklahoma

B. Submittals Required During Construction:

1. Documentation on Materials Used
2. Compaction Report on Cuts in Streets
3. Request for Telephone Line (If Required)
4. Request to Turn On Power to Station
5. Construction Staking

C. Required Inspections:

1. Materials Prior to Installation
2. Location and Elevation of Station and Force Main

3. Grouting of All Station Penetrations Before Backfilling

4. Force Main Pressure Test (Line to be tested at 1.5 times the working pressure)

5. Tie into Gravity Sewer Before Backfilling

6. Final Inspection

D. Key Items Checked by Inspectors:

1. Does the pipe size and class match the submittals?

2. Are materials in good condition and free of defects?

3. Is the force main at the proper elevation and location?

4. Are proper backfill and compaction procedures used?

5. Is the force main clean and free of obstructions?

6. Is the station at the proper location and elevation?

7. Is the wet well properly sealed to prevent I & I?

8. Are electrical controls positioned for easy access?

9. Are all safety guards in place?

10. Are fittings and valves properly restrained?

11. Is the emergency dialer programmed and tied in?

12. Do the float Switches operate properly?

13. Does the station operate properly?

14. Does the force main flow freely?

15. Was a #12 copper wire taped to the top of the forcemain and connected to the manhole ring?

3003.12 SIDEWALKS AND GENERAL SITE CONDITIONS

A. Submittals/Permits Required Prior to Construction:

1. Accepted Plans for Grading, Streets, Drainage, Water, and Sewer.

2. Concrete Mix Design

3. Testing Laboratory

4. Earth Change Permit

B. Submittals Required During Construction:

1. Documentation of Concrete Mix

2. Concrete Test Results

3. Construction Staking

4. Erosion Control

C. Required Inspections:

1. Forms and Reinforcement Prior to Placing Concrete

2. Erosion Control During Project

3. Construction Staking

4. Erosion Control

D. Key Items Checked by Inspectors:

1. Has unsuitable material been removed from sidewalk subgrade?

2. Is the sidewalk at least 4" thick and 4' wide?

3. Is reinforcement placed as called for in the plans?

4. Does the concrete conform to the submittal?

5. Are wheelchair ramps placed as required?

6. Are expansion joints placed at less than 30'?

7. Are sawed joints placed at 5’ or less?

8. Is the proper finish being placed on the sidewalk?

9. Is the sidewalk in the proper location?

10. Is erosion control being used properly?

11. Is the site clean and trash free?

12. Have all brush piles been removed and disposed of properly?

13. Is construction debris properly disposed of?

14. Does the site entrance have the required structure?

3003.13 WATER LINE TEST - ALLOWABLE LEAKAGE CHART

No pipe installation shall be accepted if the leakage is greater than that determined by the following formula:

$$L = .0000075\ SDP^{1/2}$$

Where:
L = Allowable leakage in gallons per hour
S = Length of pipe tested in feet.
D = Nominal diameter of pipe in inches.

P = Average test pressure during the leakage test, in pounds per square inch (gauge).

Allowable Leakage Per 1,000 Feet of Pipe in Gallons Per Hour

	Nominal Pipe Diameter (Inches)										
P(PSI)	4	6	8	10	12	16	24	36	42	48	54
350				1.40	1.69	2.25	3.37	5.06	5.90	6.74	7.58
300				1.30	1.56	2.08	3.12	4.68	5.46	6.24	7.02
275				1.24	1.49	1.99	2.99	4.48	5.23	5.98	6.72
250				1.19	1.42	1.90	2.85	4.27	4.99	5.70	6.41
225				1.13	1.35	1.80	2.70	4.05	4.73	5.41	6.03
200				1.06	1.28	1.70	2.55	3.82	4.46	5.09	5.73
175	0.40	0.59	0.80	0.99	1.19	1.59	2.38	3.58	4.17	4.77	5.36
150	0.37	0.55	0.74	0.92	1.10	1.47	2.21	3.31	3.86	4.41	4.97
125	0.34	0.50	0.67	0.84	1.01	1.34	2.01	3.02	3.53	4.03	4.53
100	0.30	0.45	0.60	0.75	0.90	1.20	1.80	2.70	3.15	3.60	4.05
95	0.29	0.44	0.58	0.73	0.88	1.17	1.76				
90	0.02	0.03	0.04	0.05	0.06	0.08	0.13				
85	0.001	0.002	0.003	0.004	0.004	0.006	0.009				
80	0.0001	0.0002	0.0002	0.002	0.003	0.004	0.0006				
75	0.00001	0.00001	0.00001	0.00002	0.00002	0.00003	0.00004				

END OF SECTION 3000

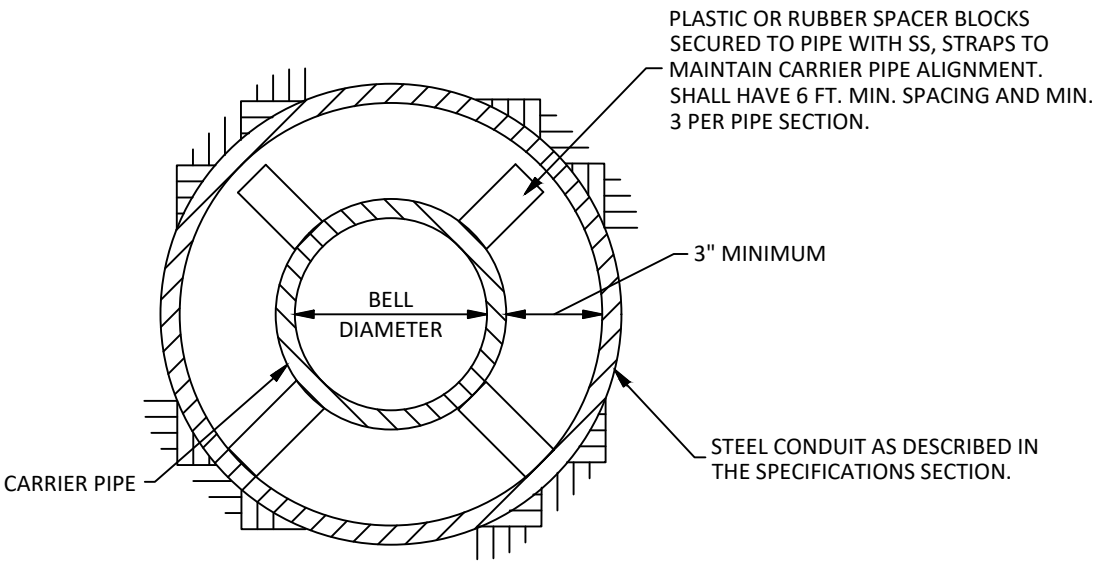
Section 4000 Construction Drawings

February 2, 2023

City of Norman
STANDARD SPECIFICATIONS AND CONSTRUCTION DRAWINGS

SECTION 4000 CONSTRUCTION DRAWINGS

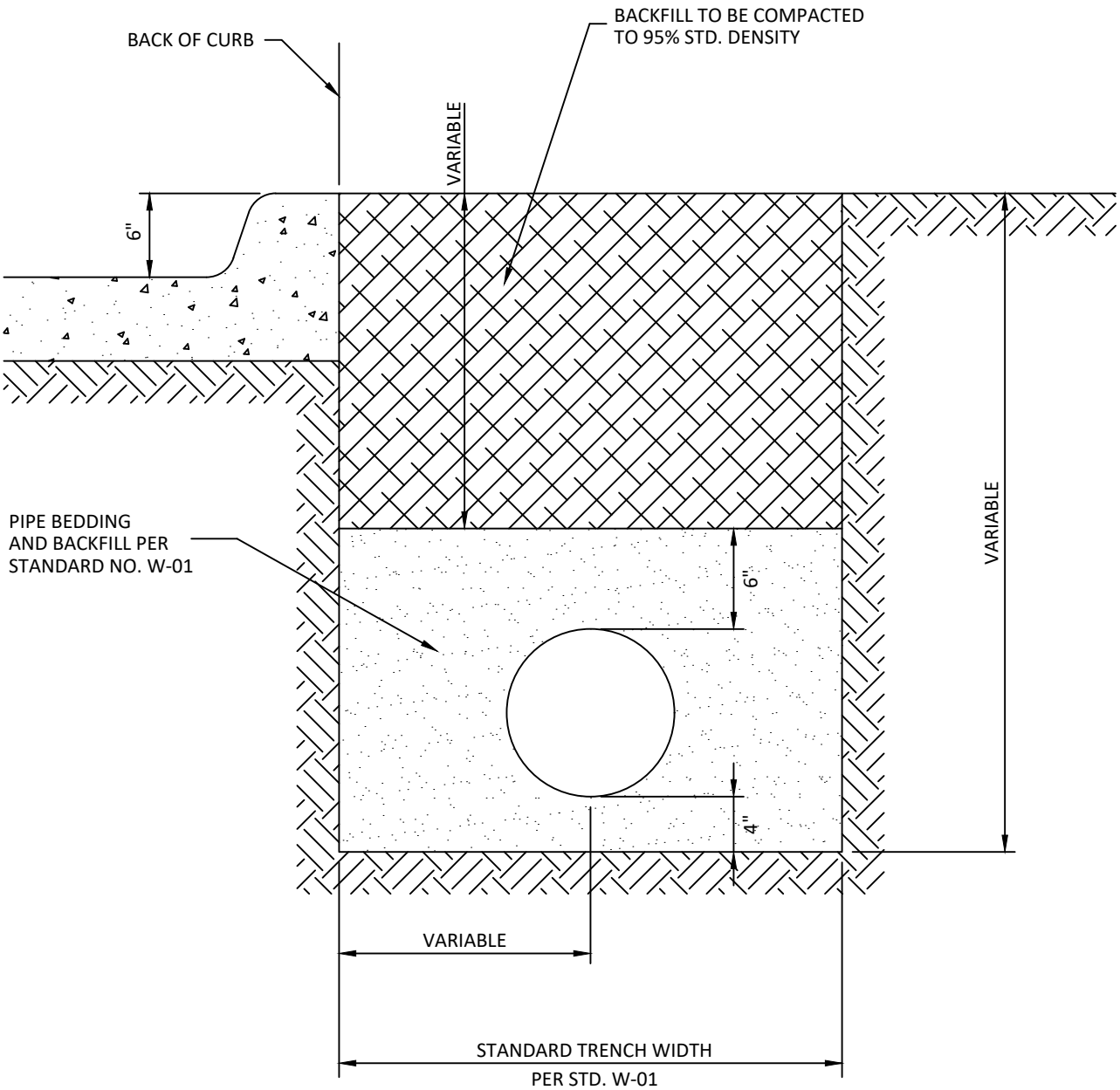
Standard Recessed Curb Inlet	SD 16	109
Standard Drop Inlet 15”, 18”, and 24”	SD 17	110
Standard Drop Inlet 30”, 36”, and 42” with no Access Manhole	SD 18	111
Standard Drop Inlet 48” Pipe	SD 19	112
Standard Three Way Drop Inlet 48” Pipe	SD 20	113
Recessed Curb Inlet A	SD 21a	114
Recessed Curb Inlet B	SD 21a	115



PIPE & STEEL CONDUIT SCHEDULE	
CARRIER PIPE DIAMETER IN.	MIN. CONDUIT DIAMETER IN.
4	10
6	12
8	14
10	18
12	20
16	24
18	26
20	30
24	33
30	40
36	54
42	60

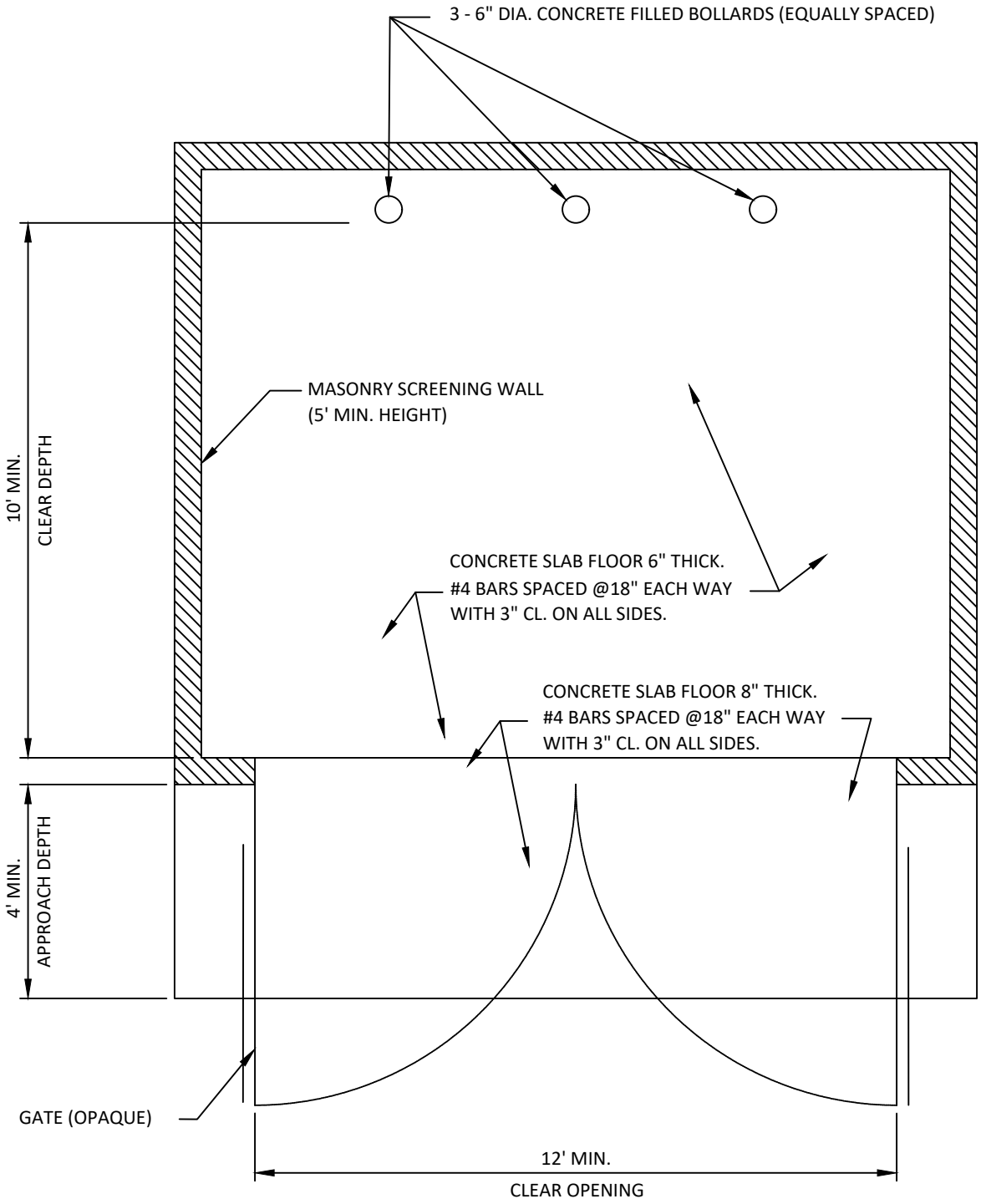
BORING AND CONDUIT

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. GC 01



TRENCH ADJACENT TO ROADWAY

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. GC 02

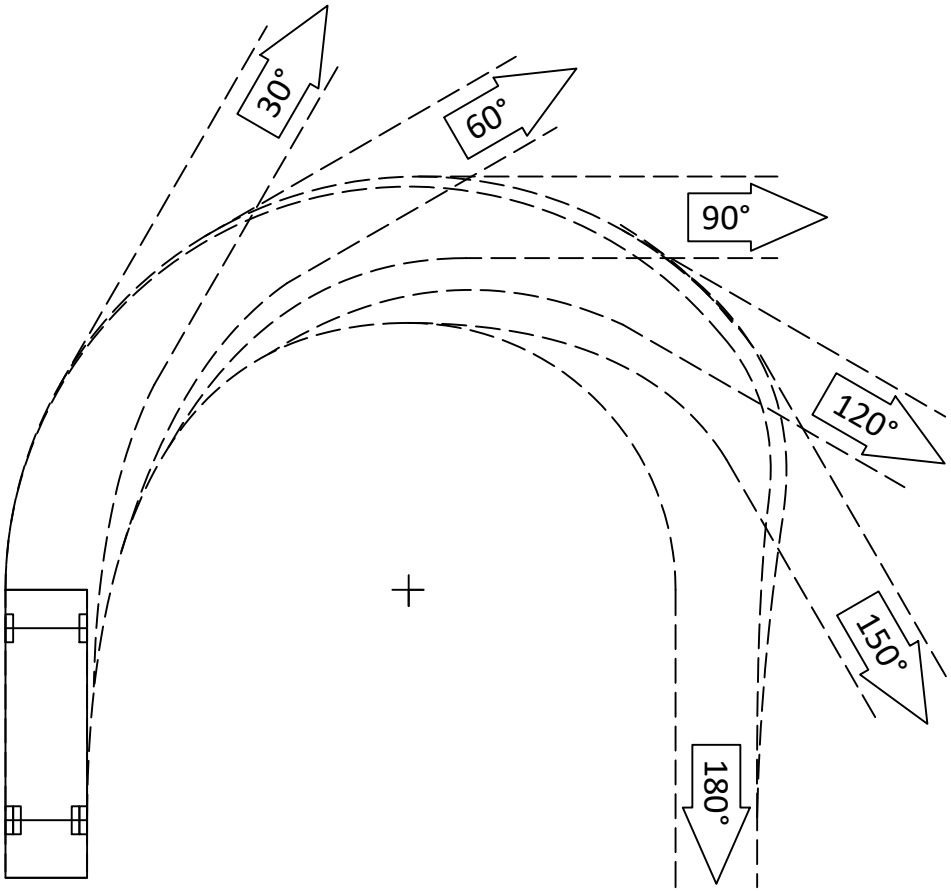


NOTES:

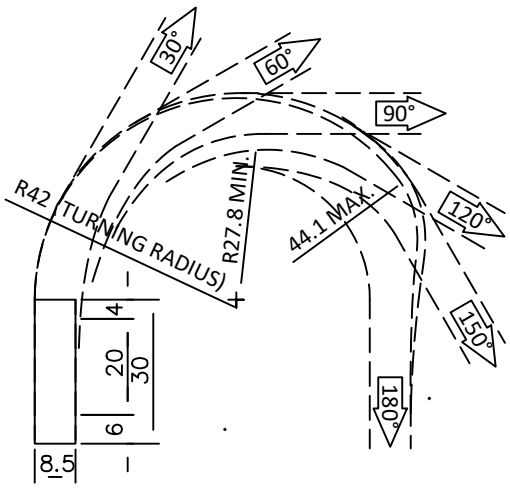
1. FOUNDATION SHALL COMPLY WITH CURRENT CITY OF NORMAN BUILDING CODE DESIGN.
2. SCREENING MUST BE BUILT OF MASONRY.
3. HEIGHT OF SCREENING SHALL BE 1-FOOT ABOVE HEIGHT OF CONTAINER WITH A MINIMUM HEIGHT OF 5-FOOT.
4. GATES MUST BE OPAQUE AND HAVE A PERMANENT HOLD OPEN DEVICE.
5. AN UNOBSTRUCTED OVERHEAD CLEARANCE OF 22-FEET IS REQUIRED.
6. SEE STANDARD GC-04 FOR TURNING RADII OF SANITATION VEHICLES.

SOLID WASTE CONTAINER ENCLOSURE

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. GC 03



SCALE: 1"=20'



SCALE: 1"=40'

FROM THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS; "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS"; 1990: SINGLE UNIT TRUCK DESIGN VEHICLE

SANITATION TRUCK TURNING RADIUS

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
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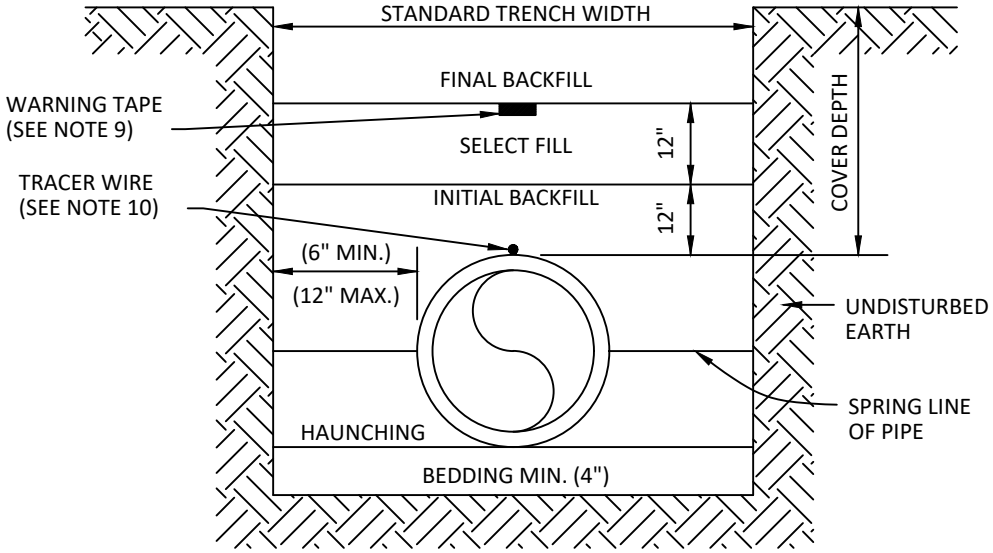
NOMINAL PIPE INSIDE DIAMETER IN.	STANDARD TRENCH WIDTH IN.
6	18
8	24
10	30
12	30
15	36
18	36
21	42
24	42
27	48
30	48
36	54
42	60
48	66



TRENCHING MATERIALS				
BACKFILL DESCRIPTION	NON-PAVED AREAS		PAVED AREAS (SEE NOTE 8)	
	PVC	DUCTILE IRON	PVC	DUCTILE IRON
FINAL BACKFILL	EXCAVATED MATERIAL	EXCAVATED MATERIAL	SBM	SBM
SELECT BACKFILL	SELECT FILL	SELECT FILL	SBM	SBM
INITIAL BACKFILL	SAND	SAND	SAND	SAND
HAUNCHING	SAND	SAND	SAND	SAND
BEDDING	SEE NOTE 5	SEE NOTE 5	SEE NOTE 5	SEE NOTE 5

NOTES:

1. INSTALLATION AND BACK FILLING SHALL MEET MANUFACTURER'S RECOMMENDATIONS.
2. SELECT FILL CONSISTS OF EXCAVATED MATERIALS CONTAINING NO ROCKS LARGER THAN 2-INCHES.
3. STANDARD BACKFILL MATERIAL (SBM) SHALL CONFORM TO ODOT 703.01, TYPE A AGGREGATE BASE, RECYCLED CONCRETE, OR FLOWABLE FILL PER ODOT SECTION 701.19.
4. COMPACTION REQUIREMENTS:
   A. NON-PAVED AREAS: 90% MAXIMUM STANDARD PROCTOR DENSITY FOR COHESIONLESS SOILS AND 85% FOR COHESIVE SOILS.
   B. PAVED AREAS: 95% MAXIMUM STANDARD PROCTOR DENSITY FOR COHESIONLESS SOILS.
5. IF TRENCH IS DRY, BEDDING SHALL BE 4-INCH SAND odot 703.06, CLASS C. IF WET, MATERIAL SHALL BE 4-INCH NO. 57 OR 67 ROCK PER SECTION 701.06.
6. IN SANDY SOIL, CONTRACTOR MAY BACKFILL WITH NATIVE SANDY MATERIAL.
7. WITH APPROVAL FROM ENGINEER, WATER JETTING MAY BE ALLOWED IN OPEN TRENCHING, BUT NOT UNDER PROPOSED PAVEMENT.
8. THE BACKFILL MATERIAL SHALL EXTEND A MINIMUM OF 2-FEET BEHIND THE BACK OF CURB, OR THE EDGE OF PAVEMENT WHERE NO CURB EXISTS.
9. 3- OR 4-INCH WIDE BLUE METALLIC WARNING TAPE SHALL BE INSTALLED APPROXIMATELY 18- TO 24-INCHES ABOVE ALL WATERLINE PIPE.
10. TRACER WIRE SHALL BE #12 AWG SOLID COPPER WIRE WITH 30 MIL HDPE COATING. (SEE "H" IN SPECIAL PROVISIONS)
11. ONE (1) CLAY PIPE PLUG OR WATER DAM IS REQUIRED EVERY 400-FEET ALONG WATER LINE. CLAY DAM SHALL BE FULL WIDTH OF THE TRENCH, 5-FEET LONG, AND EXTEND A MINIMUM OF 24-INCHES ABOVE THE TOP OF THE WATER LINE.

WATER PIPE TRENCHING AND BEDDING

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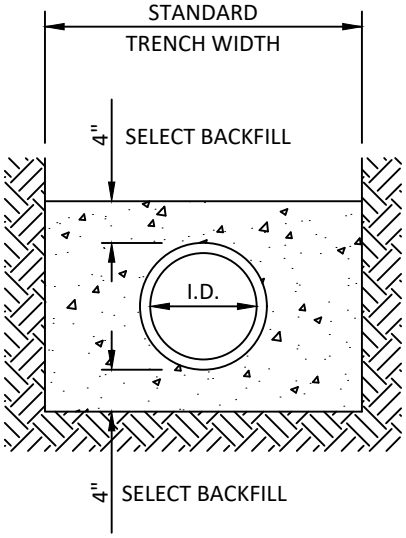

CONCRETE ENCASEMENT

PIPE INSIDE DIAMETER IN.	STANDARD TRENCH WIDTH IN.	CONCRETE ENCASEMENT VOLUME CF/LF
6	18	1.55
8	24	2.32
10	30	3.20
12	30	3.38
15	36	4.52
18	36	4.73
21	42	6.05
24	42	6.19
27	48	7.69
30	48	7.76
36	54	9.43
42	60	11.21
48	66	13.10

CONCRETE ENCASEMENT

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
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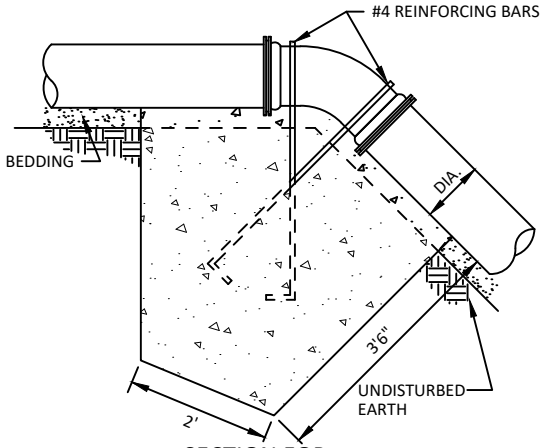
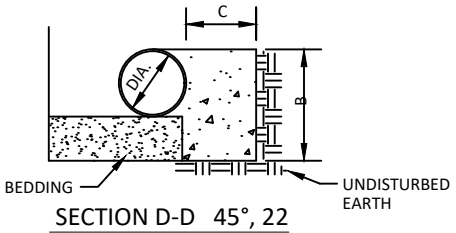
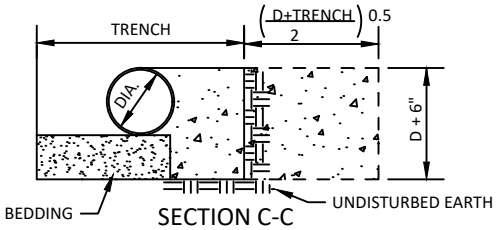


SECTION FOR VERTICAL BENDS
45°, 22 1/2°, 11 1/4°
(14" OR SMALLER)

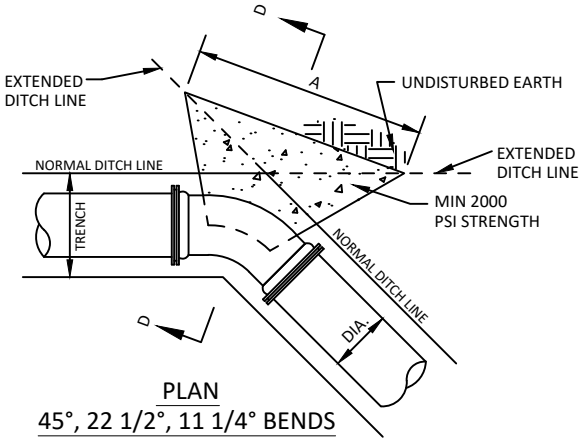
NOTE:
1. THRUST BLOCKS SHALL BE POURED SO THAT ALL FITTING BOLTS & NUTS REMAIN CLEAR AND ACCESSIBLE.
2. CONCRETE SHALL BE 3,500 PSI MIN.
3. THRUST BLOCKS ARE NOT REQUIRED ON T-FITTINGS FOR FIRE LINES.



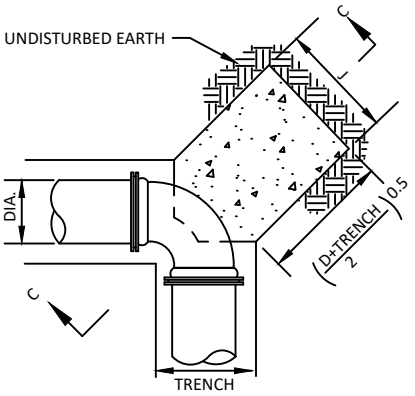
SECTION D-D 45°, 22 1/2°, 11 1/4° BENDS



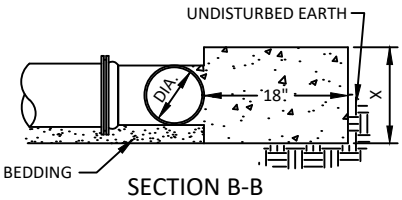
SECTION C-C
90° BENDS



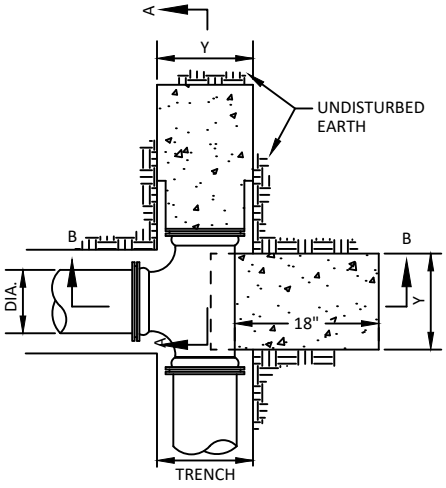
PLAN
45°, 22 1/2°, 11 1/4° BENDS



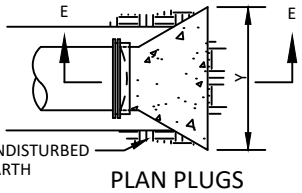
PLAN 90°
BENDS



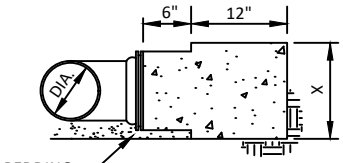
SECTION B-B
TEES



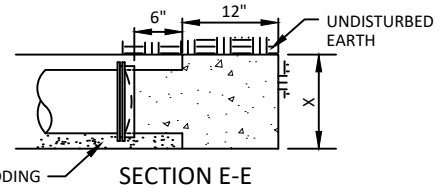
PLAN TEES



PLAN PLUGS



SECTION A-A
TEES



SECTION E-E
PLUGS

DIMENSIONS FOR CONCRETE THRUST BLOCKS

PIPE	TRENCH	45° BEND			22 1/2° BEND			11 1/4° BEND			TEE OR PLUG		90° BEND
DIA.	WIDTH	A	B	C	A	B	C	A	B	C	X	Y	J
36	54	7'-0"	3'-0"	2'-6"	6'-0"	3'-0"	2'-6"	6'-0"	3'-0"	2'-6"	3'-4"	4'-0"	6'-5"
30	48	5'-6"	2-6"	2'-0"	4'-6"	2'-6"	2'-0"	4'-6"	2'-6"	2'-0"	3'-0"	3'-6"	5'-8"
24	42	3'-9"	2'-6"	1'-10"	2'-6"	2'-6"	1'-1"	2'-0"	2'-6"	1'-0"	3'-0"	3'-3"	4'-9"
20	36	2'-9"	2'-2"	1'-8"	2'-0"	2'-2"	1'-1"	2'-0"	2'-2"	0'-11"	2'-0"	3'-0"	4'-1"
18	36	2'-3"	2'-0"	1'-6"	2'-0"	2'-0"	1'-1"	2'-0"	2'-0"	0'-11"	2'-0"	2'-3"	3'-9"
16	36	2'-0"	1'-10"	1'-5"	2'-0"	1'-10"	1'-1"	2'-0"	1'-10"	0'-11"	2'-0"	1'-6"	3'-6"
12	30	2'-0"	1'-6"	1'-4"	2'-0"	1'-6"	1'-0"	2'-0"	1'-6"	0'-11"	2'-0"	1'-0"	3'-0"
10	30	2'-0"	1'-4"	1'-4"	2'-0"	1'-4"	1'-0"	1'-10"	1'-4"	0'-11"	1'-8"	1'-0"	2'-8"
8	24	2'-0"	1'-2"	1'-4"	1'-10"	1'-2"	1'-0"	1'-8"	1'-2"	0'-11"	1'-6"	0'-10"	2'-4"
6	18	2'-0"	1'-1"	1'-4"	1'-8"	1'-1"	1'-0"	1'-6"	1'-0"	0'-11"	1'-4"	0'-8"	2'-1"

THRUST BLOCKS

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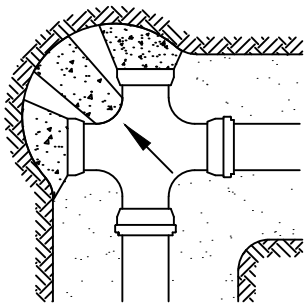
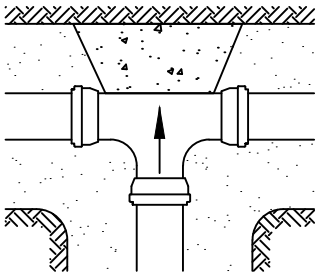
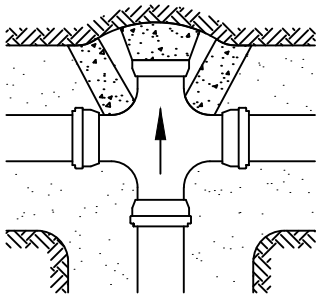


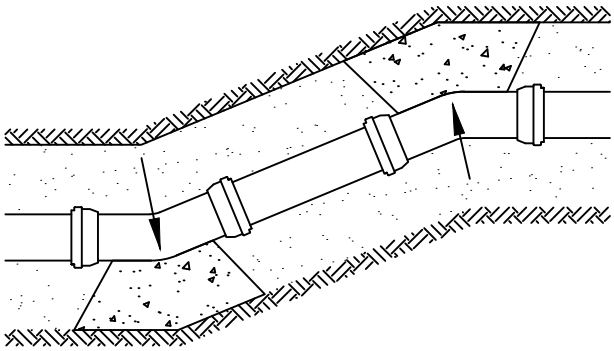
HORZ. CROSS W/2 PLUGS



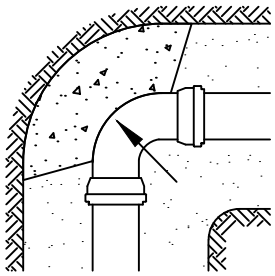
HORZ. TEE



HORZ. CROSS W/1 PLUG



HORZ. 11.25, 22.50 & 45 DEGREE BENDS



HORZ. 90 DEGREE BENDS

HORIZONTAL AND DOWNWARD THRUST

THE FOLLOWING PROCEDURE SHALL BE USED TO ARRIVE AT THE AREA OF THRUST BLOCKING REQUIRED FOR DISTRIBUTION OF HORIZONTAL AND DOWNWARD THRUST TO UNDISTURBED SOIL:

A. USE TEST PRESSURE OF 150 PSI OR AS DETERMINED BY THE ENGINEER.
B. MULTIPLY PRESSURE OBTAINED FROM STEP A BY THE VALUE SHOWN IN TABLE 1 FOR THE APPROPRIATE FITTING AND PIPE SIZE. THIS IS THE TOTAL THRUST IN POUNDS AT THE FITTING.
C. USE TABLE 2 TO DETERMINE THE BEARING STRENGTH OF THE SOIL AT THE SPECIFIC LOCATION.
D. DIVIDE THE THRUST OBTAINED FROM STEP B BY THE BEARING STRENGTH OF THE SOIL OBTAINED FROM STEP C IN ORDER TO ARRIVE AT THE AREA REQUIRED FOR THRUST BLOCKING IN SQUARE FEET. THIS AREA IS THE MINIMUM SURFACE AREA THAT WILL BE IN CONTACT WITH UNDISTURBED SOIL.
E. THRUST BLOCKS MAY BE USED IN LIEU OF MECHANICAL RESTRAINTS "MEGALUGS" FOR 4- TO 8-INCH WATERLINE CONSTRUCTION ONLY. IF MECHANICAL RESTRAINTS "MEGALUGS" ARE USED, THRUST BLOCKS ARE NOT REQUIRED FOR 4- TO 8-INCH MAINS. FOR 12-INCH AND LARGER MAINS, THRUST BLOCKS ARE REQUIRED ALONG WITH "MEGALUGS".
F. CONTRACTOR HAS THE OPTION OF PLACING THRUST BLOCKING ALONG WITH MECHANICAL RESTRAINTS "MEGALUGS", IF SO DESIRED.
G. SEE STANDARD DRAWING W04 FOR MECHANICAL "BELL RESTRAINT" JOINT REQUIREMENTS.

TABLE 1
THRUST PER 1 PSI OF WATER PRESSURE AT VARIOUS FITTINGS (LBS)

PIPE SIZE (IN.)	DEAD END, TEE OR FH	90° ELBOW	45° ELBOW	22 ½° ELBOW
4	19	27	15	7
6	39	55	30	15
8	67	94	51	26
10	109	154	84	43
12	155	218	119	61
14	210	296	161	82
16	272	383	209	106
18	351	494	269	137
20	434	611	333	169
24	623	878	478	244

TABLE 2
BEARING STRENGTH OF SOILS

SOILS AND SAFE BEARING LOADS	LBS. PER SQ. FT.
SOUND SHALE	10,000
CEMENTED GRAVEL AND SAND (DIFFICULT TO PICK)	4,000
COARSE AND FINE COMPACTED SAND	3,000
MEDIUM CLAY (CAN BE SPADED)	2,000
SOFT CLAY	1,000
MUCK	0

MINIMUM THRUST BLOCK REQUIREMENT
(MINIMUM SURFACE AREA IN CONTACT WITH UNDISTURBED SOIL AT THE LOCATION INDICATED.)

NOTE:
1. FITTINGS WHERE THRUST BLOCKS ARE REQUIRED SHALL BE WRAPPED WITH POLY WRAP PRIOR TO PLACING CONCRETE. THRUST BLOCKS SHALL BE FORMED & POURED SO THAT TEE, BOLTS, AND NUTS REMAIN ACCESSIBLE. CONCRETE SHALL BE 3,500 PSI (MIN.).

THRUST BLOCKS CONT.

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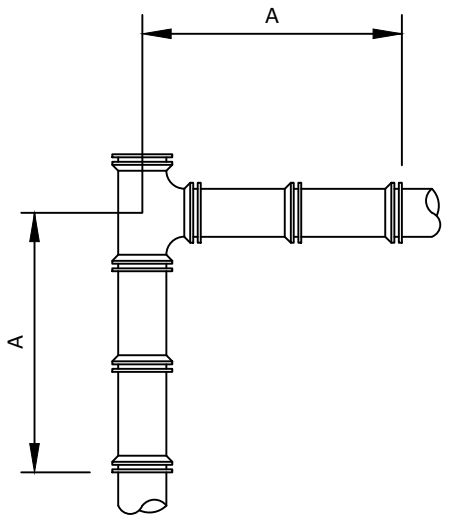

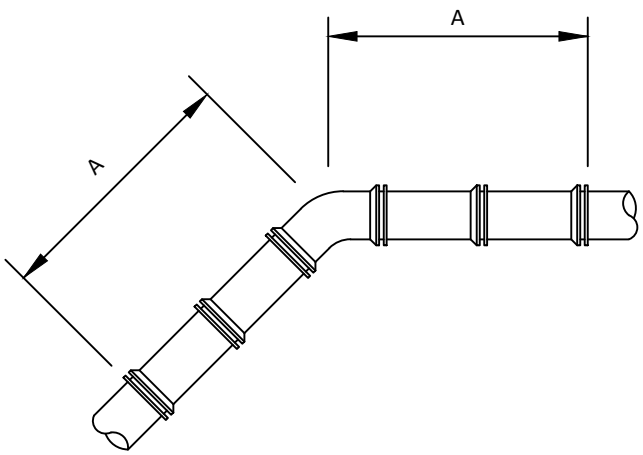

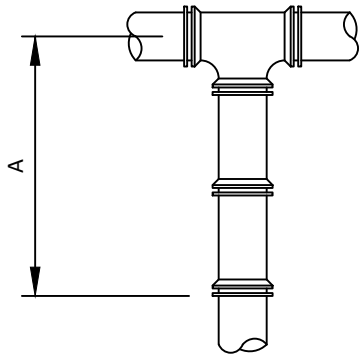

NOTES:

1. THE LENGTHS OF PVC DR18 PIPE WITH RESTRAINED JOINTS ARE BASED ON A COMPACTED SAND SURROUNDING THE PIPE WITH 3'-6" OF COVER.
2. ALL PIPE 12-INCHES AND LARGER SHALL HAVE MECHANICAL JOINT RESTRAINTS INSTALLED WITH ALL FITTINGS EXCEPT FOR "IN-LINE" FITTINGS SUCH AS SOLID SLEEVES. THE CONTRACTOR HAS THE OPTION ON 6- AND 8-INCH WATER LINE CONSTRUCTION TO USE THRUST BLOCKS PER STANDARD DRAWING W-03 IN-LIEU OF MECHANICAL JOINT RESTRAINTS.
3. MECHANICAL BELL/JOINT RESTRAINTS SUCH AS EBAA 1900 SPLIT SERRATED RESTRAINT HARNESS OR STAR PVC STARGRIP SERIES 4400 OR APPROVED EQUAL.
4. DIP THRUST RESTRAINT DESIGN MUST BE APPROVED BY THE UTILITIES ENGINEER.

RUN	RESTRAINT LENGTH "A"				
SIZE	TEE & PLUG	90° BEND	45° BEND	22-1/2" BEND	11-1/4" BEND
IN.	FT.	FT.	FT.	FT.	FT.
6	12	17	10	6	3
8	16	22	13	8	4
10	19	27	16	9	5
12	23	32	19	11	6
14	26	36	21	12	7
16	29	41	24	14	8
18	32	45	26	15	8
20	35	50	29	16	9
24	41	58	34	19	10
30	50	70	40	22	12
36	58	82	46	26	14
42	66	93	52	29	15

(LENGTH REQUIRED FOR RESTRAINING JOINTS)

RESTRAINED JOINTS

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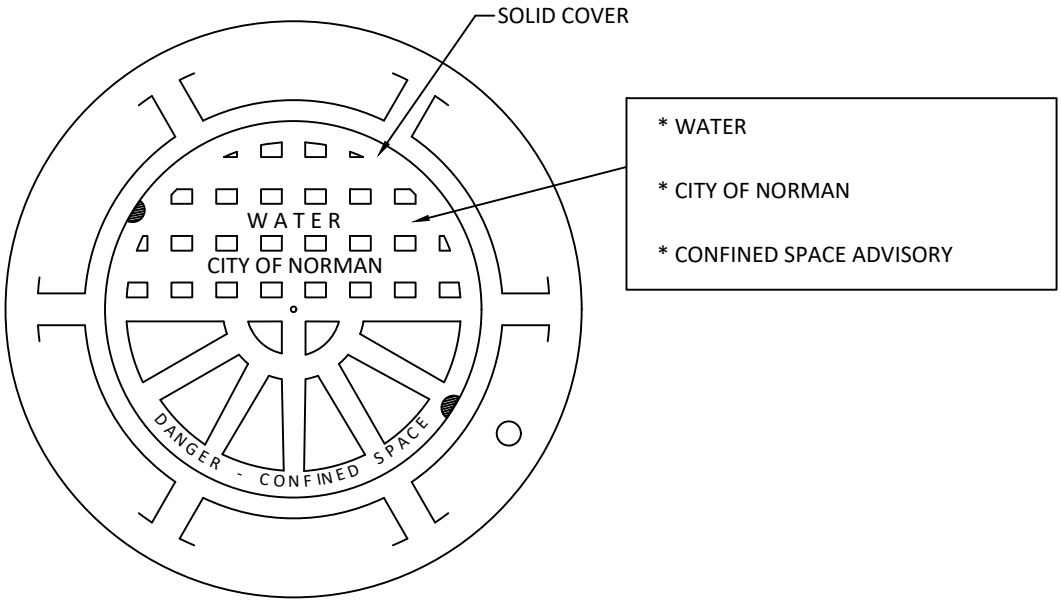
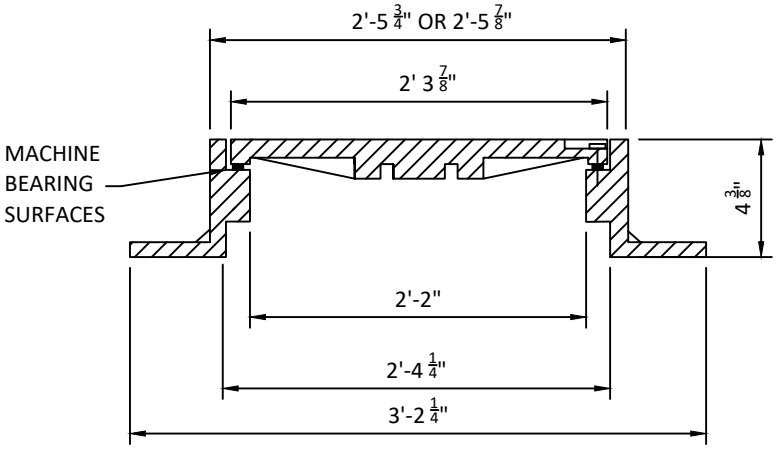


PLAN



SECTION

NOTE:

1. ACCEPTABLE UNITS:
   A. NEENAH NO. R-1682
   B. EJI NO. 210 OR APPROVED EQUAL
2. REVIEWING AUTHORITY MAY REQUIRE LARGER OPENING OR RECTANGULAR HATCH AS NEEDED TO ACCESS INTERNAL COMPONENTS.

WATER VAULT FRAME AND COVER

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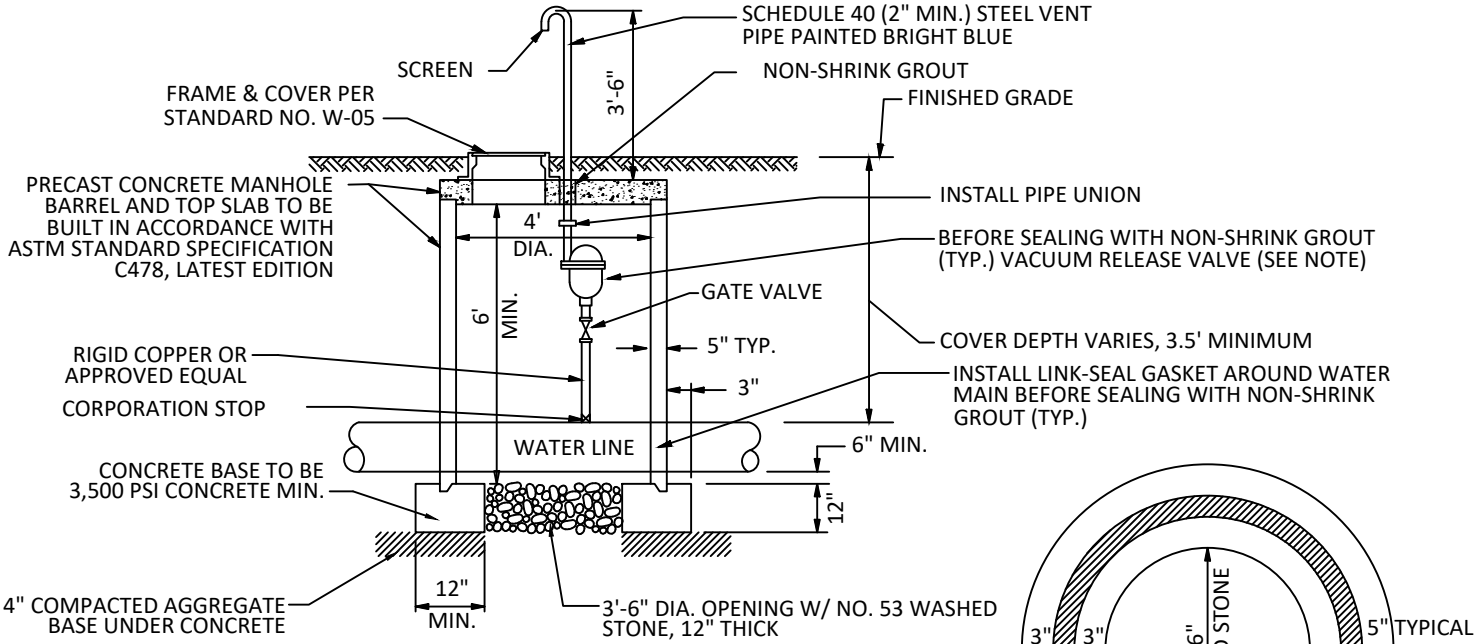
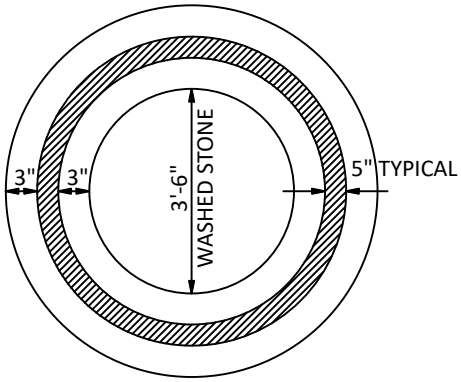
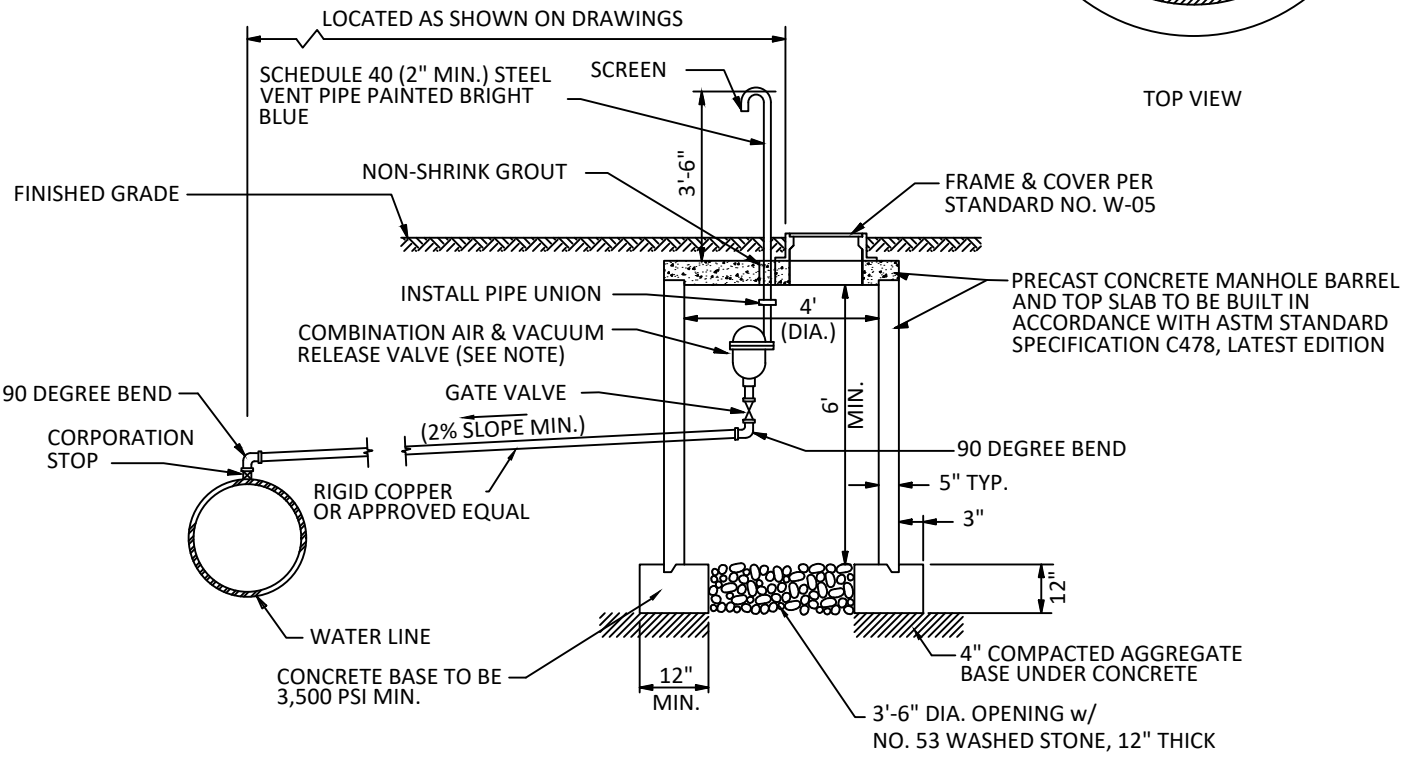


VAULT DIRECTLY OVER MAIN



TOP VIEW



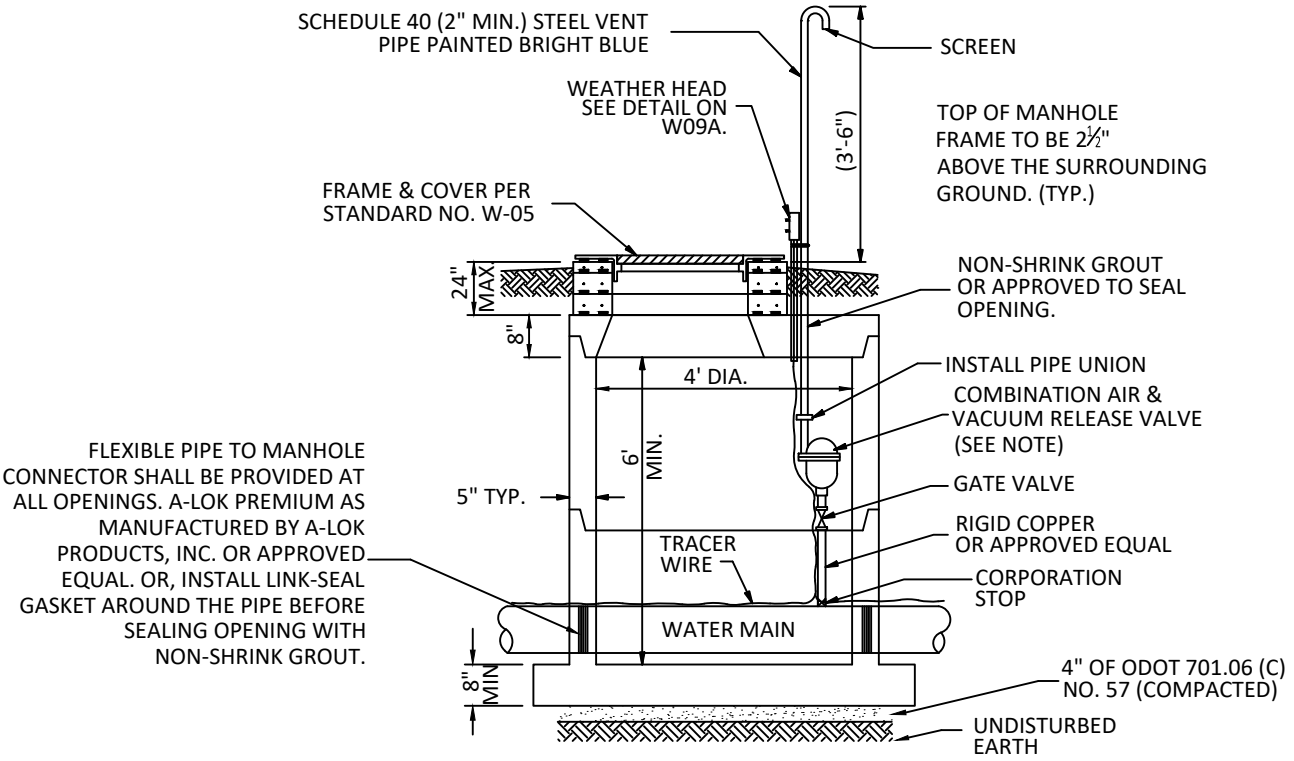
VAULT OFFSET FROM MAIN

NOTES:

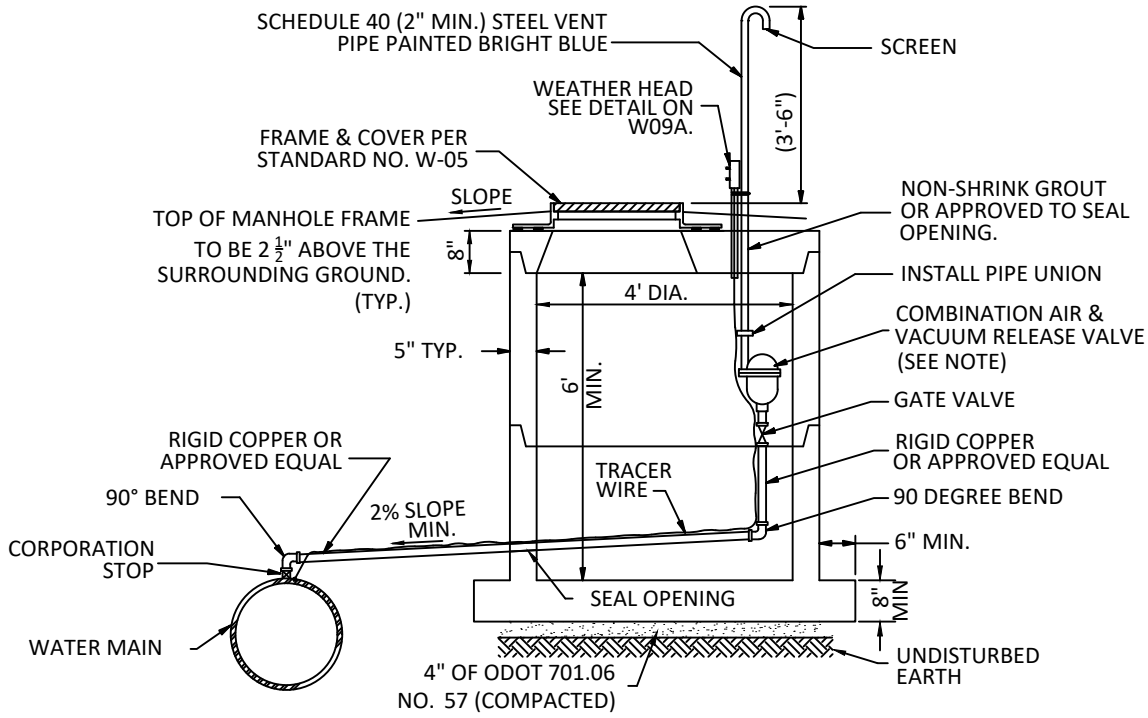
1. COMBINATION ARV SHALL BE VAL-MATIC MODEL 101S, 102S, 103S; CLA-VAL 36 SERIES; OR APPROVED EQUAL. SIZE SHALL BE PER ENGINEER

1" & 2" WATER AIR RELIEF VALVE & VAULT

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 02	DRAWING NO. W 06



VAULT DIRECTLY OVER MAIN



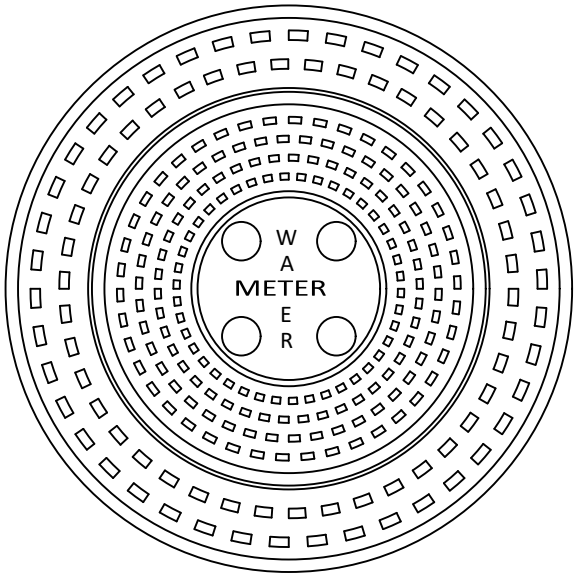
VAULT OFFSET FROM MAIN

NOTES:

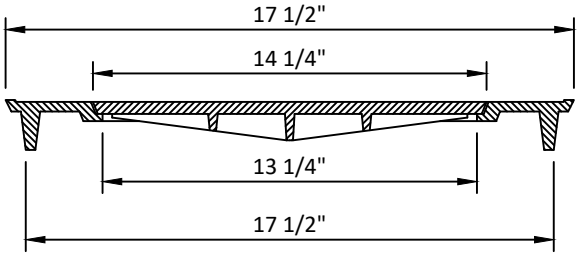
1. COMBINATION ARV SHALL BE VAL-MATIC MODEL 101S, 102S, 103S; CLA-VAL 36 SERIES; OR APPROVED EQUAL. SIZE SHALL BE PER ENGINEER.
2. PRECAST CONCRETE MANHOLE BOTTOM BARREL SECTION & FLAT TOP TO BE BUILT IN ACCORDANCE WITH ASTM STANDARD SPECIFICATION C478, LATEST EDITION
3. MANHOLE FRAME TO BE SECURED AND SEALED TO MANHOLE WITH MASTIC SEALANT (RAM-NECK).
4. MANHOLE FRAME CAN BE INVERTED INSIDE MANHOLE IF POSSIBLE.
5. 2- OR 4-INCH REINFORCED CONCRETE ADJUSTMENT RINGS MAY BE USED AS NEEDED. RINGS SHALL BE SECURED & SEALED TO MANHOLE WITH MASTIC SEALANT (RAM-NECK).

WATER AIR RELIEF VALVE & VAULT

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 06A



TOP VIEW
(SMALL METER ONLY)



SECTION VIEW
(SMALL METER ONLY)

	WEIGHT
LID	(19 LBS)
RING	(12 LBS)
SET	(31 LBS)

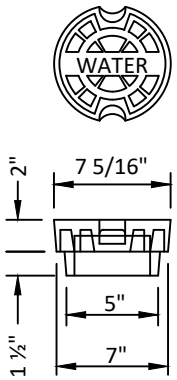
(SMALL METER ONLY)

NOTE:

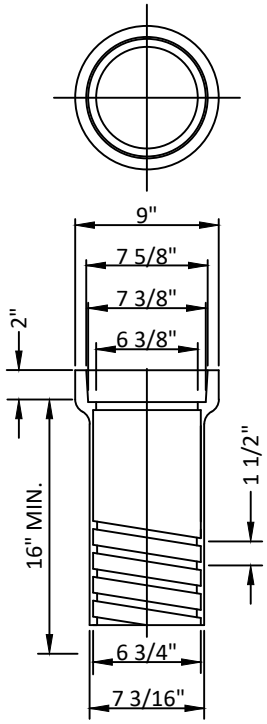
1. SMALL METER BOX (3/4" METER): COVER TO BE "OLD CASTLE" CARSON MODEL 2200 CAST IRON WITH LOCKING DEVICE OR EQUAL. CAST IRON COVER SHALL INDICATE WATER METER IN THE CASTING.
2. MEDIUM METER BOX (1 1/2" METER): COVER TO BE "OLD CASTLE" CARSON MODEL 1324 HDPE FLUSH MOUNT WITH CAST IRON READER DOOR AND LOCKING DEVICE OR EQUAL.
3. LARGE METER BOX (2" METER): COVER TO BE "OLD CASTLE" CARSON MODEL 1730 HDPE FLUSH MOUNT WITH CAST IRON READER DOOR AND LOCKING DEVICE OR EQUAL.

WATER METER FRAME & LID

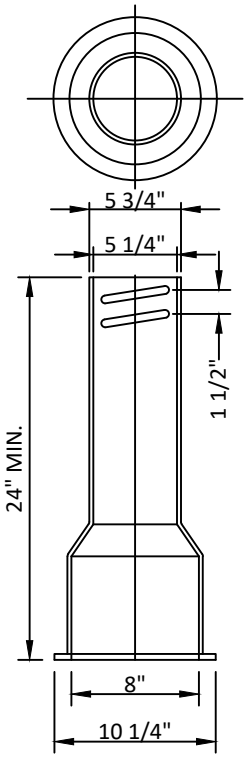
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 07



LID



TOP



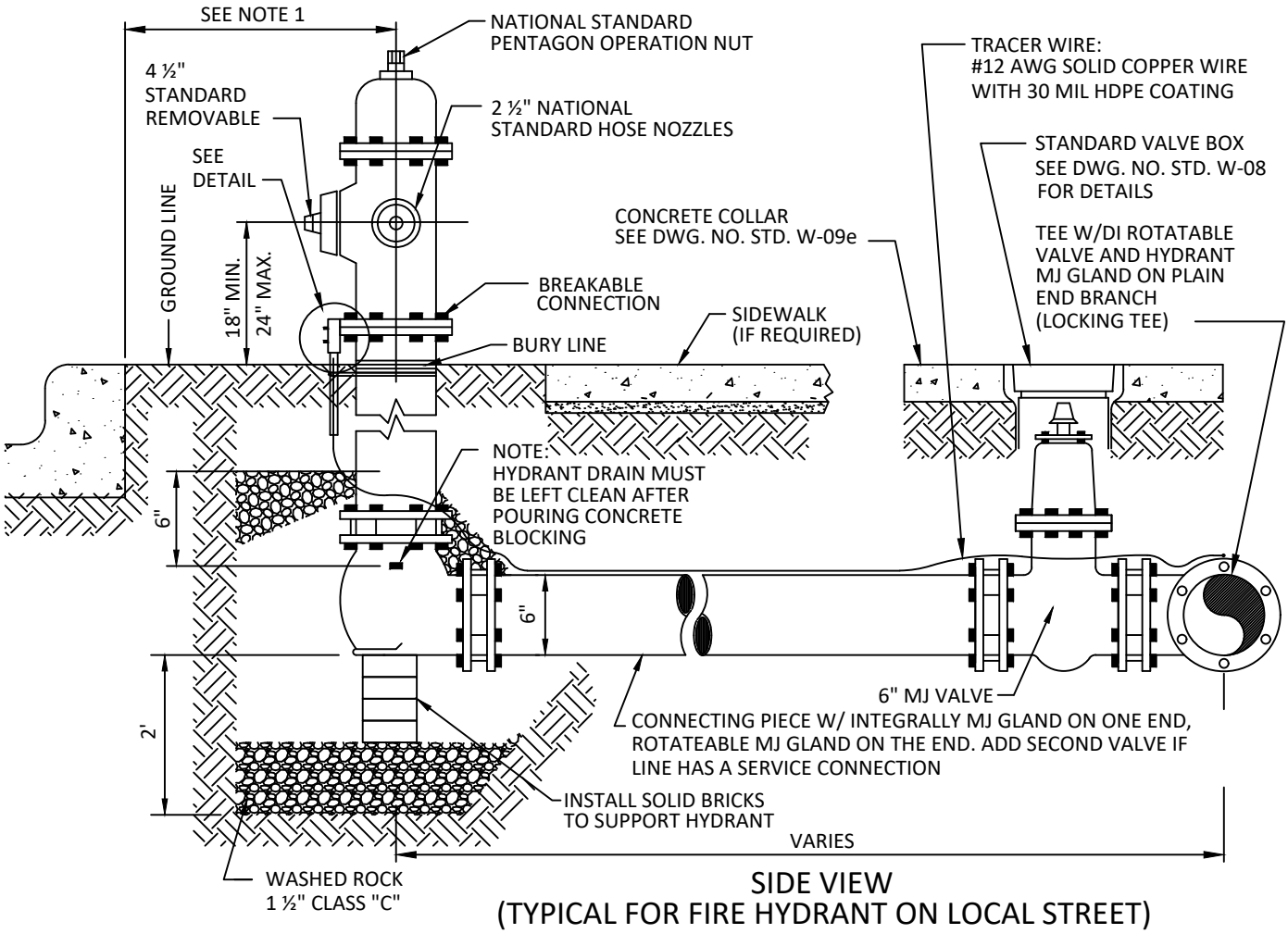
BOTTOM

NOTES:

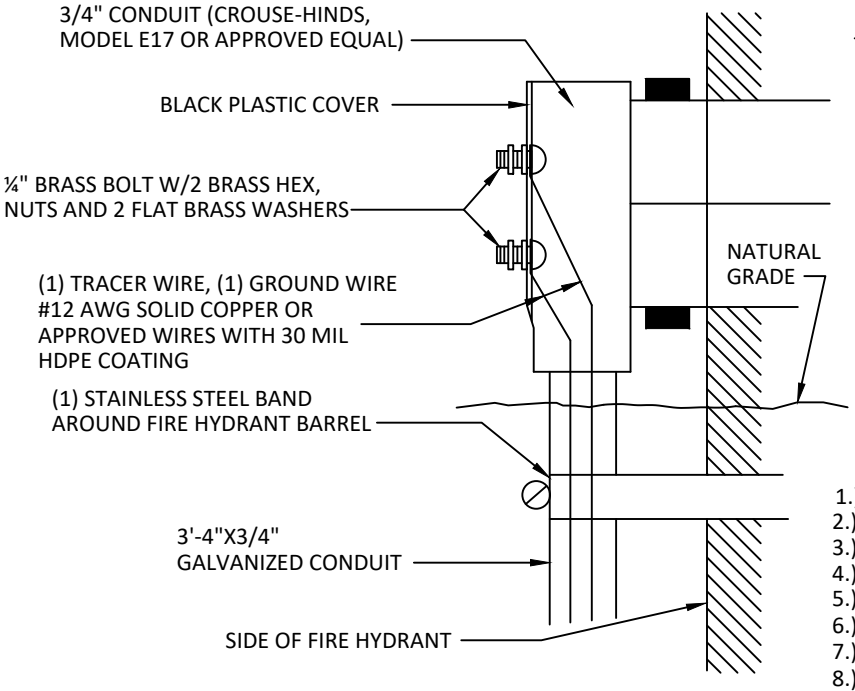
1. CONTRACTOR TO PLACE TYPE A OR TYPE B CONCRETE GRADE RING AROUND EACH WATER LINE VALVE BOX AFTER FINAL GRADING HAS BEEN COMPLETED AND TRENCHES HAVE SETTLED. (SEE DETAIL W-09e)
2. VALVE BOXES REQUIRING ADDITIONAL HEIGHT SHALL BE EXTENDED USING 6-INCH PVC DR18 PIPE WITH A BOTTOM AND TOP SECTION PLACED ON TOP OF THE PVC PIPE. PIPE SHOULD BE CUT TO FIT VALVE.
3. CONTRACTOR SHALL ADJUST CONCRETE GRADE RINGS AS NECESSARY IF GROUND SETTLES LATER.

VALVE BOX

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 08



SIDE VIEW
(TYPICAL FOR FIRE HYDRANT ON LOCAL STREET)



NOTES:

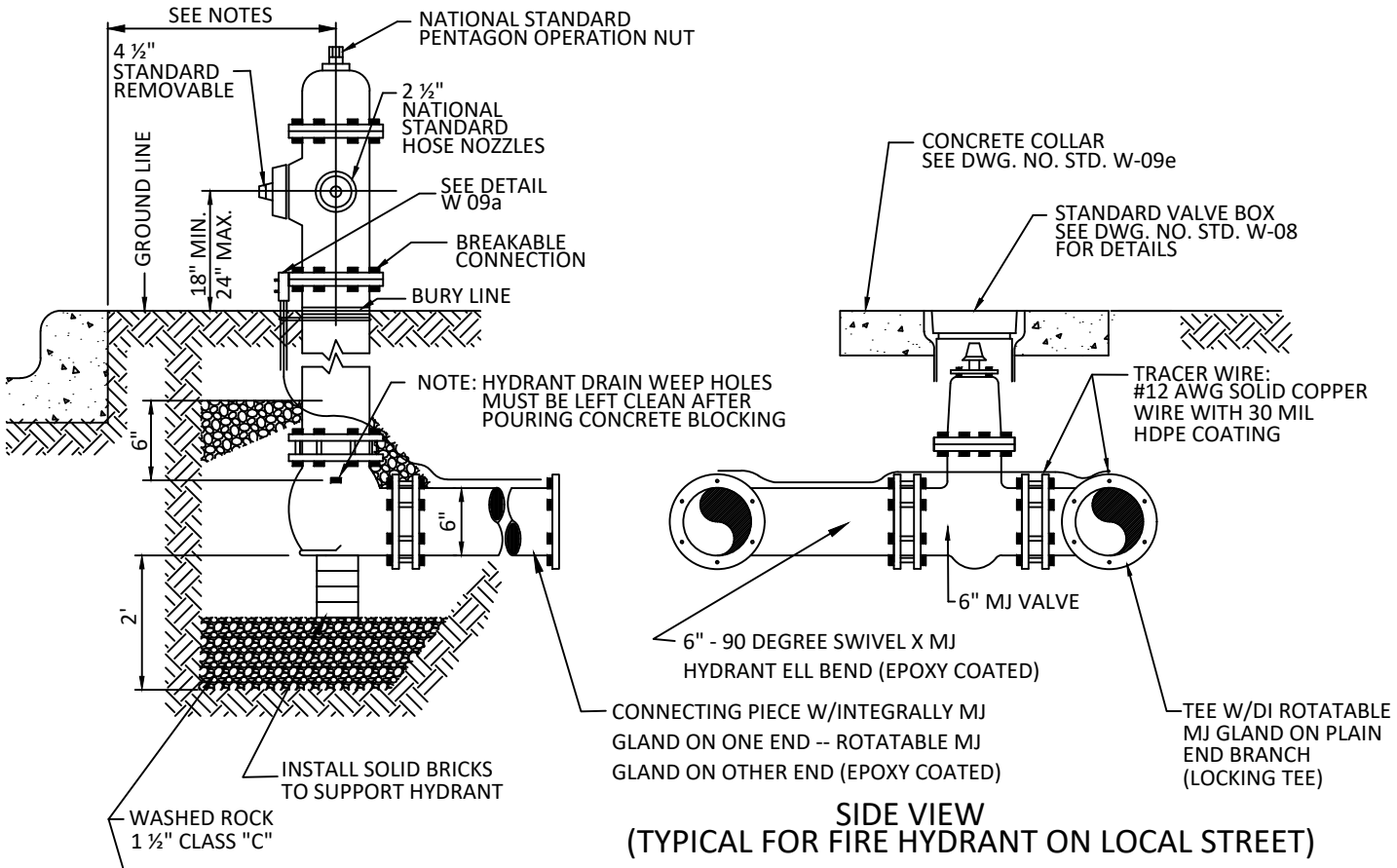
1. INSTALLATION DEPTH SHOULD BE 3-FEET MIN. AND 6-FEET MAX.
2. THRUST BLOCKING IS REQUIRED BEHIND BOTH THE TEE & THE FIRE HYDRANT IF RESTRAINED JOINTS ARE NOT USED. THRUST BLOCKING IS NOT REQUIRED IF RESTRAINED JOINTS ARE UTILIZED ON THE FIRE HYDRANT ASSEMBLY.
3. WRAP TEE AND FIRE HYDRANT WITH POLY WRAP IF THRUST BLOCKS WILL BE POURED.
4. ALL FITTINGS SHALL BE EPOXY COATED AND CONNECTED USING STAINLESS STEEL BOLTS AND NUTS.
5. IF LOCKING TEE IS NOT USED THEN TEE, VALVE, & FH ASSEMBLY MUST BE TIED TOGETHER WITH SS ALL-THREAD THRUST BLOCKING BEHIND TEE & FIRE HYDRANT MAY BE USED INSTEAD OF ALL-THREAD.
6. CONNECTING PIECE BETWEEN VALVE, FH, & TEE MAY BE PVC DR18 PIPE WITH RESTRAINTS IF NEEDED.
7. TEE'S LARGER THAN 12-INCHES WILL BE PAID SEPARATELY.

FH ASSEMBLY INCLUDES

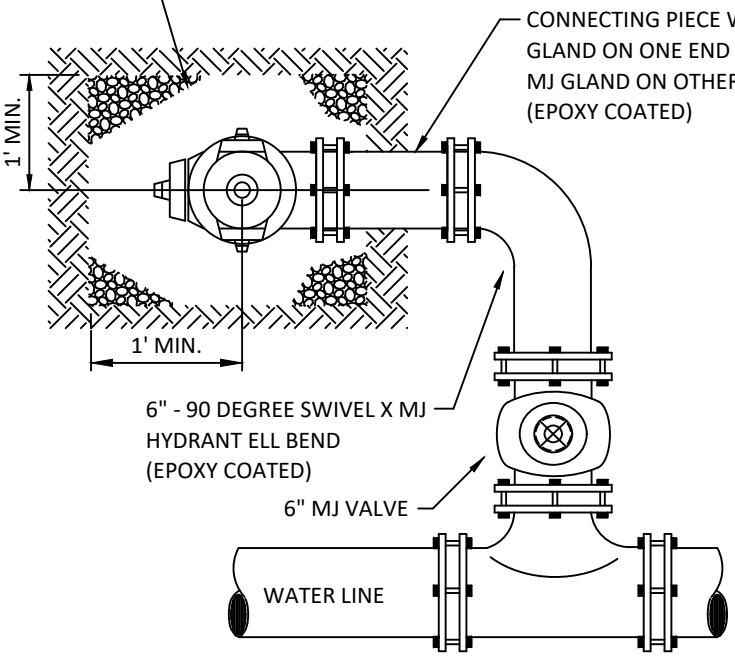
1.) (1)-3-WAY FIRE HYDRANT
2.) (1)-6" CONNECTING PIECE
3.) (1)-6" MJ GATE VALVE
4.) (1)-LOCKING TEE (6" THRU 12" LINE)
5.) (1)-CONCRETE COLLAR\THRUST BLOCKS
6.) (1)-ADJUSTABLE VALVE BOX W/LID & COLLAR
7.) (1)-WEATHERHEAD ASSEMBLY
8.) SS ALL-THREAD AND RESTRAINTS AS NEEDED

FIRE HYDRANT ASSEMBLY

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 04	DRAWING NO. W 09A



SIDE VIEW
(TYPICAL FOR FIRE HYDRANT ON LOCAL STREET)



TOP VIEW

NOTES:

1. INSTALLATION DEPTH SHOULD BE 3-FEET MIN. AND 6-FEET MAX.
2. THRUST BLOCKING IS REQUIRED BEHIND BOTH THE TEE & THE FIRE HYDRANT IF RESTRAINED JOINTS ARE NOT USED. THRUST BLOCKING IS NOT REQUIRED IF RESTRAINED JOINTS ARE UTILIZED ON THE FIRE HYDRANT ASSEMBLY.
3. WRAP TEE AND FIRE HYDRANT WITH POLY WRAP IF THRUST BLOCKS WILL BE POURED.
4. ALL FITTINGS SHALL BE EPOXY COATED AND CONNECTED USING STAINLESS STEEL BOLTS & NUTS.
5. IF LOCKING TEE IS NOT USED THEN TEE, VALVE & FH ASSEMBLY MUST BE TIED TOGETHER WITH SS ALL-THREAD THRUST BLOCKING BEHIND TEE & FIRE HYDRANT MAY BE USED INSTEAD OF ALL-THREAD.
6. CONNECTING PIECE BETWEEN 90 DEGREE BEND & FH MAY BE PVC DR18 PIPE WITH RESTRAINTS IF NEEDED.
7. TEE'S LARGER THAN 12-INCHES WILL BE PAID SEPARATELY.

FH ASSEMBLY INCLUDES

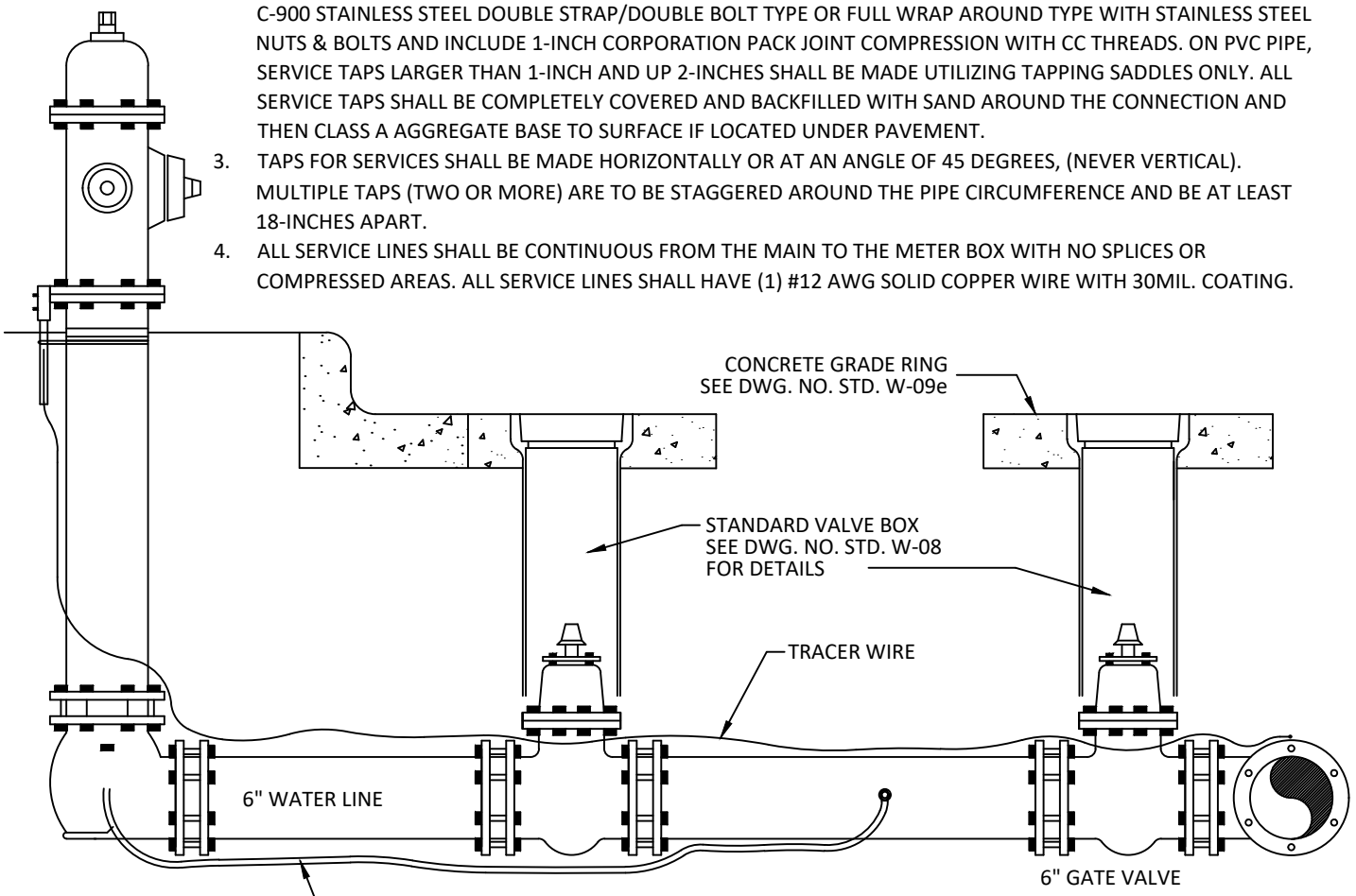
1.) (1)-3-WAY FIRE HYDRANT
2.) (1)-6" 90 DEGREE SWIVEL X MJ ELL
3.) (1)-6" MJ GATE VALVE
4.) (1)-6" CONNECTING PIPE
5.) (1)-LOCKING TEE (6" THRU 12" LINE)
6.) (1)-CONCRETE COLLAR/THRUST BLOCKS
7.) (1)-ADJUSTABLE VALVE BOX W/LID & COLLAR
8.) (1)-WEATHERHEAD ASSEMBLY (SEE W 09a)
9.) SS ALL THREAD AND RESTRAINTS IF NEEDED

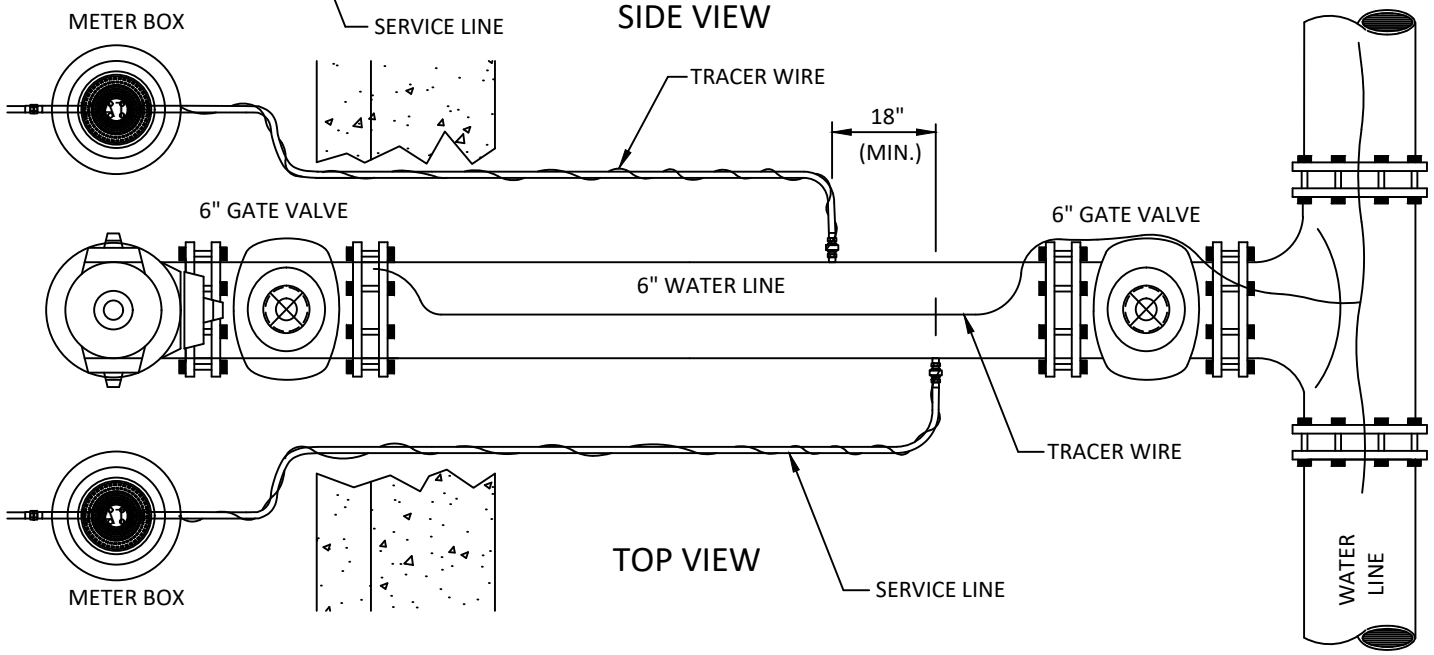
FIRE HYDRANT ASSEMBLY (ALTERNATE)

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 09B

NOTES:

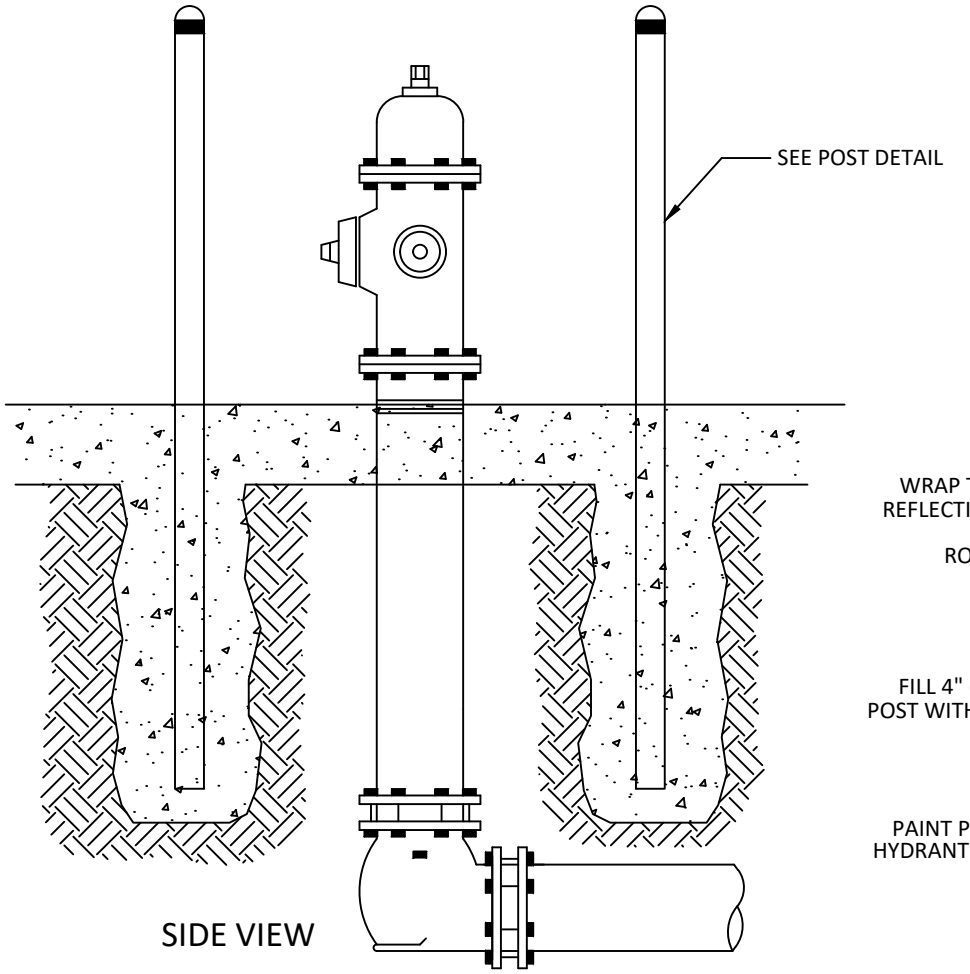
1. SERVICE LINES SHALL BE HDPE (BLUE) 1-INCH CTS (COPPER TUBE SIZE) AND CONFORMING TO ASTM D2737, PE-3408, SDR9-(200 PSI) RATED AND AWWA C-901 SHALL BE UTILIZED.
2. ALL 1-INCH SERVICE TAPS SHALL BE MADE WITH A TAPPING SADDLE ON PVC PIPE WITH A WALL THICKNESS OF AT LEAST DR18. THREADED CONNECTIONS SHALL UTILIZE TEFLON TAPE. IF SADDLES ARE USED, SADDLES SHALL BE C-900 STAINLESS STEEL DOUBLE STRAP/DOUBLE BOLT TYPE OR FULL WRAP AROUND TYPE WITH STAINLESS STEEL NUTS & BOLTS AND INCLUDE 1-INCH CORPORATION PACK JOINT COMPRESSION WITH CC THREADS. ON PVC PIPE, SERVICE TAPS LARGER THAN 1-INCH AND UP 2-INCHES SHALL BE MADE UTILIZING TAPPING SADDLES ONLY. ALL SERVICE TAPS SHALL BE COMPLETELY COVERED AND BACKFILLED WITH SAND AROUND THE CONNECTION AND THEN CLASS A AGGREGATE BASE TO SURFACE IF LOCATED UNDER PAVEMENT.
3. TAPS FOR SERVICES SHALL BE MADE HORIZONTALLY OR AT AN ANGLE OF 45 DEGREES, (NEVER VERTICAL). MULTIPLE TAPS (TWO OR MORE) ARE TO BE STAGGERED AROUND THE PIPE CIRCUMFERENCE AND BE AT LEAST 18-INCHES APART.
4. ALL SERVICE LINES SHALL BE CONTINUOUS FROM THE MAIN TO THE METER BOX WITH NO SPLICES OR COMPRESSED AREAS. ALL SERVICE LINES SHALL HAVE (1) #12 AWG SOLID COPPER WIRE WITH 30MIL. COATING.



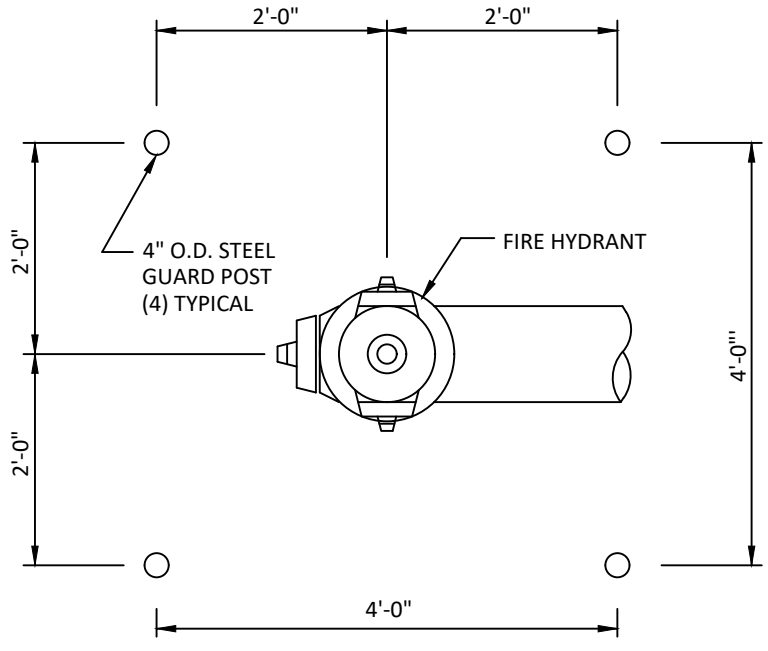


SERVICE CONNECTIONS ON FIRE HYDRANT LATERALS

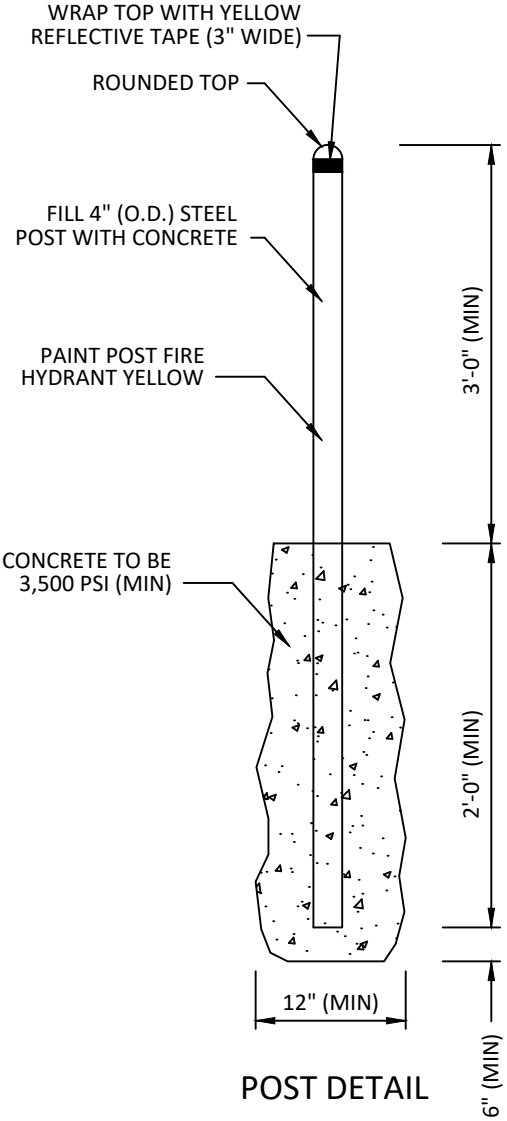
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 09C



SIDE VIEW



TOP VIEW



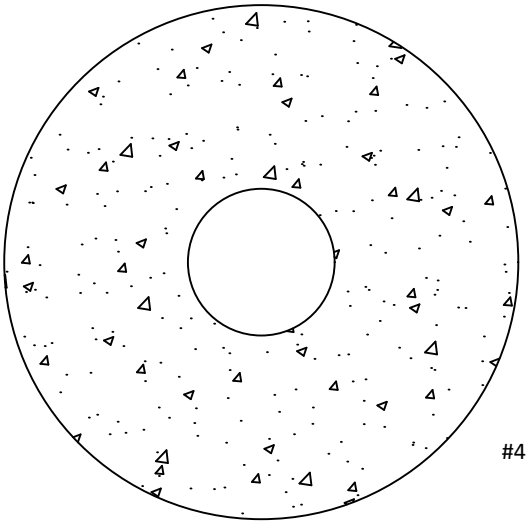
POST DETAIL

FIRE HYDRANT PROTECTION IN PARKING AREAS

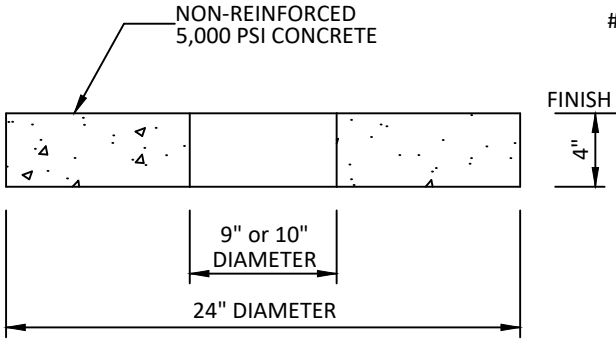
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 09D

TYPE A GRADE RING

(PRECAST)



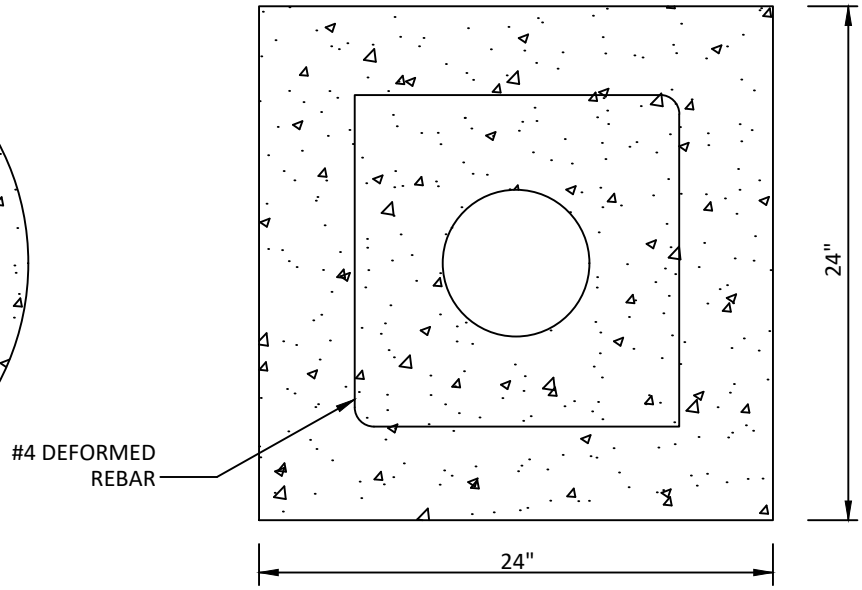
PLAN

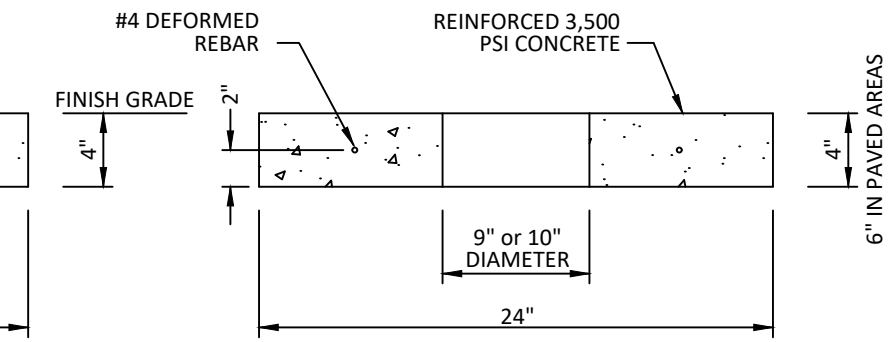


SECTION

TYPE B GRADE RING

(PRECAST OR CAST IN PLACE)





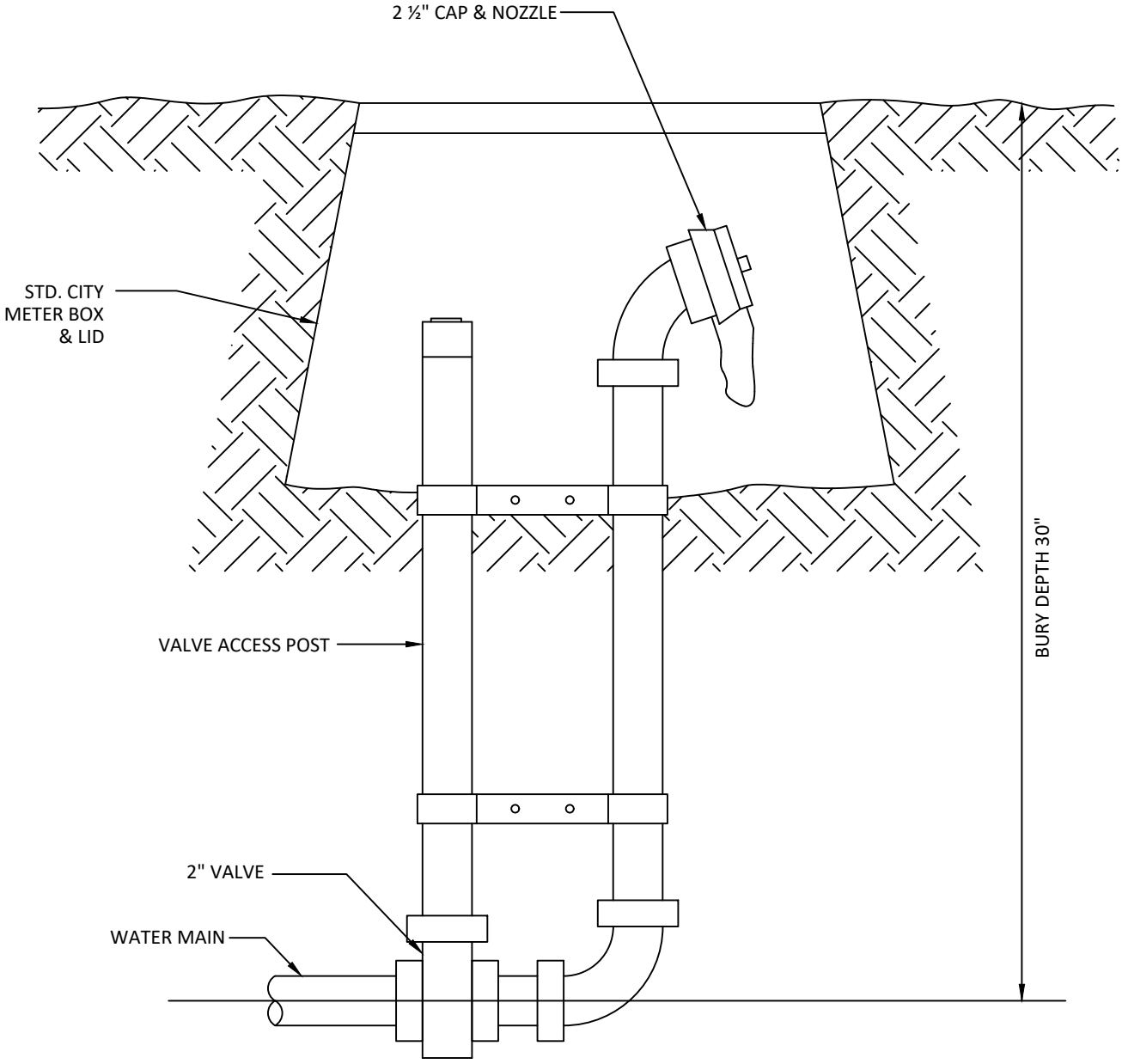
SECTION

NOTES:

1. CONTRACTOR TO PLACE TYPE A OR TYPE B CONCRETE GRADE RING AROUND EACH WATER LINE VALVE BOX AFTER FINAL GRADING HAS BEEN COMPLETED AND TRENCHES HAVE SETTLED.
2. CONCRETE GRADE RING TYPE B SHALL BE USED IN PAVEMENT AREAS. THICKNESS SHALL BE 6-INCHES MIN.
3. CONTRACTOR SHALL ADJUST CONCRETE GRADE RINGS AS NECESSARY IF GROUND SETTLES LATER.

VALVE BOX CONCRETE GRADE RING

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 09E

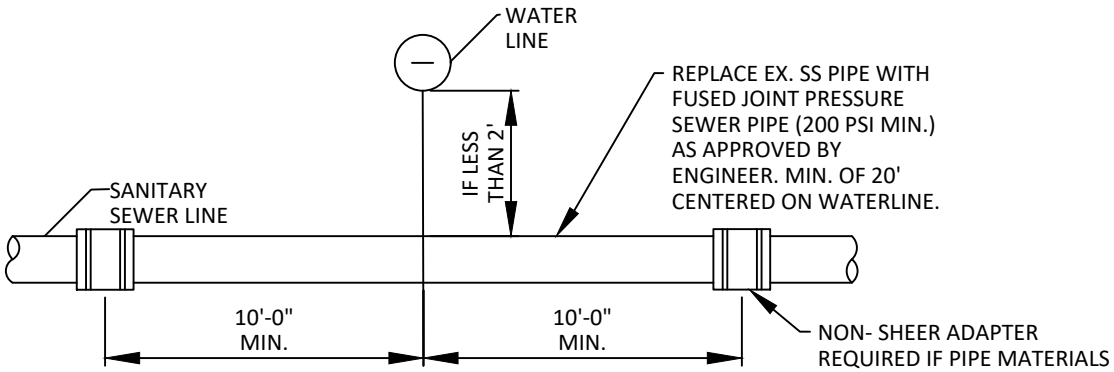


NOTES :

1. FABRICATED HIDDEN TYPE FLUSHING HYDRANT TO BE MUELLER NO. A-410 OR EQUAL.

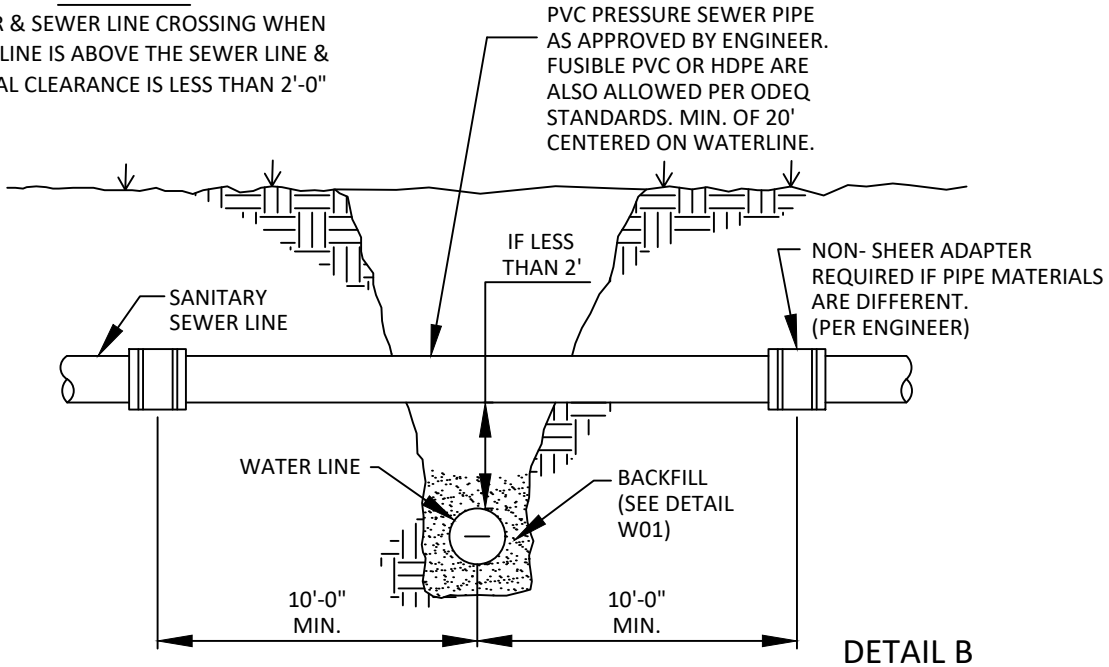
FLUSHING HYDRANT

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 10



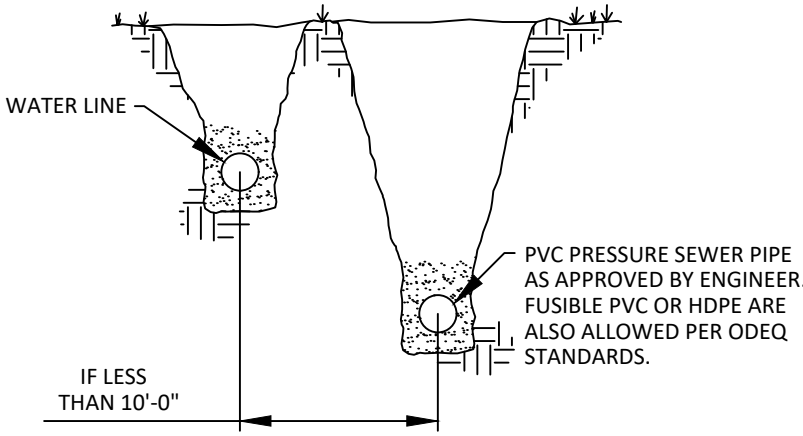
DETAIL A

WATER & SEWER LINE CROSSING WHEN WATER LINE IS ABOVE THE SEWER LINE & VERTICAL CLEARANCE IS LESS THAN 2'-0"



DETAIL B

WATER & SEWER LINE CROSSING WHEN WATER LINE IS BELOW THE SEWER LINE & VERTICAL CLEARANCE IS LESS THAN 2'-0"



DETAIL C

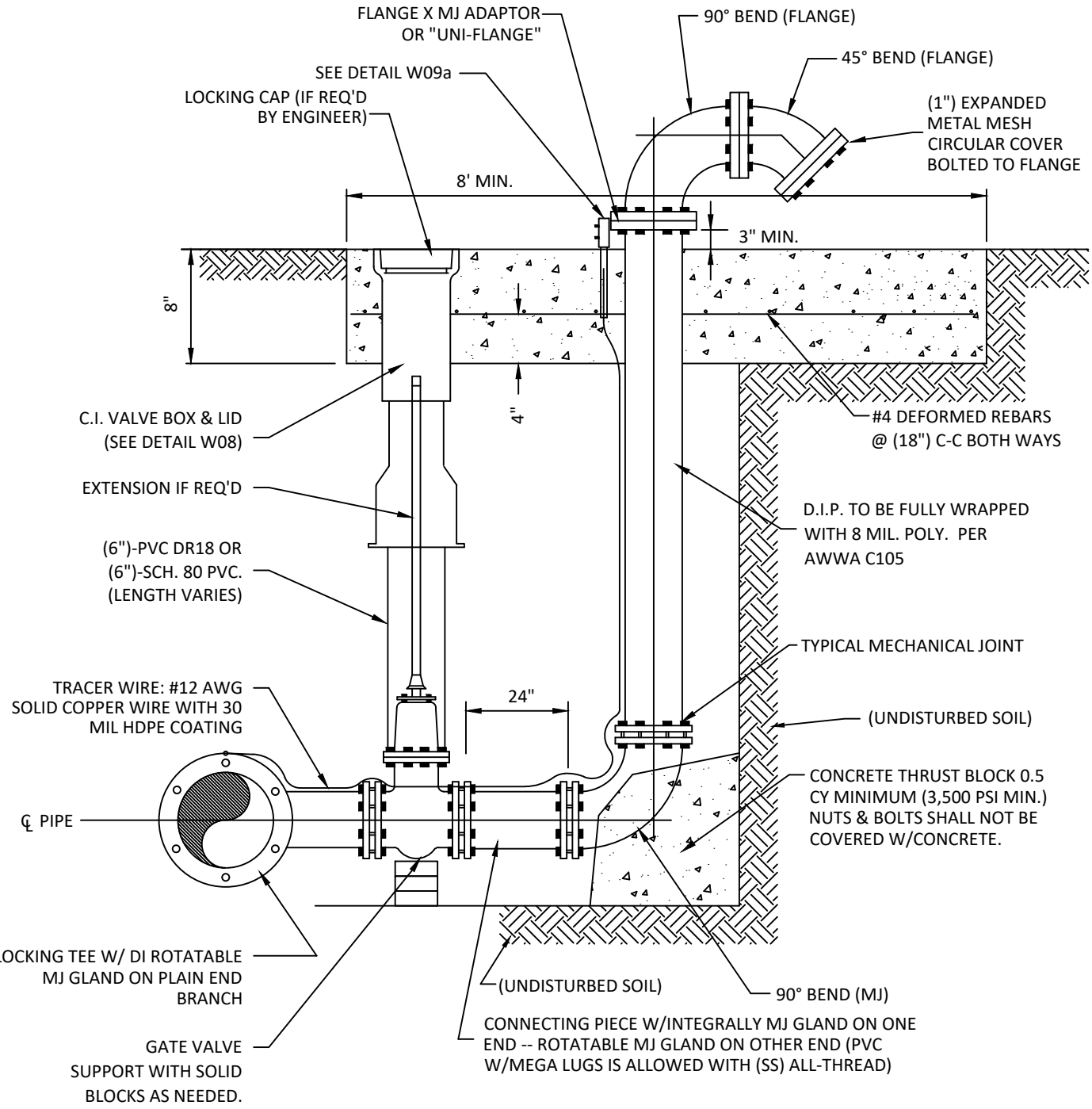
WATER & SEWER LINES WITH HORIZONTAL CLEARANCE OF LESS THAN TEN FEET

NOTE:

1. IF LESS THAN 2-FEET CLEARANCE, WATER PIPE MAY BE ENCASED IN CONCRETE OR GROUTED STEEL PIPE.

WATER & SEWER MAIN LINE CROSSING DETAILS

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 02	DRAWING NO. W 11



NOTES:

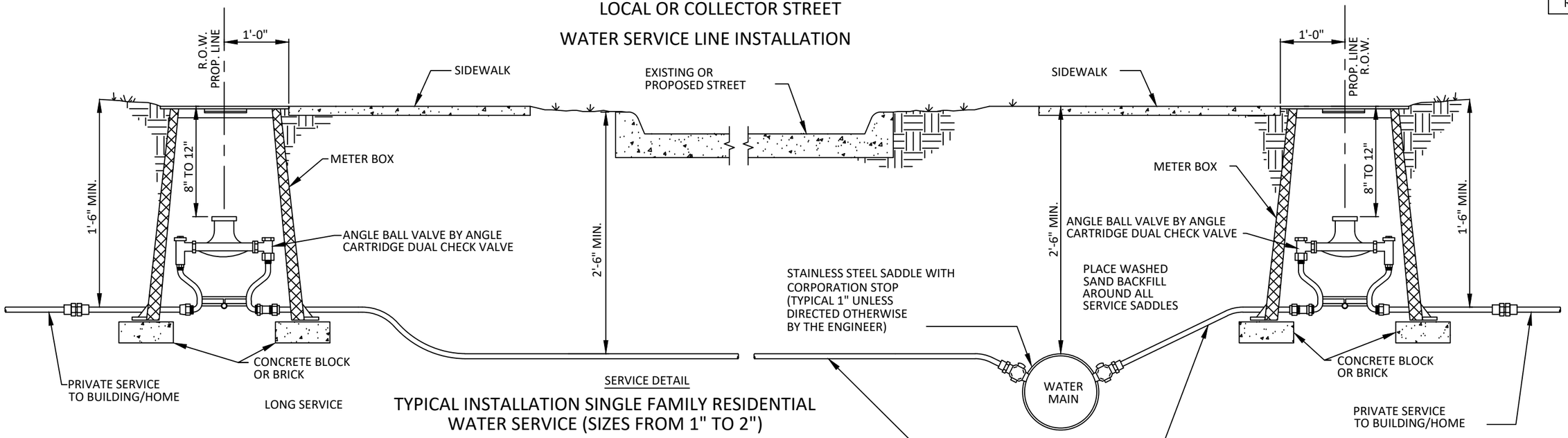
1. ALL FITTINGS (BELOW GROUND & ABOVE GROUND) TO BE EPOXY COATED WITH SS BOLTS & NUTS.
2. CONCRETE PAD TO BE 4-FEET BY 8-FEET (MIN.) BY 8-INCHES THICK AND SLOPED SO IT WILL DRAIN AWAY FROM FITTINGS.
3. PER ENGINEER, A GATE VALVE EXTENSION MAY BE REQUIRED FOR DEEP WATER LINES.
4. UNDERGROUND FITTINGS BLOCKED WITH CONCRETE TO BE FULLY WRAPPED WITH 8 MIL. POLYETHYLENE PER (AWWA C105).
5. CONCRETE FOR PAD SHALL BE 3,500 PSI @ 28 DAY. (MIN.) LARGER PAD MAYBE REQUIRED FOR LARGER PIPE.
6. BLOW OFF PIPING SIZE TO BE DETERMINED BY ENGINEER.
7. PLACE & COMPACT A MIN. OF 4-INCHES OF ODOT TYPE "A" BASE UNDER SPLASH PAD. (NOT SHOWN IN DETAIL)
8. SEE WEATHER HEAD DETAIL ON W-09a DETAIL DRAWING.
9. SLOPE ALL CONCRETE AWAY FROM FITTINGS.
10. COMPLETE ASSEMBLY SHALL COMPLETE ASSEMBLY SHALL.
11. PAD DESIGN SHALL BE CONSISTENT WITH ESTIMATED FLOWS AND SUBMITTED TO UTILITIES ENGINEER FOR APPROVAL.

WATER LINE BLOW OFF VALVE ASSEMBLY

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 12

REV 00

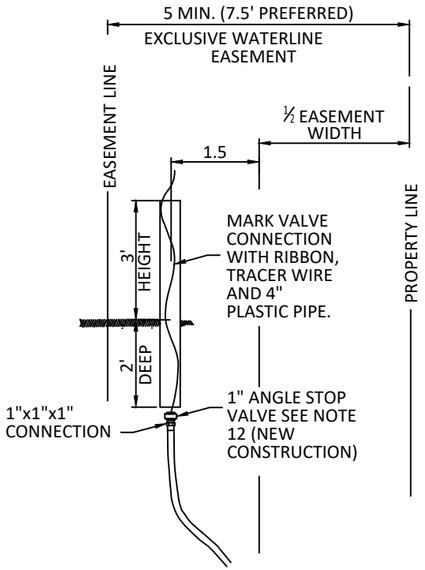
LOCAL OR COLLECTOR STREET
WATER SERVICE LINE INSTALLATION



TYPICAL INSTALLATION SINGLE FAMILY RESIDENTIAL WATER SERVICE (SIZES FROM 1" TO 2")

NOTES:

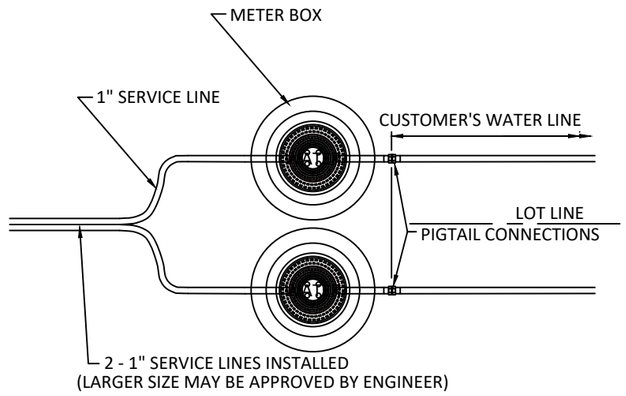
1. SERVICE LINES SHALL BE HDPE (BLUE) CTS (COPPER TUBE SIZE) 200 PSI SDR9 TYPE OR APPROVED EQUAL. (MIN. 1-INCH SERVICE LINE SIZE)
2. A MINIMUM DEPTH OF SERVICE LINE SHALL BE 2'-6" BELOW THE BOTTOM OF THE ROADWAY (LONG SERVICE) AND 1'-6" BELOW GRADE FOR (SHORT SERVICES).
3. ALL SERVICE TAPS SHALL BE MADE WITH A TAPPING SADDLE FOR EITHER DUCTILE IRON PIPE OR PVC PIPE WITH AT LEAST A WALL THICKNESS OF DR18. CORPORATION THREADS SHALL UTILIZE TEFLON TAPE. SADDLES SHALL BE C-900 STAINLESS STEEL DOUBLE BOLT OR FULL WRAP AROUND TYPE WITH A 1-INCH CORPORATION PACK JOINT COMPRESSION WITH CC THREADS. ALL SERVICE TAPS SHALL BE COMPLETELY COVERED AND BACKFILLED WITH WASHED SAND.
4. TAPS FOR SERVICES SHALL BE MADE HORIZONTALLY OR AT AN ANGLE UP TO 45 DEGREES, (NEVER VERTICAL UNLESS APPROVED). MULTIPLE TAPS (TWO OR MORE) ARE TO BE STAGGERED AROUND THE PIPE CIRCUMFERENCE AND BE AT LEAST 36-INCHES APART.
5. COPPER METER YOKES FOR 5/8- BY 3/4-INCH WATER METER: THE COPPER METER YOKES SHALL BE "NO LEAD BRASS" HIGH GRADE BRONZE AND/OR BRASS TO EQUAL OR EXCEED AWWA SPECIFICATIONS. THE SAFE DRINKING WATER ACT (SDWA) REQUIRES THAT THESE PRODUCT WILL NEED TO MEET A WEIGHTED AVERAGE MAXIMUM LEAD CONTENT OF 0.25%. THE COPPER METER YOKES ARE FOR 5/8- BY 3/4-INCH METERS. METER YOKES MUST BE COMPLETE WITH LOCK WING STOP AND 3/4-INCH COMPRESSION CONNECTIONS FOR COPPER ON THE INLET AND OUTLET. YOKES MUST HAVE A RISER HEIGHT OF 7- OR 9-INCH END. CONNECTIONS MUST BE ASSEMBLED TO THE YOKE. THE YOKE MUST HAVE A BALL ANGLE VALVE. ALL INTEGRAL PARTS MUST BE ASSEMBLED AND READY FOR IMMEDIATE USE. IN ADDITION, METER YOKES MUST HAVE AN INTEGRAL, CARTRIDGE-STYLE, DUAL CHECK VALVE. CARTRIDGE SHOULD BE VERTICALLY INSTALLED. COPPER METER YOKES SHALL BE MUELLER CO., A.Y. MCDONALD, FORD OR APPROVED EQUAL.
6. SERVICE SADDLES SHALL BE REQUIRED & SHALL BE STAINLESS STEEL (FULL WRAP AROUND TYPE PREFERRED.) WITH CC THREAD TAPS 304 (18-8) STAINLESS STEEL PER ASTM A240. FOR 3/4-INCH AND UP TO 2-INCHES. DOUBLE BAND OR TWO PIECE STAINLESS STEEL TYPE SADDLES MAY ALSO BE APPROVED BY THE ENGINEER. NO CAST D.I. ALLOWED.
7. ALL SERVICE LINES SHALL BE CONTINUOUS FROM THE WATER MAIN TO THE METER BOX WITH NO SPLICES OR COMPRESSED AREAS. ALL SERVICE LINES SHALL HAVE (1) #12 AWG SOLID COPPER WIRE WITH 30MIL COATING INSTALLED ALONG THE SERVICE LINE FROM THE WATER MAIN TO THE METER BOX. TRACER WIRE SHALL EXTEND 12-INCHES BEYOND ANGLE STOP. SERVICE LINE TRACER WIRES SHALL BE CONNECTED TO THE WATER MAIN TRACER WIRE WITH AN APPROVED UNDERGROUND CONNECTOR. ALL TRACER WIRES SHALL BE TESTED FOR CONTINUITY PRIOR TO THE WATERLINE BEING ACCEPTED. ALL SERVICES SHALL HAVE STAINLESS STEEL INSERTS AT EACH END.
8. METER BOXES SHALL BE INSTALLED WITH CONCRETE BLOCKING (SOLID BRICK) UNDER EACH BOX TO SUPPORT IT FROM SETTLING. BOXES SHALL BE INSTALLED SO TOP IS PARALLEL TO THE EXISTING GROUND. BOXES SHALL BE CENTERED OVER THE EXISTING WATER METER SO AS TO ALLOW EASY ACCESS TO THE ANGLE METER STOP FROM ABOVE.
9. SMALL METER BOX: (3/4-INCH METER) SHALL BE "OLDCASTLE" CARSON SPECIFICATION GRADE MODEL 2200 18-INCHES DEEP HDPE BOX WITH A CAST IRON COVER OR EQUAL, MANUFACTURED BY THE SAME. THE CAST IRON COVER SHALL INDICATE WATER METER IN THE CASTING. A TRAFFIC RATED COVER & BODY MAY BE REQUIRED AND APPROVED BY THE ENGINEER FOR TRAFFIC LOCATIONS. COVER SHALL BE LOCKING TYPE.
10. MEDIUM METER BOX: (FOR 1 1/2-INCH METER) SHALL BE "OLDCASTLE" CARSON SPECIFICATION GRADE MODEL 1324 15-INCHES DEEP HDPE BOX WITH A MODEL 1324 HDPE FLUSH MOUNT COVER WITH A CAST IRON READER DOOR AND LOCKING DEVICE OR APPROVED EQUAL.
11. LARGE METER BOX: (FOR 2-INCH METER) SHALL BE "OLDCASTLE" CARSON SPECIFICATION GRADE MODEL 1730 18-INCHES DEEP HDPE BOX WITH A MODEL 1730 HDPE FLUSH MOUNT COVER WITH A CAST IRON READER DOOR AND LOCKING DEVICE OR APPROVED EQUAL.
12. ANGLE STOP BALL VALVE SHALL BE USED AT THE END OF SERVICE LINE, WITH PACK JOINT CONNECTION. ANGLE STOP BALL VALVE SHALL MEET THE APPLICABLE REQUIREMENT OF AWWA C800, ASTM B-62FOR 85-5-5-5 COMPOSITION BRONZE, AND USAS B2.1. ANGLE STOP BALL VALVE SHALL BE MUELLER, MCDONALD, FORD OR APPROVED EQUAL. ANGLE BALL SERVICE VALVE REFERENCE NO. BA 41-444W FULL PORT VALVE OR APPROVED EQUAL. COVER ANGLE STOP BALL VALVE WITH POLYETHYLENE, MINIMUM (3MIL) THICKNESS, TO PREVENT ENTRY OF ANY FOREIGN MATERIALS. TYPICALLY, AN ANGLE BALL VALVE BY ANGLE CARTRIDGE DUAL CHECK VALVE (5/8-INCH BY 3/4-INCH METER), (1 1/2-INCH METER), OR (2-INCH METER) SHALL BE USED UNLESS OTHERWISE APPROVED BY THE ENGINEER. SEE TERMINATION DETAIL FOR NEW CONSTRUCTION.



VIEW OF WATER SERVICE TERMINATION FOR DEVELOPERS (NEW CONSTRUCTION)

NOTE:

1. BLUE "MAGNITIZED" PLASTIC RIBBON TAPE SHALL BE TIED TO THE VALVE AND EXTENDED 18-INCHES ABOVE FINISH GRADE TO MARK VALVE CONNECTION LOCATION. INSTALL A (4-INCH DIA. BY 5-FOOT) PLASTIC SCH. 40 PVC PIPE AT THE SAME LOCATION AND EXTEND THE TRACER WIRE 18-INCHES ABOVE FINISHED GRADE AND COIL WIRE AROUND PVC PIPE.



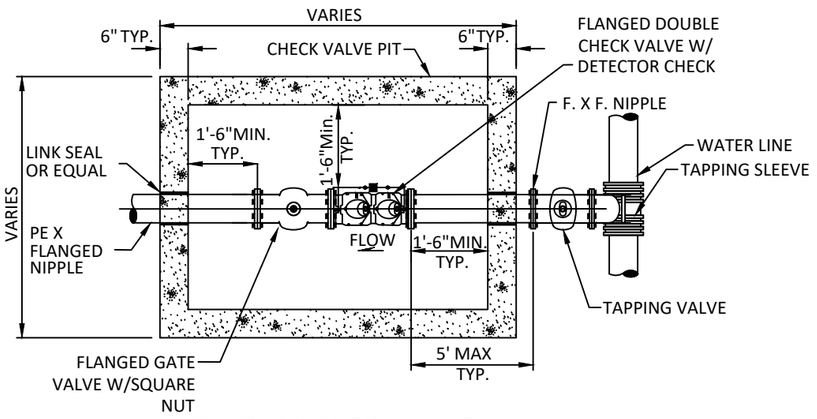
PLAN VIEW OF SIDE BY SIDE WATER METER INSTALLATION

THIS STANDARD INDICATES THE DESIRED GEOMETRIC CONFIGURATION REFERENCED TO STREET PAVINGS AND PROPERTY LINES.
THE 2, 1-INCH SERVICE LINES SHOWN IN THE UNDER STREET CROSSING IS RECOMMENDED BY THE CITY. PRIOR TO INSTALLATION BY CONTRACTOR, ACTUAL SIZE SHALL BE DETERMINED BY THE ENGINEER.

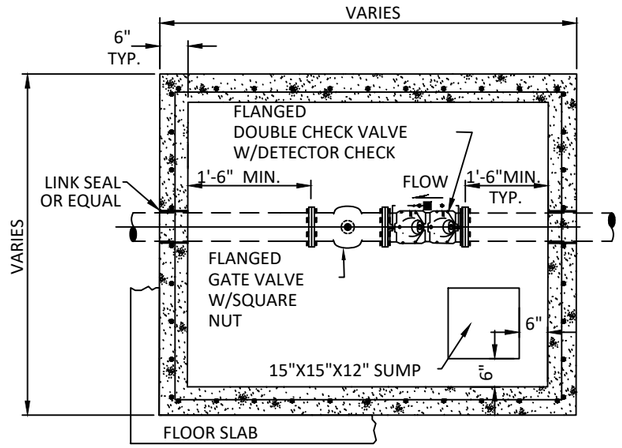
ENGINEERING DIVISION, CITY OF NORMAN

WATER METER SERVICE CONNECTION INSTALLATION

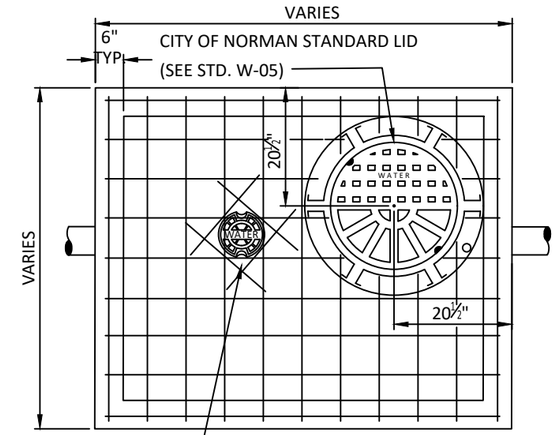
APPROVED BY: CITY ENGINEER	DATE: 01/2023	DRAWING NO: W 13



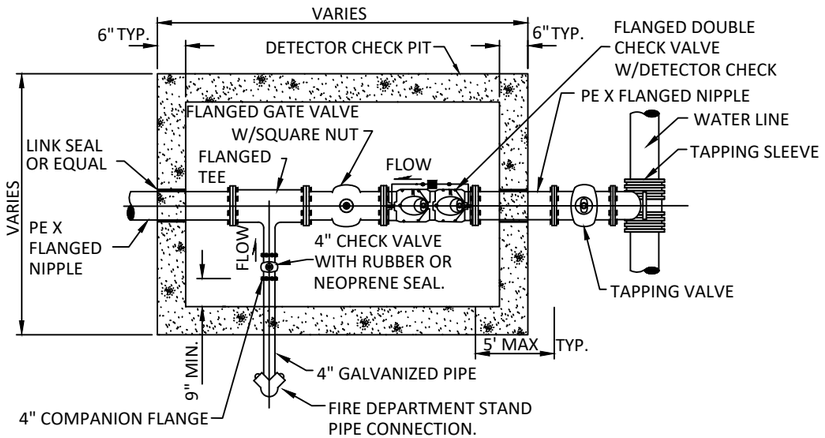
STANDARD CHECK VALVE



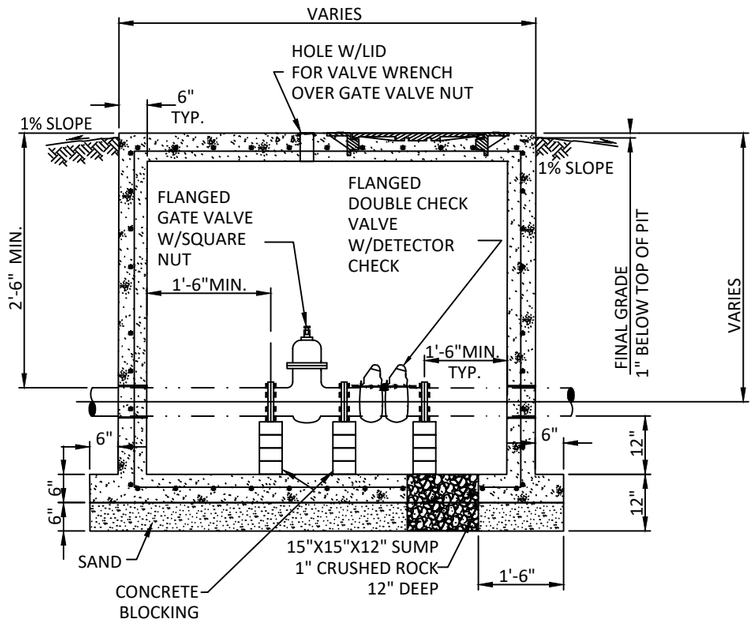
PLAN



PLAN OF TOP SECTION

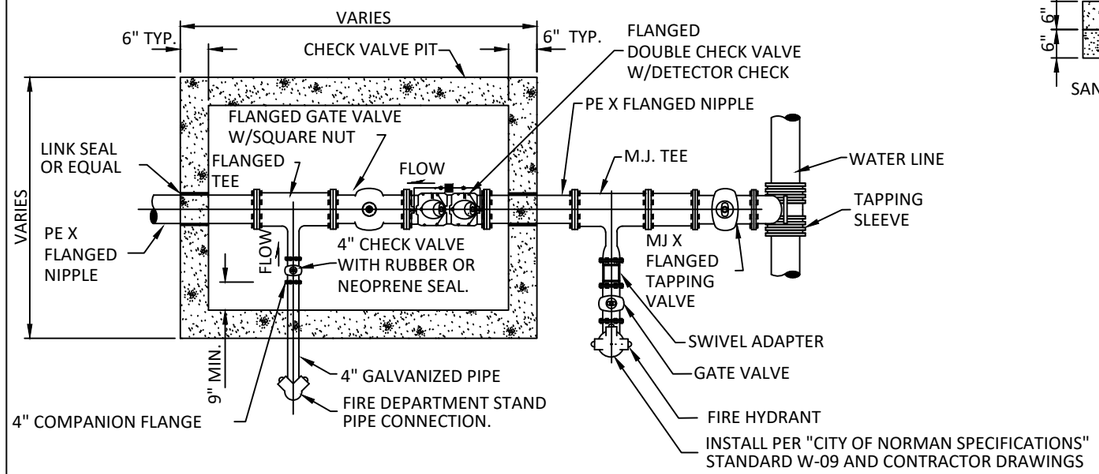


STANDARD CHECK VALVE AND STAND PIPE



ELEVATION

STANDARD METER PIT FOR STANDARD CHECK VALVE, STANDARD CHECK VALVE WITH FIRE HYDRANT AND STAND PIPE OR STANDARD CHECK VALVE AND STAND PIPE



STANDARD CHECK VALVE WITH FIRE HYDRANT AND STAND PIPE

NOTES:

1. A MINIMUM CLEARANCE OF 18-INCHES FROM THE BODY OR FLANGES OF WATERLINE VALVES AND OTHER DEVICES TO THE INSIDE WALL OF THE PIT EXCEPT AS SHOWN OR NOTED.
2. VAULT TO BE CONSTRUCTED OF CLASS A CONCRETE AS PER ODOT SECTION 701.01 WITH A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 3,500 PSI
3. REINFORCING STEEL SHALL BE GRADE 60, #4 BARS AT 8" CENTERS
4. FLOOR, WALLS & TOP MAY BE POURED SEPARATE WITH THE USE OF STEEL TIES AT ALL CONSTRUCTION JOINTS.
5. VALVE VAULT TO BE LOCATED ON PUBLIC PROPERTY OR IN A DESIGNATED UTILITY EASEMENT.
6. ALL EXTERIOR METAL SURFACES TO BE PAINTED A FIRE HYDRANT RED.
7. IF DOUBLE DETECTOR CHECK IS INSTALLED AS SHOWN, THE FIRE DEPARTMENT DOES NOT REQUIRE A DOUBLE CHECK VALVE IN BUILDING. HOWEVER, THE OWNER HAS THE OPTION OF INSTALLING ONLY A SINGLE DETECTOR CHECK VALVE AT THE WATER MAIN AND A DOUBLE CHECK VALVE IN THE BUILDING. IF THIS OPTION IS CHOSEN, THEN A SINGLE READ CHECK VALVE SHOULD BE LOCATED OFF THE WATER MAIN.
8. THE GATE VALVE SHOWN INSIDE THE VAULT MAY BE LOCATED JUST OUTSIDE THIS VAULT TOWARD THE BUILDING.
9. ALTERNATE DESIGNS SHALL BE REVIEWED BY THE UTILITIES ENGINEER.

ENGINEERING DIVISION, CITY OF NORMAN

FIRE LINE STANDARD

APPROVED BY: CITY ENGINEER _____	DATE: 01/2023	DRAWING NO: W 14

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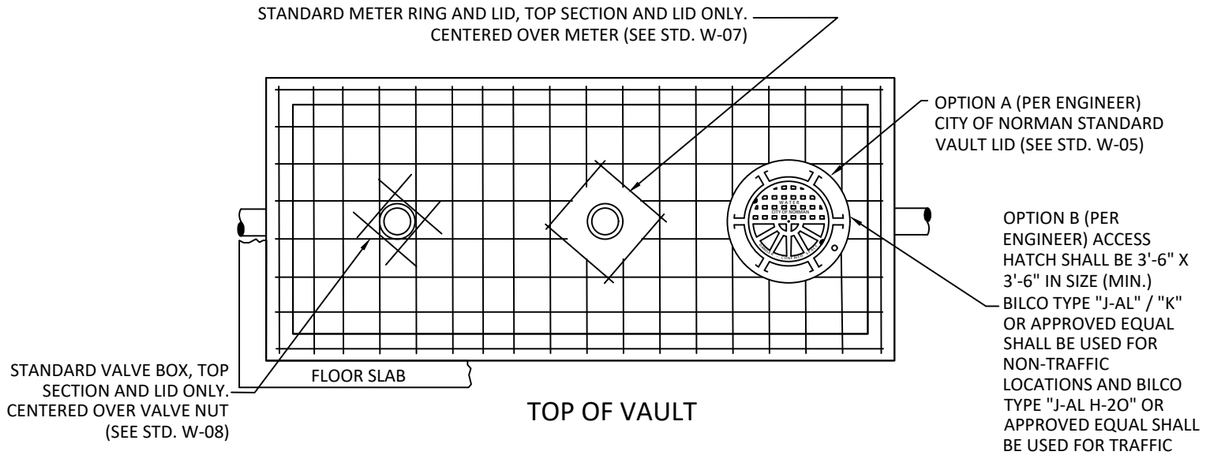
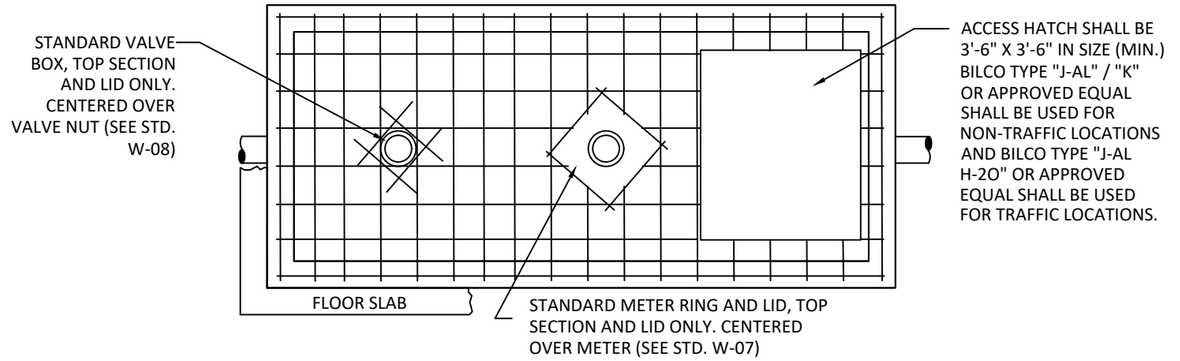
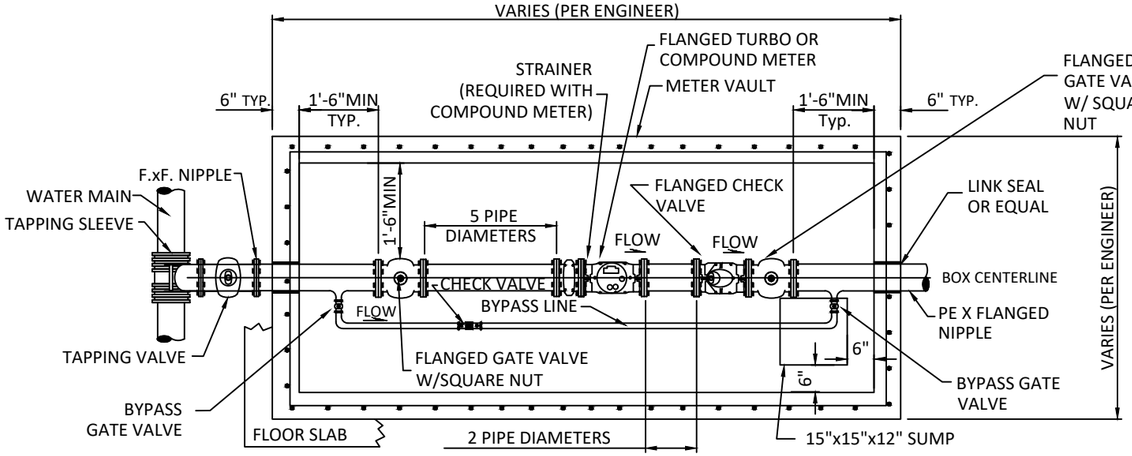


TOP OF VAULT

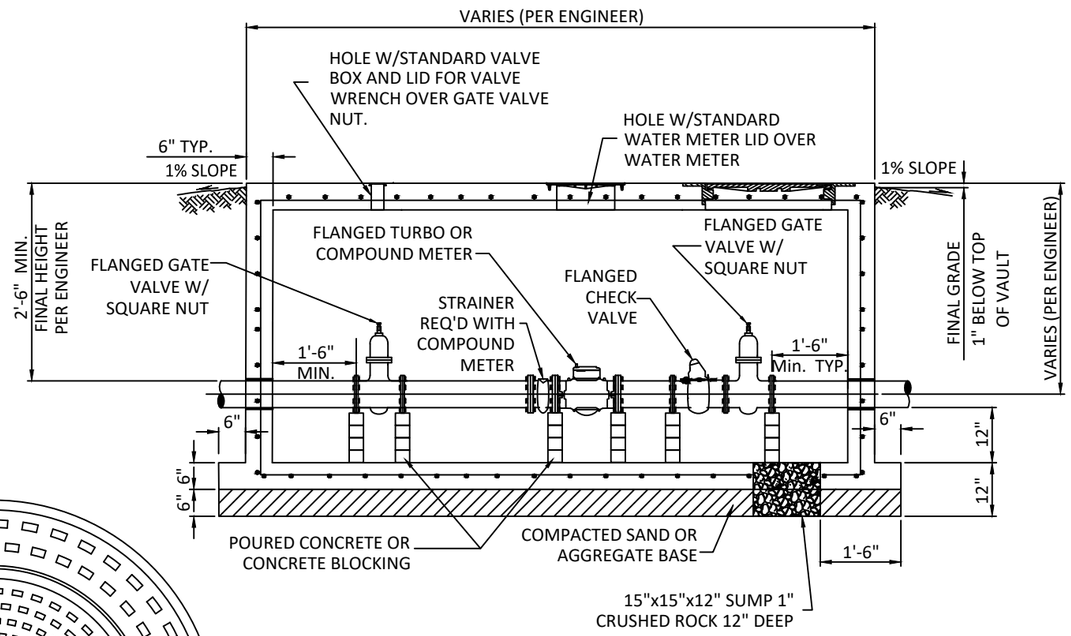


TOP OF VAULT

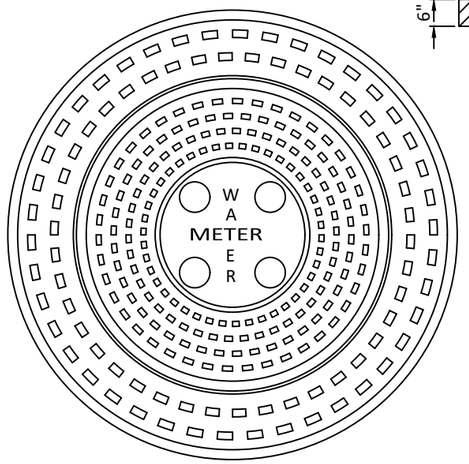
METER SIZE	WIDTH (FEET)	LENGTH (FEET)
2"	3	5.5
3"	3.5	5.5
4"	4	6
6"	5.5	7



PLAN OF WATER METER VAULT LAYOUT

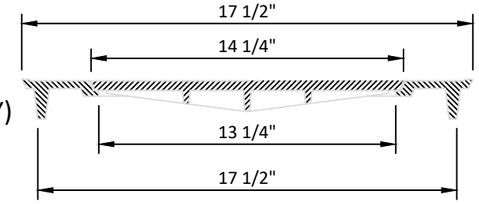


ELEVATION OF WATER METER VAULT LAYOUT



TOP VIEW
(SMALL METER ONLY)

SECTION VIEW
(SMALL METER ONLY)



	WEIGHT
LID	(19 LBS)
RING	(12 LBS)
SET	(31 LBS)

(SMALL METER ONLY)

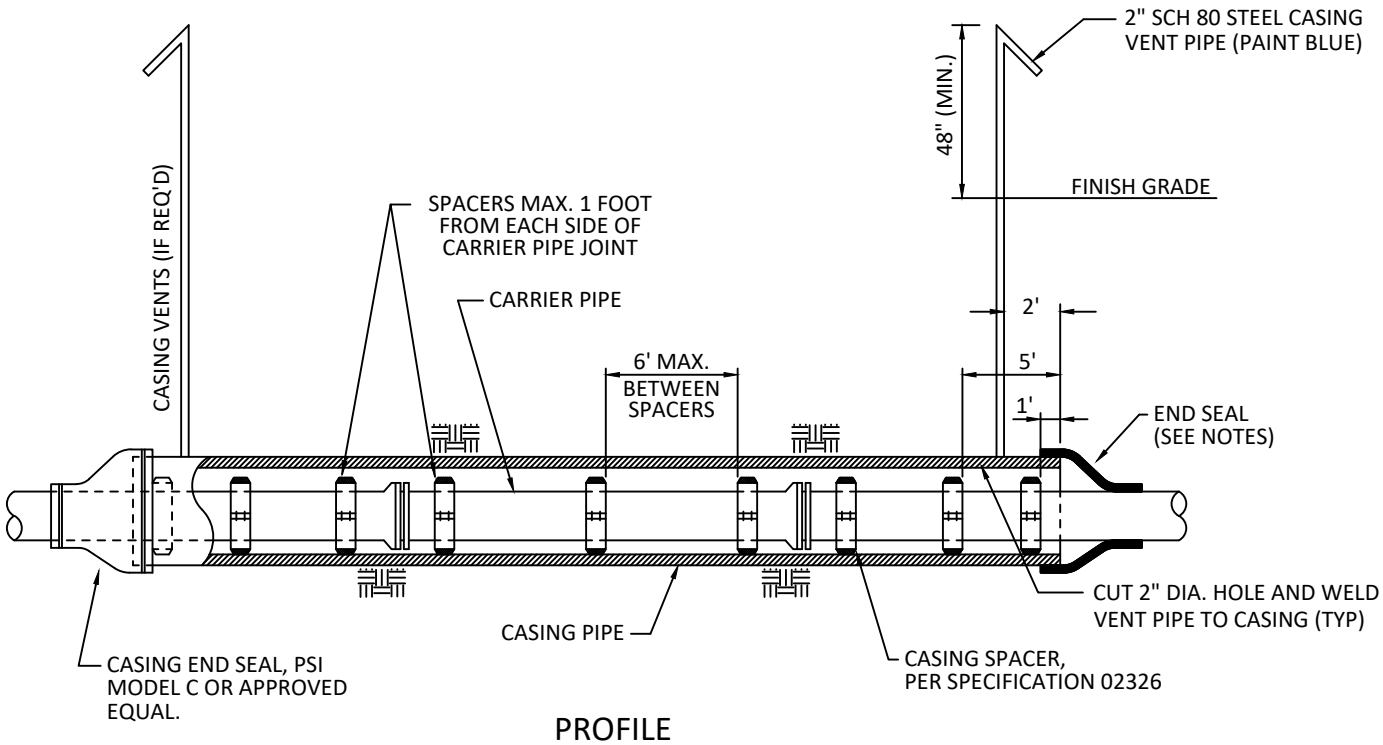
NOTES:

1. A MINIMUM CLEARANCE OF 18-INCHES FROM THE BODY OR FLANGES OF WATER LINE VALVES AND OTHER DEVICES TO THE INSIDE WALL OF THE PIT AS SHOWN OR NOTED.
2. METER MAY BE COMPOUND OR TURBO AND A STRAINER IS REQUIRED FOR USE WITH COMPOUND METERS.
3. A BYPASS LINE IS REQUIRED FOR THE METER.
4. IF TOP OF WATER METER IS OVER 30-INCHES DEEP FROM THE TOP OF LID, METER WILL REQUIRE A REMOTE READING SYSTEM. THIS WILL ELIMINATE THE CONFINED SPACE ENTRY PERMIT REQUIRED TO READ THE METER.
5. ALTERNATE DESIGNS SHALL BE REVIEWED BY THE UTILITIES ENGINEER. FINAL VAULT DIMENSIONS PER ENGINEER.
6. VAULT TO BE LOCATED ON PUBLIC PROPERTY OR IN A DESIGNATED UTILITY EASEMENT.
7. MANHOLE LID OR HATCH NEEDS TO SHOW A CONFINED SPACE WARNING.
8. SMALL METER BOX (3/4-INCH METER): COVER TO BE "OLD CASTLE" CARSON MODEL 2200 CAST IRON WITH LOCKING DEVICE OR EQUAL. CAST IRON COVER SHALL INDICATE WATER METER IN THE CASTING.
9. MEDIUM METER BOX (1 1/2-INCH METER): COVER TO BE "OLD CASTLE" CARSON MODEL 1324 HDPE FLUSH MOUNT WITH CAST IRON READER DOOR AND LOCKING DEVICE OR EQUAL.
10. LARGE METER BOX (2-INCH METER): COVER TO BE "OLD CASTLE" CARSON MODEL 1730 HDPE FLUSH MOUNT WITH CAST IRON READER DOOR AND LOCKING DEVICE OR EQUAL.

ENGINEERING DIVISION, CITY OF NORMAN

WATER METER VAULT LAYOUT

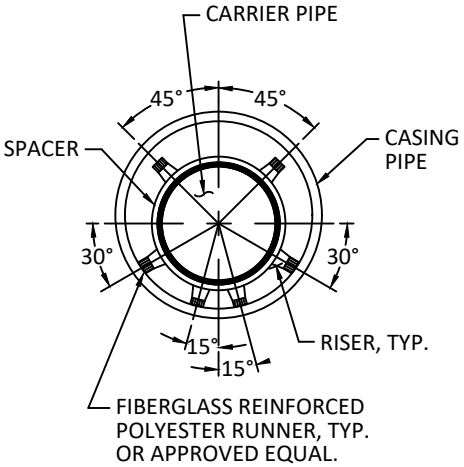
APPROVED BY: CITY ENGINEER	DATE: 01/2023	DRAWING NO: W 15



PROFILE

NOTES:

1. FOR OPEN TRENCH CONSTRUCTION OF CASING PIPE, AS A MINIMUM REQUIREMENT USE SELECT MATERIAL FOR EMBEDMENT AND BACKFILLING.
2. ALL CARRIER PIPE JOINTS WITHIN CASING PIPE SHALL BE RESTRAINED PER SPECIFICATIONS.
3. CASING VENT PIPES ARE ONLY REQUIRED IN ODOT ROW AND AS SHOWN IN THE PLANS.
4. VENT PIPES SHALL BE WELDED TO TO CASING PIPE BEFORE THE CARRIER PIPE IS INSTALLED.
5. CASING END MAY BE SEALED WITH FAST SETTING INSULATION SPRAY FOAM IN LIEU OF A CASING END SEAL. FOAM MUST EXTEND A MIN. OF 24-INCHES INSIDE CASING.

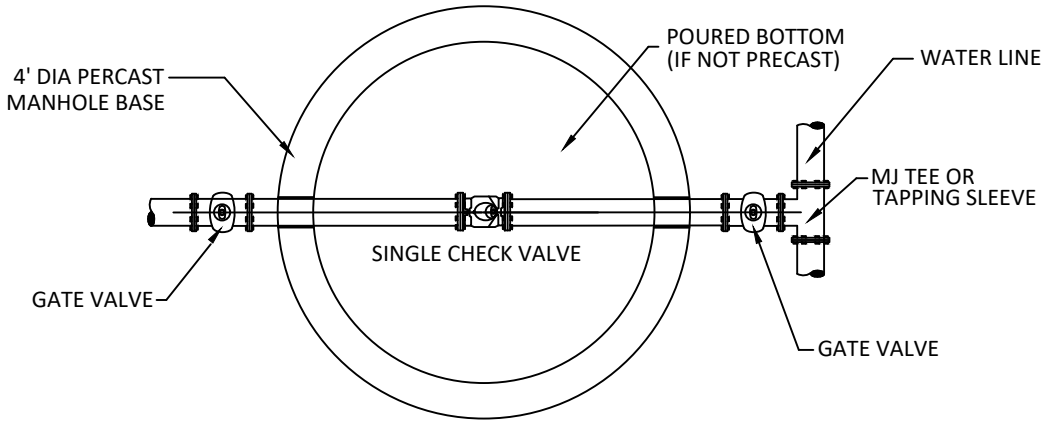


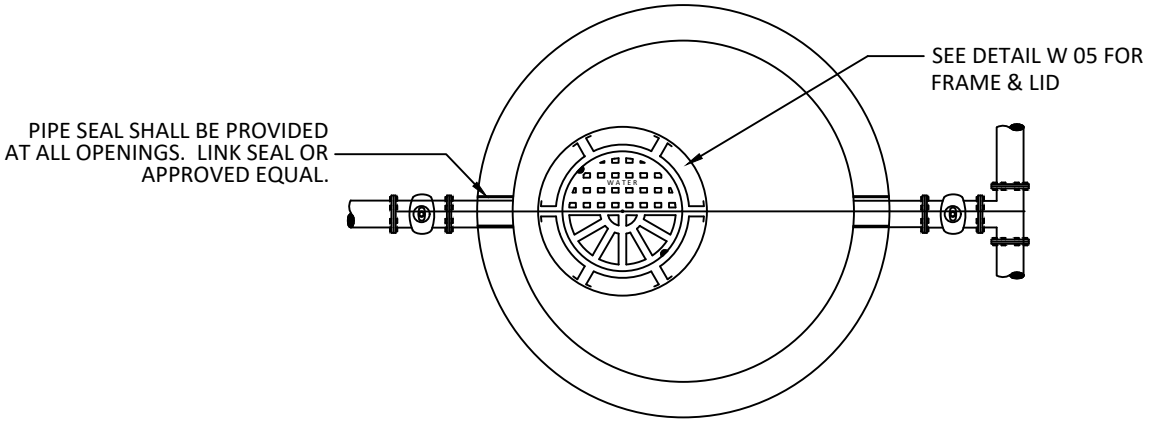
(STANDARD SPACER POSITION)

END VIEW

BORE WITH CASING DETAIL

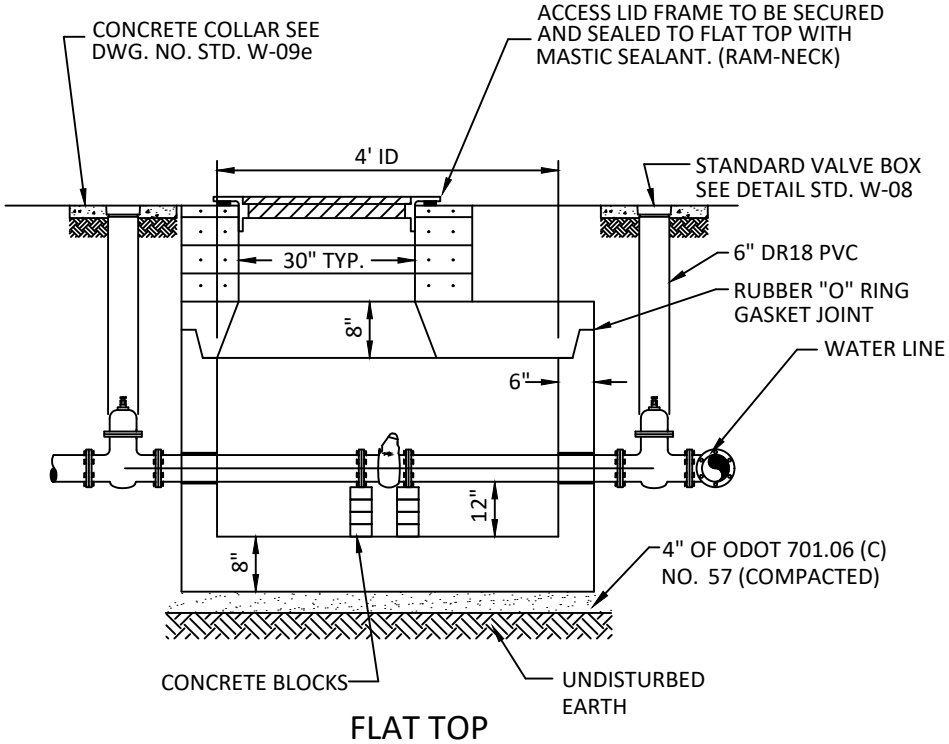
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 19





NOTES:

1. MH SHALL CONFORM TO CURRENT ASTM C-478.
2. MIN. CONCRETE STRENGTH TO BE ODOT CLASS A, 3,500 PSI @ 28 DAYS.
3. DEPTH IS VARIABLE
4. IF POOR SOIL CONDITIONS ARE ENCOUNTERED, DEPTH SHALL BE OVER EXCAVATED AND STABILIZED WITH AGG., BASE.
5. SINGLE CHECK MANHOLE MUST BE LOCATED ON PRIVATE PROPERTY ADJACENT TO THE RIGHT-OF-WAY.
6. SINGLE CHECK VALVE MUST HAVE DETECT METER AND SHALL BE ZURN MODEL 310.
7. EXTEND TRACER WIRE FROM THE MAIN INTO THE VAULT A MIN. OF 24-INCHES.
8. IF THE WATER LINE DEPTH ALLOWS, A STANDARD MH CONE SECTION CAN BE USED IN LIEU OF FLAT TOP.
9. CONTRACTOR TO INSTALL 2- OR 4-INCH REINFORCED CONCRETE CONCENTRIC ADJUSTMENT RINGS AS FINISH GRADE REQUIRES, SECURED, & SEALED WITH RUBBER RINGS OR MASTIC (RAM-NECK) 24-INCHES MAX HEIGHT.
10. TOP OF FRAME TO BE 2 1/2-INCHES ABOVE SURROUNDING GROUND (TYP).

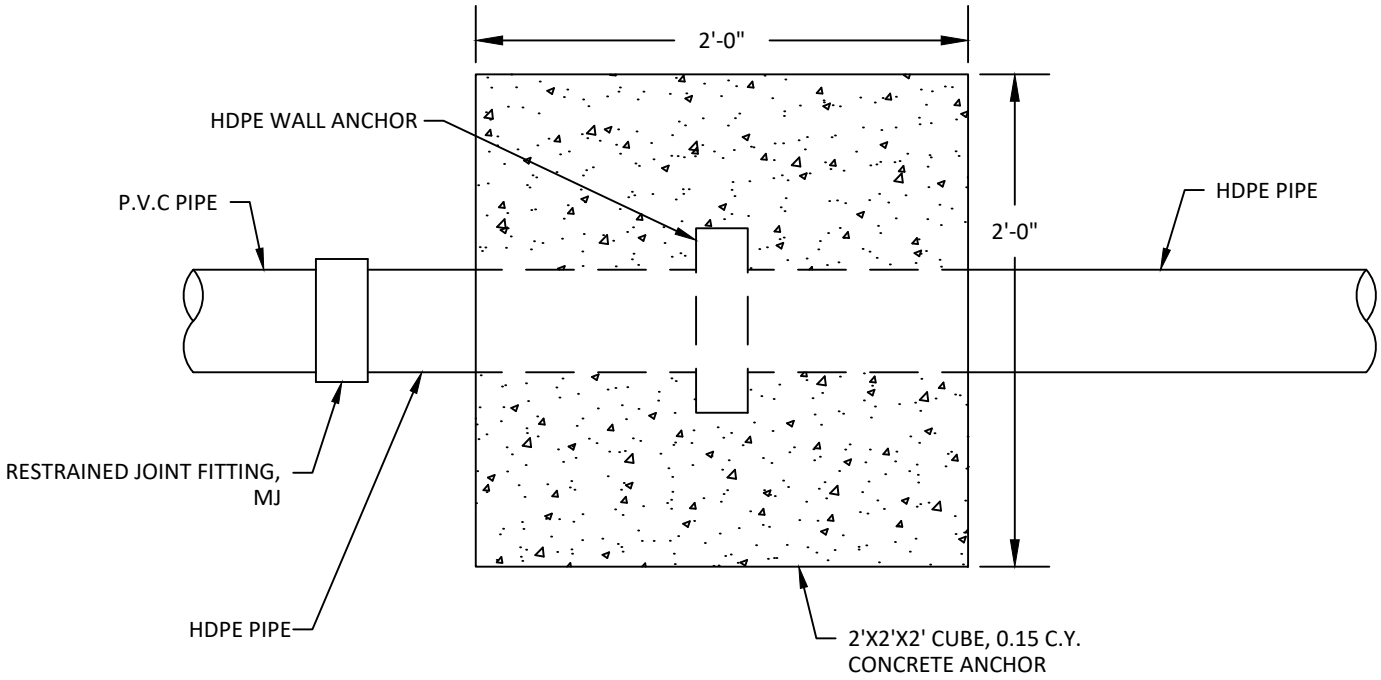


FLAT TOP

(WITH ADJUSTMENT RINGS)

FIRE LINE SINGLE CHECK VALVE MANHOLE

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 20

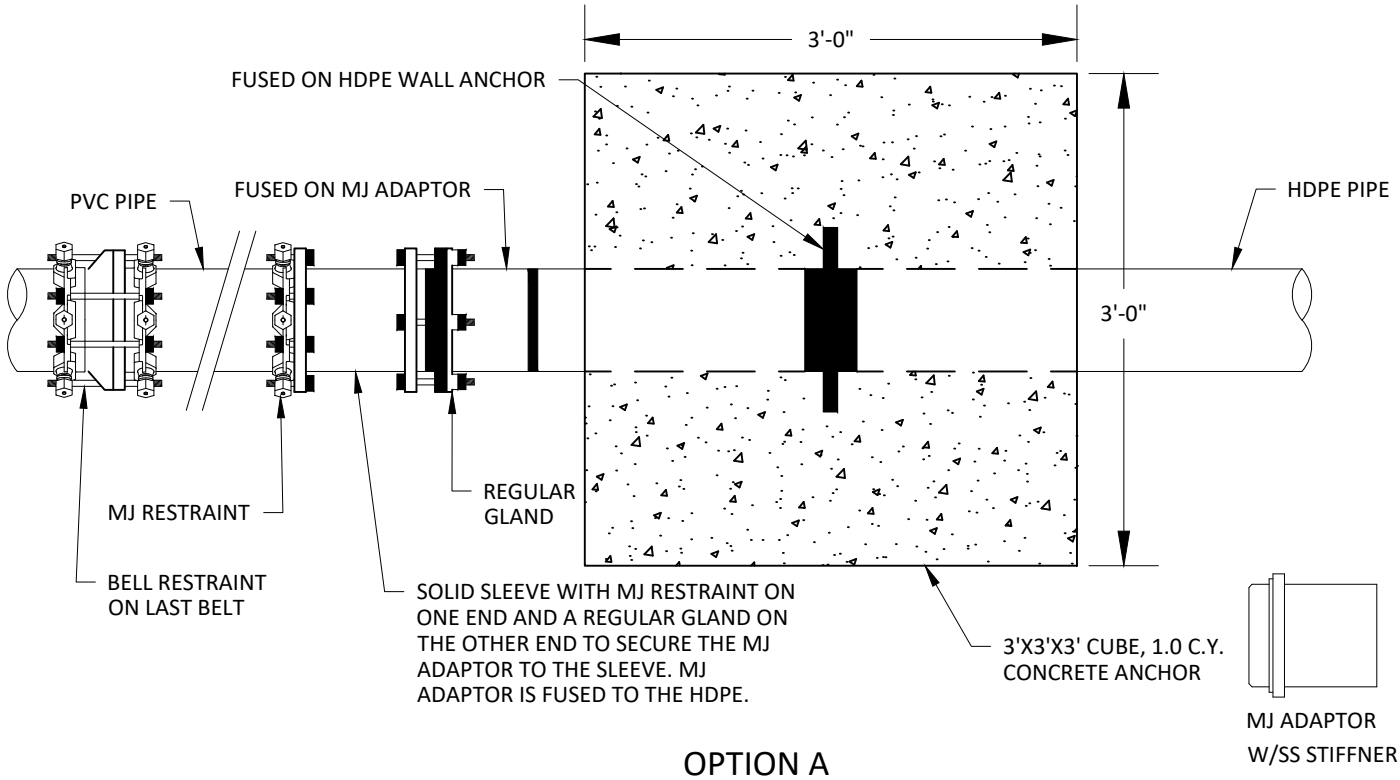


NOTES:

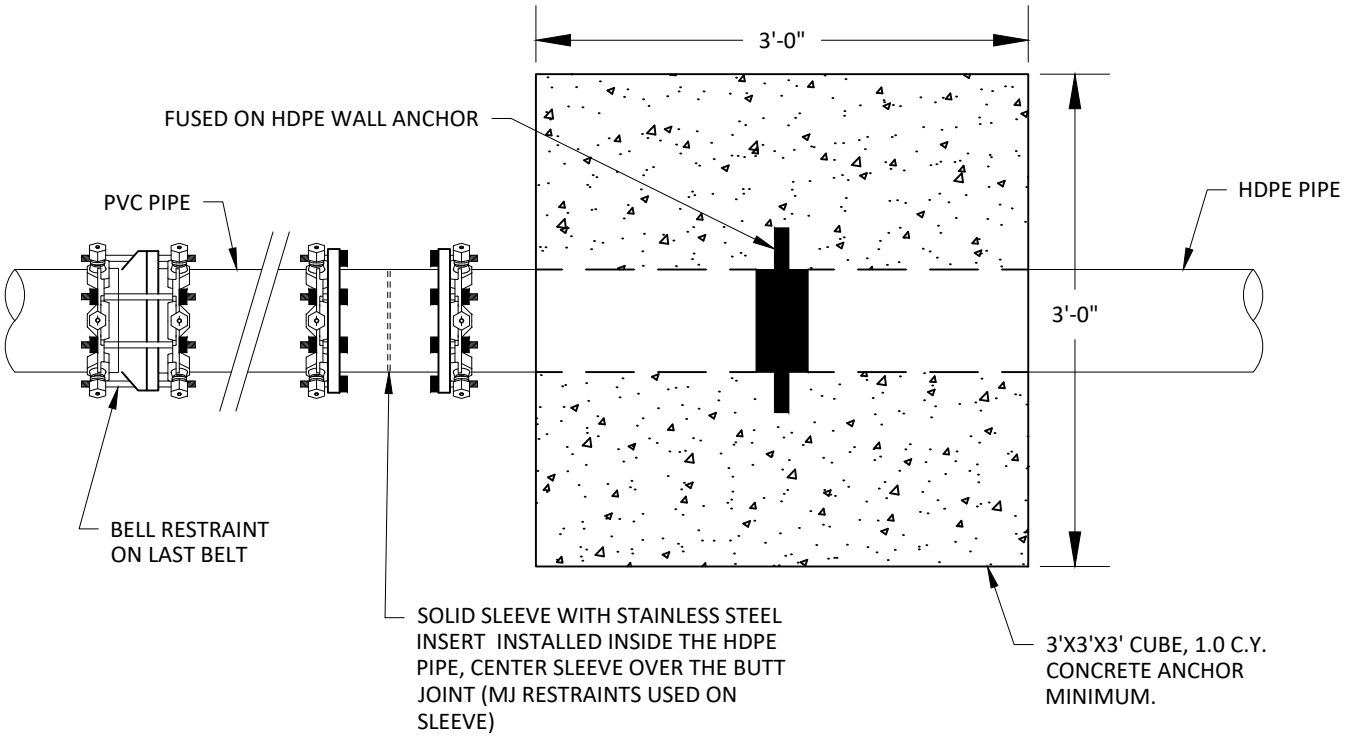
1. 2-FEET BY 2-FEET BY 2-FEET CONCRETE ANCHOR REQUIRED FOR PIPE SIZES UP TO 8-INCHES. ANCHORS FOR PIPE SIZES LARGER THAN 8-INCHES MUST BE APPROVED BY UTILITIES ENGINEER.
2. ALL PVC TO PE TRANSITIONS SHALL BE MADE AS SHOWN ON THIS DETAIL AND PER MANUFACTURER'S RECOMMENDATIONS.
3. USE ADAPTER KIT FUSED ON TO PE BUTT FUSION TO HDPE TO RESTRAINED MJ TO PVC INSTALL CONCRETE ANCHOR.
4. WHEN HDPE PIPE IS CONNECTED TO DI FITTING, USE HDPE MJ ADAPTER AND DI REDUCER AS NECESSARY TO MAKE CONNECTION.

PVC TO HDPE CONNECTION

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 21



OPTION A



OPTION B

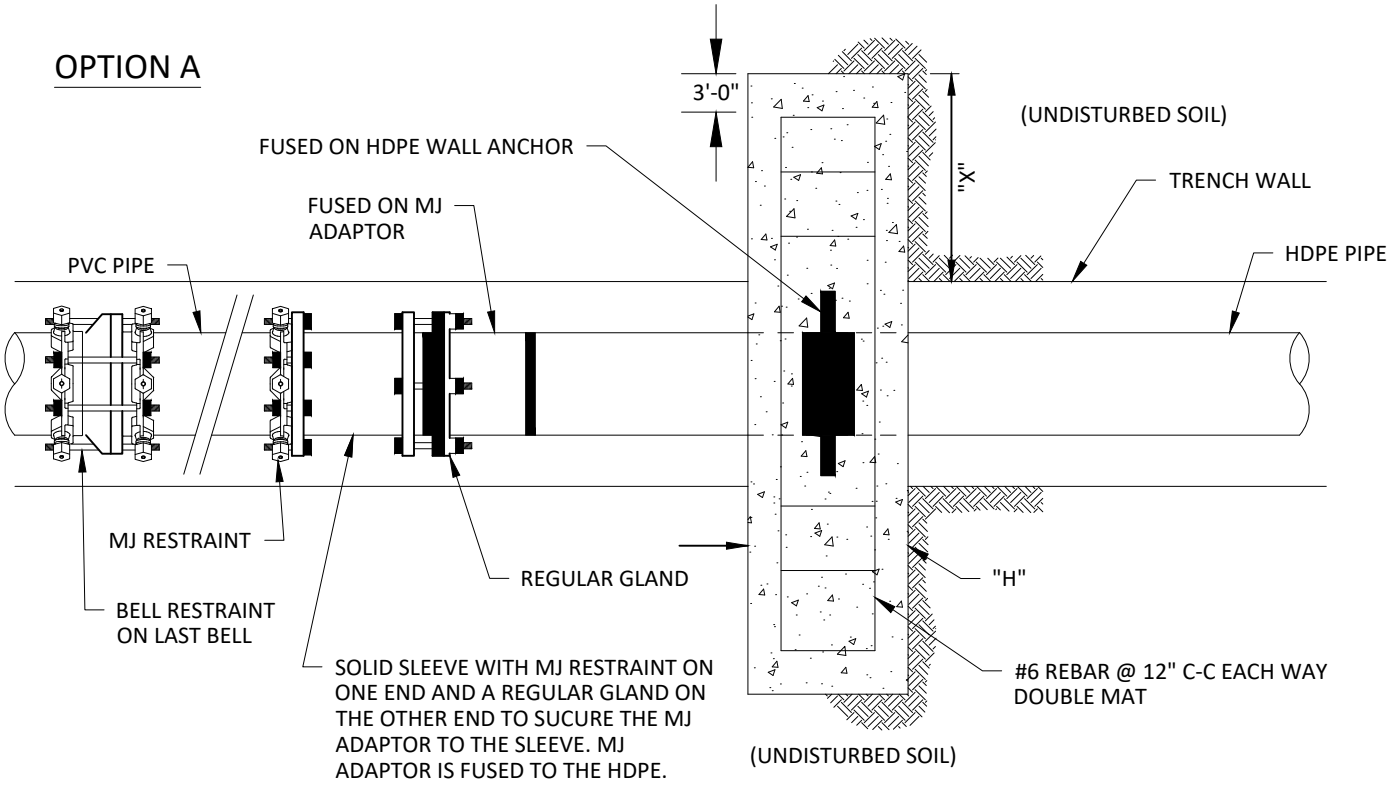
NOTE:

1. ANCHOR BLOCK SIZE MAY BE INCREASED OR DECREASED PER THE ENGINEER.

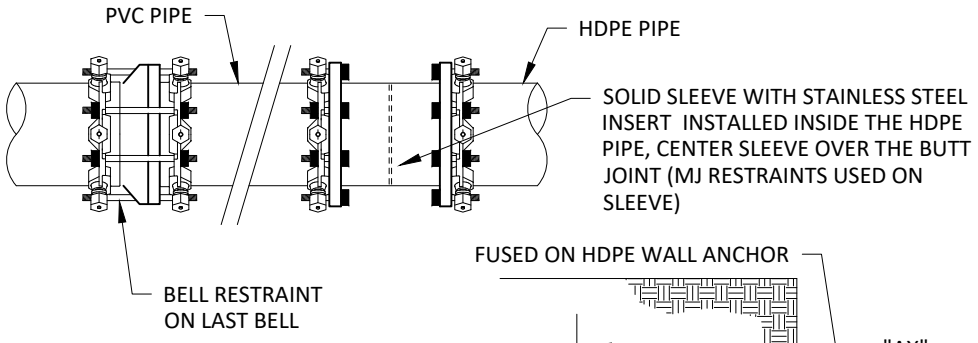
PVC TO HDPE TRANSITION WITH WALL ANCHOR BLOCK

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W-21A

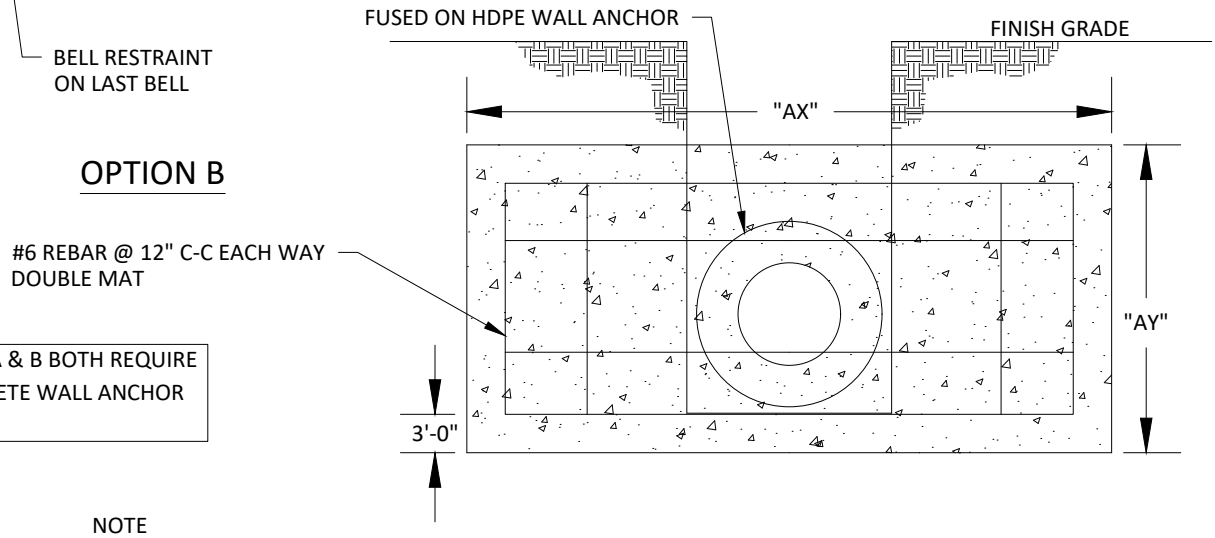
OPTION A



DIPS PIPE SIZE (DR11)	PRESSURE	"X" (IN)	"AX" (IN)	"AY" (IN)	"H" (IN)
8"	150 PSI	30	90	36	18
10"	150 PSI	36	102	42	18
12"	150 PSI	45	120	48	24



OPTION B



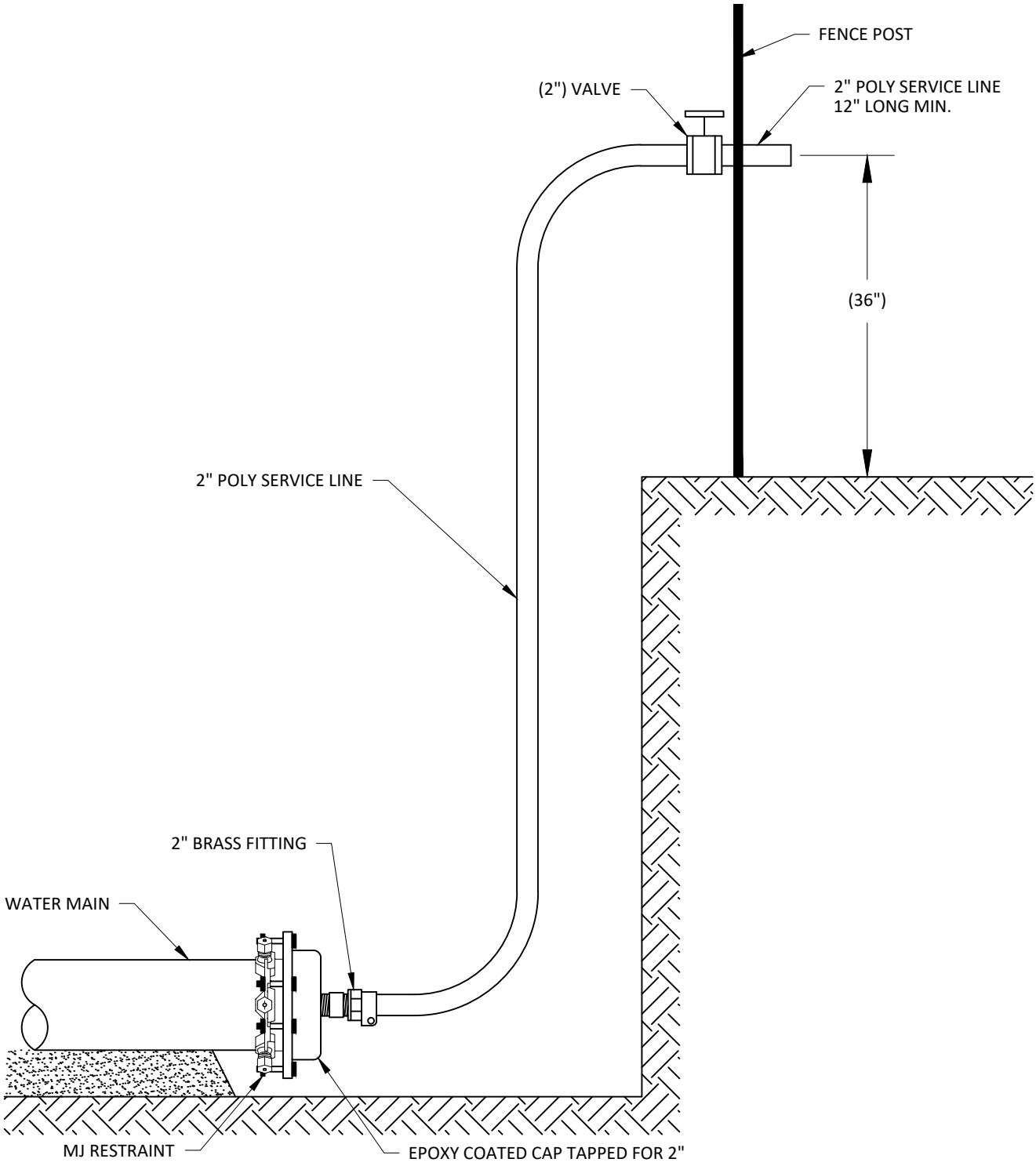
OPTION A & B BOTH REQUIRE A CONCRETE WALL ANCHOR BLOCK.

NOTE

1. ANCHOR BLOCK SIZE MAY BE INCREASED OR DECREASED PER ENGINEER.
2. OPTION A & B BOTH REQUIRE A CONCRETE WALL ANCHOR BLOCK.

PVC TO HDPE TRANSITION WITH WALL ANCHOR BLOCK

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W-21B

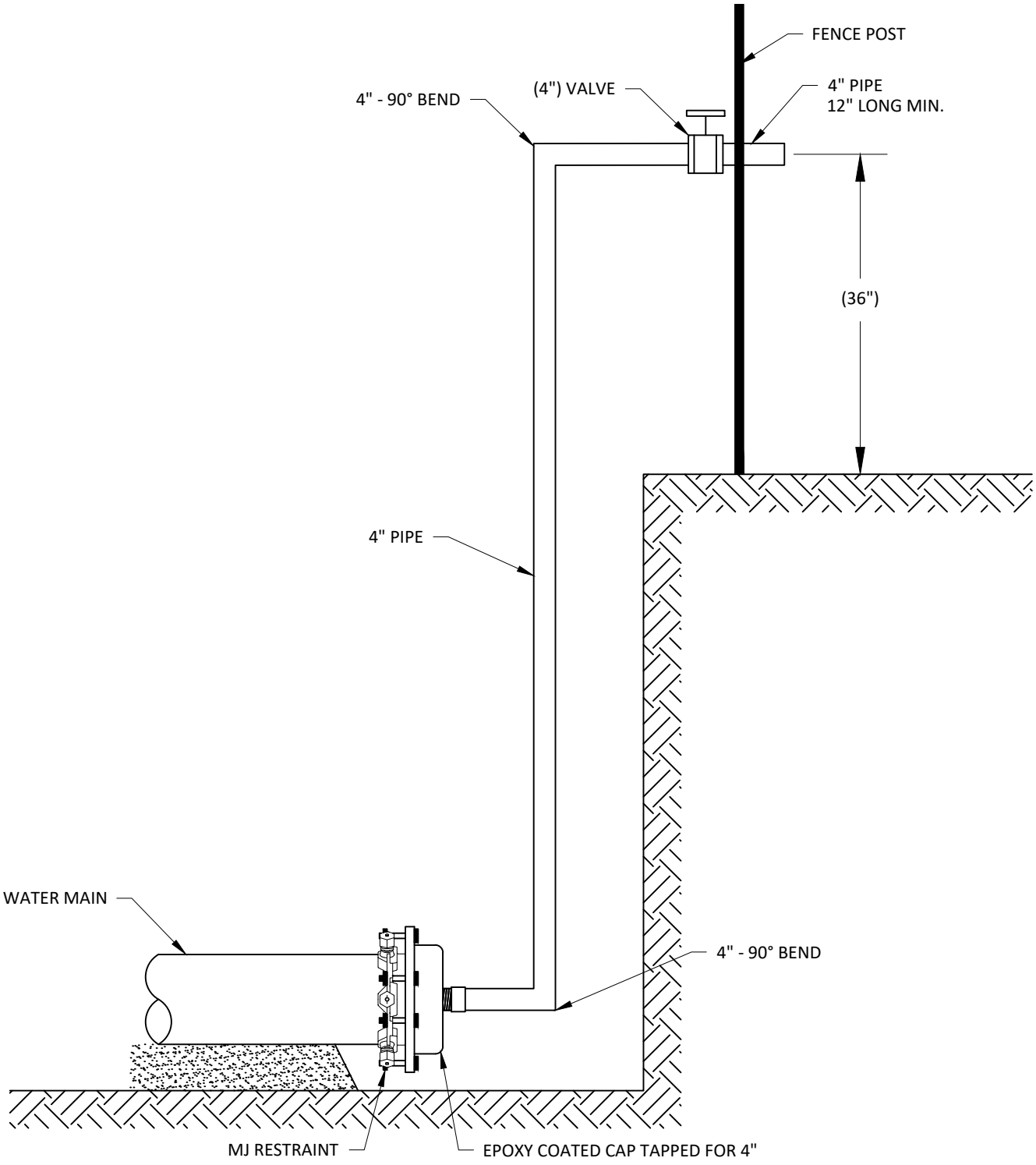


NOTES:

1. INSTALL 2" GATE OR BALL VALVE AS SHOWN.
2. SECURE 2" POLY TO FENCE POST AS SHOWN.
3. NO GALVANIZED MATERIALS MAY BE USED.
4. NO "LIQUID PIPE DOPE" SHALL BE USED.

SAMPLING/FLUSHING TAP ON 4"-8" PVC WATERLINES

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 22

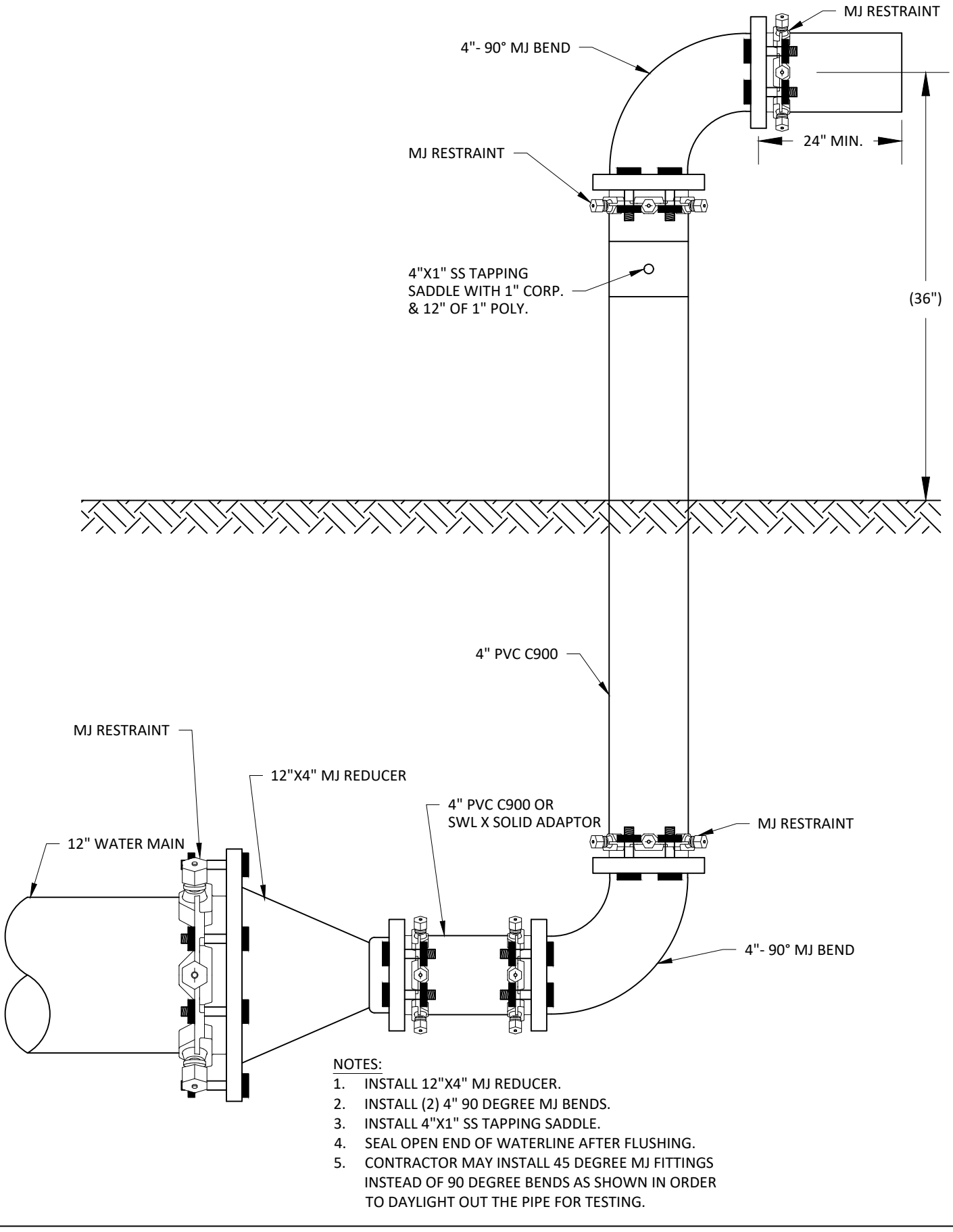


NOTES:

1. INSTALL 4" GATE OR BALL VALVE AS SHOWN
2. SECURE 4" PIPE FOR TESTING AND FLUSHING
3. NO GALVANIZED MATERIALS MAY BE USED
4. NO "LIQUID PIPE DOPE" SHALL BE USED

4" SAMPLING/FLUSHING TAP ON 12" PVC WATERLINES

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 22A

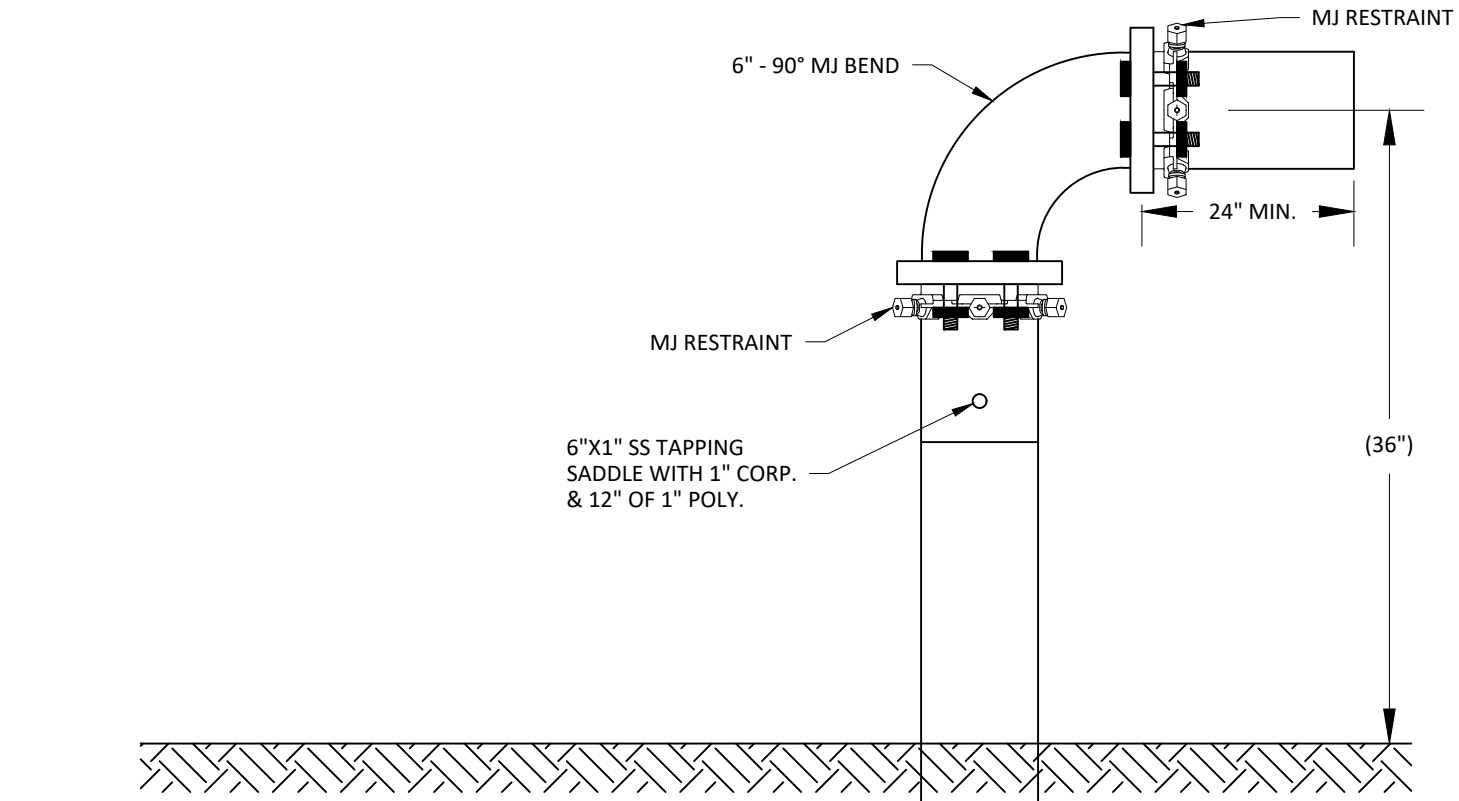


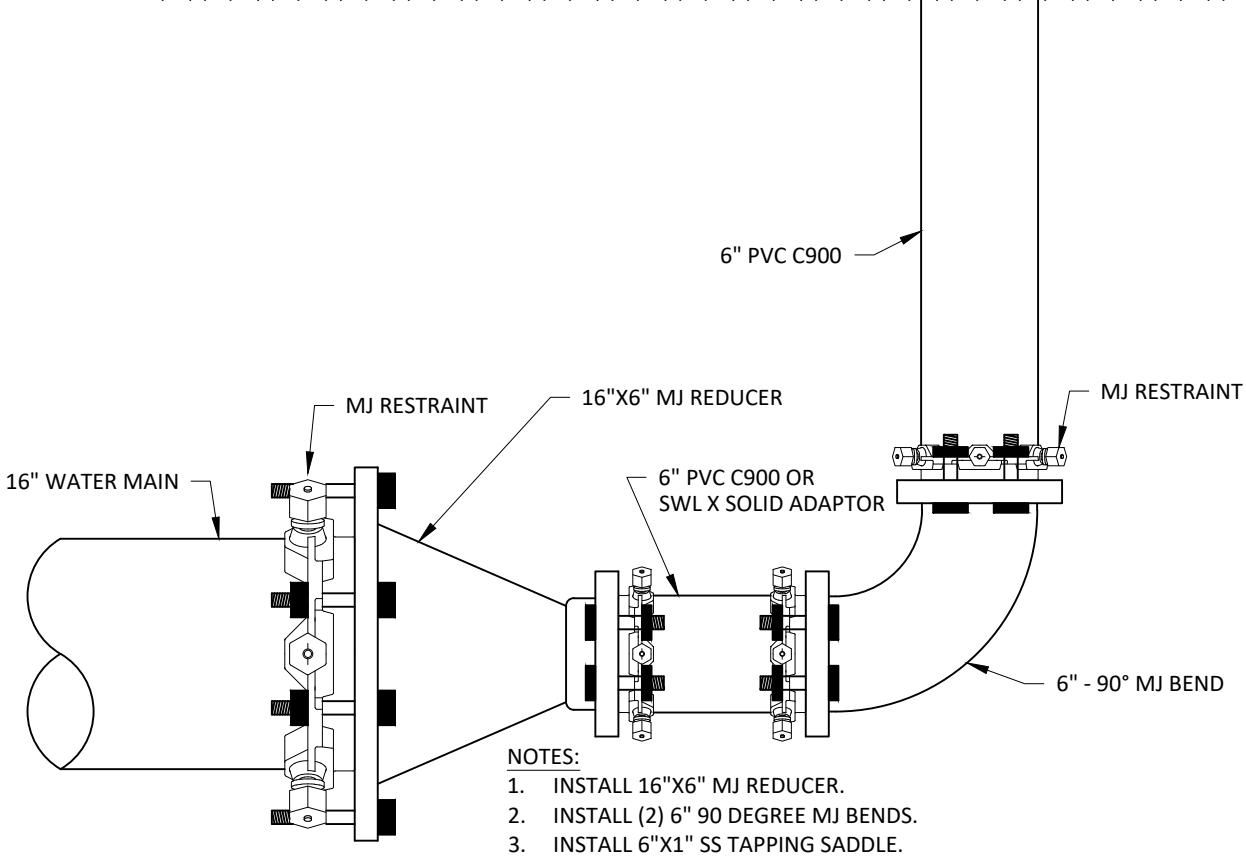
NOTES:

1. INSTALL 12"X4" MJ REDUCER.
2. INSTALL (2) 4" 90 DEGREE MJ BENDS.
3. INSTALL 4"X1" SS TAPPING SADDLE.
4. SEAL OPEN END OF WATERLINE AFTER FLUSHING.
5. CONTRACTOR MAY INSTALL 45 DEGREE MJ FITTINGS INSTEAD OF 90 DEGREE BENDS AS SHOWN IN ORDER TO DAYLIGHT OUT THE PIPE FOR TESTING.

SAMPLING/FLUSHING TAP ON 12" PVC WATERLINES

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 22B



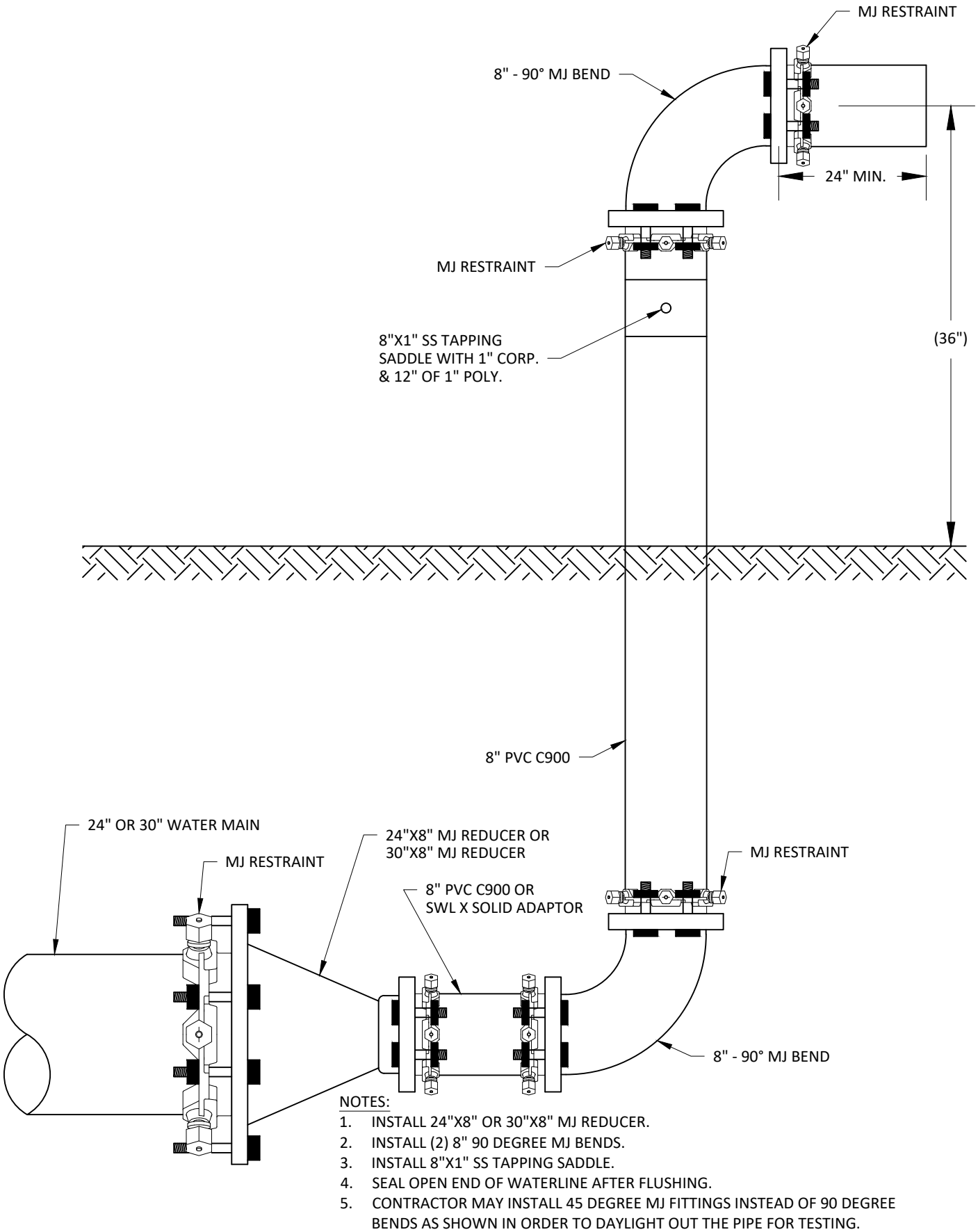


NOTES:

1. INSTALL 16"X6" MJ REDUCER.
2. INSTALL (2) 6" 90 DEGREE MJ BENDS.
3. INSTALL 6"X1" SS TAPPING SADDLE.
4. SEAL OPEN END OF WATERLINE AFTER FLUSHING.
5. CONTRACTOR MAY INSTALL 45 DEGREE MJ FITTINGS INSTEAD OF 90 DEGREE BENDS AS SHOWN IN ORDER TO DAYLIGHT OUT THE PIPE FOR TESTING.
6. CONTRACTOR MAY INSTALL A TEMPORARY FIRE HYDRANT INSTEAD OF 90 DEGREE BENDS OR 45 DEGREE BENDS FOR TESTING.

SAMPLING/FLUSHING TAP ON 16" PVC WATERLINES

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 22C

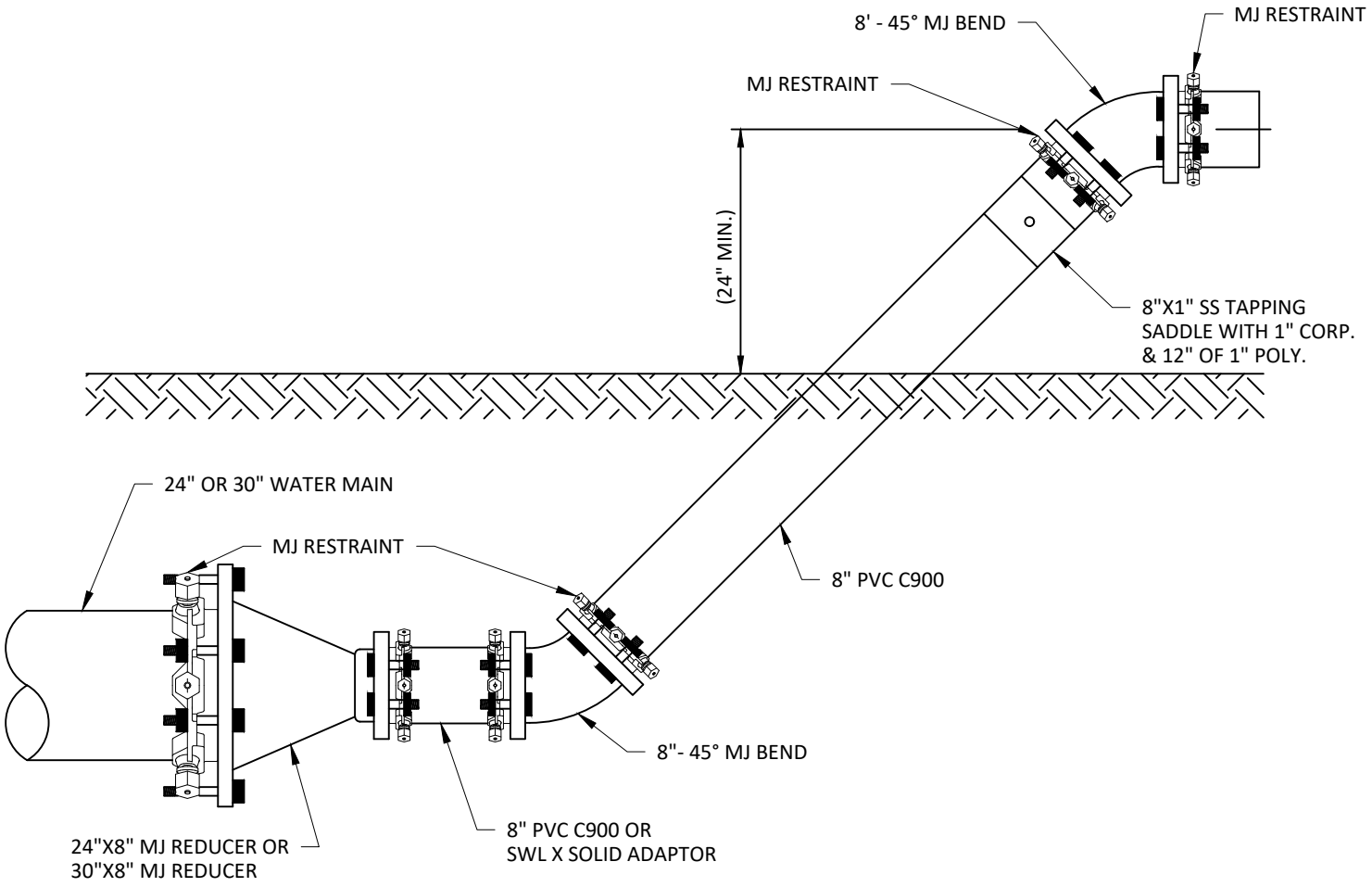


NOTES:

1. INSTALL 24"X8" OR 30"X8" MJ REDUCER.
2. INSTALL (2) 8" 90 DEGREE MJ BENDS.
3. INSTALL 8"X1" SS TAPPING SADDLE.
4. SEAL OPEN END OF WATERLINE AFTER FLUSHING.
5. CONTRACTOR MAY INSTALL 45 DEGREE MJ FITTINGS INSTEAD OF 90 DEGREE BENDS AS SHOWN IN ORDER TO DAYLIGHT OUT THE PIPE FOR TESTING.

SAMPLING/FLUSHING TAP ON 24"-30" PVC WATERLINES

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 22D

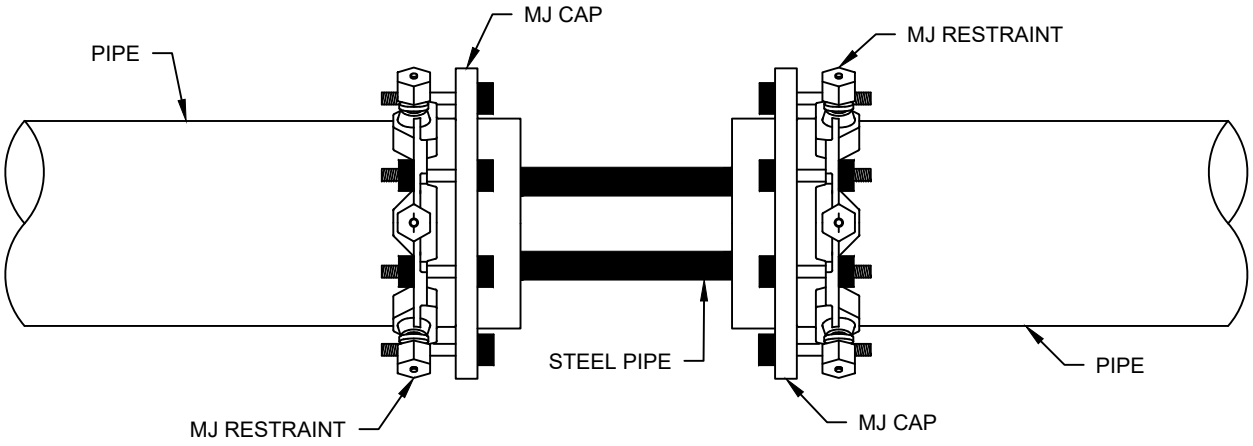


NOTES:

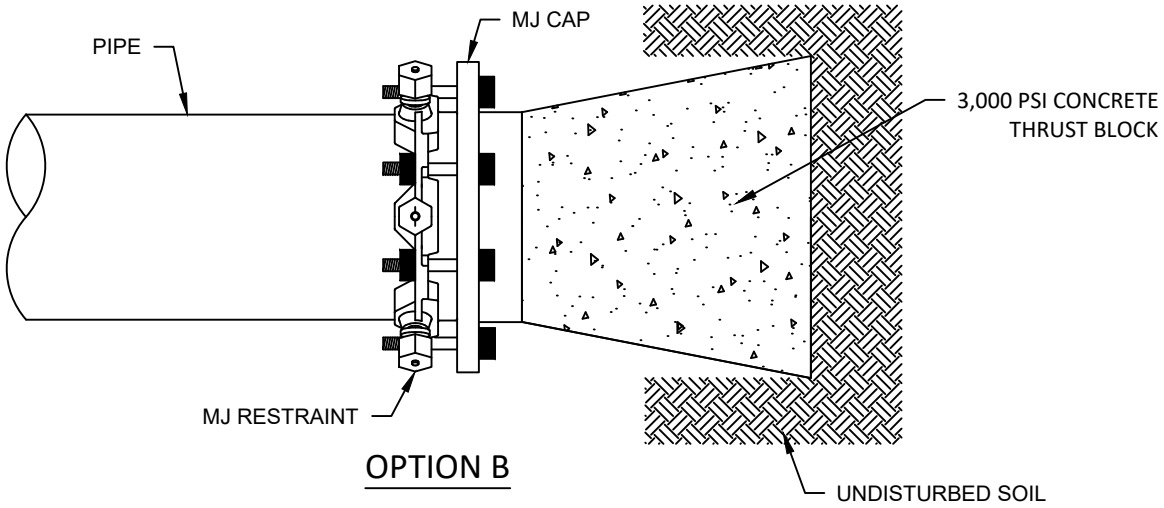
1. INSTALL 24"X8" OR 30"X8" MJ REDUCER.
2. INSTALL (2) 8" 90 DEGREE MJ BENDS.
3. INSTALL 8"X1" SS TAPPING SADDLE.
4. SEAL OPEN END OF WATERLINE AFTER FLUSHING.

SAMPLING/FLUSHING TAP ON 24"-30" PVC WATERLINES

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 22E



OPTION A



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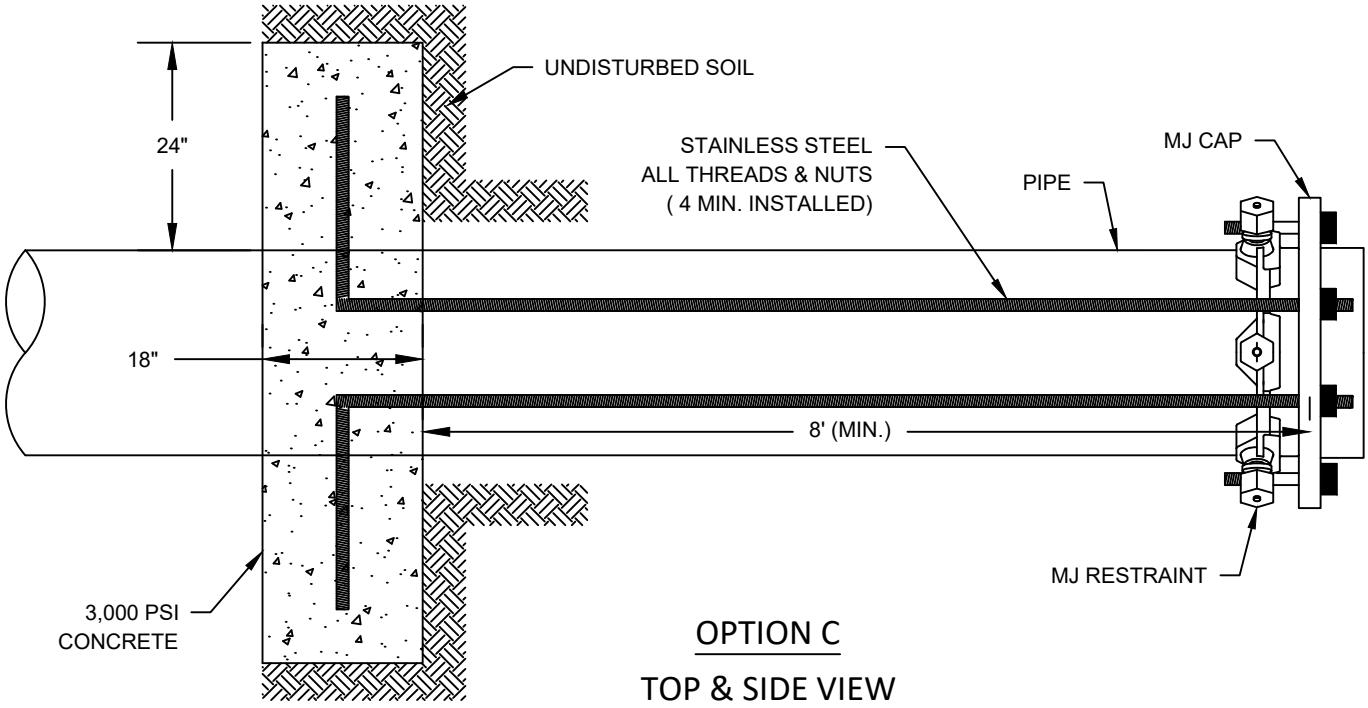

OPTION C

TOP & SIDE VIEW

CAPPING OLD WATERLINE WITH MJ CAP

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. W 23

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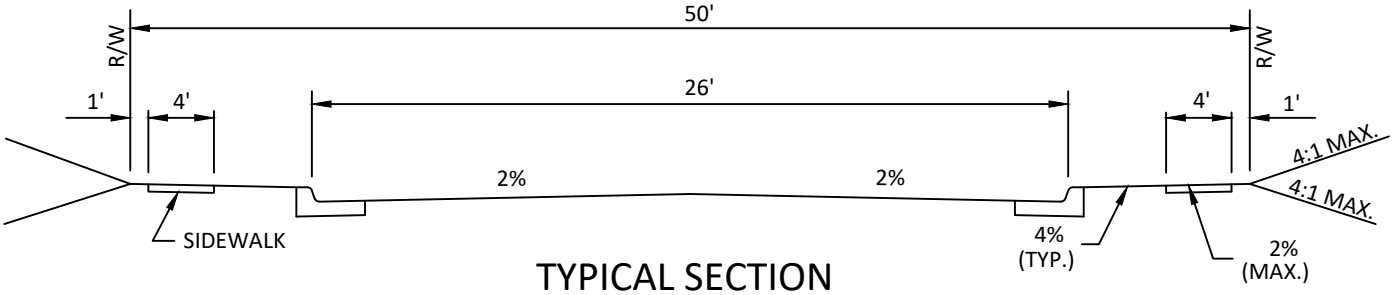
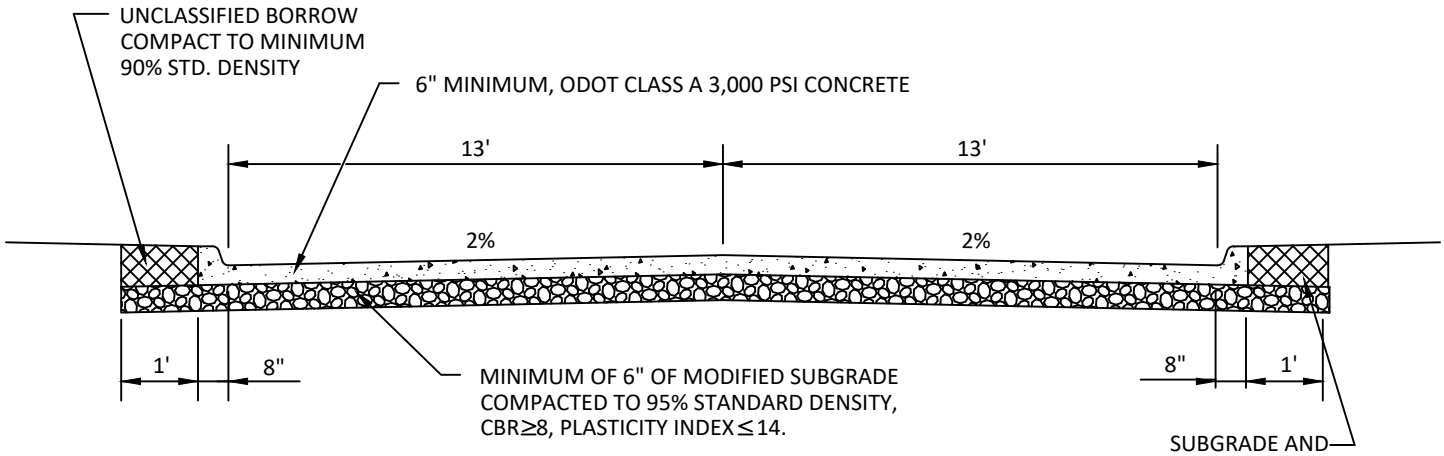
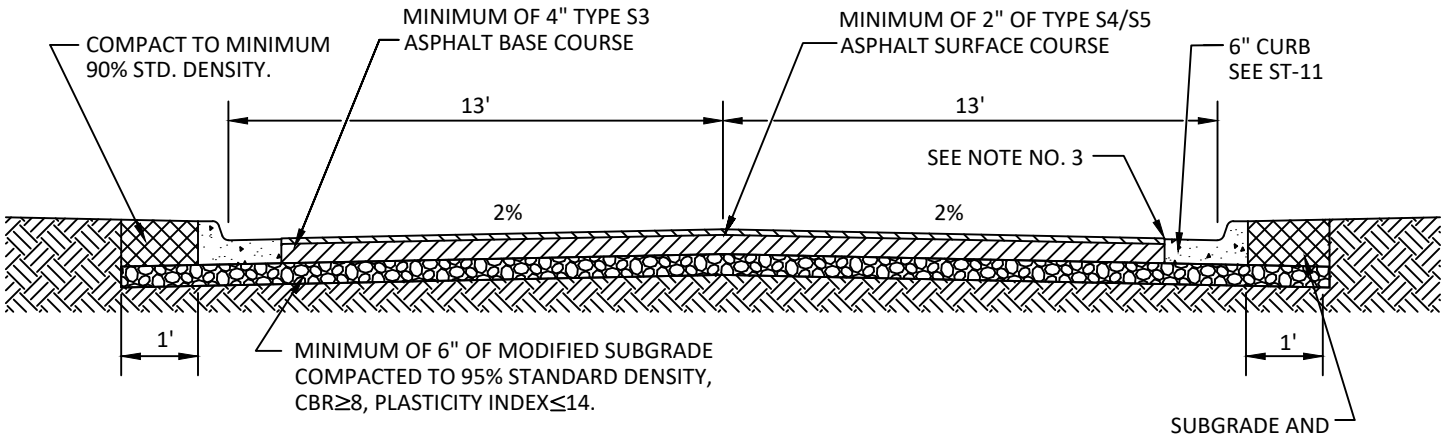


TYPICAL SECTION



CONCRETE STREET SECTION



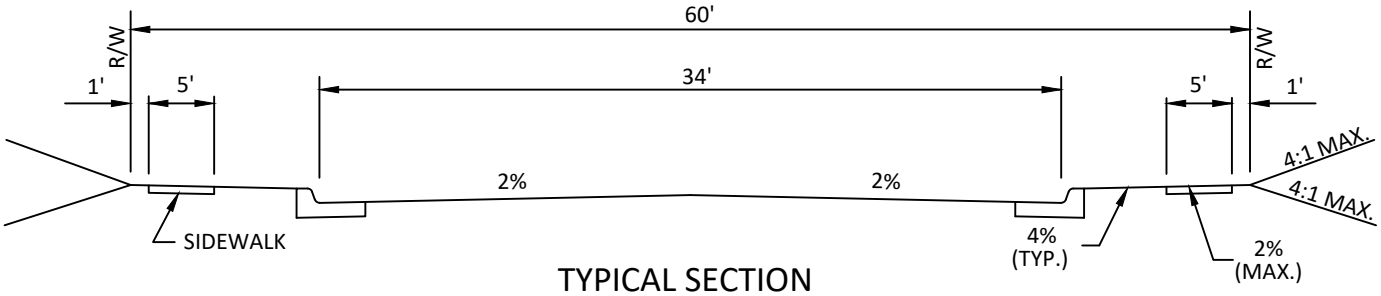
ASPHALT STREET SECTION

NOTES :

1. PAVING SECTION SHOWN IS MINIMUM ALLOWED. STREET PAVING SHALL BE DESIGNED IN ACCORDANCE WITH THE CITY'S "ENGINEERING DESIGN CRITERIA".
2. DOWELS REQUIRED FOR PCC PAVING 8" THICK, OR GREATER, IN ACCORDANCE WITH STANDARD SPECIFICATIONS SECTION 2304.4.A
3. ASPHALT SURFACE SHALL BE $\frac{1}{4}$" ABOVE EDGE OF CONCRETE GUTTER. THE GUTTER THICKNESS MAY BE REDUCED TO 5 $\frac{3}{4}$" TO ACCOMMODATE THIS REQUIREMENT.
4. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND SECTION REQUIREMENTS.

LOCAL (URBAN) STREET

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 4	DRAWING NO. ST 01



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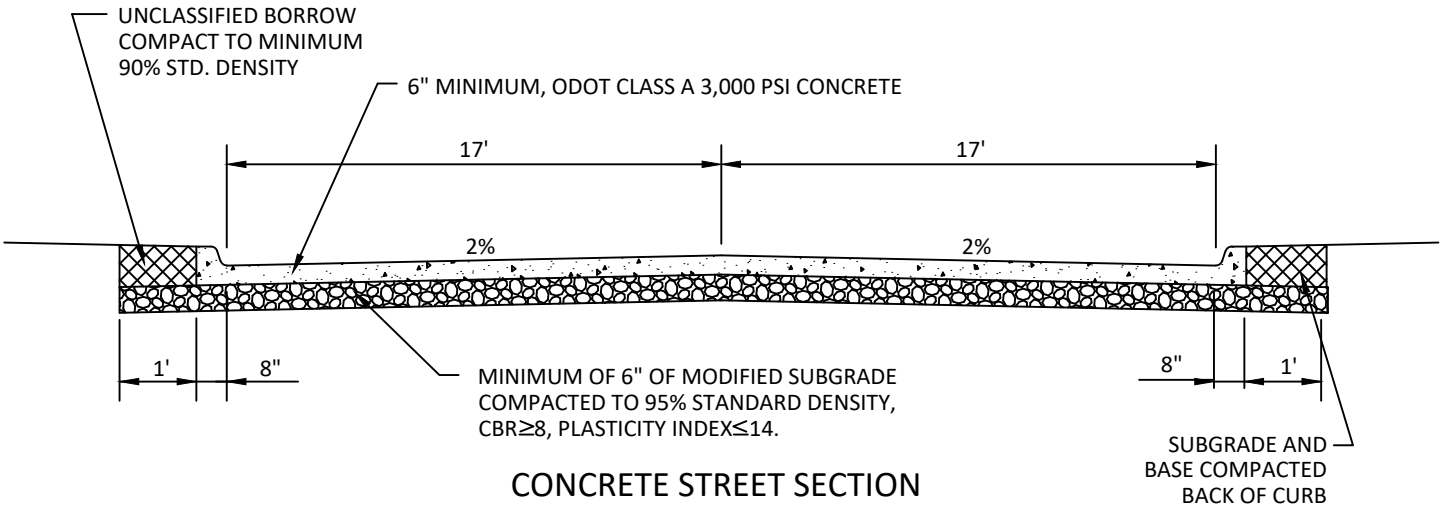

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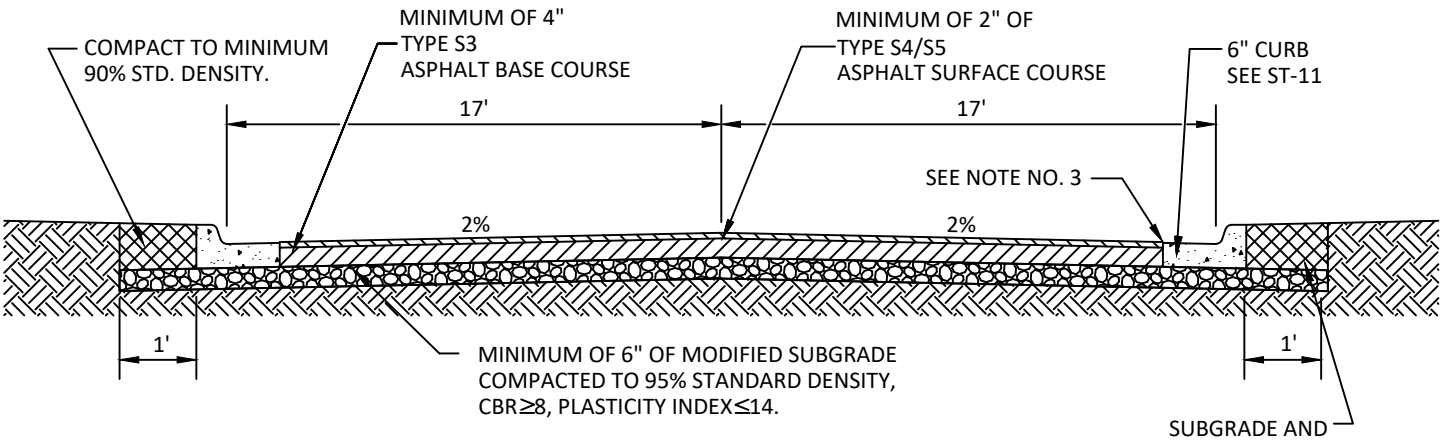


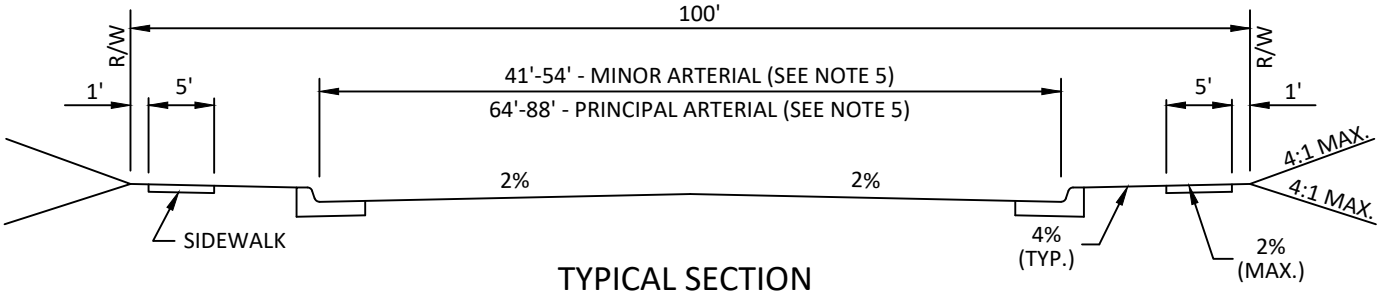
ASPHALT STREET SECTION

NOTES:

1. PAVING SECTION SHOWN IS MINIMUM ALLOWED. STREET PAVING SHALL BE DESIGNED IN ACCORDANCE WITH THE CITY'S "ENGINEERING DESIGN CRITERIA".
2. DOWELS REQUIRED FOR PCC PAVING 8" THICK, OR GREATER, IN ACCORDANCE WITH STANDARD SPECIFICATIONS SECTION 2304.4.A
3. ASPHALT SURFACE SHALL BE $\frac{1}{4}$" ABOVE EDGE OF CONCRETE GUTTER. THE GUTTER THICKNESS MAY BE REDUCED TO 5 $\frac{3}{4}$" TO ACCOMMODATE THIS REQUIREMENT.
4. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND SECTION REQUIREMENTS.

COLLECTOR (URBAN) STREET

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 4	DRAWING NO. ST 02



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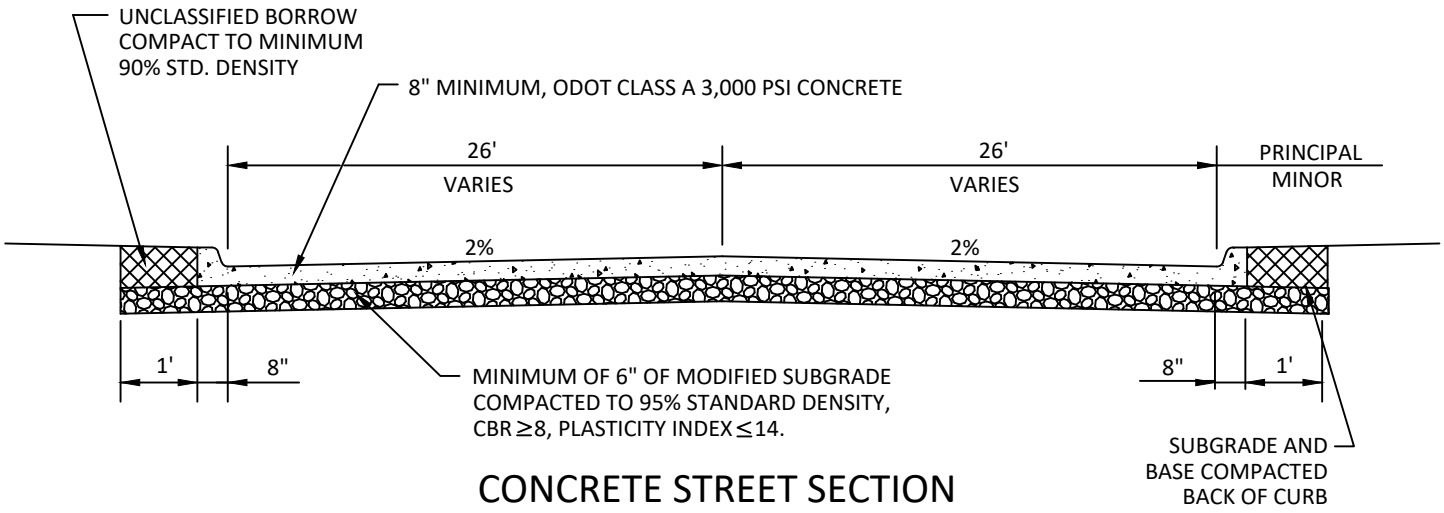

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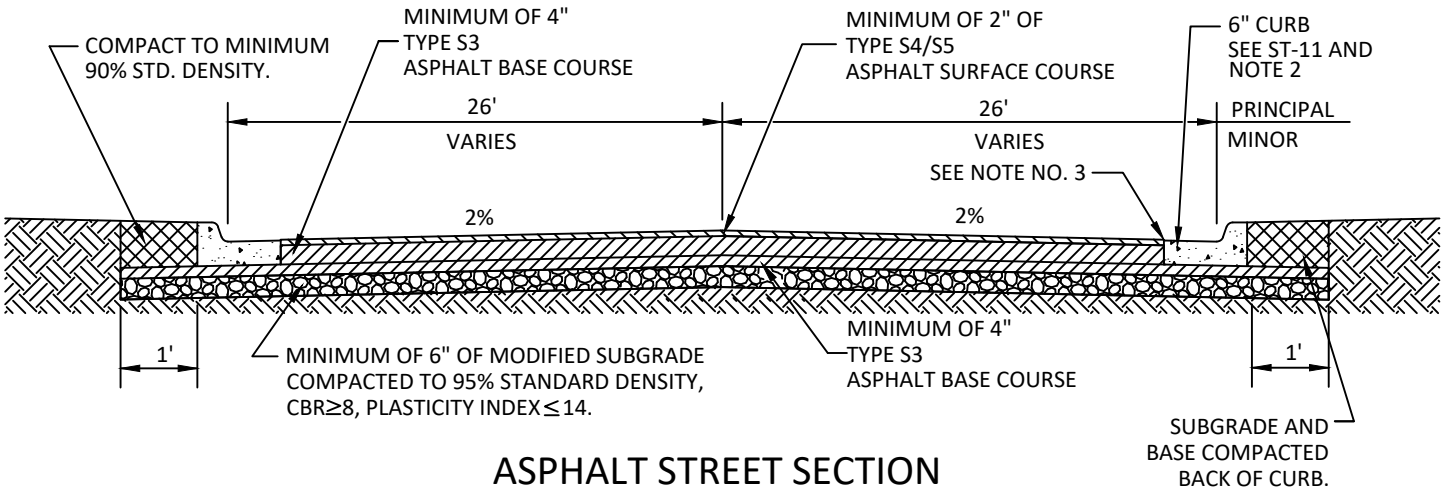


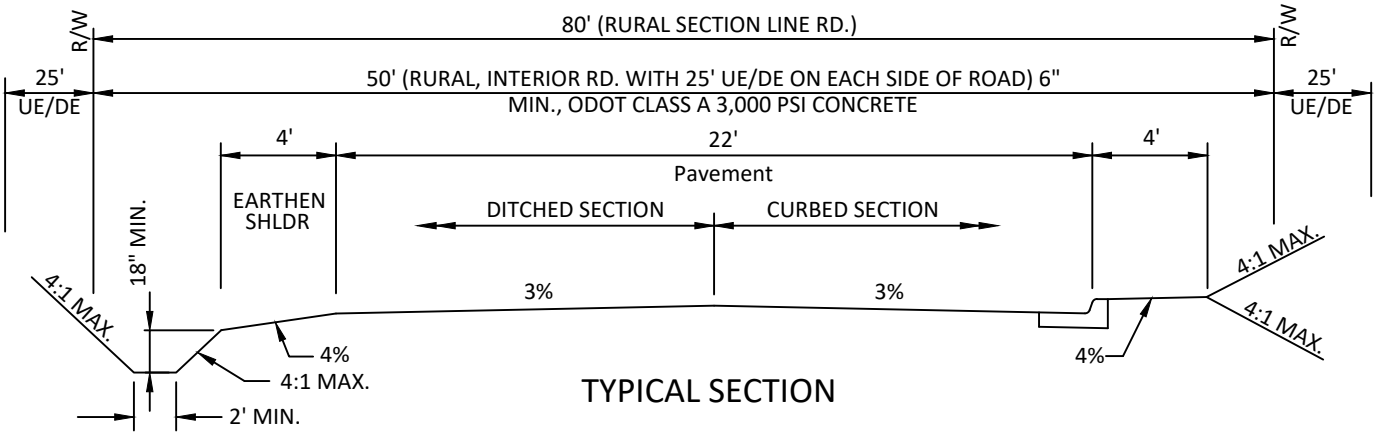
ASPHALT STREET SECTION

NOTES :

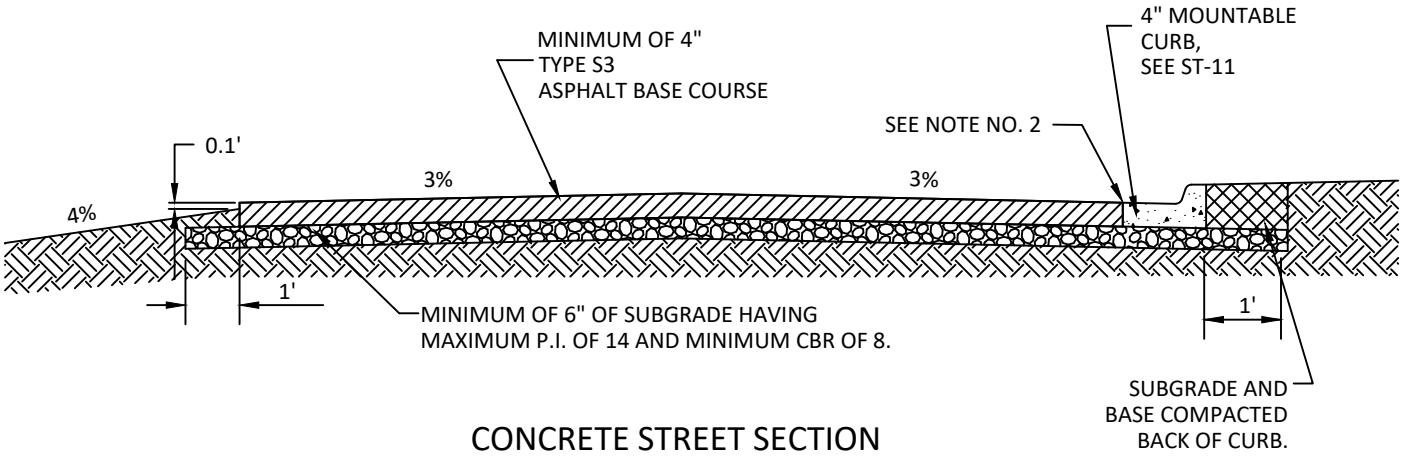
1. PAVING SECTION SHOWN IS MINIMUM ALLOWED. STREET PAVING SHALL BE DESIGNED IN ACCORDANCE WITH THE CITY'S "ENGINEERING DESIGN CRITERIA".
2. DOWELS REQUIRED FOR PCC PAVING 8" THICK, OR GREATER, IN ACCORDANCE WITH STANDARD SPECIFICATIONS SECTION 2304.4.A
3. ASPHALT SURFACE SHALL BE $\frac{1}{4}$" ABOVE EDGE OF CONCRETE GUTTER. THE GUTTER THICKNESS MAY BE REDUCED TO 5 $\frac{3}{4}$" TO ACCOMMODATE THIS REQUIREMENT.
4. PAVEMENT SECTION TO BE SUPER-ELEVATED AT ROADWAY CURVES.
5. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND SECTION REQUIREMENTS.

ARTERIAL (URBAN) STREET

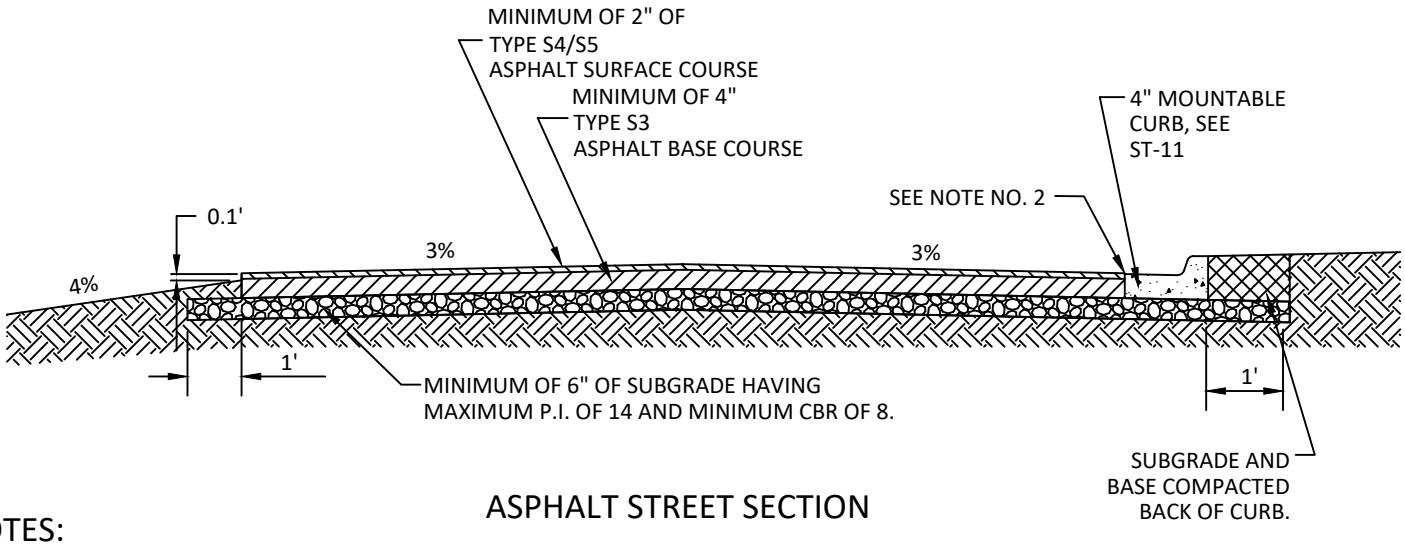
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 5	DRAWING NO. ST 03



TYPICAL SECTION



CONCRETE STREET SECTION



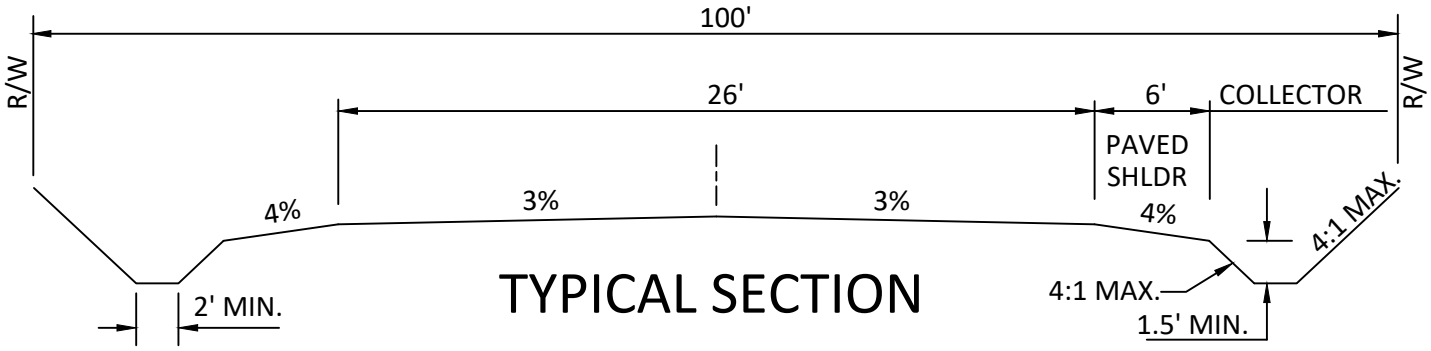
ASPHALT STREET SECTION

NOTES:

1. PAVING SECTION SHOWN IS MINIMUM ALLOWED. STREET PAVING SHALL BE DESIGNED IN ACCORDANCE WITH THE CITY'S "ENGINEERING DESIGN CRITERIA".
2. ASPHALT SURFACE SHALL BE ¼" ABOVE EDGE OF CONCRETE GUTTER. THE GUTTER THICKNESS MAY BE REDUCED TO 5¾" TO ACCOMMODATE THIS REQUIREMENT.
3. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND SECTION REQUIREMENTS.
4. TYPICAL SECTIONS ILLUSTRATE BOTH THE CURB AND GUTTER AND DITCH SECTIONS WITH CONDITIONS USED TO BE DETERMINED BY THE CLASSIFICATION OF ROADWAY DEFINED IN THE COMPREHENSIVE TRANSPORTATION PLAN.

RESIDENTIAL ESTATE/LOCAL (RURAL) ROAD

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 5	DRAWING NO. ST 04



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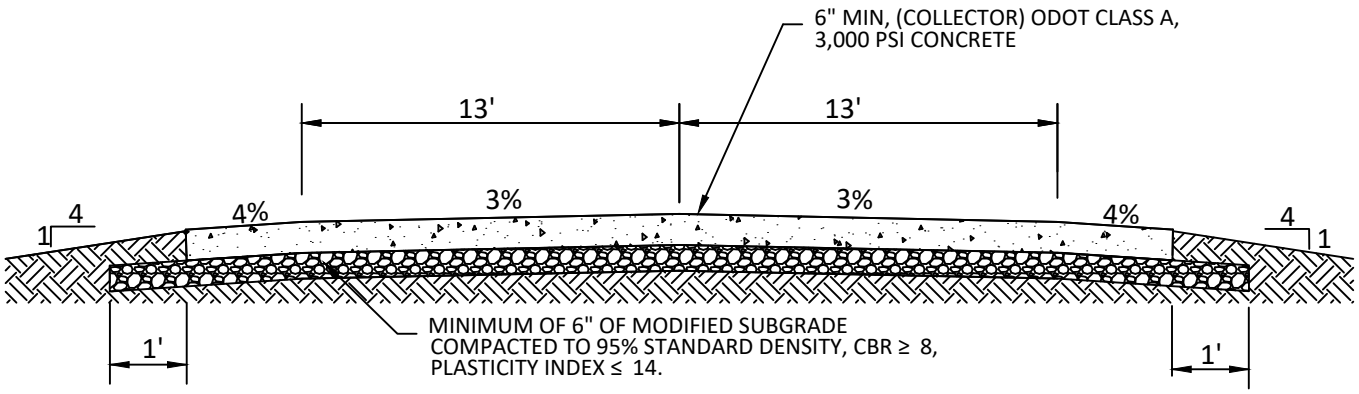

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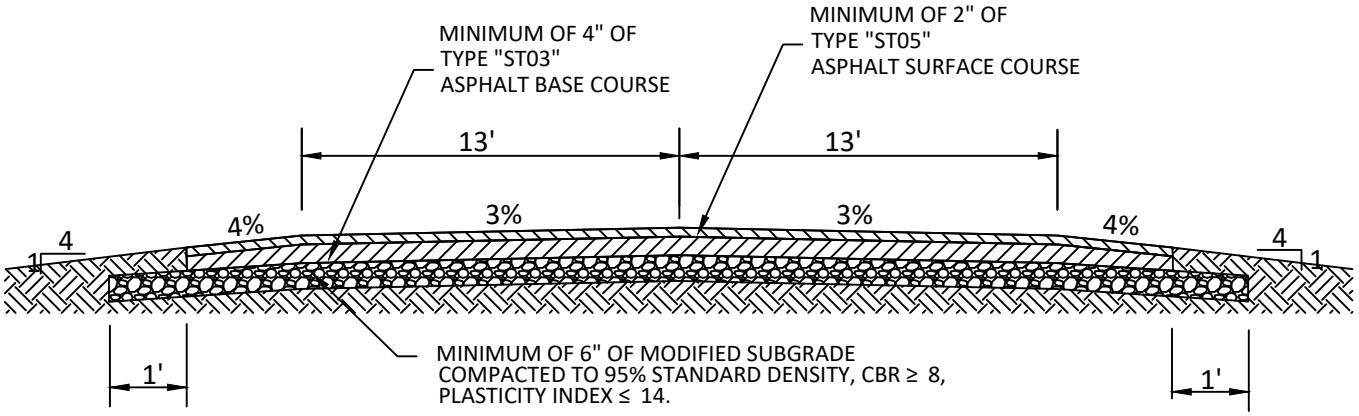


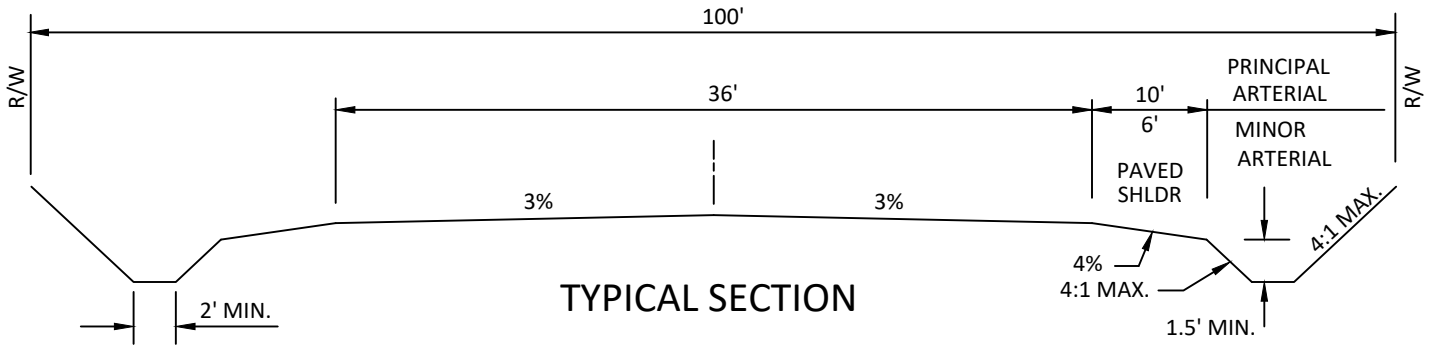
ASPHALT STREET SECTION

NOTES:

1. PAVING SECTION SHOWN IS MINIMUM ALLOWED. STREET PAVING SHALL BE DESIGNED IN ACCORDANCE WITH THE CITY'S ''ENGINEERING DESIGN CRITERIA''.
2. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND SECTION REQUIREMENTS.

COLLECTOR (RURAL) ROAD

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 04	DRAWING NO. ST 05



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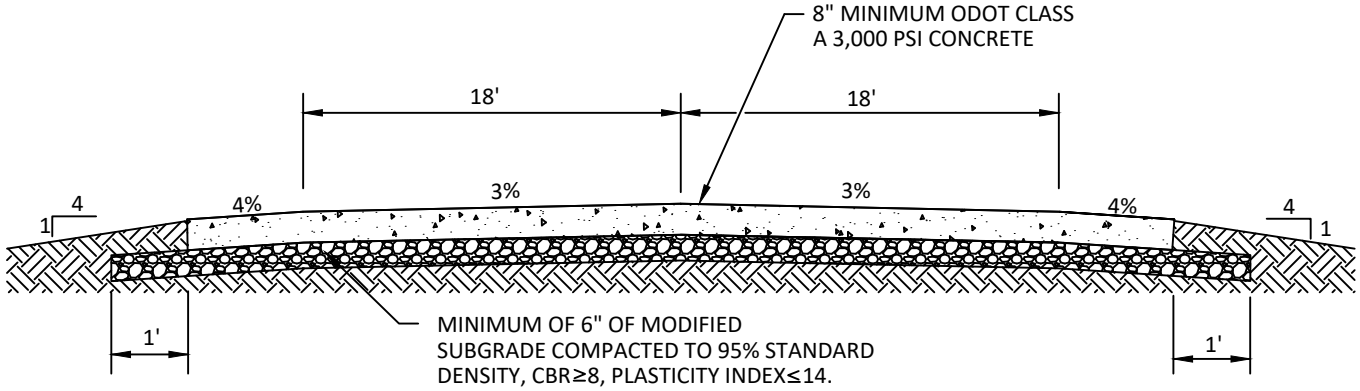

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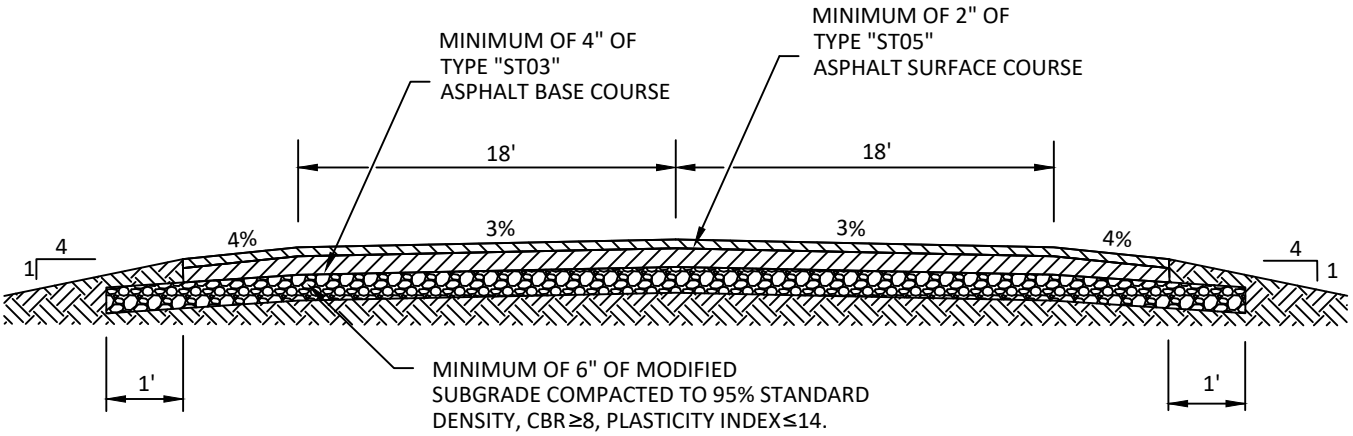


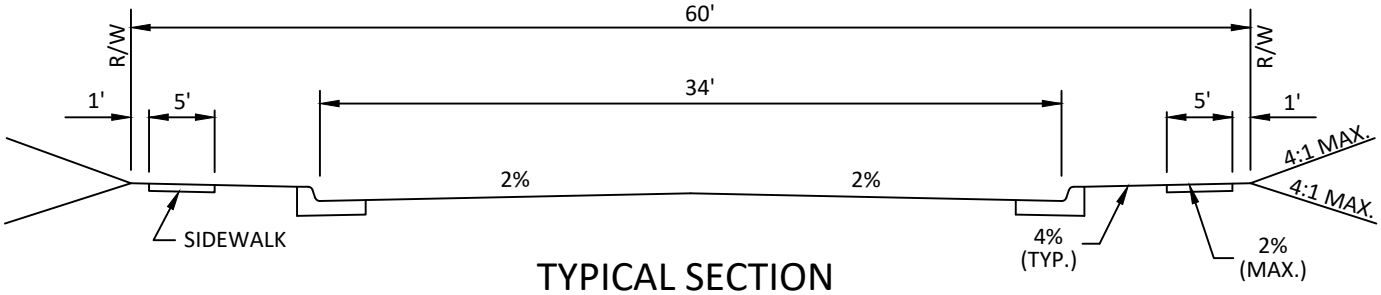
ASPHALT STREET SECTION

NOTES:

1. PAVING SECTION SHOWN IS MINIMUM ALLOWED. STREET PAVING SHALL BE DESIGNED IN ACCORDANCE WITH THE CITY'S ''ENGINEERING DESIGN CRITERIA''.
2. DOWELS REQUIRED FOR PCC PAVING 8'' THICK, OR GREATER, IN ACCORDANCE WITH STANDARD SPECIFICATIONS SECTION 2304.4.A.
3. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND SECTION REQUIREMENTS.

ARTERIAL (RURAL) ROAD

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 03	DRAWING NO. ST 06A



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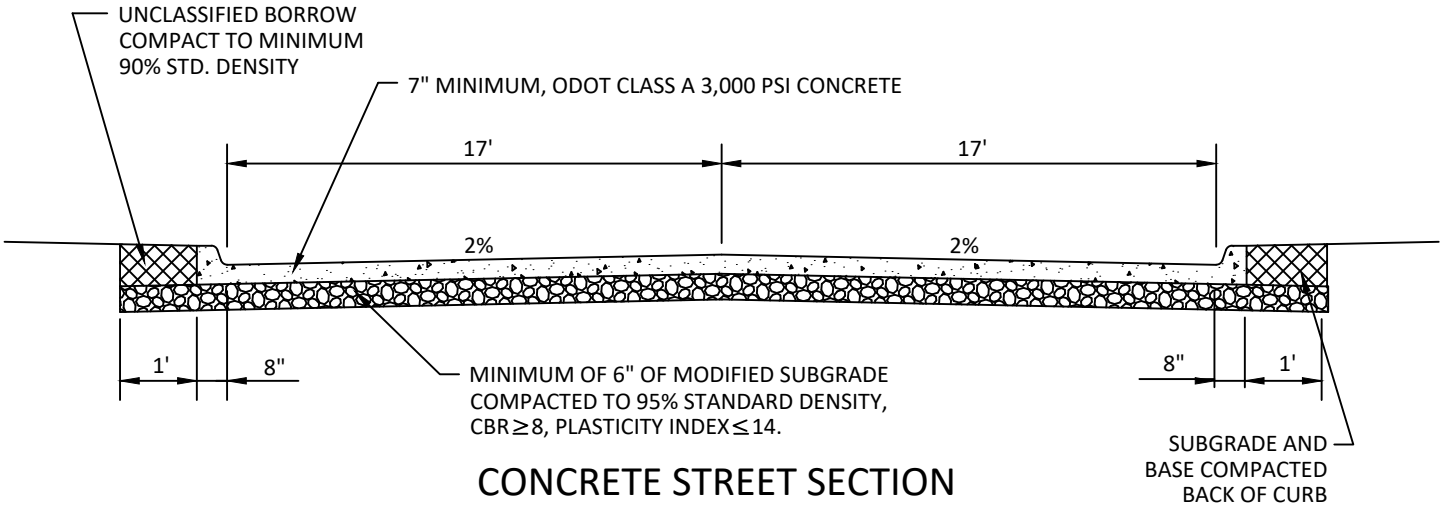
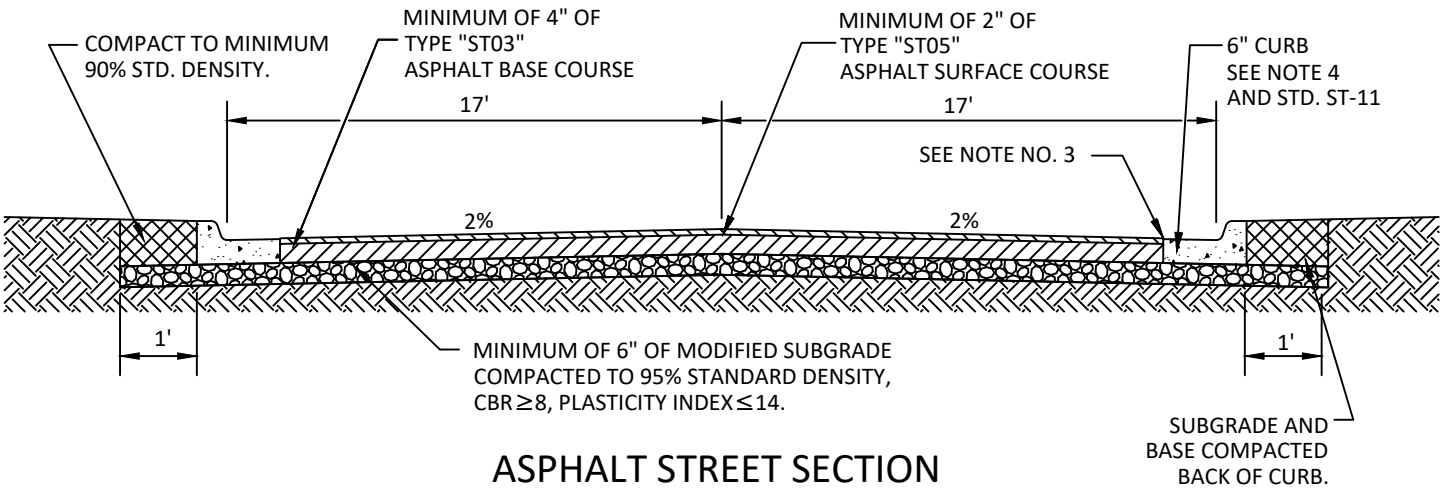


CONCRETE STREET SECTION



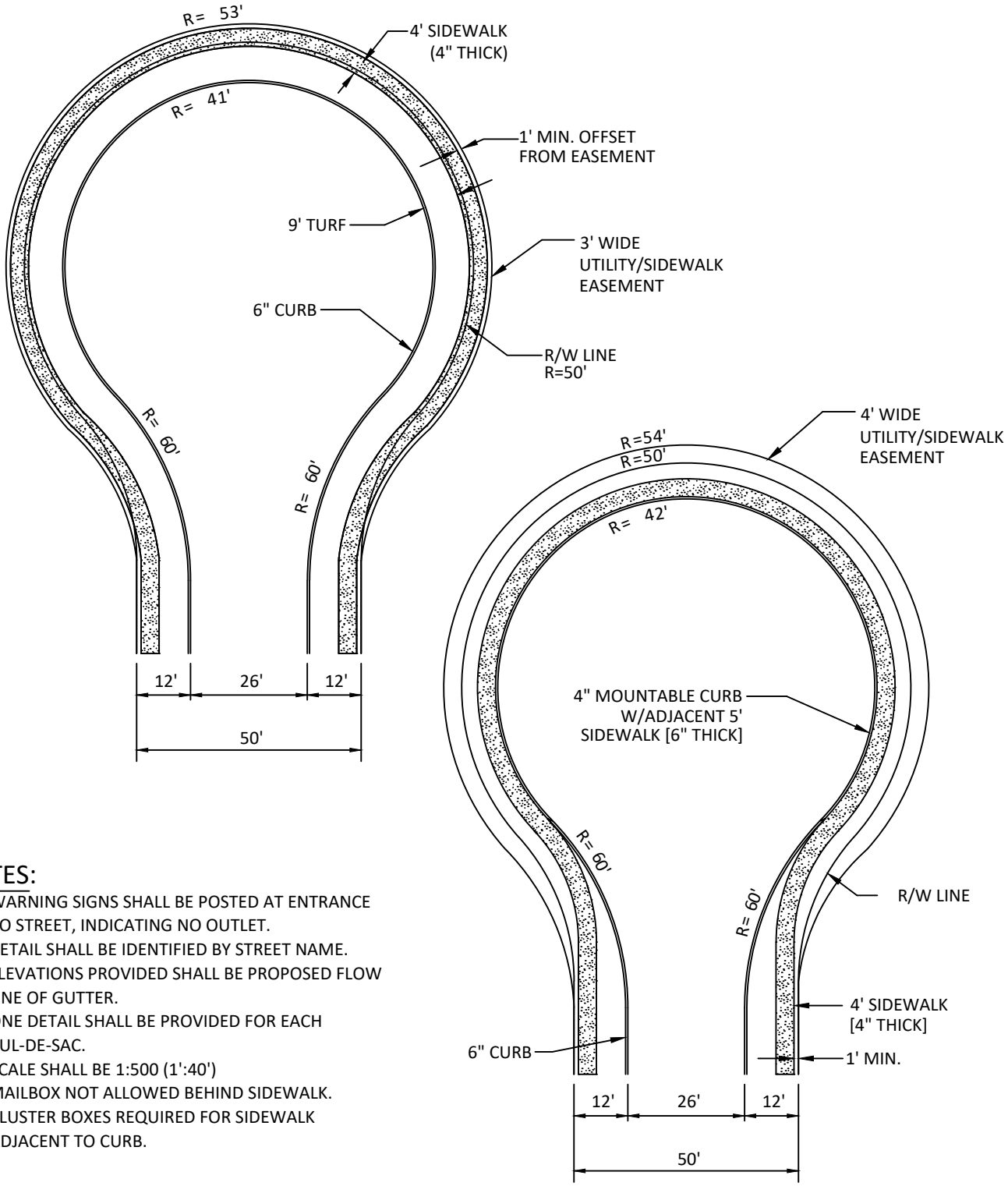
ASPHALT STREET SECTION

NOTES:

1. PAVING SECTION SHOWN IS MINIMUM ALLOWED. STREET PAVING SHALL BE DESIGNED IN ACCORDANCE WITH THE CITY'S "ENGINEERING DESIGN CRITERIA".
2. DOWELS REQUIRED FOR PCC PAVING 8" THICK, OR GREATER, IN ACCORDANCE WITH STANDARD SPECIFICATIONS SECTION 2304.4.A
3. ASPHALT SURFACE SHALL BE ¼" ABOVE EDGE OF CONCRETE GUTTER. THE GUTTER THICKNESS MAY BE REDUCED TO 5¾" TO ACCOMMODATE THIS REQUIREMENT.
4. CURB THICKNESS TO BE 8" THICK, OR 2" THICK TYPE "ST03"ASPHALT LAYER EXTENDED UNDER CURB SECTION.
5. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND SECTION REQUIREMENTS.

INDUSTRIAL / COMMERCIAL STREET

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 2	DRAWING NO. ST 60B

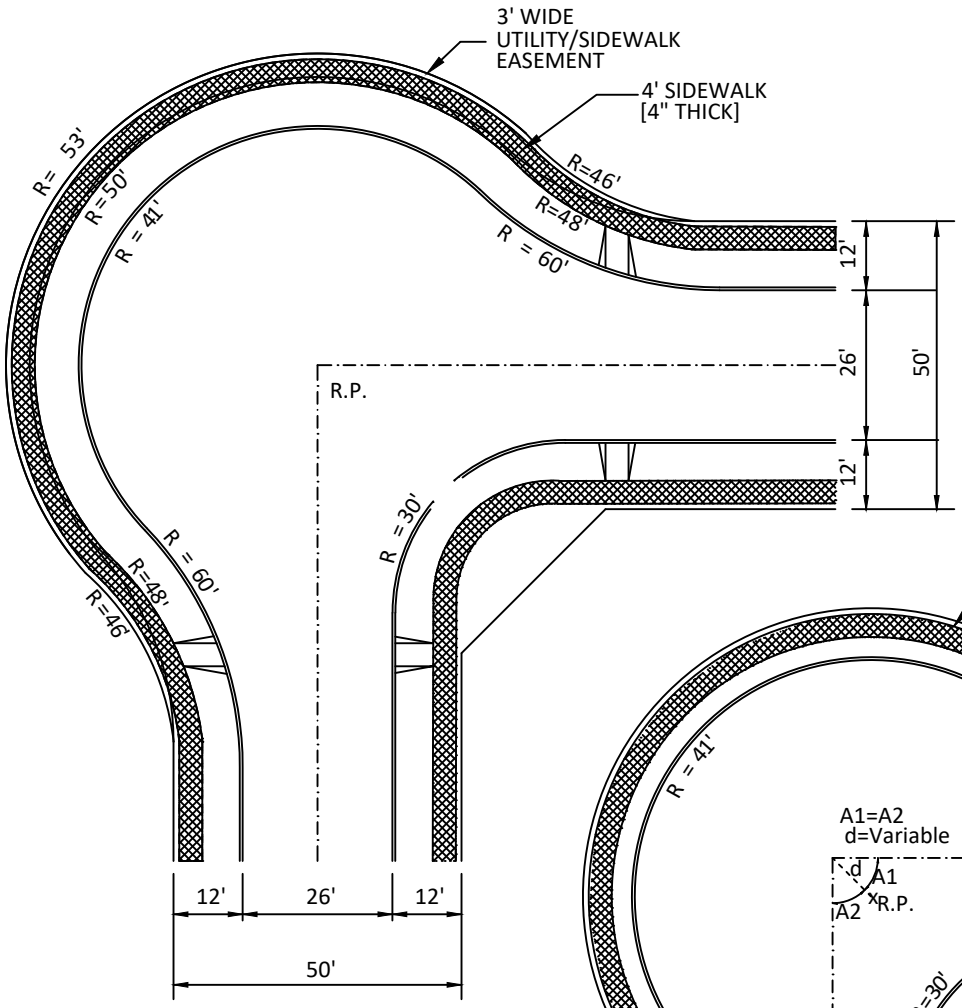


NOTES:

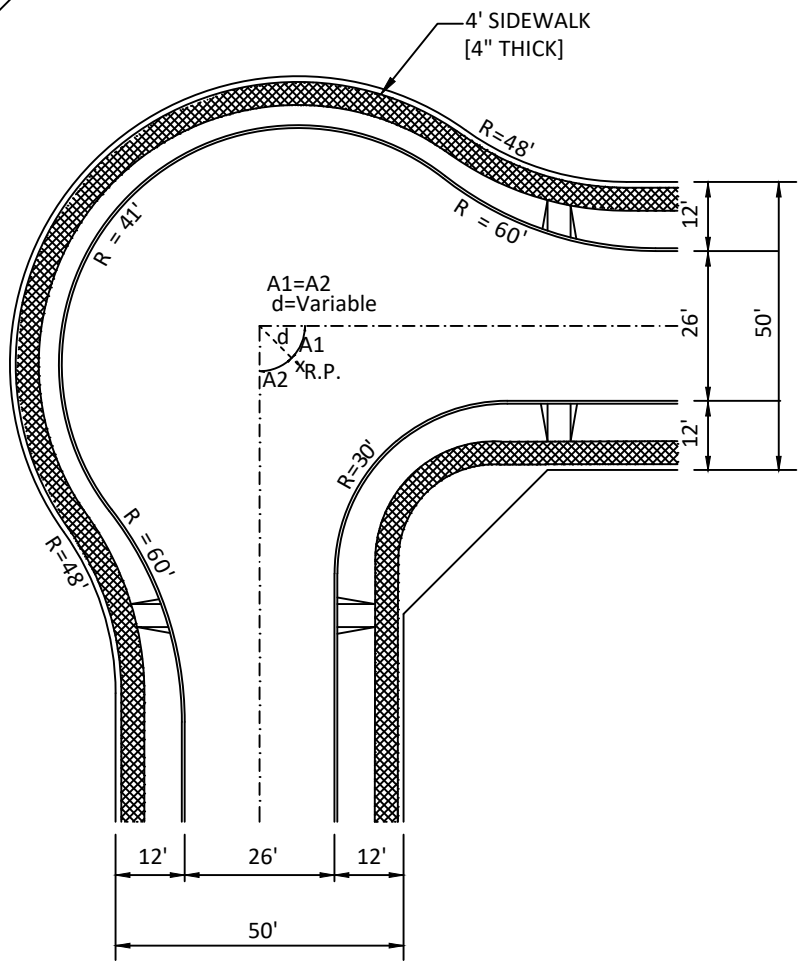
1. WARNING SIGNS SHALL BE POSTED AT ENTRANCE TO STREET, INDICATING NO OUTLET.
2. DETAIL SHALL BE IDENTIFIED BY STREET NAME.
3. ELEVATIONS PROVIDED SHALL BE PROPOSED FLOW LINE OF GUTTER.
4. ONE DETAIL SHALL BE PROVIDED FOR EACH CUL-DE-SAC.
5. SCALE SHALL BE 1:500 (1':40')
6. MAILBOX NOT ALLOWED BEHIND SIDEWALK. CLUSTER BOXES REQUIRED FOR SIDEWALK ADJACENT TO CURB.

RESIDENTIAL CUL-DE-SAC (NO ISLAND)

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 3	DRAWING NO. ST 07A



ELBOW



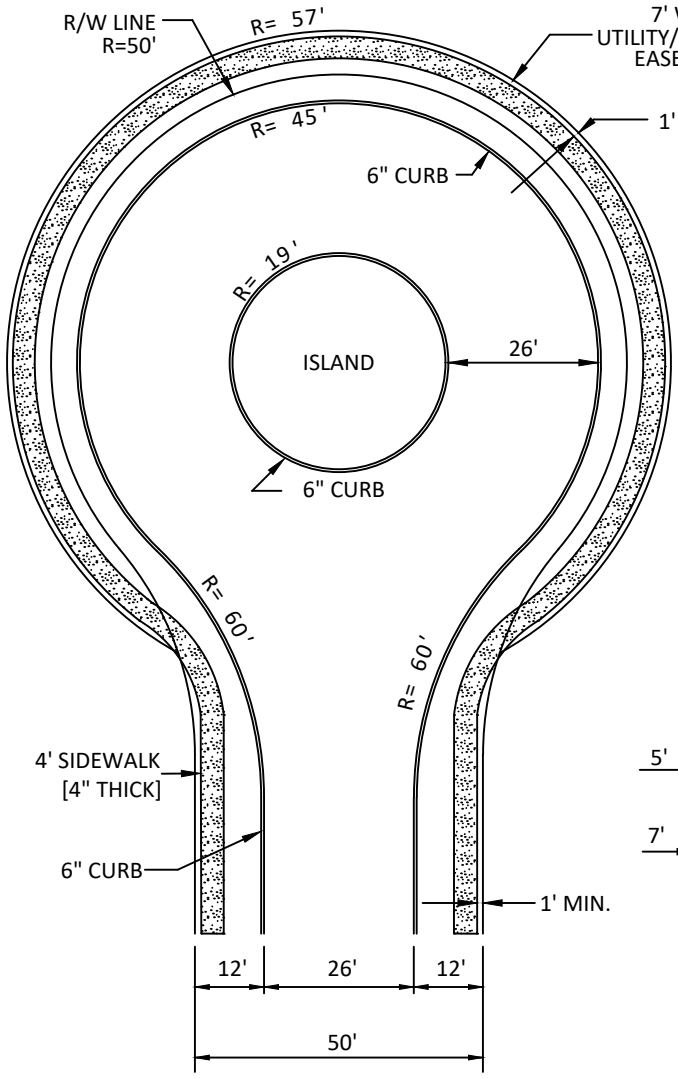
ELBOW WITH
R.P. OFFSET

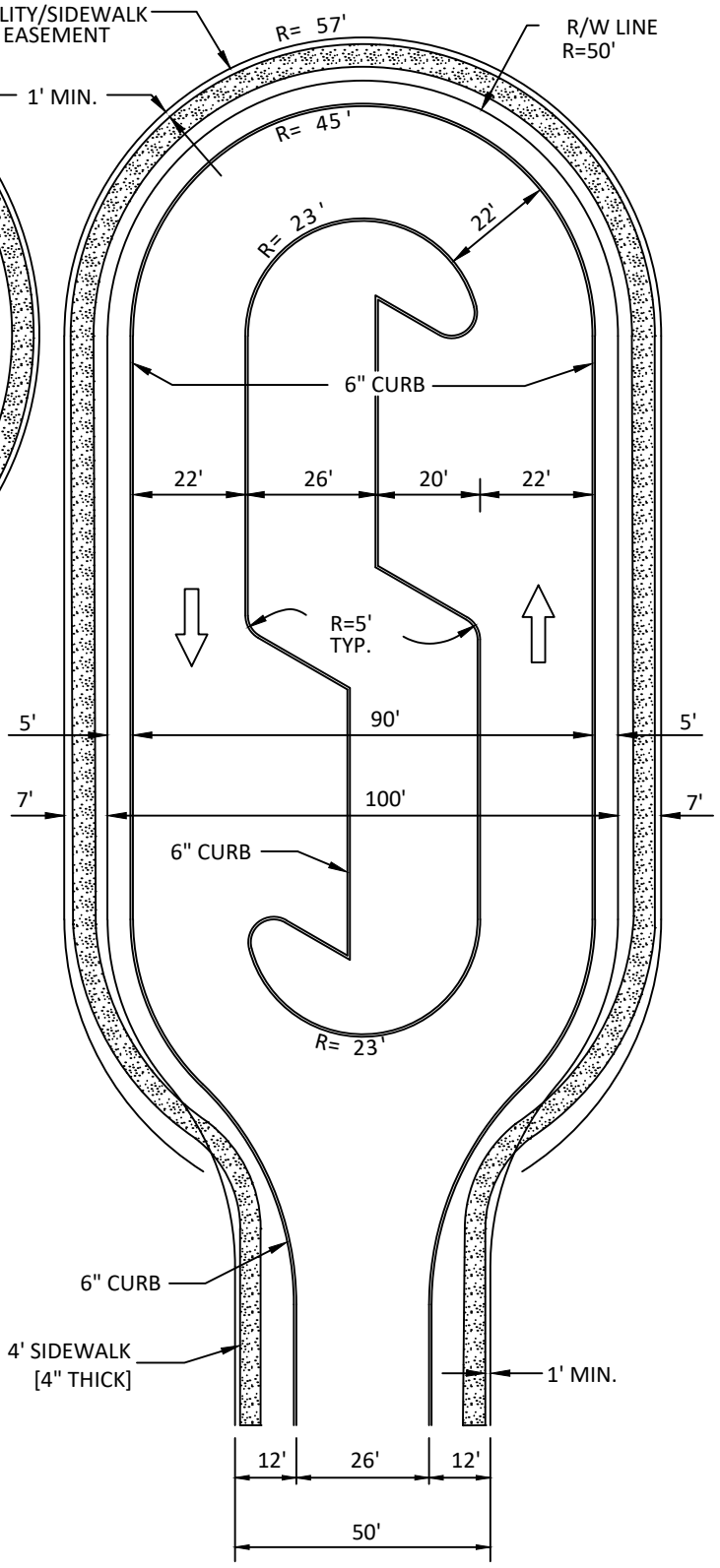
NOTES:

1. DISTANCE "d" : 10 FOOT MAXIMUM.
2. DETAIL SHALL BE IDENTIFIED BY STREET NAME.
3. ELEVATIONS PROVIDED SHALL BE PROPOSED FLOW LINE OF GUTTER.
4. ONE DETAIL SHALL BE PROVIDED FOR EACH RESIDENTIAL ELBOW.
5. SCALE SHALL BE 1:500 (1':40')
6. MAILBOX NOT ALLOWED BEHIND SIDEWALK. CLUSTER BOXES REQUIRED FOR SIDEWALK ADJACENT TO CURB.

RESIDENTIAL ELBOW (NO ISLAND)

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 2	DRAWING NO. ST 07B



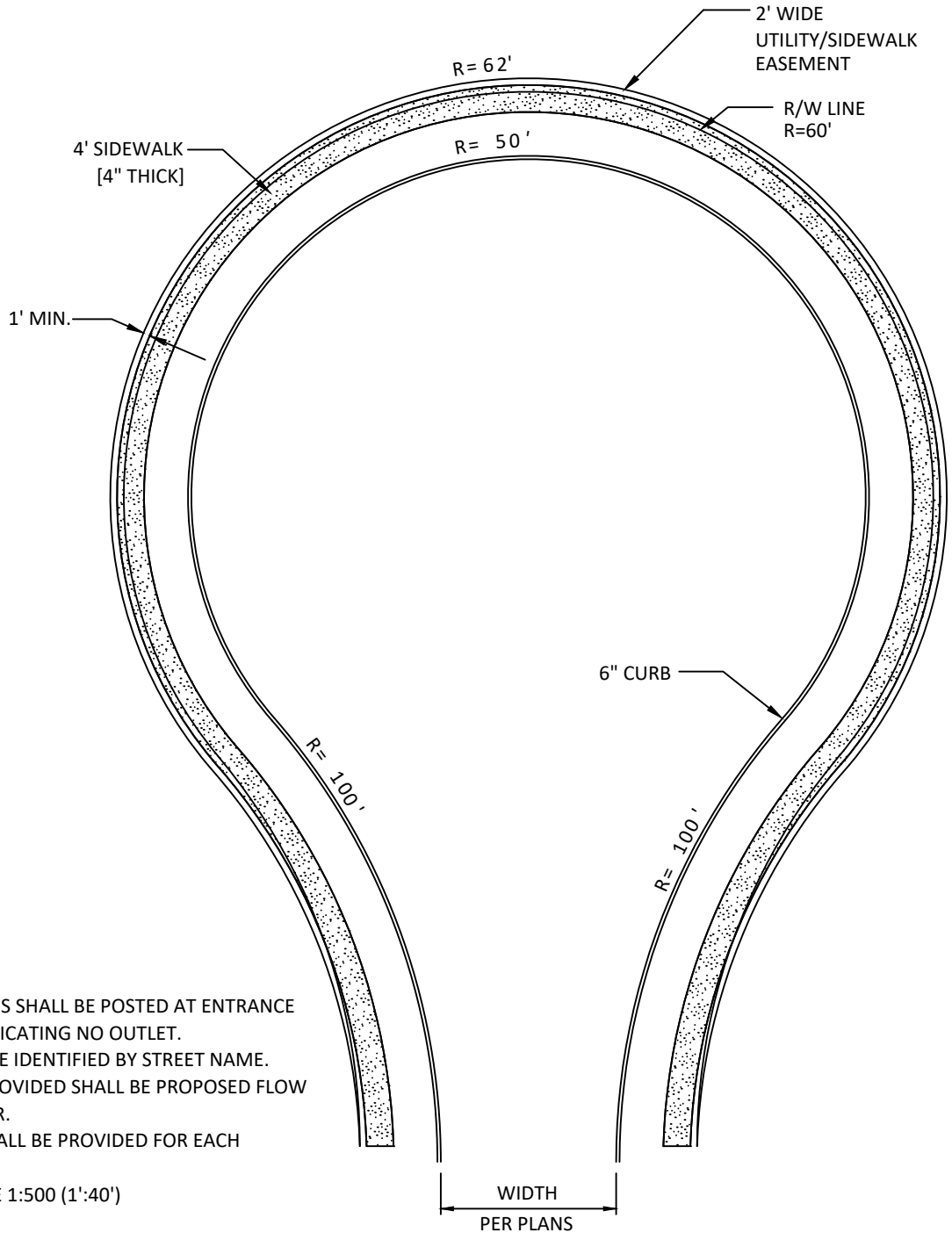


NOTES:

1. WARNING SIGNS SHALL BE POSTED AT ENTRANCE TO STREET, INDICATING NO OUTLET.
2. DETAIL SHALL BE IDENTIFIED BY STREET NAME.
3. ELEVATIONS PROVIDED SHALL BE PROPOSED FLOW LINE OF GUTTER.
4. ONE DETAIL SHALL BE PROVIDED FOR EACH CUL-DE-SAC.
5. SCALE SHALL BE 1:500 (1':40')
6. NO PARKING ALLOWED IN CUL-DE-SAC STREET.

RESIDENTIAL CUL-DE-SAC (WITH ISLAND)

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 2	DRAWING NO. ST 08



NOTES:

1. WARNING SIGNS SHALL BE POSTED AT ENTRANCE TO STREET, INDICATING NO OUTLET.
2. DETAIL SHALL BE IDENTIFIED BY STREET NAME.
3. ELEVATIONS PROVIDED SHALL BE PROPOSED FLOW LINE OF GUTTER.
4. ONE DETAIL SHALL BE PROVIDED FOR EACH CUL-DE-SAC.
5. SCALE SHALL BE 1:500 (1':40')

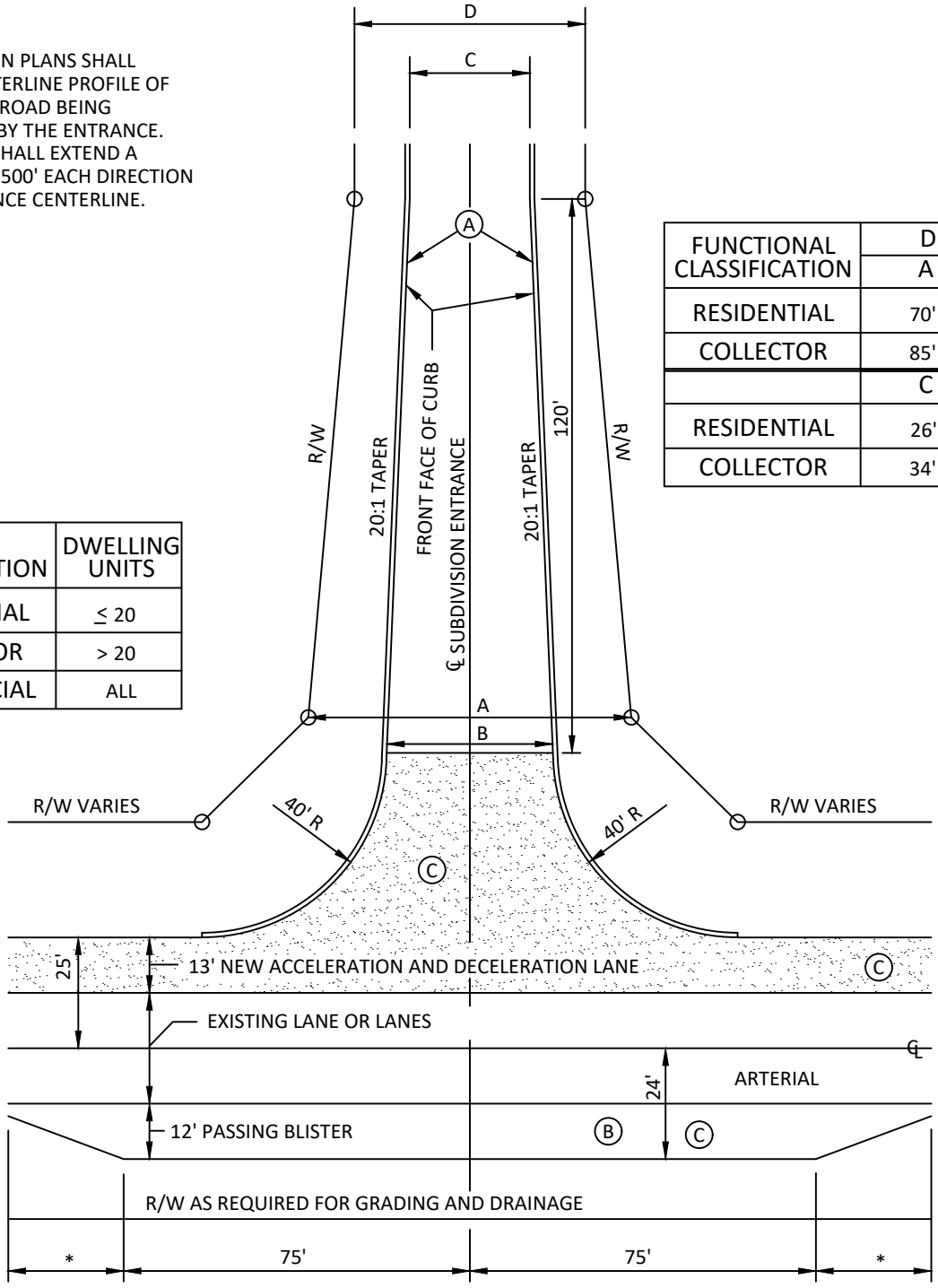
NON-RESIDENTIAL CUL-DE-SAC

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 09

CONSTRUCTION PLANS SHALL INCLUDE CENTERLINE PROFILE OF THE EXISTING ROAD BEING INTERSECTED BY THE ENTRANCE. THE PROFILE SHALL EXTEND A MINIMUM OF 500' EACH DIRECTION FROM ENTRANCE CENTERLINE.

STREET CLASSIFICATION	DWELLING UNITS
RESIDENTIAL	≤ 20
COLLECTOR	> 20
COMMERCIAL	ALL

FUNCTIONAL CLASSIFICATION	DIMENSION	
	A	B
RESIDENTIAL	70'	38'
COLLECTOR	85'	46'
	C	D
RESIDENTIAL	26'	50'
COLLECTOR	34'	60'



* 150' ARTERIAL
* 100' COLLECTOR

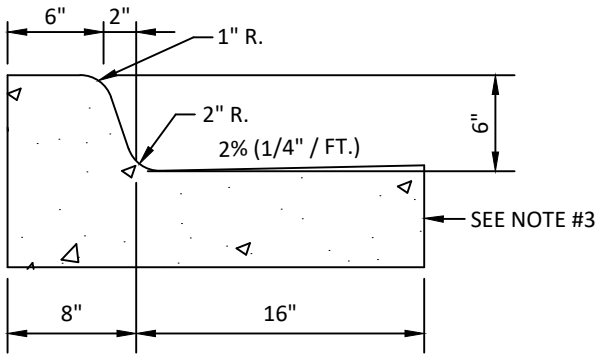
(A) STANDARD CURB & GUTTER

(B) PASSING BLISTER WHEN REQUIRED BY CITY ENGINEER

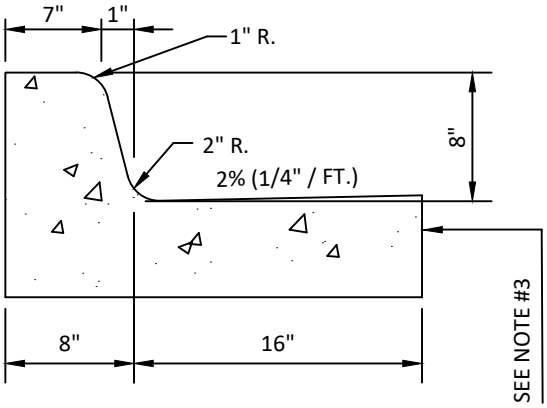
(C) LANE WIDENING SHALL MATCH EXISTING PAVEMENT SURFACE TYPE

RESIDENTIAL/ARTERIAL STREET INTERSECTION

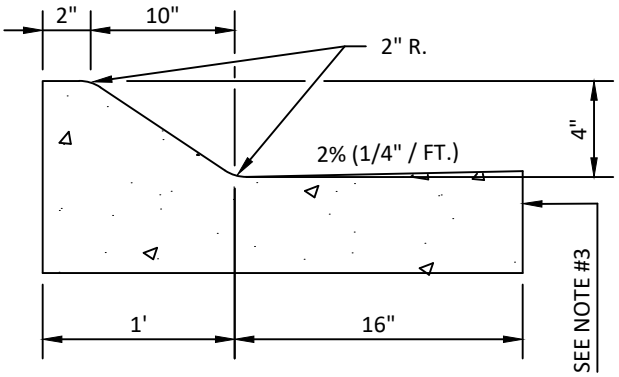
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 3	DRAWING NO. ST 10



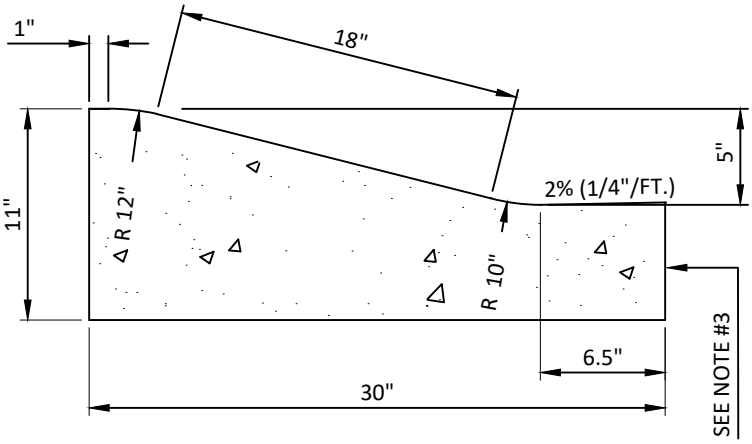
150 (6") BARRIER CURB & GUTTER



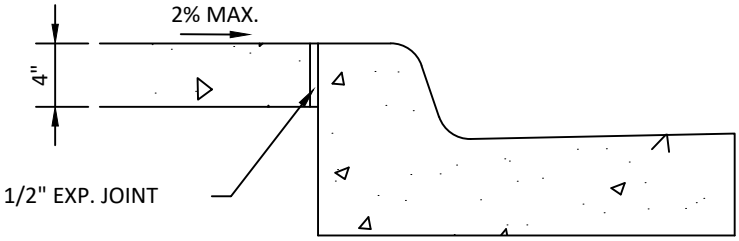
200 (8") BARRIER CURB & GUTTER



100 (4") MOUNTABLE CURB & GUTTER



125 (5") MOUNTABLE CURB & GUTTER



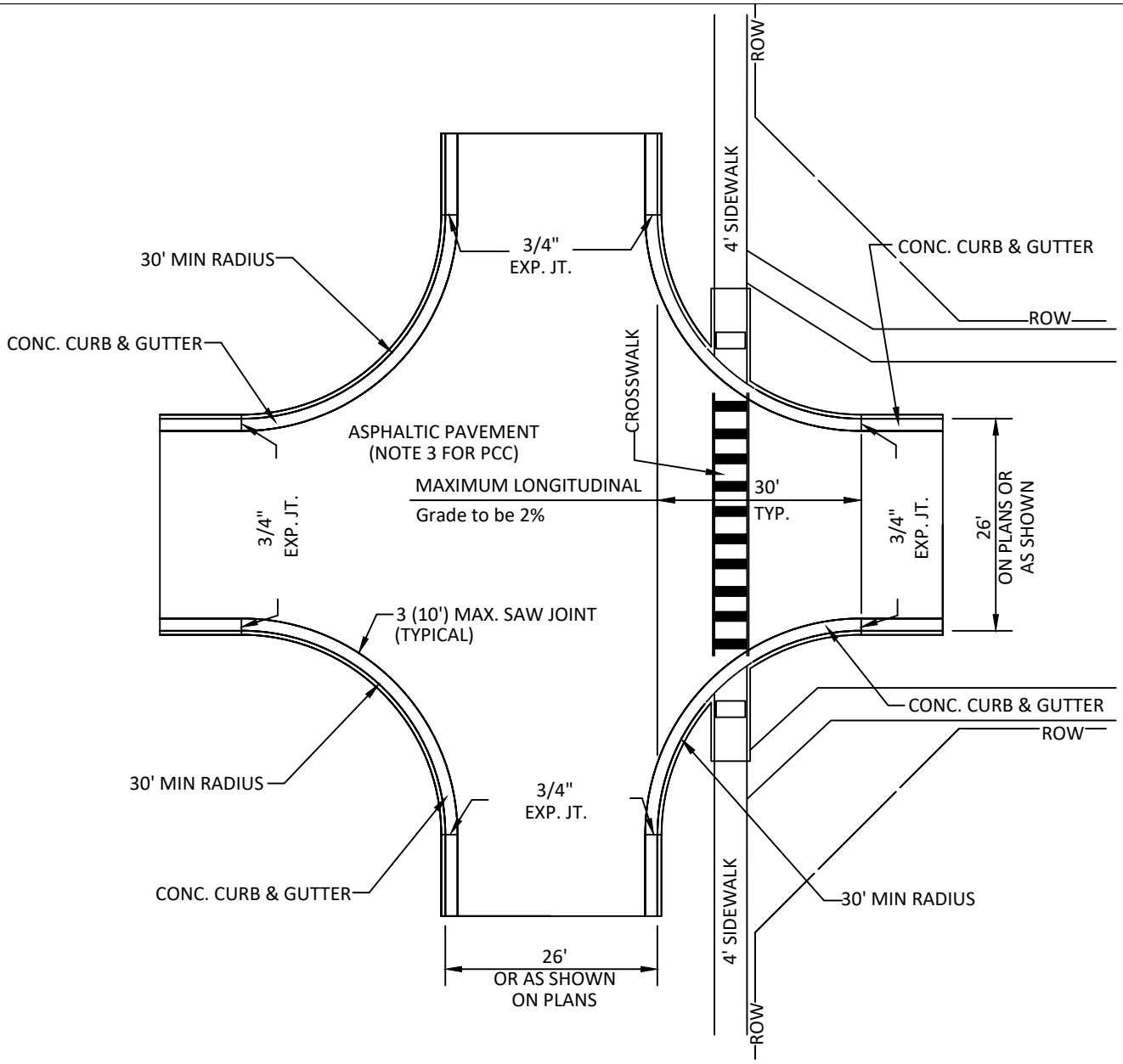
SIDEWALK ADJACENT TO CURB

NOTES:

1. SEE ODOT STANDARD CSCD FOR JOINT DETAILS.
2. #4 TIE BARS 750 2'-6" LONG REQUIRED AT 18" CENTERS WITH TONGUE AND GROOVE JOINT IF CURB AND GUTTER NOT CAST INTEGRALLY WITH STREET PAVING. LONGITUDINAL CONSTRUCTION JOINTS ON LOCAL AND COLLECTOR STREET MAY, AT THE OPTION OF THE DESIGN ENGINEER, BE BUTT TYPE JOINTS WITH TIEBARS OR KEYWAY TYPE JOINT WITHOUT TIEBARS.
3. 150 (6") MIN. WHEN CURB & GUTTER IS POURED SEPARATELY IF CURB & GUTTER IS POURED MONOLITHICLY WITH THE CONCRETE STREET PAVEMENT, THE GUTTER THICKNESS SHALL BE SAME AS THE APPROVED CONCRETE STREET PAVEMENT THICKNESS. USE 1/2 " DIA. DOWELS 18" LONG AT 24" CENTERS (SMOOTH OR DEFORMED) TO TIE CURB TO CONCRETE STREET PAVEMENT.
4. FOR ARTERIAL (URBAN) STREET SECTIONS, THE GUTTER CROSS-SLOPE SHALL BE 3%.

CURB AND GUTTER

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 4	DRAWING NO. ST 11

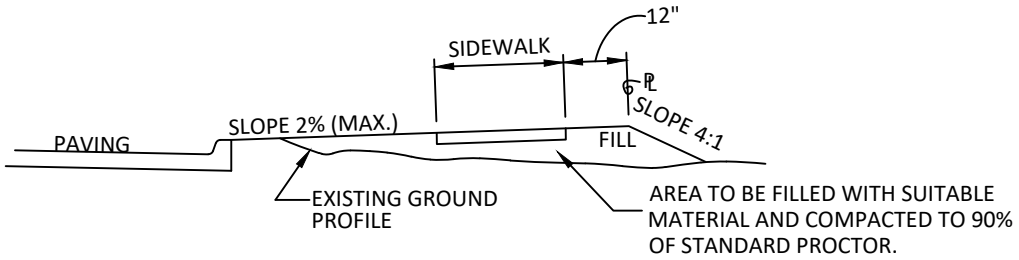


NOTES:

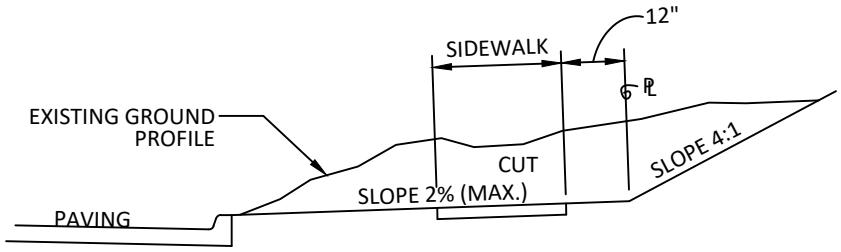
1. SIDEWALKS TO BE LOCATED PER THE LAND SUBDIVISION CODE.
2. WHEELCHAIR RAMPS PER STANDARD ST-14.
3. FOR PCC PAVING, JOINT LAYOUT TO BE SUBMITTED FOR REVIEW BY CITY ENGINEER.
4. SIDEWALKS TO BE LOCATED PER ST-01.

RESIDENTIAL STREET INTERSECTION LAYOUT

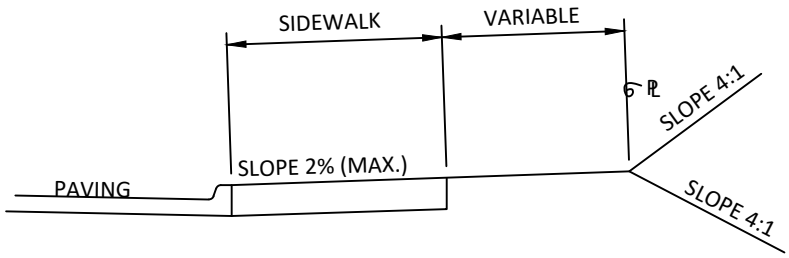
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 3	DRAWING NO. ST 12



FILL SECTION



CUT SECTION



TO BE USED WITH LESS
THAN 12' FACE OF CURB
TO LP OR PLAT WHICH
SPECIFIES RAMP DRIVES.

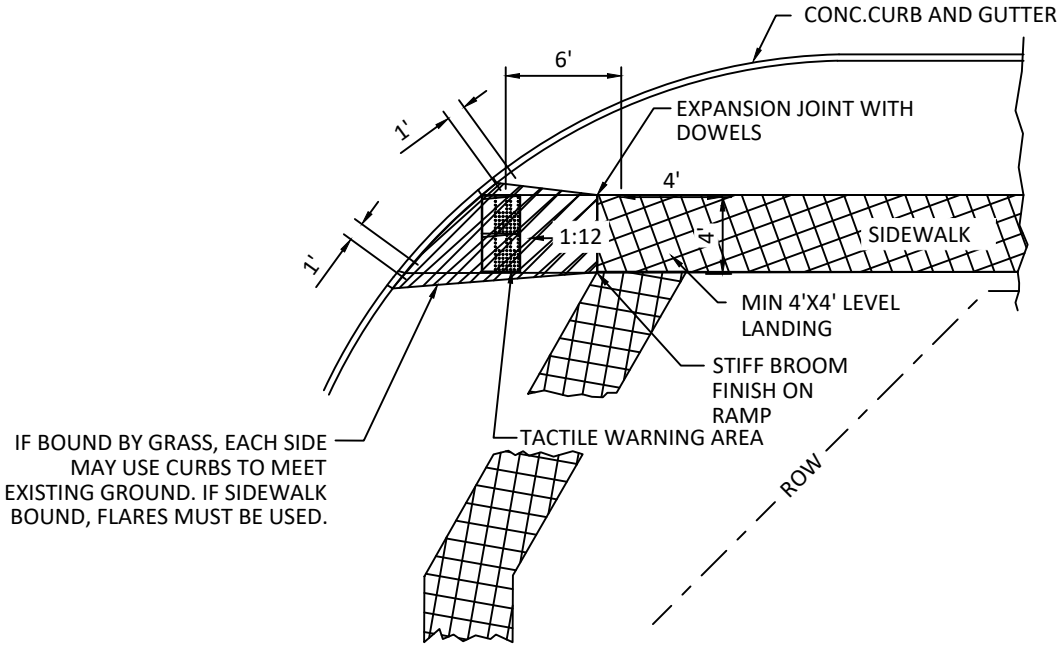
RAMP TYPE

NOTES:

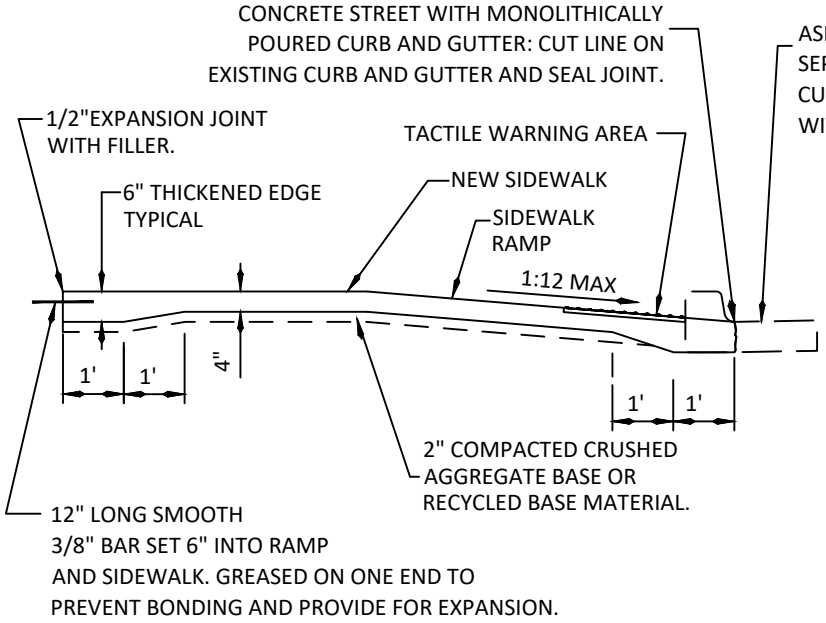
1. ENTIRE AREA BETWEEN CURB AND PROPERTY LINE TO BE GRADED AS SHOWN.
2. MINIMUM SIDEWALK THICKNESS 4".
3. MINIMUM THICKNESS THROUGH DRIVE 6".
4. INSTALL 1/2" EXPANSION JOINTS BETWEEN SIDEWALK AND CURB.

RIGHT-OF-WAY GRADING

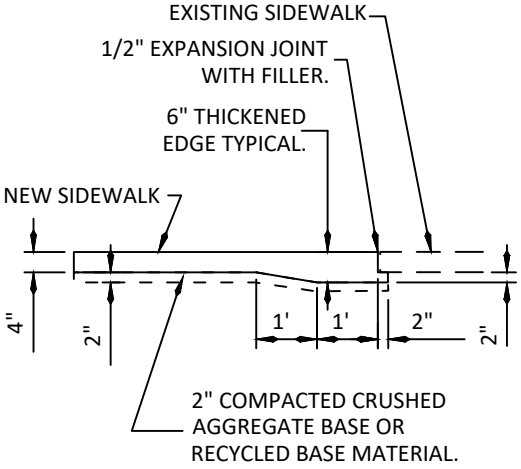
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 13



SINGLE APPROACH CORNER RAMP



PROFILE OF SIDEWALK AT RAMP



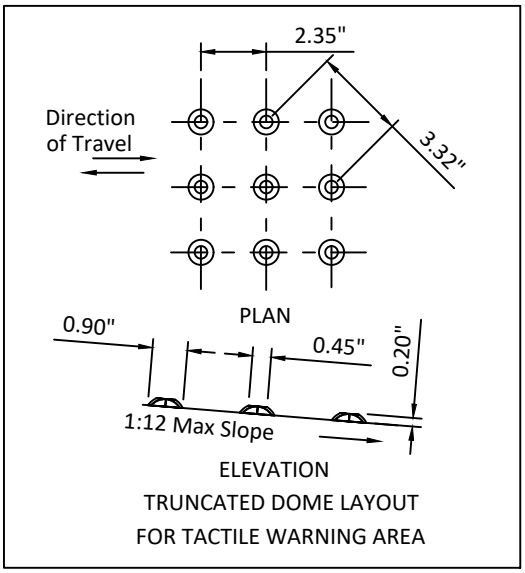
PROFILE DETAIL OF SIDEWALK CONNECTIONS

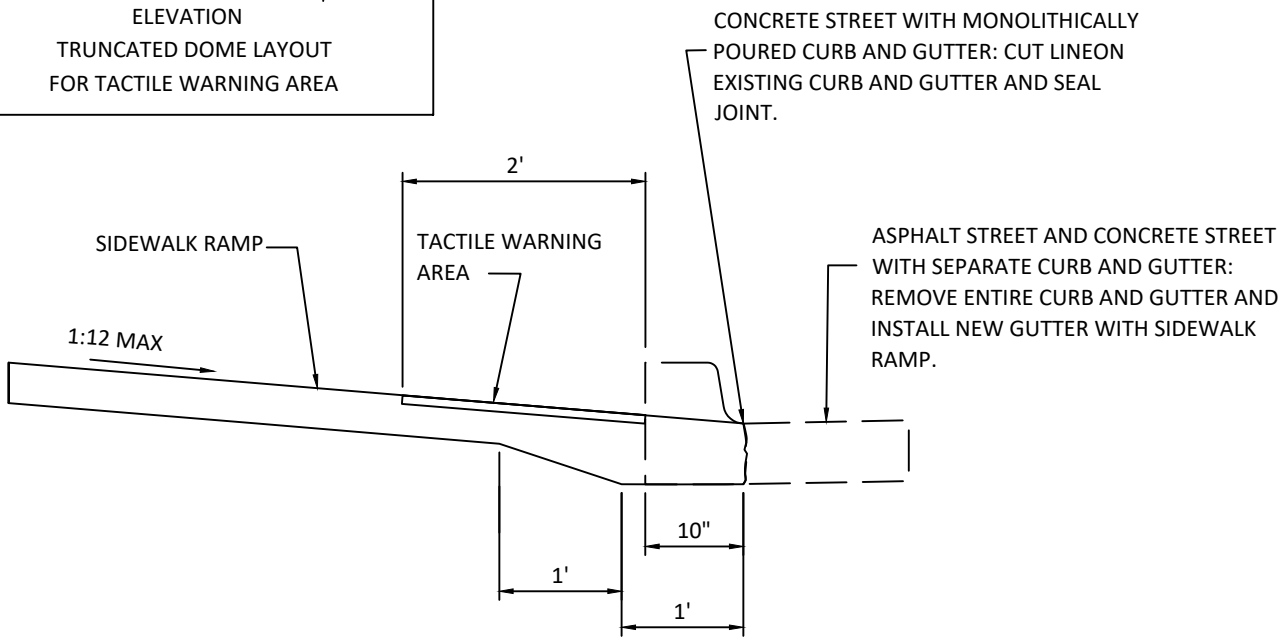
NOTES:

1. CROSS SLOPE OF LANDING AREA SHALL NOT EXCEED 2% IN ANY DIRECTION.
2. 6" THICKENING AND 3/8" SMOOTH DOWEL AND SHALL BE USED TO CONNECT NEW SIDEWALK TO EXISTING DRIVEWAY.
3. ALL SIDEWALKS AND PEDESTRIAN RAMPS SHALL BE COMPLIANT WITH THE MOST CURRENT VERSION OF THE ADA STANDARDS AND THE PUBLIC RIGHTS OF WAY ACCESSIBILITY GUIDELINES (PROWAG).
4. FOR ADDITIONAL RAMP CONFIGURATIONS, SEE THE CURRENT VERSION OF THE ODOT WHEEL CHAIR RAMP DETAILS WCR-3)

SIDEWALK DETAILS & WHEELCHAIR RAMP

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 5	DRAWING NO. ST 14





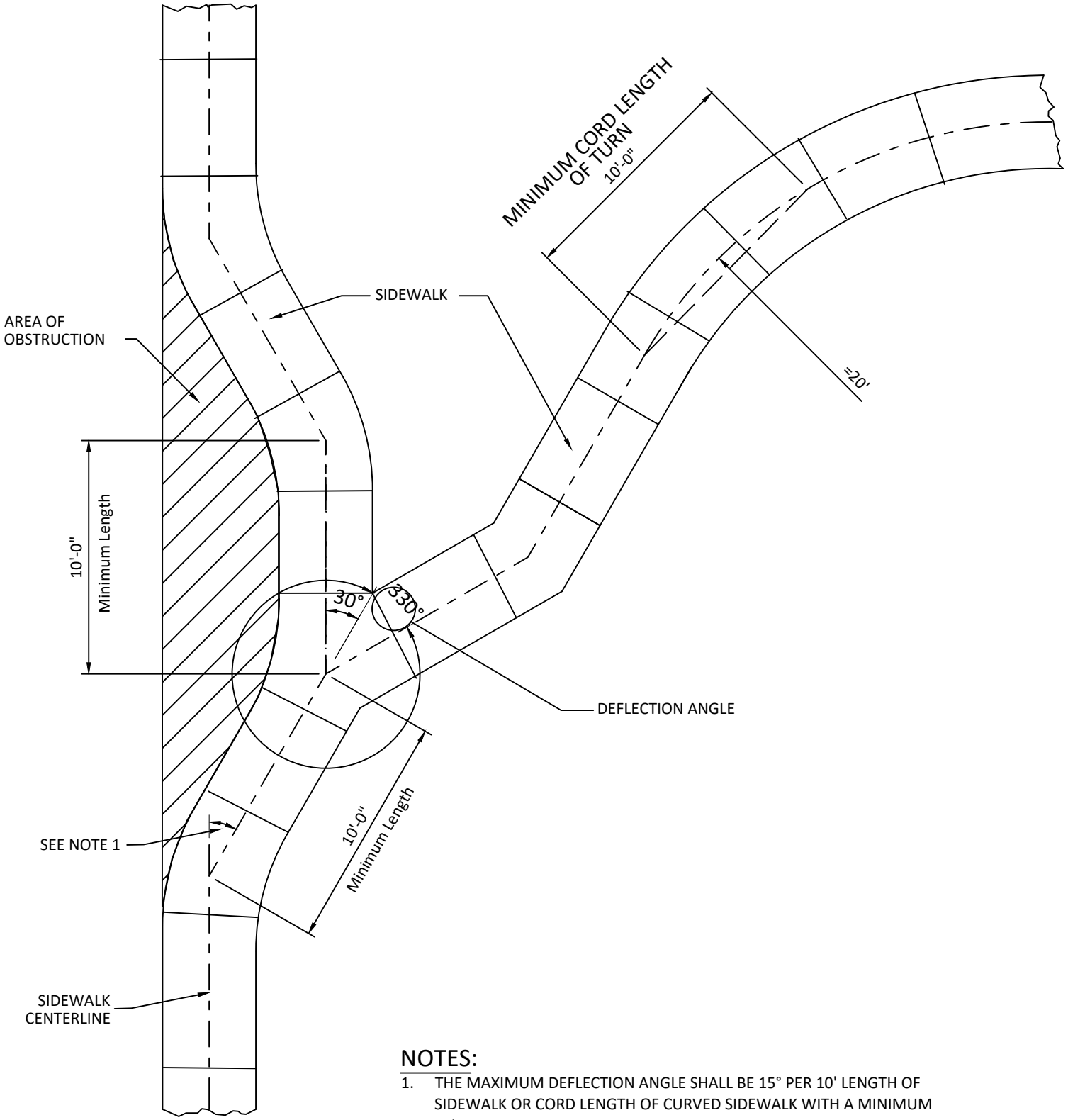
PROFILE OF SIDEWALK AT RAMP

NOTES:

1. TRUNCATED DOMES OF TACTILE WARNING AREA SHALL MEET SPECIFICATIONS AND TOLERANCES OF ADA ACT 4.29.2.
2. ALL SIDEWALKS AND PEDESTRIAN RAMPS SHALL BE COMPLIANT WITH THE MOST CURRENT VERSION OF THE ADA STANDARDS AND THE PUBLIC RIGHTS OF WAY ACCESSIBILITY GUIDELINES (PROWAG).

RAMP DETAILS

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 14a

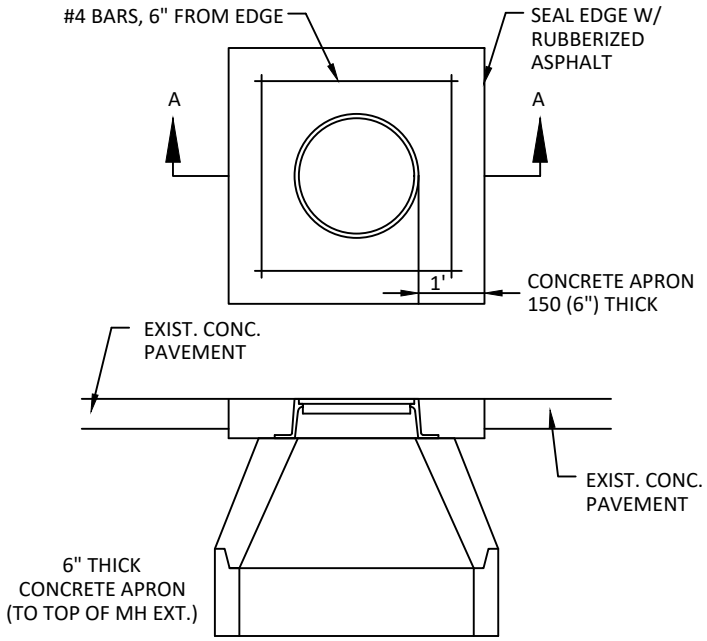


NOTES:

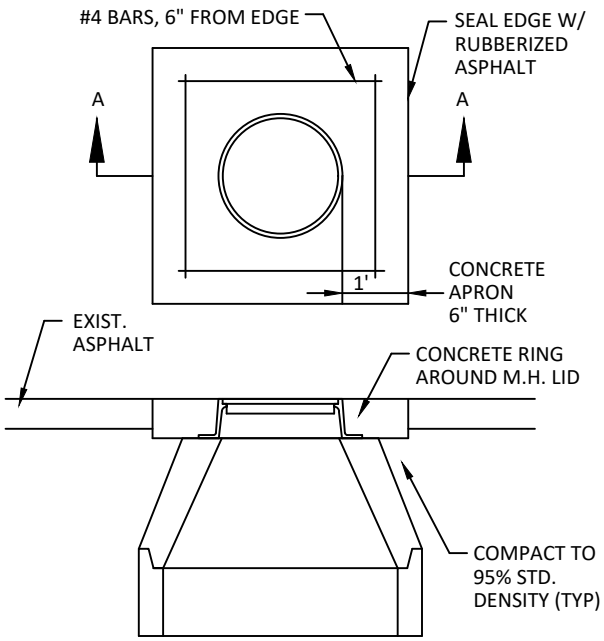
1. THE MAXIMUM DEFLECTION ANGLE SHALL BE 15° PER 10' LENGTH OF SIDEWALK OR CORD LENGTH OF CURVED SIDEWALK WITH A MINIMUM 20' RADIUS.
2. SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2%
3. SIDEWALK SHALL NOT CROSS THE CENTER LINE OF IT'S SELF EITHER DIRECTION FROM CENTER LINE, UNLESS IT IS NECESSARY TO AVOID OBSTACLES SUCH AS TREES OR FIRE HYDRANTS, ETC.

SIDEWALK HORIZONTAL ALIGNMENT DETAILS

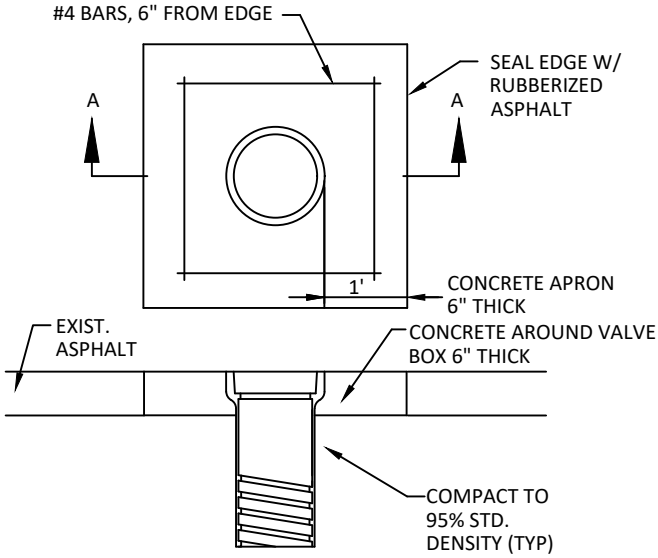
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 14B



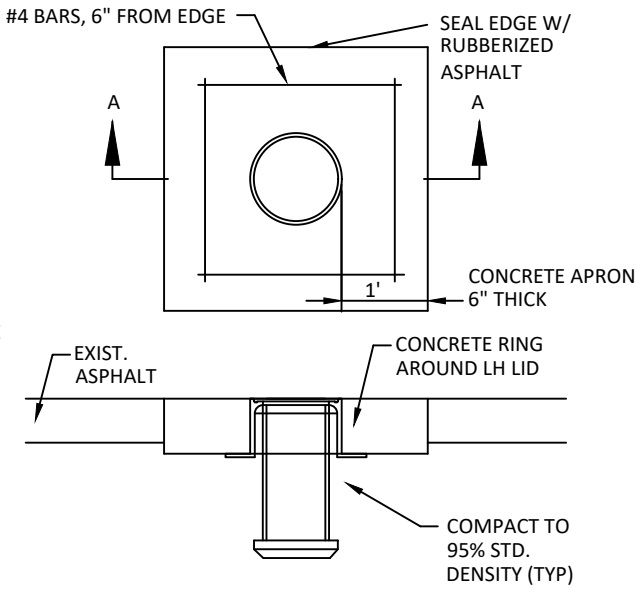
SECTION "A" MANHOLE IN CONCRETE, ADJUST TO GRADE



SECTION "A" MANHOLE IN ASPHALT, ADJUST TO GRADE



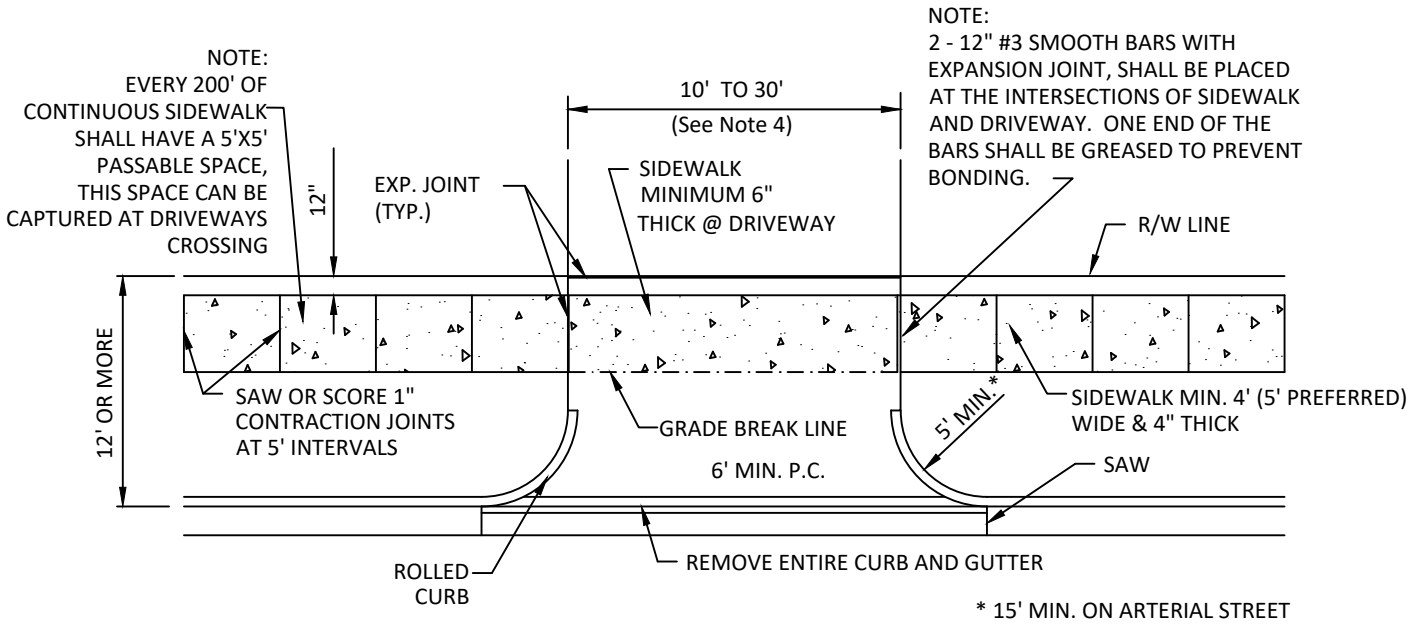
SECTION "A" WATER VALVE TO GRADE IN ASPHALT

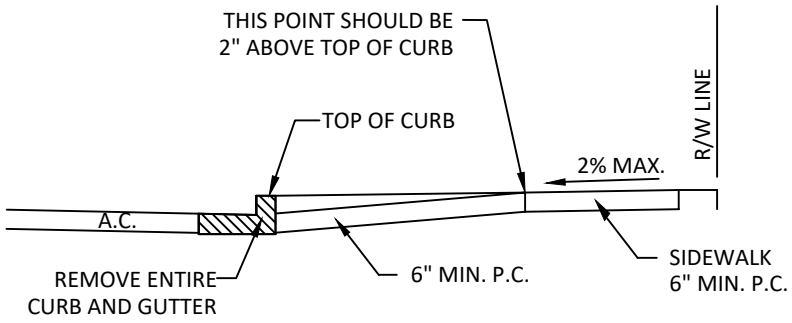


SECTION "A" LAMPHOLE IN ASPHALT ADJUST TO GRADE

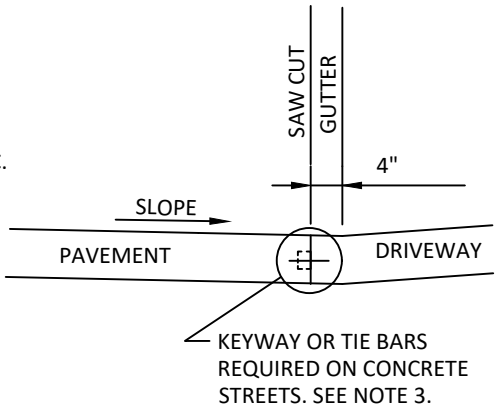
MANHOLES, LAMPHOLES, AND VALVE BOXES IN STREETS

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 15

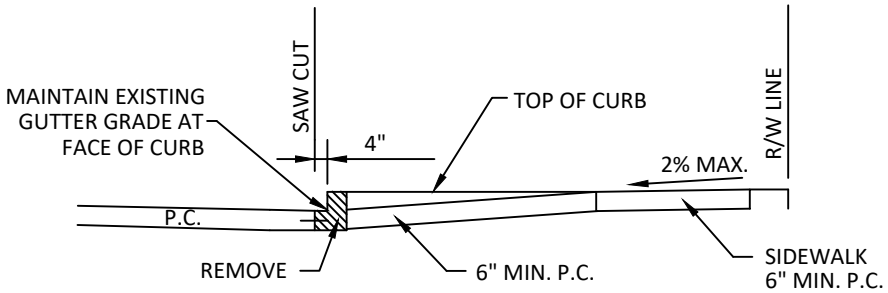




ASPHALT STREET DRIVEWAY SECTION



SECTION AT GUTTER



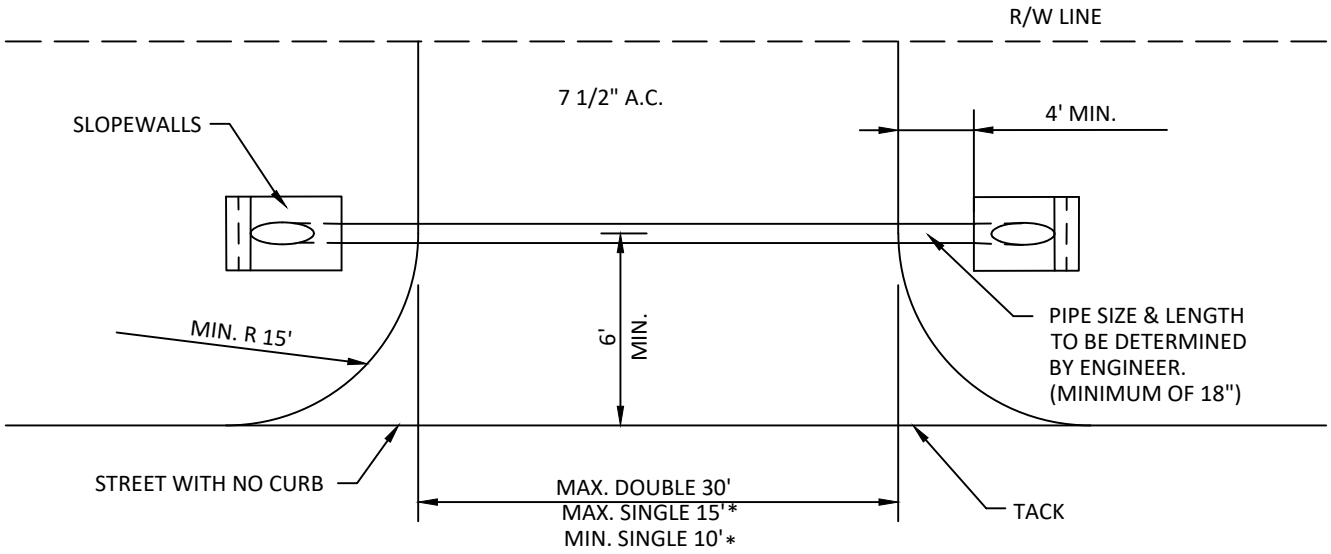
CONCRETE STREET DRIVEWAY SECTION

NOTES:

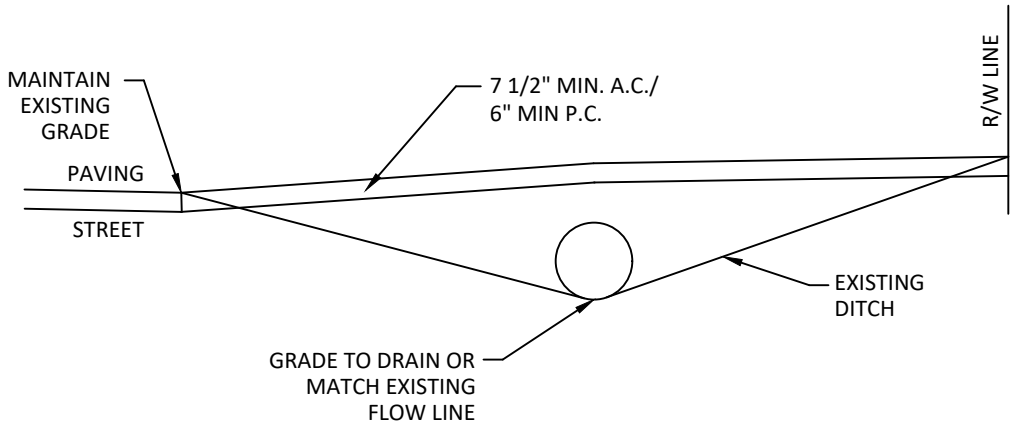
1. REFER TO DRIVEWAY APPROACH STANDARDS ST-24 THROUGH ST-27.
2. IF THE CONCRETE STREET IS CONSTRUCTED WITH A SEPARATE CURB AND GUTTER, THE ENTIRE CURB AND GUTTER SHALL BE REMOVED WHEN CONSTRUCTING A DRIVEWAY APPROACH.
3. IF CONCRETE DRIVEWAY APPROACH ABUTS A CONCRETE STREET OR MOUNTABLE CURB THE DRIVEWAY SHALL BE CONNECTED TO THE STREET OR CURB USING A KEYWAY OR TIE BARS. THE TIE BARS SHALL BE #4 BARS 450 (18") LONG REQUIRED AT 600 (24") CENTERS.
4. IN THE HISTORIC DISTRICT, THE MINIMUM DRIVEWAY WIDTH SHALL BE 8 FEET AND THE MAXIMUM 10 FEET. ALSO TWO STRIPS OF CONCRETE 18" WIDE SHALL BE ALLOWED.
5. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND DRIVEWAY REQUIREMENTS.

RESIDENTIAL DRIVEWAY, TYPE II DRIVEWAY APPROACH

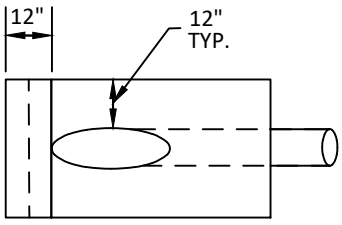
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 5	DRAWING NO. ST 16



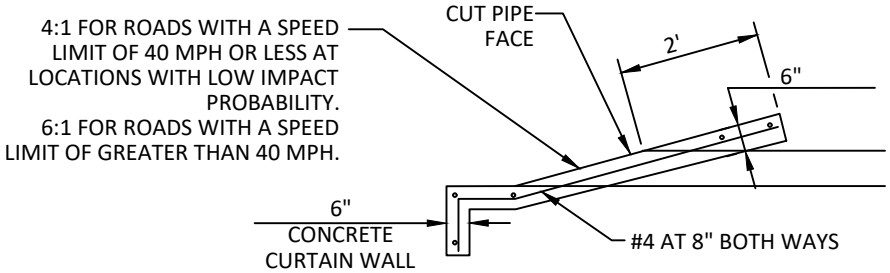
* IN THE HISTORIC DISTRICT, THE MINIMUM DRIVEWAY WIDTH SHALL BE 8 FEET AND THE MAXIMUM 10 FEET. ALSO TWO STRIPS OF CONCRETE 18" WIDE SHALL BE ALLOWED.



DRIVEWAY SECTION



PLAN



ELEVATION

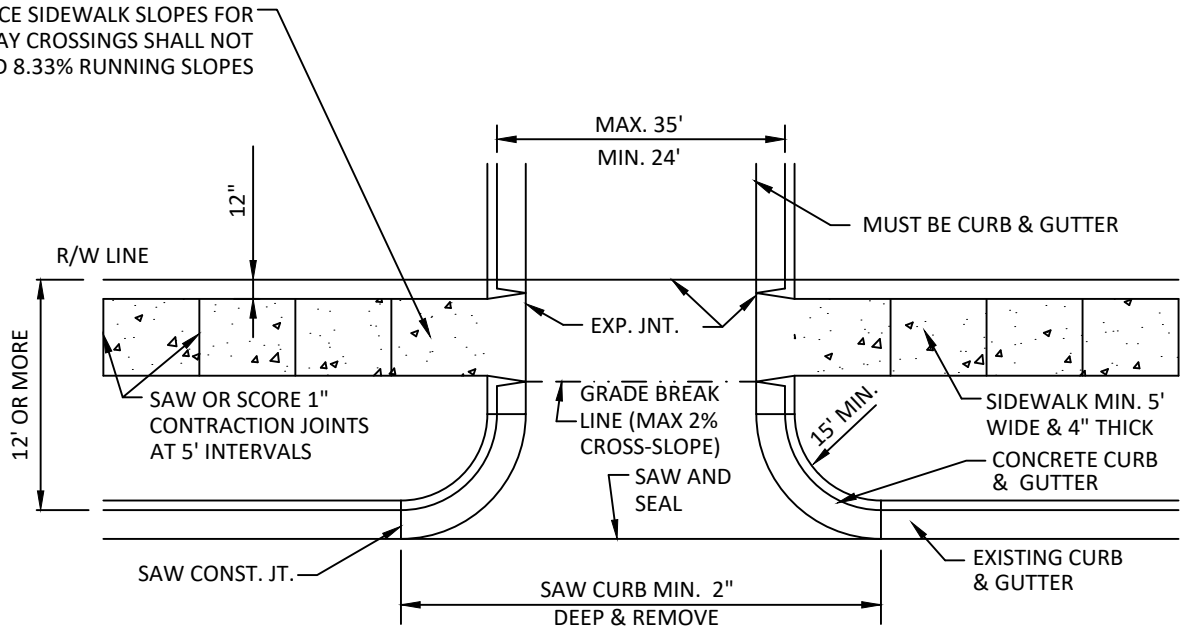
CONCRETE SLOPEWALL

NOTES:

1. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND DRIVEWAY REQUIREMENTS.

RESIDENTIAL DRIVEWAY ON STREET WITHOUT CURB

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 3	DRAWING NO. ST 17

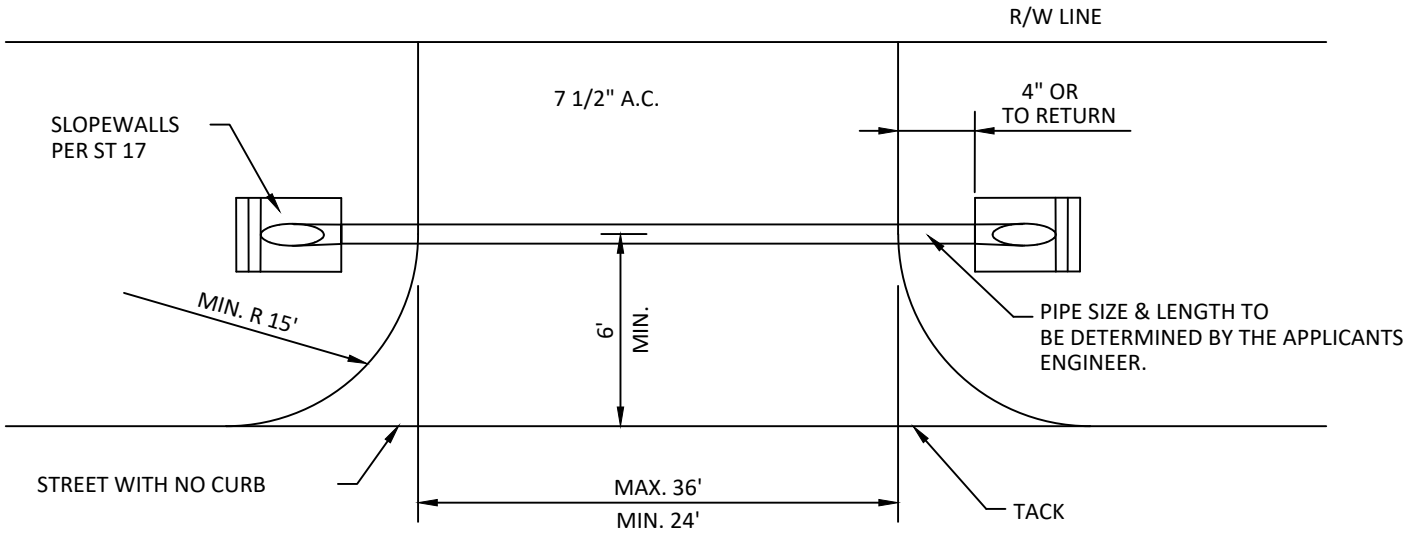


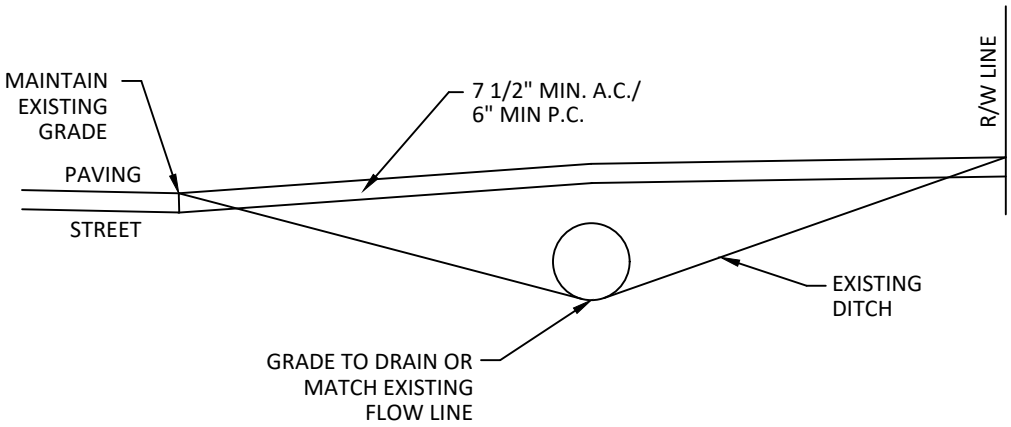
NOTES:

1. DRIVEWAY SHALL BE DESIGNED TO ACCOMMODATE LARGEST TRUCK TO USE IT.
2. REFER TO DRIVE WAY APPROACH STANDARDS ST-24 THROUGH ST-27.
3. IF CONCRETE DRIVEWAY ABUTS AN ASPHALT STREET, SAWING AND SEALING WILL NOT BE REQUIRED. CONCRETE DRIVEWAY WILL NEED TO BE EDGED.
4. IF CONCRETE DRIVEWAY ABUTS A CONCRETE STREET THE DRIVEWAY SHALL BE CONNECTED TO THE STREET USING A KEYWAY OR TIE BARS. THE TIE BAR SHALL BE *4 BARS 18" LONG REQUIRED AT 24" CENTERS.
5. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND DRIVEWAY REQUIREMENTS.

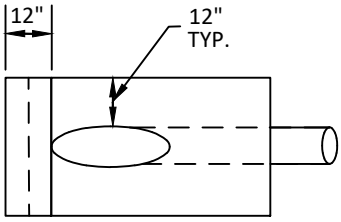
COMMERCIAL DRIVEWAY, TYPE II DRIVEWAY APPROACH

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 4	DRAWING NO. ST 18

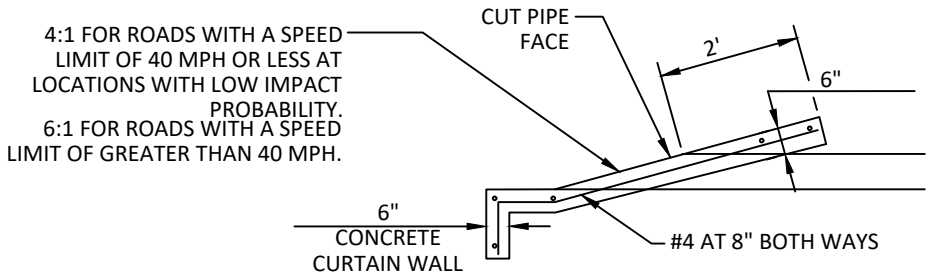




DRIVEWAY SECTION



PLAN



ELEVATION

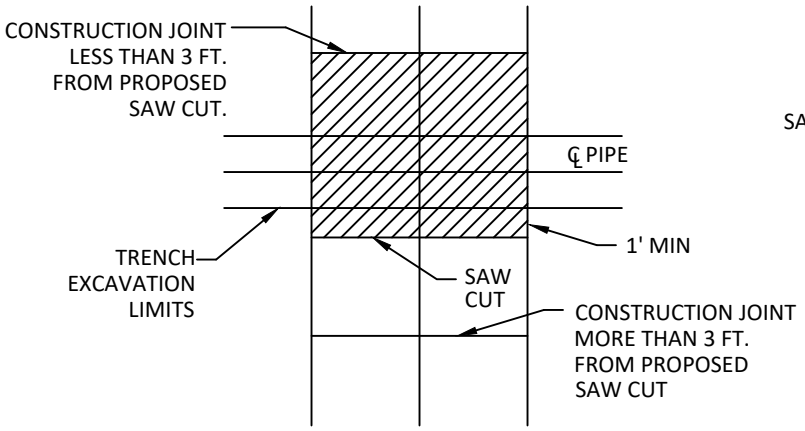
CONCRETE SLOPEWALL

NOTES:

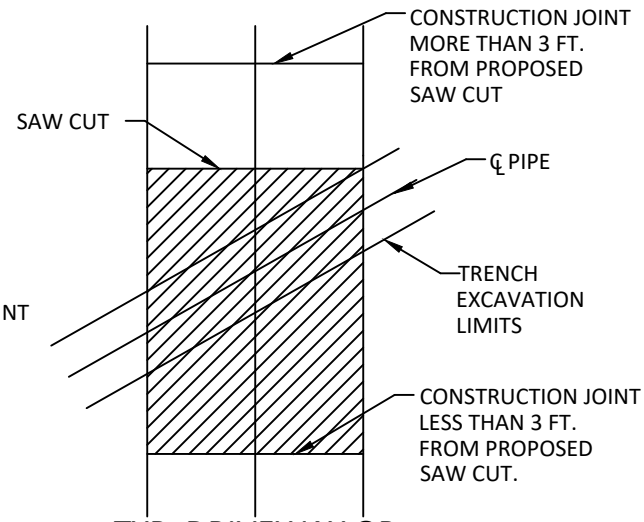
1. REFER TO DRIVEWAY APPROACH STANDARDS ST-24 THROUGH ST-27.
2. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND DRIVEWAY REQUIREMENTS.

COMMERCIAL DRIVEWAY ON STREET WITHOUT CURB

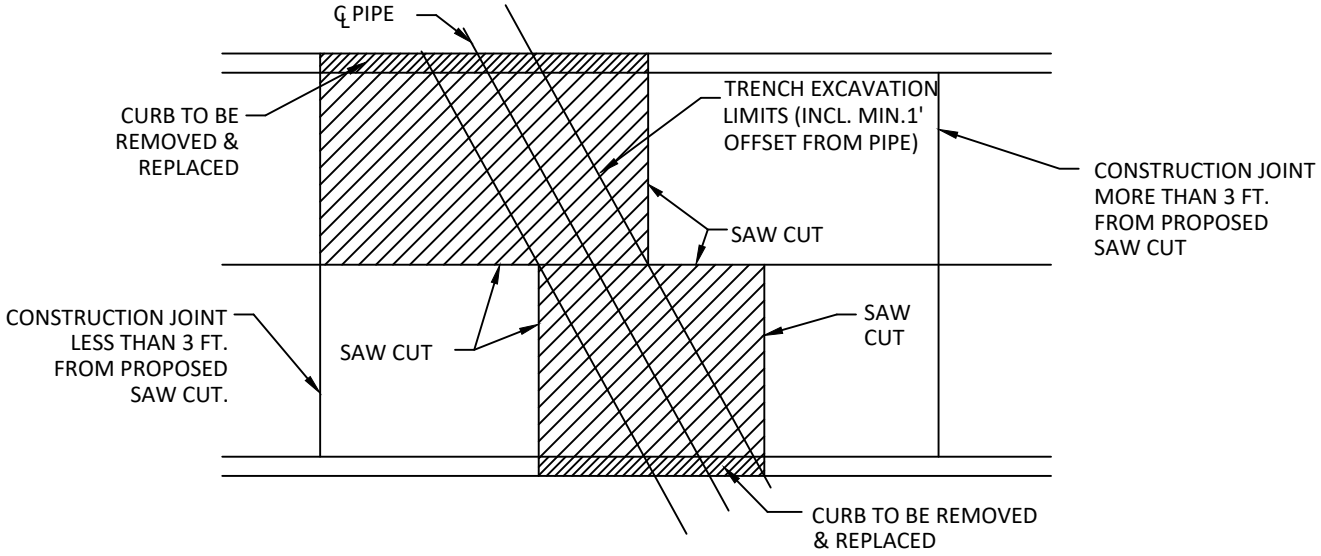
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 19



TYP. STREET, DRIVEWAY, OR SIDEWALK WITH RIGHT ANGEL CROSSING



TYP. DRIVEWAY OR SIDEWALK W/ DIAGONAL CROSSING



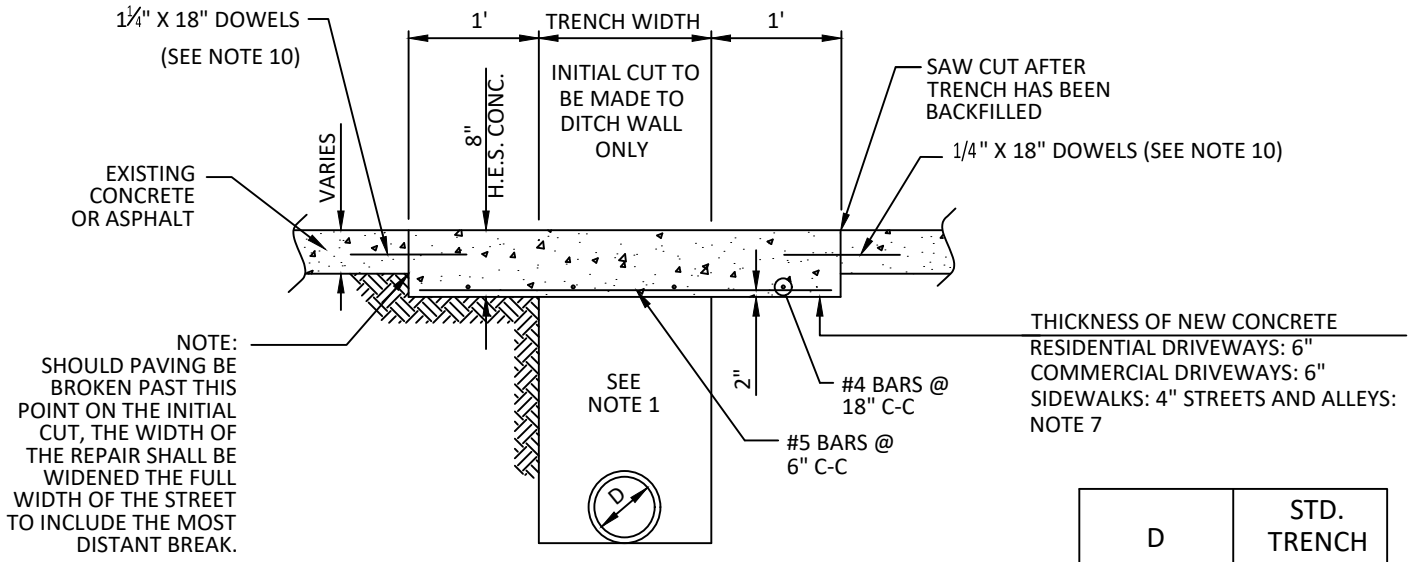
TYPICAL STREET WITH DIAGONAL CROSSING

NOTES:

1. REMOVE AND REPLACE PAVEMENT WITHIN SHADED AREAS BOUNDED BY SAW CUTS AND/OR CONSTRUCTION JOINTS.
2. FOR DIAGONAL CROSSING, REPLACE PAVEMENT USING SQUARED CUTS, AS SHOWN. PAY QUANTITY WILL INCLUDE SQUARED AREA.
3. REMOVE AND REPLACE PAVEMENT TO CONSTRUCTION JOINT IF LESS THAN 3 FT. FROM PROPOSED SAW CUT. EXTRA AREA WILL BE INCLUDED IN PAY QUANTITY.
4. FOR LONGITUDINAL INSTALLATIONS: REMOVE AND REPLACE PAVEMENT AND CURB TO EDGE OF STREET, IF THE SAW CUT IS LESS THAN 3 FT. FROM THE OUTSIDE EDGE OF THE PAVEMENT OR CURB. AVOID SAW CUTS IN THE EXISTING WHEEL LINE. TRENCHES EXCEEDING 300 L.F. SHALL BE BACKFILLED AND MADE DRIVABLE.
5. ALL CONSTRUCTION JOINTS SHALL BE REESTABLISHED IN ACCORDANCE WITH THE CITY OF NORMAN STANDARDS FOR PORTLAND CEMENT CONCRETE PAVEMENT. WHEN A NEW PAVEMENT SECTION IS REMOVED ALONG AN EXISTING LONGITUDINAL CONSTRUCTION JOINT, THE NEW PAVEMENT SHALL BE DOWELED TO THE PAVEMENT ADJACENT TO THE JOINT.
6. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND REQUIREMENTS.

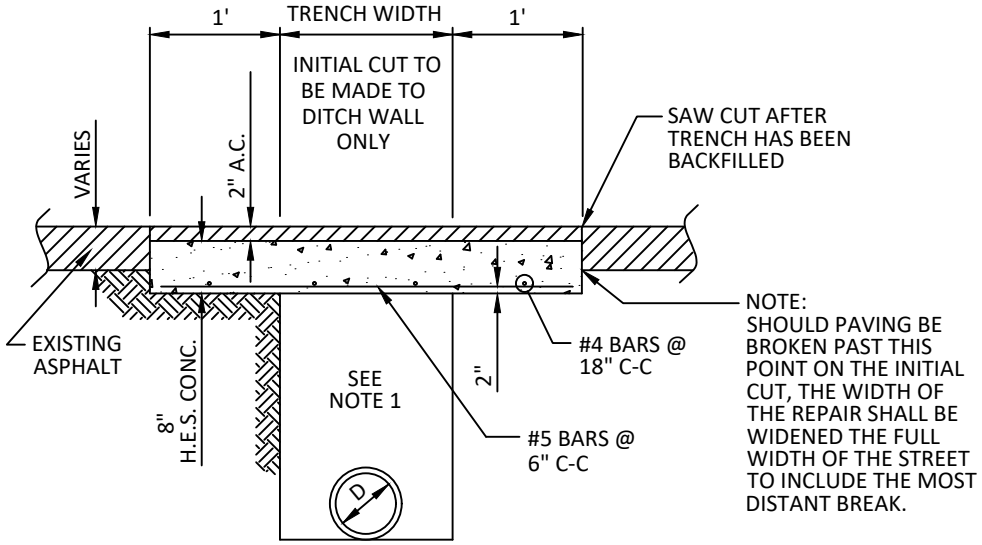
STANDARD PAVEMENT CUTS

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 2	DRAWING NO. ST 20



CONCRETE PAVEMENT

D IN.	STD. TRENCH WIDTH IN.
6	18
8	24
10	30
12	30
15	36
18	36
21	42
24	42
27	48
30	48
33	54
36	54
42	60
54	72
60	78
66	84



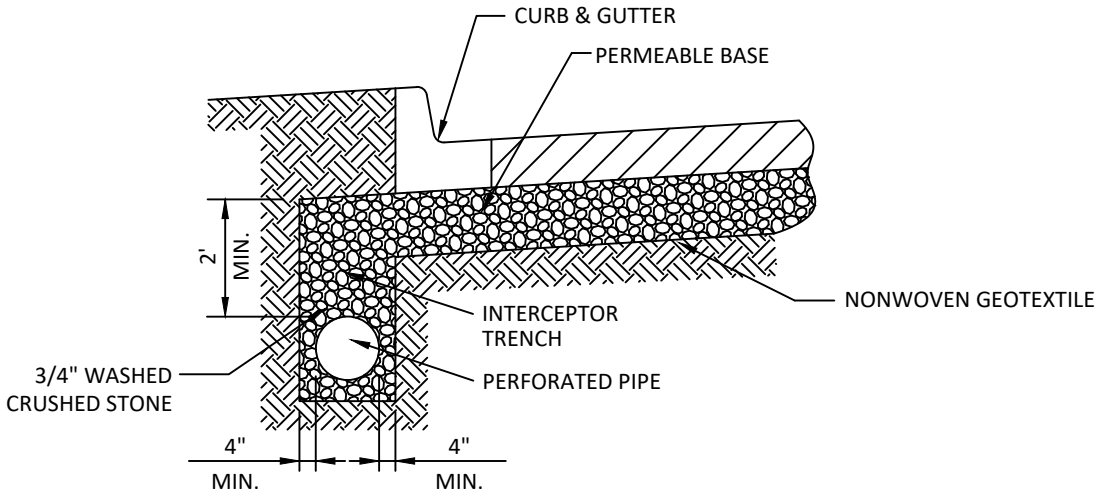
ASPHALT PAVEMENT

NOTES:

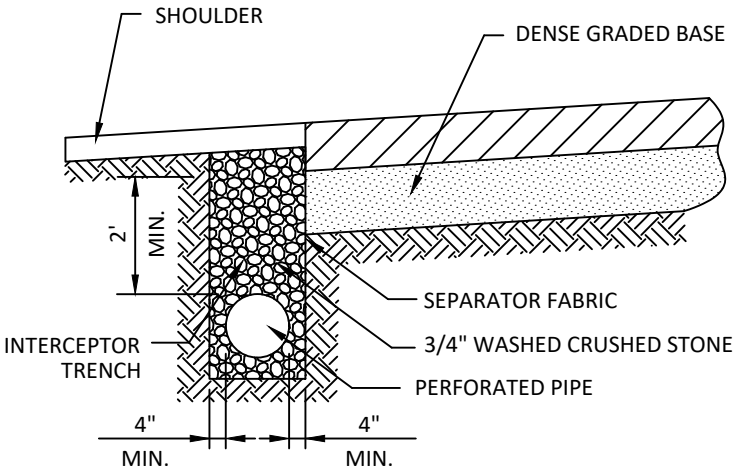
1. ALL PUBLIC ROADS AND DRIVE CROSSINGS ARE TO BE BACKFILLED WITH ODOT 703.01 TYPE A AGGREGATE BASE OR FLOWABLE FILL.
2. REMOVE AND REPLACE PAVEMENT TO NEAREST JOINT IF PROPOSED SAW CUT IS LESS THAN 3' FROM JOINT.
3. NO PAYMENT WILL BE MADE FOR REPLACEMENT OF PAVEMENT OUTSIDE OF STD. PAY WIDTH DUE TO TRENCH EXCAVATION WIDER THAN STANDARD TRENCH WIDTH.
4. PAY QUANTITY WILL INCLUDE REPLACEMENT OF PAVEMENT DUE TO SQUARING OF DIAGONAL CUTS.
5. FOR SERVICE LINES 52" AND SMALLER, THE STD. PAY WIDTH SHALL BE 2.2'.
6. WHERE TRENCH EXCAVATION IS WITHIN 12" OF BACK OF CURB STANDARD NO. GC-02 SHALL APPLY.
7. NEW PCC TO BE 2" THICKER THAN EXISTING PAVING, 8" MINIMUM.
8. CONCRETE SHALL BE 3500 PSI HIGH EARLY STRENGTH CONCRETE PER ODOT 701.01(A).
9. CITY ENGINEER SHALL DECIDE WHICH TYPE OF REPAIR TO MAKE.
10. 1" DIA. BY 18" LONG DOWELS SPACED AT 12" CENTERS ARE REQUIRED IF ADJACENT PAVEMENT IS CONCRETE.
11. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND REQUIREMENTS.

PAVEMENT REMOVAL AND REPLACEMENT

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 3	DRAWING NO. ST 21



CROSS SECTION OF NEW PAVEMENT WITH DRAINAGE SYSTEM



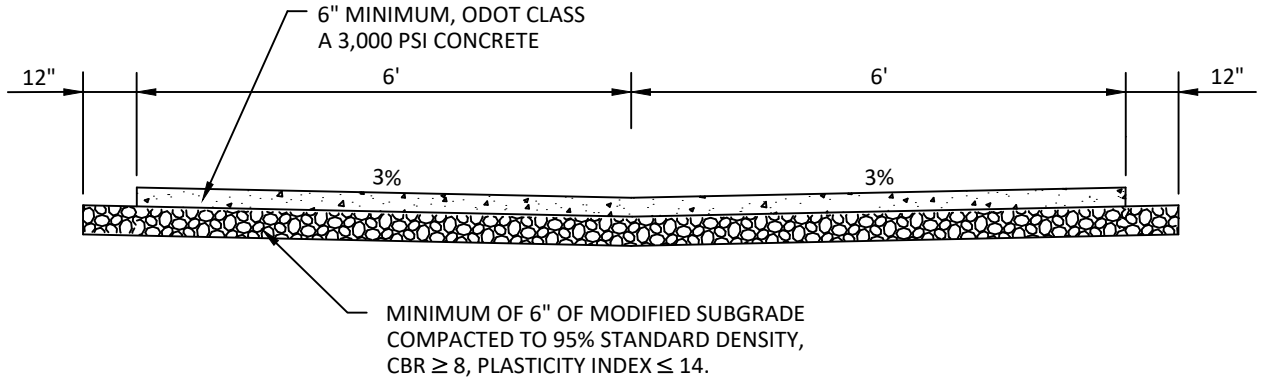
CROSS SECTION OF DRAINAGE IMPROVEMENT TO EXISTING PAVEMENT

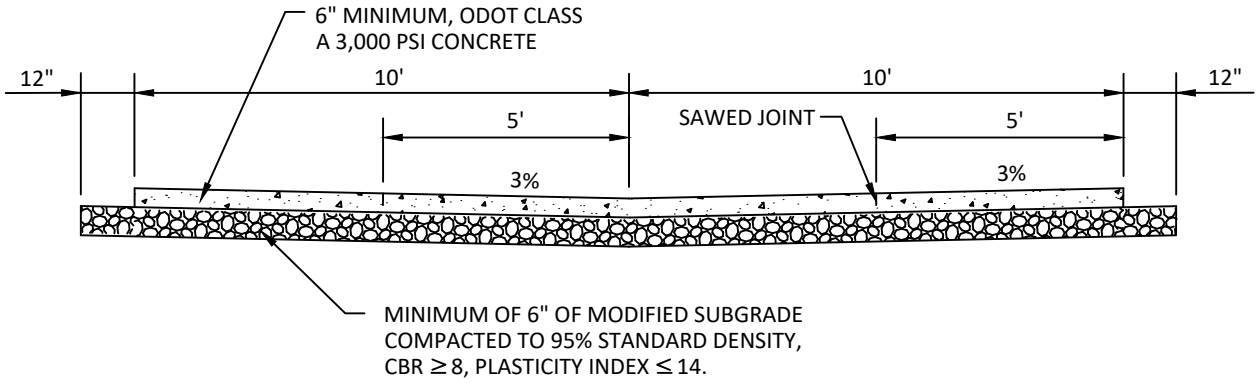
NOTES:

1. MINIMUM PERFORATED PIPE SIZE IS 4" DIAMETER.
2. PERFORATED PIPES SHALL BE TIED TO THE STORM SEWER SYSTEM.
3. ON STREETS WITH CURB AND GUTTER, THE DRAIN SHALL BE OUTSIDE OF BUT ADJACENT TO THE CURB.
4. PIPE MATERIAL SHALL BE POLYETHYLENE PIPE THAT MEETS ASTM F405 SPECIFICATIONS.
5. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATIONAL AND REQUIREMENTS.

BASE DRAINAGE

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 22



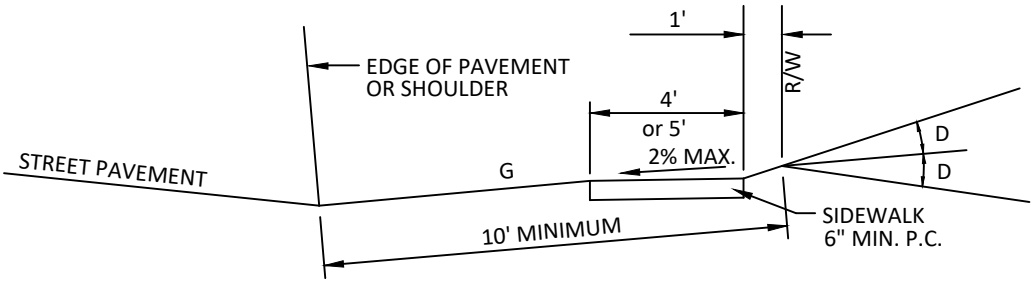


NOTES:

1. PAVING SECTION SHOWN IS MINIMUM ALLOWED. PAVING SHALL BE DESIGNED IN ACCORDANCE WITH THE CITY'S "ENGINEERING DESIGN CRITERIA".
2. LONGITUDINAL AND TRANSVERSE JOINTS SHALL BE IN ACCORDANCE WITH THE CITY'S "STANDARD SPECIFICATIONS" PAVING CONSTRUCTION SECTION 2304.4(B) & 2304.4(C).
3. PAVING CONSTRUCTION TO BE MONOLITHIC, NO CONSTRUCTION JOINTS.
4. THE MINIMUM RADIUS SHALL BE 20 FEET FOR RETURNS AT THE INTERSECTION OF AN ALLEY AND STREET. IF DEEMED NECESSARY, THE CITY ENGINEER MAY REQUIRE A LARGER RADIUS. FOR AN EXISTING ALLEY BEING RECONSTRUCTED, ON SITE CONDITIONS MAY WARRANT A SMALLER RADIUS IF APPROVED BY THE CITY ENGINEER.
5. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND REQUIREMENTS.

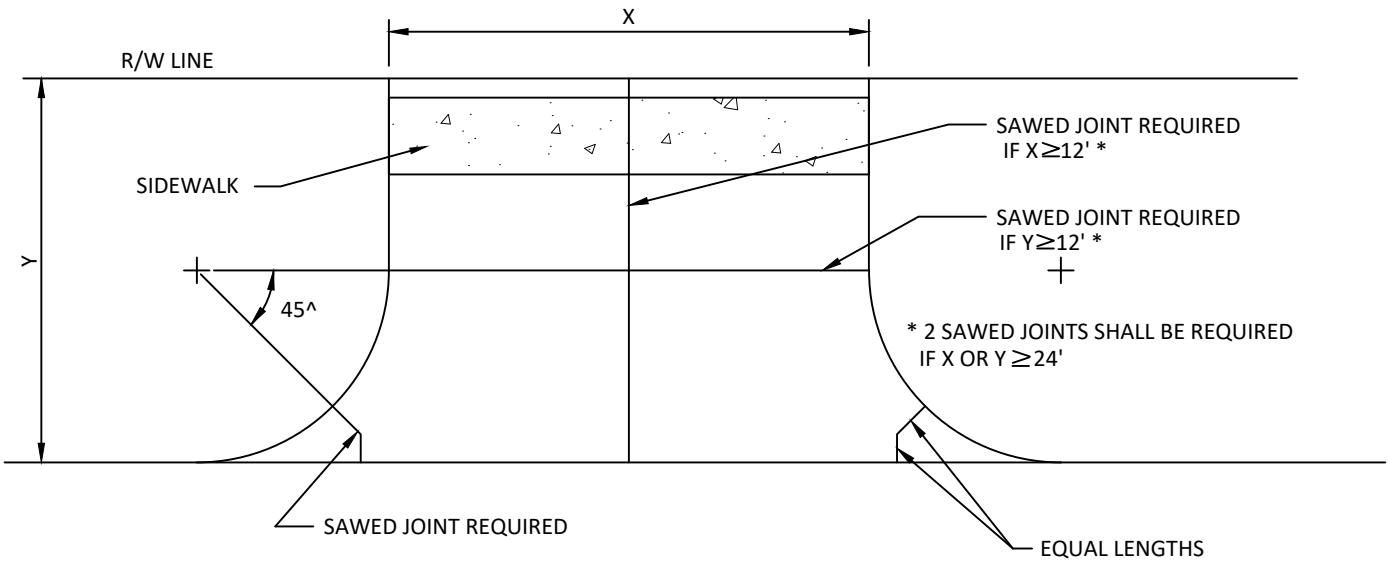
ALLEY PAVING

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 4	DRAWING NO. ST 23



DRIVEWAY GRADES				
ELEMENT	DRIVEWAY	FUNCTIONAL CLASSIFICATION		
		ARTERIAL	COLLECTOR/DISTRIBUTOR	LOCAL
RECOMMENDED GRADES (G)	RESIDENTIAL	DESIRABLE: 0-10% MAXIMUM: 10%		
	COMMERCIAL/INDUSTRIAL	DESIRABLE: 0-5% MAXIMUM: 8%		
CHANGE IN GRADE (D) WITHOUT VERTICAL CURVE	ALL	8% OR LESS	9% OR LESS	12% OR LESS

APPROACH GRADE



CONTRACTION JOINTS

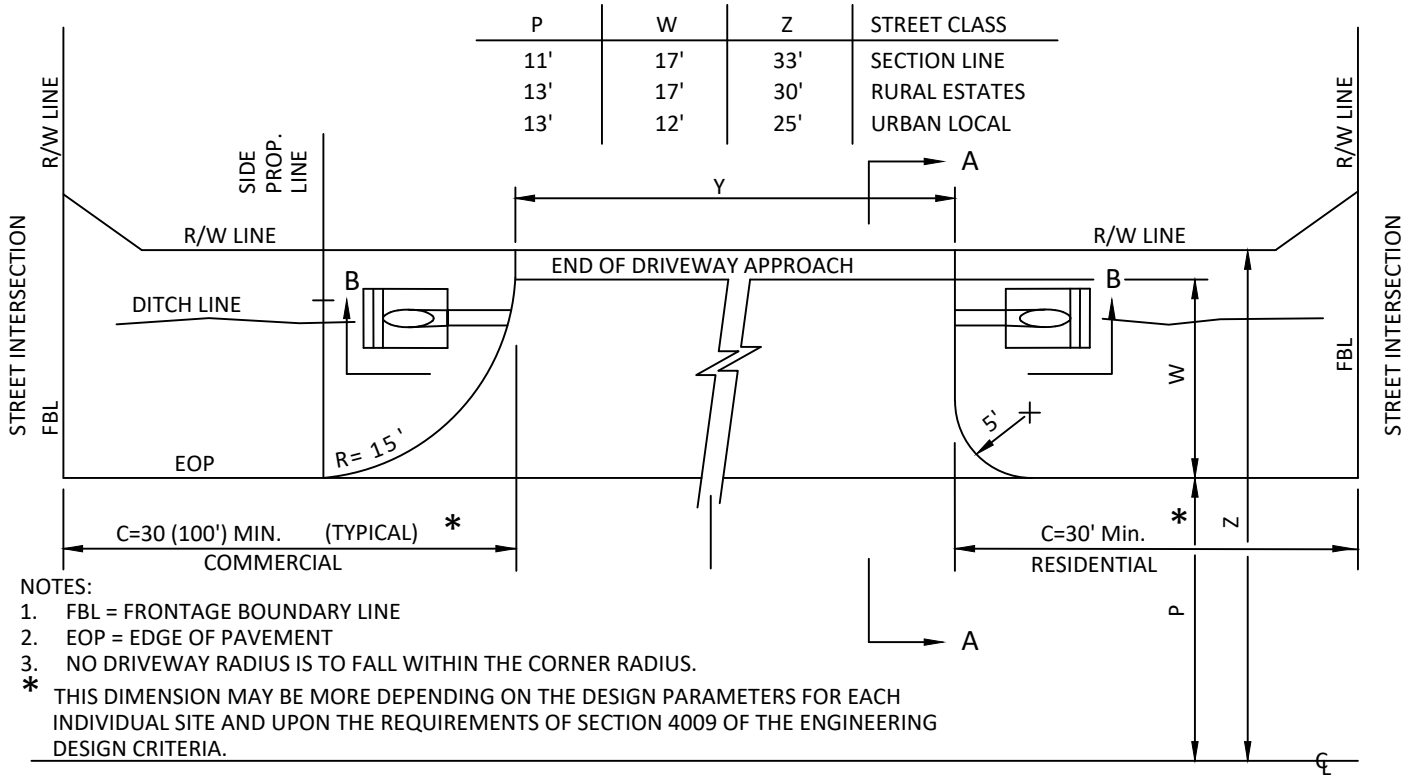
NOTES:

1. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND REQUIREMENTS.

DRIVEWAY APPROACH - GRADES & CONTRACTION JOINTS

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 4	DRAWING NO. ST 24

P	W	Z	STREET CLASS
11'	17'	33'	SECTION LINE
13'	17'	30'	RURAL ESTATES
13'	12'	25'	URBAN LOCAL

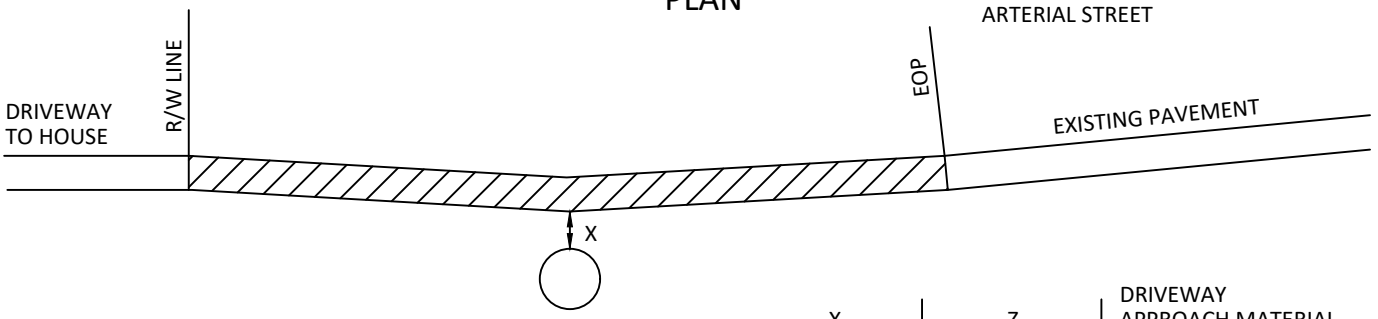


NOTES:
1. FBL = FRONTAGE BOUNDARY LINE
2. EOP = EDGE OF PAVEMENT
3. NO DRIVEWAY RADIUS IS TO FALL WITHIN THE CORNER RADIUS.

* THIS DIMENSION MAY BE MORE DEPENDING ON THE DESIGN PARAMETERS FOR EACH INDIVIDUAL SITE AND UPON THE REQUIREMENTS OF SECTION 4009 OF THE ENGINEERING DESIGN CRITERIA.

PLAN

* 15' MIN. ON ARTERIAL STREET

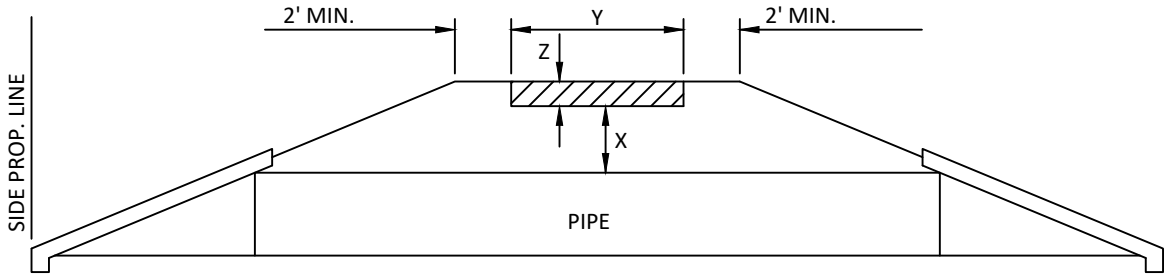


SECTION A-A

Y	TYPE DRIVE
10'-30'	RESIDENTIAL
35' MAX.	COMMERCIAL

X	Z	DRIVEWAY APPROACH MATERIAL
3"	6"	CONCRETE
6"	4" *	ASPHALT
9"	5"	OTHER

* X=1' AND Z=8" FOR COMMERCIAL



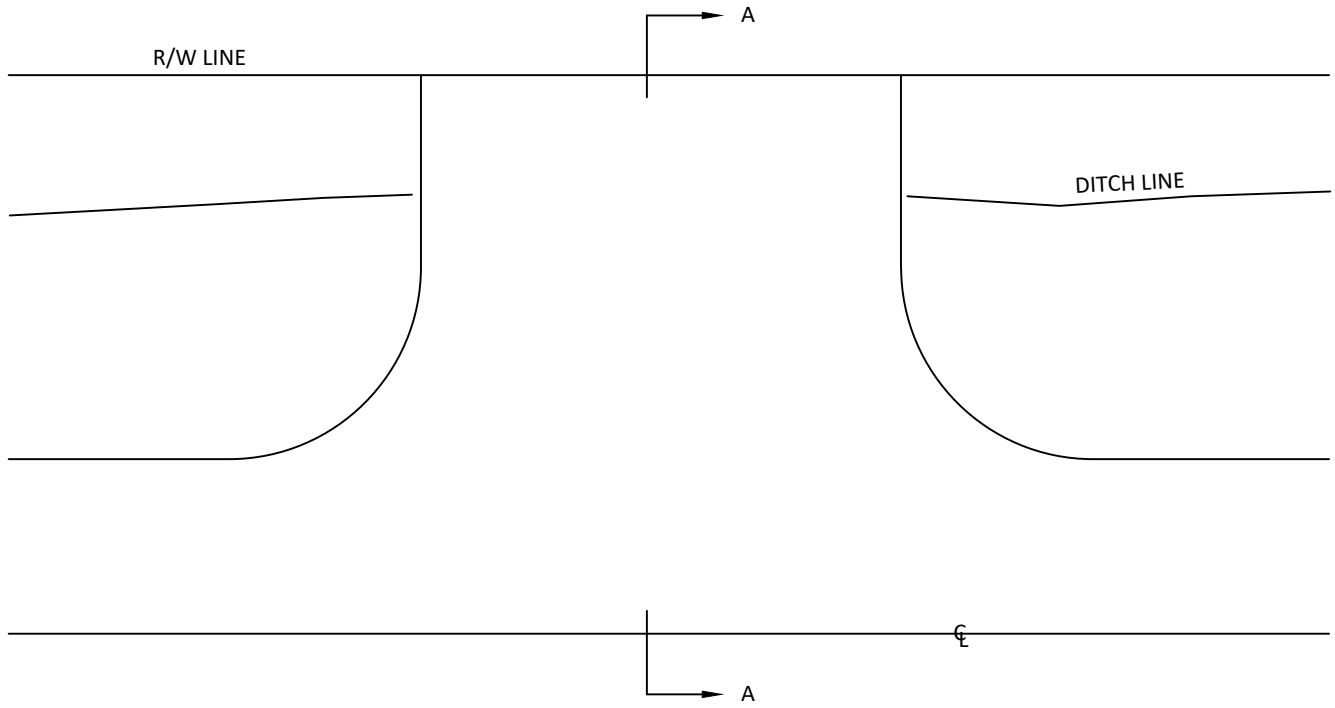
SECTION B-B

NOTES:

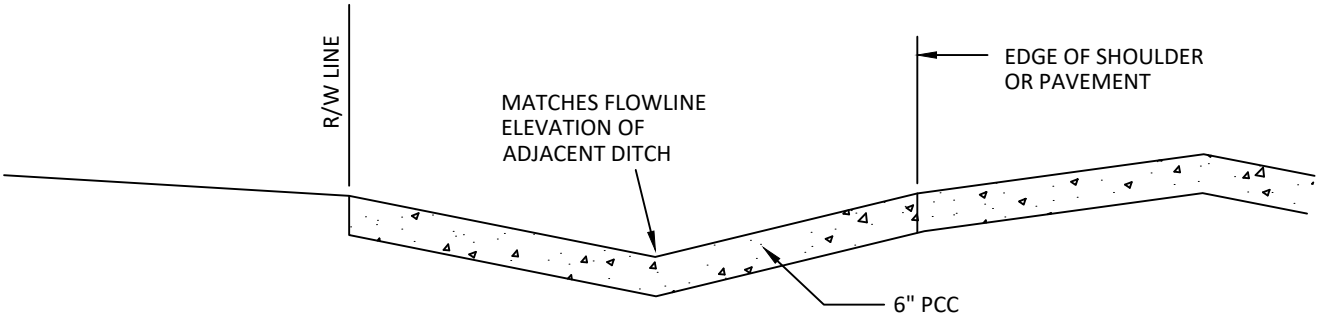
1. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND REQUIREMENTS.

TYPE I DRIVEWAY APPROACH ON STREET WITH SIDE DITCHES

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 2	DRAWING NO. ST 25



PLAN



SECTION A-A

NOTES:

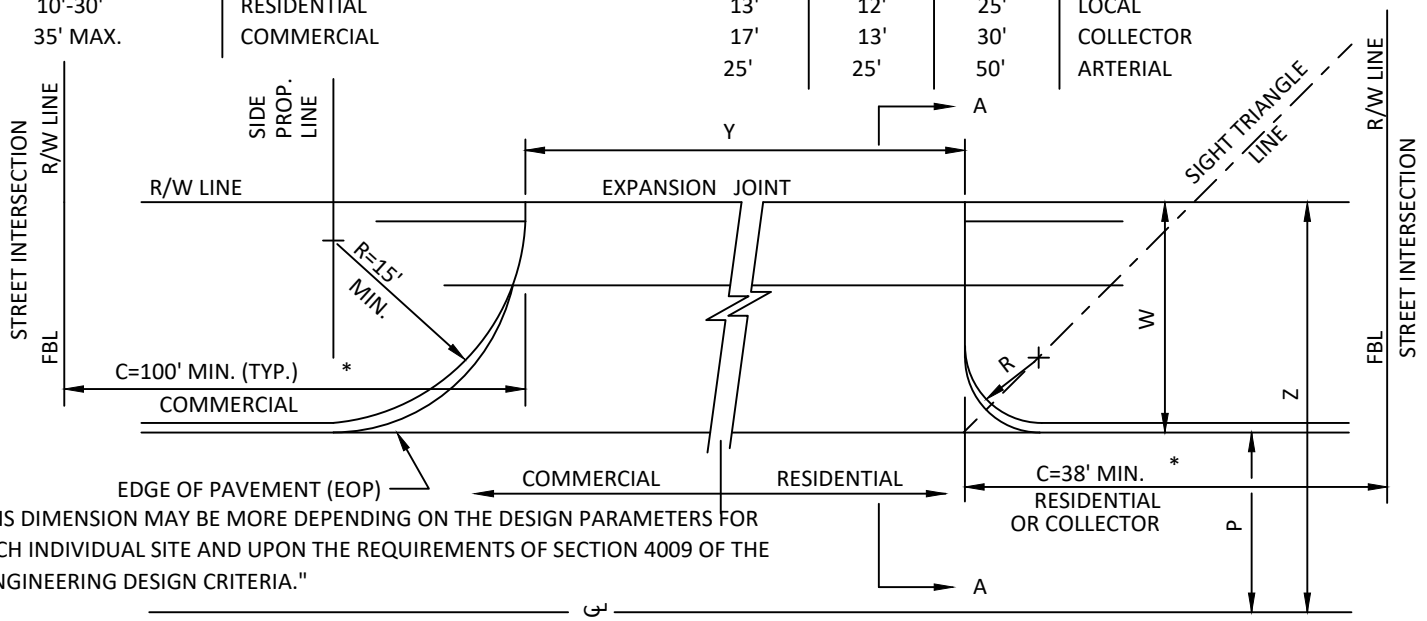
1. NO DRAINAGE PIPE REQUIRED IF THE EXISTING DRAINAGE DITCH IS SHALLOW (LESS THAN ONE FOOT DEEP FROM THE EDGE OF PAVEMENT) AND THE EXISTING DRAINAGE AREA IS SMALL (THE QUANTITY OF STORM WATER PRODUCED BY A FIFTY YEAR RAINFALL SHALL REMAIN ENTIRELY WITHIN THE DITCH AND NOT TOUCH THE STREET PAVEMENT).
2. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND DRIVEWAY REQUIREMENTS.

DRIVEWAY APPROACH-TYPE I (STREET WITH DITCHES, NO PIPE)

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 26

Y	TYPE DRIVE
10'-30'	RESIDENTIAL
35' MAX.	COMMERCIAL

P	W	Z	STREET CLASS
13'	12'	25'	LOCAL
17'	13'	30'	COLLECTOR
25'	25'	50'	ARTERIAL

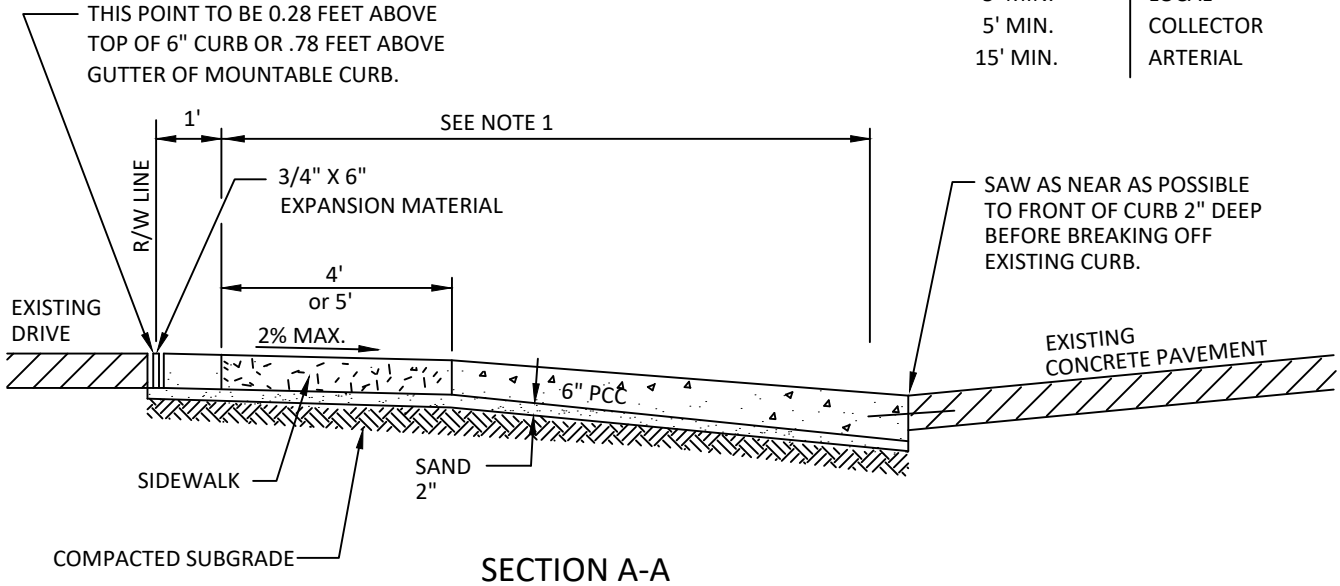


* THIS DIMENSION MAY BE MORE DEPENDING ON THE DESIGN PARAMETERS FOR EACH INDIVIDUAL SITE AND UPON THE REQUIREMENTS OF SECTION 4009 OF THE "ENGINEERING DESIGN CRITERIA."

PLAN

NOTES:
1. FBL = FRONTAGE BOUNDRY LINE
2. NO DRIVEWAY RADIUS IS TO FALL WITHIN THE CORNER RADIUS.

R	STREET CLASS
5' MIN.	LOCAL
5' MIN.	COLLECTOR
15' MIN.	ARTERIAL



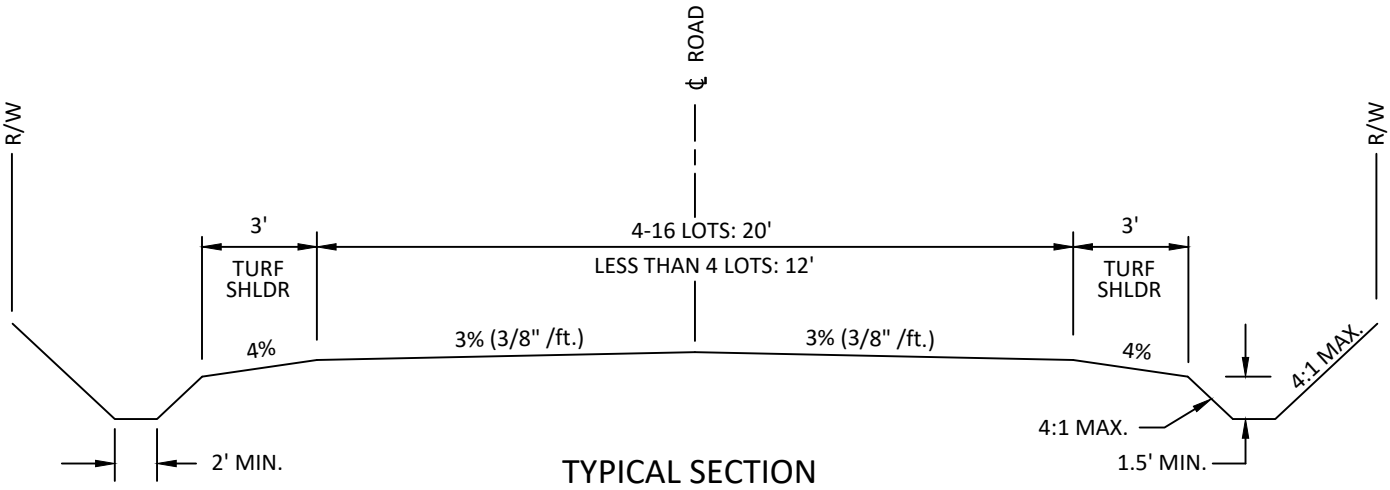
SECTION A-A
(DRIVEWAY SECTION)

NOTES:

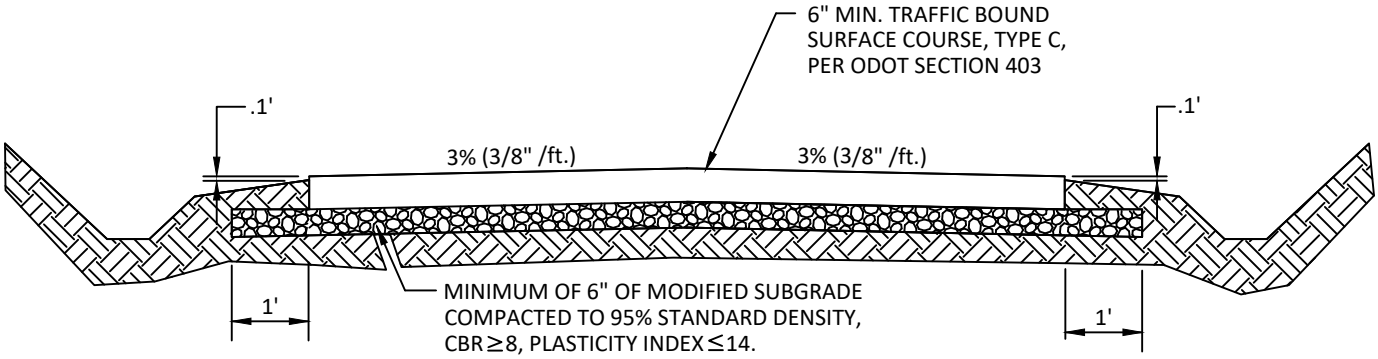
1. TYPICALLY 23.33 FEET FOR COMMERCIAL DRIVEWAY (SEE NOTE 2), 11.33 FEET FOR RESIDENTIAL DRIVEWAY ON LOCAL STREET AND 12.33 FEET FOR RESIDENTIAL DRIVEWAY ON A COLLECTOR STREET.
2. IF LESS THAN TYPICAL, THE APPROACH GRADE MAY BE STEEPER THAN RECOMMENDED ON DRAWING ST-24. THE STEEPER GRADE MAY BE APPROVED BY THE CITY ENGINEER ON A CASE BY CASE BASIS.
3. IF CONCRETE DRIVEWAY APPROACH ABUTS A CONCRETE STREET OR MOUNTABLE CURB THE DRIVEWAY SHALL BE CONNECTED TO THE STREET OR CURB USING A KEYWAY OR TIE BARS. THE TIE BARS SHALL BE #4 BARS 450 (18") LONG REQUIRED AT 600 (24") CENTERS.
4. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATION AND DRIVEWAY REQUIREMENTS.

TYPE II APPROACH ON STREET WITH CURB & GUTTER

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 4	DRAWING NO. ST 27



TYPICAL SECTION



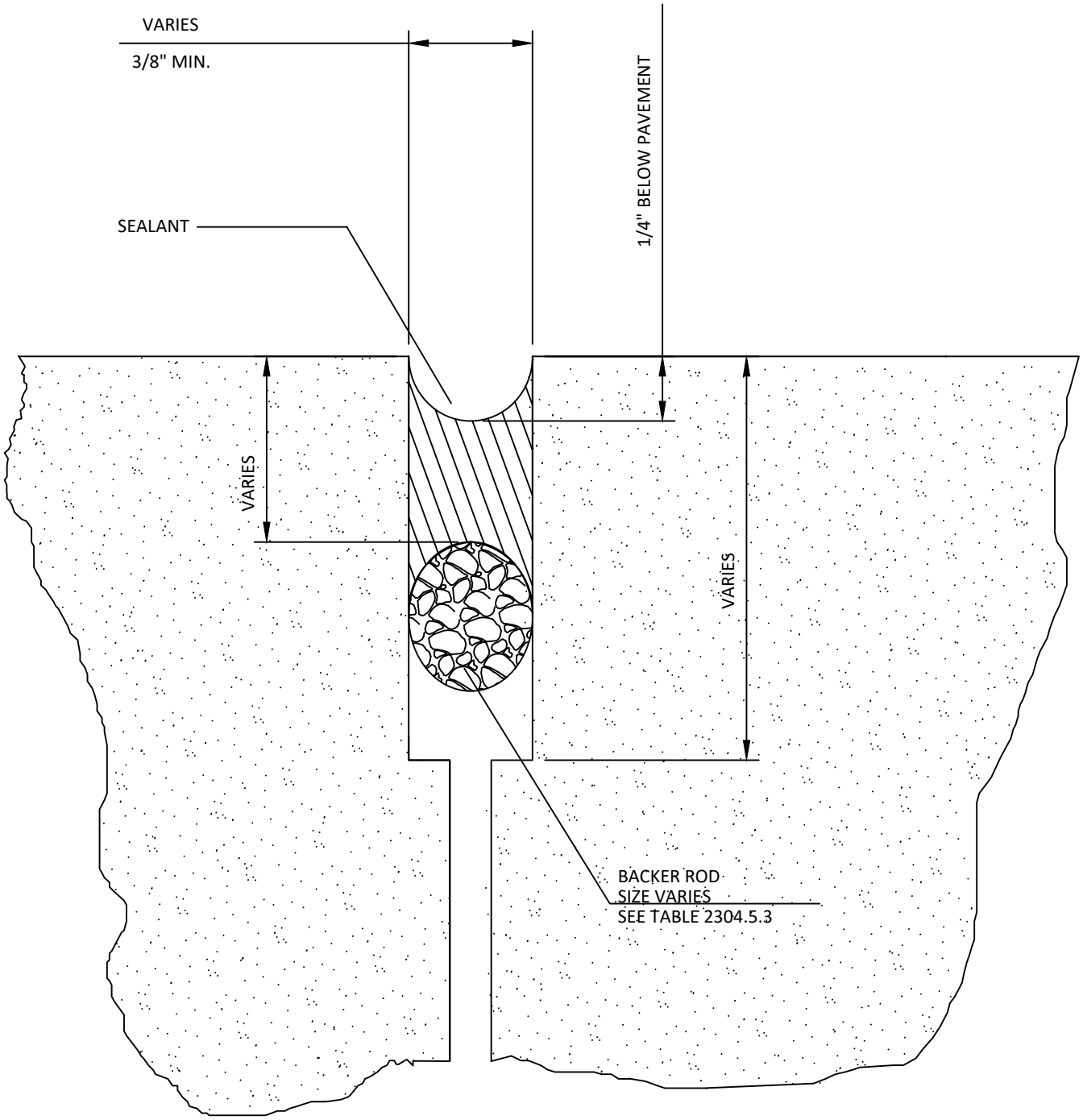
PAVING SECTION

NOTES:

1. TRAFFIC BOUND SURFACE COURSE (TBSC) AND SUBGRADE SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY.
2. TBSC SHALL BE CONSTRUCTED IN ACCORDANCE WITH ODOT STANDARD SPECIFICATIONS, SECTION 310, METHOD A.
3. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATIONAL AND SECTION REQUIREMENTS.

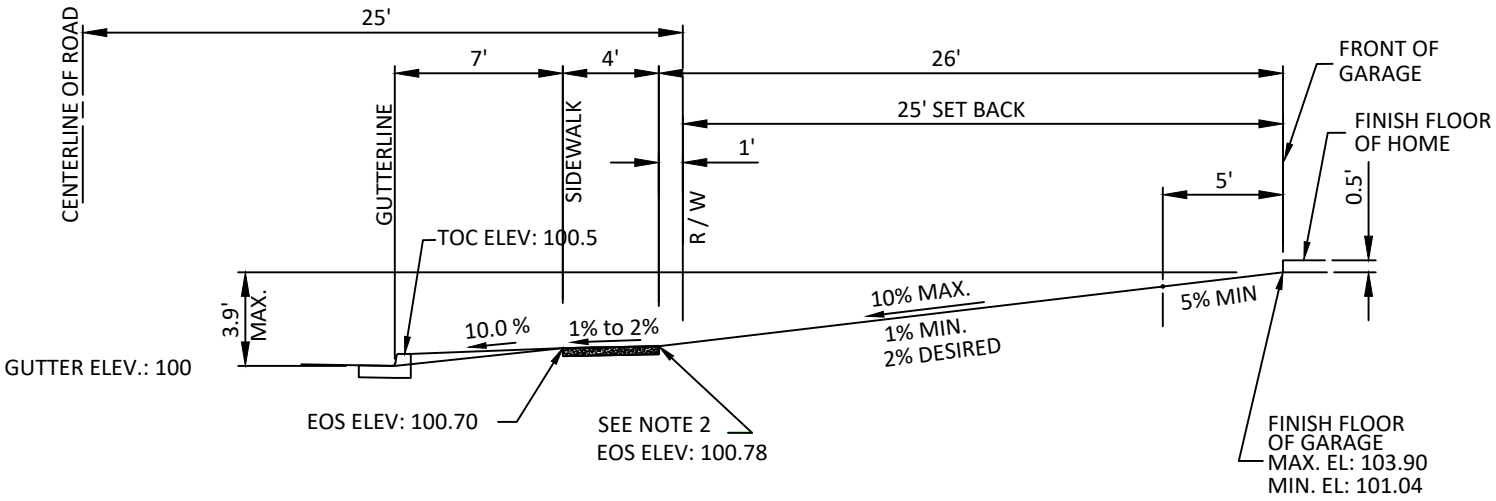
RURAL PRIVATE ROAD

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 2	DRAWING NO. ST 28



JOINT SEALING DETAIL

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 29



DRIVEWAY

(YARD SLOPES TO SIDEWALK)

	GUTTERLINE TO FINISH FLOOR OD GARAGE
MAX. ABOVE	3.90 FT. (3 FT., 10 3/4IN.)
MIN. ABOVE	1.04 FT. (1 FT., 0 1/2 IN.)

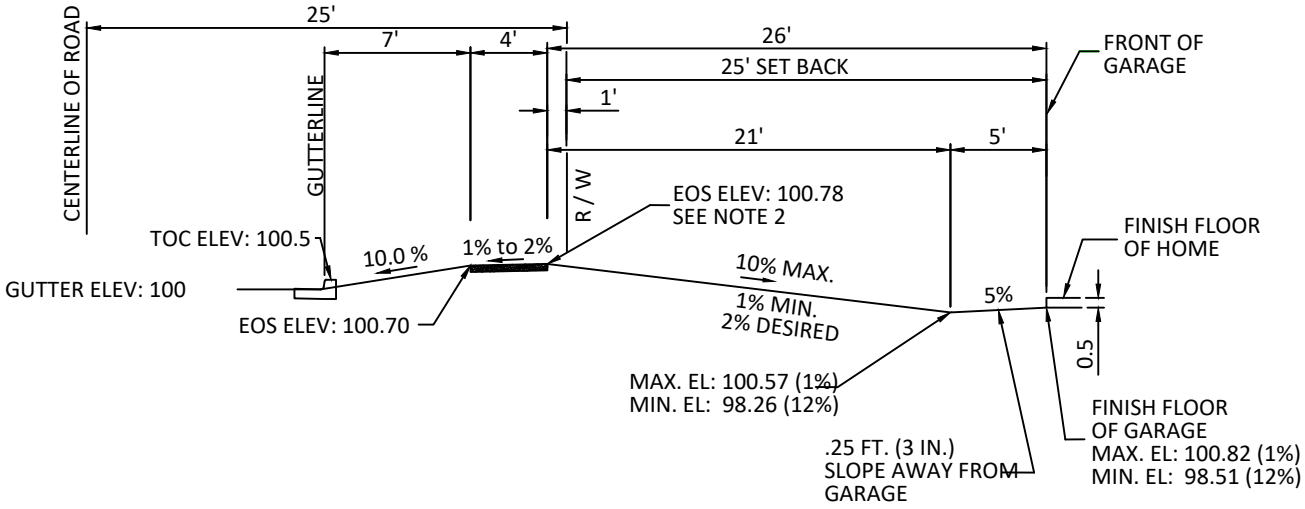
NOTES:

1. MUST HAVE A MINIMUM OF 5% SLOPE (3" IN 5') AWAY FROM THE SIDES OF THE HOUSE FOR AT LEAST 5 FT.
2. THIS POINT IS .28 FT. (3 3/8 IN.) ABOVE TOP OF 6" CURB OR 0.78 FT. ABOVE GUTTER.
3. THIS IS BASED ON A 1% FRONT YARD GRADE FROM THE HOUSE TO THE SIDEWALK.
4. THIS IS A TYPICAL DRAWING. THIS DRAWING MAY BE AMENDED BY THE CITY ENGINEER ON A CASE BY CASE BASIS.
5. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATIONAL AND DRIVEWAY REQUIREMENTS.

REQUIRED RESIDENTIAL DRIVEWAY GRADES-LOCAL STREET

(HOUSE ABOVE STREET LEVEL)

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 4	DRAWING NO. ST 30



DRIVEWAY
(YARD SLOPES AWAY FROM SIDEWALK)

	GUTTERLINE TO FINISH FLOOR OF GARAGE
MAX. BELOW THE GUTTERLINE	1.49 FT. (1 FT., 5 7/8 IN.)
MAX. ABOVE THE GUTTERLINE	.82 FT. (9 7/8 IN.)

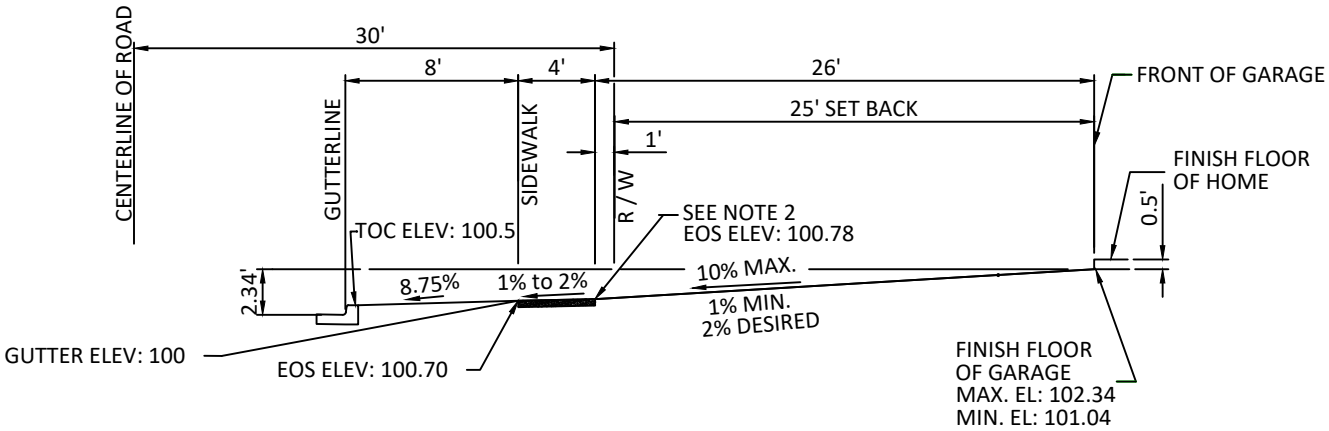
NOTES :

1. MUST HAVE A MINIMUM OF 5% SLOPE (3" IN 5') AWAY FROM THE SIDES OF THE HOUSE FOR AT LEAST 5 FT.
2. THIS POINT IS .28 FT. (3 3/8 IN.) ABOVE TOP OF 6" CURB OR 0.78 FT. ABOVE GUTTER.
3. THIS IS BASED ON A 1% FRONT YARD GRADE FROM THE HOUSE TO THE SIDEWALK.
4. THIS IS A TYPICAL DRAWING. THIS DRAWING MAY BE AMENDED BY THE CITY ENGINEER ON A CASE BY CASE BASIS.
5. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATIONAL AND DRIVEWAY REQUIREMENTS.

REQUIRED RESIDENTIAL DRIVEWAY GRADES-LOCAL STREET

(HOUSE BELOW STREET LEVEL)

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 3	DRAWING NO. ST 31



DRIVEWAY

(YARD SLOPES TO SIDEWALK)

	GUTTER LINE TO FINISH FLOOR OF GARAGE
MAX. ABOVE	2.34 FT. (2 FT., 4 IN.)
MIN. ABOVE	1.04 FT. (1 FT., 0 1/2 IN.)

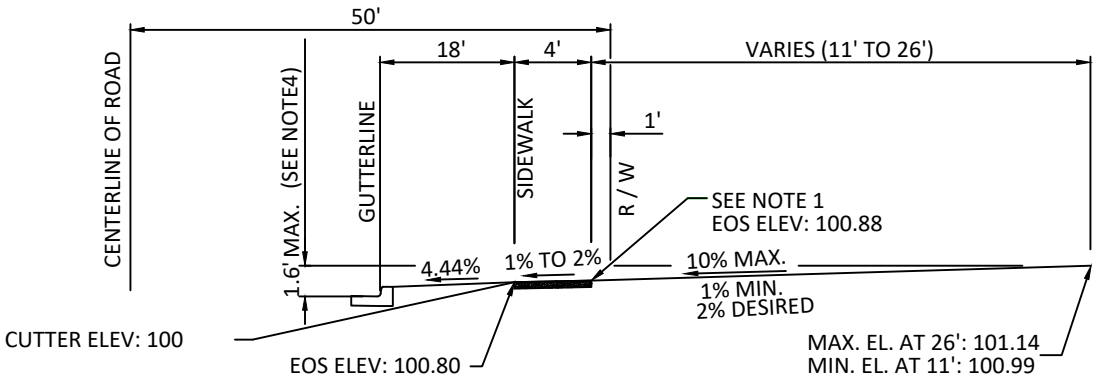
NOTES:

1. MUST HAVE A MINIMUM OF 5% SLOPE (3" IN 5') AWAY FROM THE SIDES OF THE HOUSE FOR AT LEAST 5 FT.
2. THIS POINT IS .28 FT. (3 3/8 IN.) ABOVE TOP OF 6" CURB OR 0.78 FT. ABOVE GUTTER.
3. THIS IS BASED ON A 1% FRONT YARD GRADE FROM THE HOUSE TO THE SIDEWALK.
4. THIS IS A TYPICAL DRAWING. THIS DRAWING MAY BE AMENDED BY THE CITY ENGINEER ON A CASE BY CASE BASIS.
5. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATIONAL AND DRIVEWAY REQUIREMENTS.

REQUIRED RESIDENTIAL DRIVEWAY GRADES-COLLECTOR ST.

(HOUSE ABOVE STREET LEVEL)

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 4	DRAWING NO. ST 32



DRIVEWAY
(YARD SLOPES TO SIDEWALK)

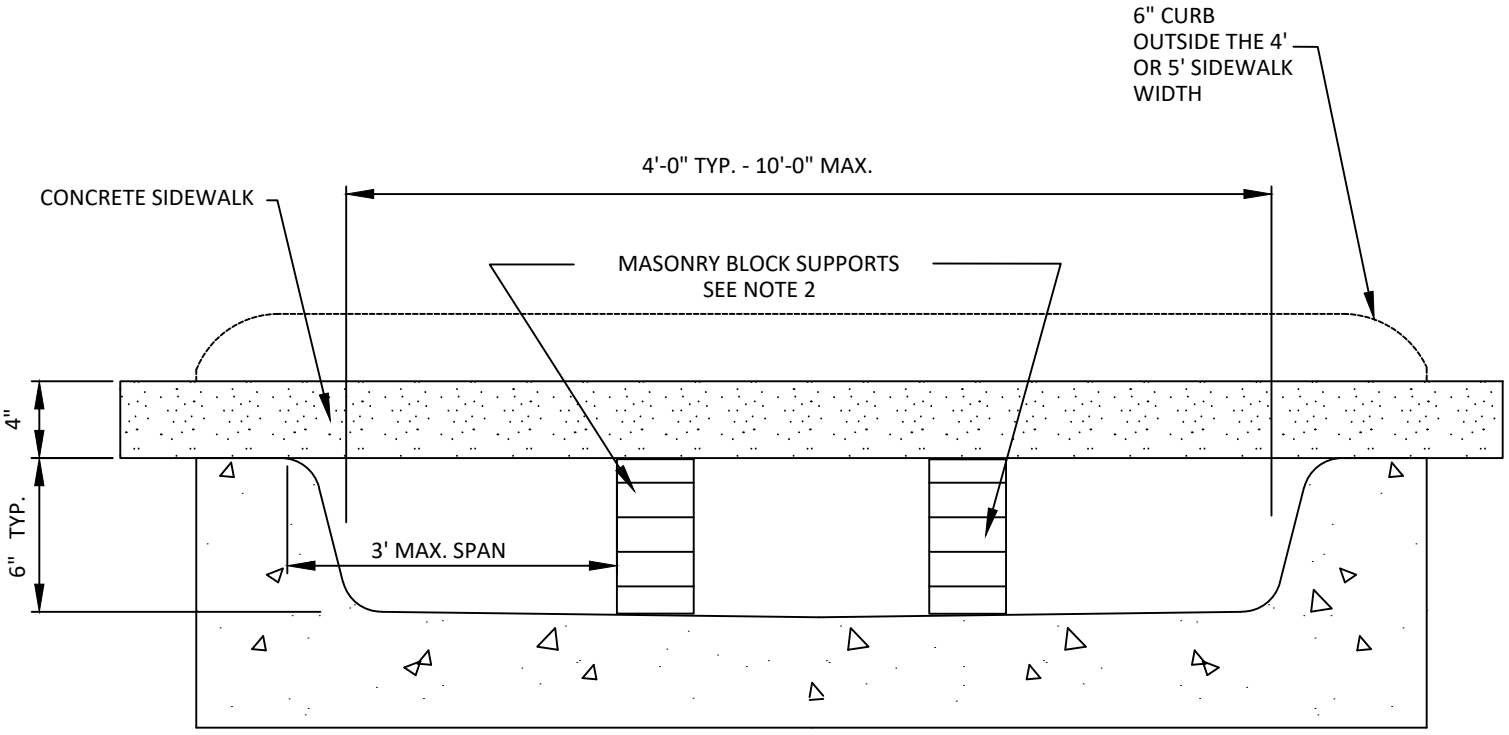
	GUTTER LINE TO FINISH ELEVATION OF PARKING AREA
MAX. ABOVE	SEE NOTE 3
MIN. ABOVE	0.99 FT. (11 7/8 IN.) FOR 10 FT. SET BACK, (SEE NOTE 2) 1.14 FT. (1 FT., 1 11/ 16 IN.) FOR 25 FT. SET BACK, (SEE NOTE 2)

NOTES:

1. THIS POINT IS AT LEAST 0.38 FT. (4 1/2 ") ABOVE TOP OF 6" CURB OR 0.88 FT. ABOVE GUTTER.
2. THIS IS BASED ON A 1% FRONT AREA GRADE FROM THE BUILDING TO THE SIDEWALK.
3. IN COMMERCIAL AREAS, THERE WILL BE A 10FT. OR 25 FT. SET BACK. THE MAXIMUM FINISH ELEVATION OF THE PARKING AREA ABOVE THE GUTTER LINE WILL CARY AND WILL BE DETERMINED ON A CASE BY CASE BASIS BY THE CITY ENGINEER.
4. REFERENCE THE CURRENT VERSION OF THE CITY'S COMPREHENSIVE TRANSPORTATION PLAN AND ENGINEERING DESIGN CRITERIA FOR ADDITIONAL INFORMATIONAL AND DRIVEWAY REQUIREMENTS.

REQUIRED COMMERCIAL DRIVEWAY GRADES - ARTERIAL ST.

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 4	DRAWING NO. ST 33



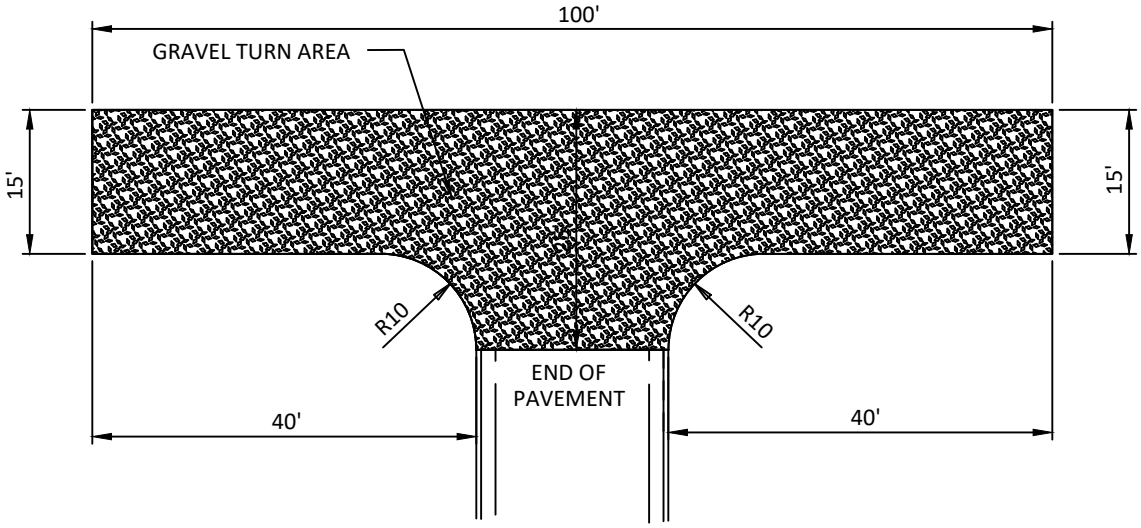
TYPICAL SECTION

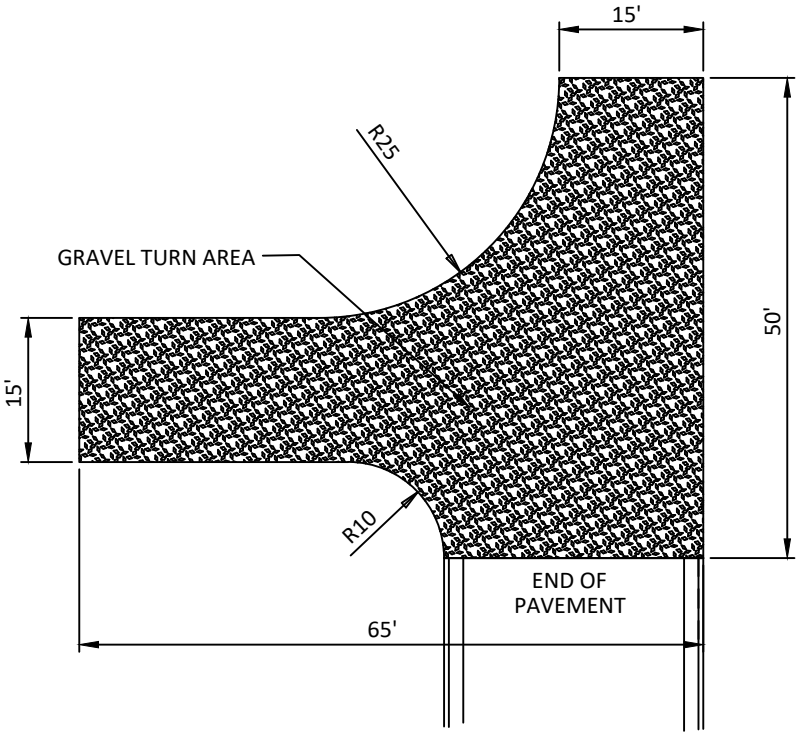
NOTES

1. CROSS SLOPE OF SIDEWALK SHALL NOT EXCEED 2% IN ANY DIRECTION.
2. ONE MASONRY BLOCK SUPPORT SHALL BE REQUIRED FOR A FLUME 6 FT. WIDE OR LESS.
3. CONCRETE SUPPORTS MAY BE IN PLACE OF MASONRY BLOCKS IF APPROVED BY THE CITY ENGINEER.

SIDEWALK CROSSING CONCRETE FLUME

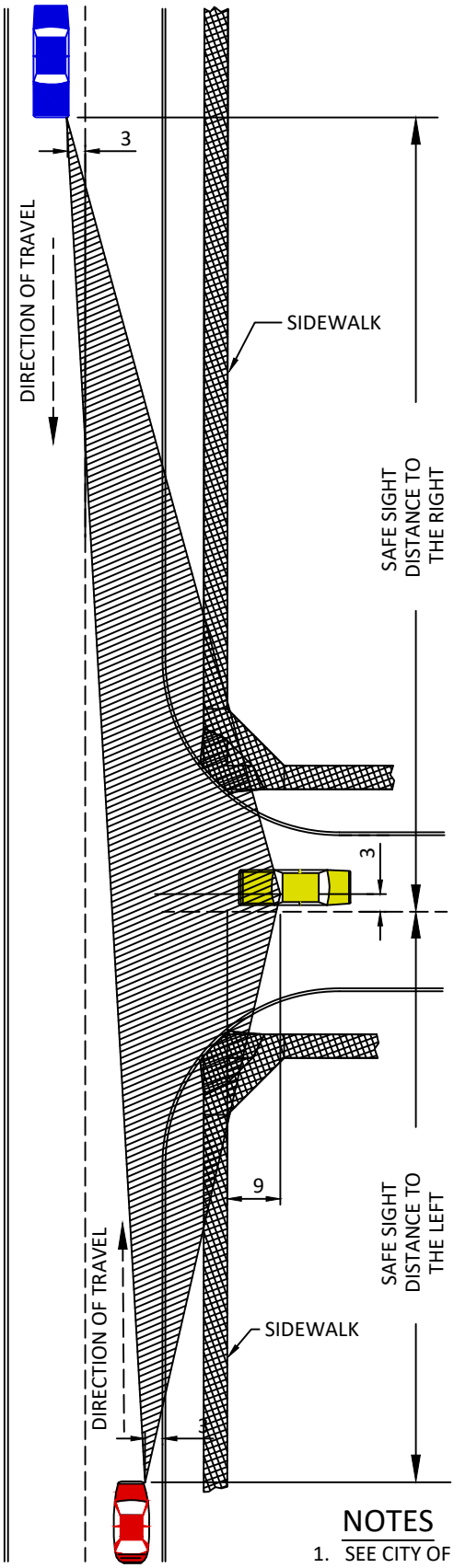
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 34





TEMPORARY T TURN AROUND

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 35



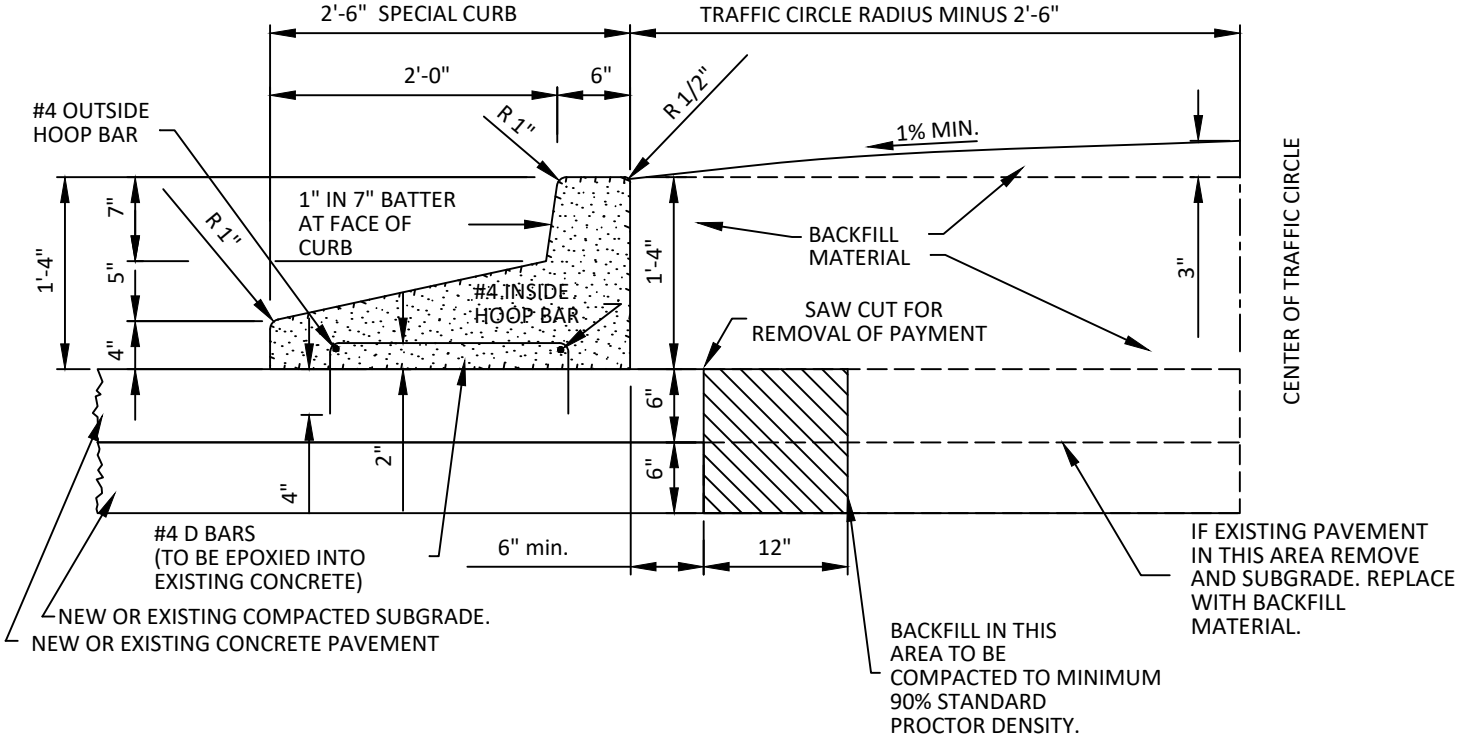
THE INTERSECTION SIGHT DISTANCE PROVISIONS CONTAINED IN THE CURRENT VERSION OF "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS" PUBLISHED BY THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (THE AASHTO GREEN BOOK REFERENCED IN SECTION 4006) ARE ADOPTED AS THE PRESUMPTIVE STANDARD APPLICABLE TO ALL INTERSECTIONS WITHIN THE CITY PROVIDED, HOWEVER, THAT DIRECTOR OF PUBLIC WORKS OR HIS DESIGNEE MAY, WHERE CONSISTENT WITH PUBLIC SAFETY, SPECIFY GREATER OR LESSER INTERSECTION SIGHT DISTANCES.

NOTES

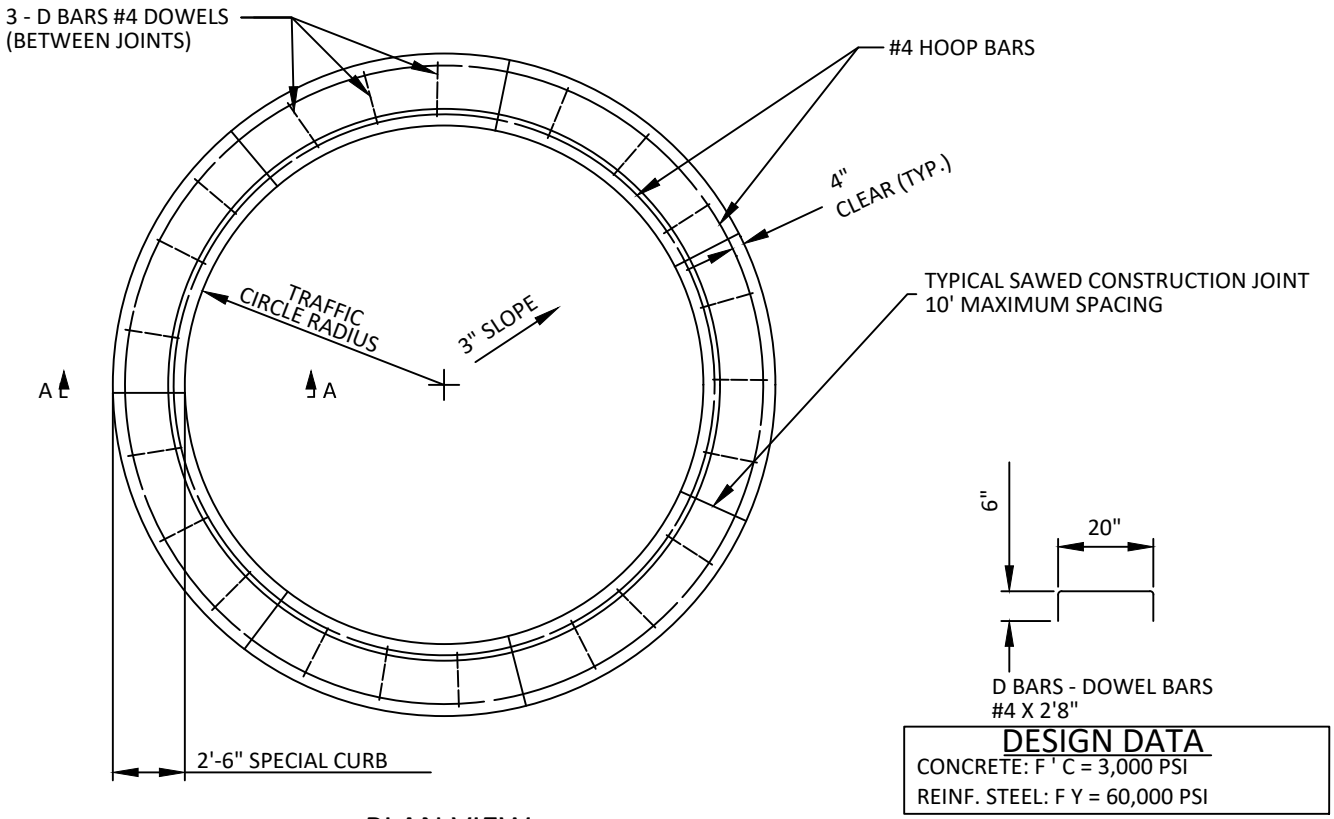
1. SEE CITY OF NORMAN "STANDARD SPECIFICATIONS" SECTION 4007.2 SIGHT DISTANCE TRIANGLE (VISION TRIANGLE).

INTERSECTION SIGHT DISTANCE

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 36



SECTION A-A



PLAN VIEW

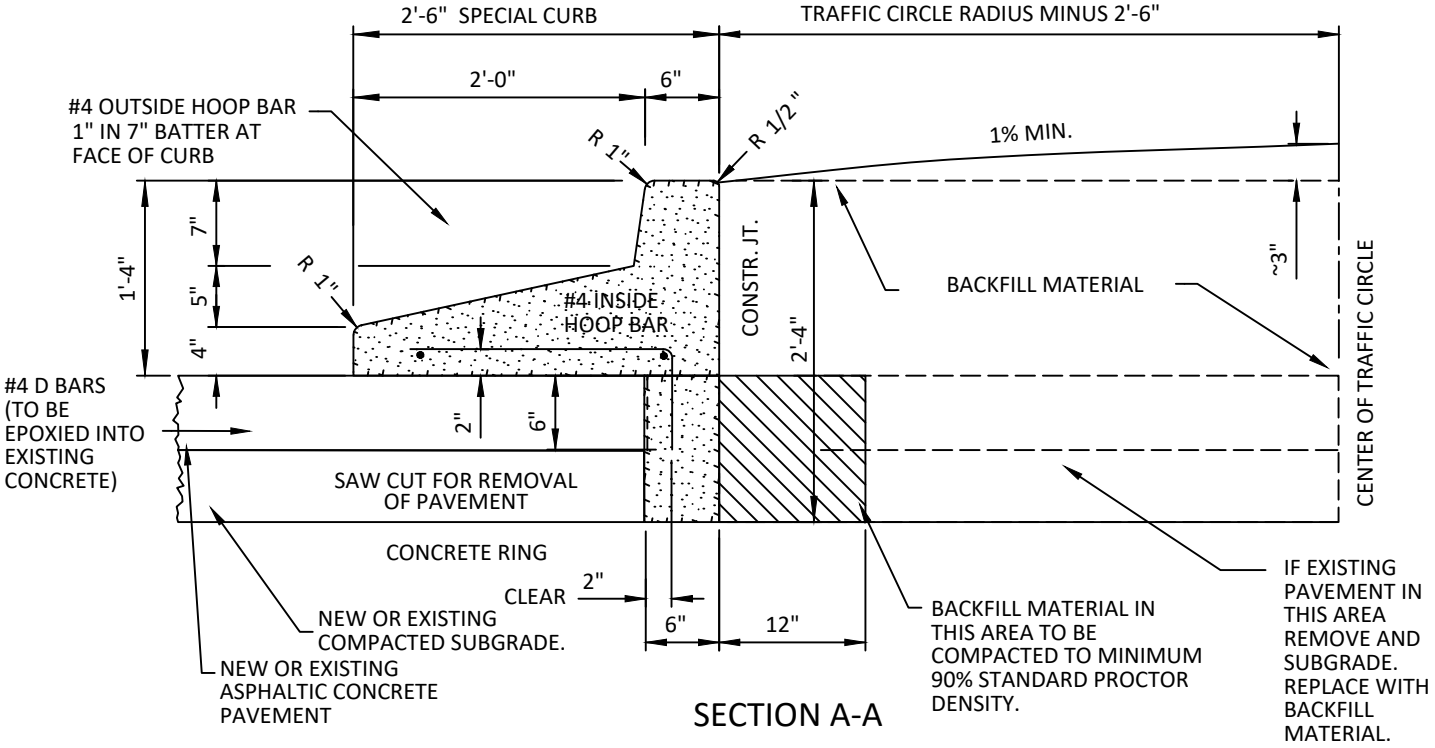
DESIGN DATA

CONCRETE: F ' C = 3,000 PSI

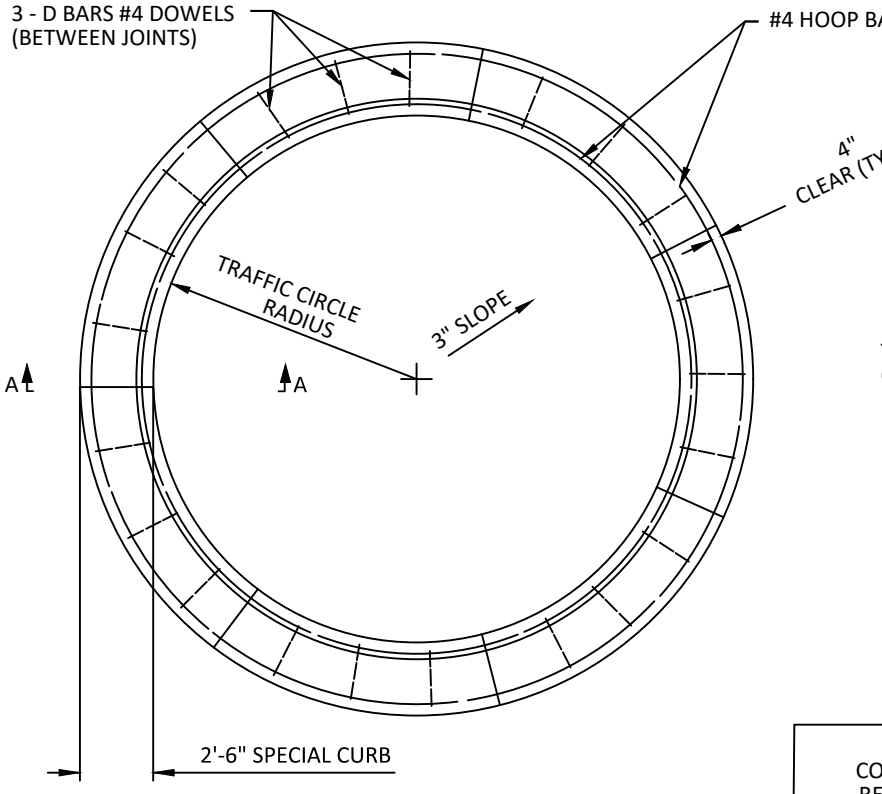
REINF. STEEL: F Y = 60,000 PSI

ROUNDABOUT TRUCK APRON DETAIL - CONCRETE

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 38

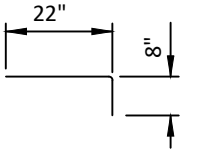


SECTION A-A



PLAN VIEW

TYPICAL SAWED
CONSTRUCTION JOINT
10' MAXIMUM SPACING

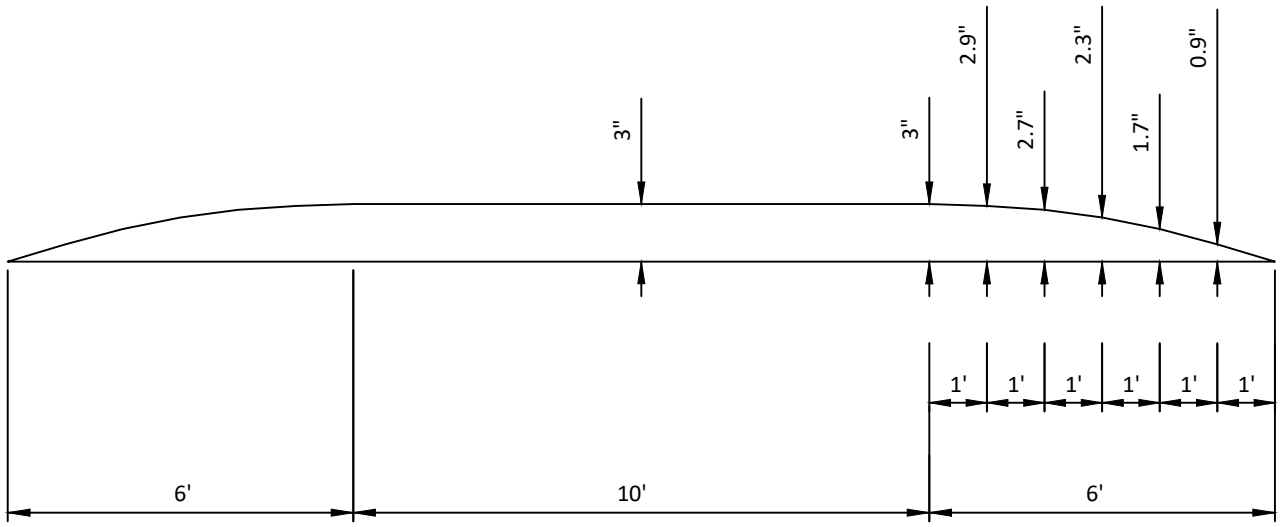


D BARS-DOWEL BARS
#4 x 2'-6"

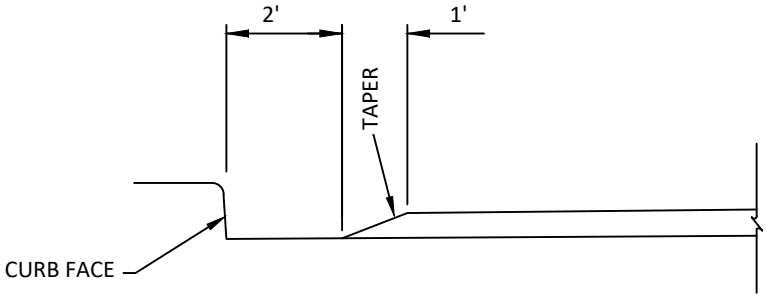
DESIGN DATA
CONCRETE: F'C = 3,000 PSI
REINF. STEEL: F Y= 60,000 PSI

ROUNDABOUT TRUCK APRON DETAIL - ASPHALT

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 39



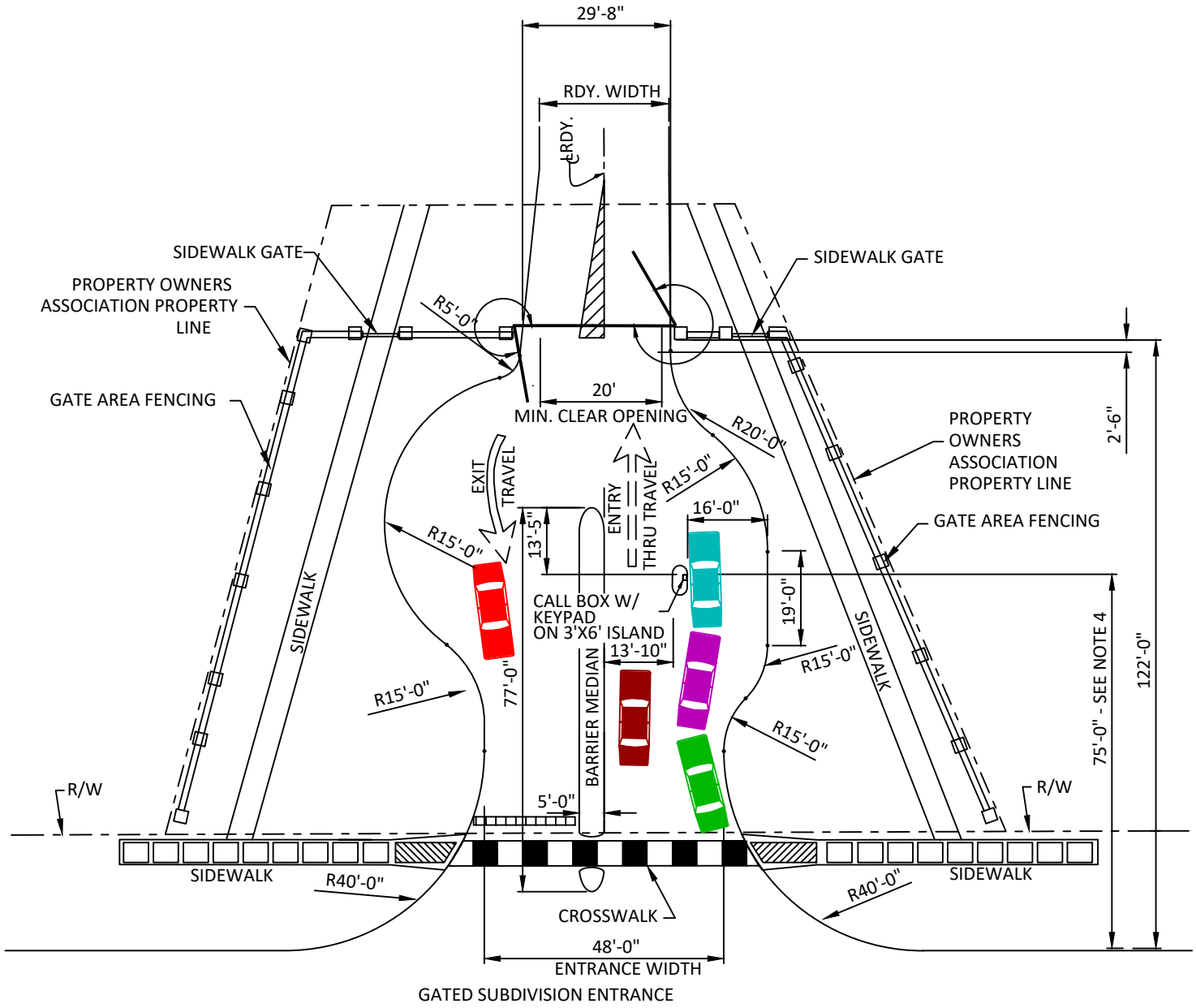
LONGITUDINAL PROFILE



AT EDGE OF ROADWAY
(TRANSVERSE DIRECTION)

SPEED TABLE - 22' LONG

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 41



GATED SUBDIVISION ENTRANCE

(VEHICLE STACKING AT KEYPAD SHOWN)

NOTES

1. A SIREN OPERATED SYSTEM (SOS) SHALL BE PROVIDED THAT WILL AUTOMATICALLY OPEN THE GATES UPON APPROACH OF EMERGENCY VEHICLES.
2. A MANUAL GATE RELEASE MECHANISM SHALL BE PROVIDED TO ALLOW A RESPONDER TO OPEN THE GATE UPON THE LOSS OF POWER TO THE GATE CONTROLS.
3. THERE MUST BE AT LEAST 20' CLEAR WIDTH GATE OPENING AND MINIMUM CLEAR HEIGHT OF 13'-6" TO ACCOMMODATE EMERGENCY VEHICLES.
4. MINIMUM QUEUING SPACE FOR FATED ENTRANCES INTERSECTING URBAN LOCAL AND COLLECTOR STREETS SHALL BE 50'. FOR GATED ENTRANCES INTERSECTING ARTERIAL AND RURAL COLLECTOR STREETS THE MINIMUM QUEUING SPACE SHALL BE 75' FOR DEVELOPMENTS WITH LESS THAN 100 LOTS. ADDITIONAL QUEUING SPACE MAY BE REQUIRED IF THE NUMBER OF LOTS SERVED BY THE THE GATED ENTRANCE EXCEEDS 100.
5. SWINGING GATES MUST OPEN IN THE DIRECTION OF NORMAL TRAFFIC FLOW AND MUST NOT IMPEDE PEDESTRIAN TRAFFIC OR TURNAROUND TRAFFIC WHILE OPENING OR WHEN IN THE OPEN POSITION.
6. GATES, FENCES, ETC. SHALL NOT INTERFERE WITH OR PREVENT ACCESS TO FIRE HYDRANTS. AREA AROUND HYDRANT(S) SHALL BE KEPT CLEAR OF OBSTRUCTIONS IN ACCORDANCE WITH CITY STANDARDS.
7. TURNAROUND AREA SHALL ACCOMMODATE A SINGLE UNIT TRUCK AS DESCRIBED IN STANDARD GC-04.
8. A "GATE HOUSE" MAY BE CONSTRUCTED USING CURRENT BUILDING CODES AND ENTRANCE, TRAVELED WAY LANES AND TURNAROUND AREA MUST BE MODIFIED TO ACCOMMODATE THE BUILDING.
9. ANY PROPOSED CHANGES SHALL BE REVIEWED AND APPROVED BY THE CITY ENGINEER, TRAFFIC ENGINEER AND THE FIRE MARSHAL'S OFFICE.

GATED ENTRANCE LAYOUT

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 1	DRAWING NO. ST 42

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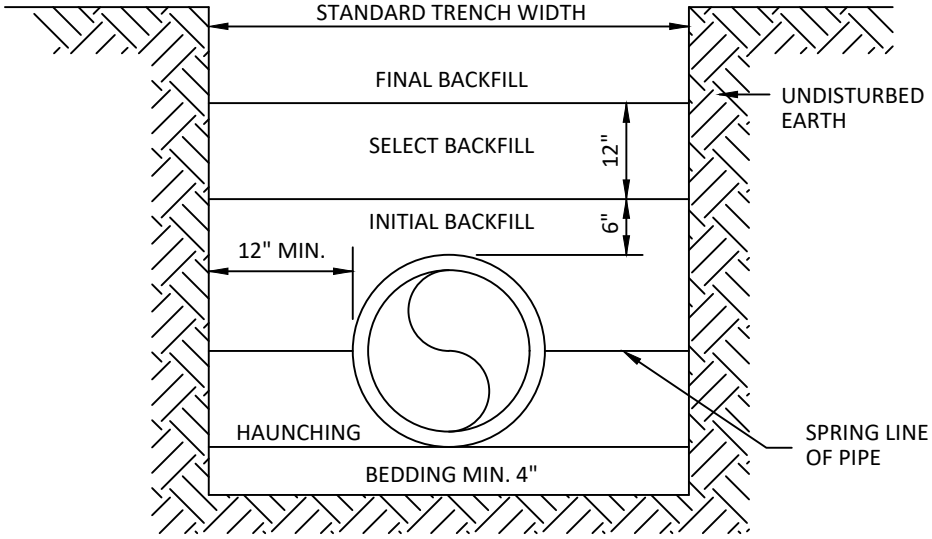
DRAWING NUMBER	DRAWING TITLE	REVISION DATE
SD 01	STORM SEWER PIPE TRENCHING AND BEDDING	01/2023
SD 02	NATURAL CHANNEL	01/2023
SD 03	GRASS LINED CHANNEL, TYPE A	01/2023
SD 04	GRASS LINED CHANNEL, TYPE B	01/2023
SD 05	RAMP FOR CONCRETE LINED CHANNEL	01/2023
SD 06	CONCRETE CHANNEL LINER & DETAILS	01/2023
SD 07	FLUME & CHANNEL LINER DETAILS	01/2023
SD 08	AREA INLET	01/2023
SD 09	JUNCTION BOX DETAIL	01/2023
SD 10	CONCRETE VALLEY GUTTER DETAIL	01/2023
SD 11	STANDARD INLETS AND GRATES W/ ACCESS MANHOLE BACK OF CURB	01/2023
SD 12	PRECAST STANDARD INLETS AND GRATES W/ ACCESS MANHOLE BACK OF CURB	01/2023
SD 13	STANDARD REINFORCED CONCRETE STORMWATER INLETS	01/2023
SD 14	STANDARD STORMWATER FRAMES	01/2023
SD 15	STANDARD CAST IRON CURB	01/2023
SD 16	STANDARD RECESSED CURB INLET	01/2023
SD 17	STANDARD DROP INLET 15", 18", AND 24"	01/2023
SD 18	STANDARD DROP INLET 30", 36", AND 42" WITH NO ACCESS MANHOLE	01/2023
SD 19	STANDARD DROP INLET 48" PIPE	01/2023
SD 20	STANDARD THREE WAY DROP INLET 48" PIPE	01/2023
SD 21A	RECESSED CURB INLET A	01/2023
SD 21B	RECESSED CURB INLET B	01/2023

TABLE OF CONTENTS - STORMWATER

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 00	DRAWING NO. SD 00



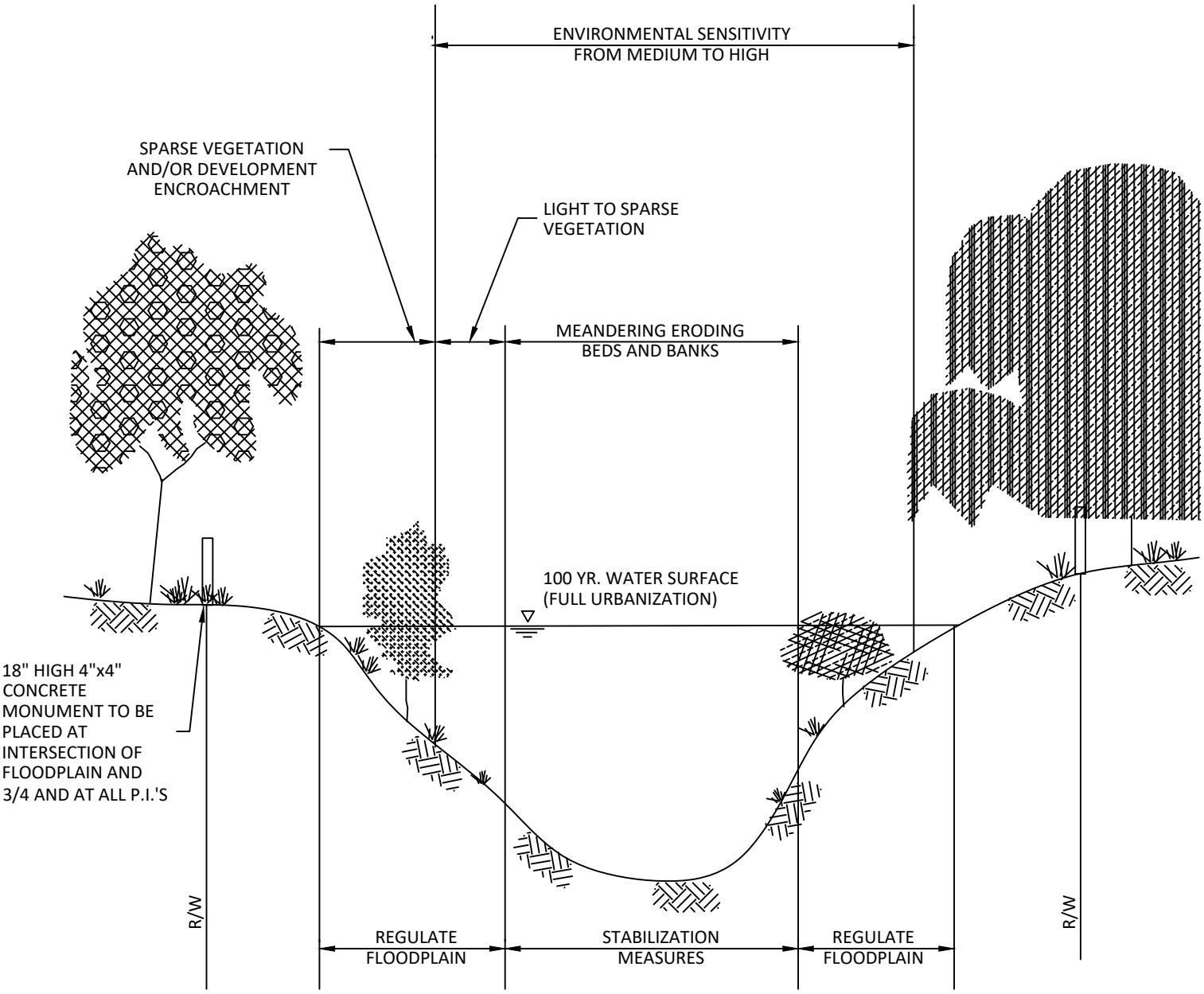
BEDDING MATERIALS					
BACKFILL DESCRIPTION	NON-PAVED AREAS			PAVED AREAS (SEE NOTE 9)	
	CORRUGATED POLYPROPYLENE		CONCRETE	CORRUGATED POLYPROPYLENE	CONCRETE
FINAL BACKFILL	EXCAVATED MATERIAL		EXCAVATED MATERIAL	SBM	SBM
SELECT BACKFILL	EXCAVATED MATERIAL		EXCAVATED MATERIAL	SBM	SBM
INITIAL BACKFILL	SAND	SAND	SELECT FILL	SBM	SBM
HAUNCHING	SBM	SBM	SELECT FILL	SBM	SBM
BEDDING	SEE NOTE 5		SEE NOTE 5	SEE NOTE 5	SEE NOTE 5

NOTES:

1. INSTALLATION AND BACK FILLING SHALL MEET MANUFACTURERS RECOMMENDATION.
2. SELECT FILL CONSISTS OF EXCAVATED MATERIALS CONTAINING NO MATERIAL LARGER THAN 2" DIAMETER.
3. STANDARD BEDDING MATERIAL (SBM) SHALL CONFORM TO ODOT 703.08, TYPE A, B, C, OR D AGGREGATE BASE OR CONTROLLED LOW-STRENGTH MATERIAL (CLSM) FILL PER SECTION 701.79.
4. COMPACTION REQUIREMENTS:
   A. NON-PAVED AREAS: 90% MAXIMUM STANDARD PROCTOR DENSITY FOR COHESIONLESS SOILS AND 85% FOR COHESIVE SOILS.
   B. PAVED AREAS: 90% MAXIMUM STANDARD PROCTOR DENSITY FOR COHESIONLESS SOILS.
5. IF TRENCH IS DRY, BEDDING SHALL BE 4" SAND OR TYPE A AGGREGATE BASE, AND IF WET SHALL BE NO. 57 OR NO.67 ROCK PER SECTION 701.06.
6. NO WATER JETTING ALLOWED.
7. IN SANDY NON-PAVED AREAS, SAND CAN BE USED FOR ALL BACKFILL.
8. FOR CONCRETE PIPES IN NON-PAVED AREAS, SAND CAN BE USED FOR ALL BACKFILL IF THE CONCRETE PIPE USES RUBBER O-RING JOINTS.
9. THE BACKFILL MATERIAL SHALL EXTEND A MINIMUM OF 2' BEHIND THE BACK OF THE CURB, OR THE EDGE OF PAVEMENT WHERE NO CURB EXISTS.
10. POLYPROPYLENE PIPE CAN ONLY BE USED OUTSIDE OF HE ROADWAY LIMITS OR PERPENDICULAR TO THE TRAVEL WAY FOR CROSSING.

STORM SEWER PIPE TRENCHING AND BEDDING

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 06	DRAWING NO. SD 01

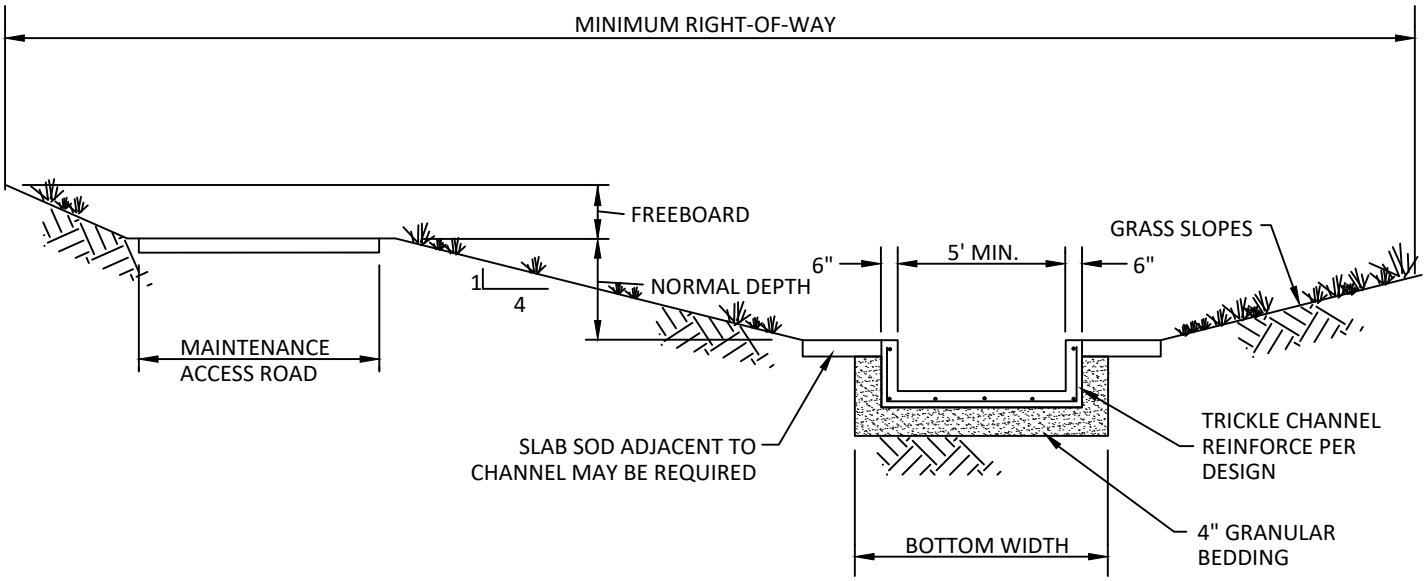


NOTES:

1. STABILIZATION MEASURES INCLUDE CHECK STRUCTURES, RIPRAP, MINOR GRADING, SHORT SECTIONS OF RETAINING WALLS.
2. GENERALLY LITTLE OR NO CAPACITY IMPROVEMENTS ARE INCLUDED - ONLY STABILIZATION AND FLOODPLAIN REGULATIONS.
3. ALL BRUSH AND TREES UNDER 4" DIAMETER MAY BE REMOVED.
4. WHERE FLOODPLAIN IS LESS THAN 150' THE R.O.W. REQUIRED SHALL BE THE FLOODPLAIN WIDTH PLUS 15' (MIN.) EACH SIDE OF FLOODPLAIN F MAINTENANCE ACCESS.

NATURAL CHANNEL

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SD 02

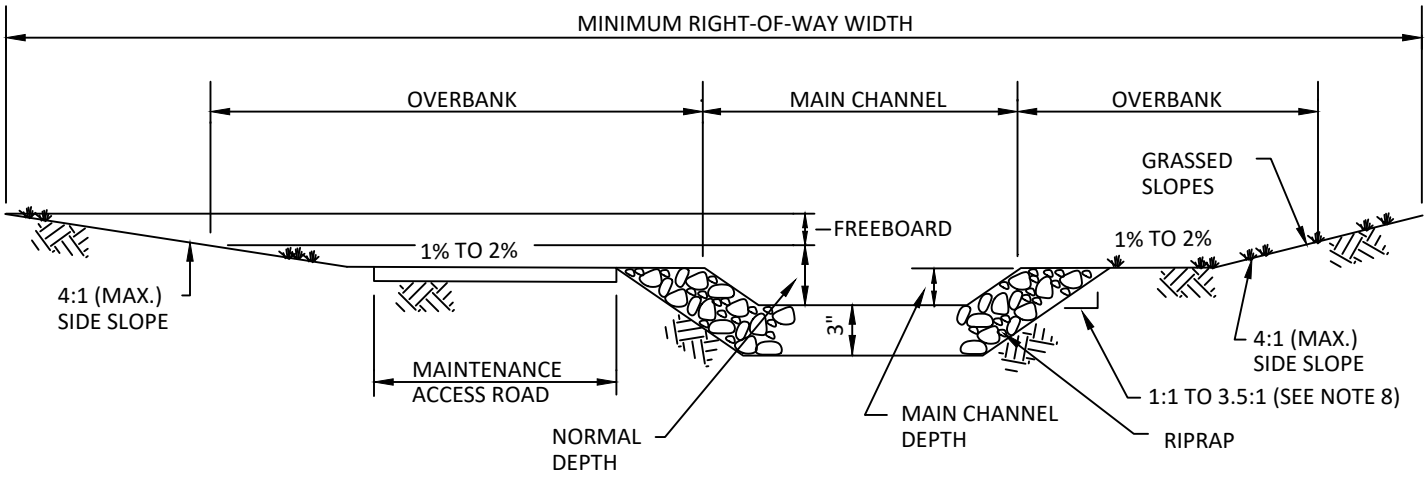


NOTES:

1. BOTTOM WIDTH: CONSISTENT WITH MAXIMUM ALLOWABLE DEPTH AND VELOCITY REQUIREMENTS. SHALL NOT BE LESS THAN TRICKLE CHANNEL WIDTH.
2. TRICKLE CHANNEL: MINIMUM CAPACITY TO BE 1% TO 3% OF 100 YEAR FLOW, BUT NOT LESS THAN 1 CFS. CHANNEL TO BE CONSTRUCTED OF CONCRETE OR OTHER APPROVED MATERIALS.
3. FREEBOARD: FREEBOARD TO BE 1' MINIMUM.
4. MAINTENANCE/ACCESS ROAD: MINIMUM WIDTH TO BE 10'.
5. R/W WIDTH: MINIMUM WIDTH TO INCLUDE FREEBOARD AND MAINTENANCE ACCESS ROAD.
6. CHANNEL SIDE SLOPE: MAXIMUM SIDE SLOPE FOR GRASS-LINED CHANNELS TO BE 4:1.
7. THE MAXIMUM FLOW VELOCITY TO BE 7 FPS FOR EROSION RESISTANT SOILS OR 5 FPS FOR SANDY SOILS.

GRASS LINED CHANNEL, TYPE A

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SD 03

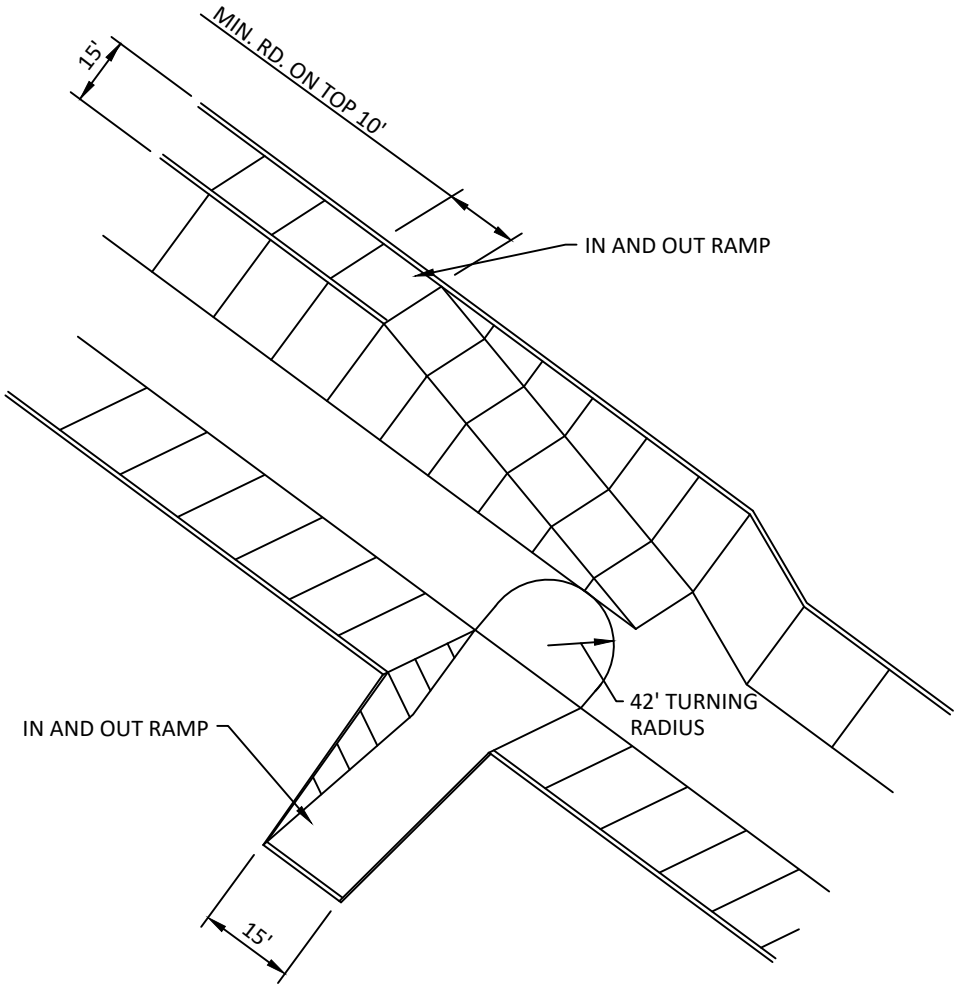


NOTES:

1. THIS SECTION IS REQUIRED FOR CHANNELS WITH SANDY SOILS.
2. MAIN CHANNEL: CAPACITY TO BE FROM 2 YEAR TO THE 5 YEAR. MAXIMUM VELOCITIES IN CHANNELS SHALL BE BASED ON ALLOWABLE SHEAR STRESS FOR CHANNEL LINING. IF RIPRAP IS USED, USE A MANNINGS N VALUE OF .03 FOR HYDRAULIC CALCULATIONS.
3. NORMAL DEPTH: FLOW DEPTH FOR 100 YEAR FLOW SHALL NOT EXCEED 5', NOT INCLUDING THE MAIN CHANNEL DEPTH.
4. FREEBOARD: FREEBOARD TO BE A MINIMUM OF 1'.
5. MAINTENANCE/ACCESS ROADS: MINIMUM WIDTH TO BE 10'. COUNTY MAY REQUIRE ALL OR PART OF THE ROAD TO BE SURFACED.
6. R/W WIDTH: MINIMUM WIDTH TO INCLUDE FREEBOARD AND MAINTENANCE/ACCESS ROAD.
7. OVERBANK: FLOW IN EXCESS OF MAIN CHANNEL TO BE CARRIED IN THIS AREA. AREA MAY BE USED FOR RECREATIONAL PURPOSES.
8. FOR TRAPEZOIDAL CHANNELS, THE MINIMUM BOTTOM WIDTH SHALL BE 4' WITH SIDE SLOPES OF NO STEEPER THAN 3.5:1 FOR SODDED SECTIONS AND A MINIMUM BOTTOM WIDTH OF 3' WITH SIDE SLOPES OF NO STEEPER THAN 1:1 FOR PAVED OR ROCK-LINED SECTIONS.

GRASSED LINED CHANNEL, TYPE B

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SD 04

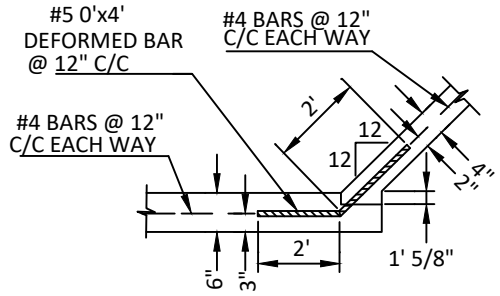


NOTES:

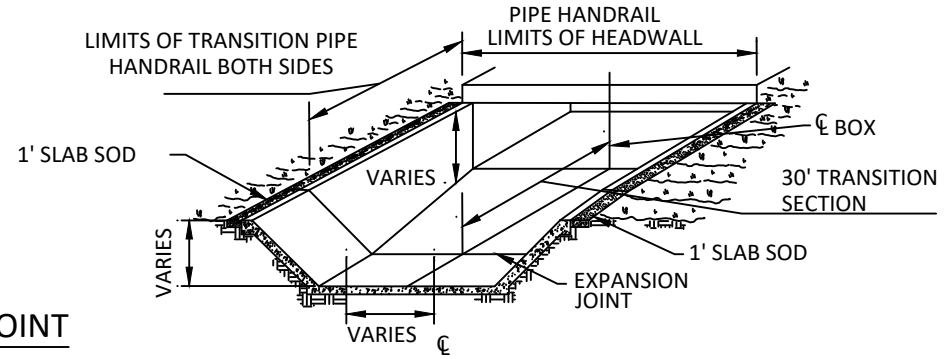
1. ALL RAMPS SHALL HAVE A MAXIMUM SLOPE OF 4:1 WITH 1" CORRUGATIONS IN ROADWAY.
2. MAXIMUM SPACING ON RAMPS SHALL BE 600' WITH A MINIMUM OF 2 RAMPS BETWEEN RESTRICTIVE STRUCTURES.
3. ALL RAMPS ARE TO BE FENCED AND LOCKED. GATE LOCKS TO BE FURNISHED BY THE CITY.
4. MINIMUM TURNING RADIUS AT THE OUTSIDE WHEEL SHALL BE 42' FOR ENTRANCE AND EXIT.

RAMP FOR CONCRETE LINED CHANNEL

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SD 05

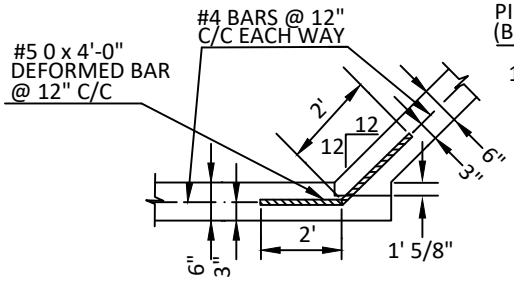


LONGITUDINAL CONSTRUCTION JOINT



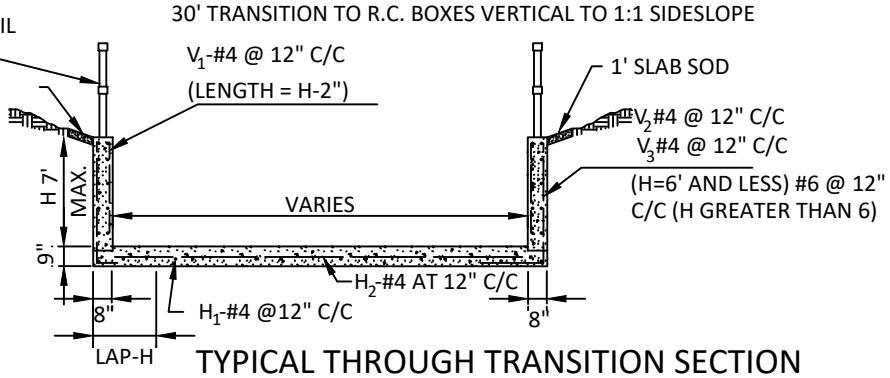
ELEVATION OF CONCRETE CHANNEL LINER

FOR 6" BOTTOM &4" SIDE WALLS 4" WALLS FOR DEPTHS OF 0'-5'



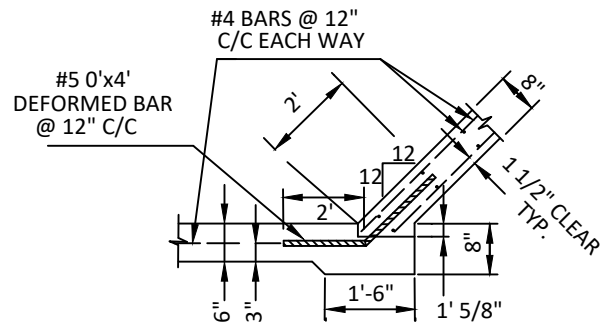
LONGITUDINAL CONSTRUCTION JOINT

30' TRANSITION TO R.C. BOXES VERTICAL TO 1:1 SIDESLOPE



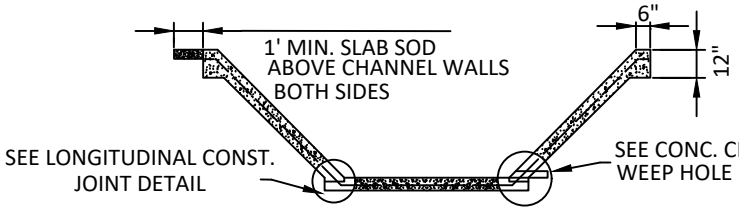
TYPICAL THROUGH TRANSITION SECTION

FOR 6" BOTTOM & 6" SIDE WALLS 6" WALLS FOR DEPTHS OF 0'-5'



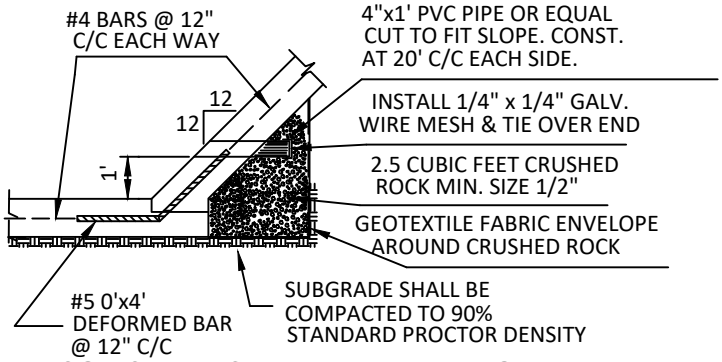
LONGITUDINAL CONSTRUCTION JOINT

ODOT TYPE II-C RETAINING WALL SECTION (MODIFIED)

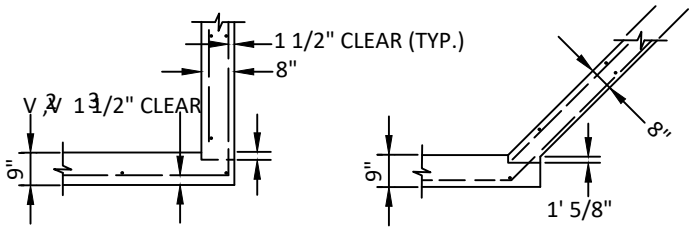


TYPICAL CONCRETE CHANNEL LINER

FOR 6" BOTTOM & 6" SIDE WALLS 8" WALLS 2/3 THE WALL FOR CHANNELS ABOVE 5'

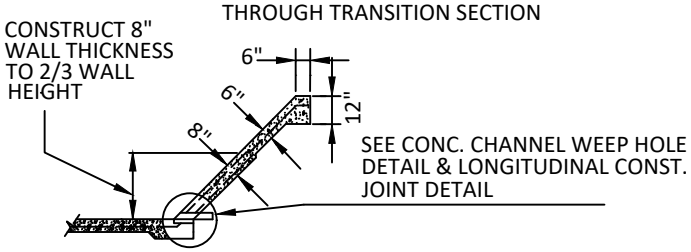


CONCRETE CHANNEL WEEP HOLE DETAIL



LONGITUDINAL CONSTRUCTION JOINT

THROUGH TRANSITION SECTION

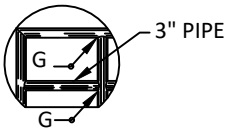


TYPICAL CONCRETE CHANNEL LINER

FOR WALL HEIGHT ABOVE 5'

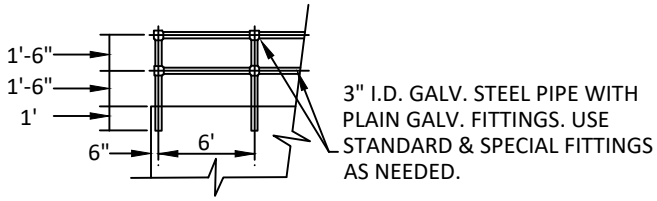
CONCRETE CHANNEL LINER & DETAILS

CITY ENGINEER APPROVAL:			CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023		REV. NO. 01	DRAWING NO. SD 06

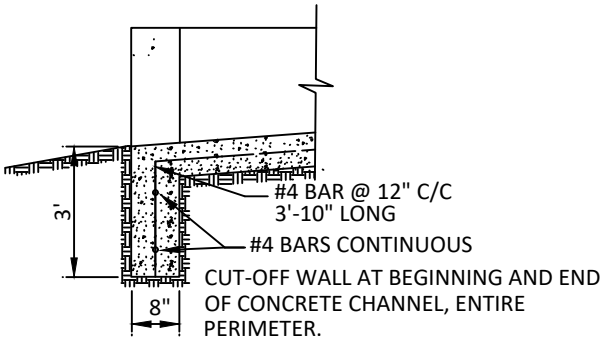


ALTERNATE DETAIL

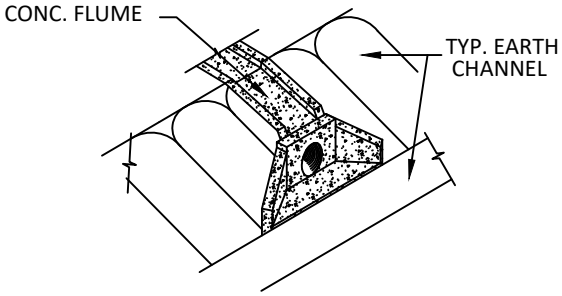
(USING WELDED CONNECTIONS PIPE HANDRAIL)



PIPE HANDRAIL DETAIL

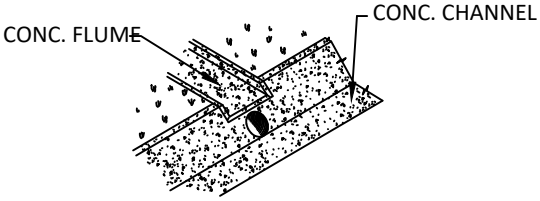


CUT-OFF WALL DETAIL



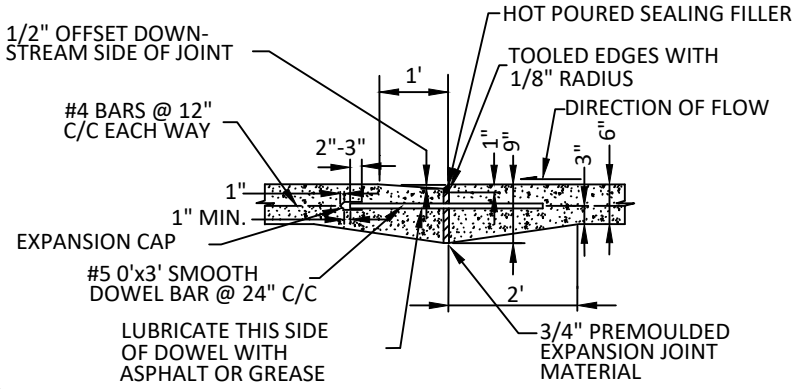
VIEW OF FLUME

AT EARTH CHANNEL



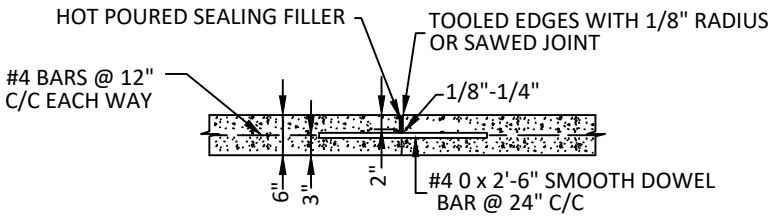
VIEW OF FLUME

AT CONCRETE CHANNEL



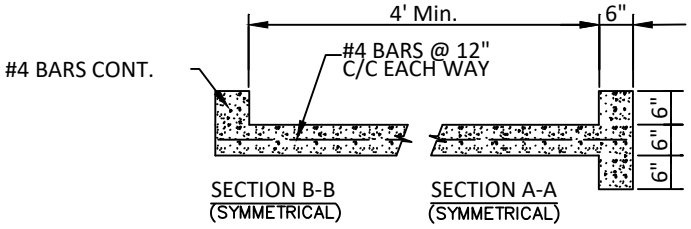
TYPICAL TRANSVERSE EXPANSION JOINT

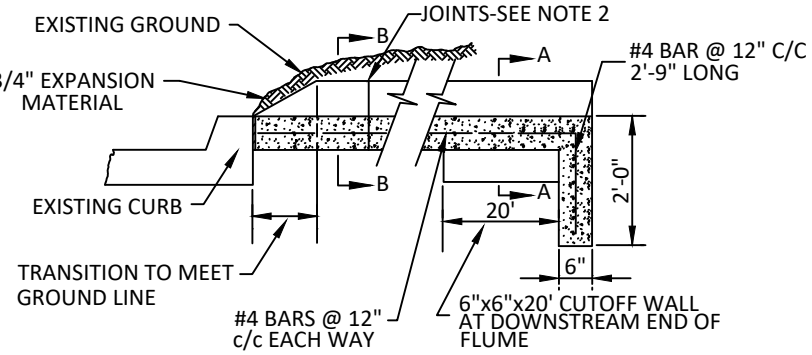
SPACED AT 100 FOOT C/C MAX.



TRANSVERSE DUMMY GROOVE CONTRACTION JOINT

SPACED AT 20 FOOT C/C





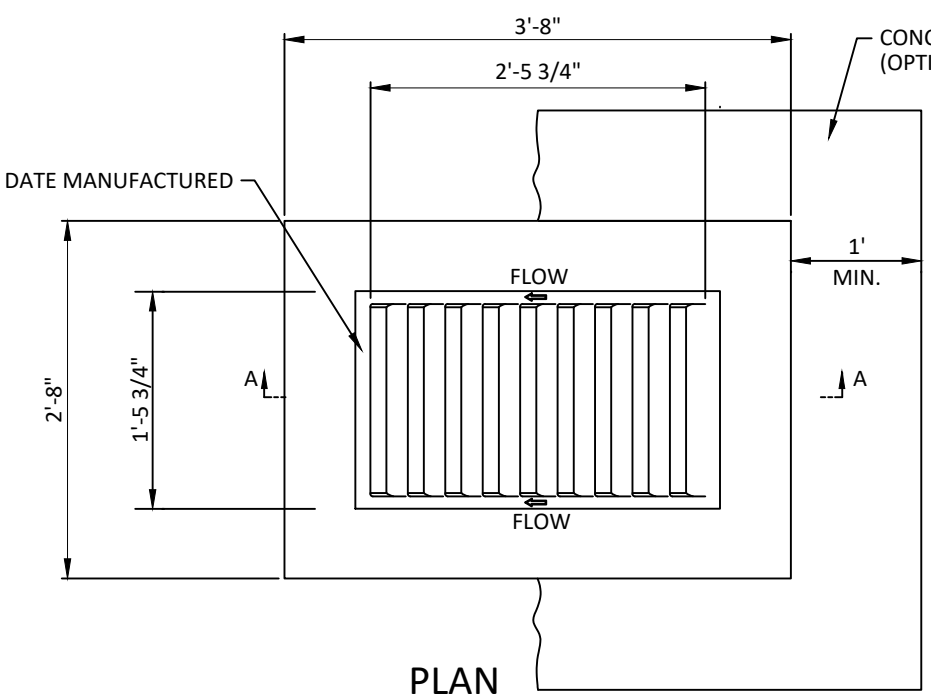
PROFILE

NOTES:

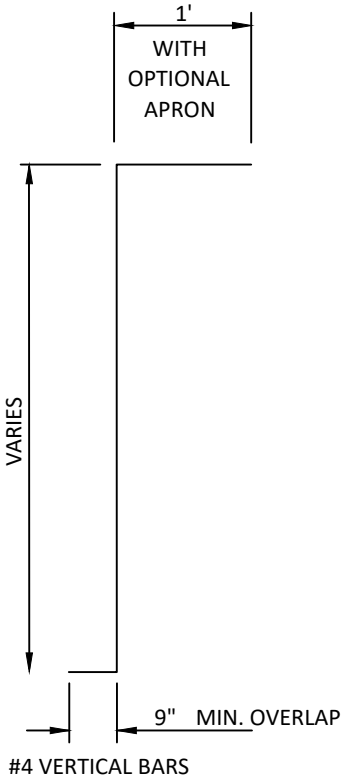
1. HANDRAIL WELDED CONNECTIONS MAY BE USED FOR PIPE HANDRAIL. WELDED CONNECTIONS SHALL BE THOROUGHLY CLEANED OF ALL LOOSE SCALE, GROUND SMOOTH & SPOT PAINTED WITH TWO COATS OF ALUMINUM PAINT.
2. 3/4" EXPANSION JOINT @ 100' MAX. SAWED CONT. JOINT @ 20' MAX.

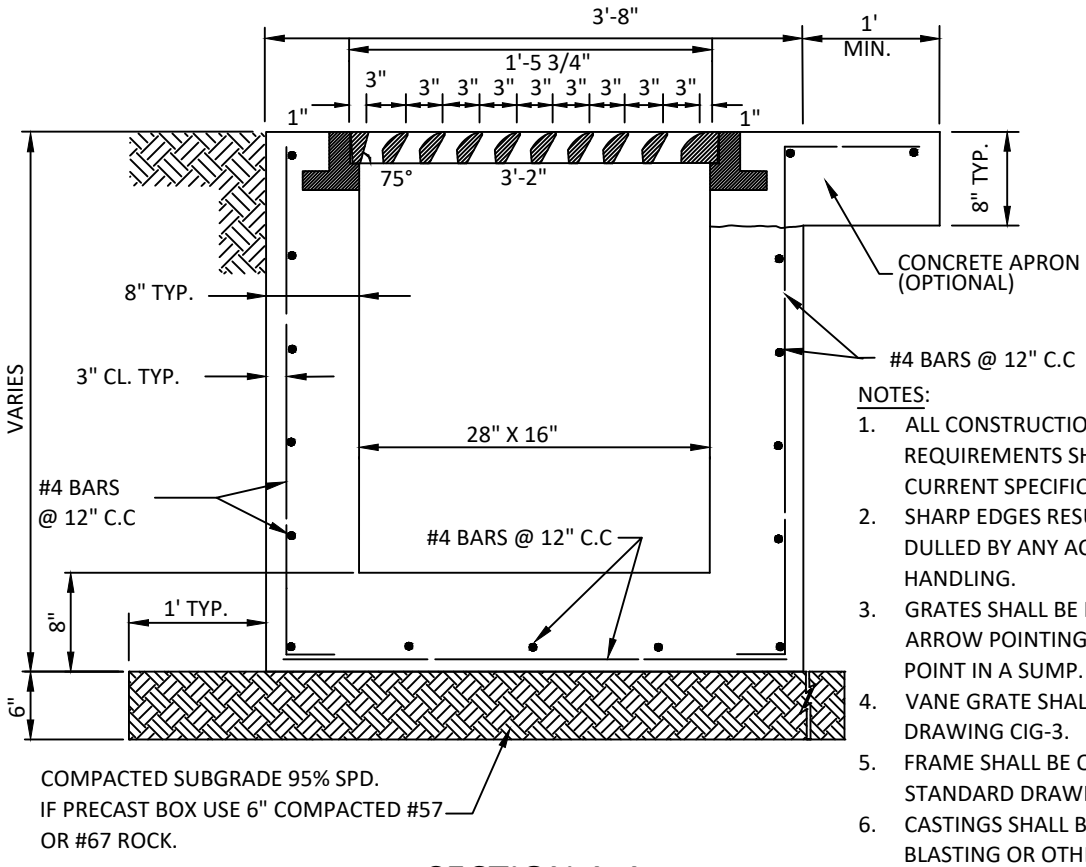
FLUME & CHANNEL LINER DETAILS

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SD 07



PLAN





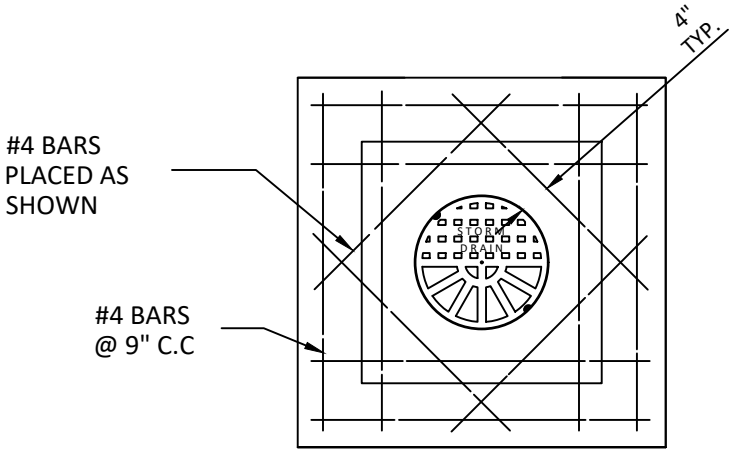
SECTION A-A

NOTES:

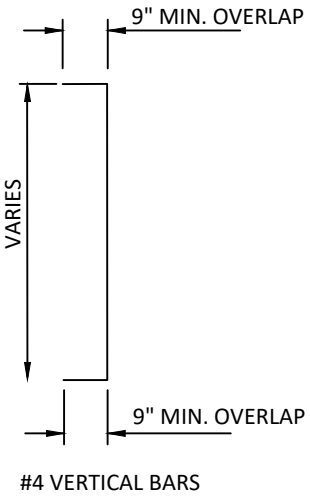
1. ALL CONSTRUCTION METHODS & MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE CURRENT SPECIFICATIONS.
2. SHARP EDGES RESULTING FROM FABRICATION SHALL BE DULLED BY ANY ACCEPTABLE METHOD FOR SAFETY IN HANDLING.
3. GRATES SHALL BE INSTALLED IN FRAME WITH FLOW ARROW POINTING DOWNSTREAM OR TOWARD THE LOW POINT IN A SUMP.
4. VANE GRATE SHALL BE ODOT TYPE VG-F, STANDARD DRAWING CIG-3.
5. FRAME SHALL BE ODOT TYPE A FOR INLET DESIGN 1, STANDARD DRAWING SSIF-4.
6. CASTINGS SHALL BE SMOOTH AND WELL CLEANED BY SHOT BLASTING OR OTHER APPROVED CLEANING.
7. ALL CASTINGS SHALL BE MANUFACTURED TRUE TO PATTERN; COMPONENT PARTS SHALL FIT TOGETHER IN A SATISFACTORY MANNER.
8. ALL LETTERING SHALL BE RECESSED 1/16".

AREA INLET

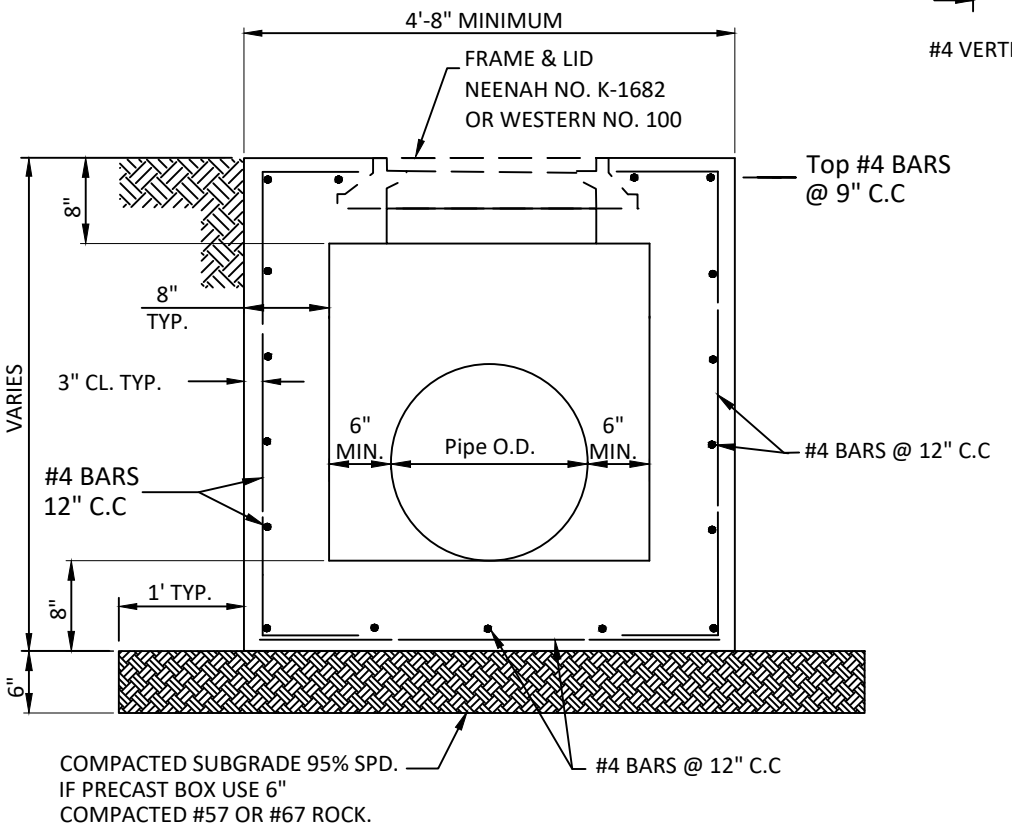
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 02	DRAWING NO. SD 08



TYPICAL SECTION AT TOP OF BOX



#4 VERTICAL BARS

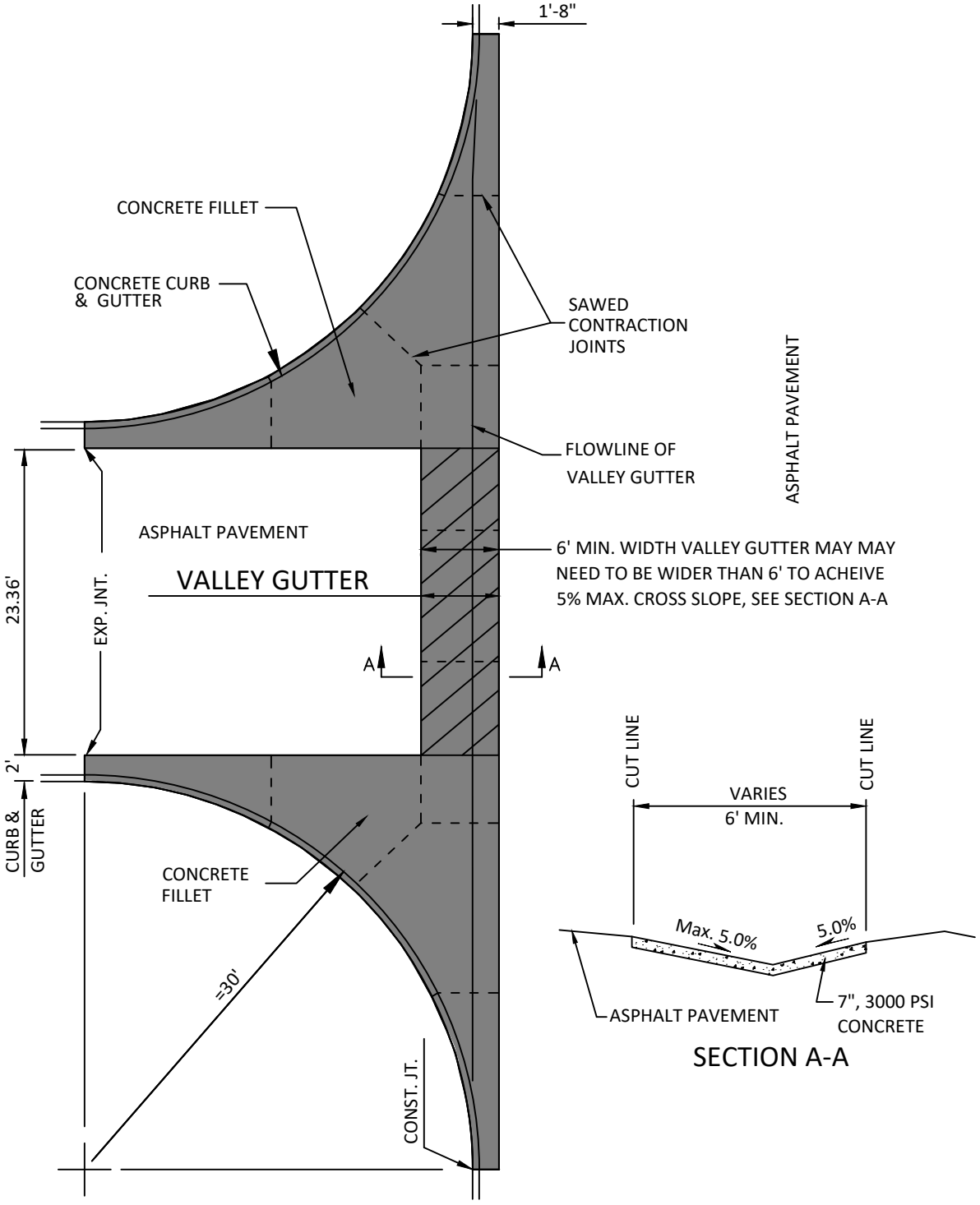


TYPICAL SECTION THRU JUNCTION BOX

NOTES:
1. ALL CONSTRUCTION METHODS & MATERIAL REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE CURRENT SPECIFICATIONS.
2. ALL LETTERING SHALL BE RECESSED 1/16".

JUNCTION BOX DETAIL

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SD 09

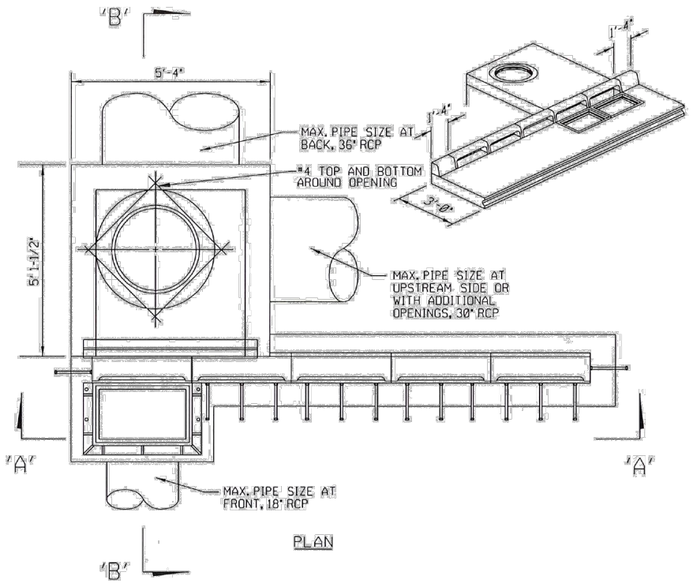


NOTES:

1. REINFORCING STEEL: THE VALLEY GUTTER AND FILLET SHALL HAVE #4 REBAR EACH WAY @ 18" CENTERS.
2. FOR 7" THICK CONCRETE, THE MAXIMUM SPACING FOR SAWED CONTRACTION JOINTS SHALL BE 14 FEET. ALL JOINTS SHALL BE SEALED PER SPECIFICATION. POLYURETHANE SEALANT MAY BE USED.
3. WHEN A CONCRETE VALLEY GUTTER IS REQUIRED, THE CONCRETE FILLET ADJACENT TO THE CURB RETURN SHALL ALSO BE CONSTRUCTED.

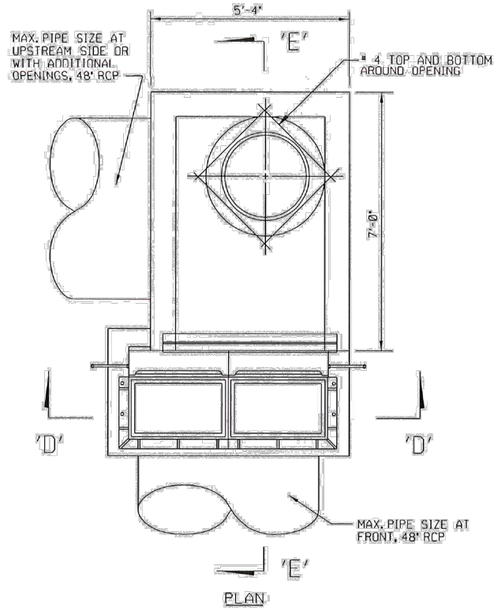
CONCRETE VALLEY GUTTER DETAIL

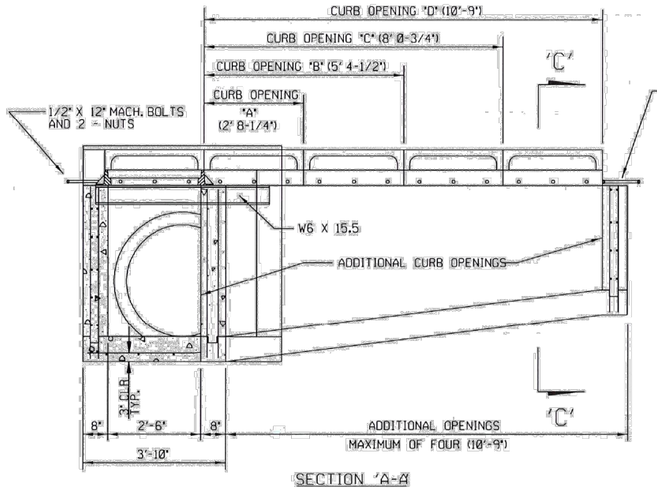
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SD 10

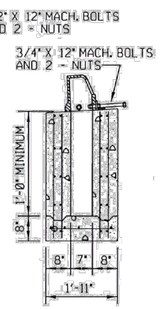


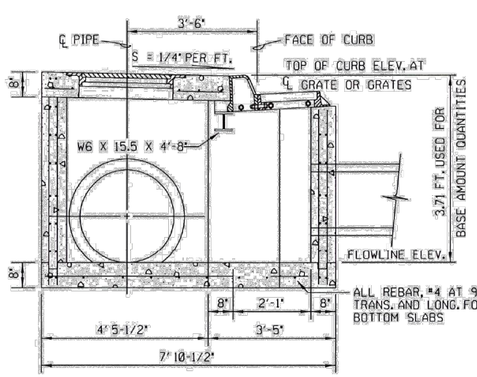
QUANTITIES FOR INLETS

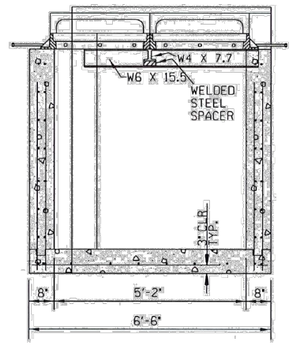
INLET	CURB OPENING	CLASS 'A' CONCRETE	INLET		INLET FRAME AND GRATE	CAST IRON CURB INLET	MH FRAME AND COVER
DESIGN	DESIGNATION	CU. YD.	BASE AM'T.	ADD'L C.F. PER VERT. FT.	EACH	EACH	EACH
1 WITH SMALL JUNCT. BOX		1.50	43.56	15.84	1	1	1
	'A'	1.60	47.34	17.43	1	2	1
	'B'	1.73	55.44	21.03	1	3	1
	'C'	1.86	62.26	24.63	1	4	1
	'D'	1.99	68.03	28.23	1	5	1
2 WITH SMALL JUNCT. BOX		1.70	47.84	17.40	2	2	1
	'A'	1.83	57.01	21.00	2	3	1
	'B'	1.96	64.86	24.60	2	4	1
	'C'	2.08	71.70	28.20	2	5	1
	'D'	2.21	77.28	31.80	2	6	1
1 WITH LARGE JUNCT. BOX		2.11	50.44	18.34	1	1	1
	'A'	2.21	54.22	19.93	1	2	1
	'B'	2.34	62.32	23.53	1	3	1
	'C'	2.47	69.14	27.13	1	4	1
	'D'	2.60	74.91	30.73	1	5	1
2 WITH LARGE JUNCT. BOX		2.31	54.72	19.90	2	2	1
	'A'	2.43	63.89	23.50	2	3	1
	'B'	2.57	71.74	27.10	2	4	1
	'C'	2.69	78.58	30.70	2	5	1
	'D'	2.82	84.16	34.30	2	6	1

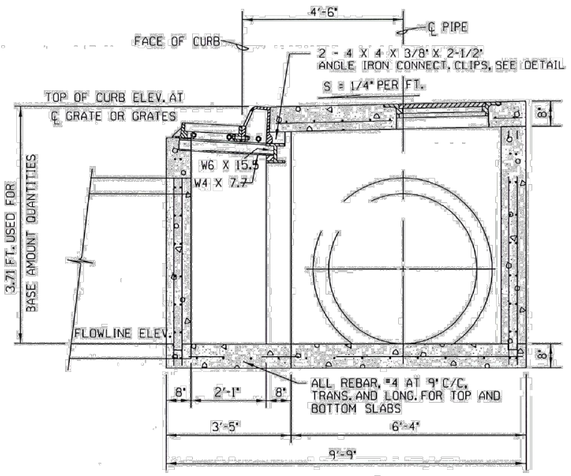






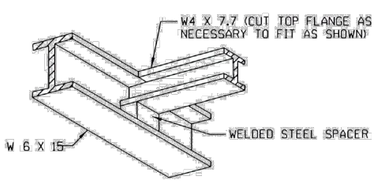




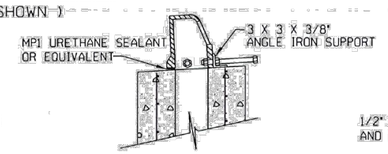


SINGLE GRATE CURB INLET WITH JUNCTION BOX

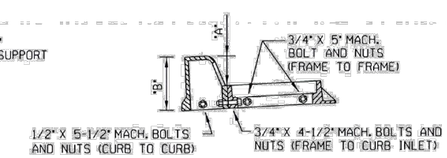
(DESIGN 1-D WITH SMALL JUNCTION BOX SHOWN)

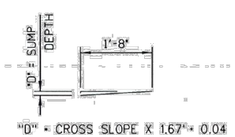


I-BEAM CONNECTION DETAIL FOR DOUBLE GRATE



ADDITIONAL CURB OPENING DETAILS





FRAME AND CURB DETAILS

DOUBLE GRATE CURB INLET WITH JUNCTION BOX

(DESIGN 2 WITH LARGE JUNCTION BOX SHOWN)

18" THRU 30" LONGITUDINAL PIPE REQUIRES SMALL JUNCTION BOX

ALL REBAR IN WALLS #4 @ 12" CTRS EA WAY (TYPICAL)

ANGLE IRON LENGTHS	
OPENING	LENGTH
"A"	2'-5-3/8"
"B"	5' 1-5/8"
"C"	7'-9-7/8"
"D"	10' 6-1/8"

C.I. CURB HEIGHTS		
TYPE	"A"	"B"
4" MOUNTABLE	4-1/2"	9-1/2"
6" MOUNTABLE	6-1/2"	11-1/2"
6" BARRIER	6-1/2"	11-1/2"
8" BARRIER	8-1/2"	13-1/2"

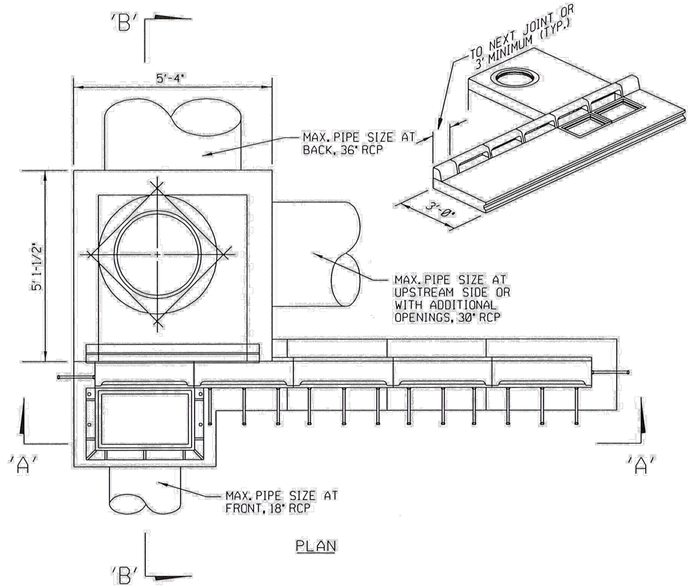
ENGINEERING DIVISION, CITY OF NORMAN

STANDARD INLETS AND GRATES W/ ACCESS MANHOLE BACK OF CURB

APPROVED BY: _____ CITY ENGINEER

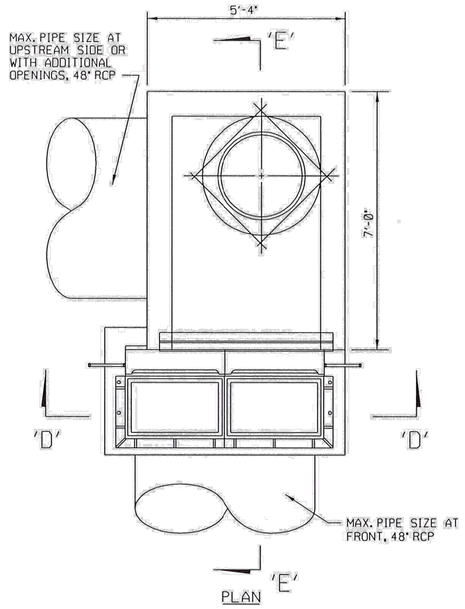
DATE: 01/2023

DRAWING NO: SD 11

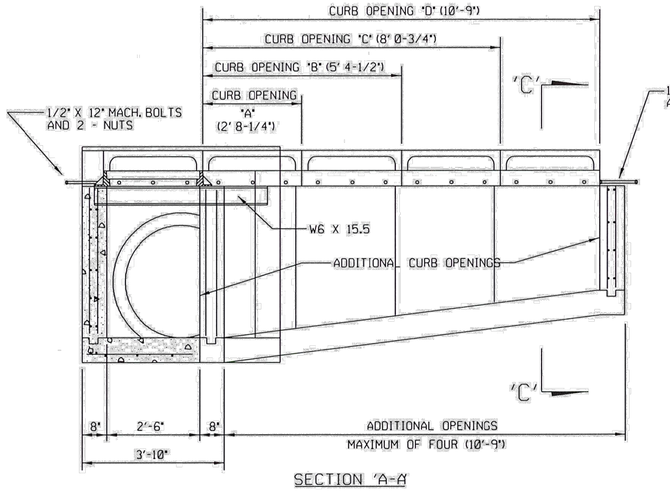


PLAN

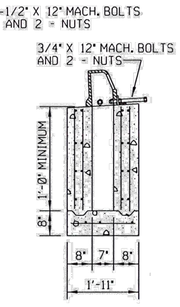
QUANTITIES FOR INLETS							
INLET	CURB OPENING	CLASS "A" CONCRETE	INLET		INLET FRAME AND GRATE	CAST IRON CURB INLET	MH FRAME AND COVER
DESIGN	DESIGNATION	CU. YD.	BASE AMT.	ADD'L. C.F. PER VERT. FT.	EACH	EACH	EACH
1 WITH SMALL JUNCT. BOX		1.50	43.56	15.84	1	1	1
	"A"	1.60	47.34	17.43	1	2	1
	"B"	1.73	55.44	21.03	1	3	1
	"C"	1.86	62.26	24.63	1	4	1
	"D"	1.99	68.03	28.23	1	5	1
2 WITH SMALL JUNCT. BOX		1.70	47.84	17.40	2	2	1
	"A"	1.83	57.01	21.00	2	3	1
	"B"	1.96	64.86	24.60	2	4	1
	"C"	2.08	71.70	28.20	2	5	1
	"D"	2.21	77.28	31.80	2	6	1
1 WITH LARGE JUNCT. BOX		2.11	50.44	18.34	1	1	1
	"A"	2.21	54.22	19.93	1	2	1
	"B"	2.34	62.32	23.53	1	3	1
	"C"	2.47	69.14	27.13	1	4	1
	"D"	2.60	74.91	30.73	1	5	1
2 WITH LARGE JUNCT. BOX		2.31	54.72	19.90	2	2	1
	"A"	2.43	63.89	23.50	2	3	1
	"B"	2.57	71.74	27.10	2	4	1
	"C"	2.69	78.58	30.70	2	5	1
	"D"	2.82	84.16	34.30	2	6	1



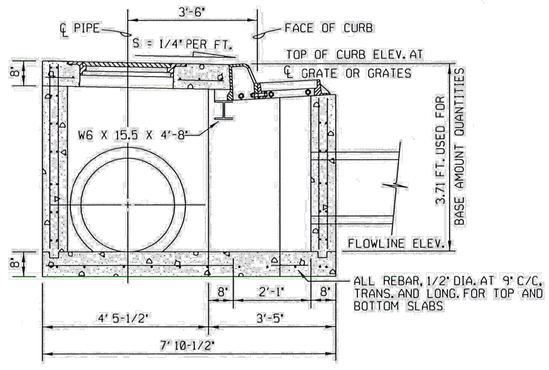
PLAN



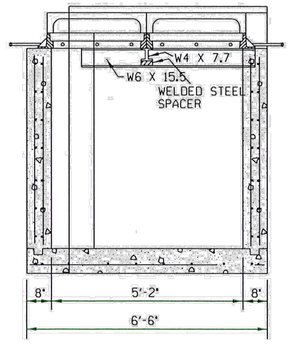
SECTION 'A-A'



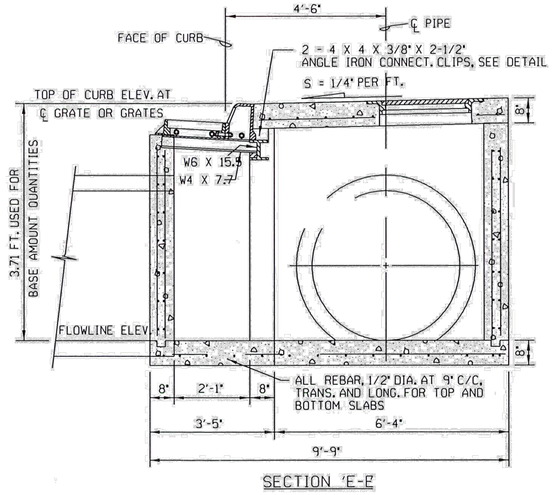
SECTION 'C-C'



SECTION 'B-B'



SECTION 'D-D'

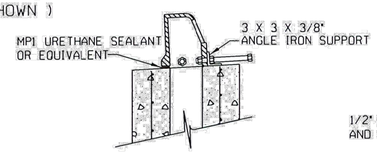


SECTION 'E-E'

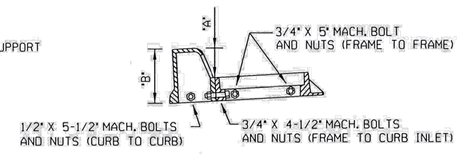
SINGLE GRATE CURB INLET WITH JUNCTION BOX

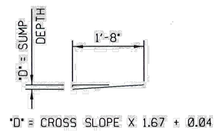
(DESIGN 1-D WITH SMALL JUNCTION BOX SHOWN)

ALL REBAR IN WALLS #4 @ 12" CTRS. EA. WAY (TYPICAL)

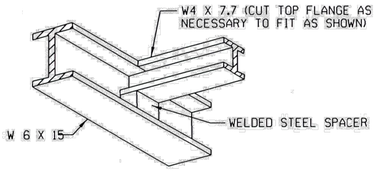


ADDITIONAL CURB OPENING DETAILS





FRAME AND CURB DETAILS



I-BEAM CONNECTION DETAIL FOR DOUBLE GRATE

ANGLE IRON LENGTHS	
OPENING	LENGTH
"A"	2' 5-3/8"
"B"	5' 1-5/8"
"C"	7' 9-7/8"
"D"	10' 6-1/8"

C.I. CURB HEIGHTS		
TYPE	"A"	"B"
4" MOUNTABLE	4-1/2"	9-1/2"
6" MOUNTABLE	6-1/2"	11-1/2"
6" BARRIER	6-1/2"	11-1/2"
8" BARRIER	8-1/2"	13-1/2"

DOUBLE GRATE CURB INLET WITH JUNCTION BOX

(DESIGN 2 WITH LARGE JUNCTION BOX SHOWN)

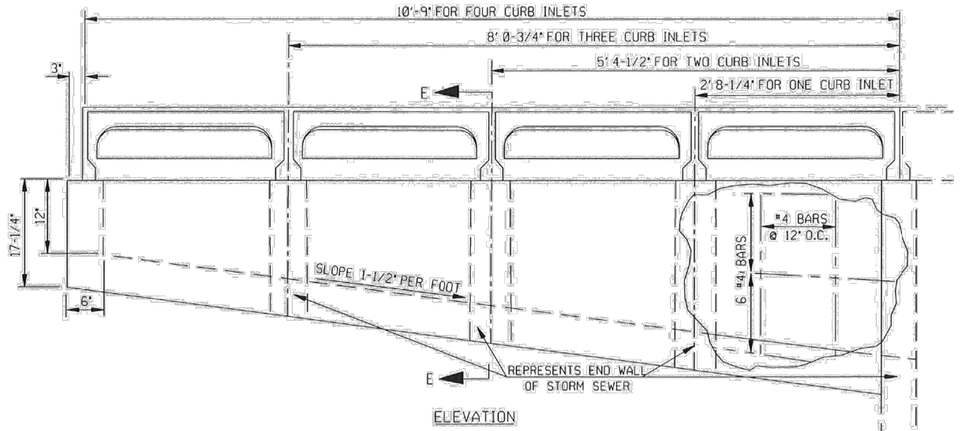
18" THRU 30" LONGITUDINAL PIPE REQUIRES SMALL JUNCTION BOX

ALL REBAR IN WALLS #4 @ 12" CTRS. EA. WAY (TYPICAL)

ENGINEERING DIVISION, CITY OF NORMAN

PRECAST STANDARD INLETS AND GRATES W/ ACCESS MANHOLE BACK OF CURB

APPROVED BY: _____ CITY ENGINEER | DATE: 01/2023 | DRAWING NO: SD 12

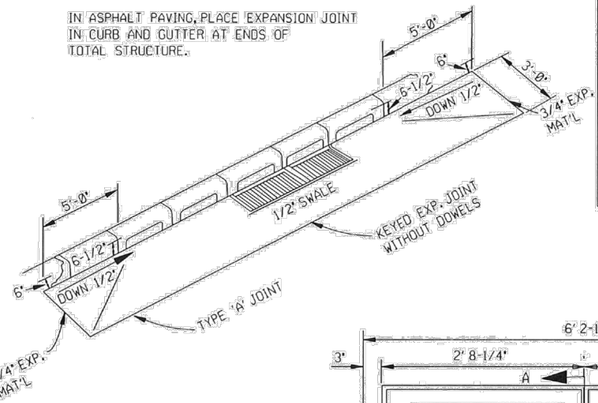


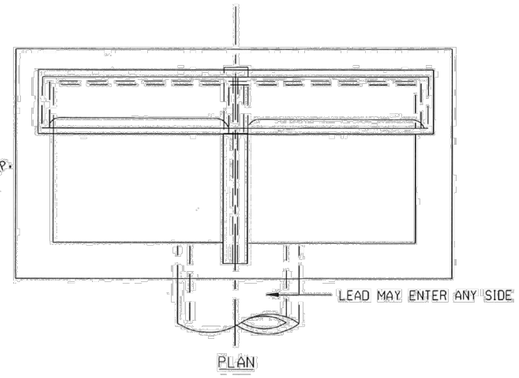
ELEVATION

• DOUBLE GRATE IN SUMP AREAS ONLY.

THIS SECTION TO BE USED IN CONCRETE PAVING.

IN ASPHALT PAVING, PLACE EXPANSION JOINT IN CURB AND GUTTER AT ENDS OF TOTAL STRUCTURE.



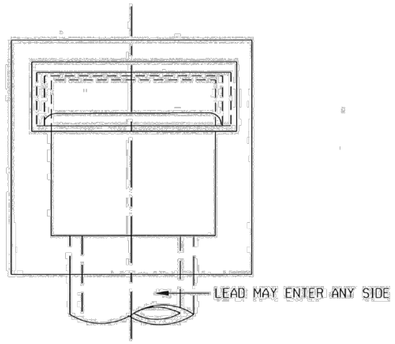


PLAN

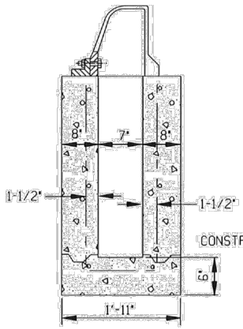
ALL PRE-CAST INLET JOINTS SHALL HAVE BUTYL ROPE INSTALLED AND GROUTING SHALL BE PLACED INSIDE THE INLET AT EACH JOINT.

CURB INLETS SHALL BE PLACED ON UPSTREAM SIDE OF GRATE INLETS UNLESS OTHERWISE SPECIFIED.

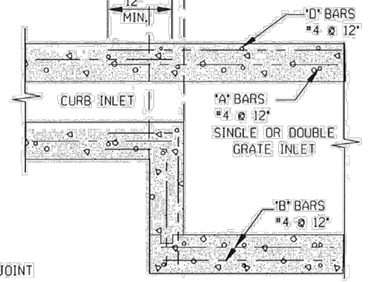
CONCRETE TROUGH FOR CURB INLETS AND CONCRETE STORM SEWER INLETS SHALL BE CONSTRUCTED AS TWO PARTS WITH OMNI-FLEX.



PLAN

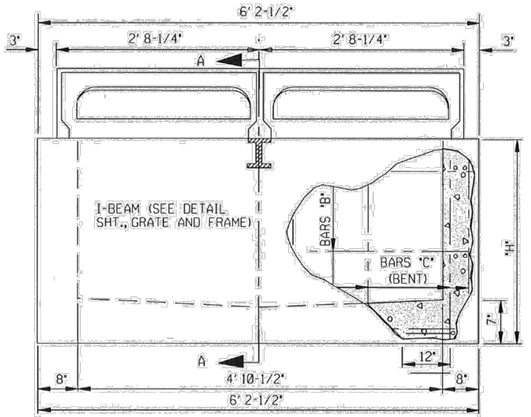


SECTION E-E

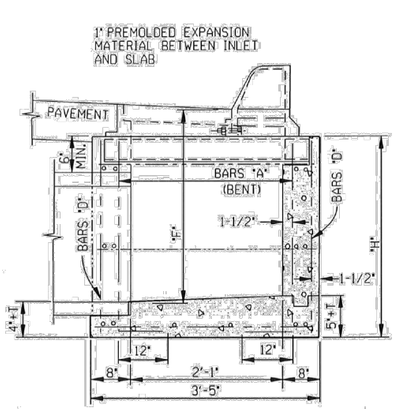


PLAN VIEW OF THROAT CONNECTION

ADDITIONAL CURB INLETS



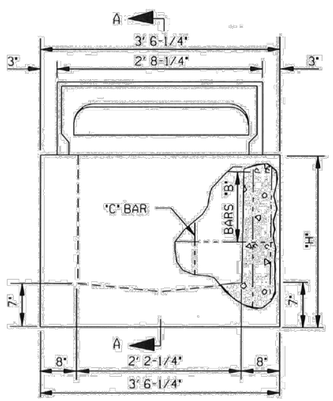
ELEVATION



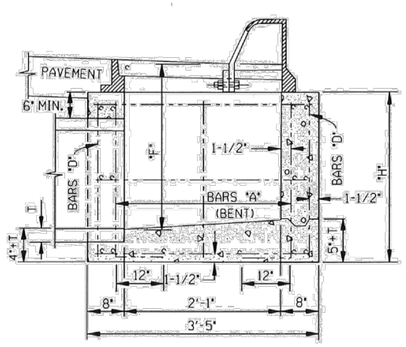
SECTION A-A

DOUBLE GRATE AND CURB INLET

DESIGN - 2



ELEVATION



SECTION A-A

SINGLE GRATE AND CURB INLET

DESIGN - 1

BAR LIST FOR SINGLE GRATE AND CURB INLET			
SIZE OF LEAD	H MINIMUM	F MINIMUM	
15"	2'-6"	2.42 FT.	
18"	2'-9"	2.67 FT.	
24"	3'-7"	3.50 FT.	
BARS "A" SIZE	BARS "B" SIZE	BARS "C" SIZE	BARS "D" SIZE
#4 X H+8"	#4 X 3'-2"	#4 X H+8"	#4 X H-4"

BAR LIST FOR DOUBLE GRATE AND CURB INLET			
SIZE OF LEAD	H MINIMUM	F MINIMUM	
18"	2'-9"	2.67 FT.	
24"	3'-7"	3.50 FT.	
30"	4'-1"	4'-0"	
BARS "A" SIZE	BARS "B" SIZE	BARS "C" SIZE	BARS "D" SIZE
#4 X H+8"	#4 X 5'-0"	#4 X H+8"	#4 X H-4"

• FOR INDUSTRIAL AND ARTERIAL STREETS

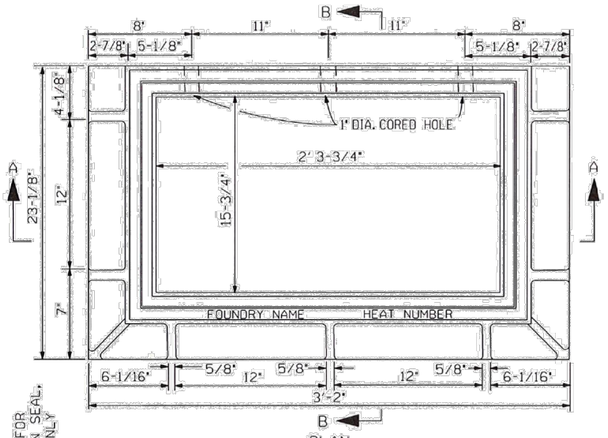
ENGINEERING DIVISION, CITY OF NORMAN

STANDARD REINFORCED CONCRETE STORMWATER INLETS

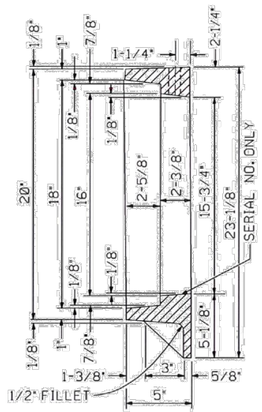
APPROVED BY: _____ CITY ENGINEER

DATE: 01/2023

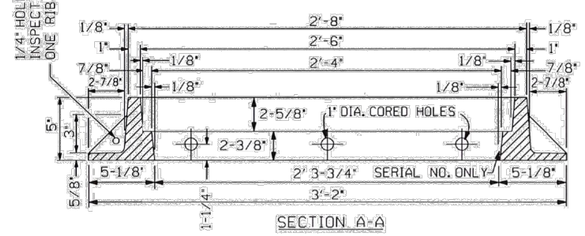
DRAWING NO: SD 13



PLAN



SECTION B-B

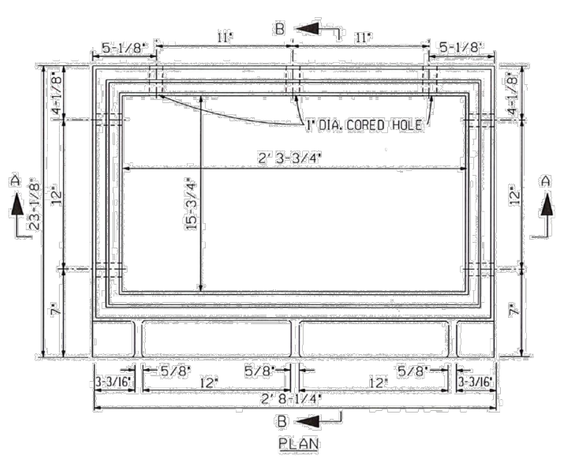


SECTION A-A

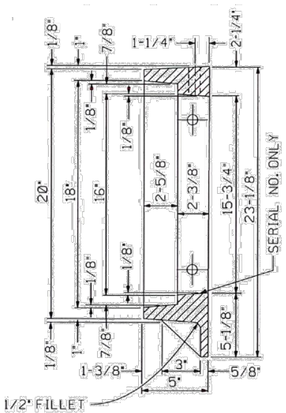
NOTE:
ONLY ONE TYPE A FRAME IS REQUIRED FOR INLET DESIGN NO. 1
WEIGHT = 252 LBS.

STORM SEWER INLET FRAME TYPE "A" FOR INLET DESIGN NO. 1

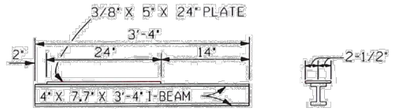
FOR USE WITH TYPE "A" GRATE



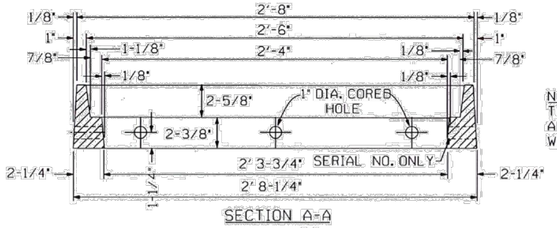
PLAN



SECTION B-B



I-BEAM SUPPORT
TO BE USED WHEN STRUCTURE IS BUILT ON CURVED CURB

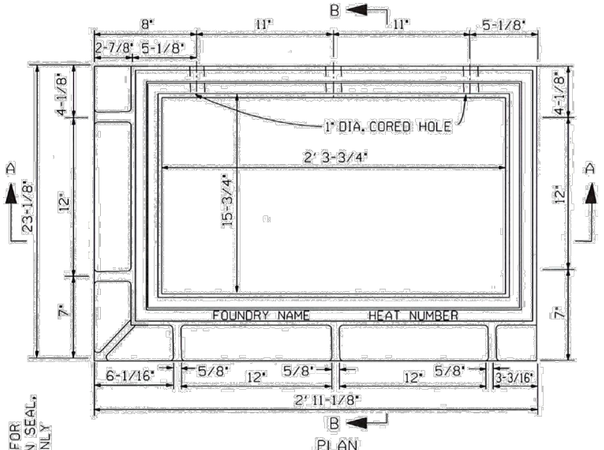


SECTION A-A

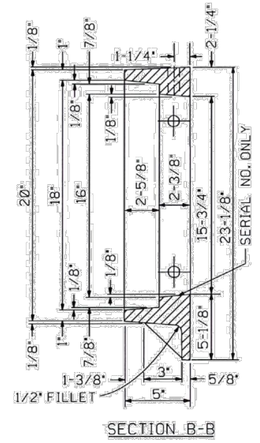
NOTE:
TWO TYPE "B" FRAMES AND ONE TYPE "C" FRAME ARE REQUIRED FOR INLET DESIGN 3
WEIGHT = 217 LBS.

STORM SEWER INLET FRAME TYPE "C" FOR INLET DESIGN NO. 3

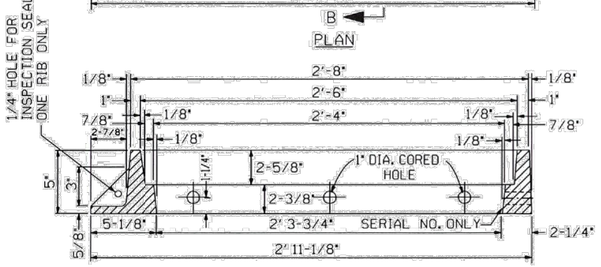
FOR USE WITH TYPE "A" GRATE



PLAN



SECTION B-B



SECTION A-A

NOTE:
MAKE ONE FRAME AS SHOWN AND ONE REVERSED FOR DOUBLE FRAMES.
WEIGHT = 234 LBS.

STORM SEWER INLET FRAME TYPE "B" FOR INLET DESIGN NO. 2 AND 3

FOR USE WITH TYPE "A" GRATE

TOLERANCES	INCHES	
	PLUS	MINUS P
DIAMETER OF ROUND LIDS AND FRAME RECESS FOR ROUND LIDS	1/16"	1/16"
LENGTH AND WIDTH OF SQUARE OR RECTANGULAR LIDS	1/16"	1/8"
LENGTH AND WIDTH OF FRAME RECESS FOR SQUARE OR RECTANGULAR LIDS	1/8"	1/16"
METAL THICKNESS	1/16"	1/16"
ALL OTHER DIMENSIONS	1/8"	1/8"

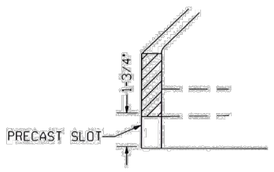
ENGINEERING DIVISION, CITY OF NORMAN

STANDARD STORMWATER FRAMES

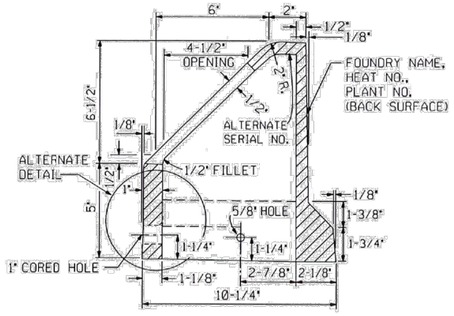
APPROVED BY: _____
CITY ENGINEER

DATE: 01/2023

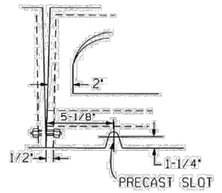
DRAWING NO: SD 14



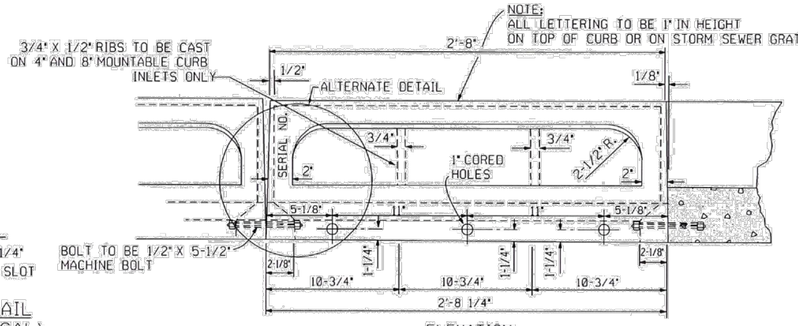
ALTERNATE DETAIL
ALL CURBS (TYPICAL)



6" MOUNTABLE CURB
183 LBS.



ALTERNATE DETAIL
ALL CURBS (TYPICAL)



ELEVATION

CAST IRON STORM SEWER CURB INLET

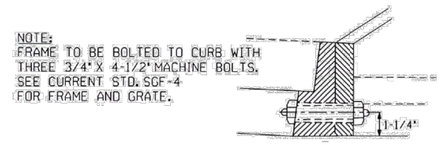
DUMP NO WASTE ◻ DRAINS TO RIVER

FOR 6" MOUNTABLE CURB

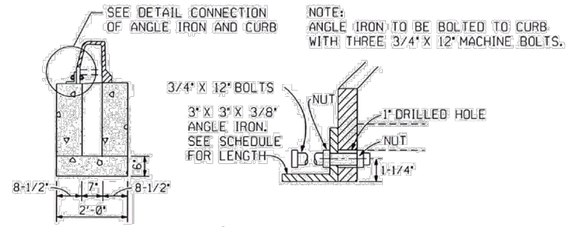
DUMP NO WASTE
DRAINS TO RIVER

FOR 6" AND 8" BARRIER CURB

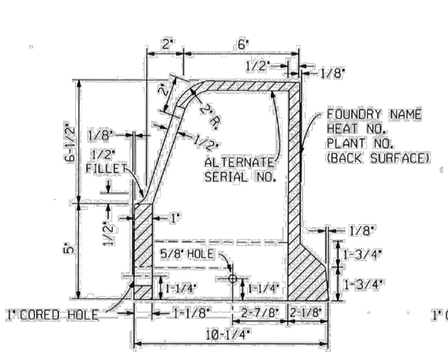
LAYOUT FOR CURB NOTE



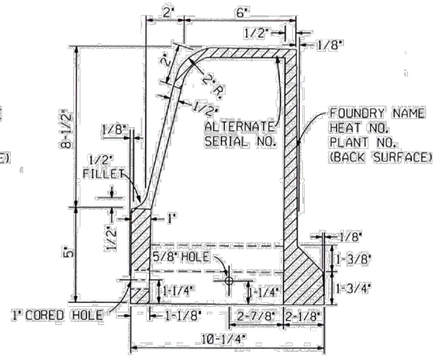
DETAIL OF CONNECTION
FRAME AND CAST IRON CURB



DETAIL OF CONNECTION
ANGLE IRON AND CAST IRON CURB



6" BARRIER CURB
200 LBS.



8" BARRIER CURB
222 LBS.

TOLERANCES	INCHES	
	PLUS	MINUS
DIAMETER OF ROUND LIDS AND FRAME RECESS FOR ROUND LIDS	1/16	1/16
LENGTH AND WIDTH OF SQUARE OR RECTANGULAR LIDS	1/16	1/8
LENGTH AND WIDTH OF FRAME RECESS FOR SQUARE OR RECTANGULAR LIDS	1/8	1/16
METAL THICKNESS	1/16	1/16
ALL OTHER DIMENSIONS	1/8	1/8

SCHEDULE

INLET DESIGN	CURB OPENING DESIGNATION	INLET FRAME AND GRATE EACH	CAST IRON CURB INLET EACH	ANGLE IRON NO.	ANGLE IRON LENGTH	
1		1	1	1		
	A	1	2	1	2' 5-3/8"	
	B	1	3	1	5' 1-5/8"	
	C	1	4	1	7' 9-7/8"	
	2A	1	3	2	2' 5-3/8"	2' 5-3/8"
	A-B	1	4	2	2' 5-3/8"	5' 1-5/8"
	A-C	1	5	2	2' 5-3/8"	7' 9-7/8"
	2B	1	5	2	5' 1-5/8"	5' 1-5/8"
	B-C	1	6	2	5' 1-5/8"	7' 9-7/8"
	2-C	1		2	7' 9-7/8"	7' 9-7/8"
2		2	2			
	B	2	4	1	5' 1-5/8"	
	D	2	6	1	10' 6-1/8"	
	2B	2	6	2	5' 1-5/8"	5' 1-5/8"
	B-D	2	8	2	5' 1-5/8"	10' 6-1/8"
	2D	2	10	2	10' 6-1/8"	10' 6-1/8"
3		3	3			
	B	3	5	1	5' 1-5/8"	
	D	3	7	1	10' 6-1/8"	
	2B	3	7	2	5' 1-5/8"	5' 1-5/8"
	B-D	3	9	2	5' 1-5/8"	10' 6-1/8"
	2D	3	11	2	10' 6-1/8"	10' 6-1/8"

NOTE: CONFIGURATIONS ARE NOT LIMITED TO THOSE SHOWN ABOVE.

ENGINEERING DIVISION, CITY OF NORMAN

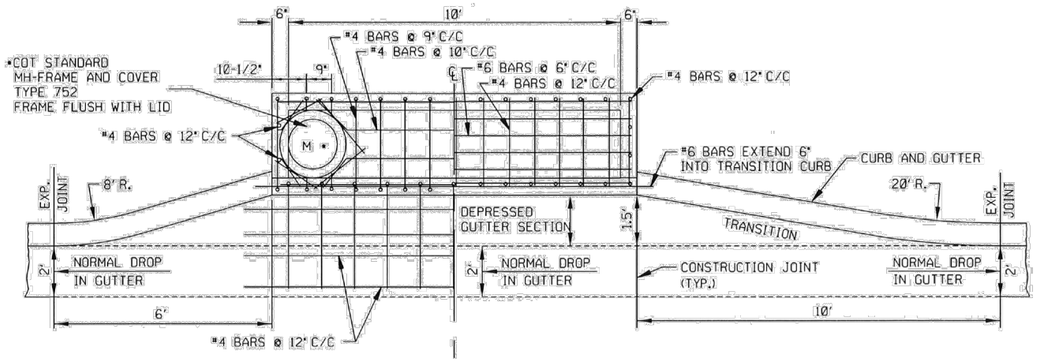
STANDARD CAST IRON CURB

APPROVED BY: _____
CITY ENGINEER

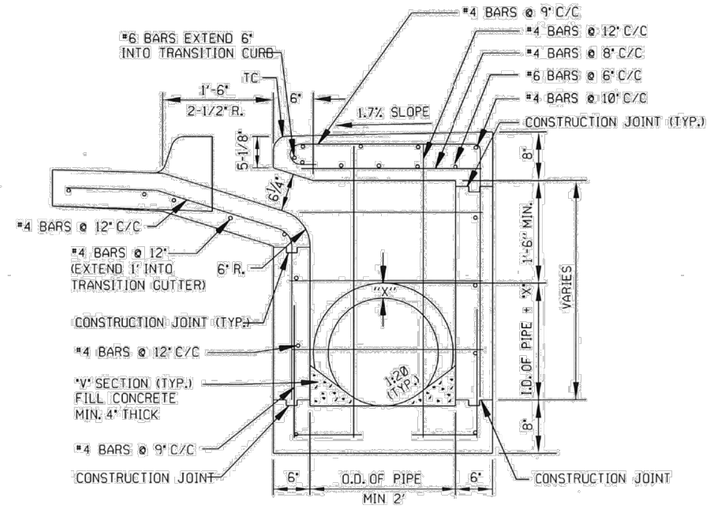
DATE: 01/2023

DRAWING NO: SD 15

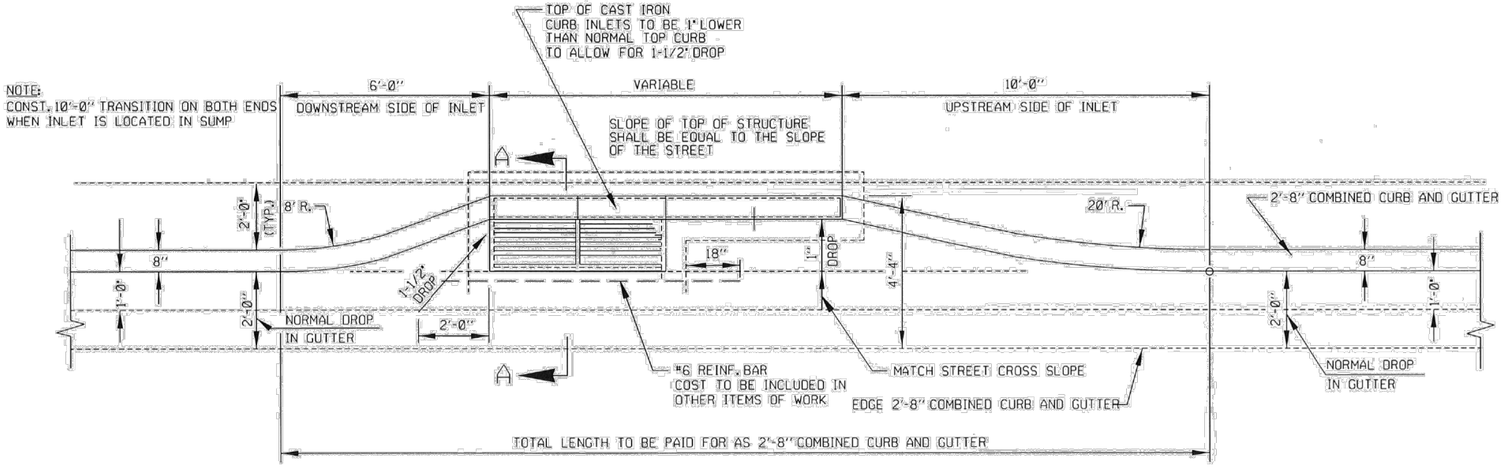
RECESSED CURB INLET



PLAN - SECTION



ELEVATION - SECTION A-A



CURB TURNOUT FOR RECESSED CAST IRON CURB INLET

NOT TO SCALE

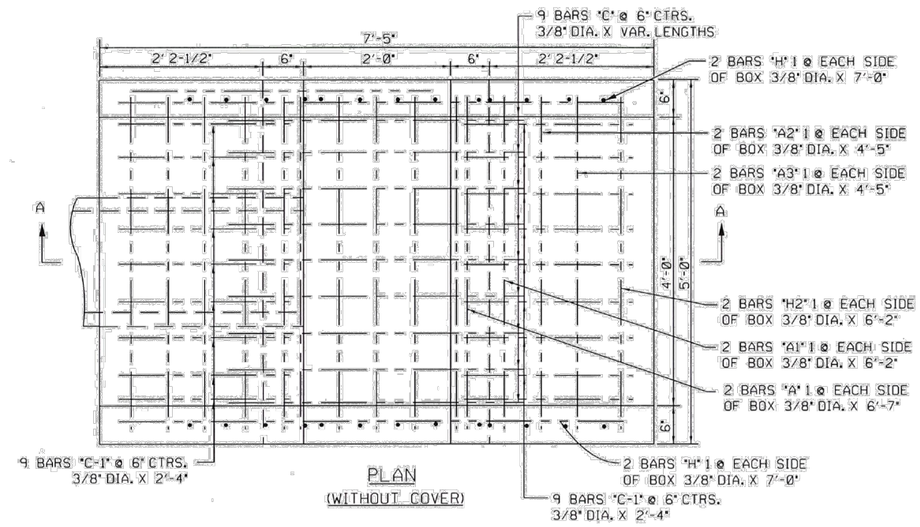
ENGINEERING DIVISION, CITY OF NORMAN

STANDARD RECESSED
CURB INLET

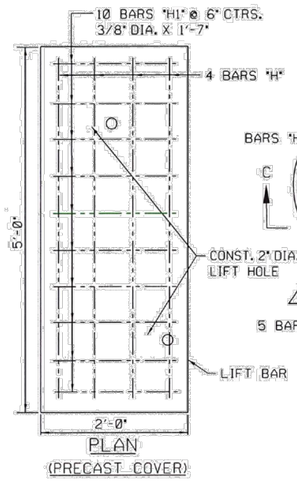
APPROVED BY: _____
CITY ENGINEER

DATE: 01/2023

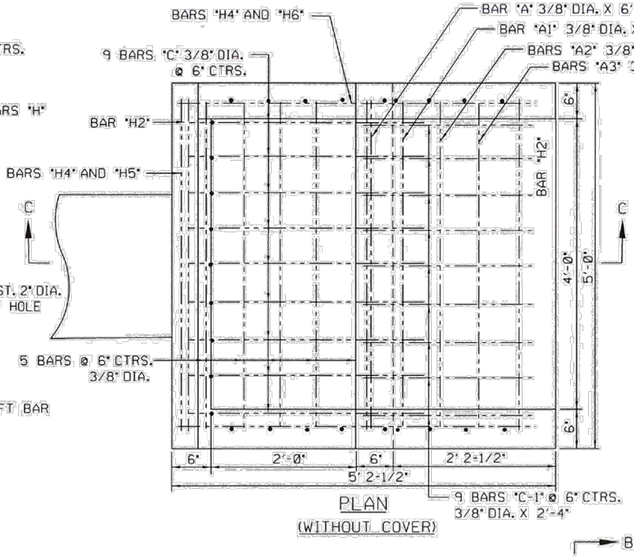
DRAWING NO: SD 16



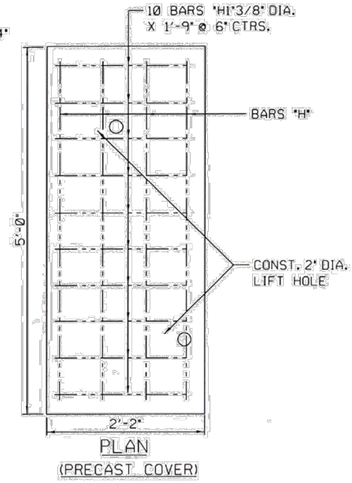
PLAN
(WITHOUT COVER)



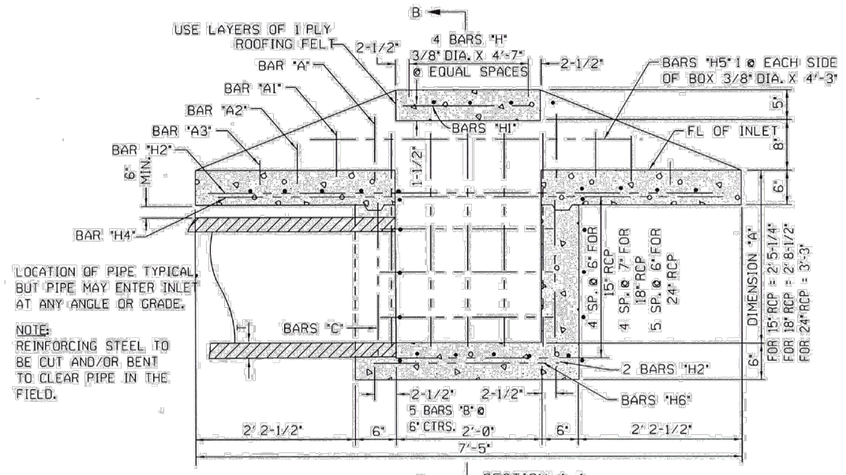
PLAN
(PRECAST COVER)



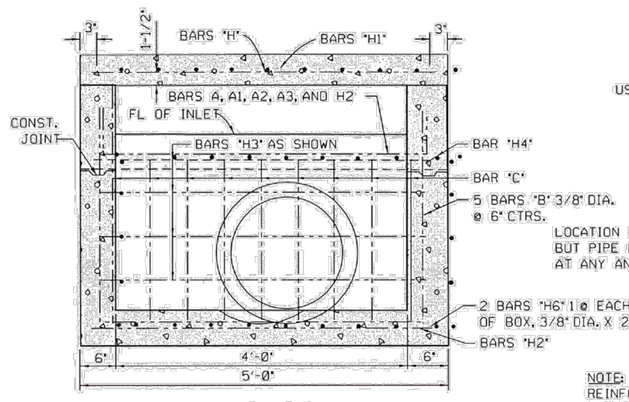
PLAN
(WITHOUT COVER)



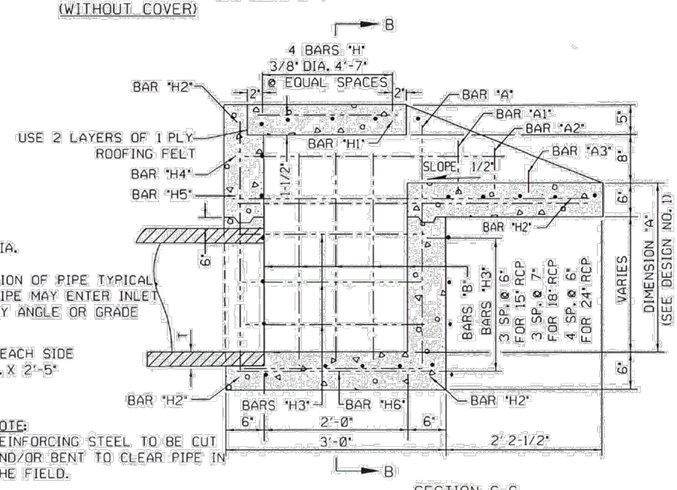
PLAN
(PRECAST COVER)



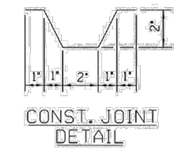
DESIGN NO. 1



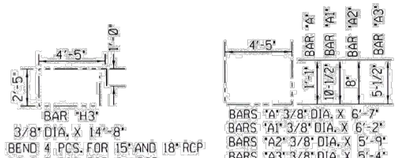
SECTION B-B



DESIGN NO. 2



CONST. JOINT DETAIL



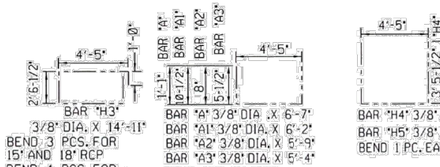
BAR BENDING DIAGRAMS
DESIGN NO. 1

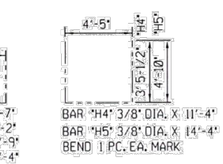
DESIGN NO. 1									DESIGN NO. 2								
	15" RCP			18" RCP			24" RCP			15" RCP			18" RCP			24" RCP	
MARK	NO. PCS.	SHAPE	LENGTH	NO. PCS.	SHAPE	LENGTH	NO. PCS.	SHAPE	LENGTH	MARK	NO. PCS.	SHAPE	LENGTH	NO. PCS.	SHAPE	LENGTH	NO. PCS.	SHAPE	LENGTH
A	2	BENT	6'-7"	2	BENT	6'-7"	2	BENT	6'-7"	A	1	BENT	6'-7"	1	BENT	6'-7"	1	BENT	6'-7"
A1	2	BENT	6'-2"	2	BENT	6'-2"	2	BENT	6'-2"	A	1	BENT	6'-2"	1	BENT	6'-2"	1	BENT	6'-2"
A2	2	BENT	5'-9"	2	BENT	5'-9"	2	BENT	5'-9"	A	1	BENT	5'-9"	1	BENT	5'-9"	1	BENT	5'-9"
A3	2	BENT	5'-4"	2	BENT	5'-4"	2	BENT	5'-4"	A	1	BENT	5'-4"	1	BENT	5'-4"	1	BENT	5'-4"
B	5	BENT	10' 7-1/2"	5	BENT	11'-2"	5	BENT	12'-3"	B	5	BENT	10' 7-1/2"	5	BENT	11'-2"	5	BENT	12'-3"
C	9	BENT	8' 7-1/2"	9	BENT	9'-2"	9	BENT	10'-3"	C	9	BENT	9' 1-1/2"	9	BENT	9' 7-1/2"	9	BENT	10' 8-1/2"
C1	18	STR.	2'-4"	18	STR.	2'-4"	18	STR.	2'-4"	C	9	STR.	2'-4"	9	STR.	2'-4"	9	STR.	2'-4"
H	4	STR.	4'-7"	4	STR.	4'-7"	4	STR.	4'-7"	H	4	STR.	4'-7"	4	STR.	4'-7"	4	STR.	4'-7"
H1	10	STR.	1'-7"	10	STR.	1'-7"	10	STR.	1'-7"	H1	10	STR.	1'-9"	10	STR.	1'-9"	10	STR.	1'-9"
H2	4	STR.	4'-5"	4	STR.	4'-5"	4	STR.	4'-5"	H2	4	STR.	4'-7"	4	STR.	4'-7"	4	STR.	4'-7"
H3	4	BENT	14'-8"	4	BENT	14'-8"	5	BENT	14'-8"	H3	3	BENT	14'-11"	3	BENT	14'-11"	4	BENT	14'-11"
H4	2	STR.	7'-0"	2	STR.	7'-0"	2	STR.	7'-0"	H4	1	BENT	11'-4"	1	BENT	11'-4"	1	BENT	11'-4"
H5	2	STR.	4'-3"	2	STR.	4'-3"	2	STR.	4'-3"	H5	1	BENT	14'-1"	1	BENT	14'-1"	1	BENT	14'-1"
H6	2	STR.	2'-5"	2	STR.	2'-5"	2	STR.	2'-5"	H6	2	STR.	2'-5"	2	STR.	2'-5"	2	STR.	2'-5"

QUANTITIES

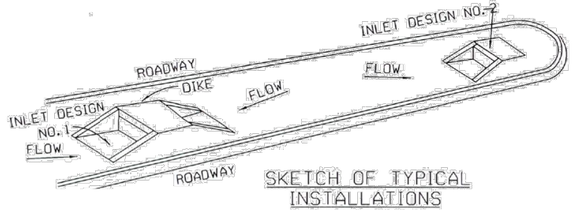
ITEM	15" RCP	18" RCP	24" RCP	ITEM	15" RCP	18" RCP	24" RCP
CLASS "A" CONCRETE	1.67 C.Y.	1.73 C.Y.	1.77 C.Y.	CLASS "A" CONCRETE	1.52 C.Y.	1.59 C.Y.	1.64 C.Y.
REINFORCING STEEL	135 LBS.	141 LBS.	147 LBS.	REINFORCING STEEL	118 LBS.	121 LBS.	132 LBS.

QUANTITIES PER FT. OF VERT. HT.-CLASS "A" CONC. -0.26 C.Y.-REINFORCING STEEL-21.79 LBS. (SEE NOTES)





BAR BENDING DIAGRAMS
DESIGN NO. 2



SKETCH OF TYPICAL INSTALLATIONS

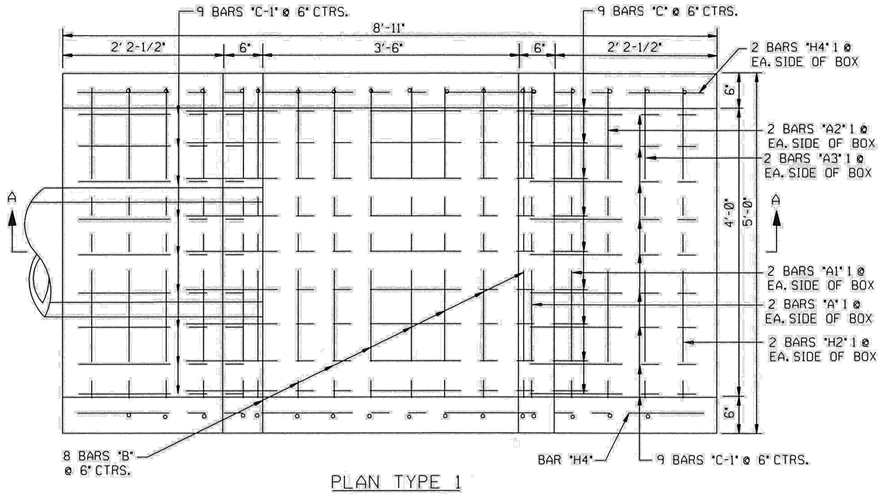
ENGINEERING DIVISION, CITY OF NORMAN

STANDARD DROP INLET 15", 18", AND 24"

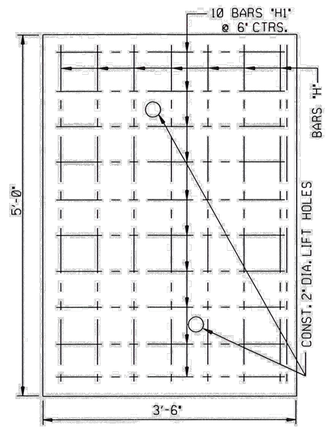
APPROVED BY: _____ CITY ENGINEER

DATE: 01/2023

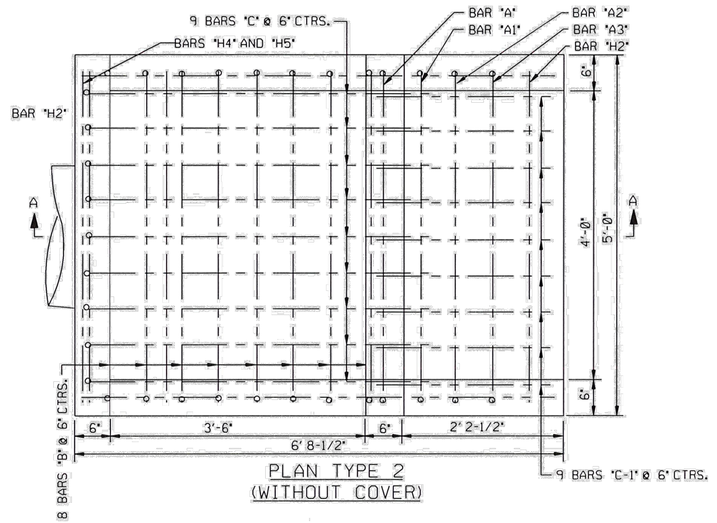
DRAWING NO: SD 17



PLAN TYPE 1
(WITHOUT COVER)



PLAN TYPE 1
(PRECAST COVER)



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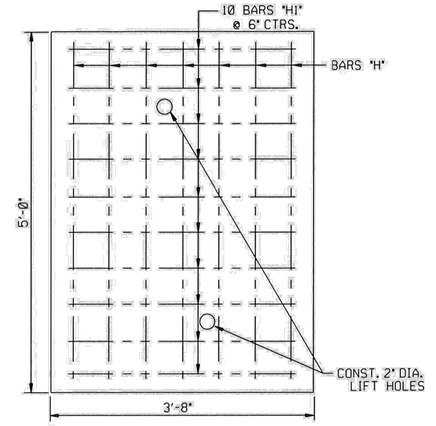

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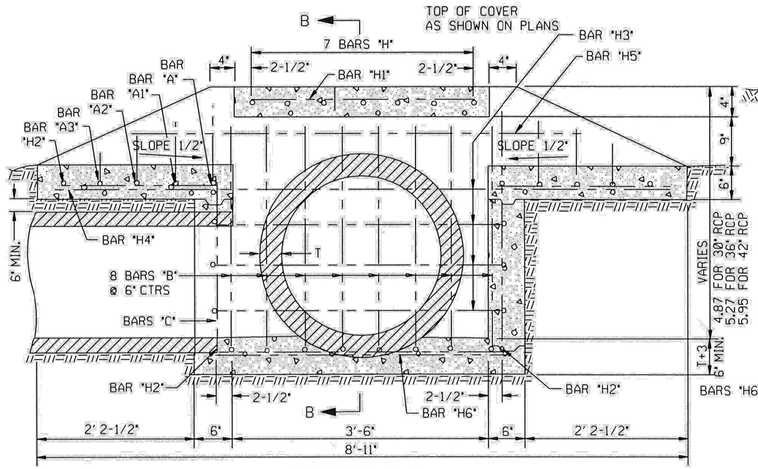
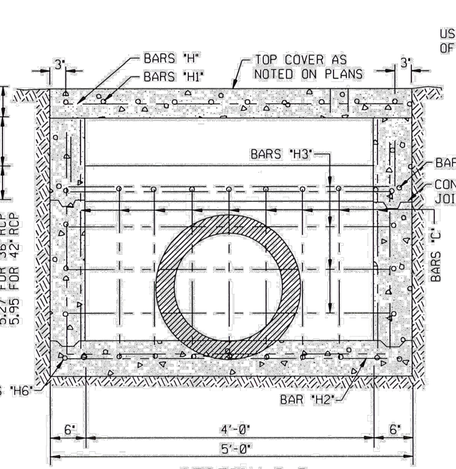
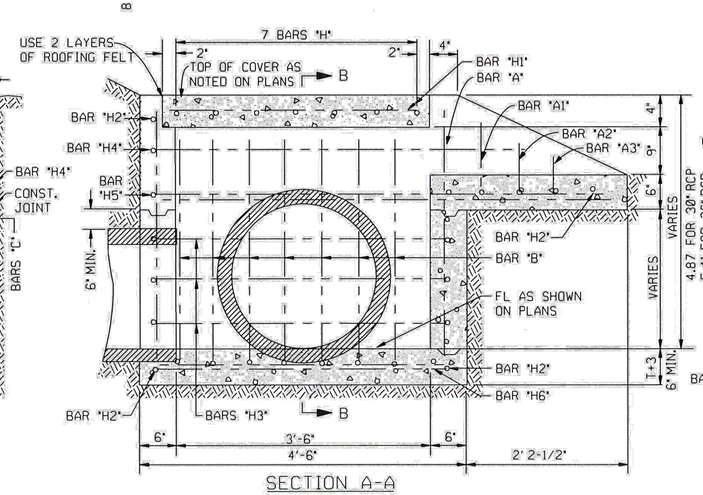


SECTION A-A

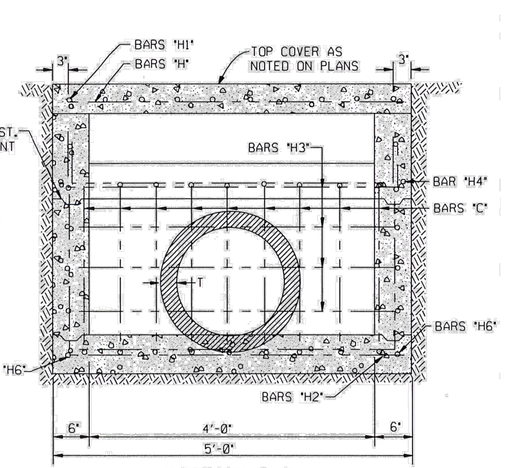


SECTION B-B

DESIGN NO. 1



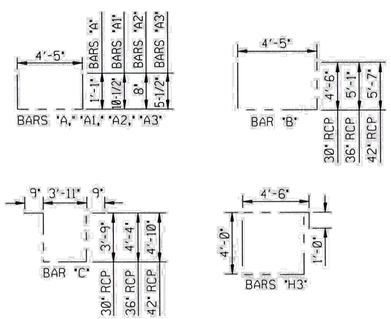
SECTION A-A



SECTION B-B

DESIGN NO. 2

NOTE:
REINFORCING STEEL TO BE CUT AND/OR BENT TO CLEAR PIPES IN THE FIELD.



BAR BENDING DIAGRAMS

BAR LIST

DESIGN NO. 1

		30" RCP			36" RCP			42" RCP		
MARK	SIZE	QUAN.	SHAPE	LENGTH	QUAN.	SHAPE	LENGTH	QUAN.	SHAPE	LENGTH
A	3/8"	2	BENT	6'-7"	2	BENT	6'-7"	2	BENT	6'-7"
A1	3/8"	2	BENT	6'-2"	2	BENT	6'-2"	2	BENT	6'-2"
A2	3/8"	2	BENT	5'-9"	2	BENT	5'-9"	2	BENT	5'-9"
A3	3/8"	2	BENT	5'-4"	2	BENT	5'-4"	2	BENT	5'-4"
B	3/8"	8	BENT	13'-5"	8	BENT	14'-7"	8	BENT	15'-7"
C	3/8"	9	BENT	12'-11"	9	BENT	14'-1"	9	BENT	15'-1"
C1	3/8"	18	STR.	2'-4"	18	STR.	2'-4"	18	STR.	2'-4"
H	1/2"	7	STR.	4'-8"	7	STR.	4'-8"	7	STR.	4'-8"
H1	1/2"	10	STR.	3'-1"	10	STR.	3'-1"	10	STR.	3'-1"
H2	3/8"	4	STR.	4'-7"	4	STR.	4'-7"	4	STR.	4'-7"
H3	3/8"	7	BENT	17'-11"	7	BENT	17'-11"	7	BENT	17'-11"
H4	3/8"	2	STR.	8'-6"	2	STR.	8'-6"	2	STR.	8'-6"
H5	3/8"	2	STR.	6'-0"	2	STR.	6'-0"	2	STR.	6'-0"
H6	3/8"	2	STR.	4'-1"	2	STR.	4'-1"	2	STR.	4'-1"

QUANTITIES

ITEM	30" RCP	36" RCP	42" RCP
CLASS "A" CONCRETE	2.49	2.65	2.80
REINFORCING STEEL	228	241	260

QUANTITIES PER FT. OF VERTICAL HEIGHT CLASS "A" CONC. 0.31
REINFORCING STEEL 26.26 LBS. PER C.Y.

BAR LIST

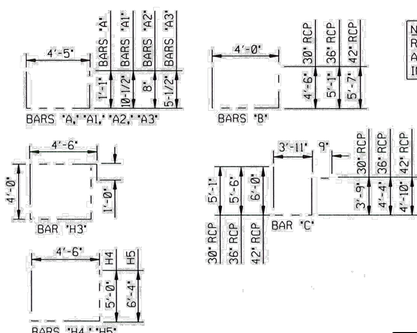
DESIGN NO. 2

		30" RCP			36" RCP			42" RCP		
MARK	SIZE	QUAN.	SHAPE	LENGTH	QUAN.	SHAPE	LENGTH	QUAN.	SHAPE	LENGTH
A	3/8"	1	BENT	6'-7"	1	BENT	6'-7"	1	BENT	6'-7"
A1	3/8"	1	BENT	6'-2"	1	BENT	6'-2"	1	BENT	6'-2"
A2	3/8"	1	BENT	5'-9"	1	BENT	5'-9"	1	BENT	5'-9"
A3	3/8"	1	BENT	5'-4"	1	BENT	5'-4"	1	BENT	5'-4"
B	3/8"	8	BENT	13'-0"	8	BENT	14'-2"	8	BENT	15'-2"
C	3/8"	9	BENT	13'-6"	9	BENT	14'-6"	9	BENT	15'-6"
C1	3/8"	9	STR.	2'-4"	9	STR.	2'-4"	9	STR.	2'-4"
H	1/2"	7	STR.	4'-8"	7	STR.	4'-8"	7	STR.	4'-8"
H1	1/2"	10	STR.	3'-3"	10	STR.	3'-3"	10	STR.	3'-3"
H2	3/8"	4	STR.	4'-7"	4	STR.	4'-7"	4	STR.	4'-7"
H3	3/8"	7	BENT	17'-11"	7	BENT	17'-11"	7	BENT	17'-11"
H4	3/8"	1	BENT	14'-7"	1	BENT	14'-7"	1	BENT	14'-7"
H5	3/8"	1	BENT	17'-2"	1	BENT	17'-2"	1	BENT	17'-2"
H6	3/8"	2	STR.	4'-1"	2	STR.	4'-1"	2	STR.	4'-1"

QUANTITIES

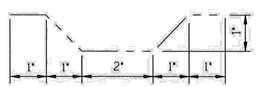
ITEM	30" RCP	36" RCP	42" RCP
CLASS "A" CONCRETE	2.32	2.49	2.66
REINFORCING STEEL	262	278	294

QUANTITIES PER FT. OF VERTICAL HEIGHT CLASS "A" CONC. 0.31
REINFORCING STEEL 26.26 LBS. PER C.Y.



BAR BENDING DIAGRAMS

NOTE:
REINFORCING STEEL TO BE CUT AND/OR BENT TO CLEAR PIPES IN THE FIELD.



CONSTRUCTION JOINT DETAIL

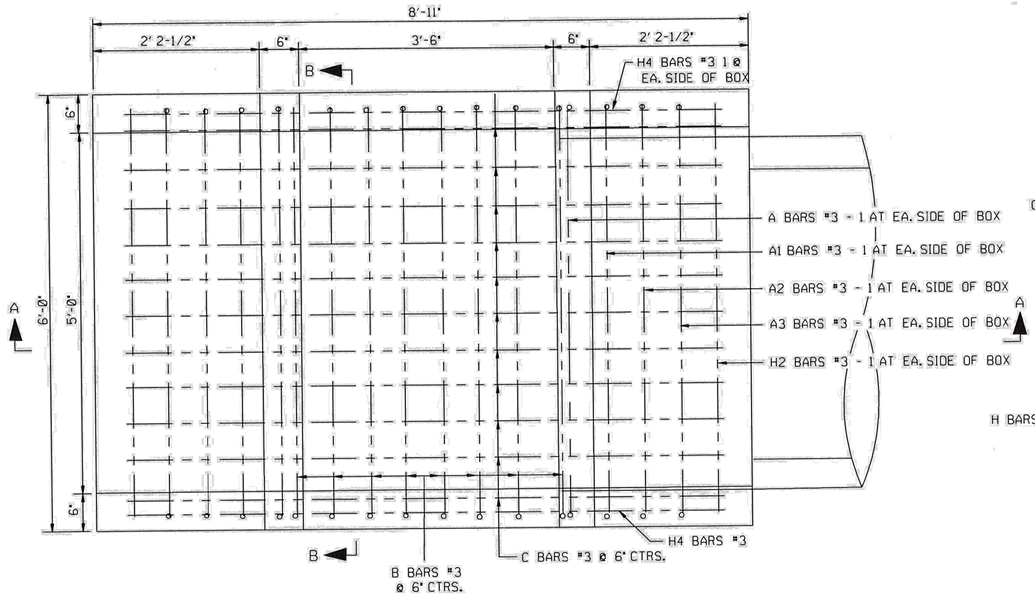
ENGINEERING DIVISION, CITY OF NORMAN

STANDARD DROP INLET 30", 36", AND 42" WITH NO ACCESS MANHOLE

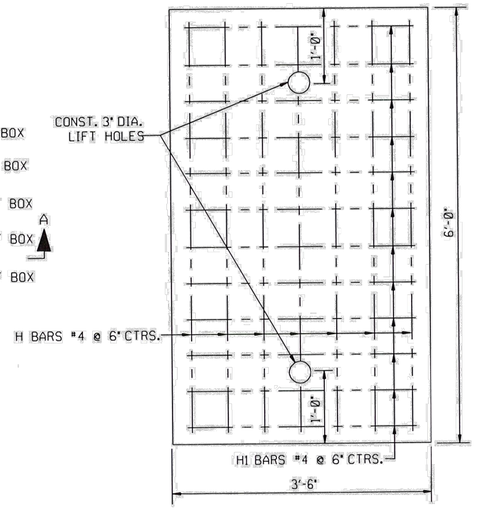
APPROVED BY: _____
CITY ENGINEER

DATE: 01/2023

DRAWING NO: SD 18



PLAN
(WITHOUT COVER)



PLAN
(PRECAST COVER)

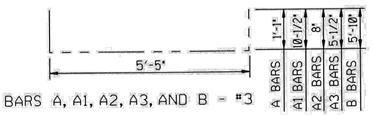
REINFORCING STEEL SCHEDULE

BARS LIST

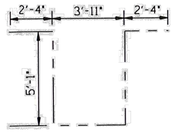
MARK	NO.	SIZE	TYPE	LENGTH
A	2	#3	BENT	7'-7"
A1	2	#3	BENT	7'-2"
A2	2	#3	BENT	6'-9"
A3	2	#3	BENT	6'-4"
B	8	#3	BENT	17'-1"
C	11	#3	BENT	18'-9"
H	7	#4	STR.	5'-8"
H1	12	#4	STR.	3'-1"
H2	4	#3	STR.	5'-7"
H3	9	#3	BENT	20'-0"
H4	2	#3	STR.	8'-6"
H5	2	#3	STR.	6'-0"
H6	2	#3	STR.	4'-1"

BEND DIAGRAMS

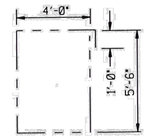
ALL DIMENSIONS ARE OUT TO OUT



BARS A, A1, A2, A3, AND B - #3



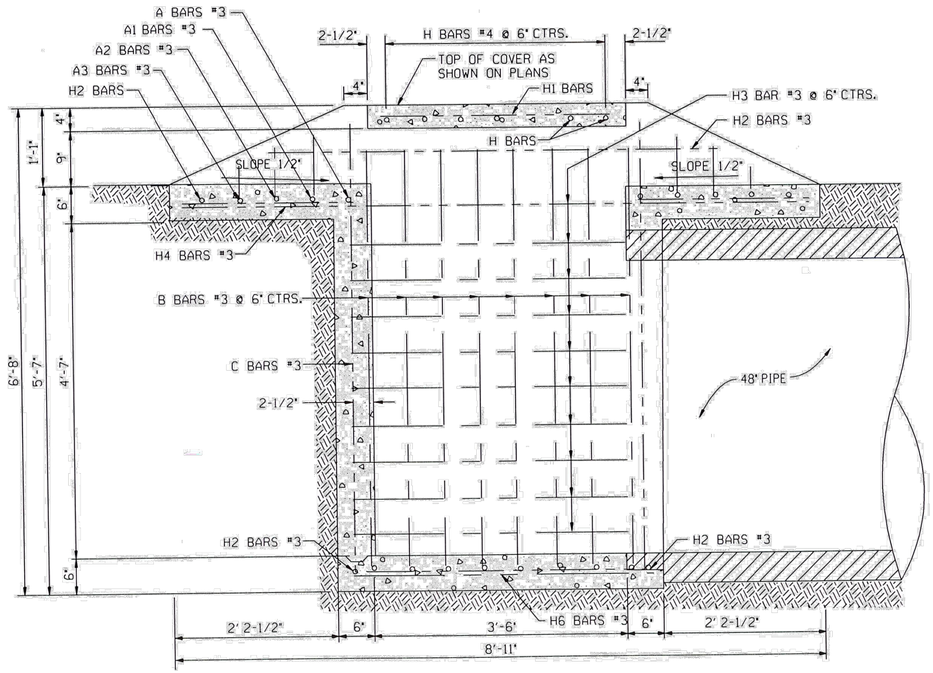
C BARS #3 X 18'-9"



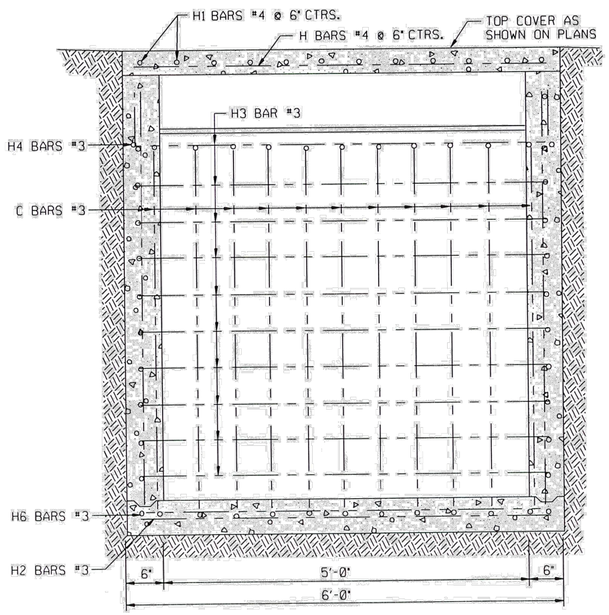
H3 BARS #3 X 20'-0"

ESTIMATED QUANTITIES

QUANTITIES FOR STRUCTURE (MIN. HEIGHT)	
CLASS A CONCRETE	3.22 C.Y.
REINFORCING STEEL	292 LBS.
QUANTITIES PER FOOT OF VERTICAL HEIGHT	
CLASS A CONCRETE	.35 C.Y.
REINFORCING STEEL	29 LBS.



SECTION A-A



SECTION B-B

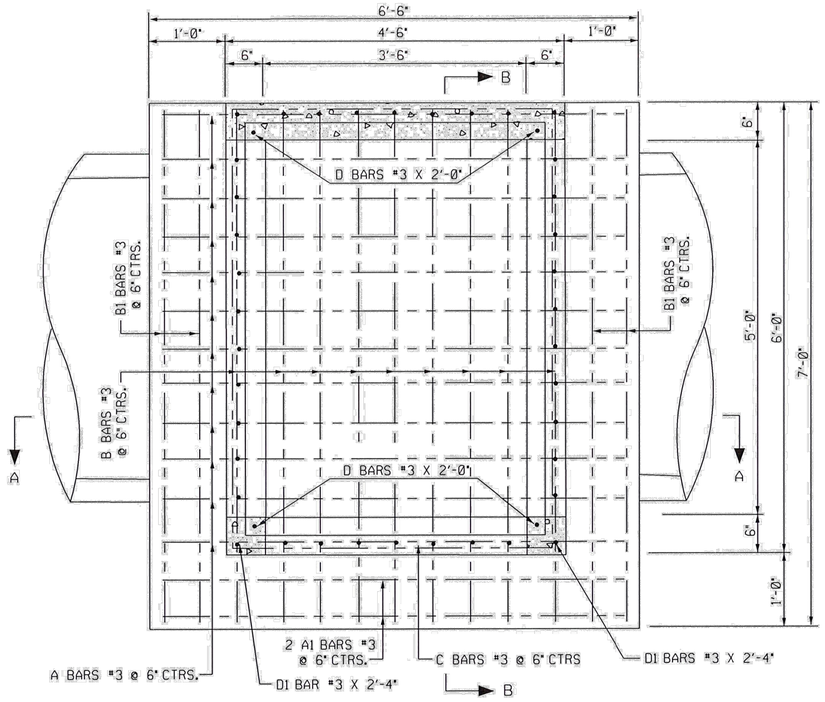
ENGINEERING DIVISION, CITY OF NORMAN

STANDARD DROP INLET 48" PIPE

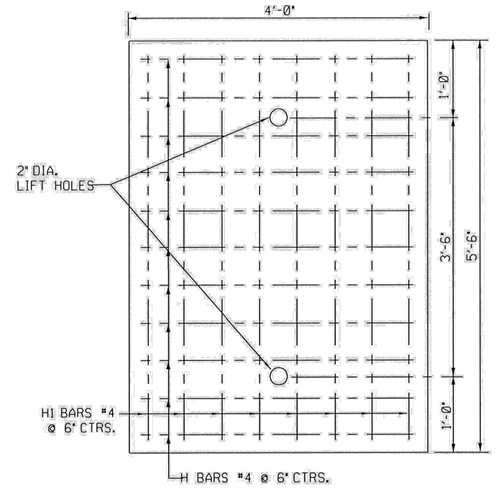
APPROVED BY: _____
CITY ENGINEER

DATE: 01/2023

DRAWING NO: SD 19



PLAN (WITHOUT COVER)



PRECAST COVER

REINFORCING STEEL SCHEDULE

BARS LIST

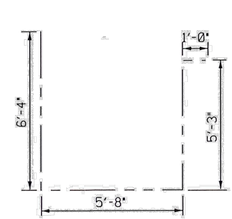
MARK	NO.	SIZE	TYPE	LENGTH
A	12	#3	BENT	16'-8"
A1	2	#3	STR.	6'-2"
A2	2	#3	STR.	4'-2"
B	9	#3	BENT	18'-3"
B1	4	#3	STR.	6'-8"
C	10	#3	BENT	20'-8"
D	4	#3	STR.	2'-0"
D1	2	#3	STR.	2'-4"
H	11	#4	STR.	3'-8"
H1	8	#4	STR.	5'-2"

QUANTITIES

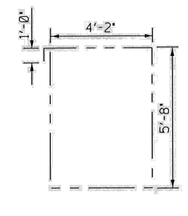
FOR INLET WITH MINIMUM HEIGHT
CLASS 'A' CONCRETE 2.16 C.Y.
GRADE 40 REINF. STEEL 282 LBS.

FOR ADD'L FOOT OF VERT. HEIGHT
CLASS 'A' CONCRETE .352 C.Y.
GRADE 40 REINF. STEEL 29.82 LBS.

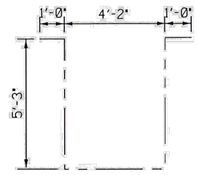
BEND DIAGRAMS



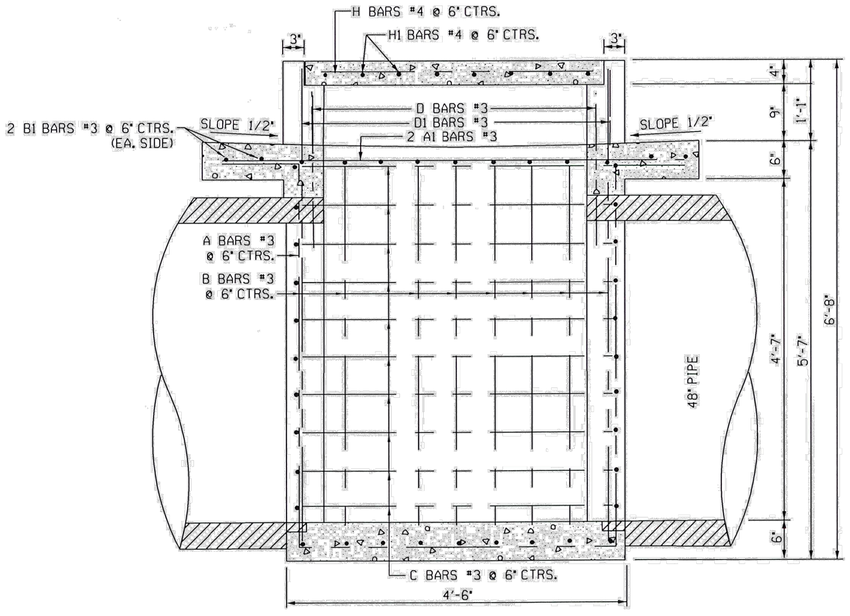
B BARS 3 X 18'-3"



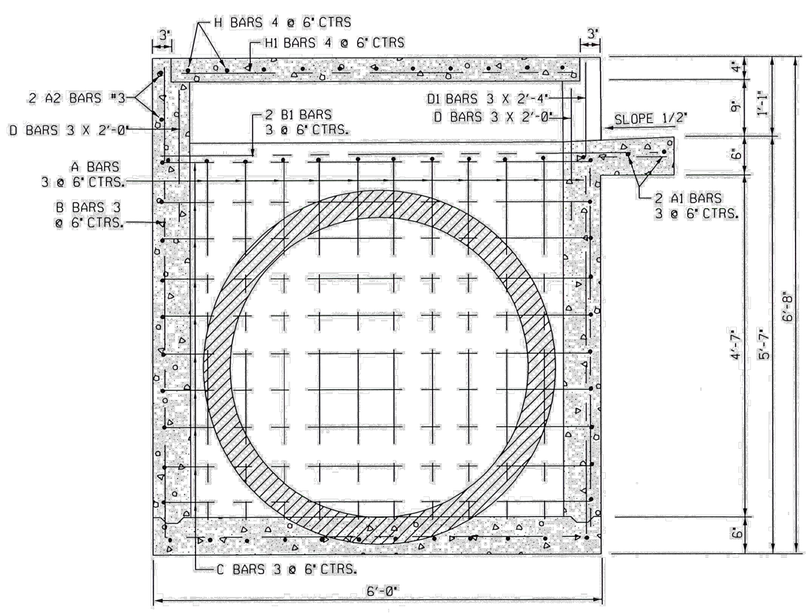
C BARS 3 X 20'-8"



A BARS 3 X 16'-8"



SECTION A-A

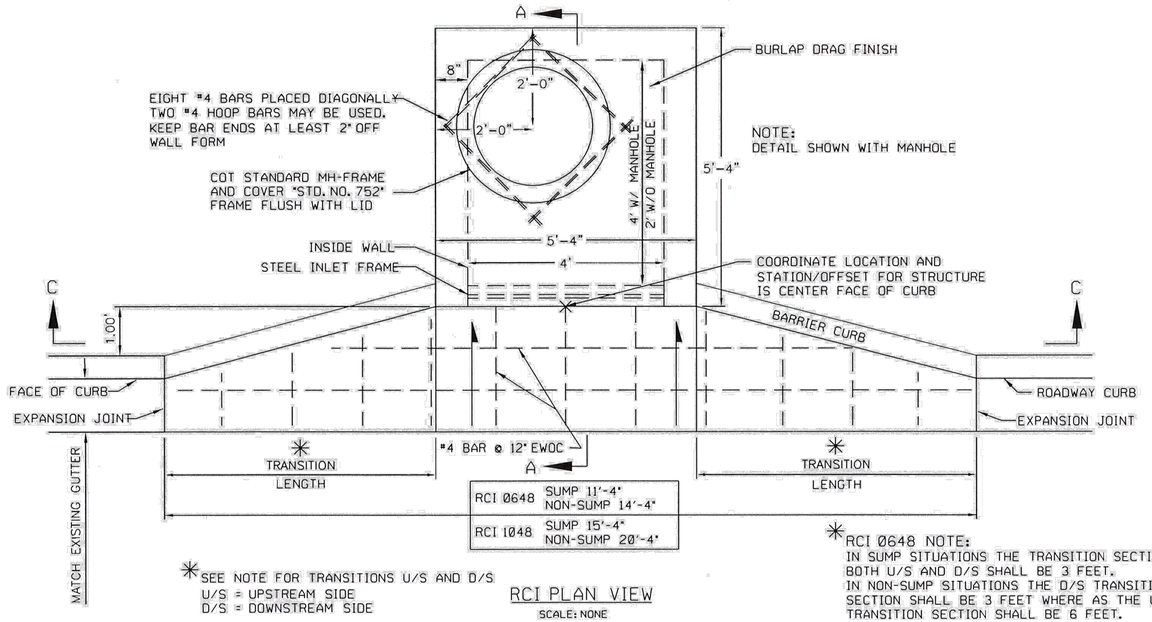


SECTION B-B

ENGINEERING DIVISION, CITY OF NORMAN

STANDARD THREE WAY DROP INLET 48" PIPE

APPROVED BY: _____ CITY ENGINEER	DATE: 01/2023	DRAWING NO: SD 20

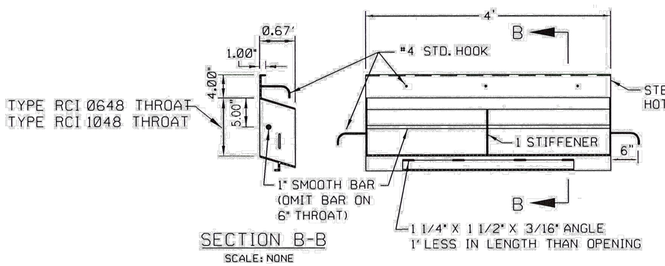


✳SEE NOTE FOR TRANSITIONS U/S AND D/S
U/S = UPSTREAM SIDE
D/S = DOWNSTREAM SIDE

RCI PLAN VIEW
SCALE: NONE

✳RCI 0648 NOTE:
IN SUMP SITUATIONS THE TRANSITION SECTION BOTH U/S AND D/S SHALL BE 3 FEET.
IN NON-SUMP SITUATIONS THE D/S TRANSITION SECTION SHALL BE 3 FEET WHERE AS THE U/S TRANSITION SECTION SHALL BE 6 FEET.

✳RCI 1048 NOTE:
IN SUMP SITUATIONS THE TRANSITION SECTION BOTH U/S AND D/S SHALL BE 5 FEET.
IN NON-SUMP SITUATIONS THE D/S TRANSITION SECTION SHALL BE 5 FEET WHERE AS THE U/S TRANSITION SECTION SHALL BE 10 FEET.



SECTION B-B
SCALE: NONE

FRONT VIEW
STEEL INLET INSERT DETAIL
SCALE: NONE

STEEL INLET FRAME NOTES
1. STEEL INLET INSERT SHALL BE AS MANUFACTURED BY SHAWNEE STEEL & WELDING, INC. OF MERIAM, KS. OR APPROVED EQUAL. REFER TO THE STEEL INLET INSERT DETAIL.

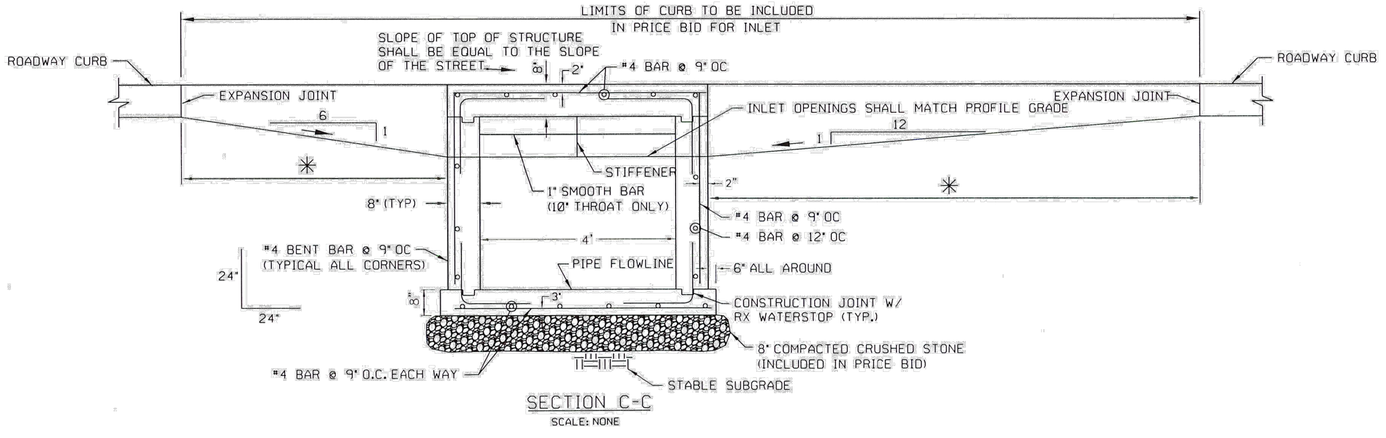
2. COST OF INLET INSERT SHALL BE INCLUDED IN THE PRICE BID FOR INLET.

3. ALL WELDS SHALL BE PERFORMED IN ACCORDANCE WITH APPROPRIATE AWS SPECIFICATIONS AND PROCEDURES.

4. ALL STEEL SHALL BE 7 GAGE OR 3/16" THICK.

5. ALL WELDS ON EXPOSED SURFACES SHALL BE DRESSED SO AS TO PROVIDE A PLEASING FINISHED APPEARANCE.

6. THE ENTIRE FRAME SHALL BE HOT DIP ZINC COATED IN ACCORDANCE WITH ASTM A-123.



SECTION C-C
SCALE: NONE

CAST IN PLACE CONCRETE NOTES
1. ALL CONCRETE SHALL BE CLASS A, AS DESIGNATED IN SECTION 509 OF THE ODOT SPECIFICATIONS, LATEST EDITION.

2. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 3/4" UNLESS OTHERWISE NOTED.

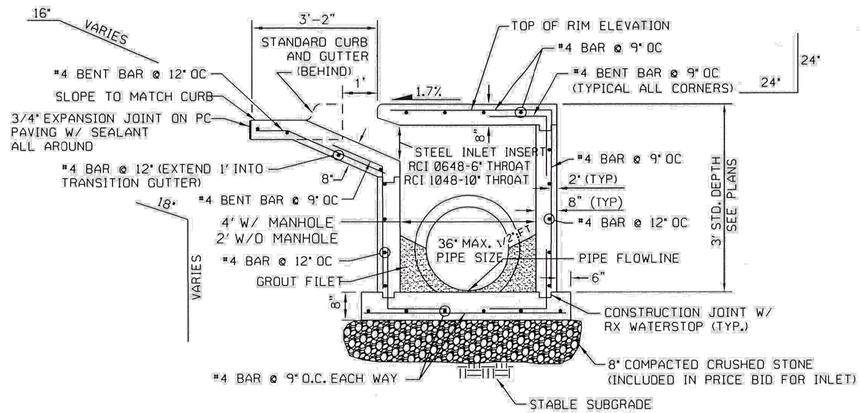
3. CLEAR DISTANCES FROM CAST-IN-PLACE CONCRETE SURFACES TO REINFORCING SHALL BE 2" FOR WALLS, 1-1/2" FOR SUPPORTED SLABS, 3" FROM THE BOTTOM OF FOOTINGS AND 2" FROM THE TOP OF SLABS, UNLESS OTHERWISE NOTED.

4. REINFORCING STEEL SHALL MEET ASTM SPECIFICATION A615, GRADE 60.

5. ALL BARS SHALL LAP A MINIMUM OF 30 BAR DIAMETERS OR 18", WHICHEVER IS GREATER, UNLESS OTHERWISE NOTED BY THE ENGINEER.

6. ALL EXPOSED CAST IN PLACE CONCRETE SURFACES SHALL HAVE ALL VOIDS FILLED, BURRS AND FINS REMOVED.
7. ALL JOINTS SHALL BE SEALED WITH AN APPROVED SILICONE SEALANT.

8. MINIMUM CONCRETE COVER OF REINFORCING STEEL SHALL CONFORM TO AMERICAN CONCRETE INSTITUTE STANDARD OR BE 2" FOR EXTERIOR WALL STEEL OR 3" FOR THE BOTTOM FLOOR STEEL.



SECTION A-A
SCALE: NONE

NOTE:
RCI STRUCTURES W/O MANHOLES SHOULD BE LIMITED TO CASES WHERE A SINGLE INLET IS EXTENDED BEYOND A JUNCTION BOX.

BASIS OF PAYMENT		
ITEM NO.	ITEM	UNIT
611.06 (G)	INLET, TYPE "RCI 0648 & RCI 1048"	EA.
611.06 (H)	ADDITIONAL DEPTH IN INLET TYPE "RCI 0648 & RCI 1048"	V.F.

NOTE:
DETAIL SHOWN WITH MANHOLE

RCI 0648 (6" THROAT)

	SUMP W/ MANHOLE		SUMP W/O MANHOLE		NO SUMP W/ MANHOLE		NO SUMP W/O MANHOLE	
	CONC. CY	STL. LBS.	CONC. CY	STL. LBS.	CONC. CY	STL. LBS.	CONC. CY	STL. LBS.
STD. DEPTH 3'	3.1	290	2.3	215	3.3	299	2.6	225
ADD. VERT. FT.	1	31	.7	24	1	31	.7	24

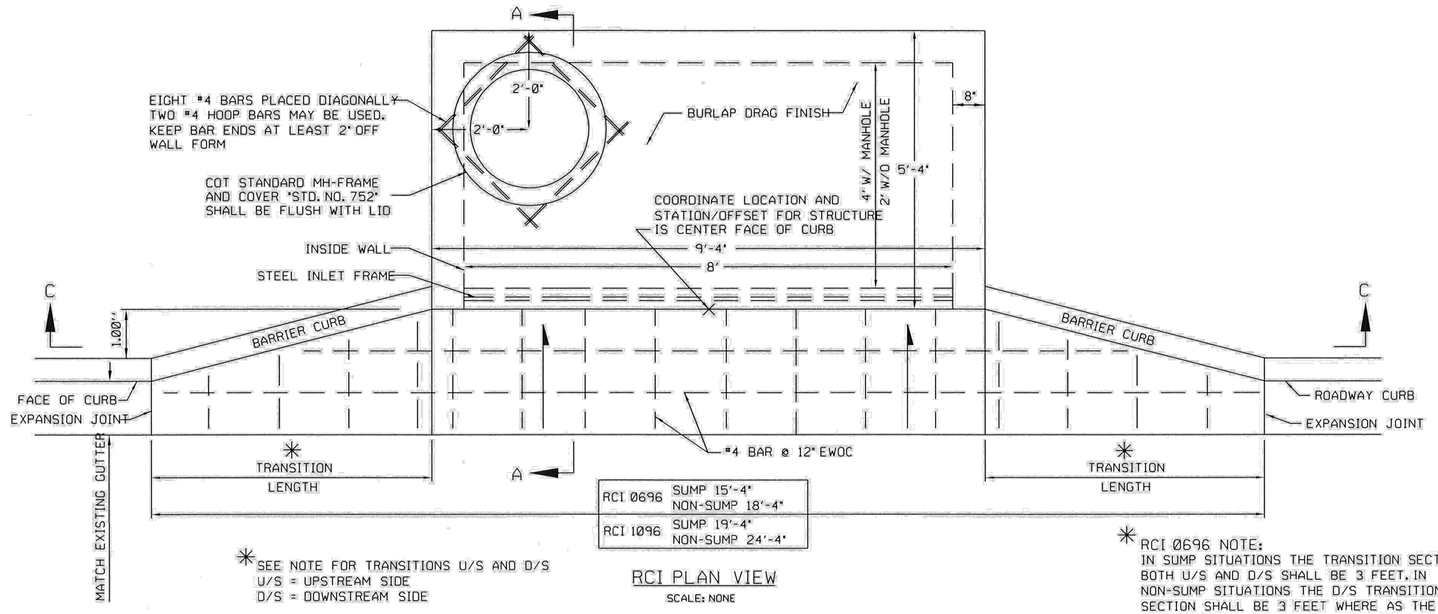
RCI 1048 (10" THROAT)

	SUMP W/ MANHOLE		SUMP W/O MANHOLE		NO SUMP W/ MANHOLE		NO SUMP W/O MANHOLE	
	CONC. CY	STL. LBS.	CONC. CY	STL. LBS.	CONC. CY	STL. LBS.	CONC. CY	STL. LBS.
STD. DEPTH 3'	3.5	295	2.6	221	3.7	307	2.8	236
ADD. VERT. FT.	1	31	.7	24	1	31	.7	24

ENGINEERING DIVISION, CITY OF NORMAN

RECESSED CURB INLET A

APPROVED BY: _____ CITY ENGINEER | DATE: 01/2023 | DRAWING NO: SD 21A

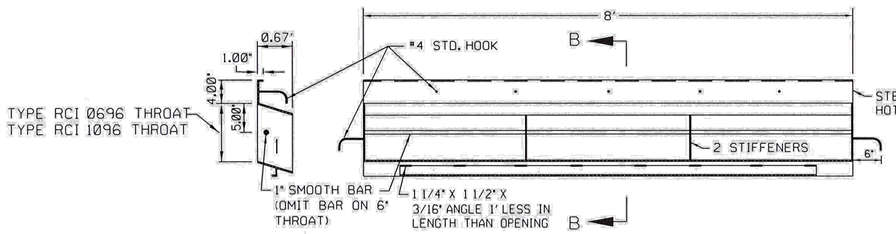


✳ SEE NOTE FOR TRANSITIONS U/S AND D/S
U/S = UPSTREAM SIDE
D/S = DOWNSTREAM SIDE

RCI PLAN VIEW
SCALE: NONE

✳ RCI 0696 NOTE:
IN SUMP SITUATIONS THE TRANSITION SECTION BOTH U/S AND D/S SHALL BE 3 FEET. IN NON-SUMP SITUATIONS THE D/S TRANSITION SECTION SHALL BE 3 FEET WHERE AS THE U/S TRANSITION SECTION SHALL BE 6 FEET.

✳ RCI 1096 NOTE:
IN SUMP SITUATIONS THE TRANSITION SECTION BOTH U/S AND D/S SHALL BE 5 FEET. IN NON-SUMP SITUATIONS THE D/S TRANSITION SECTION SHALL BE 5 FEET WHERE AS THE U/S TRANSITION SECTION SHALL BE 10 FEET.



SECTION B-B
SCALE: NONE

FRONT VIEW
STEEL INLET INSERT DETAIL
SCALE: NONE

STEEL INLET FRAME NOTES
1. STEEL INLET INSERT SHALL BE AS MANUFACTURED BY SHAWNEE STEEL & WELDING, INC. OF MERIAM, KS. OR APPROVED EQUAL. REFER TO THE STEEL INLET INSERT DETAIL.

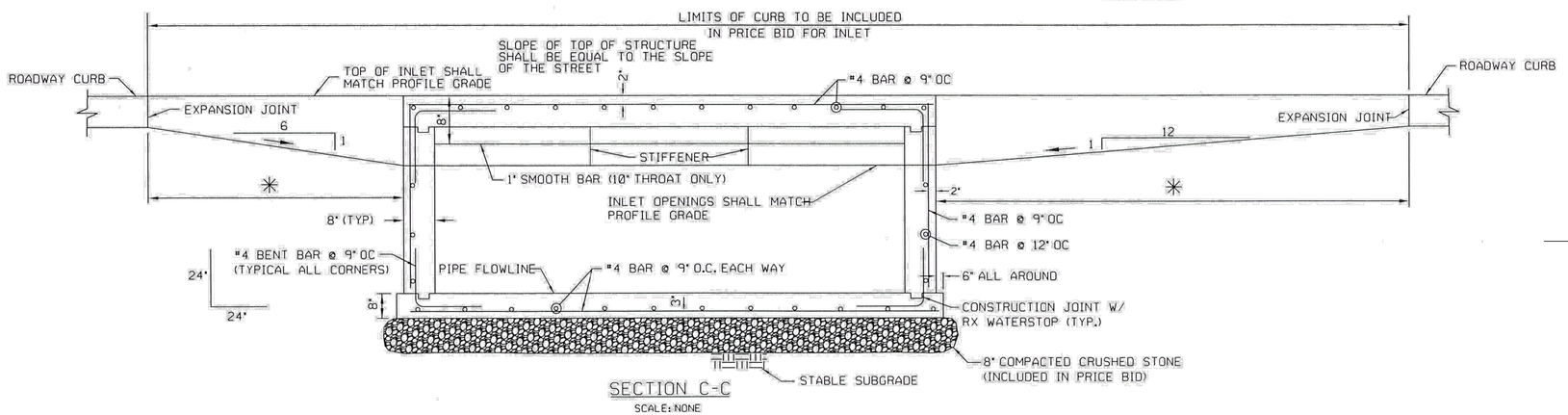
2. COST OF INLET INSERT SHALL BE INCLUDED IN THE PRICE BID FOR INLET.

3. ALL WELDS SHALL BE PERFORMED IN ACCORDANCE WITH APPROPRIATE AWS SPECIFICATIONS AND PROCEDURES.

4. ALL STEEL SHALL BE 7 GAGE OR 3/16" THICK.

5. ALL WELDS ON EXPOSED SURFACES SHALL BE DRESSED SO AS TO PROVIDE A PLEASING FINISHED APPEARANCE.

6. THE ENTIRE FRAME SHALL BE HOT DIP ZINC COATED IN ACCORDANCE WITH ASTM A-123.



SECTION C-C
SCALE: NONE

CAST IN PLACE CONCRETE NOTES
1. ALL CONCRETE SHALL BE CLASS A, AS DESIGNATED IN SECTION 509 OF THE ODOT SPECIFICATIONS, LATEST EDITION.

2. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 3/4" UNLESS OTHERWISE NOTED.

3. CLEAR DISTANCES FROM CAST-IN-PLACE CONCRETE SURFACES TO REINFORCING SHALL BE 2" FOR WALLS, 1-1/2" FOR SUPPORTED SLABS, 3" FROM THE BOTTOM OF FOOTINGS AND 2" FROM THE TOP OF SLABS, UNLESS OTHERWISE NOTED.

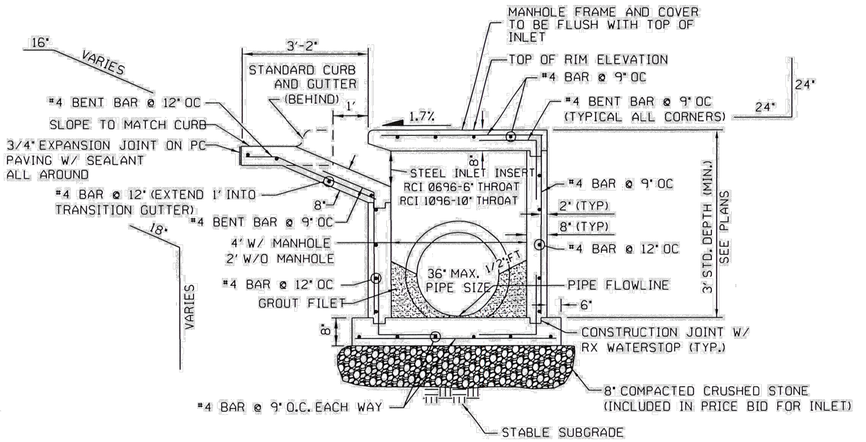
4. REINFORCING STEEL SHALL MEET ASTM SPECIFICATION A615, GRADE 60.

5. ALL BARS SHALL LAP A MINIMUM OF 30 BAR DIAMETERS OR 18", WHICHEVER IS GREATER, UNLESS OTHERWISE NOTED BY THE ENGINEER.

6. ALL EXPOSED CAST IN PLACE CONCRETE SURFACES SHALL HAVE ALL VOIDS FILLED, BURRS AND FINS REMOVED.

7. ALL JOINTS SHALL BE SEALED WITH AN APPROVED SILICONE SEALANT.

8. MINIMUM CONCRETE COVER OF REINFORCING STEEL SHALL CONFORM TO AMERICAN CONCRETE INSTITUTE STANDARD OR BE 2" FOR EXTERIOR WALL STEEL OR 3" FOR THE BOTTOM FLOOR STEEL.



SECTION A-A
SCALE: NONE

NOTE:
RCI STRUCTURES W/O MANHOLES SHOULD BE LIMITED TO CASES WHERE A SINGLE INLET IS EXTENDED BEYOND A JUNCTION BOX.

BASIS OF PAYMENT		
ITEM NO.	ITEM	UNIT
611.06 (G)	INLET, TYPE 'RCI 0696 & RCI 1096'	EA.
611.06 (H)	ADDITIONAL DEPTH IN INLET TYPE 'RCI 0696 & RCI 1096'	V.F.

NOTE:
DETAIL SHOWN WITH MANHOLE

RCI 0696 (6" THROAT)

	SUMP W/ MANHOLE		SUMP W/O MANHOLE		NO SUMP W/ MANHOLE		NO SUMP W/O MANHOLE	
	CONC. CY	STL. LBS.	CONC. CY	STL. LBS.	CONC. CY	STL. LBS.	CONC. CY	STL. LBS.
STD. DEPTH 3'	5.3	451	4	268	5.6	457	4.2	275
ADD. VERT. FT.	1.3	45	.8	38	1.3	45	.8	38

RCI 1096 (10" THROAT)

	SUMP W/ MANHOLE		SUMP W/O MANHOLE		NO SUMP W/ MANHOLE		NO SUMP W/O MANHOLE	
	CONC. CY	STL. LBS.	CONC. CY	STL. LBS.	CONC. CY	STL. LBS.	CONC. CY	STL. LBS.
STD. DEPTH 3'	5.7	464	4.3	281	6.1	477	4.7	295
ADD. VERT. FT.	1.3	45	.8	38	1.3	45	.8	38

ENGINEERING DIVISION, CITY OF NORMAN

RECESSED CURB INLET B

APPROVED BY: _____ CITY ENGINEER

DATE: 01/2023

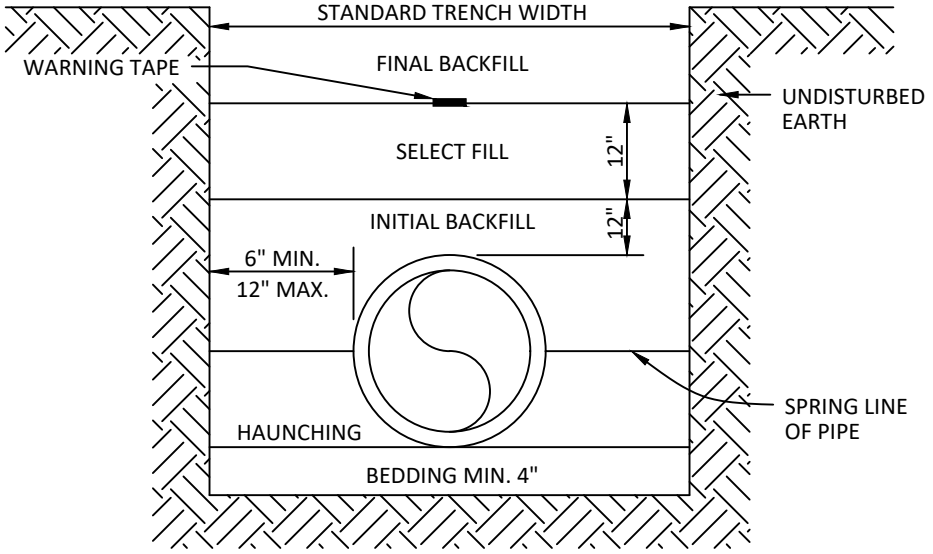
DRAWING NO: SD 21A

TABLE OF CONTENTS		
DRAWING NUMBER	DRAWING TITLE	REVISION DATE
SS 01	SANITARY PIPE TRENCHING AND BEDDING	01/2023
SS 02	PRECAST "SHALLOW" MANHOLE	01/2023
SS 03	CAST IN PLACE MANHOLE	01/2023
SS 04	MANHOLE FRAME AND COVER	01/2023
SS 04B	SANITARY SEWER MANHOLE COVER	01/2023
SS 04C	REVERSIBLE SANITARY SEWER MANHOLE FRAME	01/2023
SS 04D	REVERSIBLE SANITARY SEWER MANHOLE FRAME	01/2023
SS 04E	SANITARY SEWER MANHOLE COVER	01/2023
SS 04F	BOLT DOWN SANITARY SEWER MANHOLE FRAME & COVER	01/2023
SS 05	MANHOLE CONNECTIONS	01/2023
SS 06	WATER TABLE CRADLE FOR FLEXIBLE PIPE	01/2023
SS 07A	TAPPING A SANITARY SEWER LINE	01/2023
SS 08	SANITARY SEWER TEE AND RISER	01/2023
SS 10	SANITARY SEWER TAP AT MANHOLE	01/2023
SS 11	SANITARY SEWER AIR RELIEF VALVE	01/2023
SS 13	SUBMERSIBLE LIFT STATION	01/2023
SS 14	6" SEWER SERVICE CONNECTION INSTALLATION	01/2023

TABLE OF CONTENTS - SANITARY SEWER

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 00	DRAWING NO. SS 00

PIPE DIA.	DESIGN GRADE
6 IN	0.75%
8 IN	0.50%
12 IN	0.29%
15 IN	0.22%
18 IN	0.17%
21 IN	0.14%
24 IN	0.12%



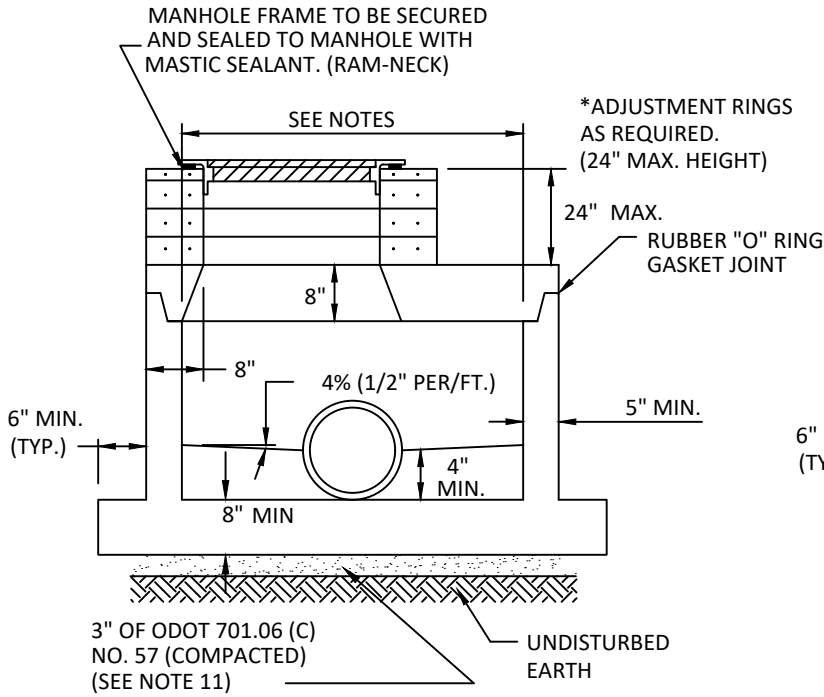
TRENCHING MATERIALS				
BACKFILL DESCRIPTION	NON-PAVED AREAS		PAVED AREAS (SEE NOTE 7)	
	PVC	HDPE/FRP	PVC	HDPE/FRP
FINAL BACKFILL	EXCAVATED MATERIAL	EXCAVATED MATERIAL	SBM	SBM
SELECT BACKFILL	SELECT FILL	SELECT FILL	SBM	SBM
INITIAL BACKFILL	SAND	SAND	SAND	SAND
HAUNCHING	SAND	SAND	SAND	SAND
BEDDING	SEE NOTE 5	SEE NOTE 5	SEE NOTE 5	SEE NOTE 5

NOTES

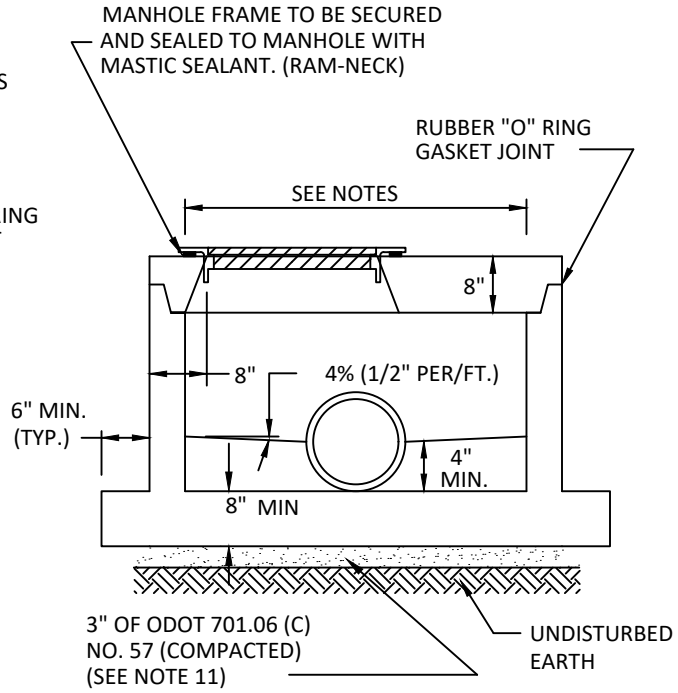
1. INSTALLATION FOR PVC PIPE SHALL MEET THE REQUIREMENTS OF ASTM D2321.
2. SELECT FILL CONSISTS OF EXCAVATED MATERIALS CONTAINING NO ROCKS LARGER THAN 2-INCHES.
3. STANDARD BACKFILL MATERIAL (SBM) SHALL CONFORM TO ODOT 703.01, TYPE A AGGREGATE BASE, OR FLOWABLE FILL PER ODOT SECTION 701.19.
4. THE MINIMUM DEPTH OF EARTH COVER IS 30-INCHES.
5. COMPACTION REQUIREMENTS:
   A. NON- PAVED AREAS: 90% MAXIMUM STANDARD PROCTOR DENSITY FOR COHESIONLESS SOILS AND 85% FOR COHESIVE SOILS.
   B. PAVED AREAS: 95% MAXIMUM STANDARD PROCTOR DENSITY FOR COHESIONLESS SOILS.
6. IF TRENCH IS DRY BEDDING SHALL BE 4-INCH TYPE A AGGREGATE BASE, AND IF WET SHALL BE NO. 57 OR NO. 67 ROCK PER ODOT SECTION 701.06. IF POOR SOIL CONDITIONS ARE ENCOUNTERED, DEPTH SHALL BE OVER EXCAVATED AND STABILIZED WITH AGG BASE.
7. WITH APPROVAL FROM UTILITIES ENGINEER, WATER JETTING MAY BE ALLOWED IN OPEN TRENCHING, BUT NOT UNDER EXISTING OR PROPOSED PAVEMENT.
8. THE BACKFILL MATERIAL SHALL EXTEND A MINIMUM OF 2-FEET BEHIND THE BACK OF CURB, OR THE EDGE OF PAVEMENT WHERE NO CURB EXISTS.
9. WARNING TAPE SHALL BE INSTALLED ABOVE ALL NEW UNDERGROUND PIPING AFTER PLACEMENT OF SELECT BACKFILL AS PER SPECIFICATION 2506.1(J).
10. CONCRETE CRADLE SHALL BE USED WHEN SEWER DEPTH EXCEEDS 16-FEET.
11. ONE(1) CLAY PIPE PLUG OR WATER DAM IS REQUIRED BETWEEN EACH MANHOLE. CLAY DAM SHALL BE THE FULL WIDTH OF THE TRENCH, 5-FEET LONG, AND EXTENDED A MINIMUM OF 24-INCHES ABOVE THE TOP OF THE SEWER MAIN.
12. PIPELINES INSTALLED AT SLOPES GREATER THAN 20% SHALL BE ANCHORED EVERY 16-FEET.

SANITARY PIPE TRENCHING AND BEDDING

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 07	DRAWING NO. SS 01

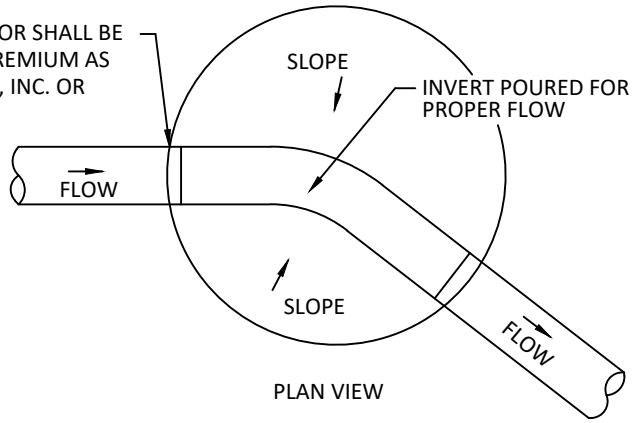


(FLAT TOP)
(WITH ADJUSTMENT RINGS)



(FLAT TOP)
(NO ADJUSTMENT RINGS)

FLEXIBLE PIPE TO MANHOLE CONNECTOR SHALL BE PROVIDED AT ALL OPENINGS. A-LOK PREMIUM AS MANUFACTURED BY A-LOK PRODUCTS, INC. OR APPROVED EQUAL.



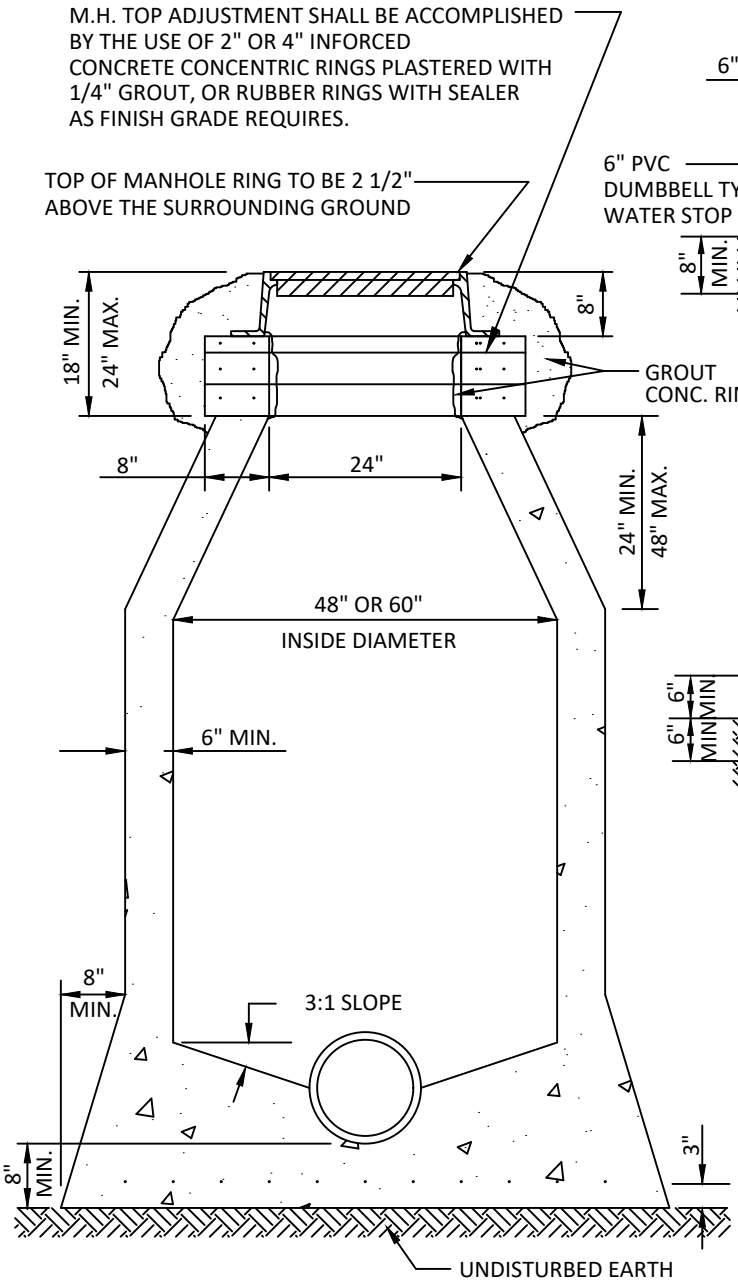
PLAN VIEW

NOTES:

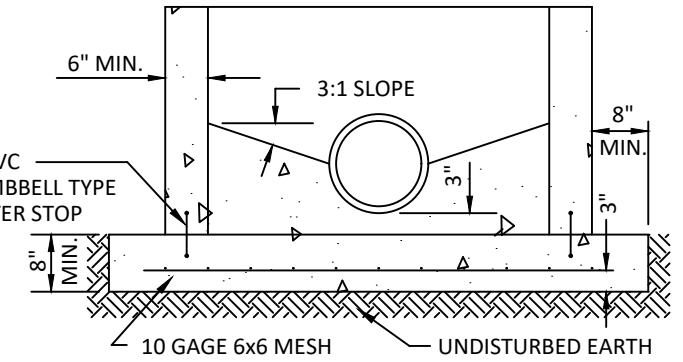
1. MH SHALL CONFORM TO CURRENT ASTM C-478.
2. 8- TO 15-INCH PIPE, 4-FEET ID MANHOLE REQUIRED.
3. 18- TO 27-INCH PIPE, 5'-FEET ID MANHOLE REQUIRED.
4. OVER 27-INCH PIPE MANHOLE ID AS SPECIFIED BY ENGINEER.
5. MIN. CONCRETE STRENGTH TO BE ODOT CLASS A, 3,500 PSI @ 28 DAYS.
6. MANHOLE DEPTH IS VARIABLE, STANDARD MANHOLE DEPTH IS 6'-0".
7. CAST IN PLACE MANHOLES MAY ONLY BE USED WITH WRITTEN PERMISSION OF THE OWNER.
8. MANHOLES LESS THAN 4'-6" IN HEIGHT SHALL HAVE A FULL 4-FEET ID OR LARGER FROM TOP TO BOTTOM.
9. IN ASPHALT STREETS, MANHOLES SHALL HAVE 4-FEET BY 4-FEET BY 8-INCHES CONCRETE COLLARS W/4-#5 DEFORMED REINFORCING BARS.
10. ALL BACKFILL MATERIAL USED AROUND MANHOLE SHALL BE MECHANICALLY TAMPED IN 12"-INCH LIFTS.
11. IF POOR SOIL CONDITIONS ARE ENCOUNTERED, DEPTH SHALL BE OVER EXCAVATED AND STABILIZED WITH ODOT 701.06 NO. 57 OR 67 ROCK.
12. IF MANHOLE IS IN THE STREET THE FRAME SHALL BE INVERTED UP AS SHOWN ON SSO4c SECTION/INVERTED DETAIL.
13. MANHOLE FRAME SHALL BE INVERTED INSIDE THE MANHOLE OR ADJUSTMENT RINGS AND SEALED WITH MASTIC SEALANT (RAM-NECK).
14. 2- OR 4-INCH REINFORCED CONCRETE CONCENTRIC ADJUSTMENT RINGS AS FINISH GRADE REQUIRES, SECURED & SEALED WITH RUBBER RINGS OR MASTIC (RAM-NECK).
15. TOP OF MANHOLE FRAME TO BE 2 1/2-INCHES ABOVE THE SURROUNDING GROUND (TYP.)

PRECAST "SHALLOW" MANHOLE

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SS 02

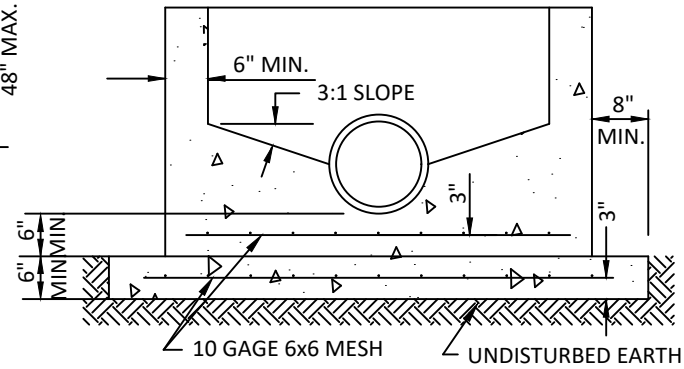


MONOLITHIC CONSTRUCTION

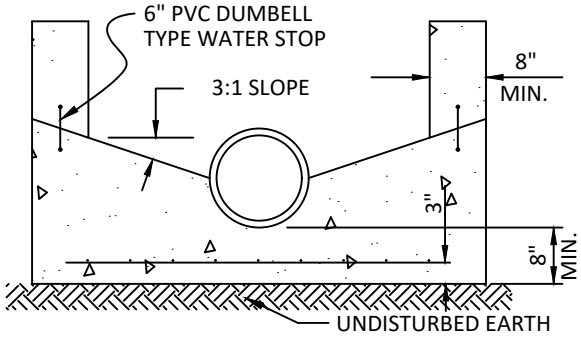


STAGE CONSTRUCTION

ALTERNATE 1



STAGE CONSTRUCTION
ALTERNATE 2



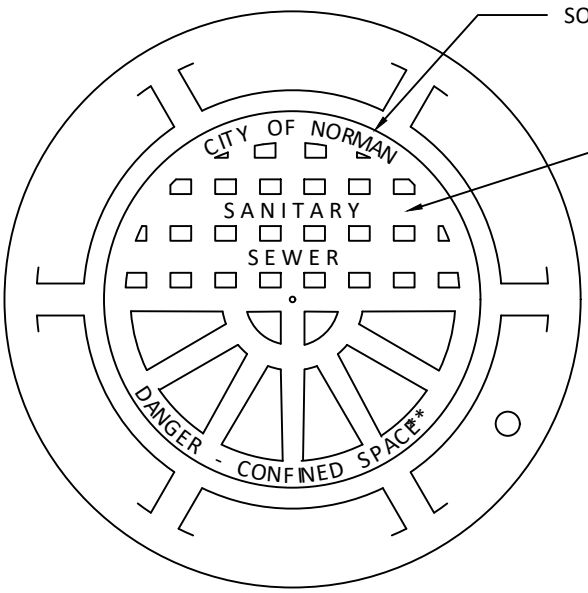
STAGE CONSTRUCTION
ALTERNATE 3

NOTES:

1. LOW SLUMP CONCRETE SHALL BE PLACED IN THE FOOTINGS AND LOWER WALLS, AND SHALL BE PLACE AND VIBRATED IN 12-INCH LIFTS.
2. AN INSPECTOR MUST BE PRESENT BEFORE AND DURING THE PLACING OF THE CONCRETE.
3. THIS MANHOLE SHALL NOT BE USED IN PAVED STREETS OR OTHER TRAVELED AREAS.
4. THE CONCRETE MUST SET FOR 48 HOURS BEFORE PIPE INSIDE OF MANHOLE IS TRIMMED.
5. ALTERNATE 3 INVERT MUST BE FORMED AT TIME OF BOTTOM POUR.
6. WATER STOPS MAY BE ELIMINATED IF BARREL OF MANHOLE IS POURED WITHIN 4 HOURS AFTER BASE IS CLEANED OF ALL MUD, SILT AND DEBRIS.
7. MIN. CONCRETE STRENGTH TO BE ODOT CLASS A, 3,500 PSI.
8. IN ASPHALT STREETS, MANHOLES SHALL HAVE 4-FEET BY 4-FEET BY 8-INCHES CONCRETE COLLAR W/4-#6 REINFORCING BARS.
9. 8- TO 18-INCH PIPE, 4-FEET ID MANHOLE REQUIRED.
10. 21- TO 27-INCH PIPE, 5-FEET ID MANHOLE REQUIRED.
11. OVER 27-INCH PIPE, MANHOLE I.D. SPECIFIED BY ENGINEER.

CAST IN PLACE MANHOLE

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 05	DRAWING NO. SS 03



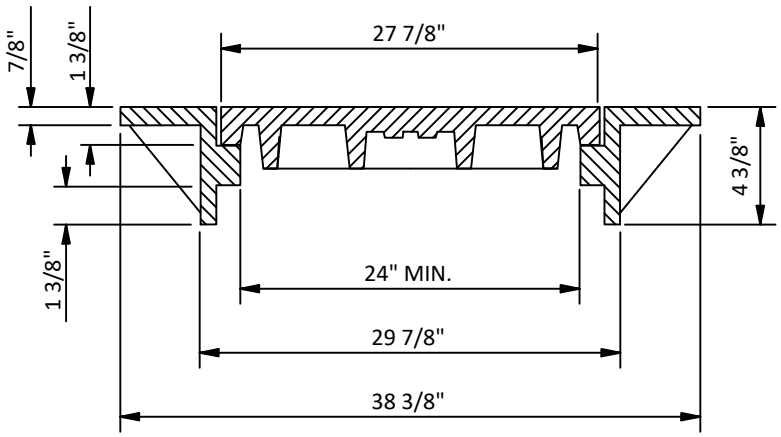
LETTERING

* CITY OF NORMAN
* SANITARY SEWER
* CONFINED SPACE ADVISORY

PLAN

NOTE:

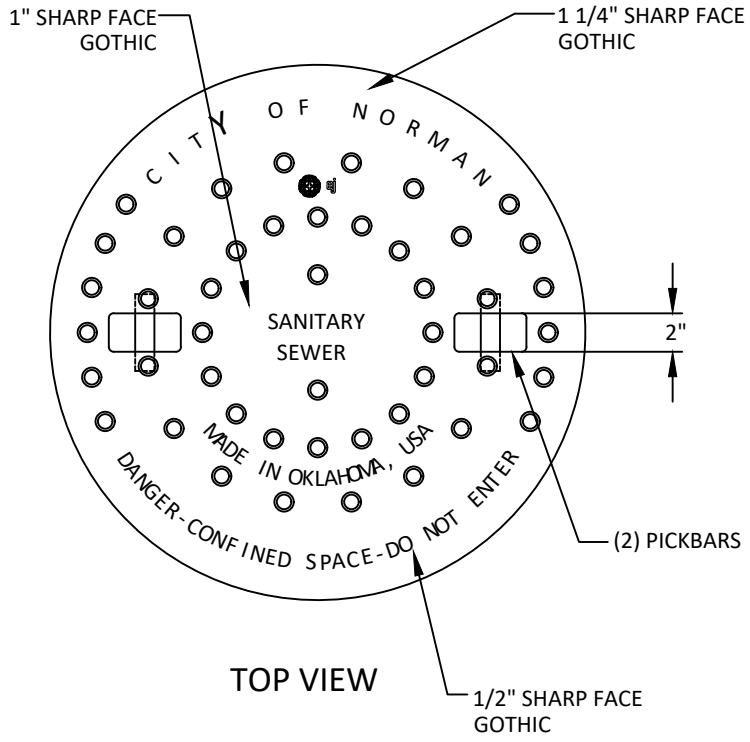
1. ACCEPTABLE UNITS:
   A. NEENAH NO. R-1682
   B. WESTERN NO. 100
   C. POINT-A-MOUSSON NO. GTS, CLASS 400
   D. EAST JORDAN IRON WORKS 2100CSE



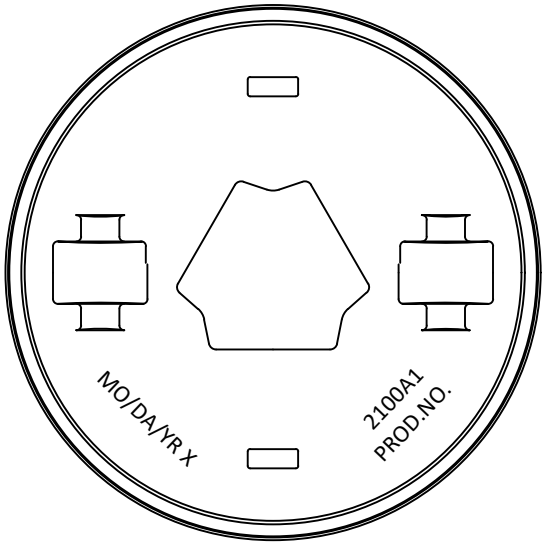
SECTION

MANHOLE FRAME AND COVER

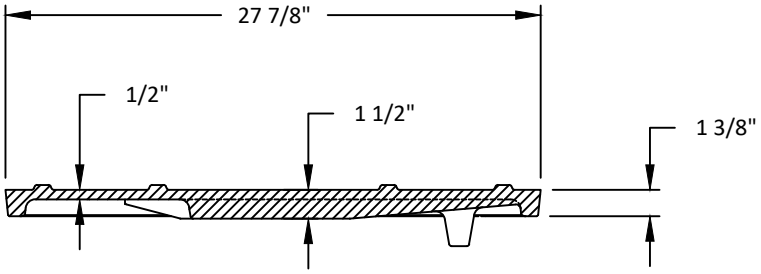
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 03	DRAWING NO. SS 04



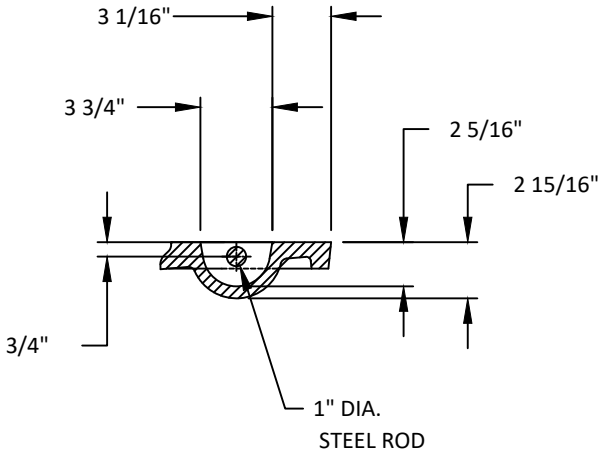
TOP VIEW



BOTTOM VIEW



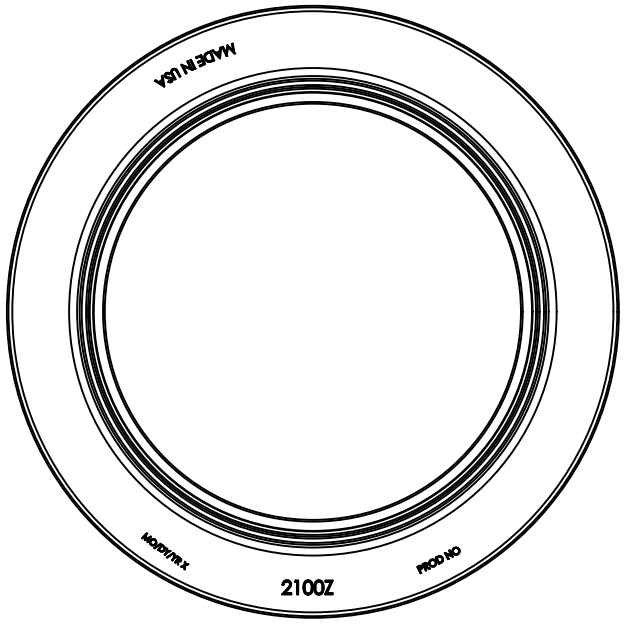
SECTION



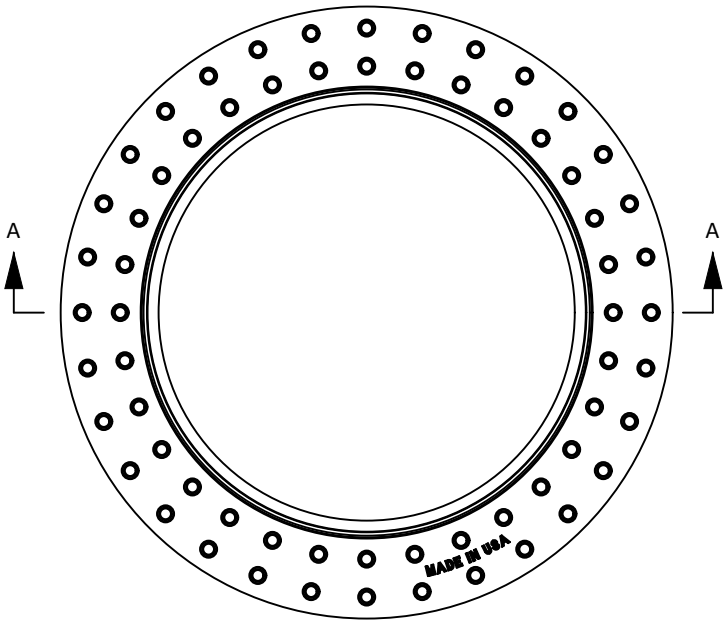
PICKBAR DETAIL

SANITARY SEWER MANHOLE COVER

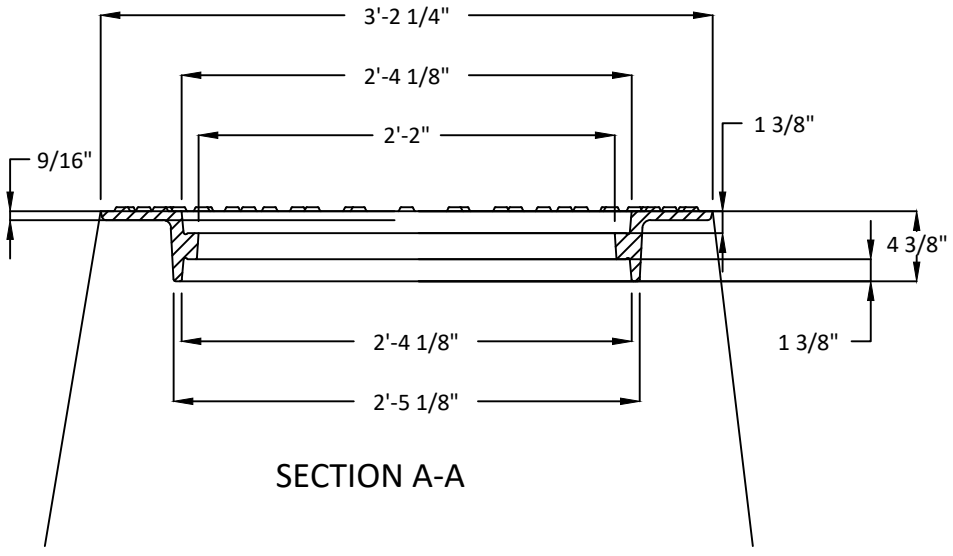
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SS 04B



BOTTOM FLANGE VIEW



TOP FLANGE VIEW



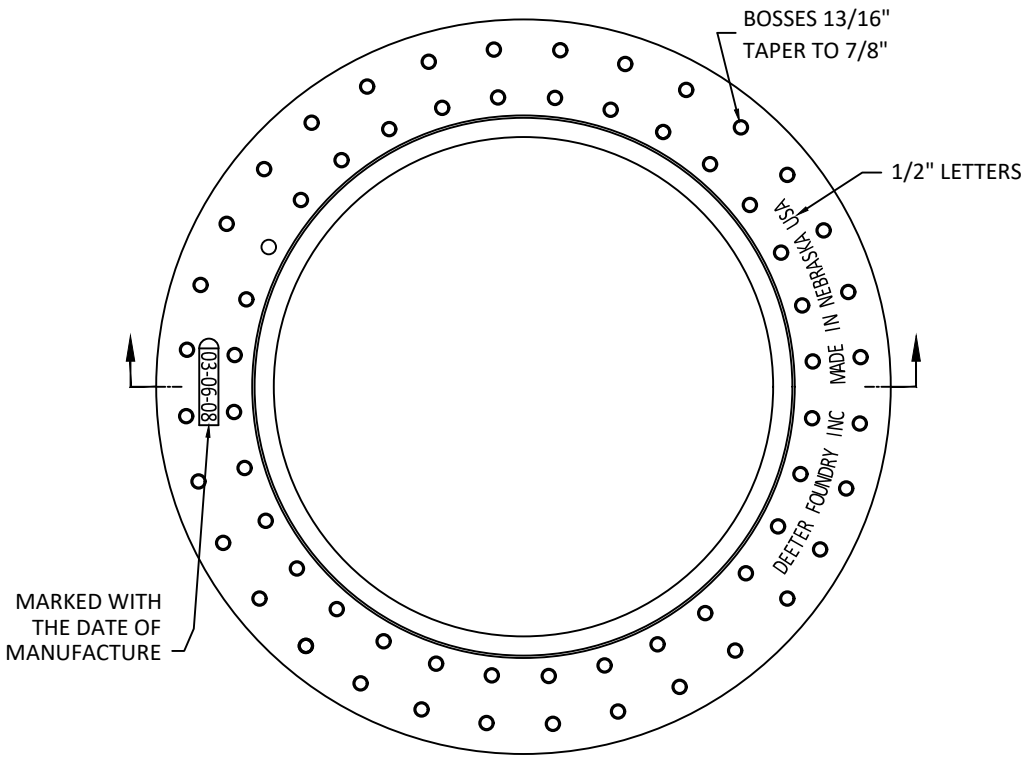
SECTION A-A

NOTE:

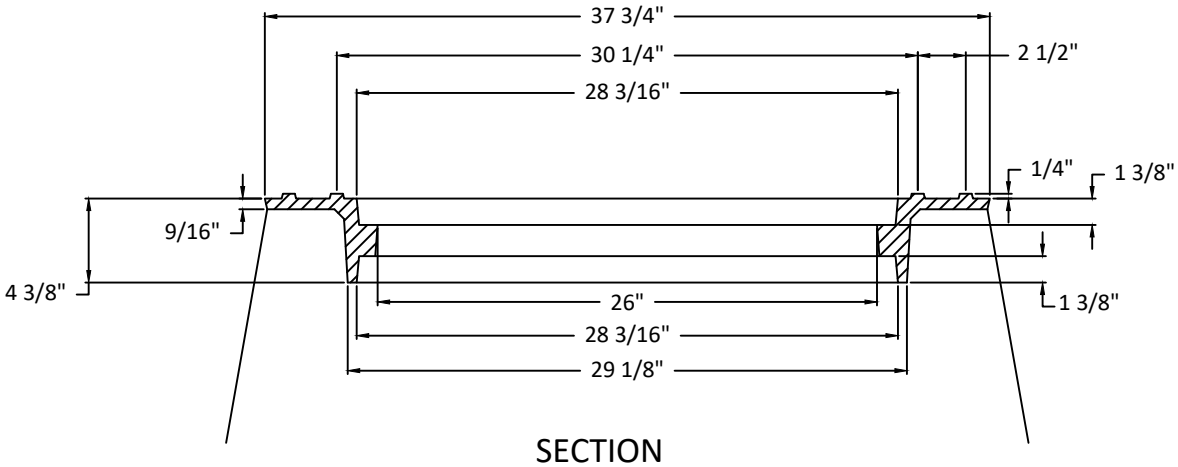
1. RING IS REVERSIBLE, CAN BE INSTALLED AS BOTTOM FLANGE UNIT.

REVERSIBLE SANITARY SEWER MANHOLE FRAME

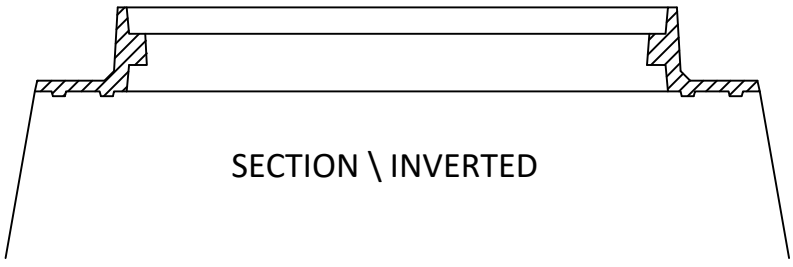
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SS 04C



TOP VIEW



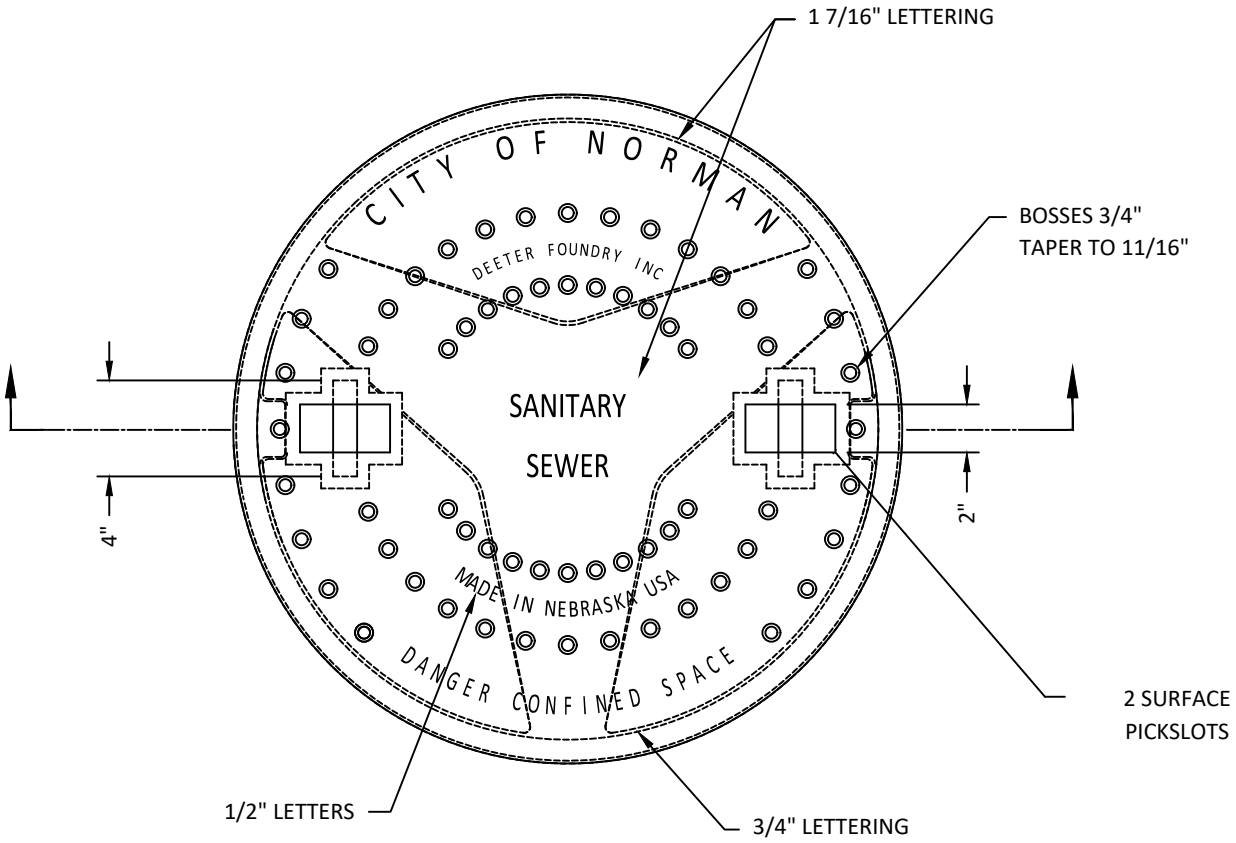
SECTION



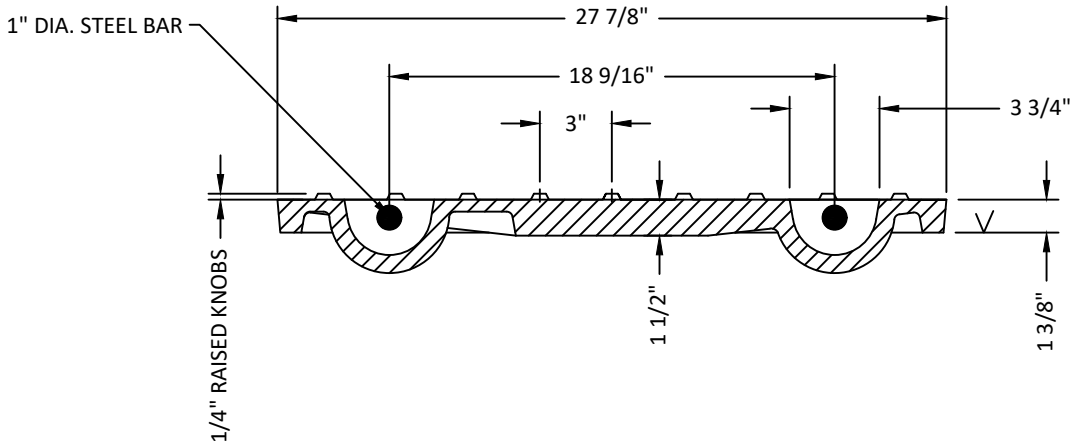
SECTION \ INVERTED

REVERSIBLE SANITARY SEWER MANHOLE FRAME

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SS 04D



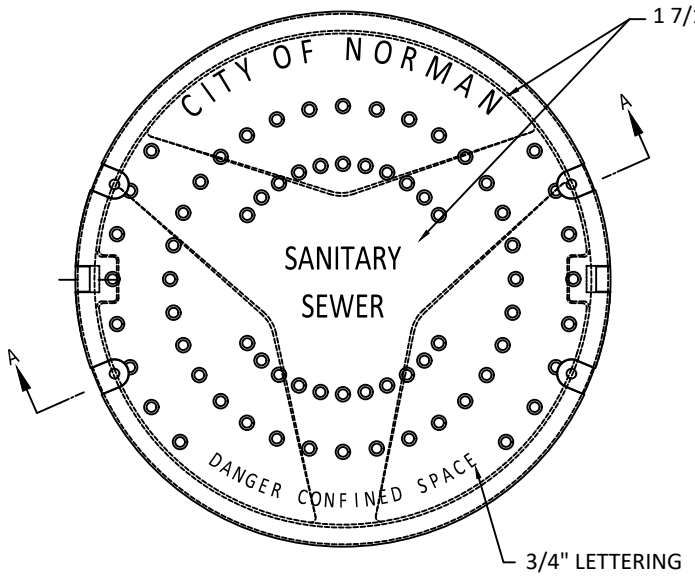
TOP VIEW



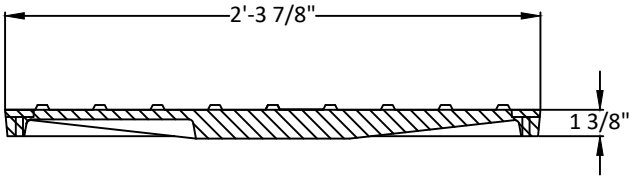
SECTION

SANITARY SEWER MANHOLE COVER

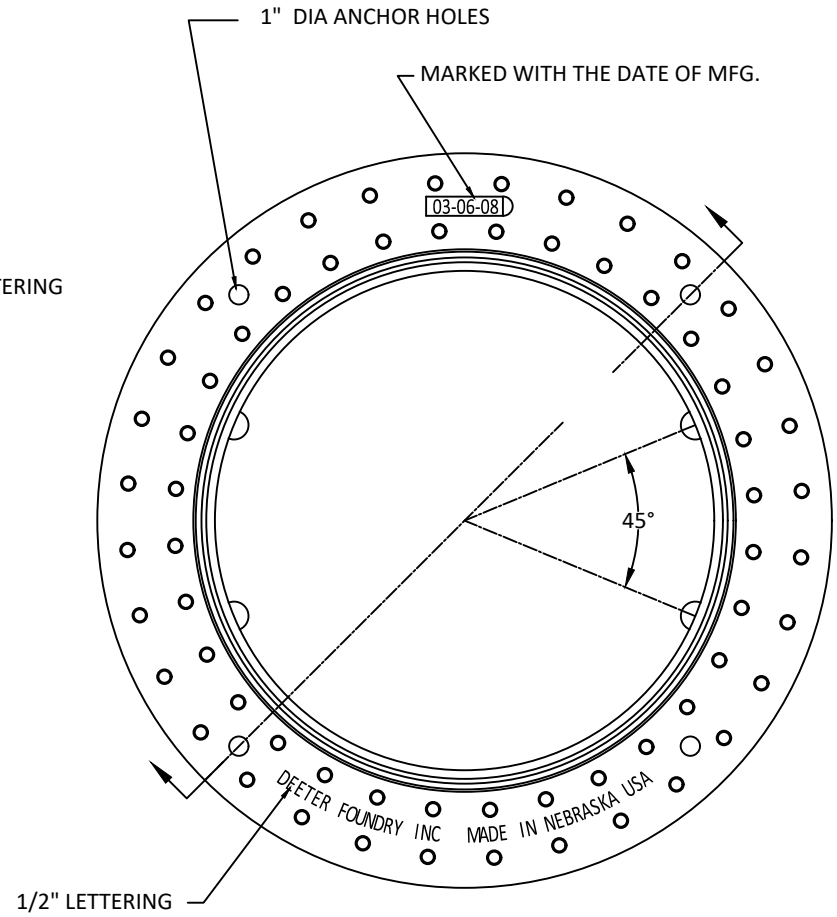
CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SS 04E



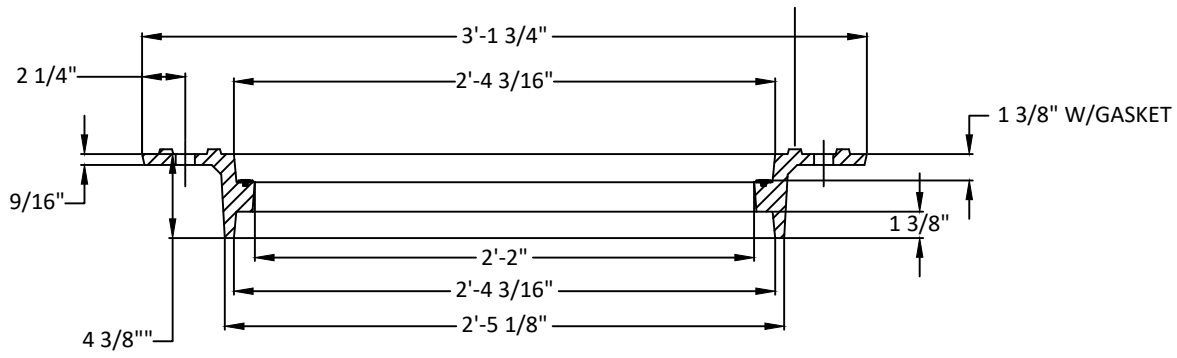
TOP VIEW



SECTION



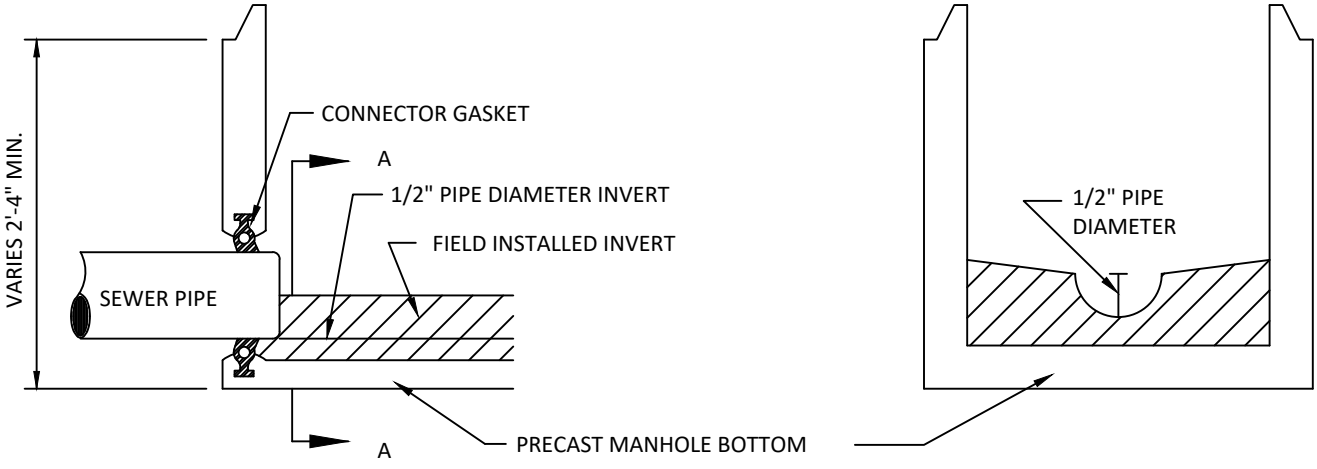
TOP VIEW



SECTION

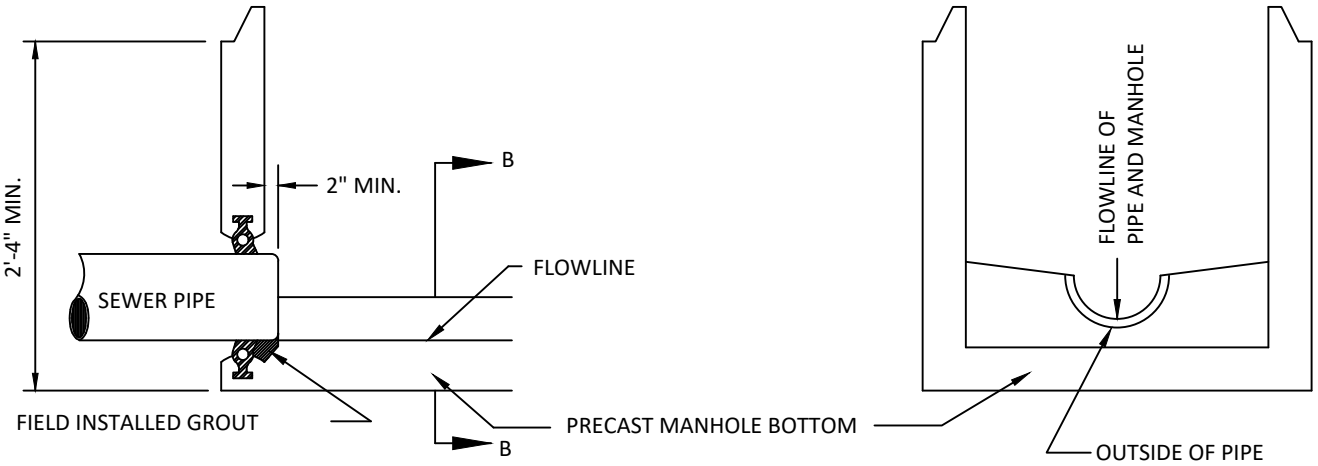
BOLT DOWN SANITARY SEWER MANHOLE FRAME & COVER

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SS 04F



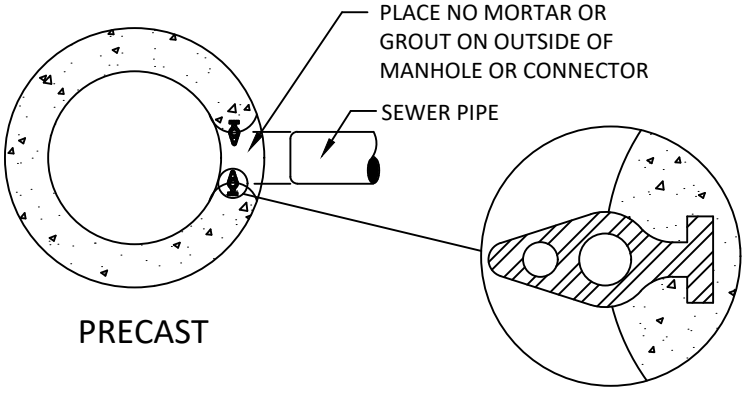
TYPE A MANHOLE

SECTION A-A

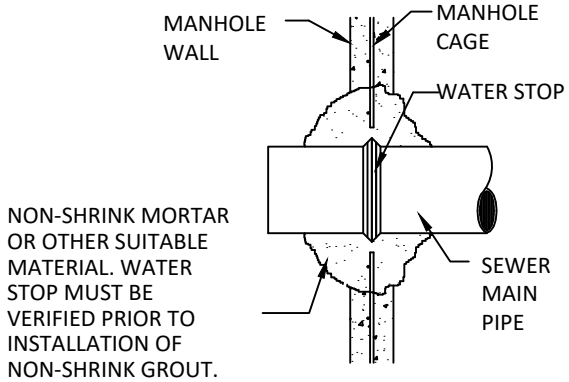


TYPE B MANHOLE

SECTION B-B



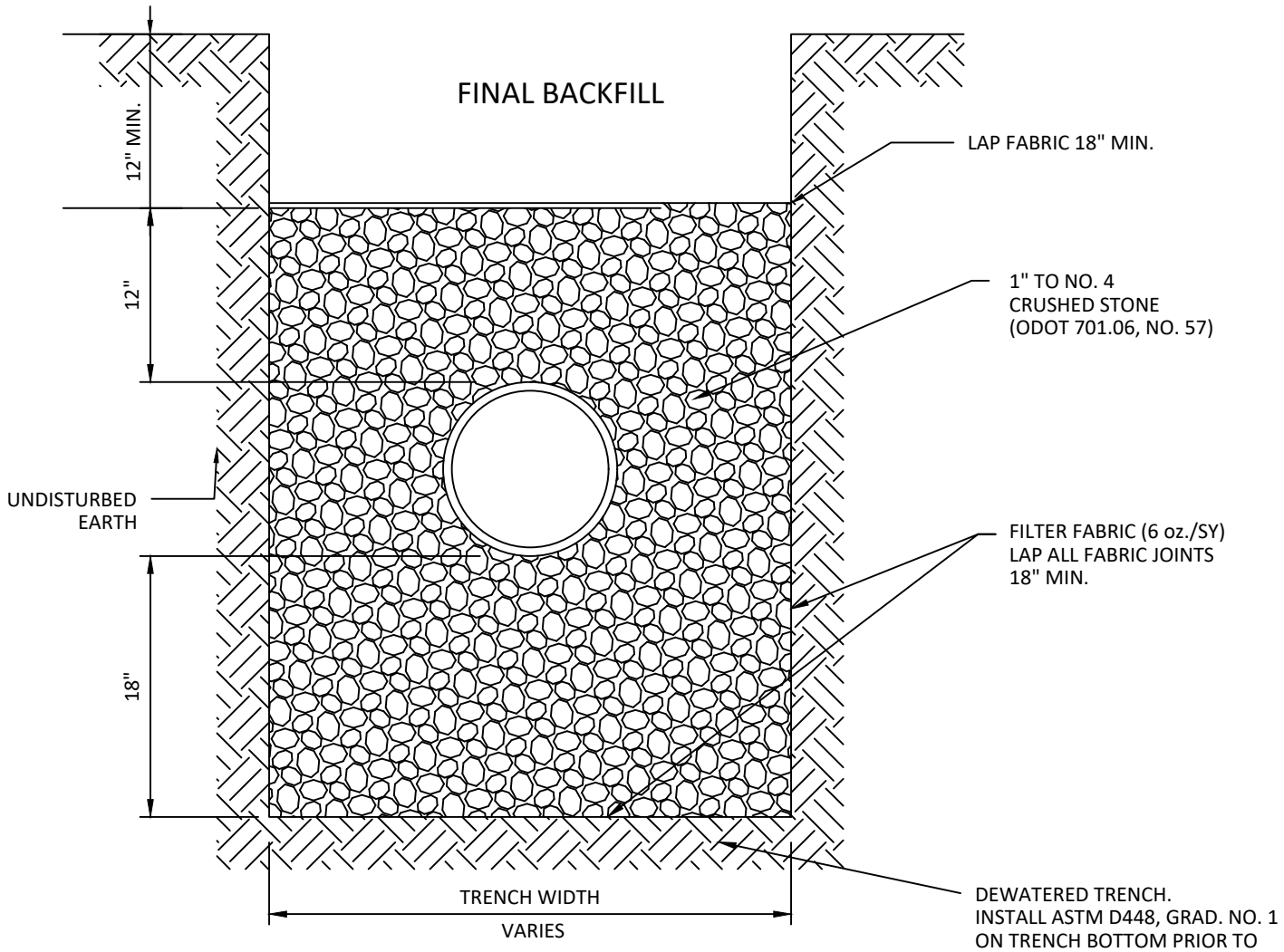
PRECAST



INSTALLED IN THE FIELD

MANHOLE CONNECTIONS

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SS 05



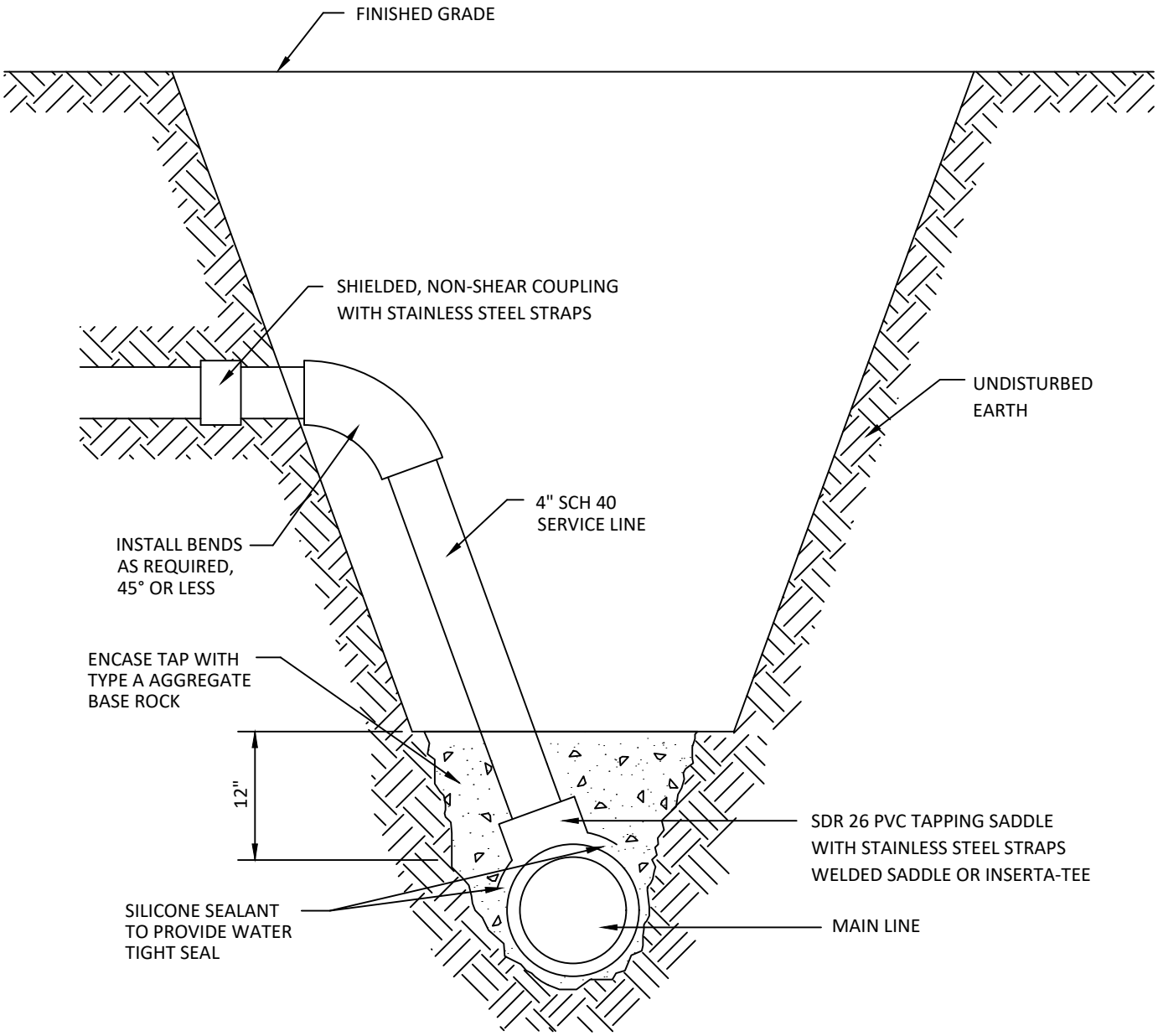
MINIMUM TRENCH WIDTH FOR PVC PIPES	
PIPE I.D.	MIN. TRENCH WIDTH
IN.	FT.
6" - 12"	3' - 0"
15" - 18"	4' - 6"
21" - 24"	6' - 0"

NOTES

1. NOT ALL OTHER PIPE MATERIALS, USE THE STANDARD TRENCH WIDTH (SS 01).
2. FOR ALL PIPES GREATER THAN 24-INCHES, TRENCH DESIGN SHALL BE APPROVED BY THE UTILITIES ENGINEER.
3. SLIDING TRENCH SUPPORTS SHALL NOT BE PLACED BELOW THE TOP OF PIPE. BACKFILL ABOVE WATER TABLE SHALL MATCH SS01.

WATER TABLE CRADLE FOR FLEXIBLE PIPE

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 02	DRAWING NO. SS 06

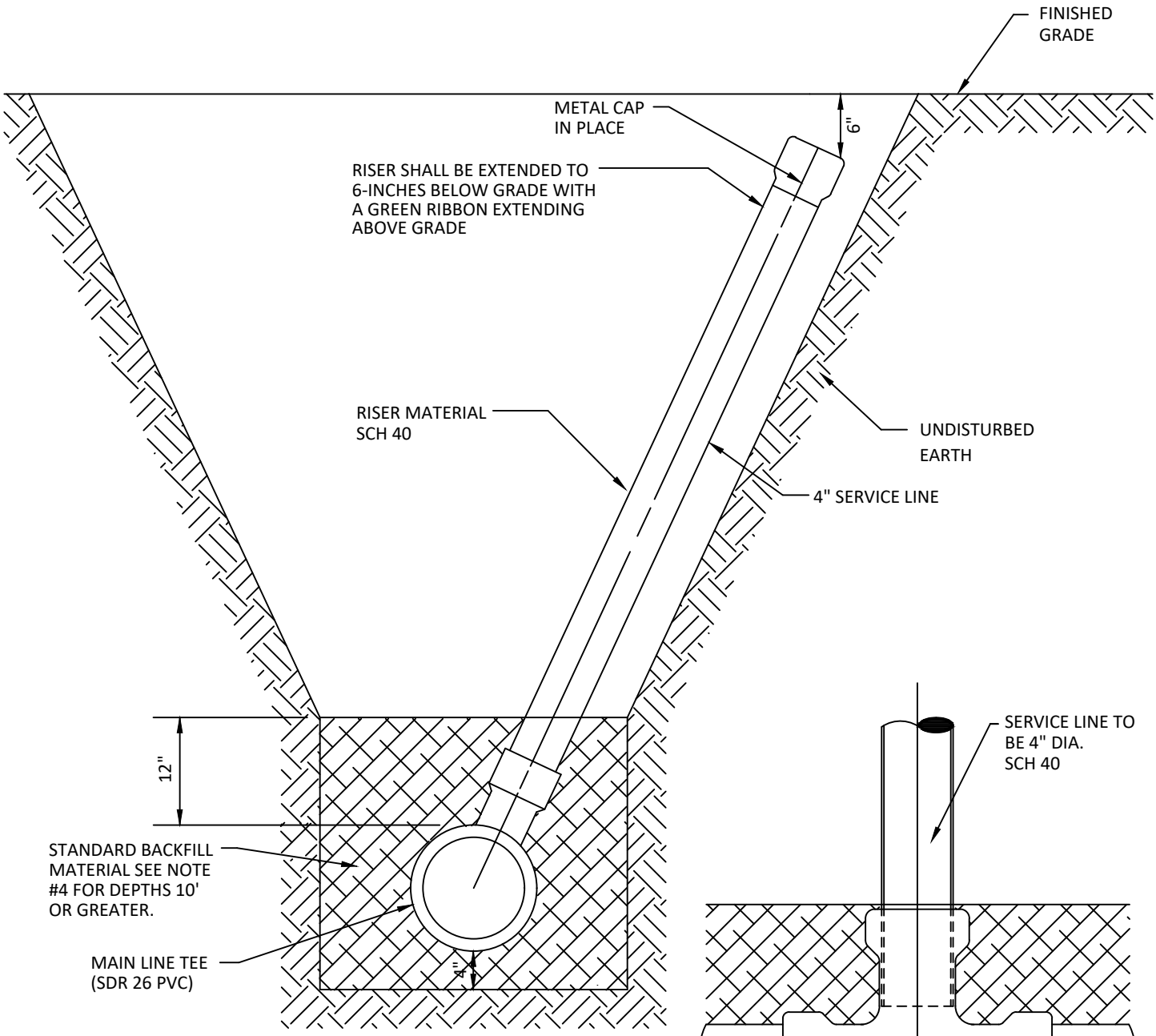


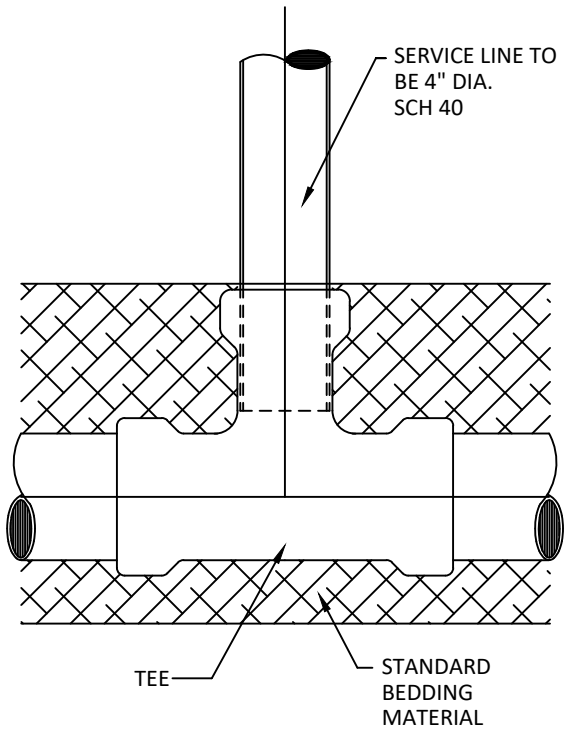
NOTES:

1. ALL MAIN LINE HOLES TO BE CORE DRILLED AND COUPON PRESENTED AT TIME OF INSPECTION.
2. TAPS SHALL BE LEFT UNCOVERED UNTIL TAP IS INSPECTED BY LINE MAINTENANCE.
3. THE CONTRACTOR SHALL DRILL OR SAW A 4-INCH DIAMETER HOLE INTO THE EXISTING SEWER MAIN.
4. THERE SHALL BE A MINIMUM OF 2-INCHES FROM THE EDGE OF THE HOLE TO THE OUTSIDE EDGE OF THE TAPPING SADDLE.
5. ON AN EXISTING TAP THAT IS BEING REPAIRED, IF THE HOLE IS LARGER THAN 4-INCH DIAMETER OR THE PIPE IS IN POOR CONDITION, THEN THAT SECTION OF SANITARY SEWER PIPE SHALL BE REPLACED. SAID PIPE SHALL BE REPLACED WITH SDR 35 PVC TO A POINT UNTIL SOUND PIPE IS FOUND. THE MINIMUM LENGTH OF PIPE TO BE REPLACED IS 4-FEET. CITY WILL PROVIDE PLUMBER WITH COUPLINGS OR ADAPTERS AND PIPE TO REPLACE BROKEN SEWER LINE. WORK WILL BE INSPECTED BY LINE MAINTENANCE BEFORE BEDDING IS INSTALLED OVER PIPE.
6. FOR CLAY PIPE ONLY, A FLEXIBLE SADDLE MAY BE USED. THE SADDLE SHALL BE A DFW/HPI FLEXIBLE SADDLE AS MANUFACTURED BY "DFW QUALITY PRODUCTS BY NDS" OR EQUAL. WHEN INSTALLING A FLEXIBLE SADDLE, THE ABOVE REQUIREMENTS STILL APPLY.
7. FOR VERTICAL SERVICE, AN ADDITIONAL BEND WILL BE REQUIRED. THE USE OF 90 DEGREE BENDS IS NOT ALLOWED.

TAPPING A SANITARY SEWER LINE

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 04	DRAWING NO. SS 07A



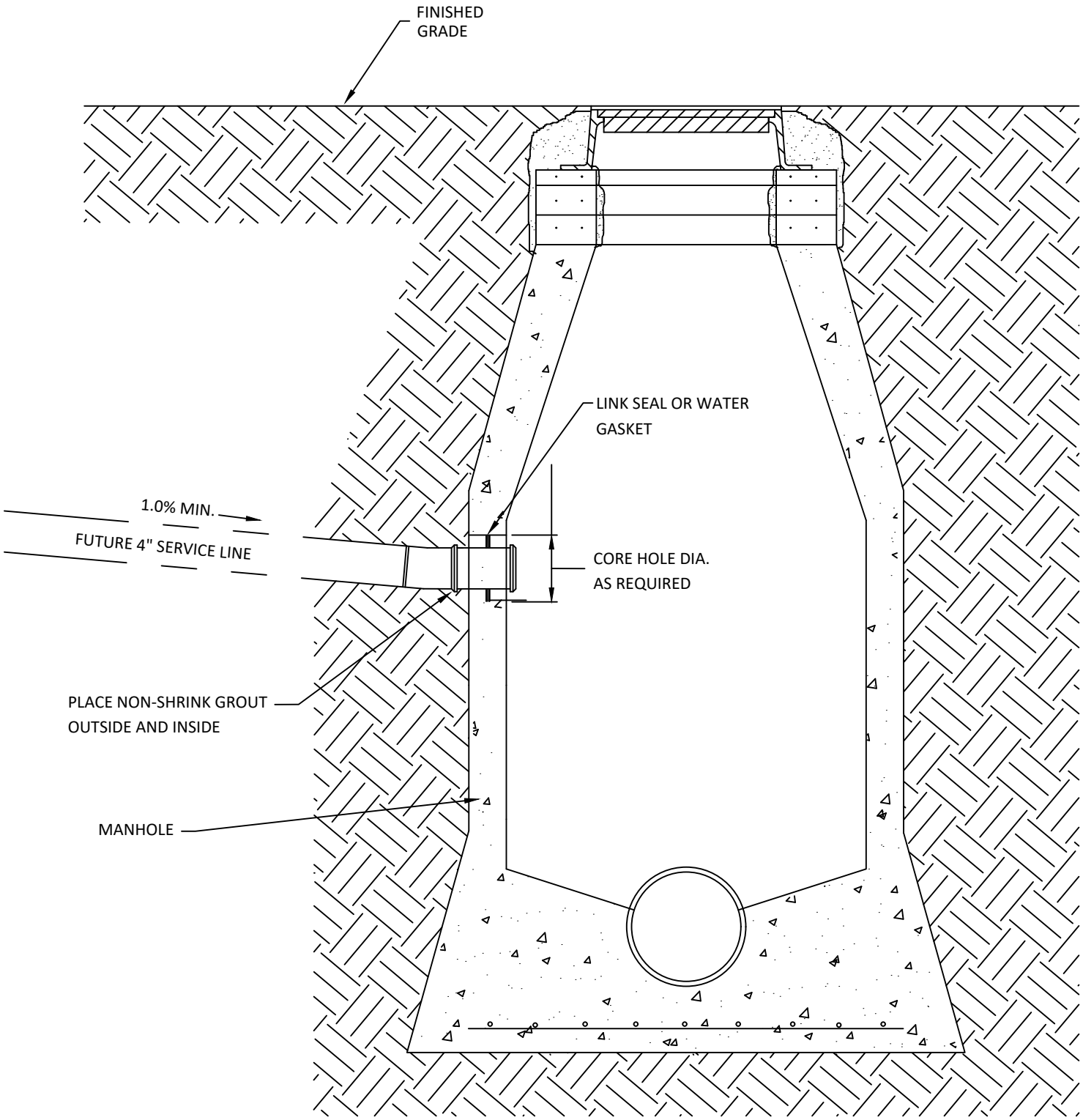


NOTES:

1. ALL NEW SANITARY SEWER LINES SHALL HAVE TAPS INSTALLED AS SHOWN ON THIS DETAIL.
2. LOOKING UPSTREAM, ALL TAPS TO THE LEFT SHALL BE INSTALLED 10-FEET UPSTREAM FROM THE PROPERTY CORNER AND ALL TAPS TO THE RIGHT SHALL BE INSTALLED 15-FEET UPSTREAM FROM THE PROPERTY CORNER.
3. FOR NARROW TRENCHES USE 4-INCH SDR 35 PVC RATHER THAN SCH 40.
4. DEPTHS OF 10-FEET OR GREATER THE BEDDING AROUND TEE SHALL BE IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS.

SANITARY SEWER TEE AND RISER

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 05	DRAWING NO. SS 08

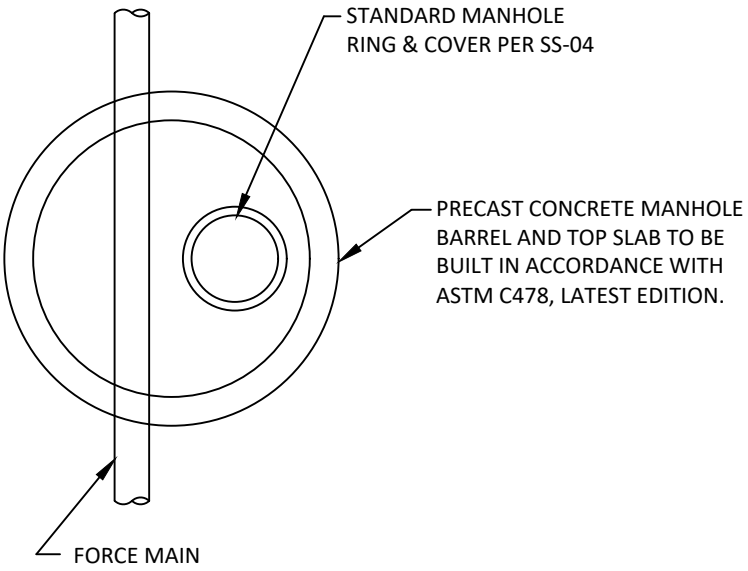


NOTE:

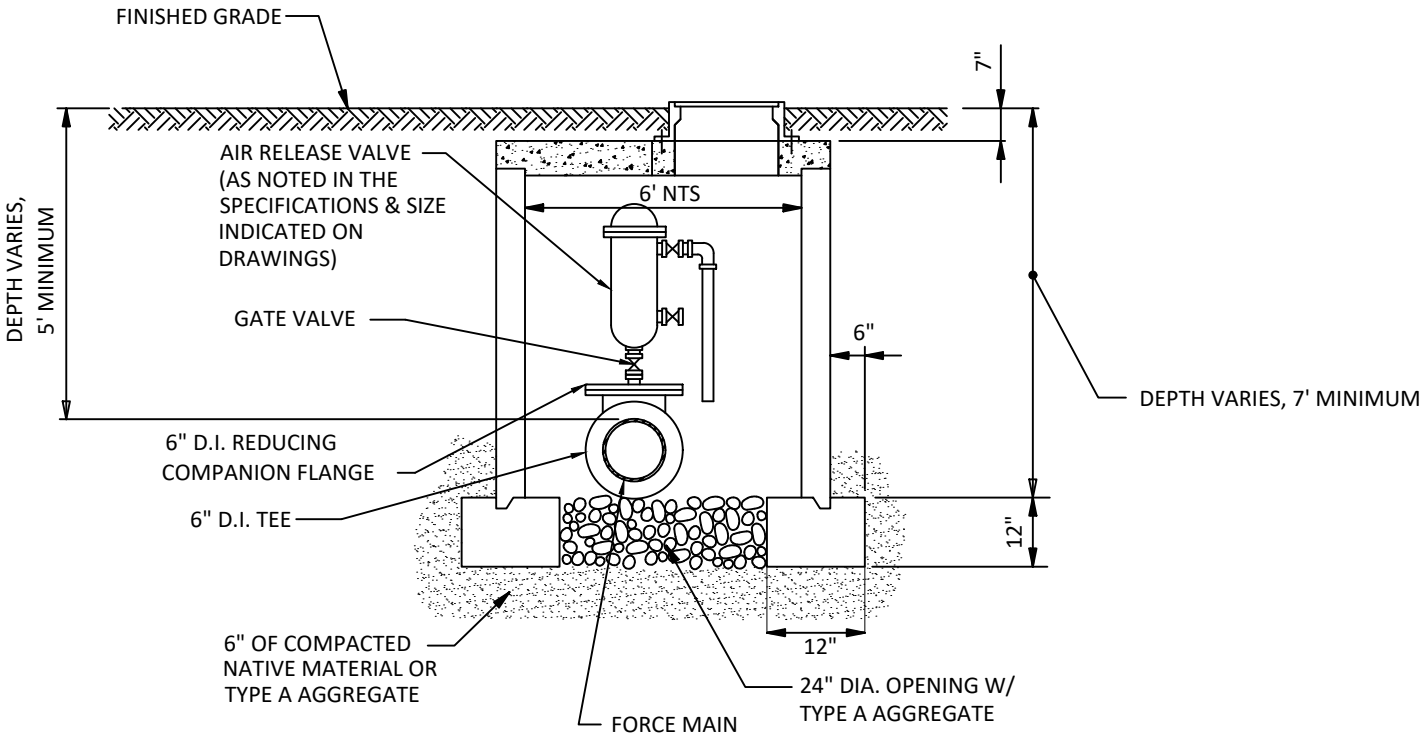
1. LINE MAINTENANCE WILL INSPECT CORE HOLE AND LINK SEAL OR WATER STOP.
2. ODEQ HAS GRANTED NUA A VARINCE FROM ITS REQUIRED DROP MANHOLE-(NONE REQUIRED)

SANITARY SEWER TAP AT MANHOLE

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 02	DRAWING NO. SS 10



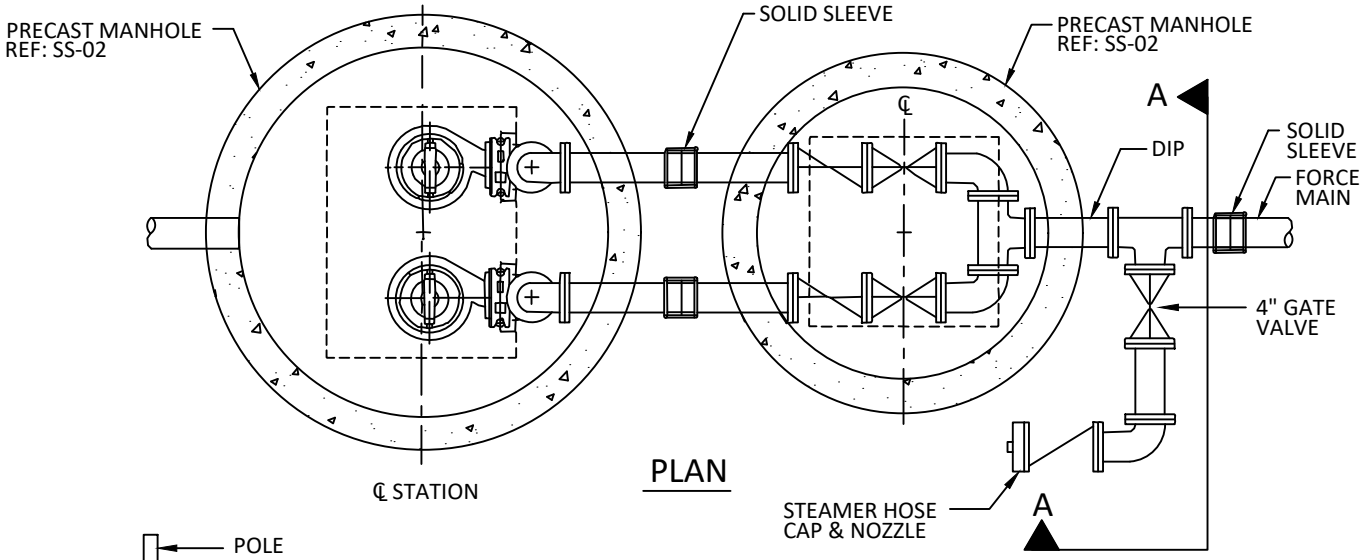
PLAN

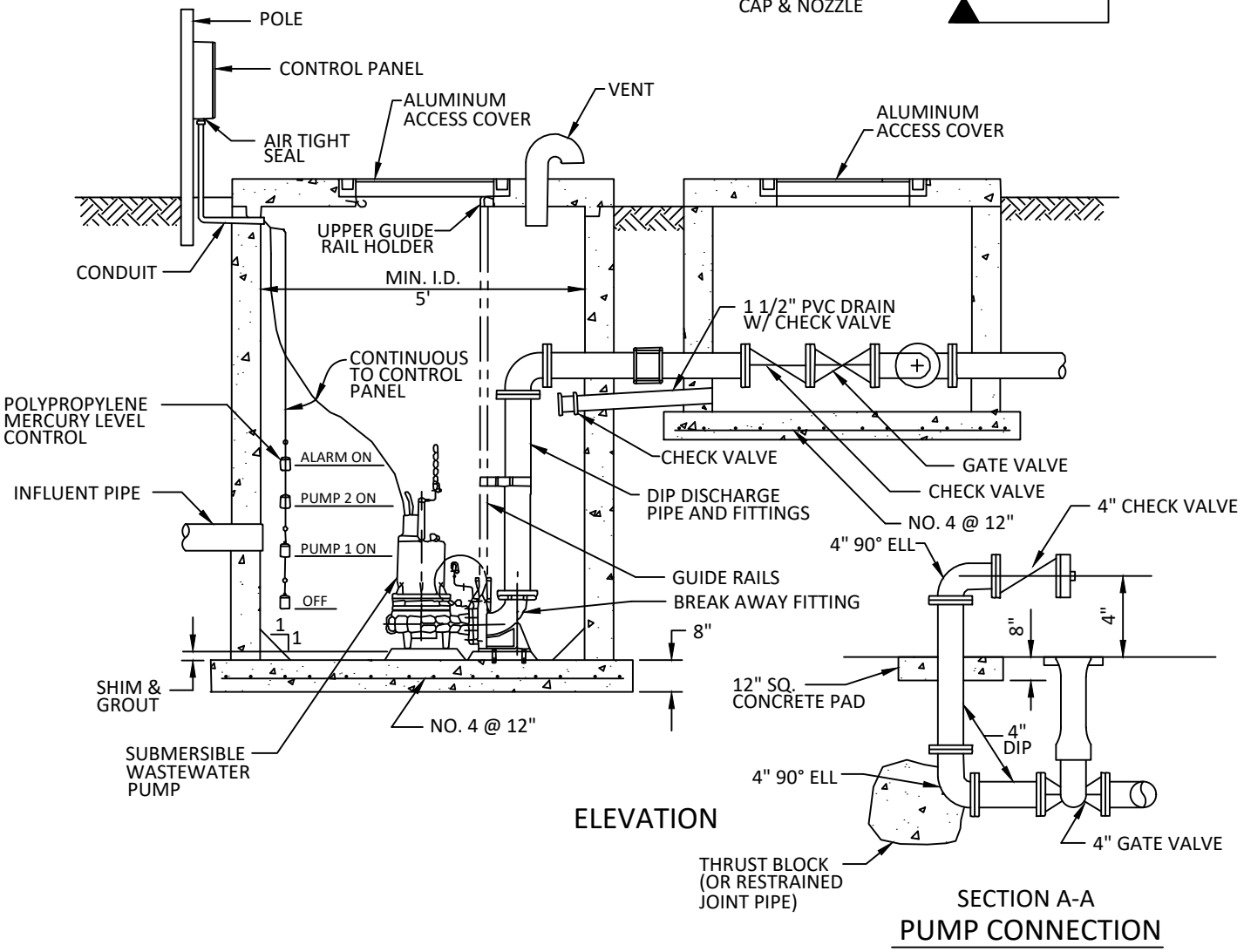


SECTION

SANITARY SEWER AIR RELIEF VALVE

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SS 11

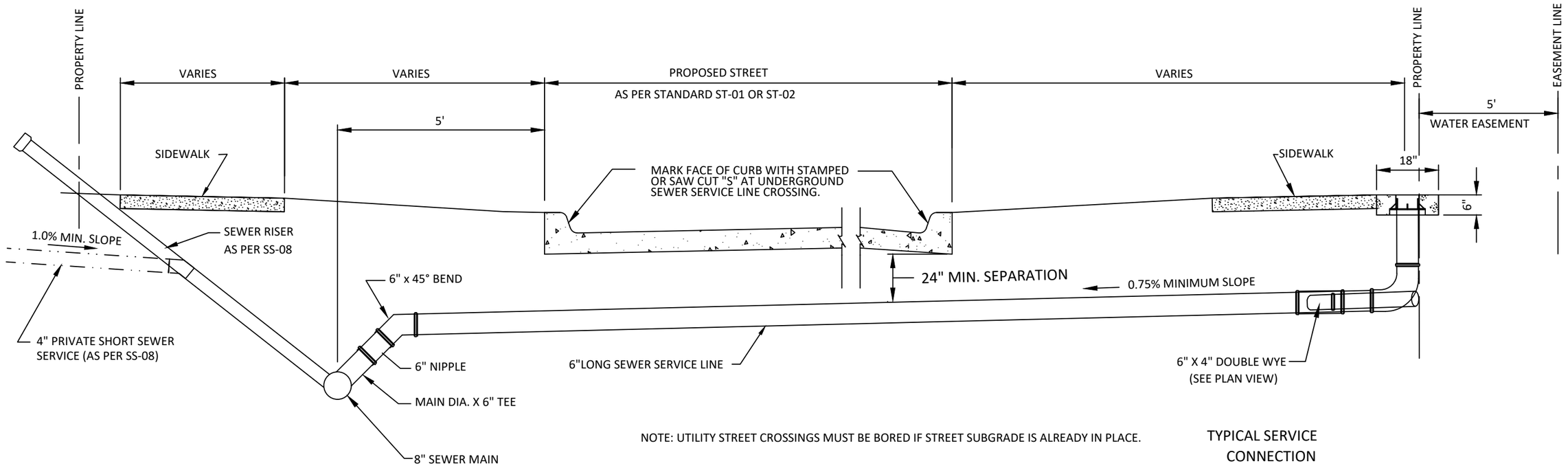




SUBMERSIBLE LIFT STATION

CITY ENGINEER APPROVAL:		CITY OF NORMAN, OKLAHOMA	
APPROVAL DATE:	REVISION DATE: 01/2023	REV. NO. 01	DRAWING NO. SS 13

Rev. No. 1



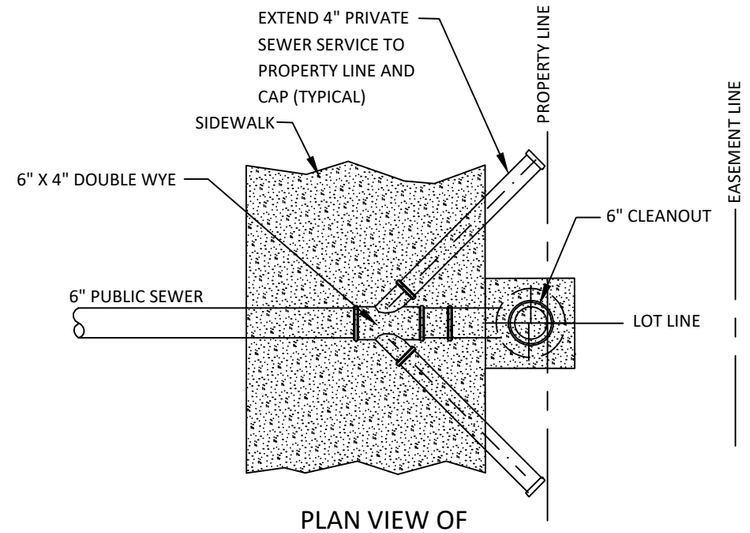
NOTE: UTILITY STREET CROSSINGS MUST BE BORED IF STREET SUBGRADE IS ALREADY IN PLACE.

TYPICAL SERVICE CONNECTION

LOCAL OR COLLECTOR STREET
6" SEWER SERVICE LINE INSTALLATION

NOTES :

1. THIS STANDARD INDICATES THE DESIRED GEOMETRIC CONFIGURATION REFERENCED TO STREET PAVING AND PROPERTY LINES.
2. ALL SEWER SERVICE LINES AND FITTINGS INSTALLED WITHIN THE STREET RIGHT-OF-WAY (ROW) SHALL BE SDR 26 PVC PIPE OR BETTER.
3. LONG SEWER SERVICES FOR TWO ADJACENT LOTS SHALL BE PROVIDED IN ONE TRENCH. THE DEVELOPER/CONTRACTOR HAS THE OPTION OF INSTALLING A SINGLE 6-INCH DIAMETER PUBLIC SERVICE LINE WITH DOUBLE WYE AND TERMINATION MANHOLE AS DETAILED HEREIN OR TWO 4-INCH PRIVATE SERVICE LINES WITH INDIVIDUAL RISERS AT THE PROPERTY LINE.
4. THE MINIMUM VERTICAL SEPARATION BETWEEN THE STREET BASE AND THE TOP OF THE LONG SEWER SERVICE PIPE IS 24-INCHES.
5. THE MINIMUM VERTICAL GRADE DIFFERENCE FOR A 6-INCH PUBLIC SEWER SERVICE LINE IS 24-INCHES AS MEASURED BY SUBTRACTING THE FLOW LINE OF THE MAIN SEWER FROM THE FLOW LINE OF THE TERMINATION MANHOLE.
6. MINIMUM DOWNWARD SLOPE OF A SEWER SERVICE LINE CROSSING THE STREET ROW IS 1.00% FOR 4-INCH PIPE AND 0.75% FOR 6-INCH PIPE.
7. BACKFILL FOR SEWER SERVICES BENEATH AND 2-FEET EITHER SIDE OF THE ROADWAY SHALL BE SBM AS PER SS-01.
8. SHORT SERVICE LINES SHALL BE CONSTRUCTED AS PER SS 08 EXCEPT THAT THE SERVICE LINE SHALL BE EXTENDED SO THAT A VERTICAL RISER TERMINATES JUST BEYOND THE PROPERTY LINE.
9. ALTERNATE CONFIGURATIONS MAY BE INSTALLED IN LIEU OF THAT SHOWN UPON APPROVAL OF THE UTILITIES ENGINEER.



PLAN VIEW OF
SEWER LAMPHOLE WITH DOUBLE WYE SEWER SET

ENGINEERING DIVISION, CITY OF NORMAN

6" SEWER SERVICE CONNECTION INSTALLATION

APPROVED BY: CITY ENGINEER	DATE: 01/2023	DRAWING NO: SS 14