



ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT  
CONSTRUCTION STANDARDS

2019 EDITION

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**ST. MARY'S GLACIER WATER SANITATION DISTRICT**  
**CONSTRUCTION STANDARDS**  
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**2019 EDITION**



ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT  
CONSTRUCTION STANDARDS

Chapter 1

General Requirements

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**CHAPTER 1**  
**GENERAL REQUIREMENTS**

**1.00.0 INTENT**

The intent of these CONSTRUCTION STANDARDS is to provide MINIMUM standards to safeguard life, health, property, and public welfare by regulating and controlling the design, construction, quality of materials, use, location, and maintenance of all public improvements and private improvements of common ownership including, but not limited to, sanitary sewer systems and potable water supply systems, and appurtenances thereto.

The intent of these CONSTRUCTION STANDARDS is also to insure that the St. Mary's Glacier Water & Sanitation District (District) receives public facilities which are constructed with the quality and materials such that the facility meets or exceeds the normal service life requirements for similar installations and to insure that when said facilities are transferred to the District's ownership that they will be free from all defects and in suitable working order to provide the service capabilities anticipated with such a facility.

**1.01.0 TITLE**

These regulations, together with all future amendments, shall be known as the CONSTRUCTION STANDARDS for the Design and Construction of District Improvements, 2019 Edition, and may be cited as such and will be referred to herein as the CONSTRUCTION STANDARDS.

**1.02.0 APPLICABILITY**

Any reference to District CONSTRUCTION STANDARDS, construction regulations, or the like in any District ordinance, contract, policy, permit, license or regulations shall be deemed to mean these documents. These CONSTRUCTION STANDARDS shall apply to construction, alteration, moving, removal, conversion, demolition, repair, and excavation of any public improvements or private improvements of common ownership specifically regulated herein. The provisions of these CONSTRUCTION STANDARDS applies to District contracts, utility extension agreements, and contracts made for the development of property within the District service area. In the case of District capital improvement contracts, the project specifications may supersede or modify these CONSTRUCTION STANDARDS.

Alterations, additions or repairs to existing improvements shall comply with all requirements of these CONSTRUCTION STANDARDS unless specifically exempted, in writing, by the District. The District retains the right to require additional information, criteria, or requirements as conditions may warrant. Provisions of District ordinances inconsistent with these CONSTRUCTION STANDARDS shall control.

**1.03.0 INTERPRETATION**

In the interpretation of the provisions of these CONSTRUCTION STANDARDS, the following shall govern:

- (A) In its interpretation, the provisions of these CONSTRUCTION STANDARDS shall be regarded as the minimum requirements for the protection of the public health, safety, comfort, convenience, prosperity, and welfare of the residents of the District.
- (B) Whenever a provision of these CONSTRUCTION STANDARDS or any provision in any

law, ordinance, resolution, rule or regulation of any kind, contain any restrictions covering any of the same subject matter, whichever standards produce higher quality shall govern.

**1.04.0 ENFORCEMENT RESPONSIBILITY**

It shall be the duty of the District Manager or his representative to interpret and enforce the provisions of these CONSTRUCTION STANDARDS.

**1.05.0 VIOLATIONS**

No person, firm, or corporation shall construct, enlarge, alter, repair, move, improve, remove, excavate, convert, or demolish any public improvements or private improvements in common ownership or permit the same to be done in violation of these CONSTRUCTION STANDARDS. Whenever any work is being done contrary to the provisions of these CONSTRUCTION STANDARDS, the District Manager or his/her designee may order the work stopped by a written notice in accordance with Section 1.26.4 of these CONSTRUCTION STANDARDS.

**1.06.0 VARIANCES**

The provisions of these CONSTRUCTION STANDARDS are not intended to prevent the use of any material or method of construction not specifically prescribed by these standards, provided any alternate has been previously approved and its use authorized in writing by the District. Whenever there are practical difficulties involved in carrying out the provisions of these procedures, the District may grant a variance for individual cases, provided that the District shall first find that a unique reason makes these standards impractical and that the modification is in conformity with the intent and purpose of these standards, and providing that such variance does not lessen any design requirements or any degree of structural or operational integrity. The District shall require that sufficient specifications, evidence, justification, and/or proof be submitted to substantiate any claims that may be made regarding the alternate material, detail, or technique. The District, in its sole discretion, will decide upon the acceptability of any proposed variance.

**1.07.0 AMENDMENTS AND REVISIONS**

These CONSTRUCTION STANDARDS may be amended as new technology is developed and/or if experience gained in the use of these CONSTRUCTION STANDARDS indicate a need for revision. The District shall have full power and authority to promulgate rules, regulations, or new standards of a technical nature, which rules, regulations, or standards shall be effective immediately upon their approval and certification by the District Manager or his/her designee. It is the responsibility of the Responsible Party to obtain all revisions to these CONSTRUCTION STANDARDS.

**1.08.0 SEVERABILITY**

If any section or article of these CONSTRUCTION STANDARDS is found to be unconstitutional or illegal by any court, the said section or article shall have no bearing on the effectiveness of the rest of these CONSTRUCTION STANDARDS.

**1.09.0 DEFINITIONS**

AIR GAP shall mean the unobstructed vertical distance through the free atmosphere between the lowest opening of the potable water system feeding into a vessel and the flood level of the vessel.

BACKFLOW shall mean the undesirable reversal of the direction of flow of non-potable water in the potable water supply.

BACKFLOW PREVENTION DEVICE shall mean a device or means designed to prevent backflow or backsiphonage.

BACKPRESSURE shall mean a condition that results when the downstream pressure in a system connected to the potable water supply exceeds the upstream pressure of the potable water supply.

BACKSIPHONAGE shall mean a type of backflow created by negative pressure or sub-atmospheric pressure in the potable water supply.

District shall mean the St. Mary's Glacier Water & Sanitation District, in the State of Colorado, acting by and through the District Manager, District Board of Directors, or other authorized representative.

District RULES & REGULATIONS shall mean the official adopted Rules and Regulations for St. Mary's Water & Sanitation District, Colorado.

District REPRESENTATIVE shall mean the District Manager or his/her authorized representative acting on behalf of the District.

CROSS-CONNECTION shall mean a link or channel between a source of a non-potable substance and a potable water supply.

DESIGNATED PRIVATE CONSTRUCTION WORK includes: water and sewer service lines to buildings, grading, drainage structures, retaining walls, parking lots, private streets and walks, fire lanes, driveways, and associated construction.

DOUBLE CHECK VALVE ASSEMBLY shall mean an assembly of two independently operating check valves between two tightly closing shut-off valves with four properly located test cocks for the testing of each check valve.

EXPRESSIONS: Wherever the words "as directed", "as required", "as permitted", or words of like meaning are used, it shall be understood that the direction, requirements, or permission of the District Representative is intended. Similarly, the words "approved", "acceptable", "satisfactory" shall refer to approval by the District Representative.

Whenever the words "CONSTRUCTION STANDARDS" are used it shall be understood that reference is made to the "District of Georgetown", CONSTRUCTION STANDARDS for the Design and Construction of Public Improvements.

GRAVITY GREASE INTERCEPTOR (GGI): A plumbing appurtenance or appliance that is installed in a wastewater drainage system to separate non-petroleum fats, oils, and greases (FOG's) and solid food particles from wastewater and is identified by outdoor (usually below grade) installation, 300-gallon minimum volume, 30-minute minimum retention time, baffles, a minimum of two compartments, and gravity separation.

GREASE TRAP: A generic term used to refer to all forms of grease separation and retention, no longer officially used in codes and standards.

HYDROMECHANICAL GREASE INTERCEPTOR (HGD): A plumbing appurtenance or appliance that is installed in a wastewater drainage system to separate non-petroleum fats, oils, and greases (FOG's) from wastewater and is identified by indoor installation, separation and retention efficiency, and flow rate. The design incorporates air entrapment, hydromechanical separation, internal baffling

and/or barriers in combination or separately, and one of the following:

- 1) External flow control with air intake, directly connected
- 2) External flow control without air intake (vent), directly connected
- 3) Without external flow control, directly connected
- 4) Without external flow control, indirectly connected.

Certified under POI G-101 and ASME A112.14.3

OWNER shall mean a person, company, firm, or corporation holding title to land that is being developed or modified within the District.

PUBLIC IMPROVEMENTS include: all work in the public right-of-way, District property, easements dedicated to the District, private property that will become District property or an easement to the District in the future, and projects or utilities that will become the District's responsibility to maintain.

RECORD DRAWINGS: A set of drawings prepared by a registered Professional Engineer in the State of Colorado which reflect the information of record for construction of any public improvements. Commonly referred to as "As-Built".

REDUCED PRESSURE ZONE ASSEMBLY shall mean an assembly of two independently operating check valves with a hydraulic automatic operating differential relief valve between the two check valves and located between two tightly closing shut-off valves with four properly located test cocks.

RESPONSIBLE PARTY: These "CONSTRUCTION STANDARDS" are for the Design and Construction of Public Improvements. Therefore the Responsible Party shall be anyone liable for the design and/or construction of public improvements projects related to these CONSTRUCTION STANDARDS and may include but not be limited to the Contractor, Developer, Permittee, Builder, Engineer, Consultant, and Owner.

SUBCONTRACTOR: Any person, company, firm, or corporation performing work within the District limits which has a direct or indirect contract with the Responsible Party or other subcontractors and furnishes and/or performs on-site labor, and/or furnishes materials in connection with the performance of the work.

SURETY: shall mean the entity that is bound with and for the Responsible Party for the performance of the work as described in these specifications. (Bonded)

TESTING AGENCY: Any individual, partnership, or corporation which is qualified and licensed to perform the required sampling, analysis, testing, and professional recommendation service.

VACUUM BREAKER shall mean a device designed to prevent backsiphonage.

**1.10.0 ABBREVIATIONS**

AASHTO	American Association of State Highway and Transportation Officials
AASHTO	"Green" A Policy on Geometric Design of Highways and Streets, 1990. American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADA	American Disabilities Act
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
APWA	American Public Works Association
ASA	American Standards Association



ASTM	American Society for Testing and Materials
ATSSA	American Traffic Safety Services Association
AWWA	American Water Works Association
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health & Environment
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
CPSC	Consumer Product Safety Commission
CUHP	Colorado Urban Hydrograph Procedure
CWCB	Colorado Water Conservation Board
DIP	Ductile Iron Pipe
FEMA	Federal Emergency Management Agency
Fe	Footcandles
FHW	Federal Highway Administration
A FIRM	Flood Insurance Rate Map
HERCP	Horizontal Elliptical Reinforced Concrete Pipe
HDPE	High Density Poly-Ethylene
HPSS	Handbook for Public Playground Safety
IAAF	International Amateur Athletic Federation
IMSA	International Municipal Signal Association
ITE	Institute of Transportation Engineers
MUTCD	Manual on Uniform Traffic Control Devices
NCAA	National Collegiate Athletic Association
NFIP	National Flood Insurance Program
NPDES	National Pollution Discharge Elimination System
OSHA	Occupational Safety and Health Association
PUD	Planned Unit Development
PVC	Polyvinyl Chloride
RCBC	Reinforced Concrete Box Culvert
RCP	Reinforced Concrete Pipe
ROW	Rights-of-Way
SCS	Soil Conservation Service
SPP	Structural Plate Pipe
SPP A	Structural Plate Pipe Arch
SWMM	Stormwater Management Manual
UNCC	Utility Notification Center of Colorado
USC FCCCHR	University of Southern California Foundation for Cross-Connection Control and Hydraulic Research
USGS	United States Geological Survey

## **1.20.0 GENERAL CONDITIONS**

### **1.21.0 RESPONSIBILITY FOR DESIGN AND CONSTRUCTION**

The District shall have full authority to review and approve all submittals and construction for compliance with these CONSTRUCTION STANDARDS. An approval or acceptance by the District does not relieve the Responsible Party from responsibility for ensuring that the calculations, plans, specifications, construction, and record drawings are in compliance with these CONSTRUCTION STANDARDS. Any approval or acceptance by the District shall not result in any liability to the District or its employees for any claim, suit, loss, damage, or injury resulting from the use or implementation of the approved documents.

### **1.22.0 WORK CONDITIONS**

#### **1.22.1 Site Conditions**

The Responsible Party shall maintain the condition of the work site such that public safety and welfare is protected. This shall include but not be limited to providing proper sanitary facilities for the duration of the construction of any public improvement project. The Responsible Party shall also take care in "tracking" debris onto any public street and will be responsible for the cleaning of such debris that is "tracked". Responsible party shall also provide a designated pedestrian route that is appropriate to help pedestrians safely pass through the work zone. If the District representative sees any unsafe work condition at any time, they shall cause a stop work order to be issued in conformance to Section 1.26.04.

#### **1.22.2 Emergency Work**

When, in the opinion of the District, the Responsible Party has not taken sufficient precautions for the safety of the public or the protection of the work to be constructed, or if adjacent structures or property which may be damaged by processes of construction on account of such neglect, and an emergency arises and immediate action is considered necessary in order to protect private or public interests, the District, WITH OR WITHOUT NOTICE to the Responsible Party, may provide suitable protection by causing such work to be done and material to be furnished and placed as the District may consider necessary and adequate. The cost and expense of such work and material so furnished will be borne by the Responsible Party and will be paid within 30 days of presentation of the bills. The District may also draw from the developer's surety to cover any non-payment, including accrued interest and applicable overhead costs. The performance or non-performance of such emergency work under the direction of the District will in no way relieve the Responsible Party of responsibility for damages which may occur during or after such precaution has been taken.

#### **1.22.3 Final Clean-Up**

Upon completion of the work and prior to any inspection by the District, the Responsible Party shall remove from the project area all surplus and discarded material, rubbish, and temporary structures and leave the project area in a neat and presentable condition. The Responsible Party shall restore all work that has been damaged by his operations to general conformity with the specifications for the item(s) involved. The Responsible Party shall inspect the interior of all manholes and catch basins within the construction limits for construction materials, dirt, stones, or other debris and remove same prior to any inspection by the District.

## **1.23.0 CONTROL OF WORK AND MATERIALS**

### **1.23.1 Authority of District**

The District will have the authority to stop work whenever such stoppage may be deemed necessary. The District will resolve all questions that arise as to the quality and acceptability of materials furnished, work performed, interpretation of the plans and specifications, and acceptable fulfillment of the requirements of these CONSTRUCTION STANDARDS. The District representative shall resolve all questions that may arise relative to the performance of the work with respect to these CONSTRUCTION STANDARDS.

District inspectors are authorized to inspect all work and all material furnished. Inspections may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The inspector is not authorized to revoke, alter, or waive any requirements of these CONSTRUCTION STANDARDS. They are authorized to call the attention of the Responsible Party to any failure of the work or materials to conform to these CONSTRUCTION STANDARDS. The Inspector will have the authority to reject materials until the District resolves any and all questions at issue.

The Inspector will, in no case, act as foreman or perform other duties for the Responsible Party nor interfere with the management of the work performed by the Responsible Party. Any "advice" or "opinion" which the inspector may give the Responsible Party will not be construed as binding upon the District representative or the District in any way or release the Responsible Party from fulfilling all of the terms of these CONSTRUCTION STANDARDS. The presence or absence of the inspector will not relieve, in any degree, the responsibility or the obligation of the Responsible Party.

The District and its inspector will, at all times, have reasonable and safe access to the work whenever it is in preparation or progress and the Responsible Party will provide proper facilities for such access and inspection.

### **1.23.2 Responsibilities of the Responsible Party**

In case of suspension of work for any cause whatsoever, the Responsible Party, before leaving the job site, will take such precautions as may be necessary to prevent damage to the project, provide for public safety, normal drainage, and erect any necessary barricades, signs, or other facilities at his expense as directed by the District and required by these CONSTRUCTION STANDARDS. The Responsible Party is responsible for ensuring that all construction and construction activities and materials are in compliance with these CONSTRUCTION STANDARDS. He shall be solely responsible for all construction means, methods, techniques, sequences, and procedures. The Responsible Party shall be responsible for the acts and omissions of his employees, subcontractors, and their agents and employees. The Responsible Party shall be solely responsible for locating all existing underground installations, including service connections, in advance of excavating. District maps and databases are intended to be used for general information only, and the location of any utilities or property lines as found on the maps or databases shall be verified in the field. The Responsible Party is responsible for all testing and quality control, including providing equipment necessary to perform any necessary tests, of material and workmanship unless specified elsewhere. District may cause such testing to be completed at the expense of the responsible party if deemed necessary. If quality control testing indicates unacceptable work, Section 1.24.3 will govern.

### **1.23.3 Unauthorized and/or Unacceptable Work**

Work which does not conform to the plans and these CONSTRUCTION STANDARDS and which result in an inferior or unsatisfactory product will be considered unacceptable work. Unacceptable work, whether the result of poor workmanship, poor design, use of defective materials, damage through carelessness, or any other cause which is found to exist prior to the final acceptance of the work will be immediately removed and acceptably replaced or otherwise satisfactorily corrected by and at the expense of the Responsible Party. This expense includes total and complete restoration of any disturbed land or surface to original or better than the original condition that existed before the repairs or replacement.

### **1.23.4 Samples and Tests**

To ascertain that materials and procedures comply with contract requirements, testing will be taken at the source or at the job destination at the discretion of the District and as often as the District deems it advisable or necessary. Taking of samples will be in accordance with standard practices except where methods and procedures for sampling materials are otherwise set forth in these CONSTRUCTION STANDARDS.

The Responsible Party will furnish, without charge, any and all reports, summaries, field notes, etc. collected and compiled after tests are conducted. The Responsible Party may be required to furnish, when requested by the District, a written statement giving the origin, composition, and process of manufacture of a material.

Whenever any of the provisions of these CONSTRUCTION STANDARDS or evidence that any material or construction does not conform to the requirements herein, the District may require that the Responsible Party have tests performed, at his expense, which will be used as proof of compliance. Test methods will be as referenced by these CONSTRUCTION STANDARDS. If there are no recognized and accepted test methods for the proposed alternate, the District will determine the test procedures. All tests will be made by an agency approved by the District. The District will retain reports of such tests.

### **1.23.5 Storage of Materials**

Materials will be stored so as to ensure the preservation of their quality and suitability for the work. Stored materials, even though approved prior to storage, will be subject to inspection prior to their use in the work and will meet all requirements of these CONSTRUCTION STANDARDS at the time they are used. Stored materials will be located so as to facilitate inspection. With the prior written approval of the District, portions of the right-of-way not required for public travel may be used for storage purposes and for the placing of the Responsible Party's plants and equipment, but any additional space required will be provided by the Responsible Party at his expense. All Federal, State, and Local requirements pertaining to storage and handling of materials must be followed.

### **1.23.6 Defective Materials**

Materials not in conformance with requirements of these CONSTRUCTION STANDARDS will be considered defective and will be rejected. Rejected materials will be removed from the work site at the Responsible Party's expense, unless otherwise permitted by the District.

## **1.24.0 PROTECTION OF PUBLIC INTERESTS**

### **1.24.1 Public Convenience and Safety**

Unless otherwise specified, the Responsible Party will contact responsible parties at Clear Creek County, St. Mary's Glacier Metropolitan District, St. Mary's Glacier Water & Sanitation District, and Xcel Energy to give notice to the proper authorities in charge of streets & roads; water & sanitary sewer facilities; electric power service facilities, and other public infrastructure; and all other property that may be affected by the Responsible Party's operations at least two (2) business days after approval of permit and prior to any construction. The Responsible Party will not hinder or interfere with any person in the protection of such property or with the operation of utilities at any time. The Responsible Party must obtain all necessary information in regard to existing utilities, protect such utilities from injury, and avoid unnecessary exposure so that they will not cause injury to the public.

The Responsible Party will obtain all necessary information in regard to the planned installation of new utilities and cables, conduits and transformers, make proper provision and give proper notification so that new utilities and appurtenances can be installed at the proper time and location without delay to the Responsible Party, nor cause unnecessary inconvenience to the owner or the public. New underground utilities and appurtenances will not be covered with pavement prior to the District's inspection and approval of such facilities. When the work involves excavation adjacent to any building or wall along the work, the Responsible Party will give property owners due and sufficient notice thereof, in writing with a copy to the District.

### **1.24.2 Protection of Property and Monuments**

The Responsible Party will use every reasonable precaution to prevent the damage or destruction of public or private property such as, but not limited to, poles, trees, shrubbery, crops, fences, property and utility monuments and all overhead structures such as, but not limited to, wires or cables which are either within or outside of the right-of-way. The Responsible Party will protect and support all water, sanitary sewer, or electrical pipes, and conduits and all buildings, walls, fences, or other properties that are liable to be damaged during the execution of his work. The Responsible Party will take all reasonable and proper precautions to protect persons, animals and vehicles from injury or damage and, wherever necessary, or as directed by the District, will erect and maintain a fence or railing around any excavation and place a sufficient number of amber lights about the work and keep them operational from twilight until sunrise. The Responsible Party will employ one or more watchmen as an additional security wherever they are needed or required by the District. The Responsible Party will not prevent the flow of water in road side ditches and will use proper means to permit the flow of surface water along the roads while the work is progressing.

The Responsible Party will protect and carefully preserve all land boundary and District survey control monuments until the owner's authorized registered land surveyor has referenced their location for replacement. All monuments disturbed or removed by the Responsible Party or on the part of his employees or subcontractors will be replaced by a land surveyor registered in the State of Colorado, at the Responsible Party's expense. The Responsible Party will be responsible for the repair of any damage or destruction of property resulting from execution or non-execution of the work or caused by defective work or the use of unsatisfactory materials. The Responsible Party will restore such property to a condition equal to or better than that existing before such damage or injury was done by repairing, rebuilding, or replacing it as directed by the District, or they will otherwise make good such damage or destruction in a manner acceptable to the District. The Responsible Party will be responsible for the repair of underground pipes, wires or conduits damaged by them or their subcontractors.

**1.24.3 Installation of Survey Monuments**

Permanent survey monuments, range points, and lot pins, shall be set in the manner specified by the most current revision of Colorado Revised Statutes, 38-51-104 and 38-51-105. Permanent survey monuments will be required where, in the opinion of the District conditions warrant documentation for the sake of proper location of improvements.

**1.24.4 Explosives**

When blasting is permitted and approved in writing by the District, the Responsible Party will use the utmost care to protect life and property. Signals warning persons of danger will be given before any blast. Excessive blasting or overshooting will not be permitted. The District will have authority to order any method of blasting discontinued that leads to overshooting, is dangerous to the public, or destructive to property, environment or natural features.

Before any blasting is to be performed by the Responsible Party, a certificate of insurance indicating special blasting coverage in the following minimum amounts will be filed with the District:

Property damage, each accident, total aggregate	\$1,000,000/ \$2,000,000
Public liability, bodily injury single limit or equivalent, each accident, total aggregate	\$1,000,000/ \$2,000,000

The District reserves the right to require additional insurance coverage if the circumstances warrant.

The District has the right to require detailed inspections by an independent consultant or by District inspectors on any structures or properties located in the vicinity of the blasting, both before and after the blasting activity. The cost for such inspections shall be the responsibility of the Responsible Party.

**1.24.5 Protection of Streams, Lakes, and Reservoirs**

The Responsible Party will take all necessary precautions to prevent pollution of streams, lakes, and reservoirs by sediment, fuels, oils, bitumens, calcium chloride, fertilizers, insecticides, or other harmful materials. They will conduct and schedule their operations to avoid or minimize siltation of streams, lakes, and reservoirs. A plan for erosion protection shall be submitted to the District, approved by the District, and all required erosion control measures in place before starting work. All work must conform to all applicable local, state, and federal regulations.

**1.25.0 WORK IN PUBLIC RIGHT-OF-WAY**

**1.25.1 Relocation of Facilities**

The District may request the owner of facilities located in Public Right-of-Way, whether subject to a permit or not, to relocate its facilities, in order to allow the District to make legal use of said ROW as required to repair, maintain, and construct public potable water and or sanitary sewer infrastructure.

The District shall notify the owner of the facilities a reasonable time in advance, except in the case of emergency. The permittee shall thereupon, at its sole cost and expense, accomplish the necessary relocation, removal or change within a reasonable time from the date of the notification but in no event later than three working days prior to the date the District has specified, immediately in the case of emergencies. Upon the permittee's failure to accomplish such work, the District may cause such work to be completed at the permittee's expense and the permittee shall reimburse the District within 30 days after receipt of a written invoice. Following relocation, all affected property shall be restored to the condition which existed prior to construction by the permittee at the permittee's expense. A new permit, or amended permit, shall be issued by the District for the relocated facility.

### **1.25.2 Utility Excavation Permit**

It shall be unlawful for any person or entity to perform work related to the construction of potable water and/or sanitary sewer within public right-of-way without first obtaining written permission from the District in the form of an excavation permit. If the work to be performed involves a District utility in a Clear Creek County public right-of-way, both an excavation permit from the District and the appropriate permit from Clear Creek County shall be required. A separate written application for that work done under an excavation permit shall be submitted to the District on a form provided by the District for each job. The application shall be submitted at least 48 hours prior to the planned start of work to allow for review and approval by the District. The Responsible Party may be required to increase this time up to 10 days when the work consists of more than a single spot excavation.

The District may require submission of plans and specifications. No work shall commence until the District has approved the plans and specifications and/or permit application, except in emergency conditions. A permit application shall be required for emergency conditions within 72 hours after the performance of the work and all conditions of an excavation permit shall apply. An application form (when approved) shall constitute a valid "excavation permit." Incomplete permit applications will not be reviewed or processed by the District.

### **1.25.3 Issuance of Permits**

The District may grant permits to work in, construct, or excavate within the public way or to close traffic lanes or work in connection with a District utility system to any Responsible Party filing an application as herein provided, which application shall pertain to work which shall comply with the requirements of this chapter.

### **1.25.4 Liability for Damage & Utility Locates**

Any person or entity who shall undertake work pursuant to a permit issued under the provisions of this chapter, or to perform work under contracts with the District, or to perform work under the terms of a Utility Extension Agreement, or by virtue of permission obtained from the District Board in accordance with the provisions adopted by the said Board, shall be liable for any damage or injury to persons, animals, or property as a result of any circumstances of such work. Prior to any excavation within the public right-of-way, the Responsible Party shall contact the Utility Notification Center of Colorado.

### **1.25.5 Suspension or Revocation of Permits -- Stop Work Order**

- (A) Any permit may be revoked or suspended by the District and a stop work order may be issued after notice to the Responsible Party for:
1. Violations of any condition of the Utility Extension Agreement, or the approved construction drawings or specifications; or
  2. Violation of any provision of these CONSTRUCTION STANDARDS; or
  3. Violation of any other ordinance of the District, state law, or federal law pertaining to the work; or
  4. Existence of any condition or the occurrence of any act which may constitute or cause a condition endangering health, life, or safety, or serious damage to property.
- (B) A suspension or revocation by the District and stop work orders shall take effect immediately upon notice to the person performing the work in the field and shall remain in effect until such time as the District cancels the order in writing. A failure to abide by the terms of the suspension or revocation will be considered a violation of District ordinance.
- (C) Upon receipt of a stop work order, the Responsible Party shall be responsible for taking such precautions as may be necessary to prevent damage to the project, prevent inconvenience or hazardous conditions for the general public, provide for normal drainage, and to erect any necessary barricades, signs, or other facilities which may be necessary or directed by the District.

### **1.25.6 Application Form**

Application for a permit to work in the public way shall be made on a form provided by the District and shall recite specifically and illustrate by sketch or plan the exact location, depth, extent, nature, and purpose of the excavation desired to be made, the purposes for the which the privilege is requested, and the timing required for the work.



Applicants shall pay a fee to the District before issuance of such permit. The amount of that fee shall be established by the District and displayed on the permit. Applicants shall also post a Performance or Contract Bond, clean irrevocable Letter of Credit, or Cash Bond in the amount as specified on the permit form. The responsible party warrants to the District that all materials and equipment incorporated in the work will be new unless otherwise specified, and that all work be of good quality, free from faults and defects and in conformance with these CONSTRUCTION STANDARDS. All work not conforming to these standards shall be considered defective. No permit issued under the provisions hereof shall be for more than one excavation project for which a definite time limit shall be established by the District.

**1.25.7 Exhibition of Permit**

Such permit shall be kept at the site of the excavation while the work is in progress and shall be exhibited upon request to any police officer or other authorized representative of the District. Failure to comply with this provision shall be grounds for a revocation of the permit and the issuance of a stop work order.

**1.25.8 Correction Period**

All public improvements shall be subject to a correction period of at least one (1) year after the date of the acceptance from the District Representative. The Responsible Party shall be responsible for the maintenance of all public improvements during the correction period and shall also post a Warranty Bond, clean irrevocable Letter of Credit, or Cash Bond in the amount as specified on the original permit form. The District Representative will notify the Responsible Party of any maintenance that may be necessary during this time. Routine maintenance normally performed by the Responsible Party includes, but shall not be limited to, the cleaning of streets, patching of potholes, and removal of blockages from potable water, and sanitary sewer facilities. The cost of any routine maintenance not performed by the Responsible Party that must be performed by the District will be billed to the Responsible Party at cost plus fifteen percent (15%).

In the event of a water main break, sanitary sewer main blockage, or other emergency that may occur during the correction period, it may become necessary for the District to undertake immediate repairs to the facilities and/or make the area safe to residents, pedestrians, or motorists. The District will attempt to contact the Responsible Party in the event of such emergency. However, if the Responsible Party or his representative cannot be contacted quickly or if the Responsible Party is unable to take immediate action to relieve the urgent situation, the District may proceed with such action as deemed necessary by the District Representative, and the Responsible Party will be billed for all costs of these actions at cost plus fifteen percent (15%).

**1.25.9 End of Correction Period**

At approximately nine (9) months into the correction period, the Responsible Party will schedule an inspection of the public improvements within the development to be performed by the District Representative. The Responsible Party or his representative will be invited to accompany the Town's representative on all such inspections. The condition of the public improvements will be inspected for conformance with the approved plans, the Public Improvements Agreement, these CONSTRUCTION STANDARDS, and any other District Codes. If due to excessive dirt or snow on streets, poor weather conditions, inaccessibility, or other reasons the inspection cannot be performed, the Responsible Party will be notified of the need to postpone these activities until the cause of the delay can be rectified.

Deficiencies noted during the correction inspection will be compiled in a corrections list to be mailed to the Responsible Party.

Correction list items should be corrected within 2 months of the date of the correction list, and all corrections must be completed no later than ten (10) working days prior to the scheduled end of the correction period. If all of the noted deficiencies are not corrected within this time, the public improvements may be reinspected, a revised correction list may be issued, and the end of the correction period may be adjusted at the discretion of the District Representative to allow ample time for the completion of the corrections. The end of the correction period will not be acknowledged until all noted deficiencies are corrected within the proper time frame. The appropriate District Representative shall be notified before any corrective work commences and immediately upon the completion of the repairs.

Upon completion of the correction of all deficiencies noted in the correction list, the District Representative will issue a written acknowledgment of the end of the correction period for the public improvements.

### **1.25.10**

#### **Performance**

##### **(A) Inspection**

1. There shall be continuous inspections for each permit. The first shall occur upon notification by the Responsible Party that the work is ready for inspection and the second inspection as indicated in section 1.26.9 above.

##### **(B) Barricading and Traffic Control**

1. All work within a traveled public roadway area shall be protected at all times by safety devices as prescribed by the MUTCD and in such manner as to minimize the disruption of the flow of traffic in the vicinity of the work. Normally, only one side of a street may be closed at any given time. Traffic must be provided a minimum lane width of 10 feet in the construction area. 24 hours before the start of construction, the Responsible Party shall notify emergency services and any other critically affected vehicular or pedestrian traffic or service.

2. All work within the roadway shall take place between 8:30 a.m. and 3:30 p.m. unless otherwise stipulated on the excavation permit.

3. Unless prior approval is given by the District Representative, street excavations must be backfilled prior to leaving the site at the end of the workday, even if the work has not been completed.

4. No person shall dig or cause to be dug any hole, drain, ditch, or any other excavation in any street, alley, sidewalk, or other public place within the District without providing, during the nighttime, sufficient amber lights to be placed with a suitable barricade or temporary fence around such hole, drain, or other excavation in order to prevent persons, animals, and vehicles from sustaining injury. During the daytime the barricades shall be maintained but warning lights are not required. All barricades and lights shall be left in place until a permanent patch or temporary cold-mix patch can be made to the excavation.

**(C) Removal of Safety Devices or Barricades.**

No person shall damage, displace, remove, or interfere with any barricade warning light or any other safety device which is lawfully placed around or about any street, alley, sidewalk, or other excavations or construction work in the District.



ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT  
CONSTRUCTION STANDARDS

Chapter 2

Potable Water

System

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**CHAPTER 2**  
**POTABLE WATER SYSTEM**

**2.00.0 INTRODUCTION**

All water distribution systems constructed within the District shall comply with the requirements of these CONSTRUCTION STANDARDS and may include special criteria established by the District for overall hydraulics of the water utility system. All work performed according to this section must comply with the general requirements contained within Chapter 1. Special criteria shall be outlined at pre-design meetings, as determined necessary by the District.

**2.01.0 INTERRUPTION OF SERVICE**

The District's Operations Staff will operate all existing valves, hydrants, blow-offs and curb stops. NO VALVE OR OTHER CONTROL DEVICE ON THE EXISTING PUBLIC SYSTEM WILL BE OPERATED FOR ANY PURPOSE BY ANYONE OTHER THAN THE DISTRICT. Forty-eight (48) hours prior to the interruption of service, the Responsible Party shall notify all users whose service will be interrupted in order for them to make provisions for necessary water storage. For water mains servicing commercial areas (i.e., restaurants) work affecting the shutdown shall only be performed between the hours of 1:00 a.m. and 5:00 a.m. All other shutdowns shall occur between 9:00 am and 3:00 pm. No line in service will be shutdown for more than a four-hour period at one time. Prior approval by the District is required for all shutdowns. Wet taps shall be used unless unfeasible and be completed by a company specializing in this type of work.

**2.02.0 WATER BREAKS**

If notification prior to shutdown is impossible, the Responsible Party shall notify all users within one hour after the shutdown. Since prior notification was not possible, it will be the responsibility of the Responsible Party to supply potable water to the users affected. The Responsible Party shall also contact the District Manager and St. Mary's Glacier Metro District Fire Department in reference to this emergency shutdown within one hour.

**2.10.0 DESIGN CRITERIA**

**2.11.0 SCOPE**

It is the intent of this "design criteria" section to provide sufficient detailed information to enable the Engineer for the Responsible Party to correctly and efficiently design the overall water system for a particular development. If the District deems it appropriate to require the engineered design of a water system, criteria shall be made available to the Engineer to provide a design acceptable to the District. Any deviation from these CONSTRUCTION STANDARDS must be approved in writing by the District.

**2.12.0 GENERAL**

The water system shall be designed by a professional engineer registered in the State of Colorado utilizing the most current technical standards along with good, sound engineering judgment throughout the design process. Depending on the extent of the improvements, the design process may require the submittal of construction plans and specifications for review and approval by the District.

Following completion of the Utility Permit Application by the Responsible Party per Section 1.25.6, the District will determine the requirement to submit engineering construction documents as identified in Section 1.25.2. If required by the District, said documents shall be prepared and sealed by a professional civil engineer registered in the State of Colorado and shall be in full conformance with these CONSTRUCTION STANDARDS.

At the completion of the project, the engineer shall provide the District with two (2) sets of wet stamped record drawings to document the final "as constructed" conditions.

**2.13.0 DESIGN FLOW**

The flows used to design the water system for a particular development vary depending on the type of development. A list of criteria to be used in the preparation of all water system analysis will be provided if the District deems it appropriate for the design of the water system.

**2.14.0 WATER SYSTEM DESIGN REPORT**

If the District requires, a water system design report shall be prepared by the Responsible Party's engineer and submitted for review and approval. Criteria to be used in the preparation of the report will be site specific and will provided by the District.

**2.15.0 OPERATING PRESSURES WITHIN THE DISTRIBUTION SYSTEM**

Pressure within the distribution system shall be a minimum of 40 pounds per square inch during the maximum hour demand and a maximum of 110 pounds per square inch static pressure at the main. The maximum pressure fluctuation at any location in the distribution system between maximum hour demand and minimum hour demand shall not exceed 30 pounds per square inch.

**2.16.0 PRESSURE REGULATING STATIONS**

Pressure-regulating valve (PRV) installations are used to control pressure between distribution zones. When main extension plans are submitted for review, the need for a pressure-regulating valve installation shall be determined by the Responsible Party's engineer and shall be based on existing zones and the existing distribution system. Plans shall be submitted to complement the Water System Design Report indicating size, type, and location of the PRV installation. All calculations shall be submitted to the District for review. A PRV may be required at the direction of the District.

**2.17.0 SIZING OF MAINS**

**2.17.1 Distribution Mains**

All mains shall be sized large enough to provide for potable domestic, and fire protection flows to the area serviced according to the water system design report submitted to the District by the Responsible Party's Engineer. The maximum allowable headloss for six, eight, and 12 inch mains is two feet per thousand lineal feet of main. The minimum diameter for water mains in residential areas including cul-de-sacs, shall be 6 inches. All schools, commercial developments, industrial areas, and high density multi-family areas shall be looped with mains at least 8 inches in diameter. All water mains shall be looped and dead end lines will not be permitted unless approved by the District representative.

**2.17.2 Transmission Mains**

All transmission mains shall be sized according to these CONSTRUCTION STANDARDS.



## **2.18.0 SYSTEM LAYOUT**

### **2.18.1 General**

All mains shall be installed in dedicated rights-of-way or public easements. Water main installation in easements between single-family residential lots will only be allowed for the purpose of looping a water main at the end of a cul-de-sac. Under no circumstances should waterlines be installed parallel to and directly below any concrete such as sidewalks, curbs, or gutters. Lines shall normally be located 5 feet north or east of street centerline, unless otherwise approved by the District.

The minimum depth of cover for water mains from the final approved grade of the surface to the top of the water main, shall be 9 feet. Where final grades have not been established, mains shall be installed to a depth great enough to insure 9 feet of cover below the approved future grade. The maximum depth of cover for water mains shall be 12 feet below the final approved grade of the surface unless approved otherwise by the District.

Water mains shall be laid a minimum of ten feet horizontally from any existing or proposed utility. Upon written approval by the District, a water main may be laid closer than ten feet to a parallel sewer main if it is laid in a separate trench and if the elevation of the invert of the water main is at least 18 inches above the crown of the sewer main and, in addition, Sections 2.18.02- 2.18.07 are met. Water mains shall be designed such that they extend the entire frontage of the property to be served or as approved by the District.

When the water main passes under a highway, railroad, or waterway, there shall be a minimum of nine (9) feet of cover and a steel casing shall be installed in accordance with the STANDARD DETAILS in this chapter. The steel casing shall extend the entire width of the right-of-way or easement of the crossing structure or as directed by the District. In all cases, valves shall be located such that the water main at such crossings can be completely isolated without interruption of any services.

### **2.18.2 Water Main Crossing Over or Under A Sanitary Sewer Line**

When there is less than 18 inches of vertical clearance between the water main and the sanitary sewer, the water main shall be depressed utilizing Detail 2-10 in the STANDARD DETAILS of this chapter. The sanitary sewer shall be encased in concrete a minimum of ten (10) feet on each side of the centerline of the crossing. Alternatively, one 20 ft. length of C900 PVC or Class 150 DIP may be used for the sewer, centered on the crossing with each transition joint concrete encased.

### **2.18.3 Water Main Crossing Over or Under A Storm Sewer Line**

When there is less than 18 inches of vertical clearance between the water main and the storm sewer, the water main shall be depressed utilizing Detail 2-10 in the STANDARD DETAILS of this chapter. Each joint of the storm sewer within ten (10) feet of the centerline of the crossing shall be encased in concrete. 3 inches of rigid EPS insulation shall be placed 6 inches above the water main extending the full width of the trench, no less than 3 feet either side of the crossing.

### **2.18.4 Water Main Crossing Over Another Water Main**

When there is less than 18 inches of vertical clearance, the smaller main shall be depressed utilizing Detail 2-10 in the STANDARD DETAILS of this chapter.

### **2.18.5 Limits On Vertical Separation**

Under no circumstances shall the vertical clearance between any lines involving a waterline, sanitary sewerline, or storm sewer be less than 12 inches without written approval from the District.

### **2.19.0 EASEMENTS**

All water mains not in public right-of way shall be in an easement that has a width of at least two times the depth to the pipe invert. The minimum easement shall be 20 feet. Site-specific circumstances may dictate the need for wider easements. The centerline of the main shall be located a minimum of 10 feet from and parallel to the edge of the easement. Meters and fire hydrants not installed within the right-of-way will require an easement dedication ten feet wide and extending three feet behind the meter or fire hydrant. If the meter or fire hydrant easement is longer than ten feet, then the width of the easement shall be a minimum of 20 feet. The fire hydrant shall be centered in such easements. Neither landscaping nor permanent structures (sheds, buildings, etc.) shall be placed in the easement.

### **2.20.0 FUTURE CONNECTIONS**

A fire hydrant, in accordance with the STANDARD DETAILS in this chapter, is required at the end of any water main that terminates and is anticipated to be extended in the future, unless otherwise approved. When a future main extension is anticipated, the main shall be valved so that only one valve will have to be closed when the main is extended. The valve shall be placed in order that no disruption to existing water service will be experienced by any water customers. The valve shall be restrained so when the one valve is closed and the line to be extended is exposed, the valve will not blow off. Restraint shall be made by the use of a mechanical joint anchoring tee (swivel tee), cross, or by installing a minimum of two full lengths of pipe on the extension side of the valve, restrained to the valve. No service taps shall be allowed on a main that can be extended in the future between the single valve to be closed and the dead end.

### **2.21.0 SERVICES**

Each structure shall be served by a separate service line and meter. No pressure booster facility of any kind shall be allowed on any service line between the public main and the meter. All service line pressure booster facilities shall be privately owned and maintained. Water service lines shall be located a minimum of 10 feet away from all sewer services, measured horizontally.

### **2.22.0 TRANSMISSION MAINS**

All water mains 12 inches and larger in diameter shall be classified as "transmission mains." However, transmission mains may be less than 12" in diameter

All transmission mains shall have air and vacuum release valves installed at all high points on the line, and on each side of gate valves in accordance with the STANDARD DETAILS in this chapter.

All transmission mains shall have blow-off assemblies installed at all low points on the line, constructed in accordance with the STANDARD DETAILS in this chapter.

No service line taps or any taps less than six inches in diameter shall be made to transmission mains. Exceptions to this will be for air and vacuum release valves only.

Valves on transmission mains shall be placed no more than 1,200 feet apart. Where there are connections to transmission mains, all connecting mains shall be valved at the connection. If the connection main is 12 inches or greater in diameter, there shall be a minimum of two valves at a tee connection and three valves at a cross connection.

### **2.23.0 UNLAWFUL CONNECTIONS**

No installation of potable water supply piping or part thereof shall be made in such a manner that it will be possible for used, unclean, polluted or contaminated water, mixtures, or substances to enter any portion of such piping from any tank, receptacle, equipment, or plumbing fixture by reason of back siphonage, suction, back pressure, or any other cause, either during normal use and operation, or when any such tank receptacle, equipment, or plumbing fixture is flooded, or subject to pressure in excess of the main line operating pressure. No person shall make a connection or allow one to exist between pipes or conduits carrying domestic water supplied by the District and any pipes, conduits, or fixtures containing or carrying water, chemicals, liquids, gases, or any other substances from any other source.

### **2.24.0 APPURTENANCES**

#### **2.24.1 Valves**

Residential distribution systems shall be valved to ensure that no more than 1,000 feet of main or 18 residential units and 1 fire hydrant will be out of service in the event of a single water main break. Valve placement shall be such that there are at least two valves at every tee and three valves at every cross.

Valves larger than 8 inches shall be resilient wedge gate valves with bevel gearing. Main line valves shall be located at a point on the main that is intersected by an extension of the side property line of lots. Valves shall not be located in concrete areas such as sidewalks, crosspans, aprons, curbs, or gutters, unless approved prior to placement by the District. Valves located on water mains in easements shall be located at the connecting tee, cross, or elbow. Butterfly valve operators shall be located on the north or east side of the water main. Any valve located in a greenbelt area shall have an 18-inch square by 6-inch thick concrete collar around the valve box.

#### **2.24.2 Fire Hydrants**

The maximum distance, as measured along the centerline of the street, between fire hydrants shall be 400 feet unless approved otherwise by the District. The number and location of fire hydrants in a given area shall be approved by the District. Where the portion of the facility or building hereafter constructed or moved into or within the District is more than 400 feet from a hydrant, on-site fire hydrants and mains may be required by the District. In no case shall a hydrant be located closer than 5 feet to obstructions, driveways, etc. Fire hydrants shall be planned and installed in such a manner as to be visibly discernible for the life of the water system. The fire hydrant shall be located within the right-of-way or easements created for utility purposes and on the same side of the street or fire apparatus access road as the water main unless otherwise approved by the District. The fire hydrant shall be installed so that the pumper nozzle faces the street and the shutoff valve. Fences, landscaping, etc., shall in no way hinder the operation of the fire hydrant. In addition, clear distances to the fire hydrant shall be in accordance with Section 2.19.0 of these CONSTRUCTION STANDARDS.

The fire hydrant lateral lines shall be set at 90 degrees to mains and shall be a minimum of 6" diameter. The fire hydrant lateral line shall be no more than 250 feet in length from the main. No horizontal bends or offsets shall be used in fire hydrant lateral lines. Under no circumstances shall any tap be made on a fire hydrant lateral line.

### 2.24.3

#### **Joint Restraint**

All bends, tees, plugs, dead-ends, wet taps (in certain cases), hydrants, and blow-offs shall be designed and constructed with joint restraint utilizing concrete thrust blocks, lengths of tied pipe or a combination thereof. If the soil-bearing strength is unknown, the soil-bearing capacity used in design shall be 1,500 pounds/square foot. Refer to the STANDARD DETAILS in this chapter. Special care shall be taken with fire hydrant thrust blocks so as not to hinder drainage of the fire hydrant barrel via the weep holes.

### 2.24.4

#### **Meters**

All meter installations shall be inspected, tested and approved by the District prior to receiving water service. Public water meter installations shall be inside buildings for freezing protection unless otherwise approved in writing by the District. Meters shall be located in an insulated non-freezing space inside the structure receiving service, and within 10 feet of the service line entering the structure. The District requires the installation of a valve shut off on the property owners side of the meter in order to allow for the shut off of water during water break emergencies.

All water meters connected to the District's utility system shall be the property of the District. Under no circumstances shall anyone other than District Utility personnel remove a water meter once the meter has been inspected and approved. No connections shall be made to the water service line other than those related to the meter and bypass.

For any installation where special or unusual conditions might exist, detailed drawings, accompanied by a letter of explanation, shall be submitted to the District for review and approval.

Inspections of all meters shall be conducted by the District. Locations and details for commercial pits or vaults shall be reviewed and approved by the District.

All meter sizes for residential, commercial or industrial use shall be determined by a Professional Engineer registered in the State of Colorado and calculations submitted to the District for review and approval.

### 2.24.5

#### **Fire Protection Service Line**

Valves on newly constructed fire lines shall be located on the tee at the main line. The owner shall maintain all private fire lines beginning at but not including this valve. All fire sprinkler taps shall be installed with an approved cross-connection protection device as specified in Section 2.24.8. A property requiring a domestic service line and a fire protection service line will have separate taps for each. The District does not charge a "tapping fee" for fire sprinkler lines, but owner is responsible and shall pay all of the cost associated with installation of required taps.

### 2.24.6

#### **Valve Vaults**

All valves larger than 10 inches shall be installed in a vault. All valve vaults shall be concrete, capable of withstanding AASHTO H-20 highway loading. The vault shall also have lifting hooks in the roof for valve removal inside the vault.

Vaults shall be made waterproof after construction by use of sealants, epoxies or other approved method. All vaults shall be designed with wall sleeves and link seals and be capable of handling thrusts caused by removing valves. The vault shall also be provided with a high/low gravity vent system. Responsible Party's Engineer shall submit valve vault design for District approval.

### **2.24.7 Manholes**

Manholes shall be installed at all pressure regulating valves, permanent blow-offs, and air release valve locations in accordance with the STANDARD DETAILS in this chapter.

### **2.24.8 Cross-Connection Prevention Device**

To protect the District's potable water supply mains against cross-connection contamination (backflow and backsiphonage), an approved cross-connection control device shall be installed at any point where the possibility of contamination due to cross-connection exists. An "approved device" is one which meets the standards of the American Water Works Association (AWWA). Any cross-connection control device required by the District shall be installed, maintained and tested annually as required by the Colorado Department of Public Health and Environment (CDPHE) Cross-Connection Control Program, and such installation shall conform to International Plumbing Code standards.

Authority to implement and maintain this cross-connection control program is contained in, but not limited to the following:

- 1) Colorado Primary Drinking Water Regulations. Article 12, Hazardous Cross-Connection
- 2) 2002 Edition of the International Plumbing Code (or more recently adopted version)
- 3) Colorado Cross-Connection Control Manual. CDPHE

## **2.30.0 CONSTRUCTION SPECIFICATIONS**

### **2.31.0 EXCAVATION, TRENCHING AND BACKFILLING**

Excavation, trenching and backfilling shall be done in accordance with Chapter 4 these CONSTRUCTION STANDARDS.

### **2.32.0 BEDDING**

Granular bedding material used shall meet the requirements of Chapter 4 of these CONSTRUCTION STANDARDS. Bedding shall be placed to six inches below the bottom of the pipe and shall be placed around the sides of the pipe and to a minimum of 12 inches above the top of the pipe and in accordance with the STANDARD DETAILS in this chapter.

### **2.33.0 PIPELINE INSTALLATION**

#### **2.33.1 General**

The District shall be notified at least 48 hours in advance of any pipe installation. The Responsible Party shall notify and arrange for all utility locates prior to excavation. No pipes shall be backfilled until they have been inspected and approved by the District. Alignment and grade of the pipe and the location of fittings, valves, and hydrants shall be staked under the supervision of a professional surveyor registered in the State of Colorado.

Proper implements, tools, and facilities shall be provided and used by the Responsible Party for the safe and convenient execution of the work. All pipe fittings, valves, and hydrants shall be carefully lowered into the trench by means of straps, ropes, or other suitable tools or equipment to prevent damage to water main materials and protective coatings and linings. Chains or cables shall not be used for handling pipe with protective coatings. Under no circumstances shall water main materials be dropped or dumped into the trench.

All pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. The groove in the bells of the pipe shall be full and continuous or the pipe will be rejected. Defective pipe or fittings shall be removed from the job site within 24 hours of notification by the District. All foreign matter or dirt shall be removed from the interior and ends of pipe and accessories before they are lowered into position in the trench and prior to connection.

Every precaution shall be taken to prevent foreign material and trench water from entering the pipe and fittings. During construction, the Responsible Party shall provide and maintain adequate equipment to properly remove and dispose of all water entering the trench and any other part of the work.

### **2.33.2 Pipe**

Immediately before joining two lengths of pipe, the inside of the bell and the outside of the spigot end, the gasket shall be thoroughly cleaned, and, if performing disinfection by tablet method, as described in Section 2.40.3, dry chlorinating tablets providing 65% hypochlorite shall be attached to the top end of the pipe with water-soluble permatex or an adhesive appropriate for potable water. A thin film of gasket lubricant shall be applied to the inside face of the gasket and the spigot end of the pipe. The spigot end of the pipe shall be placed in the bell with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home by hand with a slow steady pressure, without jerky or jolting movements. Pipe furnished without a depth mark shall be marked before assembly to ensure insertion to the full depth of the joint. The pipe shall then be properly set and brought to correct line and grade. After installation of the polyethylene protective wrap, if required, the pipe shall be secured in place by installation of bedding material and backfill, in accordance with Chapter 4 and the STANDARD DETAILS in this chapter.

Deflection from a straight line or grade, as required by horizontal or vertical alignments or offsets, shall not exceed the maximum allowable limits set by the manufacturer's specifications. If the alignment requires deflection in excess of the allowable deflection per joint, special bends, or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limits set forth, as approved, in writing, by the District.

All ductile iron pipe fittings and appurtenances shall be protected with a minimum 8 mil polyethylene film wrap. Miscellaneous steel or other ferrous pipe for temporary blow-offs, etc., shall be similarly protected. Methods for applying the wrap shall conform to the STANDARD DETAILS in this chapter.

At times when installation is not in progress, the open ends of the pipe shall be closed with a watertight plug. Cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining, leaving a smooth end at right angles to the axis of the pipe. Pipe ends shall be smooth and beveled according to the pipe manufacturer's recommendations.

Extra care should be used in handling PVC pipe during cold weather due to the reduced flexibility and impact resistance as temperatures approach and drop below freezing. PVC pipe to be stored outside and exposed to sunlight for more than 30 days shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover the pipe. Air circulation shall be provided under the covering. Any over-exposed pipe, as determined by the District, will not be permitted for installation.

During the backfilling of all water main trenches, a 2-inch-wide mylar tape labeled "Waterline Buried Below" shall be placed in the trench backfill 1 foot above at the top of the select fill and directly over the pipe.

In addition to the tape mentioned above, all PVC waterline installations shall include the installation of a single, 14 or 16-gauge, insulated copper tracing wire taped to the top of the pipe. The tracing wire shall be one piece and installed in a continuous run between valves. Tracer wire shall terminate up at the base of a fire hydrant, unless otherwise approved.

### **2.33.3 Fittings**

Pipes shall be connected to valves and fittings by mechanical joints unless specified differently in the approved drawings. For approved slip-on joints, the joint shall be assembled with a ratchet jack or other approved method in a manner that does not cause any damage to the pipe. Both the spigot and bell must be thoroughly clean and free from tar or other coatings and use.

For mechanical joint pipe, the last 8 inches of the outside of the spigot end of the pipe and the inside of the bell of all fittings and gate valves shall be thoroughly cleaned to remove oil, grit, tar (other than standard coating), and other foreign matter from the joint and then a thin film of gasket lubricant shall be applied. The cast iron gland shall then be slipped on the spigot end of the pipe with the lip extension of the gland toward the bell of the fitting. Gasket lubricant shall be applied to the rubber gasket and placed on the spigot end of the pipe with the thick edge towards the gland.

After the spigot end of the pipe is placed into the bell and fully inserted the gasket shall be pressed into place within the bell so it is even around the entire joint. After the gland is positioned behind the gasket, the Responsible Party shall install all bolts and nuts and tighten them with a torque wrench. Nuts spaced 180 degrees apart shall be tightened alternately to produce equal pressure on all parts of the gland.

Jointing shall be done, unless specifically excepted above, in accordance with AWWA Specification C-111 for a mechanical joint for cast iron pressure pipe and fittings.

### **2.34.0 VALVE AND VALVE BOX INSTALLATIONS**

In addition to the jointing requirements mentioned in Section 2.33.3 of these CONSTRUCTION STANDARDS, the additional requirements of this section shall apply. Valves and valve boxes shall be installed where shown on the approved drawings and as directed by the District. Valve boxes shall be firmly supported, centered, and plumbed over the wrench nut of the valve with the box cover at or minus 1/2-inch within the surface of the finished pavement and 6 inches below grade in gravel roadways or at such other elevation as may be directed by the District. Valve stem and box extensions to within 4 feet of the finished grade shall be provided for valves installed with more than 4 feet of cover. Earth fill shall be carefully tamped around each valve box to a minimum distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet. Valves shall have the interiors cleaned of all foreign matter before and after installation.

Gear cases shall be tightened and the valve shall be inspected in opened and closed positions to insure that all parts are in working condition prior to installation. The cases shall be supported by bricks or other means to prevent any shock or stress being transmitted to the valve.

### **2.35.0 THRUST BLOCKS**

The Responsible Party shall excavate as required to ensure that the thrust blocks are placed against undisturbed soil and shall form the sides of the thrust block to provide the size and shape required. When it is impossible, because of over excavation or other causes, to pour a thrust block against undisturbed earth, harness rods shall be used to anchor the fittings to the main in addition to the thrust block and as required by the District. After the concrete has been placed and has set, the Responsible Party shall remove all forming materials prior to backfilling around the thrust block. Concrete for the thrust blocks shall have a mix design providing a minimum strength of 4,000 psi with a water/cement ratio no greater than 0.45.

The blocking shall be placed so that the pipe and fitting joints will be accessible for repair. A bond breaker shall be placed between the fillings and the thrust block. Extra care for fire hydrant thrust blocks should be taken so as to not block proper drainage of the fire hydrant barrel from the weep holes. Backfill may be placed over the thrust blocks once the surface has set sufficiently to resist the weight of the backfill. However, no tamping or compacting shall be allowed above the thrust block for a minimum of 24 hours after placement. Concrete must set a minimum of 48 hours prior to the initial filling of the line.

### **2.36.0 CONNECTION TO EXISTING MAINS**

At locations where connections to existing water mains are to be installed, the Responsible Party shall locate the existing mains, both vertically and horizontally, and shall verify their exact size in advance of the time scheduled for making the connections. The Responsible Party shall notify and schedule the connection with the District.

Wet tap connections are preferable so as to minimize disruption of service to the system. Wet taps shall be completed by a company specializing in this type of connection. In the event a wet tap is not feasible, then every step should be taken to minimize system downtime. Prior to connecting to existing water mains, the Responsible Party shall have all personnel, materials, and equipment ready to connect the filling to the existing main to keep the shut-off time to a minimum. As soon as possible after making the connections, the Responsible Party shall flush the connection to prevent any contamination of the existing facilities. The Responsible Party shall take every precaution necessary to prevent dirt or debris from entering the main.

### **2.37.0 FIRE HYDRANT INSTALLATION**

Immediately before installation of a hydrant, the following operations shall be performed:

- (A) The hydrant shall be thoroughly inspected for any defects or damage.
- (B) The hydrant interior shall be thoroughly deaned.
- (C) The hydrant shall be opened and closed as many limes as necessary to determine that all parts are in proper working order, valves are seating properly and the drain valve is operating freely.

Hydrants shall be set so that a minimum of 9 feet of cover is provided for the lateral line and the nozzles are a minimum of 60 inches above finished grade. Each hydrant shall be set on a concrete foundation at least 18 inches by 18 inches and 6 inches thick. Each hydrant shall be blocked against the end of the trench with a concrete thrust block. If the trench is unstable then the hydrant shall be mechanically restrained from the tee at the main to the hydrant in addition to the thrust block. Hydrants shall be oriented such that the pumper nozzle shall face the street/fire access/parking area to which it serves.



Each hydrant shall have drain holes with a minimum 18-inch-thick layer of 1-1/2-inch (minimum) washed rock beneath them. A sheet of 8-mil polyethylene shall be placed over the washed rock to prevent dirt from filling the rock. All hydrants shall stand plumb and shall be connected to the street main by a minimum 6-inch lateral line. The fire hydrant base shall be adjusted to not more than 3 inches nor less than 2 inches above the approved finished grade. The maximum allowable height of extensions on hydrants is 12 inches. No hydrant lateral shall be installed any deeper than 6 feet from the top of the approved finished grade.

Hydrants shall have a traffic break-away feature in the barrel at the ground line. Depending upon hydrant location, the use of steel posts filled with concrete may be required for protection, as specified by the District. In areas where the hydrant bottom is installed below ground water, a larger area, 2 times, of 1-1/2-inch (minimum) washed rock enclosed with 8-mil polyethylene shall be installed to insure proper drainage. All other requirements shall be as shown on the STANDARD DETAILS in this chapter.

### **2.38.0 TAPS**

The size of tap shall be approved and/or determined by the District. All service taps shall be installed by the Responsible Party and inspected by the District. Tap Fees will be determined by the District. Taps will not be made on a water main until the main has passed the pressure tests and clear water tests. Tapping mains may require digging out bedding material and cutting or removing part of the corrosion protective wrapping. After the taps are made, the wrap shall be repaired or replaced by the Responsible Party to protect both the service line and the main.

### **2.39.0 METER INSTALLATION**

All meter installations shall be performed by the District.

No connections shall be made on the water service line other than those related to the meter and bypass. For single family residential lots, each individual residence shall be served by its own individual meter.

### **2.40.0 TESTS**

#### **2.40.1 General**

The Responsible Party shall disinfect and test all mains and fire lines regardless of existing conditions. This may include repairing existing facilities that must be included in the test and are not capable of holding test pressures. All thrust blocks or other bracing facilities shall be in place at least 48 hours before the initial filling of the line. All tests shall be administered by the District.

#### **2.40.2 Filling and Venting Lines**

All existing valves shall be operated by the District. The line shall be slowly filled with water and all air expelled from the pipe. Care shall be taken so that all available hydrants (including hydrant gate valves), air valves, and other vents are open during the filling of the line. Where hydrants or other vents are not available in the line, the Responsible Party shall make whatever taps are required for venting purposes. These taps shall be abandoned after testing, the taps removed and the main repaired by the use of a stainless steel repair clamp. The rate of filling the line shall not exceed the venting capacity of the vent. Except when disinfecting the line as indicated below with the chlorination tablet method.

### 2.40.3 Disinfection

The Responsible Party will be required to disinfect every new water main installed. This shall be accomplished by one of two methods. In general, the tablet chlorination method shall be used. If approved by the District, the continuous feed method may be used.

The tablet method shall not be used if trench water or foreign material has entered the line. Since preliminary flushing cannot be used with this method, the tablet method shall only be used when scrupulous cleanliness has been executed. Attach dry chlorinating tablets that provide 65% hypochlorite to the top end of each pipe joint with water-soluble permatrix or an adhesive appropriate for potable water during installation as per Section 2.33.2 of these CONSTRUCTION STANDARDS. The number of tablets shall be sufficient to produce a dose of 50 mg/l of chlorine. Refer to Table 2 of AWWA C651-92 for the required minimum number of tablets. This table shows the number of tablets for 25 mg/l so the number of tablets needs to be adjusted accordingly. Tablets must also be placed on all hydrants. Introduce water into the pipeline at a rate no greater than 1 ft./sec. and retain the water in the pipeline for a period of 24 hours. The minimum residual chlorine shall be 5 mg/l throughout the entire length.

The continuous feed method is accomplished by introducing water into the line at a constant rate while adding chlorine to maintain a minimum concentration of 50 mg/l. The chlorine must remain in the main for a contact period of no less than 24 hours after which the treated water shall contain no less than 25 mg/l of chlorine throughout the entire length.

This procedure will continue until the minimum requirements of this section are met.

### 2.40.4 Flushing the Main

The entire line shall be flushed after the specified contact time, and after passing the disinfection test. Such flushing shall continue until the water is clear and meets the chlorine content of the existing line. The entire line, including hydrant leads, branch lines, and dead-end mains shall be flushed. The discharge of flushed water shall be accomplished such that no erosion will occur and with no harm to fish, animals, or plants. Procedures for discharge will be subjected to a CDPHE Discharge Permit and approval by the District.

### 2.40.5 Pressure Tests

After the pipe and appurtenances have been laid, the line has been backfilled, and all field-placed concrete has cured in accordance with Section 2.35.0 of these CONSTRUCTION STANDARDS, each valved section, unless otherwise directed by the District, shall be subjected to a hydrostatic pressure of not less than 150 PSI or 1.5 times the normal working pressure of the lines, whichever is greater. The test duration shall be not less than one (1) hour. However, in all cases the test pressure shall be 50 percent over existing main pressure in the test area. Water added to maintain the pressure shall be per AWWA C-600. Allowable leakage shall be calculated according to the following formulas:

$$\text{Polyvinyl Chlorine Pipe: } \frac{L=N D/P}{7400}$$

L = Allowable Leakage in gallons per hour

N = Total number of joints

D = Nominal diameter of pipe in inches

P = The square root of the average test pressure in PST

When testing against existing closed valves, an additional leakage per closed valve of 0.0078 gal/hr/in. of nominal valve size may be allowed at the discretion of the District.

Each valved section of pipe shall be slowly filled with water and the specified test pressure (measured at the highest point of elevation) shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges, and all necessary apparatus and labor shall be furnished by the Responsible Party. Gauges and measuring devices shall be approved by the District. Before applying the specified test pressure, all air shall be expelled from the pipe. Any cracked or defective pipes, fittings, valves, or hydrants discovered in the pressure test shall be removed and replaced by the Responsible Party with sound material. After all visible leaks have been repaired, the pressure test shall be conducted again. Should testing show a leakage rate in excess of the rates above, the pipeline shall not be accepted. The pipeline shall be repaired, re-chlorinated to meet the criteria in Section 2.40.03 of these STANDARDS AND SPECIFICATIONS and retested as described in this section until it meets the test requirements and is accepted by the District.

## **2.50.0 MATERIALS**

### **2.51.0 GENERAL**

Only polyvinyl chloride (PVC) pipe is approved for water main installations. Any other material proposed must be approved by the District, in writing, prior to construction. All materials furnished shall be new and undamaged.

Acceptance of materials or the waiving of inspection thereof shall in no way relieve the Responsible Party of the responsibility for furnishing materials meeting the requirements of these CONSTRUCTION STANDARDS. The District reserves the right to direct or deny the use of certain types of materials in specific circumstances. All materials delivered to the job site shall be adequately housed and protected to ensure the preservation of their quality for the work. The presence of any defects in any materials may constitute sufficient cause for rejection of the pipe or appurtenances. Rejected materials shall be removed from the project site.

### **2.52.0 PIPE**

#### **2.52.1 Polyvinyl Chloride Pipe (PVC)**

All PVC pipe 8" diameter or greater shall meet the requirements of AWWA Specification C-900, and shall be Pressure Class 235 (DR 18).

All pipe shall be suitable for use as a pressure conduit. Provisions must be made for expansion and contraction at each joint with a rubber ring. The bell shall consist of an integral wall section with a solid cross-section rubber ring that meets the requirements of AWWA Specification C-900.

Standard laying lengths shall be twenty feet (20') for all sizes. Random lengths shall not be acceptable. Each length of pipe shall bear the date manufactured, type, grade, length, manufacturer's name, and NSF seal of approval.

Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint or using machined couplings of a sleeve type with rubber ring gaskets and machined pipe ends to form a push-on type joint.

Solvent cement joints are strictly prohibited.

The manufacturer shall furnish a certified statement that all of the specified tests and inspections have been made and the results thereof comply with the requirements of the applicable standard(s) herein specified. A copy of the certification shall be sent to the District upon request.

## 2.53.00

### FITTINGS

All fittings shall be manufactured in accordance with the following AWWA Standards:

C-104, "Cement Mortar Lining for Cast-Iron and Ductile Iron Pipe and Fittings for Water"

C-153, "Gray Iron and Ductile Iron Fittings"

C-111, "Rubber Gasket Joints for Cast-Iron and Ductile Iron Pressure for Pipe and Fillings"

The following are additional requirements or exceptions to the standards mentioned above:

All fittings shall be furnished with a cement mortar lining of standard thickness as defined in the referenced specifications and given a seal coat of bituminous material. All fittings shall be furnished with mechanical joints conforming to the referenced specifications and, in addition, the tee-head mechanical joint bolts and hexagon nuts shall be fabricated from a high strength, low alloy steel known in the industry as "Cor-Ten" or approved equal. Mechanical joint anchoring fittings (swivel) as approved by the District, in writing, may also be used.

All fittings shall be 150 PSI pressure rating and shall conform to the dimensions and weights shown in the tables of the referenced specifications. All fittings shall be made from gray iron or ductile iron. The manufacturer shall prepare a certified statement that the inspection and all of the specified tests have been made and the results thereof comply with the requirements of the applicable standard(s) herein specified. A copy of the certification shall be sent to the District upon request.

## **2.54.0 VALVES**

### **2.54.1 General**

All valves shall open left (counterclockwise). All valves shall have a 2-inch-square operating nut. The extension stem shall be mechanically connected to the operating nut. All valves shall have a mechanical joint end and shall be delivered complete with bolts, glands and rubber gaskets.

End connections shall be furnished with all necessary joint materials and shall have full opening flow way of equal diameter to the nominal size of the connecting pipe.

### **2.54.2 Gate Valves**

Gate valves shall be Mueller A-2361 Resilient Wedge Series. Valves 12" and greater shall be Mueller A-2361 Series Resilient Wedge with bevel gearing. Valves shall be epoxy coated iron body, resilient-seated, gate valves with non-rising bronze stems with design, construction, and pressure rating conforming to AWWA Specifications C-500, with modifications specified herein. Stem seals shall be double "O" ring seals designed so that the seal above the stem collar can be replaced with the valve under pressure and in full open position.

All ferrous internal and external surfaces of the valves shall be coated to a minimum thickness of four mils. The coating shall be a two-part thermosetting epoxy suitable for field overcoating and for touch-up with the same coating material without special surface preparation. The supplier shall furnish detailed performance tests of adhesion, hardness and abrasion resistance of the furnished coatings when requested by the District. The coating shall have a successful record of performance in valves, pipe or other fittings for a minimum of ten years. The double-disk gate valves shall have all bronze internal mechanisms. The resilient seat gate valves shall have external break-off capabilities for over-torquing and positive stop to prevent over compression.

All bolts and nuts used in conjunction with valves shall be stainless steel. "Cor-Ten." or approved equal. All gate valves shall be installed with a valve box meeting the material specifications of Section 2.54.3 of these CONSTRUCTION STANDARDS.

### **2.54.3 Valve Boxes**

Valve box parts shall be Tyler type or approved equal and made of gray cast-iron, buffalo-type with No. 160 large, oval base. A 5-1/4-inch slip-type shaft is required with two (2) or three (3) pieces. Valve boxes shall be considered integral units and shall have at least 6 inches adjustment above and below the specified depth of cover over the pipe. Valve box lids shall be marked with the word "WATER," and shall have a lip or flange extending into the valve box shaft. The valve box shall be of a design that will not transmit shock or stress to the valve.

## **2.55.0 FIRE HYDRANTS**

Hydrants shall be Mueller Super Centurion 250, model A423 with 5-1/4" main valve opening, and 3-way configuration (2 hose nozzle/1 pumper nozzle), color red or approved equal.

### **2.56.0 BLOW-OFFS**

Temporary blow-offs shall be fabricated from a 2" gate valve with drain hole in pipe a minimum of 6' below ground level. The valve shall be iron-bodied bronze mounted with a 2-inch square operating nut complete with valve box. The freeze-proof riser pipe shall be provided with drain pit and well greased plug. The standard required blow-off for 8-inch and larger mains shall be a 4-inch or larger pipe with a gate valve meeting the material requirements of Section 2.54.2 of these CONSTRUCTION STANDARDS and a manhole meeting the material requirements of Section 3.64.0 of these STANDARDS. This blow-off shall also conform to the STANDARD DETAILS in this chapter.

## **2.57.0 MANHOLES**

See Section 3.64.0 of these Standards and Specifications.

## **2.58.0 AIR VACUUM VALVES**

Above-ground air vacs may be required by the District. If deemed appropriate to install air vacs information shall be provided by the District or submitted to and approved by the District.

## **2.59.0 ENCASEMENT**

### **2.59.1 Concrete**

All concrete shall be a minimum of Class A, with 4,000 psi strength and a water/cement ratio no greater than 0.45. All concrete encasements shall be a minimum of 6 inches thick from outside of pipe to outside of encasement.

### **2.59.2 Polyethylene Wrap**

Polyethylene encasement material shall be a minimum of 8 mils thick and shall be Scotchrap No. 50 (polyvinyl), or approved equal. All polyethylene encasement material shall be manufactured in accordance with AWWA Standard C-105. The raw materials used to manufacture polyethylene film shall be Type I, Class A, Grade E-1 in accordance with ASTM Standard Designations D-1250.

## **2.60.0 METERS**

All water meters shall be provided and installed by the District. Single family residential meters shall be Badger Model 25, 5/8" x 3/4" with lead free bronze body or approved equal.

## **2.61.0 PRESSURE-REGULATING VALVE**

All pressure-regulating valves (PRV) shall be Clayval or approved equal. The valve shall be designed to reduce a high upstream pressure to a constant downstream pressure by way of a pilot control system. The pilot system shall control the main valve that shall be single-seated, hydraulically-operated, diaphragm, and globe-valve type. The valve seats shall be bronze except when subjected to sustained high velocities through the valve, the manufacturer recommends stainless steel seats. An indicator rod or flow tube shall be furnished as an integral part of the valve to show the position of the valve.

The valve shall be epoxy coated cast-iron body. Flanges and covers shall conform to ASTM Standard Designation A-50. Bronze castings or parts of internal trim shall conform to ASTM Standard B-61. All valves shall be furnished with flanged ends and drilled in accordance with ANSI B-16.1 Class 125 specifications. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA Standard C-207. The pilot valve for controlling operation of the main valve shall be single-seated, diaphragm-operated, and spring-loaded type. The pilot valve shall be attached to the main valve with piping and isolation valves arranged for easy access in making adjustments and also for its removal from the main valve while the main valve is under pressure. The pilot control system shall be case bronzed ASTM B-62 with 303 stainless steel trim. The needle valve shall be all bronze and included with the main valve to control the speed of piston travel.

## **2.62.0 COMBINATION AIR/VACUUM VALVES**

At high points in water mains where air can accumulate, provisions shall be made to remove air by means of air relief valves or other means approved by the District. Air valves shall be APCO or Valmatic automatic valves. Air relief valves shall be placed in vaults which allow convenient service of the valve and provide for adequate drainage. Valves shall be cast iron body, 3/4 inch minimum or as sized by air flow requirements, 12" above ground, pointed downward, and covered by #24 mesh.

## **2.63.0 RESTRAINING SYSTEM**

### **2.63.1 Harness Rods**

Harness rods shall be mild steel, ASTM Standard Designation A-36. Hex nuts shall be ASTM Standard Designation A-307, Grade A or B, hexagon heavy series.

### **2.63.2 Megalug**

Mechanical joint restraint can be accomplished by the use of a Megalug restraining system, JCM restraint, or approved equal. Glands shall be manufactured of ductile iron conforming to ASTM A 536. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C153/A21.53, latest revision. Twist-off nuts, sized the same as the tee-head bolts, shall be used to insure that the proper torque is applied to the bolts. In no case shall the twist-off bolts be torqued beyond 30 ft. lbs. The mechanical joint restraint device shall have a working pressure of at least 250 PSI, with a minimum safety factor of 2:1.

## **2.64.0 CONCRETE REINFORCEMENT**

All deformed reinforcing bars shall conform to ASTM Standards A-615, Grade 40 or 60, or ASTM Standard A-671, Grade 40 or 60. All welded wire steel fabric shall conform to ASTM Standard A-185.

## **2.65.0 BACKFLOW PREVENTION DEVICE**

All backflow prevention devices shall be AWWA approved (or District approved equivalent) for the intended application and shall be installed according to International Plumbing Code standards. For all devices intended for District ownership, the District retains the right to specify that the device be one of the following, depending upon the application:

- A) Febco Model #765 Pressure Vacuum Breaker
- B) Febco Model #82SY Y-Pattern Design Reduced Pressure Zone Assembly
- C) Febco Model #880V Configurable Design Reduced Pressure Zone Assembly

## **2.66.0 REPAIR CLAMPS**

Repair clamps shall be made of stainless steel bands with approved bolts. Gaskets shall be gridded virgin GPR compounded for water service and meeting the requirements of ASTM D 2000-90M 4AA607. Repair clamp design and make shall be submitted to the District for written approval prior to the installation.



ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

CONSTRUCTION STANDARDS

Chapter 2

Potable Water System

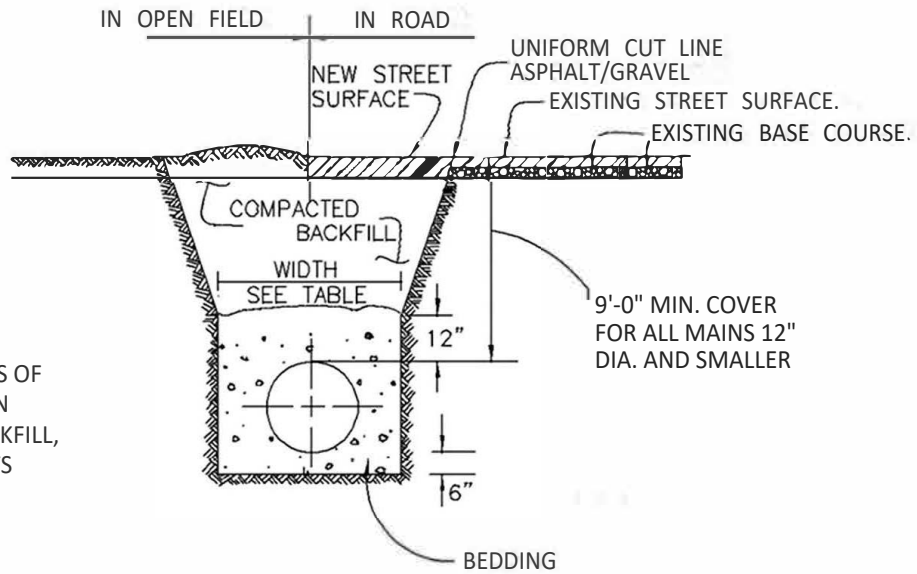
Standard Details



NOTE:  
 MINIMUM COVER TO BE BELOW OFFICIAL STREET GRADE.

TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE SAFETY OF THE WORKERS AND THE PRO-TECTION OF OTHER UTILITIES.

COMPLY WITH ALL REQUIREMENTS OF CHAPTER 4 OF THE CONSTRUCTION STANDARDS FOR TRENCHING, BACKFILL, AND COMPACTION REQUIREMENTS



TYPICAL TRENCH SECTION

FOR PATCHING IN ROAD SURFACE USE FULL DEPTH ASPHALT AS NOTED BELOW OR MATCH EXISTING PLUS ONE (1) INCH. WHICH EVER IS GREATER

PIPE DIAMETER	MINIMUM WIDTH
4"	1'-8"
6"	1 - 10"
8"	2' - 0"
12"	2'- 4"

STREET CLASSIFICATION	DEPTH ASPHALT
COLLECTOR	8"
ASPHALT LOCAL	6"
GRAVEL LOCAL	8"

ST. MARY'S GLACIER  
 WATER & SANITATION DISTRICT

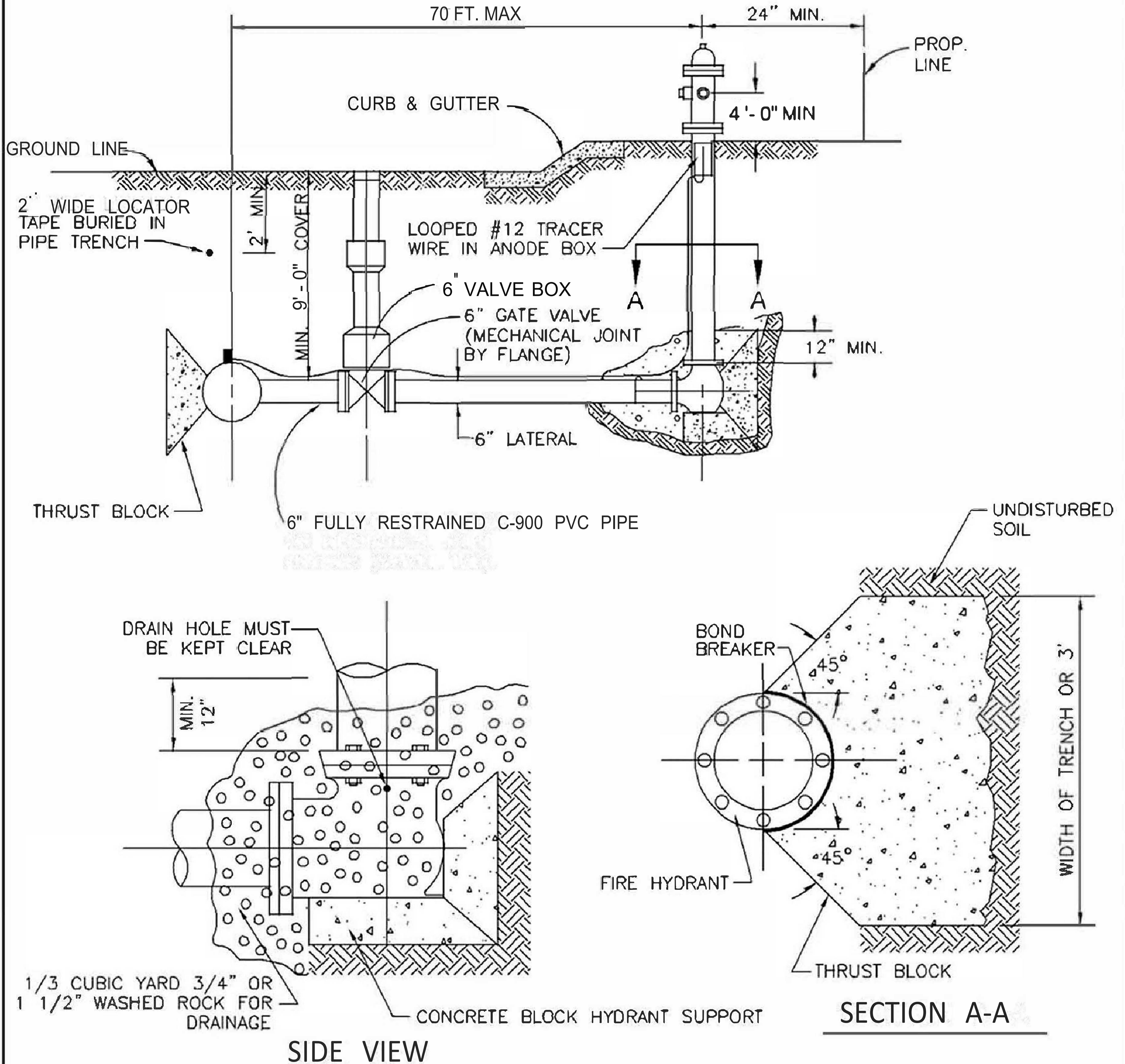
TYPICAL WATER LINE  
 TRENCH SECTION

DATE: 10/19

SHEET 2-1 of 13

## GENERAL NOTES:

1. DRAWING NOT TO SCALE.
2. ALL DIP FITTINGS TO BE EPOXY COATED.
3. IN UNSTABLE GROUND THE FIRE HYDRANT SHALL BE RODDED FROM THE TEE TO THE HYDRANT.
4. 5' UNOBSTRUCTED AREA IN FRONT AND ON SIDES WITH A 3' UNOBSTRUCTED AREA BEHIND. AREAS SHALL BE CONSTANTLY MAINTAINED.
5. VALVE SHALL BE PROVIDED WITH STEM EXTENSION PLACING NUT 2'-0" BELOW GRADE.
6. THREADS ON HOSE FITTINGS TO BE GREASED.

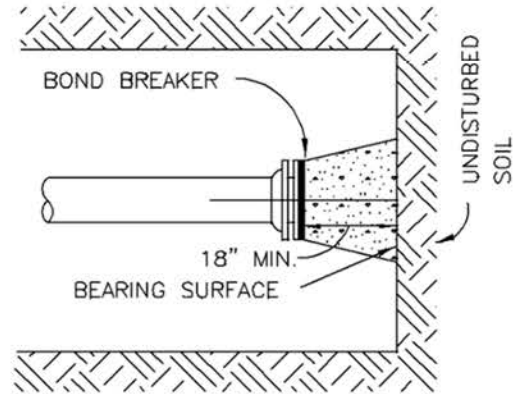
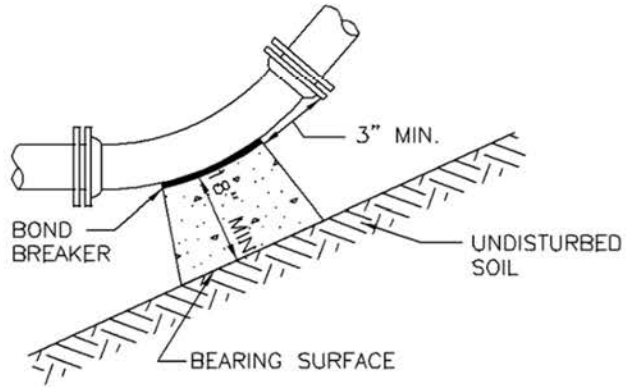


**ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT**

**FIRE HYDRANT  
INSTALLATION DETAIL**

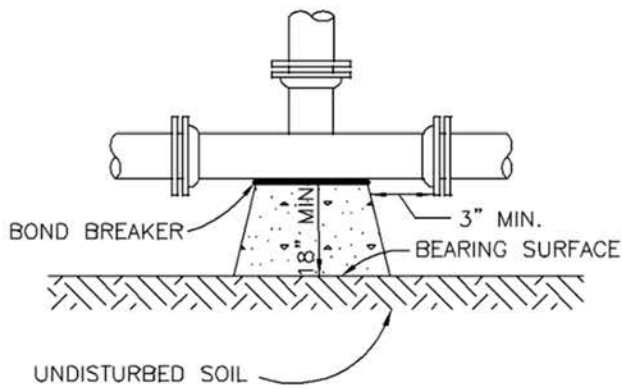
DATE: 10/2019

SHEET 2-2 of 13

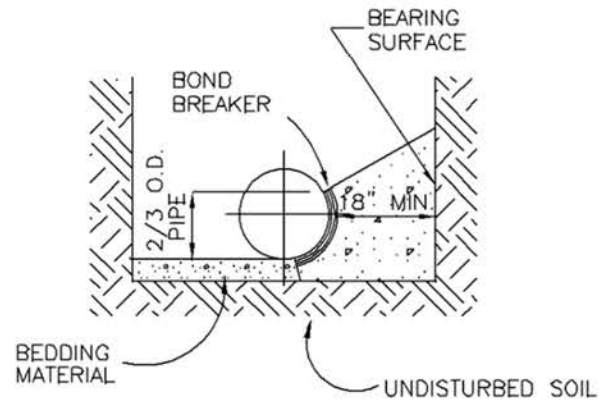


DEAD END

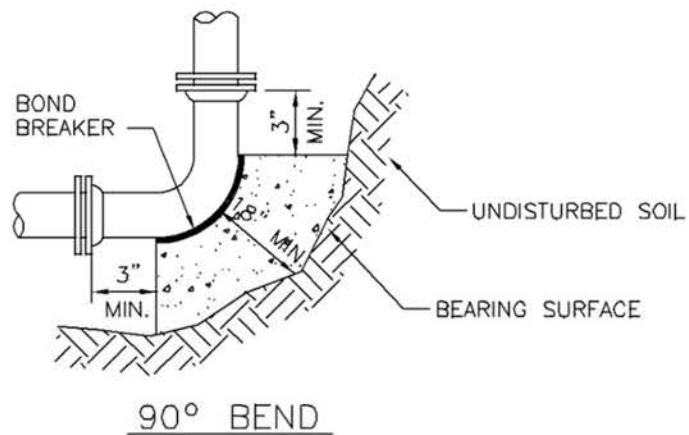
$\frac{11}{4} \frac{1^\circ}{2}$ ,  $\frac{22}{2} \frac{1^\circ}{2}$  AND  $45^\circ$  BENDS



TEE



TYPICAL CROSS SECTION



ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

THRUST BLOCK DETAILS

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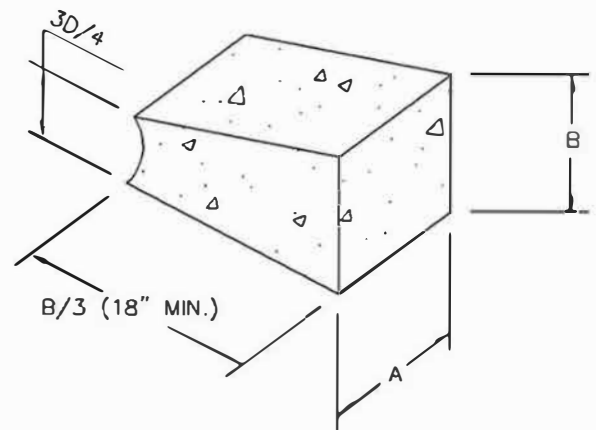
## MINIMUM DIMENSIONS FOR THRUST BLOCKS

FITTING SIZE	TEES & PLUGS		90° BEND		45° BENDS & WYES	
	A	B	A	B	A	B
4"	1'-7"	1'-2"	1'-9"	1'-6"	1'-8"	0'-10"
6"	2'-0"	1'-11"	2'-5"	2'-2"	1'-10"	1'-7"
8"	2'-8"	2'-6"	3'-2"	3'-0"	2'-5"	2'-1"
10"	3'-4"	3'-3"	4'-0"	3'-10"	3'-0"	2'-9"
12"	4'-0"	3'-10"	4'-8"	4'-8"	3'-8"	3'-3"
14"	5'-5"	3'-10"	6'-6"	4'-11"	4'-9"	3'-5"
20"	5'-0"	5'-0"	6'-0"	6'-0"	5'-0"	4'-0"
24"	6'-0"	6'-0"	7'-0"	7'-0"	5'-0"	5'-0"
30"	7'-6"	7'-6"	8'-0"	8'-0"	6'-3"	6'-3"

FITTING SIZE	REDUCERS & 22 1/2° BENDS		11 1/4° BENDS	
	A	B	A	B
4"	1'-7"	0'-6"	0'-6"	0'-6"
6"	1'-9"	0'-10"	1'-0"	0'-6"
8"	1'-9"	1'-6"	1'-0"	1'-0"
10"	2'-2"	1'-11"	1'-6"	1'-0"
12"	2'-7"	2'-3"	2'-0"	1'-0"
14"	3'-5"	2'-5"	2'-0"	1'-6"
20"	3'-6"	3'-0"	3'-0"	2'-0"
24"	4'-6"	3'-0"	3'-0"	3'-0"
30"	4'-9"	4'-6"	3'-3"	3'-3"

**GENERAL NOTES:**

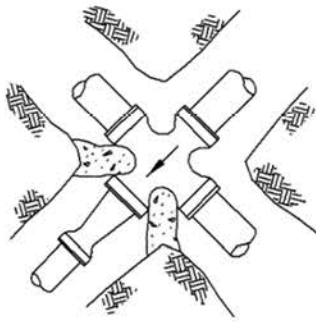
1. BEARING SURFACE AREAS SHOWN IN CHART ARE MINIMUM.
2. BASED ON 150 P.S.I. INTERNAL PIPE PRESSURE.
3. SOIL BEARING CAPACITY = 2000 LB./SQ. FT.
4. ALL FITTINGS TO BE WRAPPED WITH POLYETHYLENE (MINIMUM 8 MIL.).



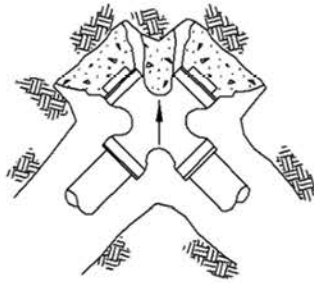
NOT TO SCALE

**ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT**

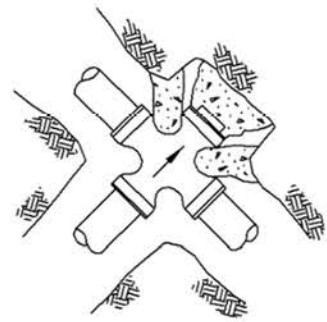
**TYPICAL THRUST BLOCK  
DIMENSIONS**



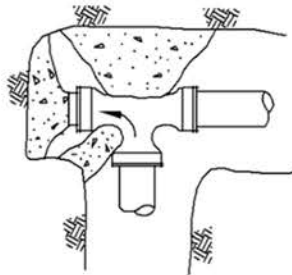
UNBALANCED CROSS



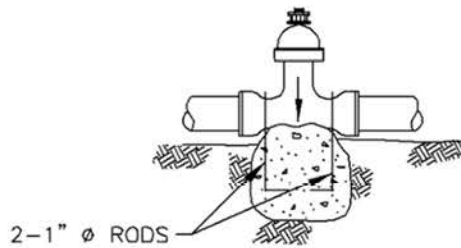
PLUGGED CROSS



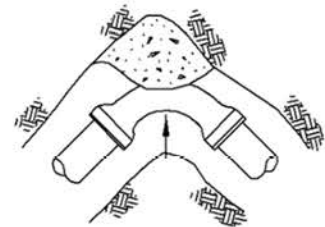
PLUGGED CROSS



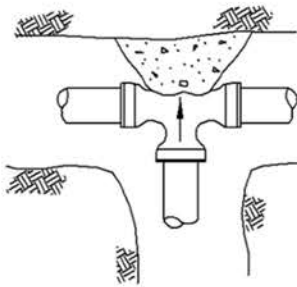
PLUGGED TEE



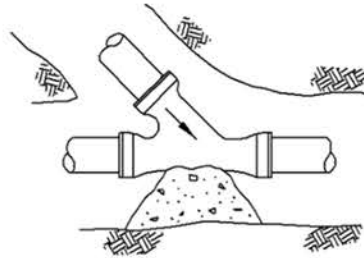
VALVE



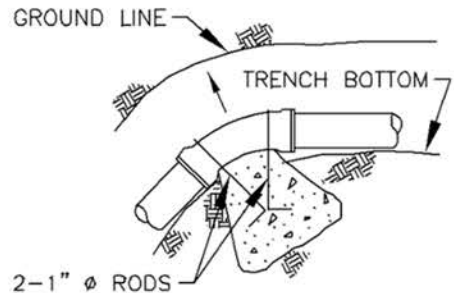
HORIZONTAL BEND



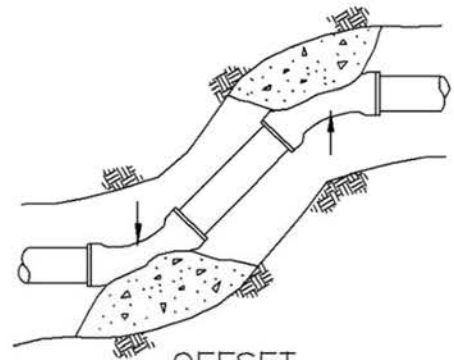
TEE



"Y" BRANCH



VERTICAL BEND



OFFSET

NOTES:

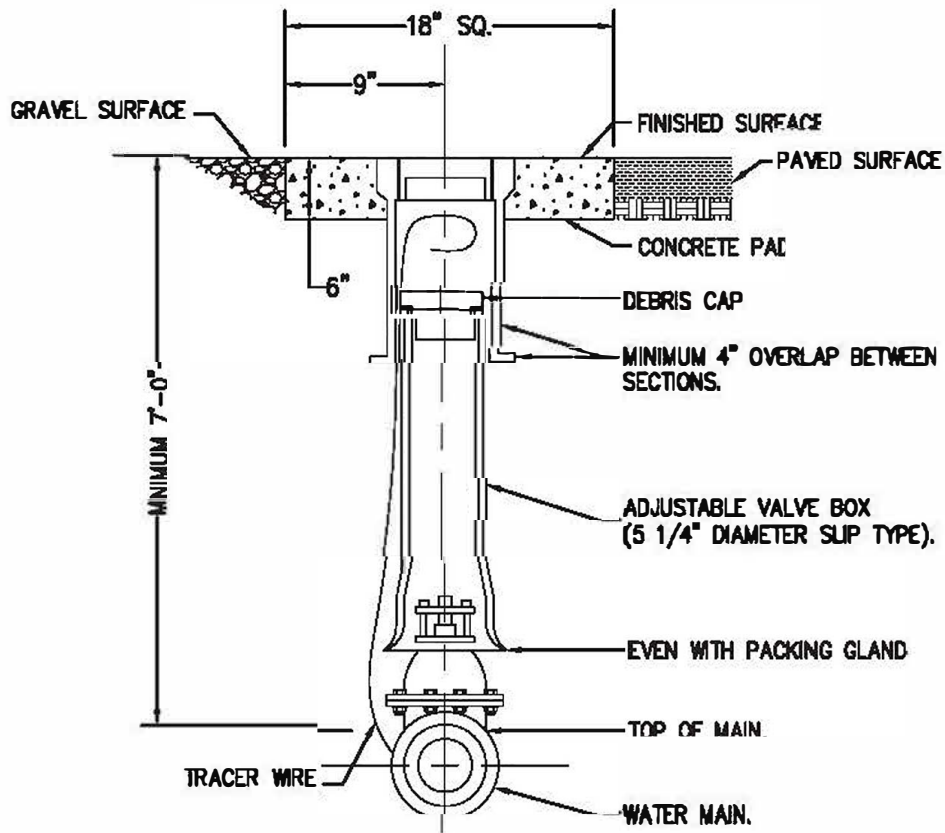
1. SIZE OF BLOCK TO BE A MINIMUM OF 18" THICK.
2. ALL BLOCKING TO BE ON UNDISTURBED MATERIAL.

ST. MARY'S GLACIER  
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THRUST BLOCK CONFIGURATION  
DETAILS

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## TYPICAL VALVE BOX SETTING

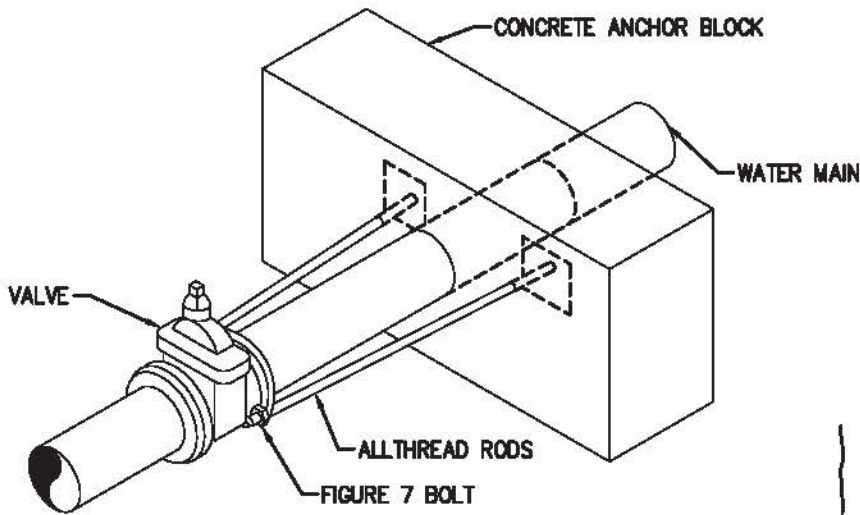
- NOTES:
1. FOR GRAVEL ROADS, VALVE BOX COVERS SHALL BE BURIED 6" BELOW FINISHED GRADE.
  2. FOR PAVED ROADS, VALVE BOX COVER AND CONCRETE PAD COLLAR SHALL BE LOCATED FLUSH WITH FINISHED PAVED SURFACE.
  3. FOR EASEMENTS NOT TRAVELED OR MAINTAINED FOR VEHICULAR TRAFFIC. VALVE BOX COVER SHALL BE LOCATED EVEN WITH FINISHED GRADE.
  4. REFER TO DETAIL 2.7 FOR TRACER WIRE DETAIL
  5. CONCRETE SHALL BE PER SPECIFICATIONS.

ST.MARY'S GLACIER  
WATER & SANITATION DISTRICT

TYPICAL VALVE BOX DETAIL

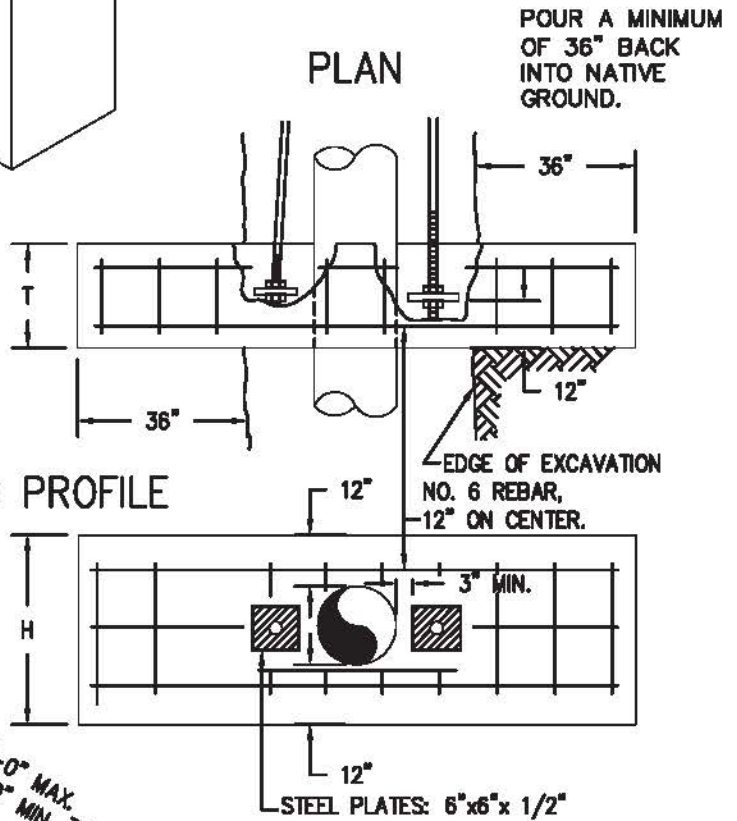
DATE: 10/2019

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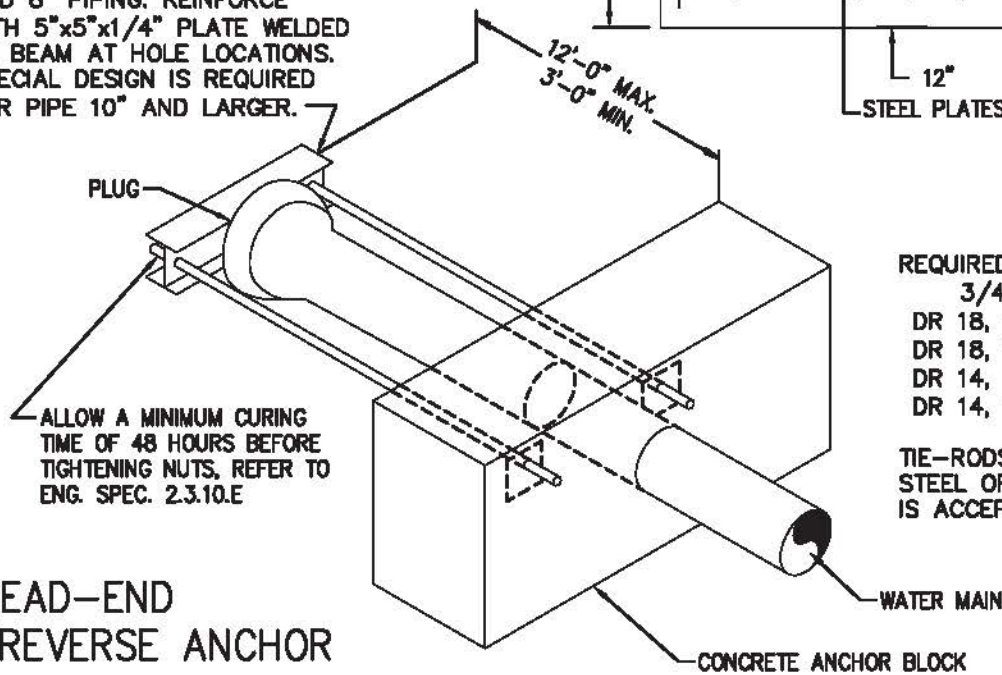


**VALVE OR TEE ANCHOR**

**DIMENSIONS:**  
 T=24" FOR PIPE 12" AND UNDER  
 T=36" FOR PIPE OVER 12"  
 H=PIPE OD. +24"



USE W6x20. BEAM FOR 6" AND 8" PIPING. REINFORCE WITH 5"x5"x1/4" PLATE WELDED TO BEAM AT HOLE LOCATIONS. SPECIAL DESIGN IS REQUIRED FOR PIPE 10" AND LARGER.



**DEAD-END REVERSE ANCHOR**

ST. MARY'S GLACIER  
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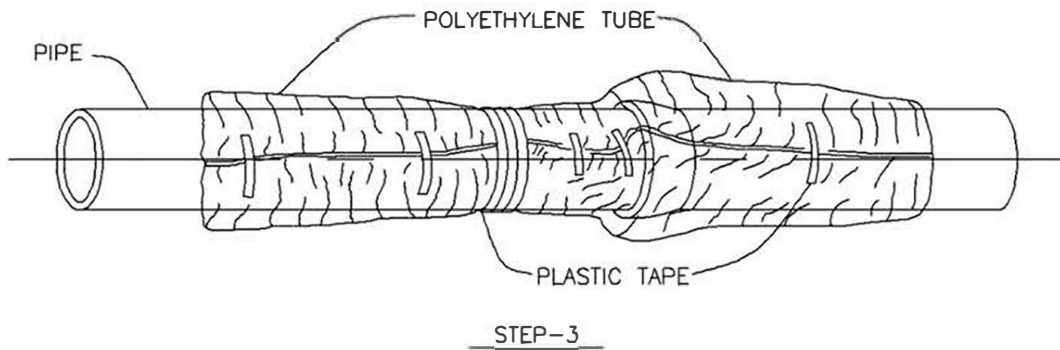
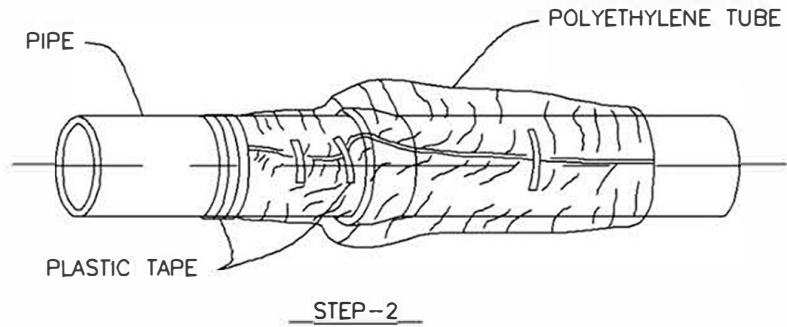
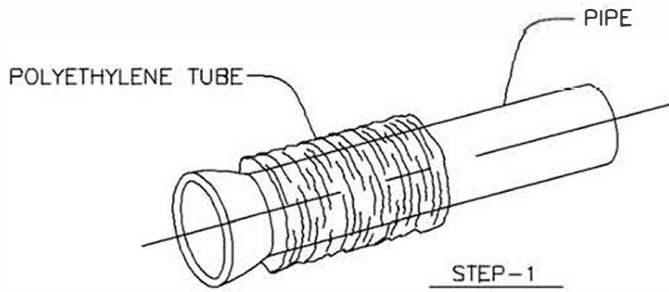
**REQUIRED NUMBER OF 3/4" TIE-RODS:**  
 DR 18, 10" AND UNDER: 2  
 DR 18, 12" AND OVER: 4  
 DR 14, 8" AND UNDER: 2  
 DR 14, 10" AND OVER: 4

TIE-RODS SHALL BE STAINLESS STEEL OR PLATED. ALLTHREAD IS ACCEPTABLE.

**REVERSE ANCHOR  
 DETAIL**

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### FIELD INSTALLATION—POLYETHYLENE WRAP

- STEP-1 PLACE TUBE OF POLYETHYLENE MATERIAL AROUND PIPE PRIOR TO LOWERING PIPE INTO TRENCH.
- STEP-2 PULL THE TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO PIPE AT JOINT. FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH TAPE TO HOLD THE PLASTIC TUBE IN PLACE.
- STEP-3 OVERLAP FIRST TUBE WITH ADJACENT TUBE AND SECURE WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE SHALL BE LOOSE. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED ON TOP OF THE PIPE AND TAPED IN PLACE.

NOTE: POLYETHYLENE SHALL BE MINIMUM 8-MIL THICKNESS

ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

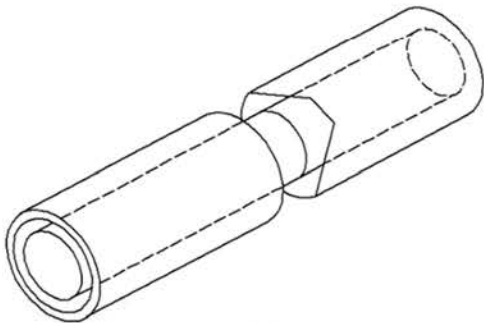
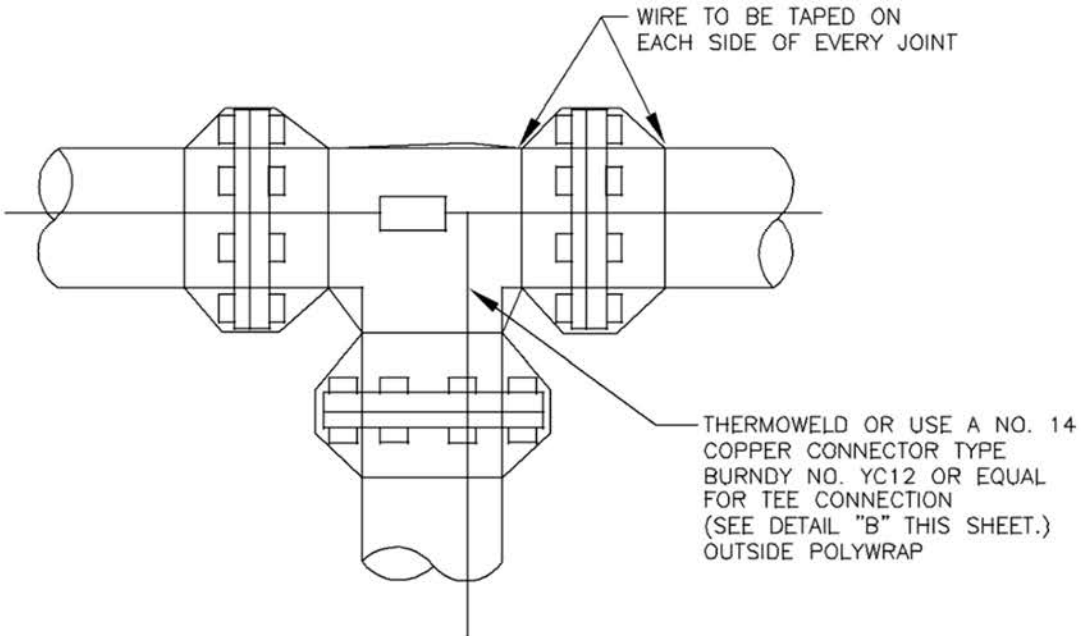
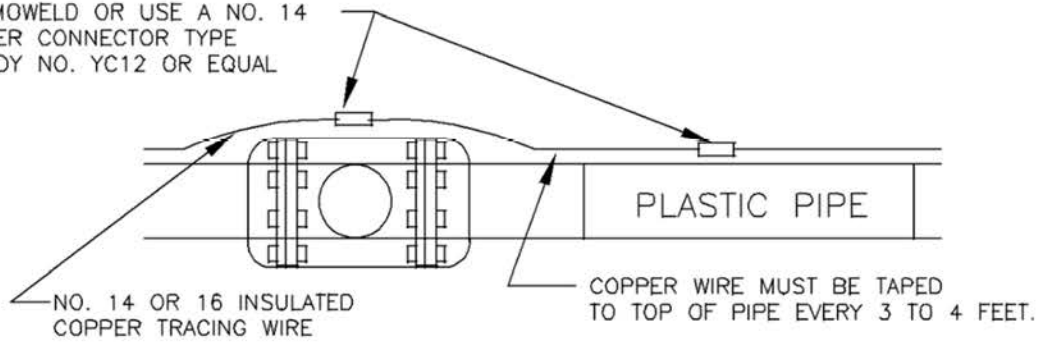
DIP POLYETHYLENE WRAP  
DETAIL

DATE: 10/2019

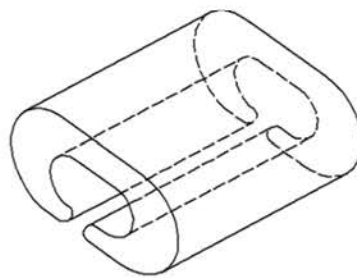
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THERMOWELD OR USE A NO. 14  
COPPER CONNECTOR TYPE  
BURNDY NO. YC12 OR EQUAL



DETAIL A



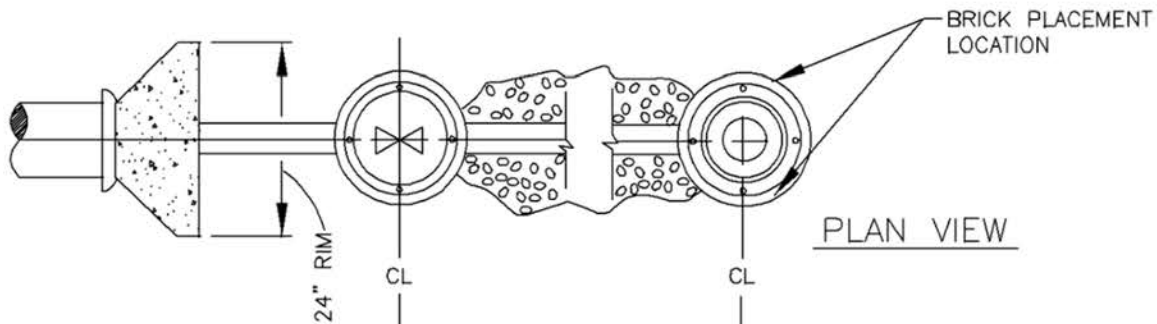
DETAIL B

ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

PVC PIPE TRACER WIRE DETAILS

DATE: 10/2019

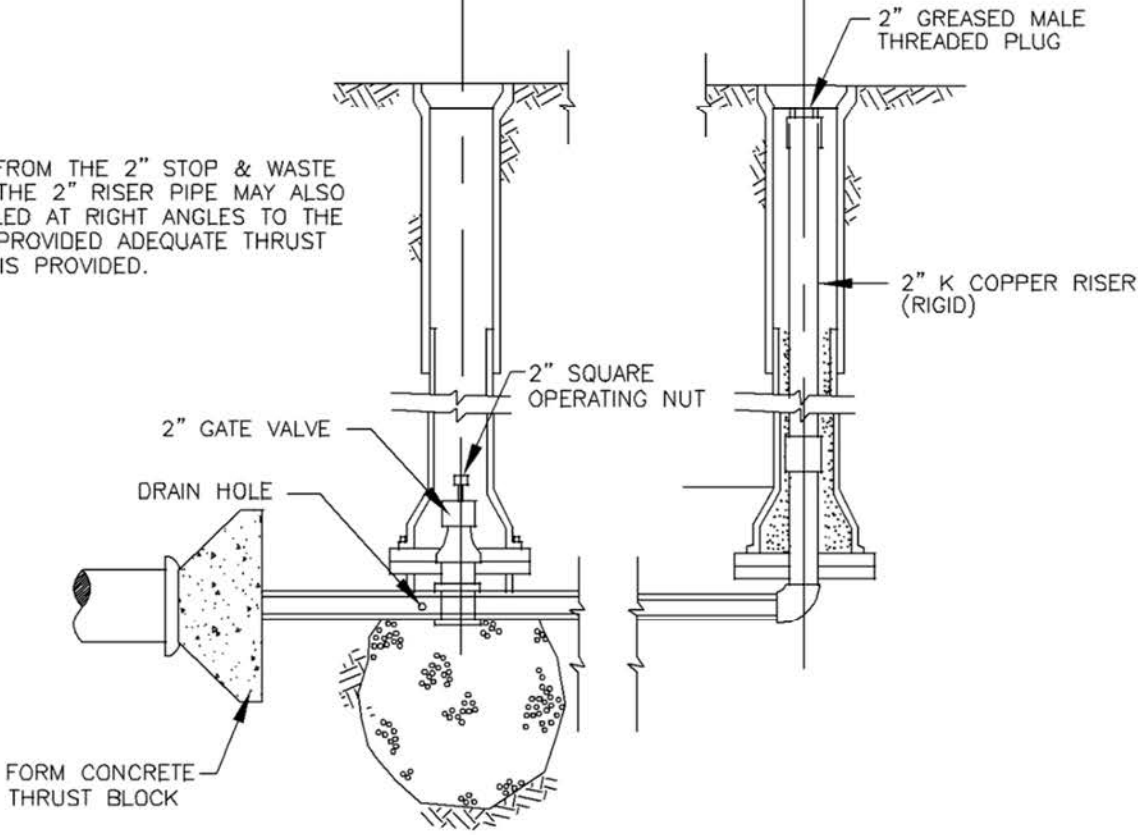
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PLAN VIEW

NOTE:

THE LINE FROM THE 2" STOP & WASTE VALVE TO THE 2" RISER PIPE MAY ALSO BE INSTALLED AT RIGHT ANGLES TO THE MAINLINE, PROVIDED ADEQUATE THRUST BLOCKING IS PROVIDED.



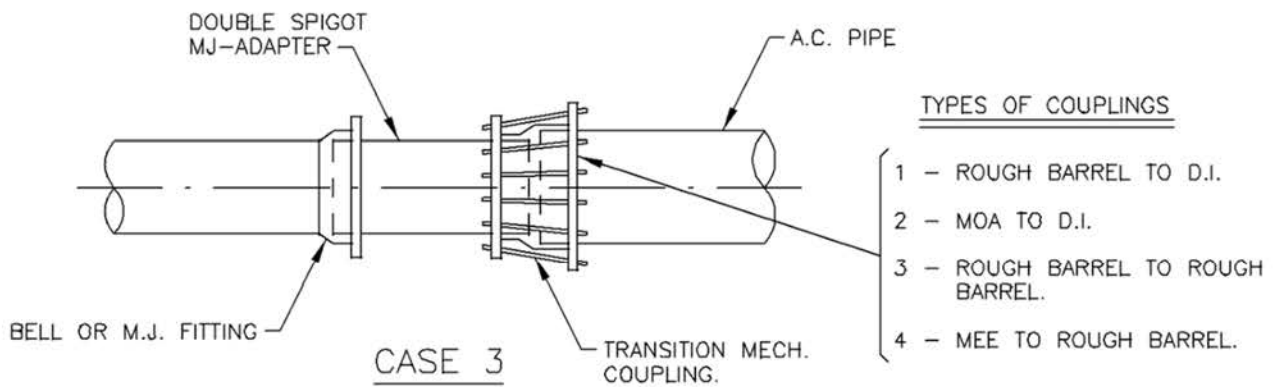
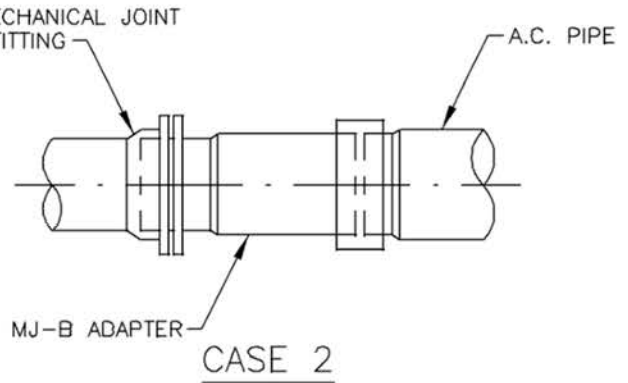
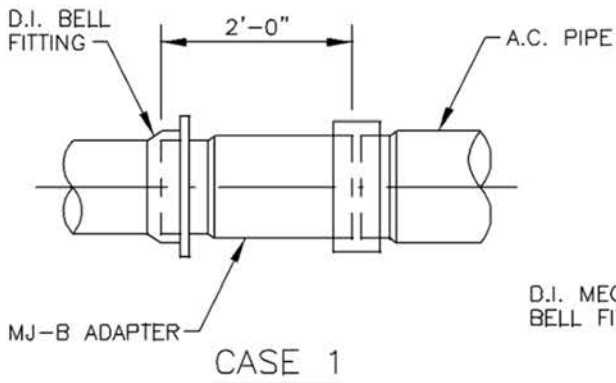
SECTION A-A

ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

WATER MAIN BLOW OFF DETAIL

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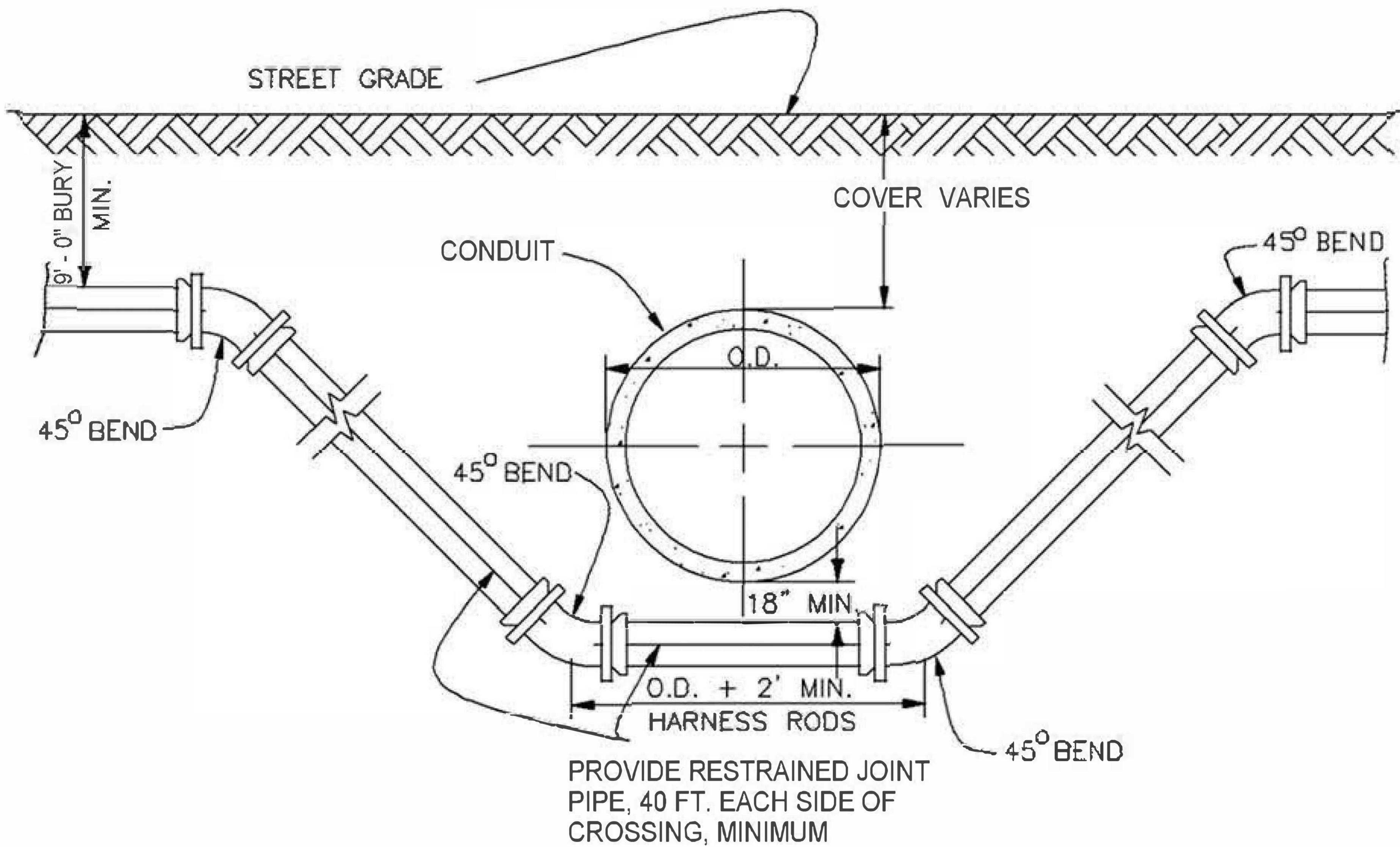
- A.C. = ASBESTOS CEMENT
- D.I. = DUCTILE IRON
- MOA = MACHINED OVER ALL.
- MEE = MACHINED EACH END.
- MJ = MECHANICAL JOINT.
- MJ-B = MECHANICAL JOINT-BELL ADAPTER.

ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

WATER MAIN ADAPTER COUPLING  
DETAILS

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NOTES:

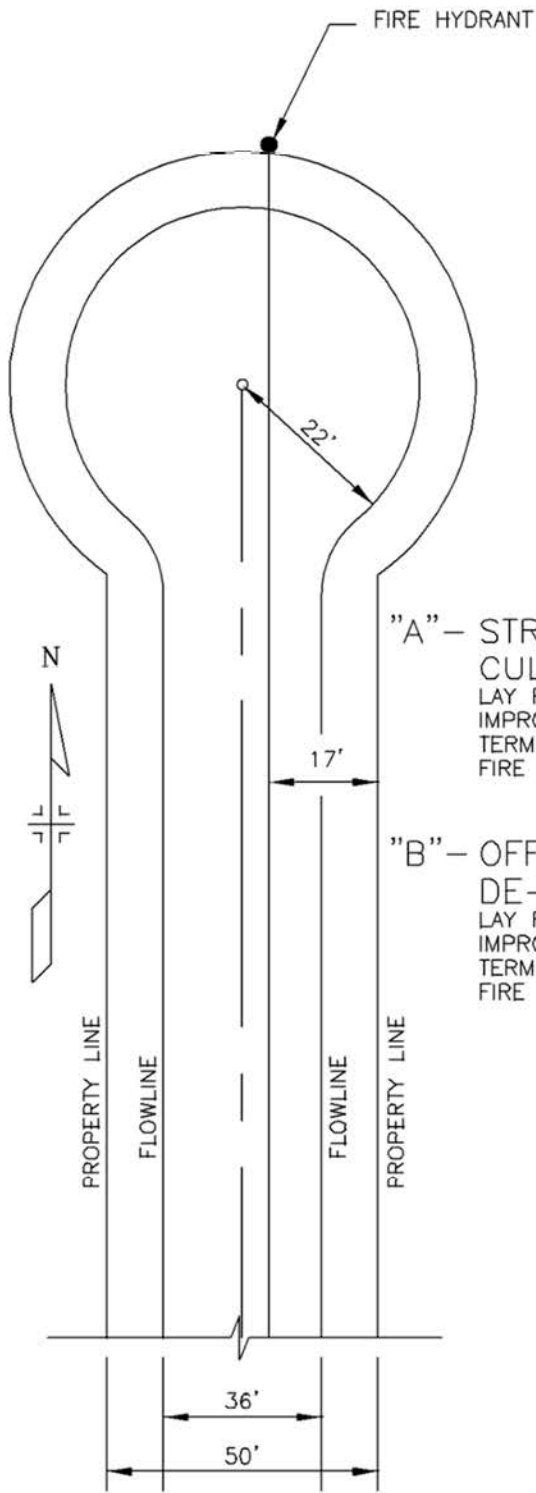
1. SEWER LINES CROSSING ABOVE WATER MAINS SHALL BE DUCTILE IRON PIPE, C900 PVC, W/ JOINTS ENCASED IN CONCRETE 10' EACH SIDE OF CROSSING (MIN.).
2. MINIMUM CLEARANCE 18" AS SHOWN ABOVE.
3. D.I.P. WILL BE WRAPPED.
4. CONDUIT TO BE PROPERLY SUPPORTED.

**ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT**

**WATER MAIN UTILITY CROSSING  
DETAIL**

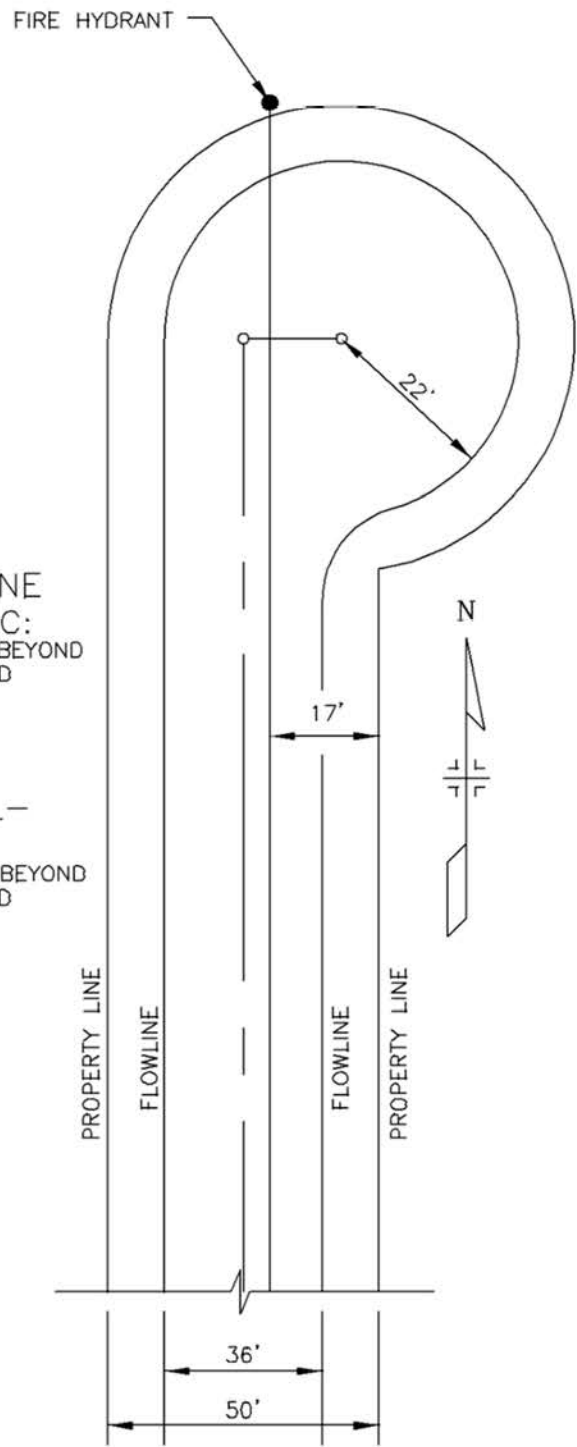
DATE: 10/2019

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"A" - STRAIGHT LINE  
CUL-DE-SAC:  
LAY PIPE TO 18' BEYOND  
IMPROVEMENTS AND  
TERMINATE IN A  
FIRE HYDRANT.

"B" - OFFSET CUL-  
DE-SAC:  
LAY PIPE TO 18" BEYOND  
IMPROVEMENTS AND  
TERMINATE IN A  
FIRE HYDRANT.

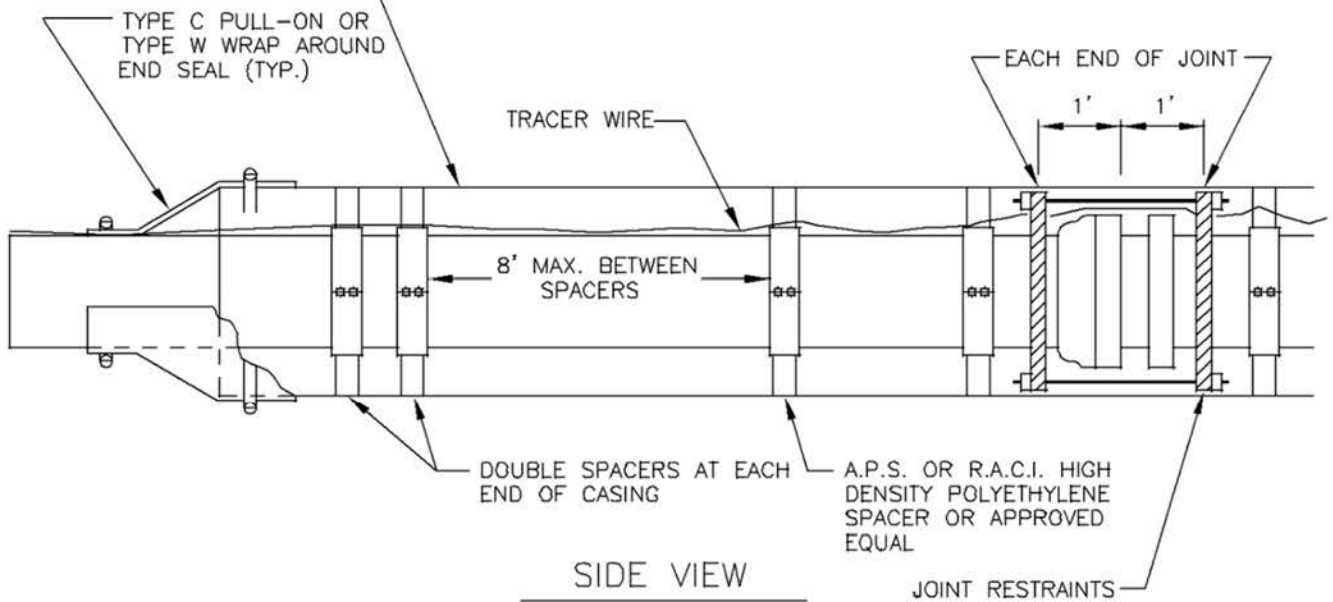
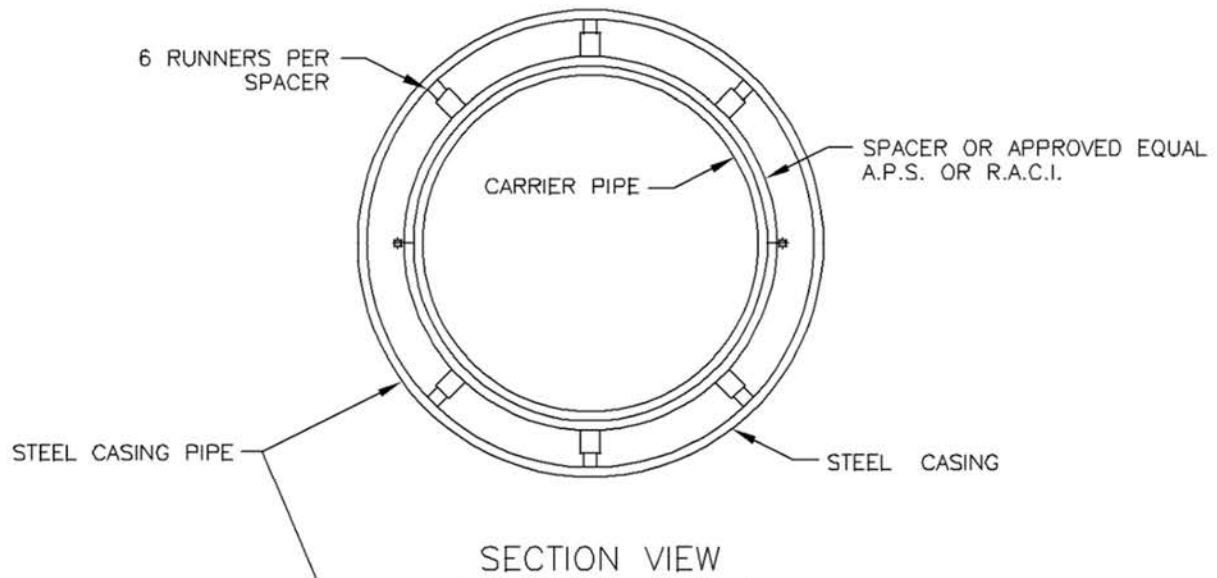


ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

CUL-DE-SAC WATER MAIN DETAILS

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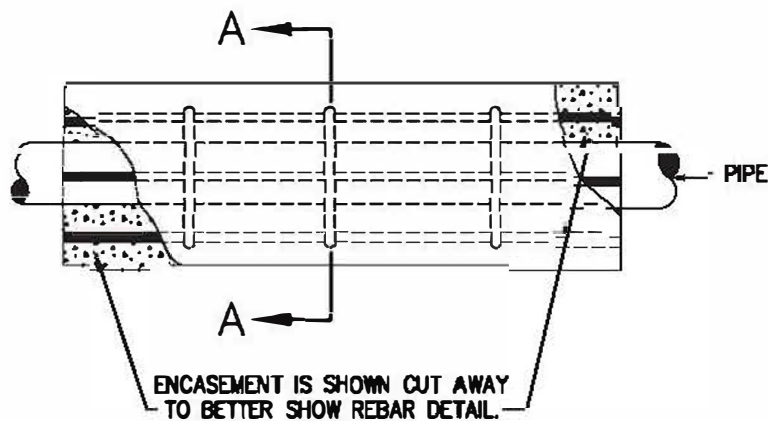
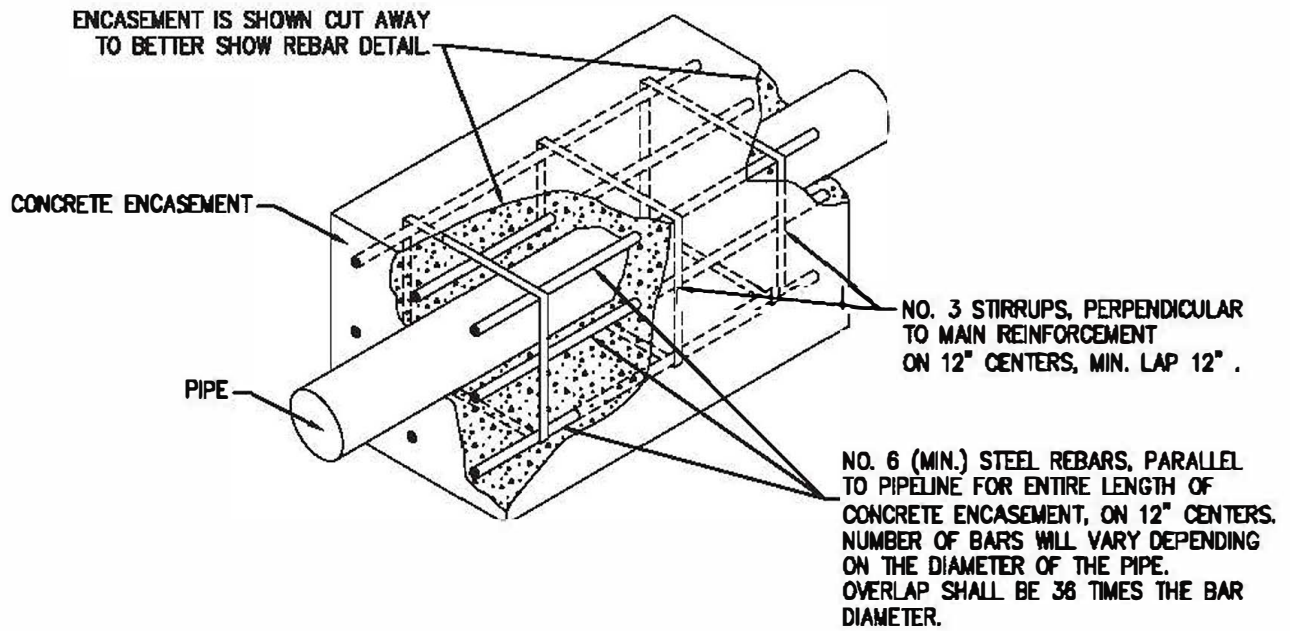


ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

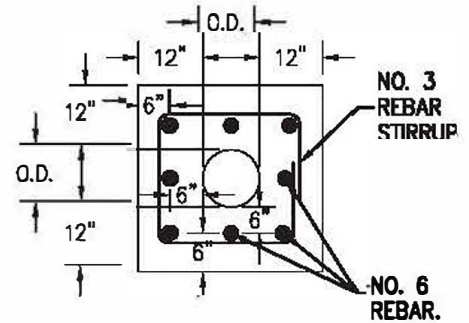
WATER MAIN CASING DETAIL

DATE: 10/2019

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PROFILE VIEW



CROSS SECTION A-A

ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

REINFORCED CONCRETE  
ENCASEMENT DETAIL

DATE: 10/2019

SHEET 2-13 of 13



ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT  
CONSTRUCTION STANDARDS

Chapter 3

Sanitary Sewer

System



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## **CHAPTER 3 SANITARY SEWER SYSTEM**

### **3.00.0 GENERAL PROVISIONS**

This chapter contains minimum criteria to be met on all sanitary sewer designed and constructed in the St. Mary's Glacier Water & Sanitation District (District), by both the Developing Party and/or by the District. All work referenced in this section must comply with the general requirements in Chapter 1.

### **3.01.0 USE OF SANITARY SEWER**

The use of sanitary sewers within the District shall be in accordance with the latest edition of the District's Rules and Regulations.

### **3.20.0 DESIGN CRITERIA**

#### **3.21.0 SCOPE**

It is the intent of this "design criteria" section to provide sufficient detailed information to enable the Engineer for the Responsible Party to correctly and efficiently design the overall sanitary sewer system for a development. If the District deems it appropriate to require the engineered design of a sanitary sewer system, criteria shall be made available to the Engineer to provide a design acceptable to the District. Any deviation from these CONSTRUCTION STANDARDS must be approved in writing by the District.

#### **3.22.0 GENERAL**

The sanitary sewer system shall be designed by a professional engineer registered in the State of Colorado utilizing the most current technical standards along with good, sound engineering judgment throughout the design process. Depending on the extent of the improvements, the design process may require the submittal of construction plans and specifications for review and approval by the District.

Following completion of the Utility Permit Application by the Responsible Party per Section 1.25.6, the District will determine the requirement to submit engineering construction documents as identified in Section 1.25.2. If required by the District, said documents shall be prepared and sealed by a professional civil engineer registered in the State of Colorado and shall be in full conformance with these CONSTRUCTION STANDARDS.

At the completion of the project, the engineer shall provide the District with two (2) sets of wet stamped record drawings documenting the final "as constructed" conditions.

#### **3.23.0 DESIGN FLOW**

The flows used to design the sewer system for a development vary depending on the type development. The following is a list of criteria to be used in the preparation of all sewer system analysis and design.

- (A) Design flow shall be calculated using peak domestic flow rate plus maximum infiltration of 400 gallons per day per Equivalent Residential Unit (EQR)
- (B) For Non-residential domestic wastewater, flow shall be calculated using specific planning information, known or predicted, using the parameters outlined in Table 3.23.1 below. Conceptual planning information listed in the table shall be used for future flow design.

TABLE 3.23.1  
Commercial/Industrial Specific Development Design Flow Parameters

Type of Establishment	Design Unit Flow (gpd/1000 sq ft)
Office Buildings	200
Restaurants	500
Bars & Lounges	300
Hotels & Motels	350
Neighborhood Stores	200
Department Stores	200
Laundries & Dry Cleaning	1000
Banks & Financial Buildings	300
Medical Building & Clinics	300
Warehouses	100
Meat & Food Processing Plants	2800
Car Washes	1900
Service Stations	20
Auto Dealer. Repair & Service	150
Super Market	200
Trade Businesses	200
Places of Assembly – Churches, etc.	600

**3.24.0 HYDRAULIC DESIGN/SIZING OF SEWER LINES**

**3.24.1 General**

Sanitary sewer shall be designed to carry the discharge calculated in accordance with Section 3.23.00 and to transport suspended material such that deposits in the sewer are precluded. The following table gives the recommended capacity criteria for sanitary sewer mains:

TABLE 3.24.1  
Recommended Capacity Criteria

Diameter (Inches)	Flow Depth Restriction (d/D)
Less than or equal to 15”	0.50
Greater than 15”	0.75

The minimum diameter for sanitary sewer mains shall be 8-inches. Oversizing of mains may be required by the District, and the recovery of the costs of such oversizing shall be the responsibility of the District. The minimum diameter for sanitary sewer service lines shall be 4 inches.

**3.24.2 Sanitary Sewer Mains**

1. Sewer line design shall incorporate the largest slope possible within the requirements of Table 3.24.2 and shall maintain a uniform slope between manholes.
2. The sewer must be designed at a slope great enough to produce a minimum flow velocity of two feet (2') per second and a maximum flow velocity of ten feet (10') per second at the peak design flow using the Manning equation and Manning's n values as indicated in Table 3.24.3 below except that the slope shall never be less than the minimum slope given in Table 3.24.2
  - a. The following table gives the minimum and maximum allowable slopes for sanitary sewer mains:

TABLE 3.24.2  
Sanitary Sewer Main Slope Criteria

<u>Diameter (Inches)</u>	<u>Minimum Slope (Feet/Feet)</u>	<u>Maximum Slope (Feet/Feet)</u>
8	0.0040	0.0180
10	0.0030	0.0120
12	0.0020	0.0100
15	0.0015	0.0080

TABLE 3.24.3  
Manning's n Values per Pipe Material

<u>Sewer Line Material</u>	<u>Manning's n Value</u>
PVC	0.009
RCP	0.013

**3.24.3 Sanitary Sewer Service Lines**

The following table shows the minimum and maximum allowable slopes for sanitary sewer service lines:

TABLE 3.24.4  
Sanitary Sewer Service Slope Criteria

<u>Diameter (Inches)</u>	<u>Minimum Slope (Feet/Feet)</u>	<u>Maximum Slope (Feet/Feet)</u>
4	0.020	0.150
6	0.020	0.100

**3.25.0 SYSTEM LAYOUT**

**3.25.1 General**

All mains shall be installed in dedicated rights-of-way or public easements. Easement widths shall be two times the sewer depth, with 20 ft. minimum width. Under no circumstances should sanitary sewer mains be installed parallel to and directly below any concrete such as sidewalks, curbs or gutters. Lines shall normally be located five feet south or west of street centerline, unless otherwise approved, in writing, by the District. Sanitary sewer mains shall be straight between manholes, both in horizontal and vertical alignment.

Sewer mains will ordinarily have a minimum of eight feet of cover to finished ground surface. Where this will provide less than nine feet of elevation difference between the finished lot grade at building line and the top of the sewer main, it will be indicated on the plans that the lot is served by a "shallow sewer" and appropriate elevation information will be given.

Extensions of sewer mains shall be located to the uppermost property line unless otherwise approved by the District.

Sewer mains shall terminate in a manhole. During a phased utility extension, the sewer main may be temporarily allowed to dead end in a cleanout provided the main extends no more than 50 feet from the last manhole and a maximum of two (2) residential connections exist. The cleanout provided shall be in accordance with the STANDARD DETAILS in this Chapter.

Sanitary sewer mains shall be laid a minimum of ten feet horizontally from any existing or proposed utility. Upon written approval by the District, a sanitary sewer main may be laid closer than ten feet to a parallel water main if it is laid in a separate trench and if the elevation of the invert of the water main is at least eighteen inches above the crown of the sewer main and, in addition, polyvinyl chloride pressure pipe is used for the sewer main.

When the sanitary sewer main passes under a highway, railroad or drainage or irrigation ditch, there shall be a minimum of 3-1/2 feet of cover and steel casing shall be installed in accordance with the STANDARD DETAILS in this chapter. The steel casing shall extend the entire width of the right-of-way or easement of the crossing structure or as directed by the District.

**3.25.2 Waterline Crossing Over or Under a Sanitary Sewer Line**

See Section 2.18.2 of these STANDARDS.

**3.25.3 Storm Sewer Line Crossing Over or Under Sanitary Sewer Line**

When there is less than 18 inches of vertical clearance between the sanitary sewer line and the storm sewer line, the sanitary sewer line shall be encased in concrete a minimum of ten feet on each side of the centerline of the crossing or polyvinyl chloride pressure pipe in accordance with AWWA C900 may be used. In the case of the sanitary sewer crossing over the storm sewer, each joint of the storm sewer within 9 feet of the centerline of the crossing shall be encased in concrete.

**3.25.4 Limits on Vertical Separation**

Under no circumstances shall the vertical clearance between any lines involving a waterline, sanitary sewer, or storm sewer be less than 12 inches without prior written approval from the District.

**3.26.0 EASEMENTS**

See Section 3.25.1 of these STANDARDS.

**3.27.0 FUTURE CONNECTIONS**

Manholes shall have a 5 ft. minimum length of pipe stubbed out which is sized to accommodate flows from the upstream basin whenever a future extension of the sanitary sewer main is anticipated. The main line stub-out shall be capped and sealed.

### **3.28.0 SERVICES**

Each structure shall be served by a separate service line. Sanitary sewer service lines shall be located a minimum of ten feet away from all water services (measured horizontally). Whenever possible, service lines shall be constructed perpendicular to the property line of the property they are going to serve and shall be located a minimum of 10 feet from either property line. Six-inch service lines and larger shall require connection to the main with a manhole. Service connections shall not be allowed onto an interceptor sewer (i.e. any sewer line greater than 12" in diameter) without prior approval of the District. The District shall not be held responsible for the locating of sewer service lateral stub-outs for future connections.

### **3.29.0 TAPS**

All sanitary sewer service connections to the sanitary sewer main shall be made using "wye" fittings, unless otherwise approved by the District.

### **3.30.0 UNLAWFUL CONNECTIONS**

It shall be unlawful to discharge roof drainage, foundation drainage, sump pumps, surface drainage or any other non-acceptable wastes to the sanitary sewer which would violate any of the provisions of the District Rules and Regulations.

### **3.31.0 WASTEWATER PRE-TREATMENT**

All uses shall be evaluated to determine the application of the District's Rules and Regulations prior to being issued a final Certificate of Occupancy. If requested use is non single family residential, an approved pre-treatment device may be required as defined in Section 3.32.5. Final determination shall be made by the District.

### **3.32.0 APPURTENANCES**

#### **3.32.1 Manholes**

The maximum spacing between manholes shall be 400 feet for sewer pipe diameters of 15" or less. For sewer pipe diameters of greater than 15", the maximum spacing shall be 500 feet. Manholes shall be provided at every change in grade, sewer line diameter, or intersection of sewer line equal to or larger than 15" in diameter. Manholes shall also be provided at every change in direction.

Manholes shall have a minimum diameter of 48" for all sewer pipe diameters less than 18". For sewer pipe diameters greater than 18", the minimum manhole diameter shall be 60". The drop across a manhole base should match the larger of the incoming or outgoing slope but shall not be less than 0.2 foot per one foot. For manholes under the following conditions, a corrosive protective material coating shall be installed within the interior:



- Manholes providing a change in direction equal to or greater than 45 degrees (for pipe diameters smaller than 18")
- Manholes in line with or at the end of sewer lines with District-preapproved slopes greater than that set forth in these criteria, manholes accepting flow from an outside drop or any form of anticipated septicity, or as required by the District.

Manholes shall not be in areas that are subject to flooding from surface runoff. Manholes shall be located within utility easement areas that allow direct access by maintenance vehicles when it is not feasible to locate the manhole in the public street. If the possibility of surface runoff cannot be avoided, an internal watertight insert shall be installed to prevent inflow. All manholes located outside dedicated street rights-of-way shall be designed and constructed with locking-type cover and the manhole ring shall be bolted to the manhole cone.

### **3.32.2 Outside Drop Manholes**

Drop manholes will only be allowed when the design engineer proves that alternates are not feasible and when approved, in writing, by the District. Outside drop manholes will be required whenever a sewer entering a manhole is at an elevation twenty-four inches or more above the manhole invert. Outside drop manholes shall be in accordance with the STANDARD DETAILS of this chapter. Outside manhole drops require filleting to avoid solids deposition. The entire outside drop piping shall be encased in concrete. No inside drops are allowed.

### **3.32.3 Underdrains**

Where underdrains are to be constructed under sewer mains, separate clean-outs shall be provided next to each manhole in accordance with the STANDARD DETAILS of this chapter. No connection to any underdrain service lines originating from within lots shall be permitted.

### **3.32.4 Lift Stations**

Lift stations will only be allowed when the design engineer proves that this is the only option available and when approved, in writing, by the District. The District shall dictate the location and type of pumping facilities to be constructed and to require extra maintenance from the Responsible Party. The District will require the lift station to contain a separate emergency power backup in cases of power outages and comply with all CDPHE Site Application requirements.

### **3.32.5 Gravity Grease and Sand/Oil Interceptors (Interceptor)**

Any new establishment, including but not limited to Food Service Establishments (FSE) and automotive related facilities, that may contribute fats, oils, grease (FOG), sand, mud, petroleum based oils, or any other potentially damaging pollutant to the District's wastewater treatment system shall be required to install and maintain, at the owner's expense, a properly designed and constructed interceptor. In addition, any existing facility that contributes FOG, sand, mud, petroleum-based oils, or any other potentially damaging pollutant to the District's wastewater treatment system may be required to install and maintain, at the owner's expense, a properly designed and constructed interceptor. Specific sizing design criteria shall be obtained from the District.

Unless otherwise approved, all exterior interceptors shall meet the following minimum standards and must be approved by the District prior to installation:

1. Engineer designed and constructed for its intended purpose.
2. Precast concrete construction, reinforced to 4000 PSI minimum compressive strength at 28 days.
3. Conforming to H-20 load rating standards if installed in vehicle traffic areas.
4. At least 2 separate chambers separated by 1 baffle between any 2 chambers, the volume of the first chamber occupying approximately 2/3 of the total volume of the interceptor.
5. 2 manholes of 24" minimum diameter for each chamber, located above the inlet and outlet pipe.
6. Minimum 4" diameter inlet pipe. Outlet pipe must be equal or greater diameter than inlet.
7. Inlet pipe must have a T, the bottom of which must extend no more than ½ the depth of the liquid.
8. Outlet pipe must have a T, the bottom of which must extend no less than 12" above the tank floor. At no time may the outlet pipe T be capped. Outlet filters shall not be installed.
9. The inlet and outlet inverts shall differ by a minimum of 2" and a maximum of 4".
10. A separate inspection/sampling chamber may be located in the discharge line beyond the interceptor but shall not be installed in place of the outlet pipe T.
11. Designed such that it shall not become air-bound if an airtight cover is used.
12. Interceptor shall be designed as close as possible to the establishment and shall be readily accessible for cleaning, maintenance, and inspection.
13. Interceptor shall be designed such that the retention time is at least 30 minutes.

### 3.32.6

#### **Hydromechanical Grease Interceptors**

An exemption to Section 3.32.5 may be requested if the establishment can show that such installation is not feasible due to physical or other limitations that would make it impractical to install an Interceptor. Such request shall be made in writing and, if approved by the District, the establishment shall be required to install and maintain, at the owner's expense, a hydromechanical grease interceptor. Such interceptor shall be constructed and sized to conform to the Plumbing and Drainage Institute Standard G-101 (PDI G-101), shall be installed according manufacturer's and International Plumbing Code requirements, and shall be located as close as possible to the source of the grease-producing fixture.

### **3.39.0 CONSTRUCTION SPECIFICATIONS**

### **3.40.0 EXCAVATION AND TRENCHING**

Excavation, trenching and backfilling shall be done in accordance with Chapter 4 of these CONSTRUCTION STANDARDS.

### **3.41.0 BEDDING**

#### **3.41.1 General**

In the event unstable trench conditions are found at pipeline grade, a minimum of one and one-half inch uniformly graded, washed rock shall be used for trench stabilization. Depth of stabilization shall be as approved by the District. Pipe bedding shall be done in accordance with Sections 3.41.0 of these CONSTRUCTION STANDARDS and the STANDARD DETAILS in this chapter.

#### **3.41.2 Class A Bedding**

Class A bedding is defined as that method of bedding in which the lower half of the pipe is set in a reinforced concrete cradle. The minimum thickness of concrete under the lowest part of the conduit shall be one-fourth of the outside pipe diameter but not less than four inches. The concrete shall extend around the pipe to the spring line of the pipe barrel. The width of the concrete cradle shall be at least equal to the outside pipe diameter plus twelve inches.

#### **3.41.3 Class B Bedding (Granular II)**

Class B bedding is defined as that method of bedding in which the pipe is set on granular material meeting the requirements of Chapter 4 in these CONSTRUCTION STANDARDS. Bedding shall be placed to a depth below the bottom of the pipe equal to one-fourth of the outside pipe diameter but not less than four inches. In rock excavation, this minimum depth shall be six inches. Granular material shall be placed around the sides of the pipe and to a minimum of twelve inches above the top of pipe.

### **3.42.0 PIPELINE INSTALLATION**

#### **3.42.1 General**

The District shall be notified at least 48 hours in advance of any pipe installation. The Responsible Party shall notify and arrange for all utility locates prior to excavation. No pipes shall be backfilled until they have been inspected and approved by the District. Alignment and grade of the pipe and the location of fittings, and manholes shall be staked under the supervision of a professional surveyor registered in the State of Colorado.

Proper implements, tools and facilities shall be provided and used by the Responsible Party for the safe and convenient execution of the work. All pipe fittings, and manhole sections shall be carefully lowered into the trench by means of a derrick, ropes or other suitable tools or equipment to prevent damage to sanitary sewer line material. Under no circumstances shall sanitary sewer line materials be dropped or dumped into the trench.

All pipe fittings shall be carefully examined for cracks and other defects immediately before installation. The groove in the bells of the pipe shall be full and continuous or the pipe will be rejected. Defective pipe or fittings shall be removed from the job site within 24 hours of notification by the District. All foreign matter or dirt shall be removed from the interior and ends of the pipe before they are lowered into position in the trench and prior to connection.

Every precaution shall be taken to prevent foreign material and trench water from entering the pipe and fittings. During construction, the Responsible Party shall provide and maintain adequate equipment to properly remove and dispose of all water entering the trench and any other part of the work.

A green plastic identification strip, a minimum of three-inch wide, continuously labeled "Caution Sewer Line Below" shall be installed directly above all gravity sewer main, the full length of the sewer, and shall be buried two feet below the finished ground surface elevation. For pressure sewer main, a brown plastic identification strip, a minimum of two-inch wide, continuously labeled "Caution Buried Force Main Below" shall be installed directly above the pressure sewer, the full length of the sewer, and shall be buried two feet below the finished ground surface elevation.

### 3.42.2

#### **Pipe**

Pipe shall be laid from downstream to upstream with spigot ends pointing downstream. All pipe shall be placed true to line and grade and carefully centered and with a smooth invert at the joint. Pipe shall be laid with a pipe laser or similar instrument to ensure proper grade is maintained. Any pipe installed at a slope less than 2% shall have a plate-tamped trench bottom to ensure proper grade is maintained.

The joint shall be made in a workmanlike manner and shall be watertight. Immediately before joining two lengths of pipe, the inside of the bell and the outside of the spigot end and the gasket shall be thoroughly cleaned. Caution shall be exercised to ensure that the correct type of gasket is used. A thin film of gasket lubricant shall be applied to the inside face of the gasket and the spigot end of the pipe. The spigot end of the pipe shall be placed in the bell with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home by hand with a slow steady pressure, without jerky or jolting movements. Pipe furnished without a depth mark shall be marked before assembly to ensure insertion to the full depth of the joint. The pipe shall then be properly set and brought to correct line and grade. The pipe shall then be secured in place by installation of bedding material and backfill, in accordance with Chapter 4 and the STANDARD DETAILS in this chapter.

At times when installation is not in progress, the open ends of the pipe shall be closed with a watertight plug. Cutting of pipe for inserting closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining, leaving a smooth end at right angles to the axis of the pipe. Pipe ends shall be smooth and beveled with a file or other tools according to the pipe manufacturer's recommendations.

Extra care should be used in handling PVC pipe during cold weather due to the reduced flexibility and impact resistance as temperatures approach and drop below freezing. PVC pipe to be stored outside and exposed to sunlight for more than 30 days shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover the pipe. Air circulation shall be provided under the covering. Any over-exposed pipe, as determined by the District, will not be permitted for installation.

No pipe or appurtenant structure shall be installed upon a foundation in which frost has penetrated or at any time when the District deems there is a danger of ice formation or frost penetrations at the bottom of the excavation. No pipe or appurtenant structure shall be installed unless backfilling can be completed before the formation of ice and frost.

### **3.43.0 MANHOLE CONSTRUCTION**

#### **3.43.1 Cast-in-Place Base**

Manhole bases shall be constructed with Class A concrete, placed on undisturbed ground and in conformance with the STANDARD DETAILS in this chapter. Changes in direction of flow through the manhole shall be made with a smooth curved channel having as large a radius as possible. The change in size of channels shall be made gradually and evenly and shall be formed directly in the concrete. The floor of the manhole outside of the channel shall be finished to a brushed surface.

Concrete bases shall extend at least eight inches below the invert of the pipe and shall be benched to at least two inches over the top of the pipe. The manhole floor between the sewer pipe and the outer portions of the bench shall be flush with the top edges at the pipe spring line and shall slope upward at least two inches per foot. Wherever grade and alignment permit, the sewer shall be laid continuously through the manhole and the manhole built later. In such cases, the foundation shall be placed as mentioned above and once the manhole is constructed, the upper half of the pipe shall be sawed out and the rough edges smoothed with cement mortar. Breaking out the top of the pipe is not permitted

Where it is not practicable to use split pipe through manholes due to breaks in alignment, grade, or elevation of intersecting sewers, the sewer invert shall be made of concrete deposited between forms. The shape of the invert shall conform to the lower half of the pipe it connects. Side branches shall be constructed with as large a radius of curvature as possible. Inverts shall be plastered with cement mortar and left smooth and clean. Where called for on the plans, a pipe bell shall be stubbed out and plugged. The bell shall be placed as close to the manhole wall as possible, unless showing otherwise on the approved plans.

Reinforcement will be required in the manhole base when the distance from the pipe invert to the top of the manhole cover exceeds 15 feet or when poor soil conditions exist. Reinforcement shall be approved by the District prior to installation.

#### **3.43.2 Pre-Cast Base/Inverts**

Pre-cast bases will be allowed by the District and shall be in conformance with this section. The ground surface below the precast concrete base shall be excavated three inches below the elevation of the bottom of the base and backfilled with three quarter inch gravel meeting the requirements of Section 4.22.0. The gravel shall be carefully leveled and smoothed to give uniform support to the precast base over its entire area. The precast base shall be set at the proper location to center the manhole over the sewer main.

The precast base shall also conform to the requirements of Section 3.43.3 of these CONSTRUCTION STANDARDS.

### **3.43.3 Pre-Cast Barrel**

Precast manhole sections shall not be placed on the foundation until it has reached sufficient strength to provide support without damage. The joint between the manhole base and the barrel section shall be made with a flexible butyl resin joint sealing compound. Each succeeding precast section shall be joined in a similar manner and smoothly finished, inside and out.

### **3.43.4 Manhole Grouting Treatment**

The horizontal joints between precast manhole sections shall be plastered and troweled smooth, inside with cement mortar in conformance with Section 3.64.5 if deemed appropriate by the District Representative. The mortar shall be not less than five-eighths inch in thickness over the joint and shall extend at least four inches on either side of the joint.

All smooth surface pipes, such as PVC or VCP shall have a manhole water-stop gasket, to be furnished by the Responsible Party, firmly attached to the pipe prior to grouting into the manhole. The opening in the manhole wall where a pipe enters or leaves shall be sealed and patched in a neat workmanlike manner, both inside and out with cement mortar. All lifting holes and other imperfections in the interior manhole wall shall be filled with cement mortar.

### **3.43.5 Adjustment Rings**

Precast concrete adjustment rings shall be used on top of the cone to support and adjust the manhole frame to the required final grade. The maximum depth of the adjustment rings shall be twelve inches, and the maximum depth from top of cone to final grade shall be eighteen inches.

The top elevation of the manhole shall be adjusted to match final street grade. If manholes are located in open fields, they shall be left at least eighteen inches above grade and a locking ring and cover shall be installed. In cultivated areas, manholes shall be properly marked by a steel post painted red on the top six inches and located five feet from the centerline of the manhole cover.

### **3.43.6 Cleanouts**

Cleanouts shall be installed next to the manhole base in conformance with the STANDARD DETAILS in this chapter where an underdrain is installed with the sanitary sewer system. Cleanouts may also be used as discussed in Section 3.25.1.

### **3.44.0 CONNECTIONS TO EXISTING MANHOLES**

Sewer pipe connections to existing manholes where there is no existing pipe stubbed out shall be made in such a manner that the finished work will conform as nearly as practicable to the requirements specified for new manhole construction. The Responsible Party shall carefully cut out as small an opening in the existing manhole as necessary to insert the new sewer pipe. The existing concrete foundation bench shall be ground out for a new invert with a hand grinder to the cross-section of the new pipe to form a smooth continuous invert like what would be formed in a new concrete base. Where practical, the downstream invert shall be plugged during construction to prevent storm and non-sewage flow from entering the system. The Responsible Party shall pump out and clean the manhole before removing the plug. Cement mortar shall be used to smoothly finish the new invert and to seal the new line, both inside and outside, so the junction is watertight.

## **3.45.0 UNDERDRAINS**

### **3.45.1 General**

Where excessive ground water is encountered, the District may require construction of a piped underdrain, to reduce infiltration. Underdrains shall be daylighted to the nearest suitable point as approved by the District.

Underdrain main construction shall be done in accordance with engineered construction plans for the work prepared under the direction of a registered professional engineer and approved by the District.

Soil samples are a prerequisite to the underdrain system. A written proposal on the underdrain system must be presented to the District before the Construction Agreement is approved.

### **3.45.2 System Layout**

Underdrain shall be placed in its own trench approximately 1-1.5 feet below sanitary sewer main, unless otherwise approved by the District Representative.

All underdrain cleanouts should be located in either a storm sewer vault or in its own valve box. Underdrain cleanouts will not be permitted in sanitary sewer manholes.

### **3.45.3 Materials**

All underdrains shall be constructed in perforated and/or non-perforated SDR-35 PVC pipe, with a tracer wire attached for locating purposes.

A minimum of 6-inch PVC pipe shall be used for all underdrain mains and services.

Underdrains shall be lined in filter fabric prior to installation only if perforated.

### **3.45.4 Record Documents**

Record drawings shall be provided to the District prior to date of acceptance. All maps must provide adequate details of the underdrain prior to being accepted by the District.

### **3.45.5 Inspections**

Underdrain mains will be thoroughly inspected by the District Representative prior to backfill. Underdrain cleanouts must be located outside of sanitary sewer manholes, as detailed in the Construction Agreement. Underdrain daylightings shall be free from being covered by dirt. An engineering drawing of all proposed daylightings shall be submitted prior to District approval.

### **3.45.6 Bedding**

Granular bedding material shall be installed a minimum of 12 inches above the top of the pipe. Backfill must be placed in lifts not exceeding 12 inches.

### **3.45.7 Compacting Ordinary Backfill**

All trenching, backfilling and compaction of underdrain shall be done in accordance with Chapter 4 of these CONSTRUCTION STANDARDS.

### **3.46.0 PRESSURE SEWERS**

All requirements of Chapter 2 of these CONSTRUCTION STANDARDS shall apply to the installation of pressure sanitary sewer lines. All pressure sanitary sewers shall be installed using PVC C-900 per AWWA for 6" diameter or greater pipe. For pipe 4" diameter or smaller, pipe shall conform to AWWA Schedule 40 class 200 PVC. If pressure sewers are allowed by the District, design will include cleanouts and lift stations according to the District.

A brown plastic identification strip, a minimum of a two-inch wide, continuously labeled "Caution Buried Force Main Below" shall be installed directly above the pressure sewer, the full length of the sewer, and shall be buried two feet below the finished ground surface elevation. Responsible party has the option of installing either a metallic identification strip or tracer wire along the pipe in conformance with Section 2.33.2 of these CONSTRUCTION STANDARDS.

### **3.47.0 SANITARY SEWER SERVICE LINE CONSTRUCTION**

All sanitary sewer service lines that connect to the District's sanitary sewer system shall comply with these CONSTRUCTION STANDARDS, the District's Rules and Regulations, and the most current District adopted Uniform Plumbing Code.

The Responsible Party shall place wyes, stubs, and risers where required by the approved plans. Wyes shall be angled upwards so that the upper invert of a one-eighth bend connected to the fitting will have an elevation equal to or higher than the inside crown of the sewer main. Riser connections shall be installed where the elevation of the top of the branch is more than twelve feet below the approved finished grade. Riser connections will ordinarily reach to a grade ten feet below the finished ground surface.

Watertight plugs shall be installed in each branch pipe or stub. As-built measurements shall be made by the Responsible Party or his representative to reference the wye or riser connection to the nearest manhole as well as the depth from the finished grade elevation to the invert of the stub before backfilling is completed. Said measurements shall be carefully and accurately made and recorded and shall be shown on the construction record plans furnished to the District prior to acceptance.

All installation work shall conform to applicable portions of ASTM C-12 and to the pipe manufacturer's installation instructions. The grooves shall be cleaned free of all foreign materials prior to assembling the joint. The pipe shall be laid with the spigot end pointing in the direction of the flow.

Trenches shall be kept free of water during laying and jointing. Lines longer than fifty feet shall be laid with batter boards, a laser, or other means approved by the District. Clean-outs are required at a minimum interval of one hundred feet or at all bends exceeding 60 degrees or changes in grade. The area around a clean-out shall be graded so water runs away from the clean-out. No clean-outs, other than those installed as part of the sewer main underdrain system, shall be installed in publicly owned rights-of-way or easements.

Service stub-ins shall be extended at least 10 ft. into the property and be plugged with a compression stop. Service stub-in locations shall be marked with a green post or pipe for future location and connection.

Backfilling shall be in accordance with Chapter 4 of these CONSTRUCTION STANDARDS.



Service lines that need to be disconnected or abandoned shall be excavated at the main line and capped, plugged, or otherwise blocked within 2 ft. of the main line to prevent future connection or infiltration/inflow.

### **3.48.0 TAPPING EXISTING SANITARY SEWERS**

Where tees have not been installed in the sewer main, the main shall be tapped by machine drilling a hole sized to fit the saddle for the service line. The drilling machine, method of drilling, and the saddle shall be approved by the District. The saddle shall be sealed when attached to the main and held in place with 316 stainless steel metal pipe clamps or other approved methods.

### **3.49.0 TESTS**

#### **3.49.1 General**

All sanitary sewer mains and appurtenances shall be cleaned and tested after backfilling operations have been completed and compaction test results have been submitted to and approved by the District. Should the District find that the completed line or any portion thereof fails any of the specified tests, the District will not accept the new sewer line until the sewer line meets the test specifications.

Once the sewer line is completed the Responsible Party shall perform an air test and lamp test on the completed line. The use of alternate testing methods may be allowed or required in addition to those stated herein and determined necessary by the District. Alternate testing methods include water exfiltration test, infiltration test, deflection test, and television inspection.

The Responsible Party shall furnish all labor, materials, tools and equipment necessary to clean the pipe and appurtenances, make the tests and perform all work incidental thereto with the exception of a television inspection which the District will perform. Any damages to the pipeline caused by cleaning or testing operations shall be repaired or replaced by the Responsible Party at his expense.

#### **3.49.2 Air Tests**

The Responsible Party shall perform these tests with suitable equipment specifically designed for air testing sewers. The pipe, or sections of concrete pipe to be tested, may be wetted before the air test. The line shall be plugged at each manhole with pneumatic balls. All service plugs shall be secured in place to prevent displacement during testing operations.

Low pressure air shall be introduced into the plugged lines until the internal air pressure reaches 4.0 psi plus 0.4 psi per foot of water table above the pipe invert, if any. At least two minutes shall be allowed for the air temperatures to stabilize before readings are taken and the timing started.

The portion being tested shall pass if it does not lose air at a rate to cause the pressure to drop from 3.6 to 3.0 psi (plus any adjustments for water table pressure as mentioned previously) in less time than listed below:

Pipe Diameter <u>In Inches</u>	Minimum Allowable Minutes <u>3.6 to 3.0 psi Pressure</u>
4	3.0
6	3.0
8	4.0
10	5.0
12	6.0
15	7.0

If the installation fails this test, the testing equipment may be used to determine the location of the pipe leak.

### 3.49.3 Deflection Test

The maximum vertical deflection allowed for PVC pipe is five percent. The District may require the Responsible Party to perform deflection tests of the pipe before acceptance. Optional devices for testing include calibrated television, photography, properly sized go-no-go mandrel, sewer ball, or deflectometer. The method used shall be approved by the District. To insure accurate testing, the line shall be thoroughly cleaned prior to testing. Testing shall be done no sooner than 30 days after the pipe has been backfilled.

The Responsible Party shall schedule the test with the District 48 hours prior to the test and the District shall be present during the test and shall verify the accuracy of the equipment used. The District may require the Responsible Party to perform another deflection test prior to the end of the warranty period.

### 3.49.4 Lamping Test

Prior to acceptance into the one-year warranty period of the pipeline installation, the District shall perform a lamp test to verify the alignment and condition of the pipe. The lamp test shall be performed only after the Responsible Party has completely cleaned the line to the satisfaction of the District. Should the lamp test indicate an alignment problem, the District shall be the sole judge of the need for replacement. Unsatisfactory alignment may be the cause for rejection. The Responsible Party shall furnish the light source to be used in the lamp test and the labor necessary for the District to perform the test.

### 3.49.5 Pressure Test for Pressure Sewers

After the pipe has been laid, including fittings, thrust blocks, and backfill in accordance with the specifications, it shall be subjected to a hydrostatic pressure of not less than 150 P.S.I. for one hour. The allowable leakage shall not exceed the following formula:

$$L = \frac{ND(P)^{0.5}}{8,223}$$

where

- L = Allowable Leakage in Gallons Per Hour
- N = Number of Joints in Length of Pipeline Tested
- D = Nominal Diameter of Pipe in Inches
- P = Average Test pressure during the Test, PSIG

Each valved section or the entire line if there are no valves, shall be slowly filled with water and the specified test pressure, measured at the highest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges, and all necessary apparatus shall be furnished by the Responsible Party. Gauges and measuring devices shall be approved by the District and the necessary taps made as required by the Responsible Party. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made at the highest elevations of the test section and plugged with brass plugs once the pipeline has passed the test.

Any cracked or defective pipes, fittings, or valves discovered in removed and replaced by the Responsible Party with sound material. until the pipeline passes the pressure test and is accepted by the District.

#### **3.49.6 Manhole Leakage Test**

Manholes shall be tested for leakage separately from the pipe when deemed appropriate by the District Representative. The sewer pipe in the manhole shall be plugged. If the ground water table is below the invert, the manhole shall be filled with water to a depth of five feet above the invert. If the ground water table is above the invert of the manhole, then the manhole shall be filled to a level at least three feet above the ground water table or to the top of the uppermost precast manhole section, whichever is less, but not less than five feet above the invert.

After soaking for one hour, the manhole shall be filled to the original level. It shall then be tested for two hours. The allowable drop in the water level shall be one inch. No manhole shall be accepted that has any visible infiltration when empty. Any manhole whose test is unsatisfactory shall be repaired at the Responsible Party's expense and retested until satisfactory results are obtained.

#### **3.49.7 TV Inspection**

The Responsible Party will perform TV inspections of all new sewer lines and confirm all defects have been repaired prior to acceptance. The Responsible Party will provide the District with the video record of the inspection with an accompanying inspection report certified by the Responsible Party's Engineer.

To be considered for inspection, the improvements shall have been completed, accessible and cleaned enough to allow for detailed inspection by the District. When requested by the District, the Responsible Party shall provide personnel and equipment to assist in the inspection process.

### **3.60.0 MATERIAL SPECIFICATIONS**

#### **3.60.1 GENERAL**

Only those pipeline materials described in this section are approved for sanitary sewer installations. Any other material proposed as an equal shall be approved by the District prior to construction. All pipe materials to be incorporated in the construction of sanitary sewers shall conform to the requirements specified herein or as modified elsewhere in these CONSTRUCTION STANDARDS. All materials furnished shall be new and undamaged. Everything necessary to complete all installations shall be furnished and installed whether shown on the approved drawings or not, and all installations shall be completed and fully operational. Acceptance of materials or the waiving of inspection thereof shall in no way relieve the Responsible Party of the responsibility for furnishing materials meeting the requirements of these CONSTRUCTION STANDARDS.

All materials delivered to the job site shall be adequately housed and protected to ensure the preservation of their quality and fitness for the work.

#### **3.61.0 DEFECTS**

The presence of any of the following defects in an individual pipe, or in a shipment of pipe, may constitute enough cause for rejection of the pipe. Rejected materials shall be removed from the work site within 24 hours unless otherwise permitted by the District. Examples of defects include the following:

- Pipe length varying more than two inches from the specified length. Pipe shall not be ordered in random lengths.
- Pipe having a deviation from straight which exceeds the following:  
Length of Pipe in Feet = Maximum Deviation in Inches/32
- Porous areas on either the inside or the outside surface of a concrete pipe having an area of more than five square inches and a depth of more than one-half inch.
- Pipe which has been patched or repaired without written approval of the District.
- Exposure of the reinforcement.
- Pipe damaged during shipment or construction.
- Any deficiencies noted in applicable ASTM Specifications

#### **3.62.0 CERTIFICATION**

A manufacturer's certification that material was manufactured and tested in accordance with applicable ASTM designations, together with a report of all test results, may be required by the District prior to final acceptance of the work.

### 3.63.0 PIPE

#### 3.63.1 Polyvinyl Chloride Pipe (PVC)

Polyvinyl chloride pipe is the preferred material for all sewer line construction. All pipe materials and fittings shall meet the minimum requirements of ASTM D-3034, SDR-35, latest revision. Pipe shall be subjected to drop-impact tests in accordance with ASTM D-2444. The pipe shall have bell and spigot joints with gasketed joint. The spigot end shall be marked so the installer and the inspector can determine when the pipe is properly inserted into the bell. The maximum pipe length shall be twenty feet.

Minimum wall thickness shall be:

Pipe Diameter (Inches)	4	6	8	10	12
Wall Thickness (Inches)	.125	.180	.240	.300	.360

All fittings and accessories shall be as manufactured and furnished by the pipe supplier and have bell and/or spigot configurations compatible with that of the pipe.

PVC pressure sewer pipe and all fittings shall conform to Sections 2.52.1 and 2.53.0 of these CONSTRUCTION STANDARDS.

Pipe stiffness for all pipe sizes shall be tested in accordance with ASTM D-2412. Joint tightness shall be tested in accordance with ASTM D-3212.

#### 3.63.2 Reinforced Concrete Pipe (RCP)

Reinforced concrete pipe shall only be used when the design engineer can provide sufficient proof as the positive benefit/cost ratio to the District. If RCP is to be used, it shall be T-Locked lined and a product life span or benefit/cost calculations should be provided in order for the District to determine the benefit of use.

Reinforced concrete pipe in sizes twenty-one inches or larger shall conform to the requirements of the standard specifications for reinforced concrete sewer pipe, ASTM Designation C-76 for Classes II, III, IV, and V and as modified in this Section.

All RCP shall be constructed with Type II modified cement. The absorption of the pipe shall not exceed 5.5 percent of volume.

All concrete pipe fittings, wyes, tees, and bends shall be cast as an integral part of the pipe to which they are attached and shall be the same pipe classification.

The following shall be clearly marked on the exterior surface of all pipe with waterproof paint:

- ASTM Specification.
- Class and Size.
- Date of Manufacture.
- Name or Trademark of Manufacturer.

## **3.64.0 MANHOLES**

### **3.64.1 General**

Manholes, reducing sections, ladder rungs and traffic lids shall be precast and conform to ASTM Standard Designation C-478. All traffic lids shall be designed for AASHTO H-20 traffic loading. All ladder rungs or manhole steps shall be cast into the manhole barrel when the manhole barrel is poured unless approved otherwise, in writing, by the District. Concrete reducing sections shall not be used. Concrete extension collars shall be used to bring the manhole ring and cover up to approved street or ground surface elevation.

Concrete used in the manufacturing or construction of manholes shall be a minimum of Class A concrete, 3,500 psi strength with a minimum of 600 lbs. cement per cubic yard of concrete and a water/cement ratio no greater than 0.48.

Precast manhole risers and cones shall be manufactured in conformity with ASTM Designation C-478.

### **3.64.2 Manhole Rings and Covers**

All cast iron manhole rings and covers and other iron castings shall be made of gray pig iron conforming to ASTM Designation A-48 and shall be free from cracks, holes, swells and cold shuts and shall have a smooth finish. Fittings shall be hot dipped in asphalt varnish meeting Federal Specification TT-V-51a or joint Army-Navy Specification JAN-P-450 in such a manner as to form a firm and tenacious coating. Cast iron manhole rings and covers shall have a combined weight of not less than 400 pounds. All metal-bearing surfaces between the ring and cover shall be machined to ensure flush seating. Ring and cover shall provide a minimum 24-inch diameter clear opening

### **3.64.3 Manhole Base Slabs**

Manhole base slabs may be poured in place or precast. The slab shall be designed to uniformly support AASHTO H-20 traffic loading and any earth loading. The minimum slab thickness shall be eight inches below bottom of the pipe and 2-inches above the top of the pipe. The minimum reinforcement when required in the base slab shall conform to the STANDARD DETAILS in this chapter.

### **3.64.4 Joint Material**

Joint material used to set barrel sections shall be a flexible butyl resin joint sealing compound meeting Federal Specifications SS-S-00210(210-A) and AASHTO M 198-B.

### **3.64.5 Mortar**

Mortar used in repair of precast sections shall be composed of one-part Portland Cement and not more than three nor less than two parts of fine aggregate. Hydrated lime or masonry cement shall not be used. Portland cement shall meet the requirements

of ASTM C-250, Type II. Fine aggregate shall consist of well-graded natural sand having clean, hard, durable, uncoated grains, free from organic matter, soft or flaky fragments or other deleterious substances. The fine aggregate shall be thoroughly washed and shall be uniformly graded from coarse to fine with a minimum of 95 percent passing a No. 4 sieve and a maximum of seven percent passing a No. 100 sieve.



ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

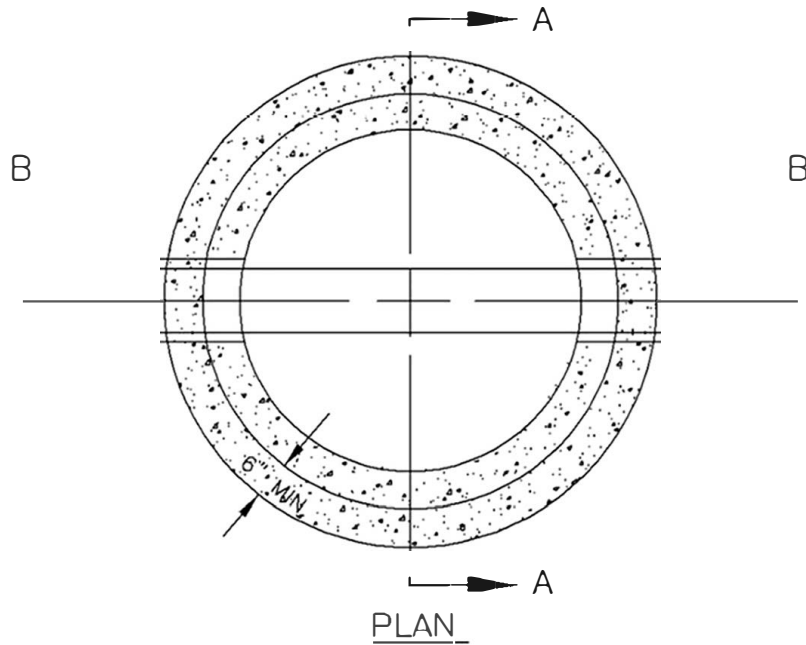
CONSTRUCTION STANDARDS

Chapter 3

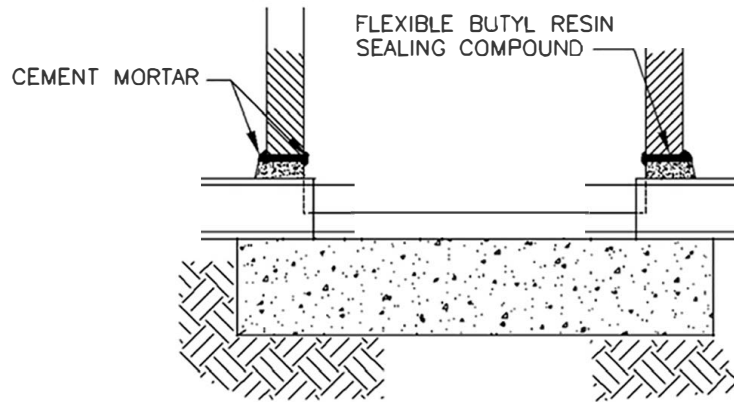
Sanitary Sewer System

Standard Details

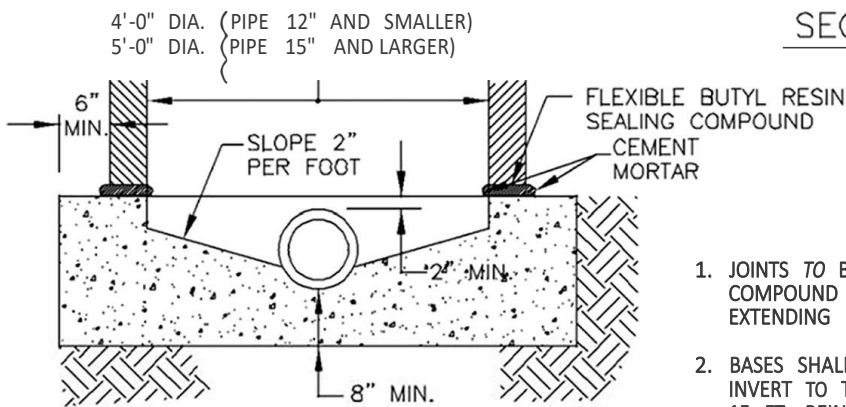




PLAN



SECTION B-B



SECTION A-A

NOTES:

1. JOINTS TO BE SET IN FLEXIBLE BUTYL RESIN SEALING COMPOUND AND GROUTED WITH MORTAR 5/8" THICK AND EXTENDING 4" EACH SIDE OF JOINT INSIDE AND OUTSIDE.
2. BASES SHALL BE REINFORCED WHEN THE DISTANCE FROM INVERT TO TOP OF COVER WILL EXCEED 15 FT. REINFORCING TO BE APPROVED BY DISTRICT.
3. PRECAST INTEGRAL BASE AND BARREL SECTIONS ARE ACCEPTABLE.

ST. MARY'S GLACIER  
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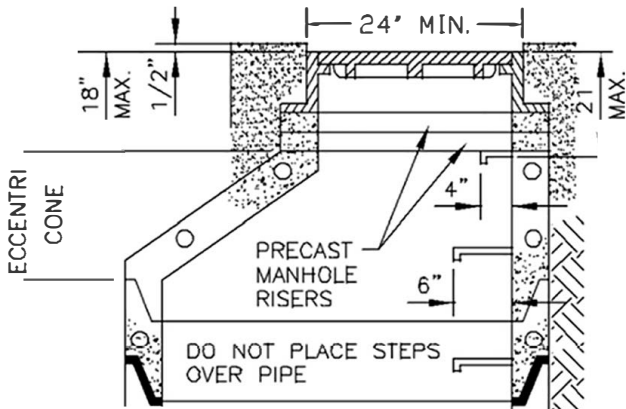
STANDARD MANHOLE  
BASE DETAIL

DATE: 10/2019

SHEET 3 - 01 OF 10

**NOTES:**

1. ALL JOINTS TO BE SET IN FLEXIBLE BUTYL RESIN SEALING COMPOUND AND PLASTERED WITH MORTAR 5/8" THICK AND EXTENDING 4" EACH SIDE OF JOINT INSIDE AND OUTSIDE.
2. MORTAR ON RISER RINGS IS ACCEPTABLE.
3. MANHOLES INSTALLED OUTSIDE OF STREET RIGHT-OF-WAY MAY REQUIRE LOCKING COVERS.
4. "SEWER" TO BE IMPRINTED ON COVER.



ALUMINUM STEPS OR PLASTIC COVERED STEPS (M.A. INC. INC. PS-2-PF-S) CAST INTO SECTIONS AT 12"-16" CONSISTENT VERTICAL SPACING AND ALIGNED

FLEXIBLE BUTYL RESIN SEALING COMPOUND

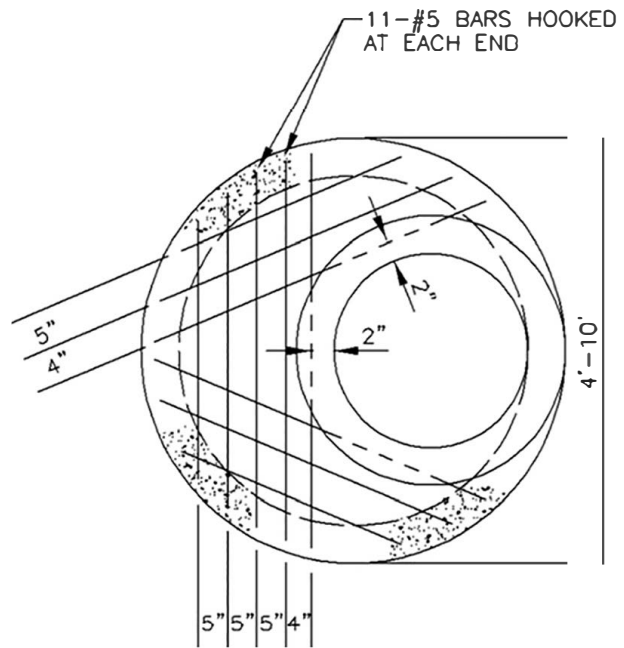
48" MIN. 4 WIRE HOOPS CAST INTO EACH SECTION AS SHOWN

18" MAX.

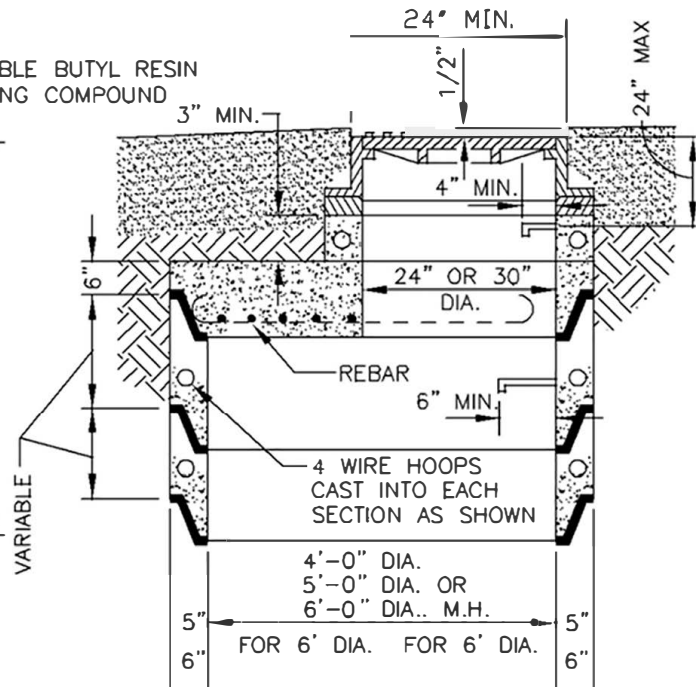


4'-0" DIA. (PIPE 15" & SMALLER)  
 5'-0" DIA. (PIPE 18" THROUGH 27")  
 6'-0" (PIPE 30" & LARGER)

TYPICAL MANHOLE SECTION WITH ECCENTRIC CONE



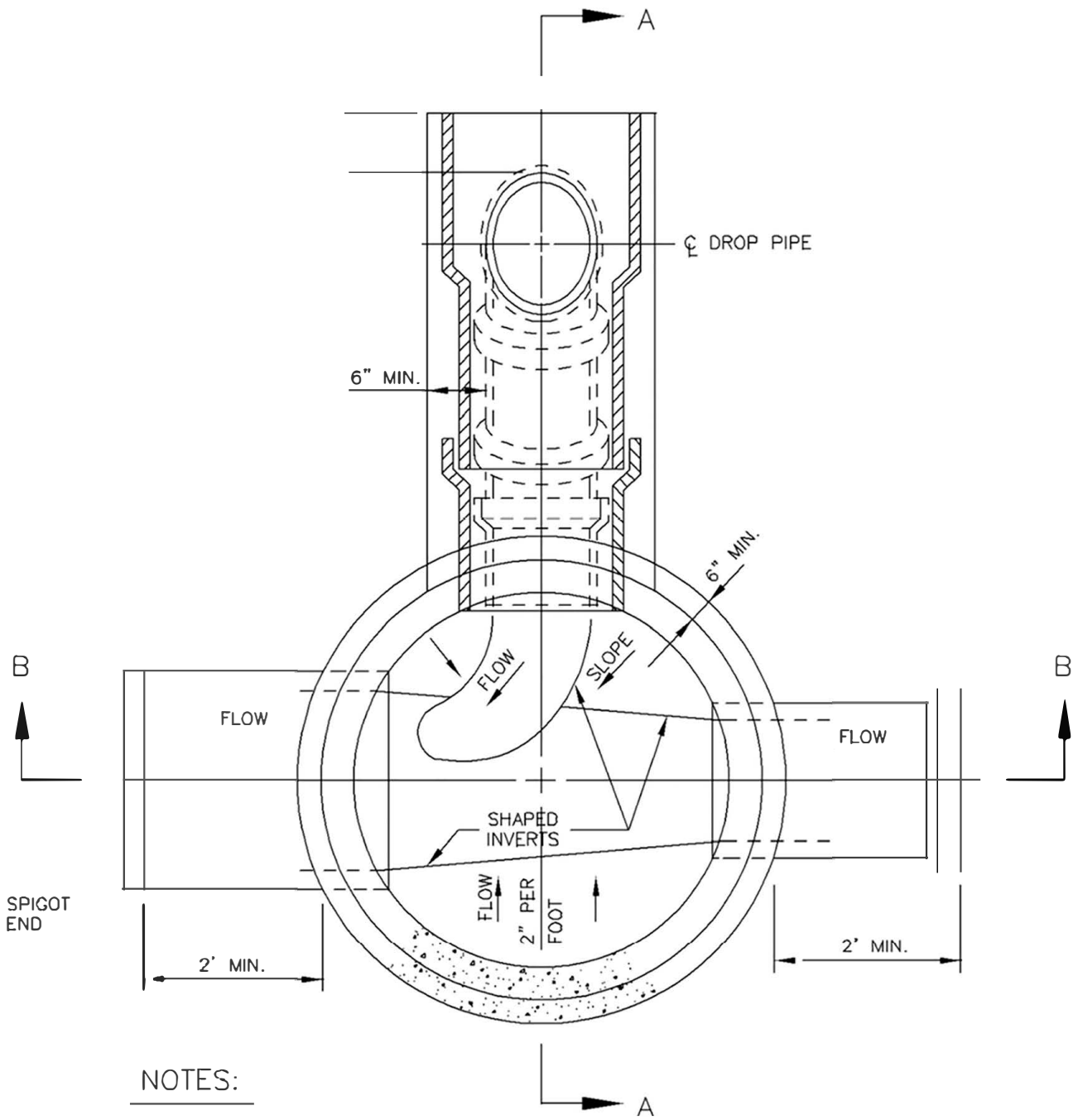
PLAN



ALTERNATE FLAT TOP

**ST. MARY'S GLACIER  
 WATER & SANITATION DISTRICT**

**MANHOLE BARRELS  
 &  
 ALTERNATE TOPS DETAIL**



NOTES:

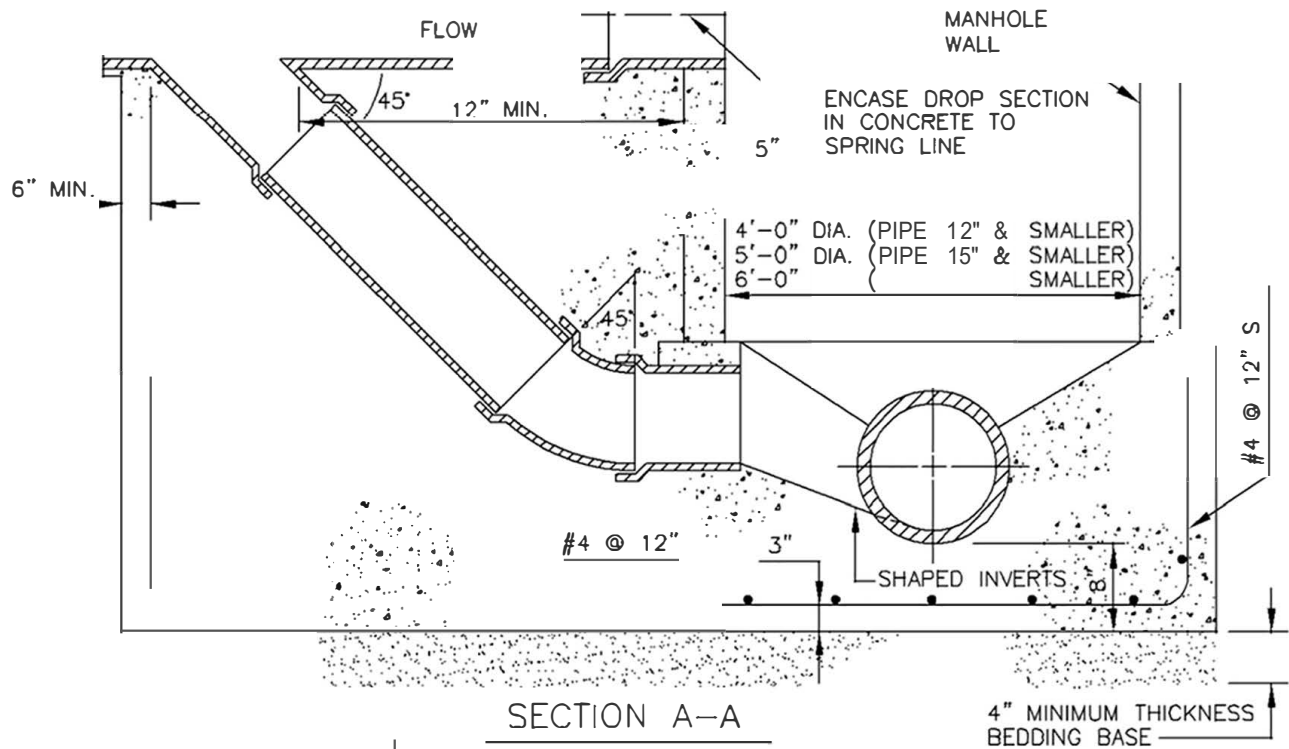
1. BASES SHALL BE REINFORCED WHEN THE DISTANCE FROM INVERT TO TOP OF COVER WILL EXCEED 15 FT., AND IN ANY CASE WHEN INTERIOR DIA. OF MANHOLE IS 5' AND LARGER.
2. SQUARE BASES ARE ACCEPTABLE.

ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

MONOLITHIC BASES FOR  
DROP MANHOLE DETAIL

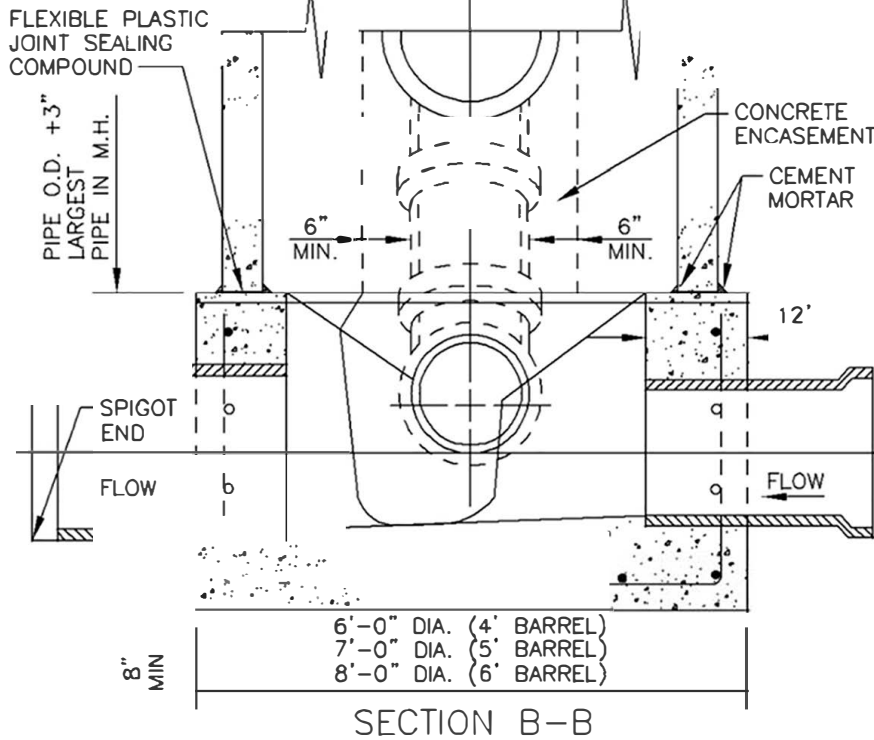
DATE: 10/2019

SHEET 3 - 03 OF 10



**NOTES:**

1. THIS MANHOLE IS REQUIRED WHEN A SEWER ENTERS A MANHOLE AT AN INVERT ELEVATION OF 24" OR MORE ABOVE THE INVERT OF THE MANHOLE (SEE DESIGN STDS. 4.32.02).
2. JOINTS TO BE SET IN FLEXIBLE BUTYL RESIN SEALING COMPOUND AND GROUTED WITH MORTAR INSIDE AND OUTSIDE.

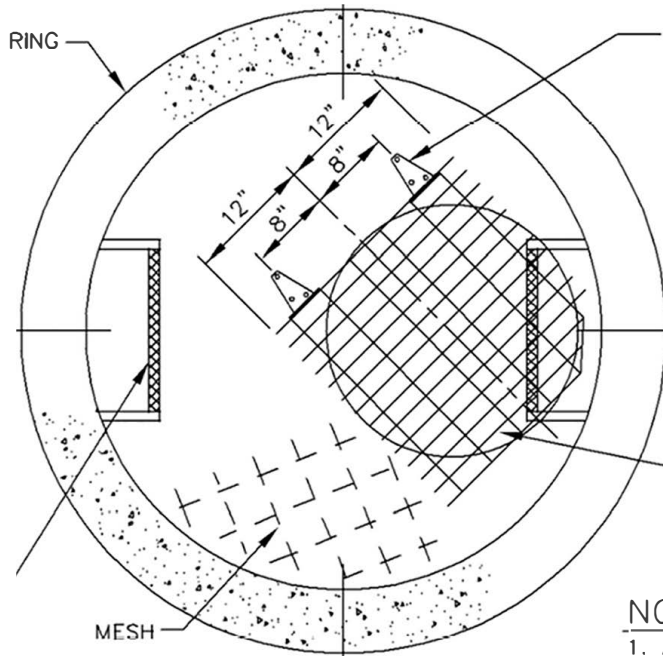


**ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT**

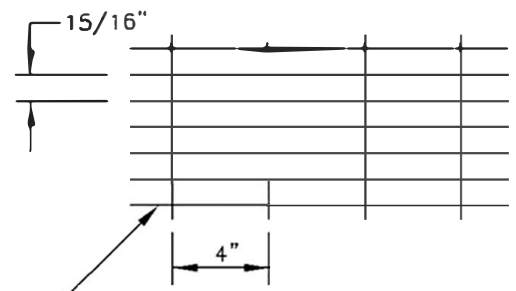
**DROP MANHOLE DETAIL**

DATE: 10/2019

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ATTACH HINGE TO GRATING WITH (2) 3/8" DIA. BOLTS x 1" O.C. W/HEX NUTS. ATTACH HINGE TO PLATFORM WITH (2) 3/8 DIA. x 3" LG. RED HEADS OR EQUAL.

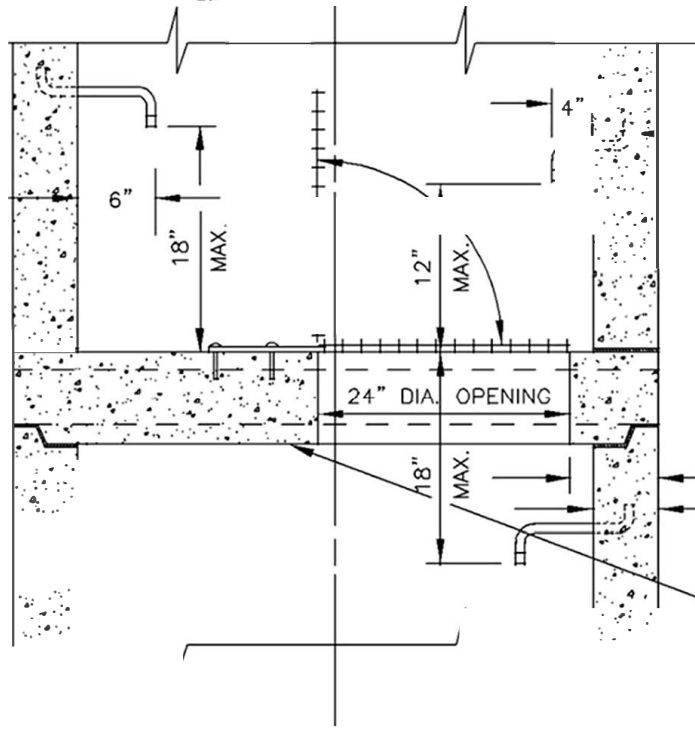


ALUMINUM GRATING, 3/16" x 1 1/4" BEARING BARS.

**NOTE:**

1. ALL JOINTS TO BE SET IN FLEXIBLE BUTYL RESIN SEALING COMPOUND AND PLASTERED WITH MORTAR 5/8" THICK AND EXTENDING 4" EACH SIDE OF JOINT INSIDE AND OUTSIDE.

ALIGN STEPS ABOVE & OPPOSITE PLATFORM OPENING AS SHOWN TO TOP OF MANHOLE



SAFETY HANDHOLD TO PLATFORM

STANDARD PRECAST FLAT TOP WITH 4X4, 4/4 MESH

**NOTES:**

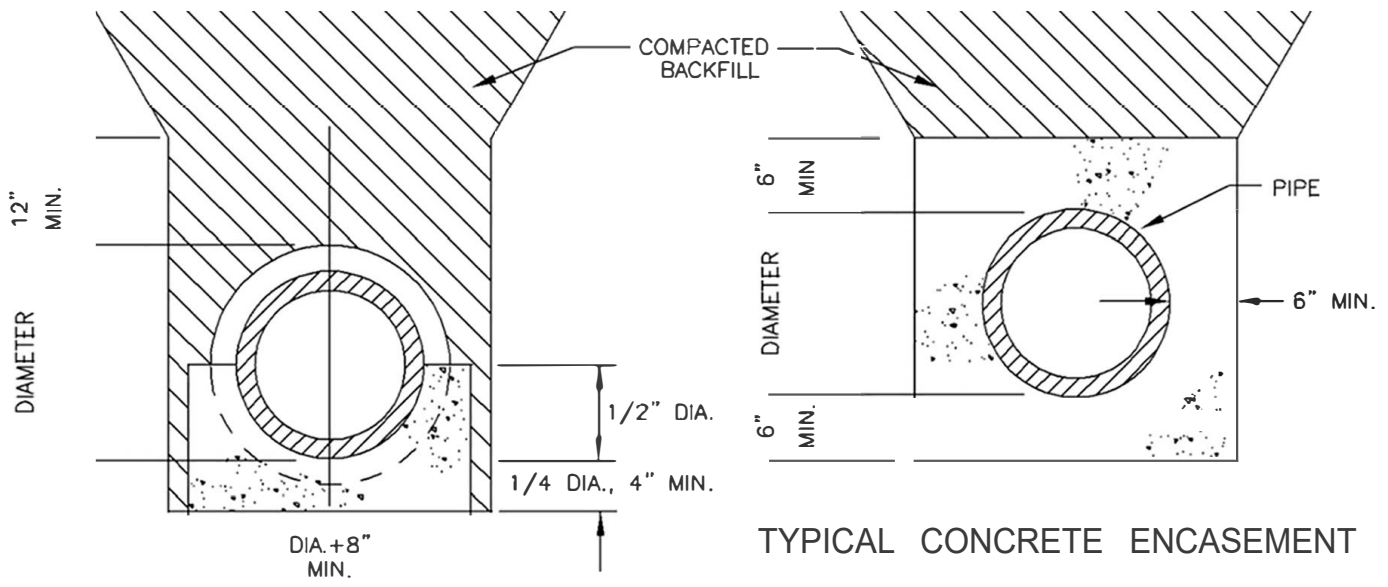
TO BE USED WHEN THE DISTANCE FROM INVERT TO TOP OF COVER EXCEEDS 17 FT.

ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

INTERMEDIATE MANHOLE  
PLATFORM DETAIL

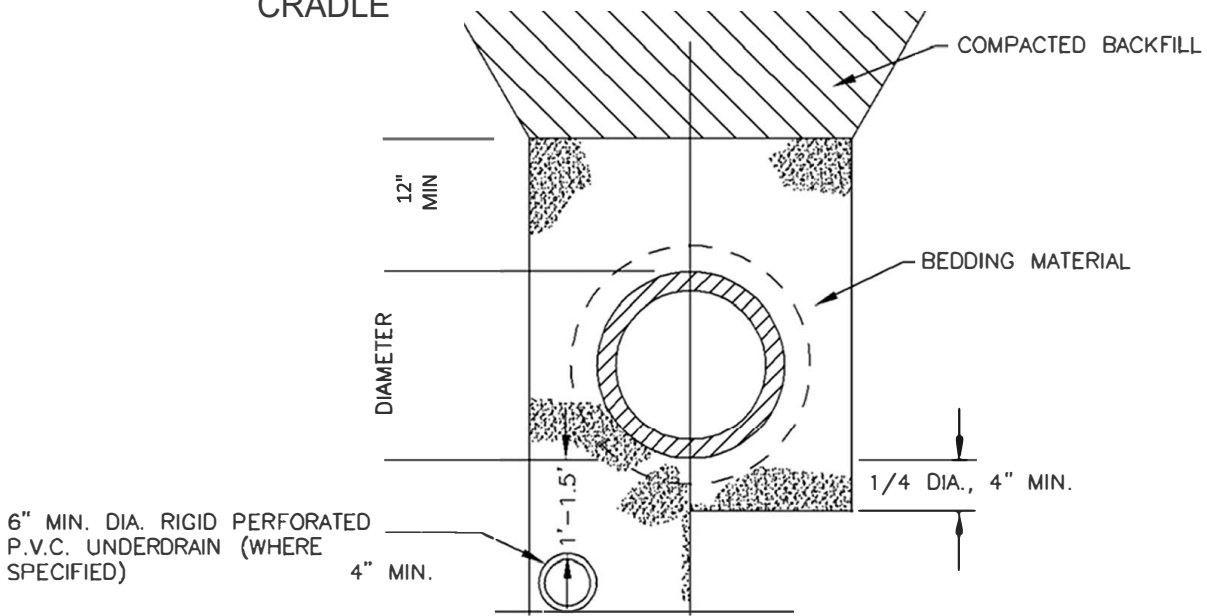
DATE: 10/2019

SHEET 3 - 5 OF 10



TYPICAL CONCRETE ENCASEMENT

CLASS A  
CONCRETE  
CRADLE



CLASS B GRANULAR  
BEDDING

NOTES:

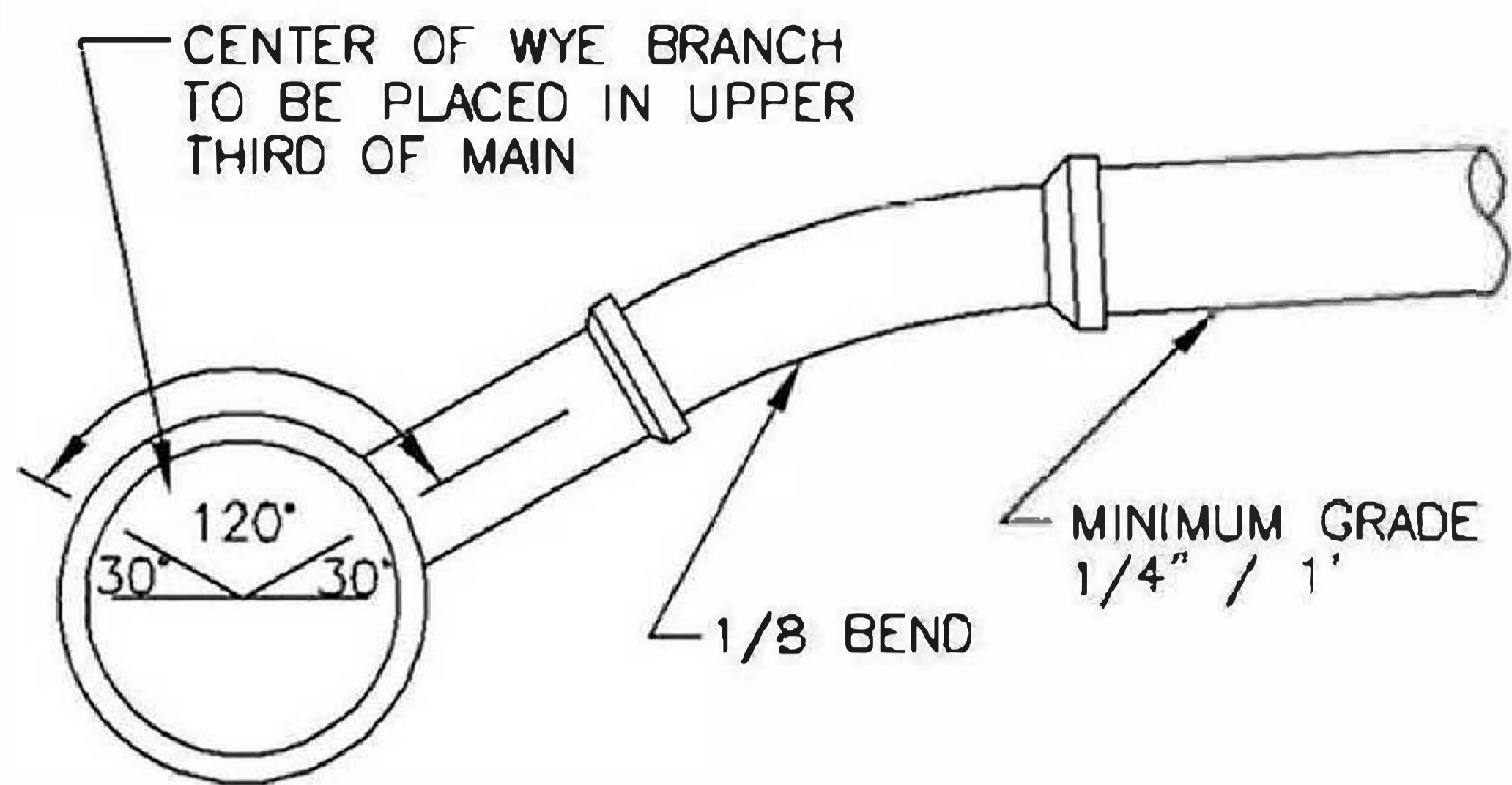
1. THIS DETAIL IS TO BE USED UNDER NORMAL CONDITIONS. WHERE EXCESSIVE GROUND WATER IS PRESENT AN ALTERNATE DESIGN WILL BE REQUIRED.

ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

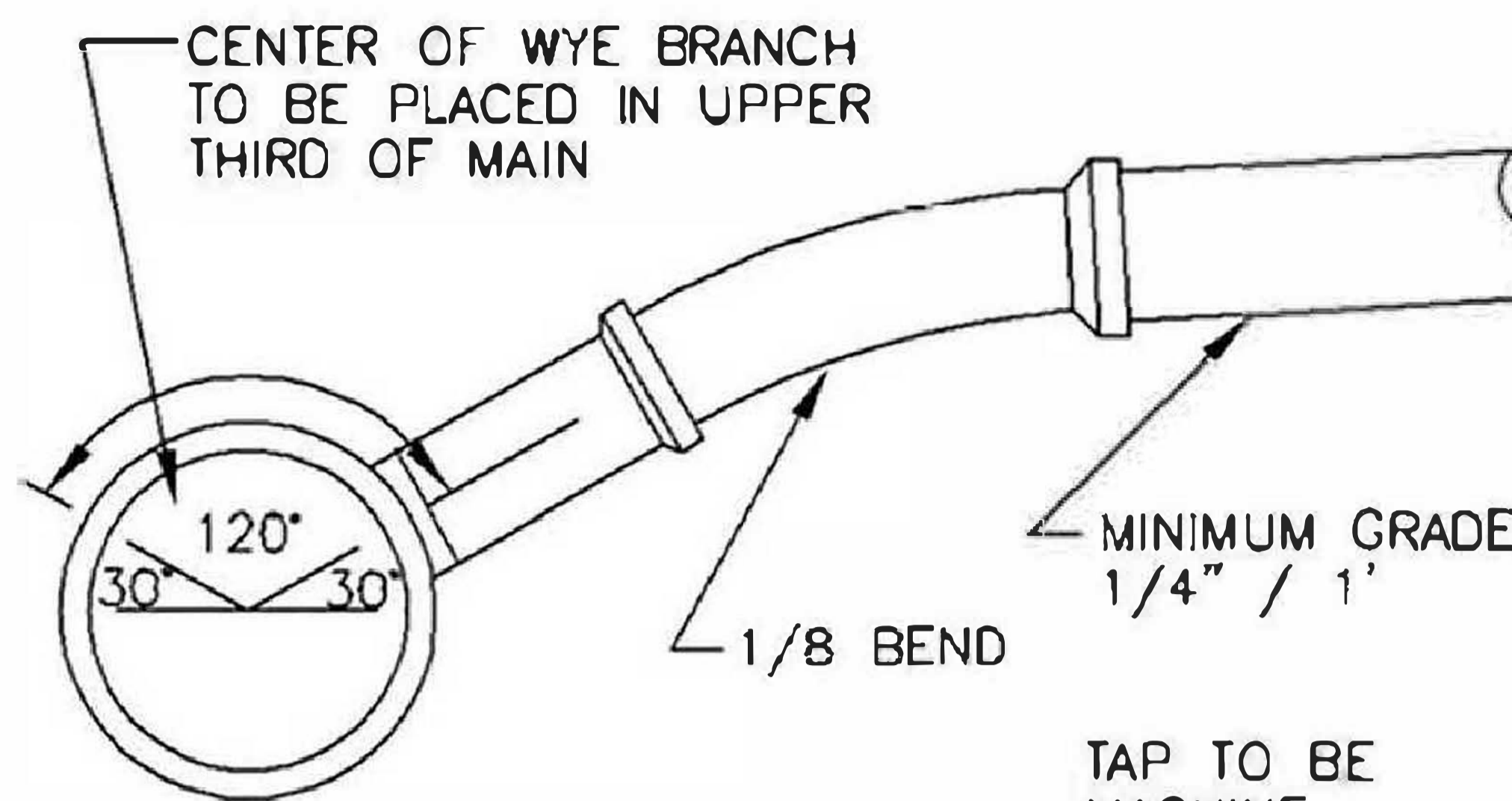
TYPICAL PIPE BEDDING DETAIL

DATE: 10/2019

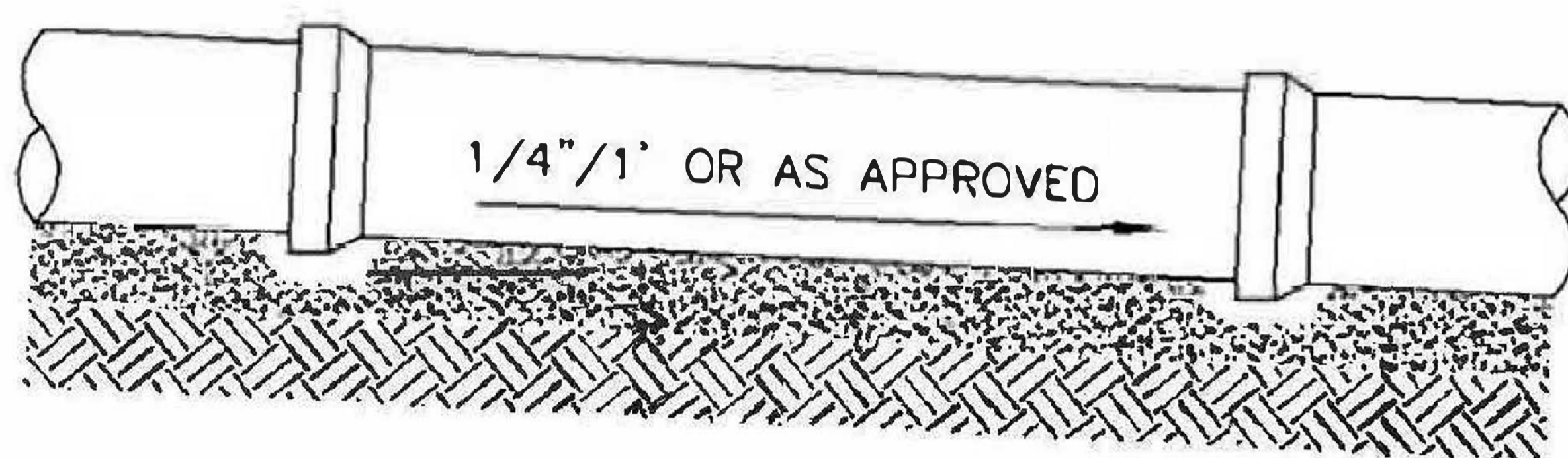
SHEET 3 - 6 OF 10



1/8 BEND CONNECTION TO TEE



1/8 BEND & SADDLE CONNECTION

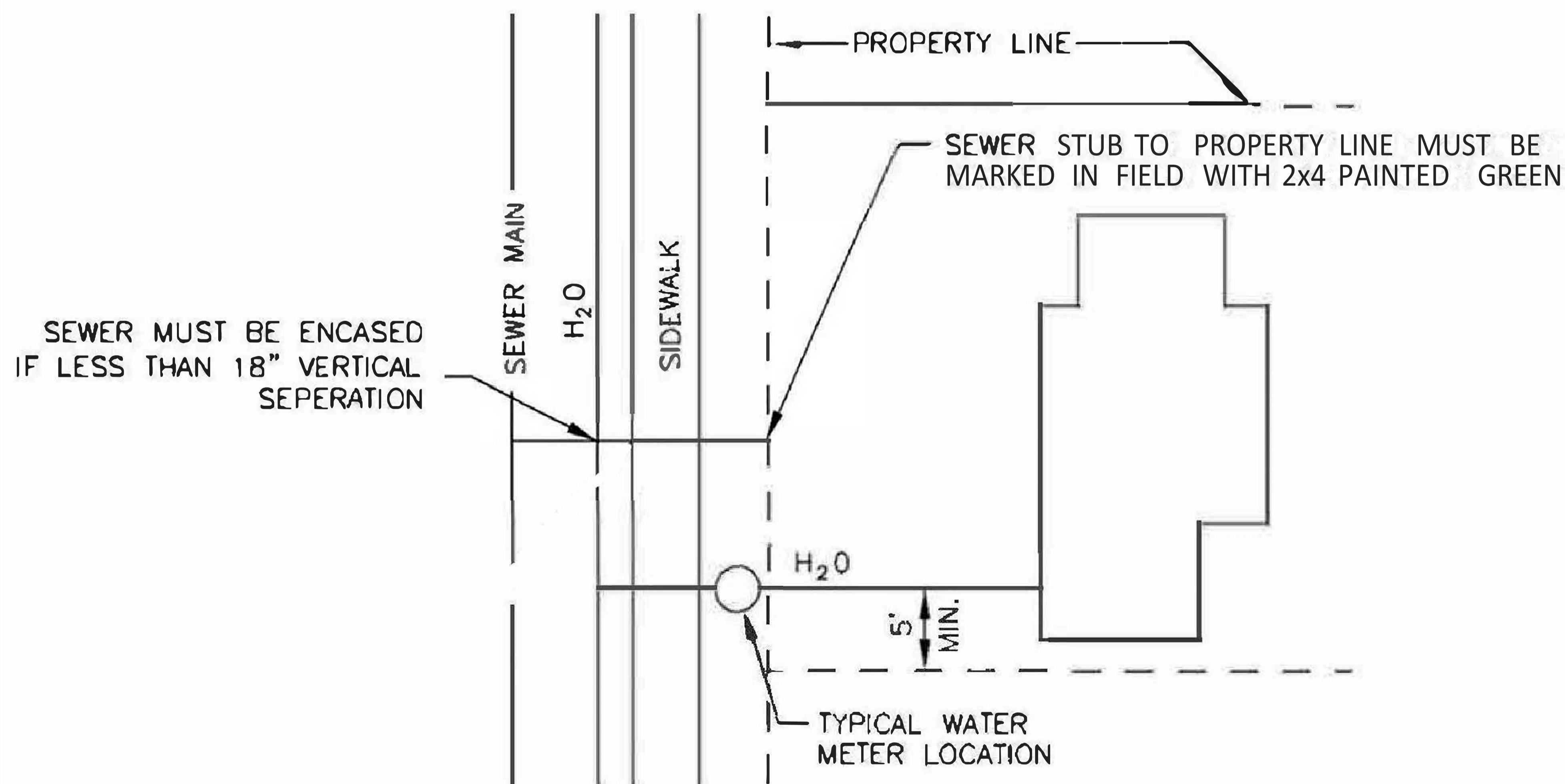


FACTORY PREPARED A.S.T.M. C-425 COMPRESSION TYPE JOINTS ONLY OR APPROVED EQUIVALENT.

BELL SHOULD NOT TOUCH SIDES OR BOTTOM OF BELL HOLE.

4" MINIMUM GRANULAR BEDDING BELOW PIPE AND 12" MINIMUM BEDDING ABOVE PIPE.

ACCEPTABLE BEDDING

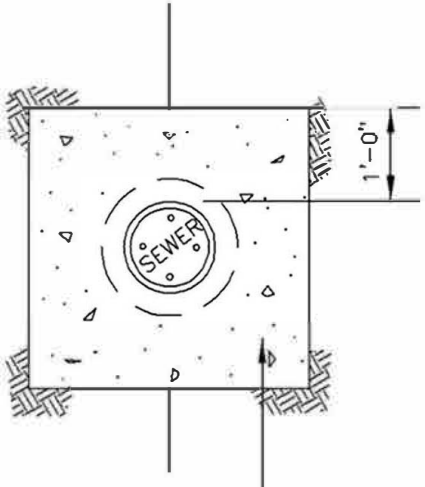


ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

SANITARY SEWER SERVICE  
DETAIL

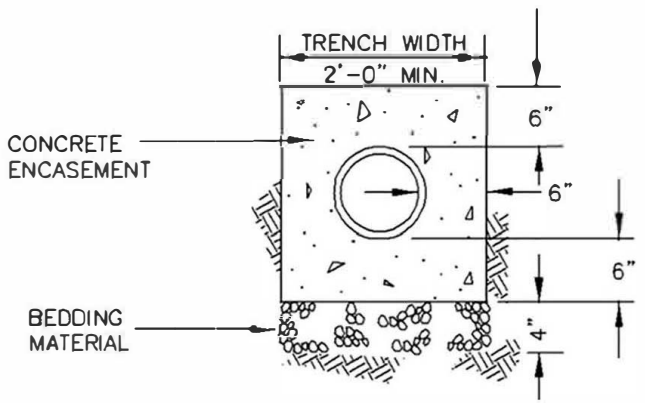
DATE: 10/2019

SHEET 3 - 7 OF 10

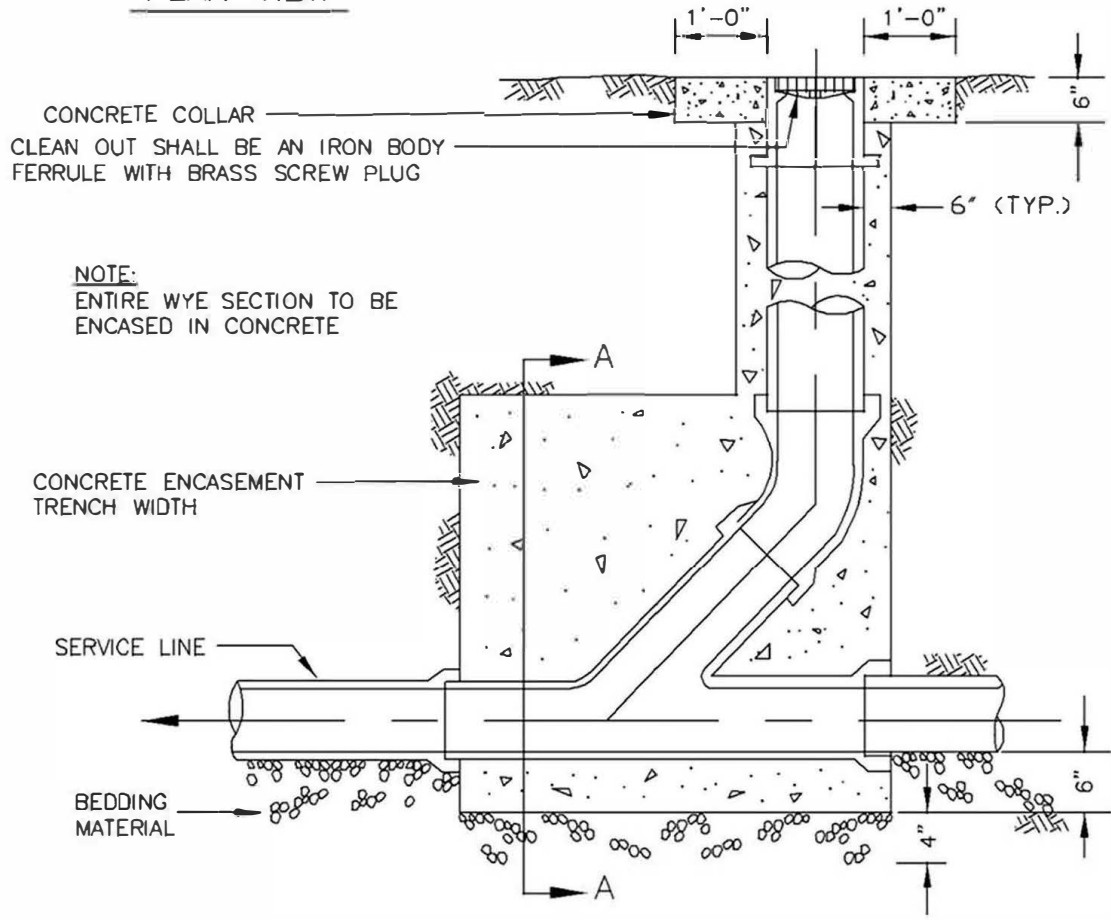


CONCRETE COLLAR TO BE USED IN UNPAVED AREAS ONLY

PLAN VIEW



SECTION A-A



NOTE:  
ENTIRE WYE SECTION TO BE ENCASED IN CONCRETE

ELEVATION

N.T.S.

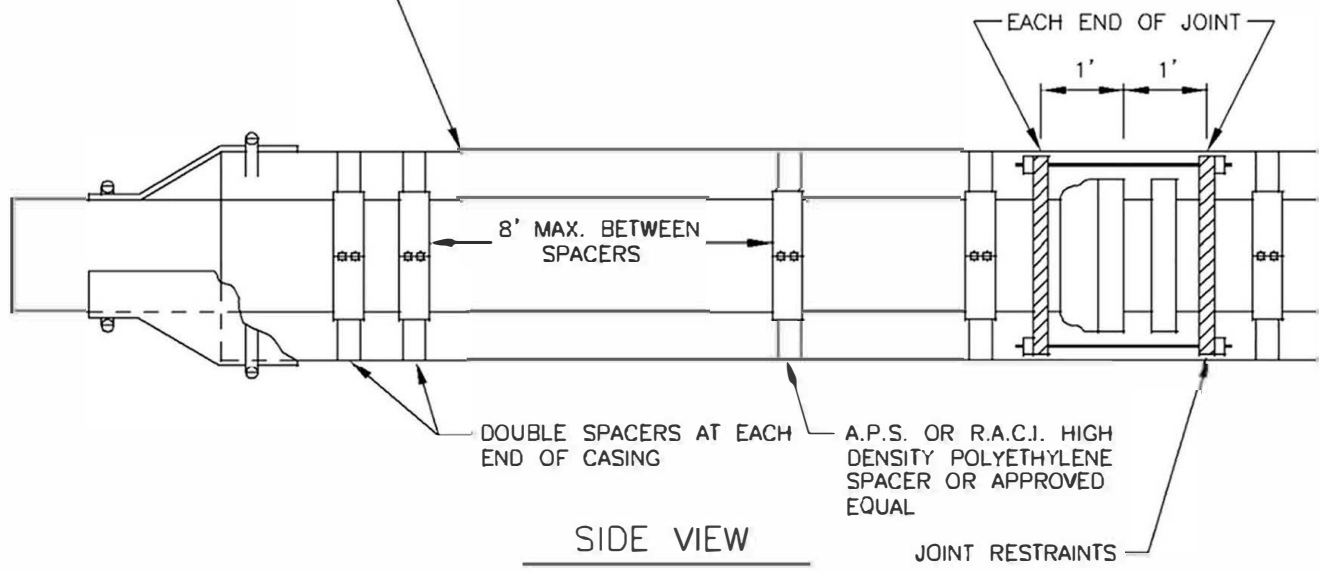
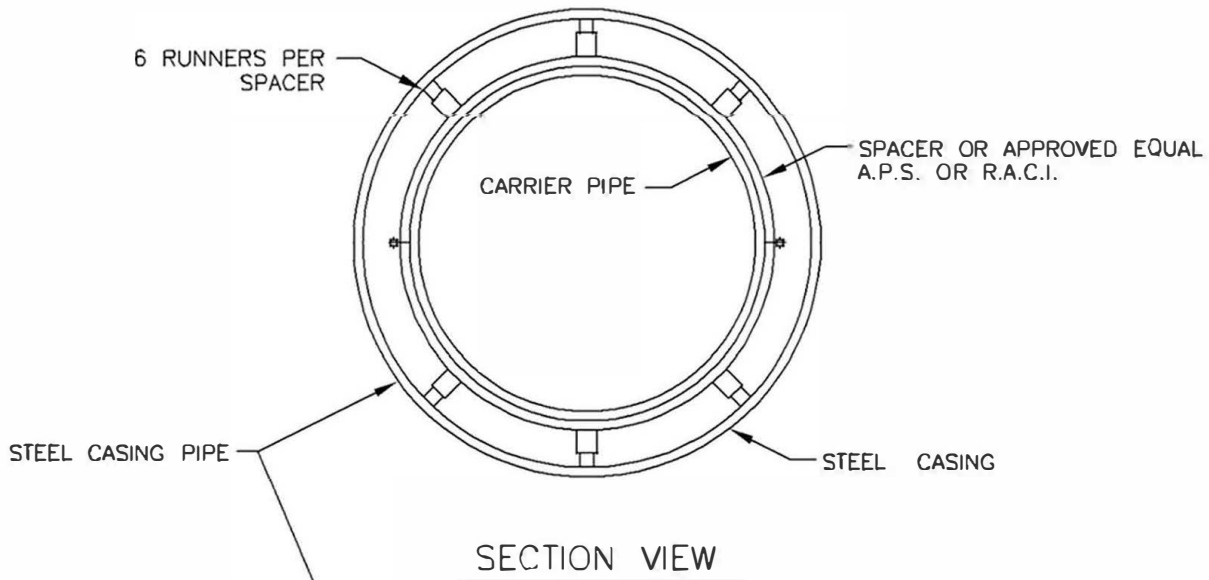
ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

STANDARD CLEANOUT DETAIL

DATE: 10/2019

SHEET 3 - 8 OF 10



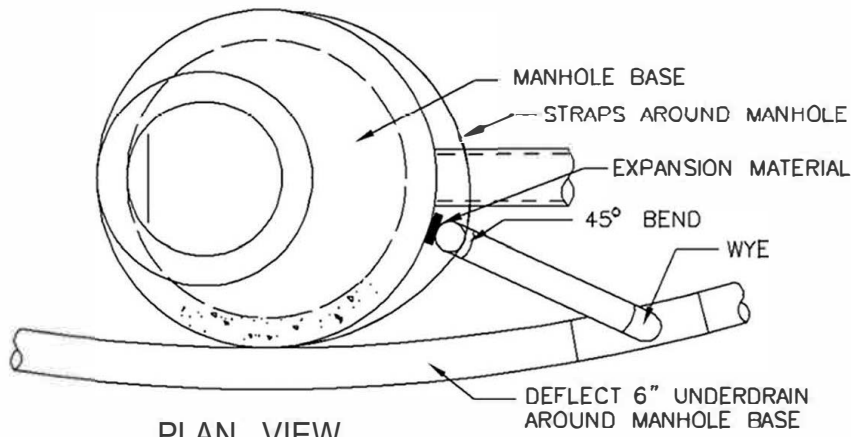


ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

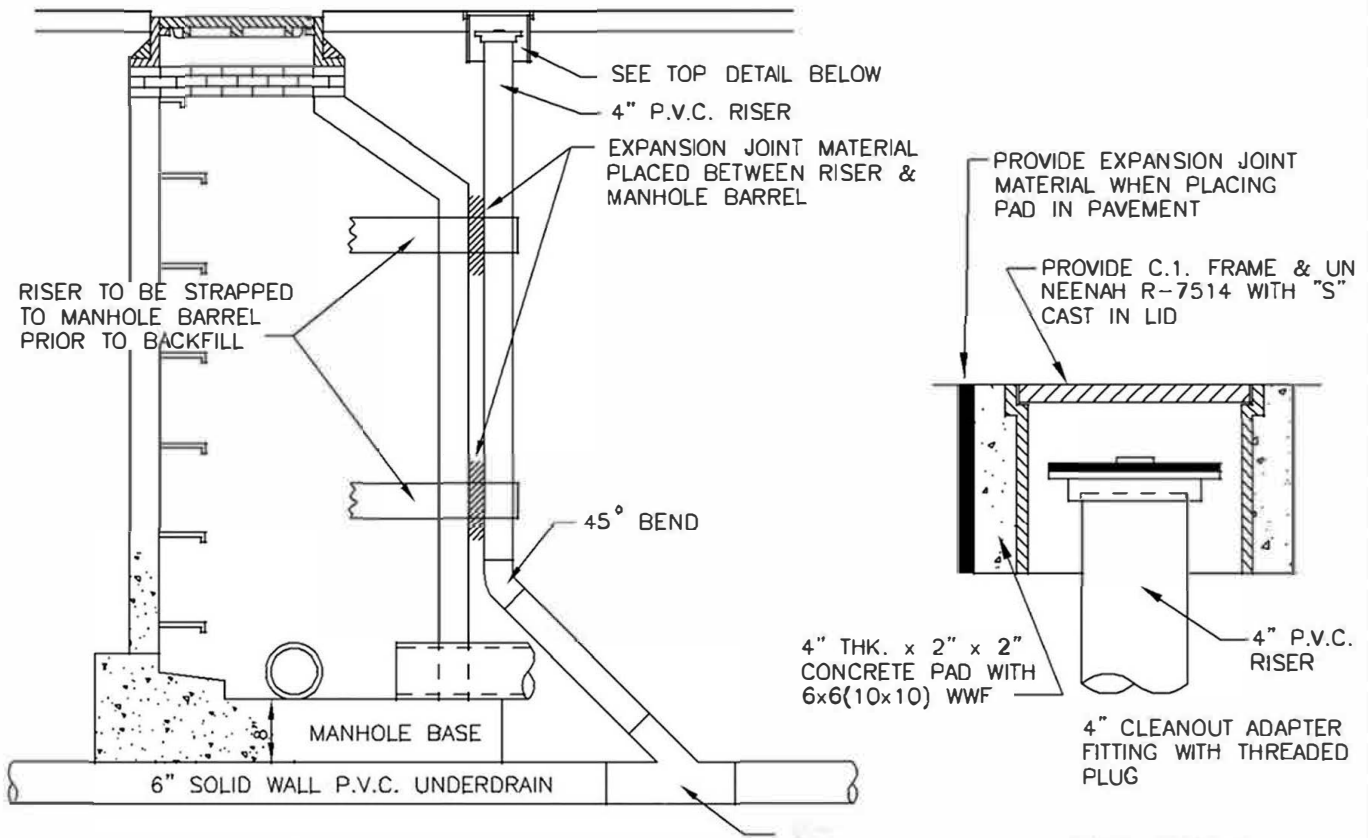
SANITARY SEWER CASING DETAIL

DATE: 10/2019

SHEET 3 - 9 OF 10



PLAN VIEW



SIDE VIEW

TOP DETAIL

N.T.S.

ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT

SANITARY SEWER UNDERDRAIN  
CLEANOUT DETAIL

DATE: 10/2019

SHEET 3 - 10 OF 10



ST. MARY'S GLACIER  
WATER & SANITATION DISTRICT  
CONSTRUCTION STANDARDS

Chapter 4

Trenching, Backfill  
& Compaction

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**CHAPTER 4  
TRENCHING, BACKFILL AND COMPACTION**

**4.00.0 GENERAL**

**4.01.0 DESCRIPTION**

- (A) This section covers excavation and trenching including drainage, dewatering, preparation of subgrades, pipe bedding, backfilling, compaction, and finish grading for underground pipe lines, service lines, and appurtenances.
- (B) Reference detail drawing in the appropriate chapter of these CONSTRUCTION STANDARDS. All work performed according to this section must comply with the general requirements contained within Chapter 1.
- (C) Responsible Party shall contact Colorado 811, one call utilities location service, before beginning any excavation

**4.02.0 QUALITY ASSURANCE**

**4.02.1 Soils Report**

All quality assurance criteria within the approved soils report shall be followed.

**4.02.2 Quality Control**

- (A) Responsible Party is responsible for all costs associated with Quality Control.
- (B) Soil compaction tests shall be performed in accordance with:
  - 1) ASTM D 698 or ASTM D 1557, Standard Modified Method of Test for Moisture Density Relationships of Soils
  - 2) ASTM D 2049, Standard Method of Test for Relative Density of Cohesionless Soils

**4.02.3 Construction Staking**

- (A) Construction staking shall be performed with qualified, competent personnel under the direction of a professional land surveyor registered in the State of Colorado.
- (B) All survey notes & construction staking notes shall be entered into bound, hard cover field books.
- (C) Staking of the work shall be at fifty-foot (50') stations (maximum).
- (D) Offsets shall be staked so that vertical and horizontal alignment may be checked.
- (E) All survey data that is developed by the Responsible Party or the Responsible Party's surveyor in performing surveys that are required by the work shall be available to the District for examination throughout the construction period.

## 4.03.0

### JOB CONDITIONS

#### 4.03.1 Drainage and Groundwater

- (A) All excavations and trenches shall be kept free from excess groundwater during construction.
- (B) Any water that is encountered in the trench shall be removed to the extent necessary to provide a firm subgrade to permit joints to be made in the dry, and to prevent the entrance of water into the pipeline.
- (C) Surface run-off shall be diverted as necessary to keep excavations and trenches free from water during construction.
- (D) The excavation or trench shall be kept free from water until the structure or pipe to be installed therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
- (E) Water shall be prevented from entering into previously constructed pipe.
- (F) Except for storm drains, the pipe under construction shall not be used for dewatering.

#### 4.03.2 Sequencing

- (A) Pipeline installation shall be performed within two hundred (200) linear feet of trench excavation. If construction is occurring in an open field, this distance may be increased at the District's discretion.
- (B) Initial trench backfill shall be performed within fifty (50) linear feet of pipeline installation. If construction is occurring in an open field, this distance may be increased at the District's discretion.
- (C) Where excavation is a burden to automotive or pedestrian traffic, the building of an open trench and the duration of that opening is to be minimized. The Responsible Party shall coordinate the amount and duration of road closure with the District.

#### 4.03.3 Underground Obstructions

- (A) The Responsible Party shall field verify all drawing & record information obtained from the District or other affected utility company.
- (B) The Responsible Party shall notify each utility OWNER and request utilities to be field located by surface markings at least forty-eight (48) hours, prior to trenching or excavation. This may be accomplished by calling the Utility Notification Center of Colorado.
- (C) In situations where conflicts may exist, the Responsible Party shall expose and verify the size, location, and elevation of underground utilities and other obstructions sufficiently in advance of construction to permit changes to be made to the construction drawings.

- (D) In the case of a conflict, the Responsible Party shall notify the District and affected utility company. The proposed work may then be modified by the Design Engineer and after the District's Representative's approval.
- (E) Existing improvements, adjacent property, utilities, trees and plants that are not to be removed shall be protected from injury or damage resulting from the Responsible Party's operations. If damage should occur, the Responsible Party shall make repair such that damaged materials be restored in original or better condition, as directed by the District Representative, utility or property owner in question.
- (F) If the Responsible Party removes any underground obstructions, the following shall apply:
  1. Drainage culverts located within public ROWs may be salvaged, stored, and reused in the original location if approval is obtained from Clear Creek County. All other underground obstructions shall be replaced with new materials.
  2. The area in which the underground obstruction was located shall be restored to original or better condition.

**4.04.0 MAINTENANCE AND CORRECTION**

**4.04.1 Trench Settlement**

The Responsible Party shall maintain and repair all trench settlement and make necessary repairs to pavement, sidewalks or other structures which may be damaged as a result of backfill settlement. Responsible Party shall warrant work for a period of one (1) year after final completion and District acceptance of the work.

**4.04.2 Subcontractor**

The Responsible Party may perform such maintenance and repairs by subcontract. If the Responsible Party chooses to subcontract the warranty work, Responsible Party shall submit to the District Representative a copy of the subcontract or the work authorization as evidence of the Responsible Party's faithful intention to perform any repairs which may become necessary during the one- (1) year warranty period.

**4.10.0 CONSTRUCTION SPECIFICATIONS**

**4.11.0 PREPARATION**

- (A) Topsoil shall be stripped from areas that are to be disturbed by construction and stockpiled.
- (B) Topsoil shall be segregated from non-organic, trench excavation material and debris.

**4.12.0 TRENCHING**

- (A) Trenches shall be excavated by open-cut methods, except where boring or tunneling is indicated, shown on drawings, or approved by the District Representative.
- (B) Trench width shall be maintained to within three inches (3") of that specified on plans.

- (C) Care shall be used when operating mechanical equipment in locations where it may cause damage to trees buildings, culverts, or other existing property, utilities, or structures above or belowground.
- (D) Mechanical equipment shall be designed and operated in such a manner that the bottom elevation of the trench can be controlled with uniform trench widths and vertical sidewalls which extend from the bottom of the trench to an elevation one foot (1') above the top of the installed pipe.
- (E) Trench alignment shall be accurate to permit pipe to be aligned properly with an eight-inch (8") minimum clearance between the pipe and the sidewalls of the trench. The trench sidewall shall not be undercut in order to obtain clearance.
- (F) Responsible Party shall over-excavate minimum of six inches (6") below the bottom of the pipe wherever the trench bottom is rock, shale, wet, or other unsuitable condition. Over-excavation shall be backfilled and compacted with acceptable granular material. Granular material shall conform to Section 4.22.0 of these CONSTRUCTION STANDARDS.
- (G) Preparation of Trench Bottom:
  - 1. Trench bottoms shall be graded uniformly to provide clearance for each section of pipe.
  - 2. Loose material, water, and foreign objects shall be removed from the trench.
  - 3. The Responsible Party shall provide a firm subgrade that is suitable for application of bedding material.
  - 4. Wherever unstable material is encountered in the bottom of the trench, said material shall be over-excavated to a depth suitable for construction of a stable subgrade. The depth suitable for construction of a stable subgrade shall be determined by the District Representative. The over-excavation shall be backfilled with stabilization material and compacted as required by the District Representative. Stabilization material shall conform to Section 4.21.0 of these CONSTRUCTION STANDARDS.
- (H) Stockpiling Excavated Materials:
  - 1. Suitable material for backfilling shall be stockpiled in an orderly manner at a minimum of four feet (4') from the edge of the trench.
  - 2. Excess excavated materials not suitable or not required for backfilling shall be removed from the site and disposed.
  - 3. Excavated material shall not be stockpiled against existing structures or appurtenances.
  - 4. Excavated materials containing any hazardous material shall be disposed of at an approved site in accordance with an abatement plan to be prepared by the Responsible Party or other qualified professional in accordance with all federal, state, and local ordinances.
- (I) Limiting Trench Widths:
  - 1. Trenches shall be excavated to a width necessary to provide an eight-inch (8") minimum working space between the pipe and the trench walls for proper pipe installation, joining and bedding.



2. The minimum trench width at an elevation twelve inches (12) above the top of the installed pipe shall be the pipe diameter of the pipe plus 24 inches, or thirty inches (30") whichever is greater. If the width of the trench, twelve inches (12") above the top of the pipe, exceeds the maximum allowable trench width, a higher strength pipe or special pipe bedding shall be provided as required by 80' soil-loading conditions and as approved by the District Representative.

#### **4.13.0 PIPE BEDDING**

- (A) Placement and Compaction:
  1. Bedding material shall be distributed and graded to provide uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. Pipe shall not be supported by the bells.
  2. To prevent lateral displacement, granular bedding material shall be deposited and compacted uniformly and simultaneously on each side of the pipe.
  3. Granular bedding material shall be compacted in accordance with these CONSTRUCTION STANDARDS.
- (B) Ground water barriers shall be constructed in such a manner to prevent passage of water through bedding material for the full depth of the granular bedding material and the full width of the trench.
  - 30 Ground water barriers, if shown on the approved construction plan, shall be approximately four feet (4') long and spaced not more than four hundred feet (400') apart.
  - 40 Material for ground water barriers shall be as specified by the ditch company which controls the irrigation ditch to be crossed. In absence of that direction, Wyoming Bentonite clay shall be used.

#### **4.14.0 BACKFILLING AND COMPACTION**

- (A) Trenches shall be backfilled promptly after the pipe has been installed and inspected. Backfill around manholes and valve boxes shall be compacted with hand-operated equipment.
- (B) Backfill material shall be deposited in uniform horizontal layers which may not exceed six inches (6") of compacted depth in all areas. Other thickness may be used with the prior written approval of the District Representative.
- (C) Methods and equipment that are that are appropriate for the backfill of the material shall be employed. Backfill equipment or backfilling methods that transmit damaging shocks to the pipe shall not be used.
- (D) Compaction shall not be performed by jetting or water settling.
- (E) If compaction cannot be obtained with job excavated material, trench backfill material shall be imported.
- (F) Topsoil shall be replaced to the depth of stripping over all areas that are to receive vegetation.
- (G) Excess excavated materials and materials not suitable for backfill shall be removed from the site.

#### 4.15.0

#### FIELD QUALITY CONTROL

(A) Field Compaction Control:

1. Field tests will be conducted to determine compliance of compaction methods with specified density in accordance with ASTM D 2922 (Test for Density of Soil and Soil-Aggregate in Place by Nuclear Method).
2. Compaction tests shall be performed at a depth of eighteen (18) inches above the top of the pipe and in twelve (12) inch vertical increments up to the finish grade.
3. Compaction tests shall be performed at least once every one hundred (100) linear feet as measured along the length of the pipe.
4. If the District Representative determines that reliable and uniform results are produced by the Responsible Party's construction techniques, the frequency of testing may be changed subject to the District Representatives discretion, but no more than one test per three hundred (300) linear feet.

(B) Compaction shall be to the following minimum densities (reference ASTM D 698 or AASHTO T 99 unless otherwise indicated):

1. Barrier Material - 95 Percent of Maximum Standard Density.
2. Pipe Bedding:
  - a. Compacted Granular Material - 80 percent of Maximum Relative Density (ASTM D 2049)
  - b. Carefully Compacted Select Soil - 90 Percent of Maximum Standard Density
  - c. Barrier Material - 95 Percent of Maximum Standard Density
3. Trench Backfill:
  - a. Paved roadways, sidewalks, and other areas to be paved: Top Two Feet (2') - 98 Percent of Maximum Standard Density; Remainder of Trench - 95 Percent of Maximum Standard Density
  - b. Gravel Roadways - 95 Percent of Maximum Standard Density
  - c. Fields and All Other Areas - 90 Percent of Maximum Standard Density
  - d. Under Footings, Foundations, Structures, 100 Percent of Maximum Standard Density or in Conformance with the Approved Soils Report and Recommendations

(C) Moisture Content:

1. All compacted backfill shall be within two percent (2%) (plus or minus) of the optimum moisture content of the soil as determined by ASTM D 698.
2. Water shall be added to the material or the material shall be harrowed, disced, bladed, or otherwise worked to insure a uniform moisture content, as specified.

**4.20.0 MATERIAL SPECIFICATIONS**

**4.21.0 STABILIZATION MATERIAL**

- (A) If the existing soil in the trench bottom is judged to be unsuitable by the District Representative, the top six inches (6") of the pipe subgrade shall be removed and replaced with stabilization material.

Stabilization material shall conform to ASTM D448 or CDOT No. 4, according to Table 4.21.0:

**TABLE 4.21.0 Stabilization Material**

Sieve Size	Percent Passing
2 Inch	100
1-1/2 Inch	90-100
1 Inch	20-55
3/4 Inch	0-15
3/8 Inch	0-5

- (B) Geotextiles used for erosion control, drainage and silt fence shall conform to CDOT requirements of 712.08 in the Standard Specifications for Road and Bridge Construction.

**4.22.0 BEDDING MATERIALS**

- (A) Granular Material. Uniformly-graded material conforming to AASHTO M6, according to Table 4.22.0:

**TABLE 4.22.0 Bedding Material**

Sieve Size	Percent Passing
3/8 Inch	100
No. 4	95-100
No.16	45-80
No. 50	10-30
No.100	2-10

- (B) Select Soil. Excavated material which is free from rocks, clods, and stones greater than one-and-one-half inches ( 1-1/2") in any dimension and which meets other requirements of trench backfill material.

- (C) Barrier Material -- Soil Classification:

1. GC - Clayey gravel, gravel-sand-clay mixtures.
2. GC - Clayey Sands, sand-clay mixtures.
3. CL --Inorganic clays of low to medium plasticity, gravely clays,, sandy clays, silty clays, clean clays.
4. Material may be finely divided, suitable, job-excavated material free from stones, organic matter, and debris.

**4.23.0**

**TRENCH BACKFILL MATERIAL**

- (A) Trench backfill material shall be placed from a point twelve inches (12") above the pipe to twelve inches (12") below the ground surface or to the bottom of the pavement subgrade which ever is greater.
- (B) Trench backfill material shall be either soil excavated from the trench or imported soil.
  - 1. Any soil used for trench backfill shall be free from frozen matter, stumps, roots, brush, other organic matter, cinders or other corrosive material, hazardous material, debris, and any rocks or stones which are larger than six inches (6") in any dimension. Rocks or stones which are larger than three inches (3") in any dimension shall not be placed within one foot (1') of pavement subgrade or within one foot (1') of the finished surface of unpaved areas or within one foot of the pipe.
  - 2. If imported soil is used for trench backfill, it shall meet CDOT specifications for Class 2 structure backfill.

**4.24.0**

**STRUCTURE BACKFILL (FLOW-FILL)**

4.24.1 General

At the Responsible Party's option, structure backfill (flow-fill) meeting the following requirements may be used in lieu of structure backfill (Class 1 and Class 2) upon prior approval of the District Representative.

**TABLE 4.24.0 Flow-Fill**

Ingredients	Pounds Per Cubic Yard
Cement (0.45 Sack)	42
Water (39 gallons)	325 (or as needed)
Coarse Aggregate (Size No.57)	1700
Sand (ASTM C-33)	1845

The maximum desired twenty-eight day (28) strength is sixty (60) psi (not a specification requirement). The above combination of material or equivalent may be used to obtain the desired flowable fill.

Structural backfill (flow-fill) will only be allowed over any water or sanitary sewer line at the discretion of the District's Representative and shall be no more than two (2) feet thick.

4.24.2 Compaction

Compaction of structural backfill will not be required if material meeting the above requirements is used.