

CLIFTON SANITATION DISTRICT

**STANDARD SPECIFICATIONS
FOR THE CONSTRUCTION OF
SANITARY SEWERS**



**CLIFTON SANITATION
DISTRICT**



COLORADO
Environmental Leader
Gold

GOVERNING THE
OPERATION, USE AND SERVICES
OF THE DISTRICT'S SYSTEM

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SECTION 100 – GENERAL

100.1 Description

These specifications include material specifications and construction requirements for underground sewer systems installed in the Mesa County right-of-way, CDOT right-of-way, and in other areas under District jurisdiction or ownership.

The standards do not include all specifications for use on public works projects due to many specialized applications. They are intended to encompass construction typical to most residential projects.

Although this document and details have been prepared and reviewed by Professional Engineers and, as such, should be considered as applicable for most standard construction without further revisions, they are not intended to eliminate the need for the involvement of a Registered Professional Engineer on a specific project. The Registered Professional Engineer, when referencing the documents for a specific project is responsible for insuring the specifications and drawings are appropriate for the specific use.

Not all possible requirements are included in the Standards. Should additional or revised requirements be desired, the items should be included under the Special Provisions and Special Technical Provisions in the Contract Documents for the project.

100.2 Specification Modifications

Portions of these specifications may be modified or deleted by appropriate items in the project Special Provisions. All other modifications and deletions shall be approved by the District Engineer or District Representative.

100.3 Revisions of Standards

When reference is made to ASTM, AWWA, AASHTO, or other specifications or methods, it shall be understood to mean the latest edition or revision of said specification, as amended and issued at the time of the Advertisement for Bids.

100.4 Measurement and Payment

Section 107, Measurement and Payment, applies only to District projects and is not required to be used on projects which are administered and paid for by private developers or other agencies.

100.5 Definitions

The following abbreviations are used in these specifications:

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASTM	American Society for Testing Materials
AWWA	American Water Works Association
CDOT	Colorado Department of Transportation
OSHA	Occupational Safety and Health Administration
NACE	National Association of Corrosion Engineers

SECTION 101 – QUALITY CONTROL AND QUALITY ASSURANCE

101.1 Quality Control

The Contractor is responsible for quality control of all work performance and shall implement whatever procedures, methods, testing, surveying and supervision that are required in order to ensure that the Work conforms to the Construction Plans and Contract Documents.

101.2 Quality Assurance

The District, Developer, or other entity responsible for administering the construction of public facilities shall provide a quality assurance program. This program shall include systematic inspection and testing of the work and materials during construction to assure the Owner and the District that the Contractor is providing work that is in conformance with the District approved plans and specifications. Minimum quality assurance testing requirements for underground utility construction are given in Table 101.

Test Required	Test Procedure	Required or Allowed Range	Minimum Test Frequency
Compaction of bedding and haunching materials (except crushed rock)	AASHTO T 99 and T 310	90% minimum at $\pm 2\%$ of optimum moisture	1 per 400 L.F. of trench (and each branch or section of trench less than 400 feet in length) for each two-foot vertical depth of backfill material
Trench compaction to sub grade 1. Within right of way 2. In unimproved areas outside of right of way or within landscaped areas	AASHTO T 99 and T 310	95% minimum at $\pm 2\%$ of optimum moisture Match existing or 90% minimum	
Compaction of aggregate base course material	AASHTO T 180 and T 310	95% minimum at $\pm 2\%$ of optimum moisture	1 per 200 S.Y.
Compaction within 24" of all structures (manholes, catch basins, vaults, etc.)	AASHTO T 99 and T 310	95% minimum at $\pm 2\%$ of optimum moisture	3 per each two-foot vertical depth of backfill material

SECTION 102 – MATERIALS

102.1 Description

This section covers pipe and other materials to be used in the construction of the various types of underground utilities. All materials used shall be new and in conformance with the applicable standards.

102.2 Contractor Requirements

All materials to be furnished by the Contractor shall conform to the requirements of these specifications. The type, size and strength class of pipe, fittings and other materials shall be as shown on the Construction Drawings or otherwise specified in the Contract Documents.

102.3 District Furnished Materials

When the District furnishes materials that are to be incorporated in to the Work by the Contractor, provisions will be made in the Special Conditions as to the responsibilities of the District and the Contractor regarding delivery, unloading, storage, and protection of the materials.

102.4 Inspection and Testing

All pipes shall be tested in conformance with the applicable standards. Testing may be witnessed by the District Representative, or by an approved independent testing laboratory. Upon request of the District, the Contractor shall provide a copy of certified test reports indicating that material does conform to the applicable standards or specifications.

102.5 Handling

All materials shall be handled with equipment and methods adequate to prevent shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground. If any part of the coating or lining is damaged, the Contractor shall repair or replace the material at his expense as directed by the District. All pipe and appurtenances shall be handled in accordance with the appropriate AWWA and ASTM standards.

102.6 Storage

The Contractor will be held responsible for the safe storage and protection of all pipe and other materials delivered to the work site. The interiors of all pipe and fittings shall be kept free from dirt and foreign matter at all times. Gaskets for pipe joints shall be stored in a cool location out of direct sunlight.

If sunburned pipe is utilized, the District requires that the Contractor provide a manufacturer's certification that all warranties are still valid. The District reserves the right to reject sunburned pipe depending on the severity of the apparent damage.

Any material that has been damaged before actual incorporation in the Work shall be repaired or replaced at the Contractor's expense.

102.7 Pipe and Fittings for Sanitary Sewer Construction.

Pipe used in construction of gravity sanitary sewer mains and service lines shall be polyvinyl chloride (PVC). Sanitary sewers under pressure shall be PVC pipe.

The minimum pipe size for gravity sewers shall be eight-inch (8") diameter for mains and laterals, and four-inch (4") diameter for service lines unless otherwise approved.

Service taps for new construction shall be accomplished utilizing full body wye fitting. For taps into existing clay, concrete, or PVC sewer lines, "Inserta Tees" manufactured by Inserta Tee of Forest Grove, Oregon (503/357-2110) or approved equal will be used in accordance with manufacturer's specifications. The District or its representative will inspect the clay or concrete sewer main prior to installation of the Inserta Tee to ensure the pipe and proposed tap location are viable. Tapping into clay, concrete or PVC will be accomplished by using a hole cutting saw capable of making one clean hole in accordance with the manufacturers recommended size based on type of pipe. It is not acceptable to use a hammer and chisel to make tap holes.

102.7a *PVC Gravity Sewer Pipe*

PVC sewer pipe and fittings shall conform to ASTM D3034 Type PSM for diameters 4" to 15" and to ASTM F679 Type I for diameters 18" to 27". The minimum wall thickness for PVC pipe shall conform to Standard Dimension Ratio (SDR) 35. Joints shall be bell-and-spigot type with flexible electrometric seals conforming to ASTM D3212 and shall not be longer than 14 feet in length. Gaskets shall be neoprene or other synthetic rubber material conforming to ASTM F477. The bells shall be integrally formed with the pipe or fitting.

Ribbed PVC pipe may be used for sizes 15" through 30". Ribbed PVC sewer pipe shall be seamless open profile and meet the requirements of ASTM F794 and Uni-Bell UNI-B-9. Pipe shall have a smooth interior with a solid cross-sectional rib exterior. Exterior ribs shall be perpendicular to the axis of the pipe to allow placement of the sealing gasket without additional cutting or machining. The pipe stiffness shall be a minimum of 46 psi when tested at 5% deflection in accordance with ASTM D2412.

102.7 b *PVC Pressure Sewer Pipe*

PVC pipe used for sanitary sewers under pressure shall meet the requirements of ASTM D2241 (IPS) or AWWA C900. Joints shall conform to ASTM D3139 and have elastomeric seals conforming to ASTM F477. The type and pressure class shall be as shown on the Construction Drawings or otherwise specified.

Fittings. PVC pipe fittings shall be fabricated of PVC material having a pressure rating equal to or greater than the pipeline used. PVC fittings may be used only with PVC pipe. When used with AWWA C900 PVC pipe, sizes 4" through 12", the PVC fitting shall conform to AWWA C907. When used with ASTM D2241 pipe, the PVC fitting shall be of the same or higher class as the pipe and the pipe rating shall be reduced by 50%.

102.8 Manholes for Sanitary Sewers

Manholes shall be constructed in accordance with Clifton Sanitation District Standard Drawings.

Cement. All cement used in mortar, concrete bases, and precast manhole riser sections, cones and flat tops, for sanitary sewer manholes, shall be Type V or modified Type II Portland cement having less than five percent (5%) tricalcium aluminate.

Precast concrete manholes bases shall be required unless prior approval from Clifton Sanitation District Representative.

Precast Concrete Manhole Sections. Manhole risers, cones, flat tops and grade rings shall be precast reinforced concrete sections conforming to ASTM C478 or AASHTO M 199. Manhole risers, cones and flat tops shall be made with tongue and groove ends for continuous and uniform joints between sections. The joint sealant shall be a flexible preformed, bitumastic joint sealant.

Invert Coating. All manholes that are not constructed as a through manhole, pipe laid continuously through the manhole providing a PVC invert, shall have a minimum fall across the manhole of 0.16 feet. The concrete invert of the manhole shall have a steel trowel finish free of transverse or longitudinal trowel marks. Broom finishes are not acceptable.

In the event that 0.16 feet of positive fall cannot be maintained across the manhole, the manhole invert shall be coated with a coating material suitable for feathering and vertical application. Coating shall be Castagra Ecodur 201 or approved equal.

Prior to applying coating, concrete must be prepared and meet NACE No. 6/SSPC-SP 13 requirements. Concrete must be free of bug holes or voids after surface preparation. Where bug holes or voids can't be removed, fill prior to application of coating. Mixing method, rates, and air surface temperature during application and curing shall be performed per manufacturer's recommendations. Coating material shall be mixed in a clean dry container free of foreign matter or debris.

In manholes with limited fall from pipe invert in to pipe invert out, the concrete invert may need to be ground to allow continuous positive fall through the manhole. Coating may be brush applied in thin coats to provide a slick surface through the concrete invert of the manhole. The cured surface of the coating shall be free of brush marks and shall have a cross section consistent with that of the PVC pipe.

Manhole Waterproofing. When manhole waterproofing is required by the Project Specifications or Plans, the exterior surface of base, riser sections and cone shall be coated with minimum 10 mil. coal tar epoxy. Waterproofing may be field-applied.

Corrosion Protection. ALL drop manholes, force main outlet manholes and lift station wet wells shall be coated on the interior surfaces of the riser and cone with a minimum 50-mil. Castagra Ecodur 201 or approved equal. Coating is to be shop-applied to concrete after concrete has cured 28 days or steam cured over a 24-hour period or as required to meet the 28-day strength requirements.

Prior to applying coating, concrete must be prepared and meet NACE No. 6/SSPC-SP 13 requirements. Concrete must be free of bug holes or voids. Where bug holes or voids can't be removed, fill prior to application of coating. Mixing method, rates, and air surface temperature during application and curing shall be performed per manufacturer's recommendations. Coating material shall be mixed in a clean dry container free of foreign matter or debris.

Apply coating in accordance with the manufacturer's recommendations and allow to dry and harden prior to transporting precast sections to the project.

For application on existing manholes, Castagra Ecodur 201 or approved equal, may be used with prior District approval. Manhole surface preparation must meet NACE No. 6/SSPC-SP 13 requirements prior to application of the product. The manufacturer's recommendations for application in confined space areas shall be followed.

Manhole Steps. Steps are required in sanitary sewer manholes only unless otherwise shown or specified in the Contract Documents. Manhole steps shall be manufactured from copolymer polypropylene plastic with ½" diameter, Grade 60 steel core. The steps shall be set in the wall of the manhole riser at the time the riser is manufactured. For precast manhole bases with integral riser sections, the steps shall be installed at a 45-degree angle from the inlet pipe. The spacing between steps shall be such that when the manhole components are assembled the spacing is in conformance with OSHA Standards.

Pipe-to-Manhole Connector. Pipe-to-manhole connectors shall be manufactured with rubber conforming to ASTM C923. All metal components shall be stainless steel.

Rings and Covers. Manhole rings and covers shall be cast iron dipped in an asphalt-based material to resist rusting. The standard District manhole shall be Castings MH-250-24 C.I. or approved, fully interchangeable substitute. The bearing surfaces between the ring and cover shall be machine finished or ground to assure non-rocking fit in any position and interchangeability. The cover shall have a beveled pick hole that has a width of ¾" at the top and 1" at the bottom. The length of the pick hole (along the circumferences of the lid) shall be at least 1 ½". The word SEWER shall be cast in the cover.

Inverted rings and covers will NOT be allowed unless approved by the District representative.

Watertight Manhole Covers. Where a watertight manhole is required, the ring and cover shall be equipped with a gasket or o-ring, the cover shall have no holes that could allow the intrusion of water into the manhole, the ring and cover shall be drilled and tapped at 120 degree spacings and 3 stainless steel bolts (Grade 316) shall be furnished to secure the cover to the ring. Anti-seize compound will be applied to threads PRIOR to installation.

The standard ring and cover for watertight manholes shall be Castings MH-250-24 C.I. with Cover D, bolted and gasketed or approved equal.

Cast Iron-Grade Rings. Under no circumstances will cast iron grade rings be permitted for new construction. Cast iron grade rings that fit in the top of existing manhole rings shall be the same diameter as the existing ring and shall have three set screws for attachment to the existing ring. The maximum height of a grade ring shall be 4".

102.9 Concrete and Mortar

All concrete used in construction of manholes, inlet boxes, vaults, concrete encasements, thrust blocks, etc., shall meet the requirements of the Standard Specifications for Road and Bridge Construction, Class B. Unless otherwise specified, all concrete shall be made with modified Type II Portland cement.

Cement mortar used in construction or maintenance of manholes, inlets, vaults, etc., shall be a non-shrink grout conforming to ASTM C109 and ASTM C191.

Rapid-Road Repair grout or approved equal is recommended for setting the ring and cover on top of the concrete grade rings. All-Crete 5 Minute Set (Fostroc, Inc., Georgetown, KY) or approved equal is recommended for invert work.

SECTION 103 – REMOVALS, EXCAVATION, BACKFILLING AND RESTORATION

103.1 Description

For the purpose of this section, underground conduits shall be considered sanitary sewers, storm drains, water mains, irrigation lines or any other underground pipeline. Wherever the term “pipe” and “pipeline” is used, it shall mean underground conduit.

This section covers surface removals, excavation, backfilling, compaction, disposal of surplus material, restoration of disturbed surfaces, and all other work required for the safe and proper construction of underground conduits.

103.2 Survey Line and Grade

All construction surveying and staking shall be performed by or under supervision of a professional engineer or land surveyor registered in the State of Colorado. The Contractor shall use a laser instrument to maintain and control the line and grade of all gravity flow pipelines including sanitary sewers, storm drains and irrigation lines. Check points shall be set at 25 feet, 50 feet, 100 feet and 200 feet from the beginning of each reach of pipe to assure that the laser is on the correct line and grade.

103.3 Removal of Structures and Obstructions

The removal of structures and obstructions shall be in accordance with Section 202 of the CDOT Standard Specifications for Road and Bridge Construction. The Contractor shall remove surface materials and obstructions only to the widths necessary for excavation of the trench. All trees, shrubbery, fences, plantings and structures not designated for removal shall be protected, or if moved, restored to their original condition after construction is complete. Removal of concrete curbs, gutters, sidewalks, driveways, and asphalt pavement shall be along existing joints or neatly cut lines.

All vegetation, concrete, and other refuse removed from the construction limits, shall be separated from suitable topsoil and backfill material and hauled to a disposal site secured by the Contractor and approved by the District unless otherwise specified in the Contract Documents. The Contractor shall inform the District in writing of the location where any asphalt pavement removed from the project site will be disposed.

Removed asphalt pavement shall be hauled to a designated site that is approved or specified in the Contract Documents. Asphalt millings shall be separated from asphalt pavement not removed by milling (planing) and both materials placed in appropriate stockpiles.

Where the trench is in an unpaved area, clean topsoil suitable for final grading shall be stripped, stockpiled separate in approved locations, and restored to the original thickness after the trench is backfilled.

103.4 Bracing and Sheeting of Trenches

All trenches shall be properly braced, sheeted or otherwise supported to provide safe working conditions and protection of the Work, workers and adjacent property. Bracing, trench shields and sheeting shall conform to the recommendations in the Occupational Safety and Health Standards for Construction (OSHA). Unless otherwise approved, all trench support materials shall be removed in a manner that will prevent caving of the sides and movement or other damage to the pipe.

103.5 Trenches with Sloping Sides

Where working conditions and right-of-way width permit, trenches in unimproved areas may be excavated with sloping sides in accordance with OSHA requirements. All soils shall be assumed to be OSHA Type C Soil, unless otherwise classified by a qualified soils technician. Trenching and other excavations shall not extend beyond existing easements, right-of-way or limits shown on the Construction Drawings unless otherwise approved by the property owner and the Engineer.

Where trenches with sloping sides are permitted, the slopes shall not extend below a point 12 inches above the top pipe. The trench shall be excavated with the vertical sides below this point with widths not exceeding those specified on the District Standard Drawings.

In streets, alleys or narrow easements, trenches shall be excavated with vertical sides, properly braced and supported, unless otherwise approved by the Engineer.

103.6 Open Excavation Limits

The length of open trench shall be kept to a minimum and shall not exceed the length necessary to accommodate pipe laying and backfilling operations unless otherwise approved by the Engineer. The Contractor shall be responsible for covering or barricading unattended trenches and excavations as necessary for protection of the public and the Work. All trenches and excavations shall be backfilled at the end of each workday, unless otherwise shown on the plans or approved by the Engineer. The end of a trench may be left open overnight if the entire perimeter of the excavation is fenced, lighted and barricaded with construction equipment and/or Jersey barriers. No traffic lane shall be blocked by an open excavation, piece of equipment or other obstruction without a proper lane closure, road closure or other approved traffic control.

103.7 Unauthorized Excavation and Pavement Removal

Unless authorized by the Engineer, all removed pavement and excavations made beyond the lines and grades shown on the Construction Drawings or described in the Contract Documents shall be replaced at the Contractor's expense.

103.8 Unstable Trench Bottom

Where the excavation is found to consist of muck, organic matter or any other material that is determined, by the Engineer, to be unsuitable for supporting and maintaining the line and grade of the pipe, the trench shall be excavated to an additional depth as agreed upon by the Contractor and Construction Inspector/Engineer, and replaced with an approved granular stabilization material. Should the Contractor and Inspector/Engineer fail to reach an

agreement as to the depth and/or method of trench foundation stabilization, the District may secure or require the developer to secure the services of a Geotechnical Engineer to assist in determination of an appropriate method for stabilization.

103.9 Bedding and Shaping Trench Bottom

Unless otherwise directed or specified in the Special Provisions, all trenches shall be excavated to at least six inches (6") below the pipe grade and backfilled to grade with approved granular bedding material. The bedding material shall be hand shaped and graded until the trench bottom is uniform and free from rocks, bumps, and depressions. A coupling or bell hole shall be dug at each pipe joint with sufficient length, width and depth to permit assembly of the joint and provide a minimum clearance of two inches (2") between the coupling and the trench bottom.

After the pipe is joined, pipe-bedding material shall be placed and tamped under each pipe joint until all voids are filled. Care shall be taken not to displace the pipe from its line and grade.

103.10 Cutoff Walls

Cutoff walls shall be installed along every utility line to inhibit the movement of groundwater through the screened rock bedding. Cutoff walls shall be 5 to 10 feet long and consist of native material or imported material that has permeability rate the same or less than that of the native material. Cutoff walls shall be constructed by discontinuing the installation of bedding and haunching material and installing approved native or imported material. Cutoff walls shall be installed at intervals not exceeding 200 feet on pressurized lines. On gravity flow lines, cutoff walls shall be installed on every line, 10 to 20 feet upstream of every manhole or box.

103.11 Rock Excavation

Rock excavation shall consist of the removal of boulders or concrete measuring one-half (1/2) cubic yard or more, hard shale, sandstone or other bed rock which, in the opinion of the Engineer, requires for its removal the continuous use of pneumatic tools or drilling and blasting. Rock excavation shall be determined in accordance with Section 203 of the CDOT Standard Specifications for Road and Bridge Construction.

Before payment for rock excavation is approved, the Contractor will be required to demonstrate that the material cannot be removed by hand pick or by power operated excavator or shovel. No payment will be made for rock excavation unless authorized by the Engineer in writing prior to the work being done.

Blasting. Whenever rock excavation is encountered, air or hydraulic hammers or some equivalent method will be used if possible. Blasting shall be used only if other methods have proven unsuccessful and only upon the Engineer's approval.

In addition to the requirements of the General Contract Conditions, blasting will be conducted in accordance with OSHA Regulations Standard 1926 – sub part U, and will be allowed only after the following conditions have been satisfied:

1. One competent experienced person shall be specifically designated in charge of explosives and all related activities. The blaster-in-charge shall carefully supervise all work related to the use, storage, transportation and handling of explosives. The blaster-in-charge or the Contractor shall select a blasting crew to assist with

explosives activities, including transportation and area security. Only the minimum number of competent, experienced personnel, consistent with efficient operation, shall be permitted to handle explosives. Anyone demonstrating carelessness, incompetence, or inexperience shall be excluded from further handling of explosives. The blaster-in-charge shall demonstrate the following minimum qualifications:

- a. Proof of a valid Colorado Blaster's License or other license issued by an equivalent licensing body.
 - b. Written resume showing not less than three years of active involvement as blaster-in-charge on projects similar in scope to the current project.
 - c. Five references who can testify to the known qualifications and reliability of the proposed blaster-in-charge.
2. The blasting crewmembers shall demonstrate the following minimum qualifications:
- a. Completion of at least 24 hours of explosives and blasting safety training.
 - b. Written resume showing not less than one year of acceptable experience with explosives under a qualified licensed blaster.
3. At least 5 days prior to any blasting, the Contractor shall submit a blasting plan to the District Engineer or his representative. If unanticipated rock is encountered, the District may approve starting the blasting in less than 5 days from the submittal of the blasting plan. The blasting plan shall include the following items:
- a. A description and license number of the vehicle to be used for transportation of explosives, routes to be traveled and proposed hours of travel, and qualifications of driver.
 - b. Type of explosives, initiation system, drilling system, loading plan, firing plan, pre-blast and post-blast inspection, handling of misfires and removal and disposal of excess explosives.
 - c. Proposed signs, guard system, signal system, methods of communication, pre-blast notification of affected agencies or entities and traffic control measuring during blasting.
4. The safety of personnel shall be the primary consideration in decisions involving use of explosives. Protection of vehicles, utilities, and adjacent property from ground motion or fly-rock must also be provided. Use of blasting mats and other protective devices will be required. The Contractor shall retain sole responsibility for repairing or replacing any utilities or property damaged as a result of his blasting operations. Due to the proximity of residences and vehicular traffic, use of controlled blasting techniques is specifically required. A delayed blasting system shall be utilized that will not allow more than two holes to detonate simultaneously. Blasting will only be allowed during times of low traffic on the adjacent roads and only in conjunction with traffic closure for the period of time during which blasting occurs. Traffic closure must be approved by the District Representative or District Engineer.

103.12 Stockpiling Excavated Material

Excavated material shall be piled in accordance with OSHA guidelines in locations that will not endanger the Work, create traffic hazards or obstruct sidewalks and driveways. Fire hydrants, valve boxes, manholes and other utility access points shall be left unobstructed. Gutters and other watercourses shall not be obstructed unless other satisfactory provisions are made for runoff and street drainage.

All surplus material and excavated material unsuitable for backfilling shall be removed from the site and disposed of in areas secured by the Contractor.

103.13 Dewatering Trenches

Trenches shall be kept free of water during pipe-laying operations by draining, pumping or other approved methods. The water level shall be maintained at least six inches (6") below the trench bottom throughout the placement of bedding, pipe laying, joining and backfilling operations.

The dewatering shall be carried out so that it does not destroy or weaken the strength of the soil under or along the side of the trench. The method of disposal of trench water shall be approved by the District Utility Engineer or his representative. Watertight plugs shall be installed in the ends of all water and sewer lines when the trench is not being dewatered and shall remain readily available to protect the pipe and downstream appurtenances in the event of unplanned water entering the excavation. Surface water from any source shall be prevented from entering the trench excavation and open ends of the pipe. No additional payment will be made to the Contractor due to an unstable trench or pipe foundation conditions caused by surface water entering the trench.

103.14 Backfilling Pipe and Structures

Unless otherwise specified or approved by the District Representative or District Engineer, all backfill material shall be placed with moisture-density control in accordance with the typical trench detail shown on the Clifton Sanitation District Standard Drawings. All backfill material shall be adjusted to within two percent (2%) of the optimum moisture content prior to its placement in the trench. Wetting or water soaking trenches to achieve compaction of the backfill will not be permitted except when (1) soil sample tests show that the backfill and excavated trench materials consist of gravel or other granular material having less than 15 percent by weight passing a No. 200 sieve; and (2) the Engineer has given written approval prior to water soaking.

A minimum of 24 inches of compacted backfill shall be placed over the top of all polyvinyl chloride (PVC) and polyethylene (PE) pipes before vehicles or heavy equipment are allowed to pass over the pipe. Less cover may be allowed only where flow-fill or other approved material is used for the pipe haunching and backfill material. Flow-fill shall meet the requirements of Section 206.02(a) of the CDOT Standard Specifications for Road and Bridge Construction.

During initial backfilling, the Contractor shall take all necessary precautions to prevent movement or distortion of the pipe or structure being backfilled. Pipe haunching materials shall be placed and compacted in even lifts of both sides of the conduit to six inches (6") above the top of the pipe. Above the bedding and haunching material, earth backfill material shall be placed full width in uniform layers not more than twelve inches (12") thick. Each layer shall be compacted to the required density with approved mechanical or hand tamping equipment. Hydro-hammers or other heavy compaction equipment shall not be used unless approved by the District Representative or District Engineer. No hydro-hammer shall be used for compaction with less than 48 inches of cover over the pipe.

Surface water from any source shall be prevented from entering the excavation. No additional payment or extension of contact time will be made to the Contractor due to saturated or unstable conditions caused by surface water entering the excavation.

All backfill shall be frequently tested to ensure that the required density is being attained. For every 400 lineal feet of trench and each branch or section of trench less than 400 feet in length, at least one compaction test shall be performed for each two-foot vertical depth of backfill material placed. The first test shall be taken approximately two feet above the top of the pipe and the last test shall be at the pavement sub grade or 6 inches below the ground surface in unpaved areas. Compaction tests shall be taken at random locations along the trench and wherever poor compaction is suspected. If any portion of the backfill placed fails to meet the minimum density specified, the failing area shall be defined by additional tests, if necessary, and the material in the designated area shall be removed and replaced to required density at the Contractor's expense.

The frequency of compaction testing may be reduced to one test for every 1,000 feet of trench if full-time inspection is made during the backfilling operation by the Engineer or an independent testing laboratory and sufficient initial testing has been performed to demonstrate that the methodology being used achieves the required results. The methodology shall be verified for each soil type or trench condition encountered.

It shall be the Contractor's responsibility to make necessary excavations and to provide safe access into the excavations in accordance with OSHA Standards in order to accommodate compaction tests at all locations designated by the Inspector or authorized technician.

Failed compaction tests shall be immediately reported to the Inspector and the Contractor. A summary report of all compaction test results, including retests of failed tests and a test location map or other approved location format shall be submitted to the District Representative or Project Engineer and to the Contractor. Compaction test results are required as a basis of acceptance of facilities by the District in accordance with Section 106.1.

Concrete structures shall not be backfilled until the concrete and mortar therein has attained a minimum compressive strength of 2000 psi and can sufficiently support the loads imposed by the backfill. Earth backfill shall be placed simultaneously on all sides of the structure in layers approximately twelve inches (12") thick. Each layer shall be compacted to not less than ninety-five percent (95%) of the maximum dry density determined in accordance with AASHTO T 99.

103.15 Granular Stabilization, Bedding and Haunching Materials

Granular materials required for stabilization of poor sub grade soils, bedding of pipe and structures and haunching around pipe shall meet the gradation requirements shown on the following table.

Sieve Size	Percent Passing, by Weight	
	Pipe Bedding & Haunching (crushed rock)	Granular Stabilization (screened or crushed rock)
2 inch	---	100%
1 inch	100%	---
No. 200	20% maximum	15% maximum

Crushed rock shall be the product of crushing rock and gravel. The portion of the material larger than will pass a 3/8-inch sieve shall contain at least 50 percent (50%) of particles having three or more fractured faces. Not over 5 percent (5%) shall be pieces that show no fractured faces.

103.16 Earth Backfill Material

Earth backfill material shall consist of approved materials developed from project excavations or imported from another source. To be suitable for backfill, earth or earth and rock materials shall be free from muck, frozen lumps, ashes, trash, vegetation and other debris. All excavated materials which, in the opinion of the District Representative or District Engineer, are unsuitable for use in the backfill shall be removed from the site and disposed of by the Contractor at his expense. The maximum size of rock or clod allowed within 6" of any plastic pipe shall be one inch (1"). The maximum size of rock or clod allowed within 6" of a rigid pipe or structure shall be three inches (3").

Testable Materials. Any soil or soil and gravel mixture having at least 70% passing the 3/4" sieve and at least 50% passing the No. 4 sieve.

Pit-run Backfill. Pit-run, crushed asphalt pavement or other material which is "too rocky to test" the in-place density using standard AASHTO or ASTM procedures shall conform to the following requirements:

Maximum Particle Dimension	8"
Percent Passing No. 4 Sieve	20% minimum
Minus 200 Screen Size	20% maximum
Plasticity Index (PI)	7 maximum

In addition to the above requirements, the Engineer and/or the Construction Inspector shall have the authority to determine, by visual inspection, if the material delivered to the job site contains a sufficient quantity of fine graded material to fill the voids between rocks when the material is placed and compacted.

Material that is segregated, contains too much cobble or is otherwise unsuitable for use in the backfill shall be removed from the job site or blended with other suitable material as directed or approved by the Engineer or his representative.

Pit-run and crushed asphalt are typically found to be "too rocky to test" using standard density test procedures, therefore, the Contractor shall prepare and submit a Construction Procedure Plan for approval by the District. The plan shall describe the equipment, methods and procedures that the Contractor shall use to place and compact the material. The District may require that the Contractor demonstrate the proposed procedures before approval is given. The Construction Procedure Plan shall include the following:

- 1) Source(s) of the proposed backfill material.
- 2) Equipment to be used for placement and compaction of the material.
- 3) Description of how moisture content of the material will be tested, and, if necessary, adjusted.
- 4) Description of methods that will be used to place the material in the trench or excavation including the maximum lift thickness to be placed and compacted.
- 5) Description of the method of compaction including equipment to be used.

Construction Inspection. When the embankment or backfill material is too rocky to test, the District requires full-time inspection and observation during the placement and compaction of the material to assure compliance with the approved Construction Procedure Plan. For non-District managed projects, the Inspector shall be NICET Level II certified in construction materials or highway construction and shall be employed by an independent laboratory or consulting engineering firm.

Moisture Content Monitoring. The pit-run material shall be sampled and tested for moisture content at the same frequency specified in Section 103.14 for compaction testing. Samples for moisture content tests shall be randomly taken from the material being placed. The moisture content of the material shall not deviate from optimum on the dry side by more than two percentage points as determined by AASHTO T 99 or T 180. Moisture content testing shall be performed by the Inspector or by an independent laboratory at the Owner's expense.

Proof Rolling. The Engineer or Construction Inspector may require proof rolling of the compacted pit-run aggregate to test for deflection. The Contractor shall furnish a rubber-tired, self-propelled vehicle for proof rolling. If while proof rolling, any visible deflection or rutting is observed, additional compaction of the pit-run aggregate will be required.

103.17 Restoration of Grounds

The cleanup and restoration of grounds shall be a continuous process from the beginning of construction to final completion of the work. The Contractor shall keep the work site free from accumulation of debris and waste material caused by his operation.

After the pipeline is backfilled, the area shall be cleaned and restored to the original grade and condition. The cleaning and restoration shall be kept up to no greater than 500 feet behind the backfill operations unless the Construction Drawings or Contract Documents indicate otherwise. All fences, utilities, culverts, ditches, structures, grassed areas and plantings shall be replaced and restored to a condition equal to or better than that at the beginning of construction. In the case of point-location work to be performed later in the construction process, such as water line tie-ins, the restoration (but not the clean up) of the area adjacent to the point-location may be delayed until the point-location work is performed. The restoration of asphalt and concrete surfaces and structures may be performed at the completion of a segment of the project, unless otherwise specified in the Contract Documents. A segment is defined as one contiguous length of pipe installed.

103.18 Restoration of Paved Surfaces

The Contractor shall replace all paved surfaces removed or damaged by his operation. All paving, aggregate base course and concrete replacement work shall be in accordance with the Mesa County Standard Specifications for Road and Bridge Construction or CDOT Specifications or as defined in a project permit from either agency as they may be applicable. Paving and/or patching for an entire project may be performed as a single operation unless otherwise specified in the Contract Documents.

Prior to paving or patching all edges that have been broken, raveled or otherwise damaged, shall be recut to a neat line. Refer to Mesa County Standard Specifications for Road and Bridge Construction or CDOT Specifications as they may be applicable.

All curbs, gutters, sidewalks, gutter pans, driveways and other concrete street improvements within Mesa County right-of-way shall be replaced by a licensed contractor with a permit issued as required by Mesa County or CDOT as they may be applicable.

SECTION 104 – INSTALLATION OF PIPE AND APPURTENANCES

104.1 Description

All pipe, valves, hydrants, manholes and other pipeline appurtenances shall be installed and tested in accordance with these specifications and manufacturer's instructions. When

installation instructions or procedures differ, the District Representative or District Engineer will determine which will take precedence over the others.

104.2 Installation of Gravity Flow Pipelines

Gravity flow pipelines covered by this specification include sanitary sewer lines. All sanitary sewer facilities shall be in compliance with design criteria of the Colorado State Department of Health.

104.2a Pipe Laying of Gravity Flow Pipelines

After the trench has been de-watered and the bedding prepared in accordance with Section 103, the pipe shall be laid to the line and grade shown on the Construction Drawings. Variance from the designed location and elevation at the ends of every pipe section shall not be greater than three inches (3") horizontally and two inches (2") vertically while still maintaining minimum positive slope of the pipe. Variance from the design slope shall be within 0.04% of the design slope. At no point, however, shall the slope be permitted to drop less than the allowed minimum positive slope of 0.40% or the design slope shown on the Construction Drawings, whichever is less. A deflection of up to 0.8 inches, creating a sag of not longer than 4 linear feet, will be allowed once in every 100 feet of pipe laid. If a sag is identified during lamping of the sewer line, the line will be televised, closed caption, in accordance with Section 105.2b to determine the severity of the deficiency.

The Contractor shall set the line and grade of each joint of pipe with a laser unless otherwise approved by the District Representative or District Engineer. Offset hubs shall be set by the Contractor's surveyor at intervals of 25 feet, 50 feet, 100 feet and 200 feet out of each manhole, inlet box, or starting point to verify vertical and horizontal line and grade of the gravity pipe being installed. Whenever the pipe is found to be outside the specified limits, the misaligned sections shall be removed and re-laid to the correct line and grade at the Contractor's expense.

Minimum pipe slopes for various size sewer mains are shown in the table below.

Pipe Size	Minimum Slope
6-inch Sewer Main	0.48%
8-inch Sewer Main	0.40%
10-inch Sewer Main	0.24%
12-inch Sewer Main	0.19%
15-inch Sewer Main	0.19%
18-inch Sewer Main	0.15%
21-inch Sewer Main	0.12%
24-inch Sewer Main	0.10%
27-inch Sewer Main	0.08%
30-inch Sewer Main	0.07%
36-inch Sewer Main	0.06%

Pipe shall be laid upgrade from the point of connection to the existing sewer or from a designated starting point. Pipe with bell and spigot joints shall be laid with the bell end upgrade.

The inside of the pipe and jointing surfaces shall be kept clean and free from mud, soil, gravel, groundwater, and other foreign material. When pipe laying is not in progress, the upgrade end of the pipe shall be kept closed with a tightly fitting cap or plug.

For storm drain applications, approved end sections are required at the exposed ends of all polyethylene and PVC pipe to protect the pipe from prolonged exposure to ultraviolet radiation and from damage due to burning.

Sewer Line Stub Outs. All sewer line stub outs longer than 10 feet shall terminate at a manhole, unless otherwise approved by the District Representative or District Engineer. The minimum length of a stub out shall be 18". Each stub out shall be connected to the manhole with a Kor-n-seal gasket, or approved equal, and plugged with a PVC cap that can be removed for future extension, yet still prevent groundwater infiltration. The manhole base shall be formed to provide positive flow through the manhole from the inverts of all connecting pipes, including stub outs.

Minimum bury for all sewer mains within right-of-way or easement is four (4) feet unless otherwise approved by the District.

104.2b *Installation of Sewer Service Line*

Sewer service pipe within the public right-of-way shall be laid at a minimum grade of one-fourth inch (1/4") per linear foot (2%) unless otherwise approved by the District Representative or District Engineer. Flatter slopes between one-eighth inch (1/8") (1%) and one-fourth inch (1/4") per foot will be allowed only when there is not enough elevation difference to achieve one-fourth inch (1/4") per foot as verified by survey. Sewer service pipe and connections to the sewer main shall be completed by an approved Contractor and be inspected by a District Inspector prior to backfilling. The location and alignment of service lines shall be established by the Engineer.

The maximum deflection permissible at any one fitting or any combination of adjacent fittings shall not exceed 90 degrees. Ninety degree fittings shall be the long radius type.

Small Diameter Taps. Four-inch service lines shall be joined to the new sewer mains with a full body wye fitting connected above the spring line of the sewer pipe. For existing main lines the District will provide direction as to tap method to be used.

Large Diameter Taps. All 6" or larger service taps shall be accomplished using a manhole. On 8" or smaller main lines in which projected flows will be less than 1/3 full, the 6" service line shall enter the manhole approximately 0.2' higher than the invert of the existing pipe. On larger mains, the 6" line shall be placed vertically so that flow from the main line does not back into the service line.

All Taps. On all existing main lines such as concrete, clay, or PVC, Inserta Tees, as specified in Section 102.7 shall be used in accordance with the manufacturer's recommendations. Verify that the supplied tee is intended for the diameter and type of the existing pipe. At no point shall the tee protrude more than 1/2 inch into the existing pipe.

For the installation of sewer service lines to properties that will not be immediately connecting or reconnecting to the sewer system, the service lines shall be stubbed out to the house side of the multi-purpose easement, utility easement or right-of-way line where no easement exists. The end of the pipe shall be plugged and marked with either a 2"x4" wood post or steel fence post buried vertically above the end of the pipe and extending 3 feet above the ground surface with the exposed portion painted green. The ends of the service lines shall be capped with watertight plugs braced to withstand test pressures. The horizontal and vertical location of each service tap shall be measured and shown on the As-Built Drawings PRIOR to backfilling. The Contractor shall mark the end of the service with a post, as required above, with a reference mark and depth to the service pipe to be shot for elevation and documented at a later date. Tap locations shall be referenced using the stationing shown on the plans or referenced to property corners unless otherwise approved by the Engineer.

Where a PVC sewer service line is connected to an existing PVC service line, the connection shall be made with an approved gasketed PVC repair coupling. Where a PVC service line is connected to an existing service line of concrete, vitrified clay pipe, orangeburg, or truss pipe, a Mission type coupling with stainless steel bands, or District approved equal, shall be used. Mission type couplings need not be encased in concrete.

All service lines over 100 feet in length have a clean-out installed in accordance with the Uniform Plumbing Code. When the clean-outs are within the right-of-way, the clean-outs shall be enclosed in a 24" diameter concrete barrel with a standard ring and cover suitable for traffic loads as shown on the Clifton Sanitation District Standard Drawings.

Sub-drains and/or French drains will not be permitted to be connected to sanitary sewers.

Services for service stations and food-processing establishments shall have a grease and/or sand trap installed on their service lines. The trap shall be constructed to the requirements of the Clifton Sanitation District Policies.

Minimum bury for all sewer services within right-of-way or easement is four (4) feet unless otherwise approved by the District.

104.2c Construction of Manholes

The foundation for each manhole base shall be prepared by replacing unsuitable material with sub grade stabilization material in accordance with Section 103.8, and placing granular bedding material in accordance with the Clifton Sanitation District Standard Drawings.

The manhole base shall be precast or cast-in-place. The lines and grades of the pipe inverts shall be staked, as shown on the Construction Drawings. The invert shall be formed and smoothly finished to match the shape and elevation of all pipes connected to the manhole. Where the sewer line is designed with a continuous grade through the manhole, the pipe shall be laid through the manhole location, the top half of the pipe cut out and the manhole base formed around the bottom half of the pipe. A pre-cast base with a pre-cast invert may be used where there is at least 0.16 feet of elevation difference across the manhole.

Manhole inverts constructed with less than 0.16 feet of elevation drop from pipe invert in to pipe invert out, and not constructed with the sewer pipe laid through the manhole as described above, shall be coated with an coating material as specified in Section 102.8. The concrete invert shall be formed or removed to a depth to allow room to apply the coating to match to pipe invert and maintain positive fall through the manhole. The cured surface of the coating shall be smooth, free of trowel marks and shall have a cross section consistent with that of the PVC pipe.

ALL drop manholes, force main outlet manholes and lift station wet wells shall be coated on the interior surfaces of the riser and cone in accordance with Section 102.8.

Waterstops shall be installed on all pipes going into or out of a cast-in-place base. Waterstops shall be placed on both the uphill and downhill sides of the manhole on pipes laid continuously through a manhole. For pre-cast bases the pipes shall be connected to the base with flexible rubber boots with stainless steel straps.

If cast-in-place bases are used, the first pre-cast manhole section shall be placed on the concrete base structure before the base has taken initial set, or the section shall be grouted into a suitable groove formed in the top of the manhole base. The first section shall be adjusted to the proper grade and alignment so that it is uniformly supported by the base concrete and not bearing on any of the pipes. The manhole steps shall be located one-foot left or right of the main inflow pipe.

The remaining pre-cast sections shall be placed and aligned to provide vertical sides and alignment of the ladder rungs. Plumbness shall be checked as each barrel section is added. A bitumastic or other approved sealer shall be placed between pre-cast sections so that the completed manhole is rigid and watertight. The sealer shall be placed both on the inside lip as well as the outside lip of each section.

The manhole ring and cover shall be adjusted to the final pitch and grade with mortar and pre-cast concrete grade rings. The total height of the grade rings shall not be more than twelve inches (12"). Grade rings shall be dry stacked and the cast iron ring set in a bed of mortar at the finished grade elevation. Cast iron grade rings shall not be used to adjust the elevation of the manhole lid, except when a street is being overlaid. Inverted rings and covers will not be permitted without the approval of the District Representative or District Engineer.

Where the manhole is in an unpaved street, alley or other area where grade has not been established, 6 to 12 inches of grade rings shall be placed between the top of cone and bottom of the ring (to allow future adjustment of the ring to grade).

Where the manhole is in an unpaved area, a concrete collar with a #4 rebar hoop shall be cast around the ring and cover. The concrete collar shall be a continuous section with minimum dimensions of 12 inches wide and minimum 12 inches thick. Concrete shall extend from the top of the cast iron ring to six (6) inches below the top of the concrete manhole cone.

Where a manhole is in a cultivated or landscaped area, a watertight manhole cover shall be used. In cultivated areas, the top of the casting shall be 18 to 24 inches below the existing ground surface.

All newly constructed manholes shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at the time of final inspection. All ram-neck shall be trimmed flush with manhole wall.

104.3 Polyethylene Encasement

Prior to backfilling, all cast iron and ductile iron pipe, fittings, valves and appurtenances shall be wrapped with polyethylene encasement material. All other metal pipes and fittings, except copper service lines, shall be wrapped with polyethylene encasement material. Polyethylene film shall have a minimum thickness of 0.008 inches (8 mil). Installation of the polyethylene encasement shall be in accordance with one of the methods described in AWWA C105. If a soil survey has been performed in accordance with Appendix A of AWWA C105 and the soil is

found to not be corrosive to ductile iron, the ductile iron pipe and fittings may be installed without a polyethylene encasement. When performing soil survey according to AWWA C105, only the four-pin method of measuring earth resistivity will be acceptable.

Ductile iron valves and fittings shall be fully encapsulated by the polyethylene encasement, except the valve opening nut. The ends of the polyethylene shall be taped around the full circumference of the pipe. If the polyethylene is cut or more than one piece is used to wrap the valve or fitting, the pieces shall overlap a minimum of 12 inches and the full length of the seam shall be taped.

Concrete Blocking. The size and location of concrete blocking shall be as shown on the plans or in accordance with the Clifton Sanitation District Standard Drawings. Thrust blocks shall be poured on firm, stable foundation material and all bearing surfaces shall be against undisturbed earth.

Concrete for thrust blocks shall be made with modified Type II Portland cement and shall reach a minimum compressive strength of 3000 psi in 28 days. Reinforcing steel and bolts used to anchor valves, fittings, etc., to thrust blocks shall meet tensile requirements of ASTM Grade 40. All anchorage steel not embedded in concrete shall be factory epoxy coated or Cor-Ten steel.

Mechanical Restraint. Valves and fittings may be restrained by mechanically connecting them to the pipe or other fittings.

104.3a *Installation of Gate Valves and Valve Boxes*

Each gate valve shall be installed in a vertical position and set on a concrete support block as shown on the Clifton Sanitation District Standard Drawings. An adjustable slip type valve box shall be set into position during backfilling operations. The upper section of the unit shall be placed in proper alignment and adjusted so that its top will be at final grade. The completed valve box shall be vertically centered over the valve operating nut. Each valve shall be checked for proper access and operation prior to paving, and after paving.

104.3b *Installation of Butterfly Valves*

Each butterfly valve shall be installed in a vault. Pipe or valve supports shall be provided within the vault. All support materials shall be suitable for use in wet corrosive conditions. The diameter of the vault shall be as detailed on the plans.

104.4 Relationship Between Water Lines and Sanitary Sewers

To reduce the possibility of contamination of the domestic water supply in the event of a water line break or repair, the following construction techniques shall be used when a water line and a sanitary sewer line are installed in close proximity to each other. These requirements shall apply to main lines.

- 1) If the sewer line is above and within 10 feet horizontally of the water line, the sewer line shall be installed through a steel or ductile iron casing pipe or encased in reinforced concrete as shown on the Clifton Sanitation District Standard Drawings. The casing pipe or concrete encasement shall extend a minimum of 10 feet on either side of the water line, measured perpendicular to the water line.

- 2) If the sewer line is 18" or less clear distance below and within 5 feet horizontally of the water line, the sewer line shall be installed through a steel or ductile iron casing pipe or capped with concrete as shown on the Clifton Sanitation District Standard Drawings. The case pipe or concrete cap shall extend a minimum of 10 feet on either side of the water line, measured perpendicular to the water line.

In all cases, suitable backfill or other structural protection shall be provided to preclude the settling or failure of both pipes.

Crossings of sewer and water lines shall not be at an angle less than 45 degrees nor shall a sewer line and water line be installed within 10 feet of each other unless approved by the District Representative or District Engineer.

SECTION 105 – PIPELINE TESTING

105.1 Testing

All pipelines shall be tested before final acceptance. All testing shall be performed by the Contractor under direct control and observation of the District Representative, Engineer or an approved independent laboratory. The Contractor shall furnish all labor, equipment, tools, water and other incidental items required to conduct the tests. If a pipeline fails to meet the test requirements, the leak or other deficiency shall be located and repaired at the Contractor's expense. After the repairs or corrections have been made, the pipeline shall be retested. Repairs and retesting shall continue until the test requirements have been met.

105.2 Testing Sanitary Sewers

All sanitary sewer lines shall be tested for leakage and alignment before acceptance.

105.2a Leakage Tests

A leakage test shall be performed on all newly constructed sanitary sewers. The Contractor will determine which type of test will be made and furnish all labor, tools and equipment necessary to conduct the test. The allowable types of tests include exfiltration of water, exfiltration of air and infiltration of water.

Exfiltration of Water Test. The length of pipeline to be tested shall be limited so that the pressure on the lower end of the test section does not exceed ten feet (10') of water column. The test section shall be sealed off from the remaining pipeline with watertight plugs inserted in the pipes. The Contractor shall fill the pipe to the test level with potable water at least 24 hours prior to conducting the test. The test level shall be at least two feet (2') above the top of the pipe in the upper manhole or two feet (2') above the groundwater table, whichever is higher.

Throughout the test period of at least one (1) hour, the water level shall be maintained at the test level and all water added shall be accurately measured. The exfiltration rate shall not exceed 0.15 gallon per inch of inside pipe diameter per hour per 100 feet of pipe length.

Exfiltration of Air Test. Air testing shall be in accordance with ASTM C828. The ends of the test section shall be sealed at the upper and lower manholes with pneumatic plugs. One of the plugs provided shall have two taps. One tap will be used for introducing air into the pipeline through suitable valves and fittings to accept a pressure gauge to monitor the internal pressure of the sewer pipe.

The pressure gauge shall meet the following minimum specifications:

Size	4-1/2-inch diameter
Pressure Range	0 – 15 psi
Figure Intervals	1-psi increments
Smallest Intervals	0.1 psi
Pressure Tube	Bourdon tube or diaphragm

Connect the pressure gauge and air control equipment to the proper fittings and slowly apply air pressure. Pressurize the pipe line to 4.0 psig and throttle the air supply to maintain the pressure between 4.0 and 3.5 psig for at least two (2) minutes in order to allow equilibrium between air temperature and pipe walls. During this time check all plugs for leakage. If any plugs are found to leak, bleed off the air, tighten the plugs and repressurize the pipeline. After the temperature has stabilized, allow the pressure to decrease to 3.5 psig. At 3.5 psig begin timing to determine the time required for pressure to drop to 2.5 psig. The time, in seconds, for the air pressure to decrease from 3.5 psig to 2.5 psig shall be greater than the minimum test time shown in the following table.

Nominal Pipe Size (inches)	Time (min/100 ft)	Nominal Pipe Size (inches)	Time (min/100 ft)
4	0.3	<i>columns continued</i>	
6	0.7	24	3.6
8	1.2	27	4.2
10	1.5	30	4.8
12	1.8	33	5.4
15	2.1	36	6.0
18	2.4	39	6.6
21	3.0	42	7.3

In areas where the groundwater level is above the pipe, the hydrostatic pressure of the groundwater above the pipeline shall be determined and added to all test pressures (1 ft of water = 0.43 psi). Air testing shall not be done if the groundwater level is greater than 10 feet above the sewer line.

Infiltration of Water Test. If the sewer line is in an area where the water table is two feet (2') or more above the pipeline, an infiltration test may be used. Infiltration tests shall be completed prior to placing new sewer lines in service. The infiltration of groundwater will be measured with special made weirs, which will be inserted in the pipeline at manholes where flow is present. The infiltration rate shall not exceed 0.15 gallon per inch of inside pipe diameter per hour per 100 feet of pipe length.

Regardless of test results, if visible infiltration is observed in a manhole or pipe the infiltration shall be fully eliminated prior to final acceptance of the project. The Contractor shall submit the mitigation method to the District for approval prior to completing the work.

105.2b Alignment Testing

All sanitary sewer lines shall be observed for correct alignment by lamping. If the line does not pass the lamping test or if something other than crushed rock was used for pipe bedding, deflection testing shall be performed on flexible pipe or appropriate repairs shall be made on rigid pipe.

Lamping Test. Lamping will be performed on all sanitary sewer pipe by the District Representative or Engineer. All lines will be flushed at least 24 hours and no more than 48 hours prior to lamping. In order to pass the lamping test, no deformations or defects shall be observed in the pipe, the full vertical height of the pipe shall be observed and three fourths (3/4) of the pipe circle shall be observed horizontally.

For systems where a sewer line is allowed by the District Representative or Engineer to be stubbed out for a future extension without a manhole on the end, the trench shall be backfilled up to the end of the line but the end of the pipe shall remain accessible. The line shall be lamped from the open end of the pipe to the next downstream manhole.

Deflection Testing for Flexible Pipe. The maximum allowable deflection of flexible pipe shall be seven and one half percent (7.5%) of the Base Inside Diameter. The following values from ASTM D3034 shall apply for SDR 35 PVC sewer pipe:

Nominal Pipe Size (inches)	Base Inside Diameter (inches)	Mandrel Diameter (inches)
6	5.74	5.31
8	7.665	7.09
10	9.563	8.84
12	11.361	10.51
15	13.898	12.86

The deflection test will be performed by pulling a mandrel through the pipe from manhole to manhole.

Closed Caption Television (CCTV). The District retains the right to televise lines in order to evaluate any suspected or real deficiencies found during any of the above tests. All bored or microtunneled sewer lines shall be inspected by CCTV. Any suspected sags, found during lamping of the sewer line, will be evaluated with CCTV inspection to determine if a repair is needed.

CCTV inspections must have a minimum of five working days notification. The Developer/Contractor will be responsible for inspection costs incurred for private development work.

SECTION 106 – FINAL INSPECTION AND ACCEPTANCE

106.1 Final Inspection and Acceptance

The acceptance of all pipelines by the District will be based on the following:

1. Red-lined as-builts of sewer facilities including inverts on services are required PRIOR to paving.
2. Passing a final inspection of the Work by the District Representative or his representative.
3. **Non-District Managed Projects**

- a. Submittal of all quality assurance test results in accordance with Table 101 REQUIRED QUALITY ASSURANCE TESTING (see page UU-2).
- b. Submittal of satisfactory results of required tests (such as pressure test, leakage tests, compaction tests, etc.) certified by the Engineer or an approved independent laboratory.
- c. Submittal of printed "As-Built" construction drawings on 24" x 36" or 22" x 34" format and electronic file in .pdf format. All "As-Built" drawings shall be certified by a licensed Professional Engineer and shall state the dates of installation and the name of the Contractor who installed the system. As-Built drawings shall also be submitted as electronic AutoCAD AND .PDF files in accordance with District standards.

As-Built drawings shall include the following information for sewers: horizontal and vertical information on all pipes, manholes, catch basins and service stub outs including grades. As-Built drawings shall include the following information for all utilities: horizontal and vertical information is required at all crossings of other utilities.

- d. Submittal of copies of all inspection reports including the Inspector's daily diaries.

4. District Managed Projects

- a. Submittal of satisfactory results of tests (such as pipeline pressure test, leakage tests, etc.) required to be performed by the Contractor.
- b. Contractor is responsible to coordinate with the District Engineer as needed for as-built drawings which shall also include the following information. For sewers: horizontal and vertical information on all pipe, manholes, catch basins and service stub outs including grades. For water lines, both potable and irrigation: all horizontal and vertical information shall be neatly printed on a copy of the plan set.

SECTION 107 – MEASUREMENT AND PAYMENT

107.1 Description

The complete and accepted pipeline will be paid for in accordance with the items listed in the Bid Schedule, approved Change Orders and these specifications.

The contract unit prices bid for the various pay items in the Bid Schedule shall be full compensation for furnishing all materials, labor, equipment, tools, and other incidental items required for completion of the Work in accordance with the Construction Drawings and Contract Documents.

The quantities shown on the Bid Schedule are approximate only. Payment will be based on measurement of actual quantities installed and approved.

Sewer service wyes shall be paid for at the contract unit price per “each.” Sewer service connections, as required for sewer line replacement projects, will be paid for at the contract unit price per “each,” and shall include the wye, the section of new service line, the clean out assembly at the property line, and the connection to the existing service line. The length of the wye is not excluded from the conduit length for the main sewer line.

107.2 Manholes

Manholes will be paid for under a combination of two items. Every manhole will be paid for at the contract unit price per “each” for the basic manhole components. The basic manhole components include the base, eccentric cone, grade rings, ring and cover and adjustment to final grade. The manhole barrel sections will be paid for at the contract unit price per linear foot. The pay length for the manhole barrel will be the height from the lowest invert to the top of the ring minus five (5.0) feet. Manholes less than five (5) feet deep will be paid for under the basic manhole components only. The number of manholes to be paid for will be the number of complete units constructed and approved. Drop manholes will be paid for as standard manholes, plus a per “each” amount for the drop structure.

107.3 Granular Stabilization Material

When the use of granular stabilization material is ordered, or authorized by the District Representative or Engineer, it will be paid for at the contract unit price per ton of material placed and approved. The tonnage of material to be paid for will be determined from weight tickets collected at the time of delivery to the job site. Over-excavation and the disposal of over-excavated material will not be measured and paid for separately but shall be considered incidental to this item.

For each load of granular stabilization material delivered, a weight ticket shall be given to the Engineer’s field representative by the driver of the truck. Each ticket shall have the following information:

Date	_____
Truck	_____
Total Weight	_____
Tare Weight	_____

Weight of Material Delivered _____

Truck Driver's Signature _____

107.4 Rock Excavation

No payment will be made for "rock excavation" unless the method and costs of such work are established and approved by the Engineer in writing before any rock excavation is done.

107.5 Pavement Replacement

The area of pavement replacement to be paid for will be the same designated for removal.

Where pavement is removed beyond the limits designated on the Construction Drawings or otherwise approved, the Contractor shall replace the pavement at his own expense. The contract unit price per square yard for "Hot Bituminous Pavement" shall be full compensation for replacement of the hot bituminous pavement and base course material to the specified thickness. Asphalt quantities shall be agreed upon based on field measurements prior to each partial pay estimate.

In cases where the depth and width of the trench could be contingent upon the methods and equipment available to a contractor (such as shoring), the District reserves the right to bid pavement replacement on a linear foot of trench basis in order to allow the Contractor a wider range of methodologies.

107.6 Incidental Construction

The following list of materials and items of work may be required to complete the Work but may or may not be shown on the plans or described in the Contract Documents. Unless otherwise specified or provided for in the Bid Schedule, these items will be considered incidental to the Work and will not be measured or paid for separately. All costs for the following incidental items shall be included in the contract prices for the various pay items listed in the Bid Schedule.

1. The furnishing and maintenance of barricades, warning signs and other traffic control devices.
2. All surface removals including removal of asphalt pavement, concrete, fences, mail boxes, plantings and structures.
3. The location and protection of existing utilities.
4. All excavation except rock excavation (see Section 103.11 for payment for rock excavation).
5. The support bracing and sheeting of trenches.
6. The dewatering of trenches.
7. The furnishing and placement of all granular bedding and haunching material, and all backfill material with proper moisture and density control.
8. The furnishing and placement of all pipeline cutoff walls.
9. The clean-up and restoration of grounds.
10. The removal and disposal of all waste materials including excess excavated material, trash and debris resulting from the Work.
11. The furnishing and installation of tracing wire.
12. The furnishing and installation of polyethylene encasement material for all metal pipe, valves, fittings and other metal surfaces.
13. The furnishing and installation of restraints, whether mechanical or concrete support and thrust blocking, required on pressure pipelines.

14. All pressure and leakage testing.
15. The connection of new pipeline to existing facilities.
16. The separation, removal and disposal of muck, large rock, organic matter or other materials from project excavations, which in the opinion of the Engineer are unsuitable for use in the backfill. No separate or additional payment will be made for hauling and disposing of unsuitable materials.
17. Concrete encasement of sewer line connections and sewer service line connections.

SECTION 108 – GENERAL NOTES

1. Contractor shall have one signed copy of plans and a copy of the District Standards and Specifications at the job site at all times.
2. All sewer mains shall be PVC SDR 35 (ASTM D3034) unless otherwise noted.
3. All sewer mains shall be laid to grade utilizing a pipe laser.
4. All service line connections to new mains shall be accomplished with full body wyes or tees unless specified by District Representative.
5. Service line connections to existing mains shall be accomplished by using tapping saddles or Inserta Tee pending type of main line pipe and as directed by the District or its Representative.
6. No four-inch services shall be connected directly into manholes without prior approval. All six-inch services shall be accomplished inside a manhole.
7. The Contractor is responsible for all required sewer line testing to be completed in the presence of the District Representative. Pressure testing will be performed after installation of dry utilities, after all compaction of street subgrade and prior to street paving. Final lamping will also be accomplished after paving is completed. These tests shall be the minimum basis of acceptance of the sewer line extension.
8. The Contractor shall obtain, or have transferred to him, Mesa County road cut permits, or CDOT Utility permits, for all work within existing right-of-way prior to construction.
9. A clay cut-off wall shall be placed 10-20 feet upstream from all manholes unless otherwise noted. The cut-off wall shall extend from 6 inches below to 6 inches above granular backfill material and shall be 5-10 feet long. If native material is not suitable, the Contractor shall import material approved by the Engineer.
10. Sewer Service stub outs shall be capped and plugged. Stub outs shall be marked with a 2x4 inch post or steel post painted green and extending 3 feet above grade. As-built surveying for vertical and horizontal grade of stub out required prior to backfill.
11. Red line as-builts shall be submitted to the District at least 72 hours prior to paving for review.
12. Contractor shall have one signed copy of plans and a copy of the Clifton Sanitation District Standard Specifications at the job site at all times.
13. All service line connections to new mains shall be accomplished with full body wyes or tees.
14. No four-inch services shall be connected directly into manholes without prior approval. All six-inch services shall be accomplished inside of a manhole.
15. The Contractor shall notify the District Inspector 48 hours prior to commencement of construction.
16. The Contractor is responsible for all required sewer line testing to be completed in the presence of the District Inspector. Pressure testing will be performed after installation of dry utilities, after all compaction of street sub grade and prior to street paving. Final lamping will also be accomplished after paving is completed.
17. The Contractor shall obtain Mesa County Road Cutting permits for all work within existing County rights-of-way prior to construction. A copy of this permit is to be submitted to the District prior to construction.
18. All work shall be in accordance with approved plans and Clifton Sanitation District specifications.

Manhole Notes:

1. Concrete shall be Colorado Department of Transportation Class "B" (Section 601.02).
2. All cement used in mortar, concrete bases, grade rings, riser sections, cones and flat tops, for sanitary sewer, shall be type V or modified type II Portland cement with less than 5% Tricalcium Aluminate.
3. Manhole riser sections, cones, flat tops and grade rings shall be precast reinforced concrete conforming to ASTM C478 or AASHTO M 199.
4. Backfill around manholes and other structures shall be placed in 12-inch maximum lifts and compacted to 95% AASHTO T 99, or T 180 as identified in the Contract or by the Engineer.
5. All work shall be in accordance with approved plans and District specifications.
6. Manhole cone and flat top sections shall be positioned such that the manhole ring and cover is centered on the upstream flow line. If the cone is furnished with steps, the manhole ring and cover will be shifted so that the steps are installed at a 12" offset from the inlet pipe.
7. If the manhole sections are furnished with steps they shall be installed at a 12" offset from the inlet pipe to facilitate cleaning and TV equipment.
8. Manhole ring and cover shall be set to finish grade using rapid road repair (or approved equal) grout to adjust rim elevation. Grout shall not exceed 0.10 feet thickness. Grout shall be placed between top of concrete grade ring and ring and cover. Steel paving rings are not allowed for grade adjustment unless otherwise approved by the District.

END SPECIFICATIONS

LOCATE STORM SEWER MANHOLES
IN CENTER OF TRAFFIC LANE

LOCATE SANITARY SEWER
MANHOLES IN CENTER OF
STREET.

STUB-OUT FOR FUTURE EXTENSIONS
SHALL EXTEND BEYOND THE
INTERSECTION RADIUS OR
40' MINIMUM FROM VALVE.

FIRE HYDRANT WITH
VALVE AND BOX

R.O.W.

EDGE OF ASPHALT

40' MIN.

6'
MIN.

10'
MIN.

8'

10'
MIN.

SANITARY SEWER @ CL

PIPE PLUG &
THRUST BLOCK

STORM SEWER

6'
MIN.

EDGE OF ASPHALT

VALVE AND BOX
(ALT. LOC.)

TYPICAL UTILITY PLAN FOR STREETS

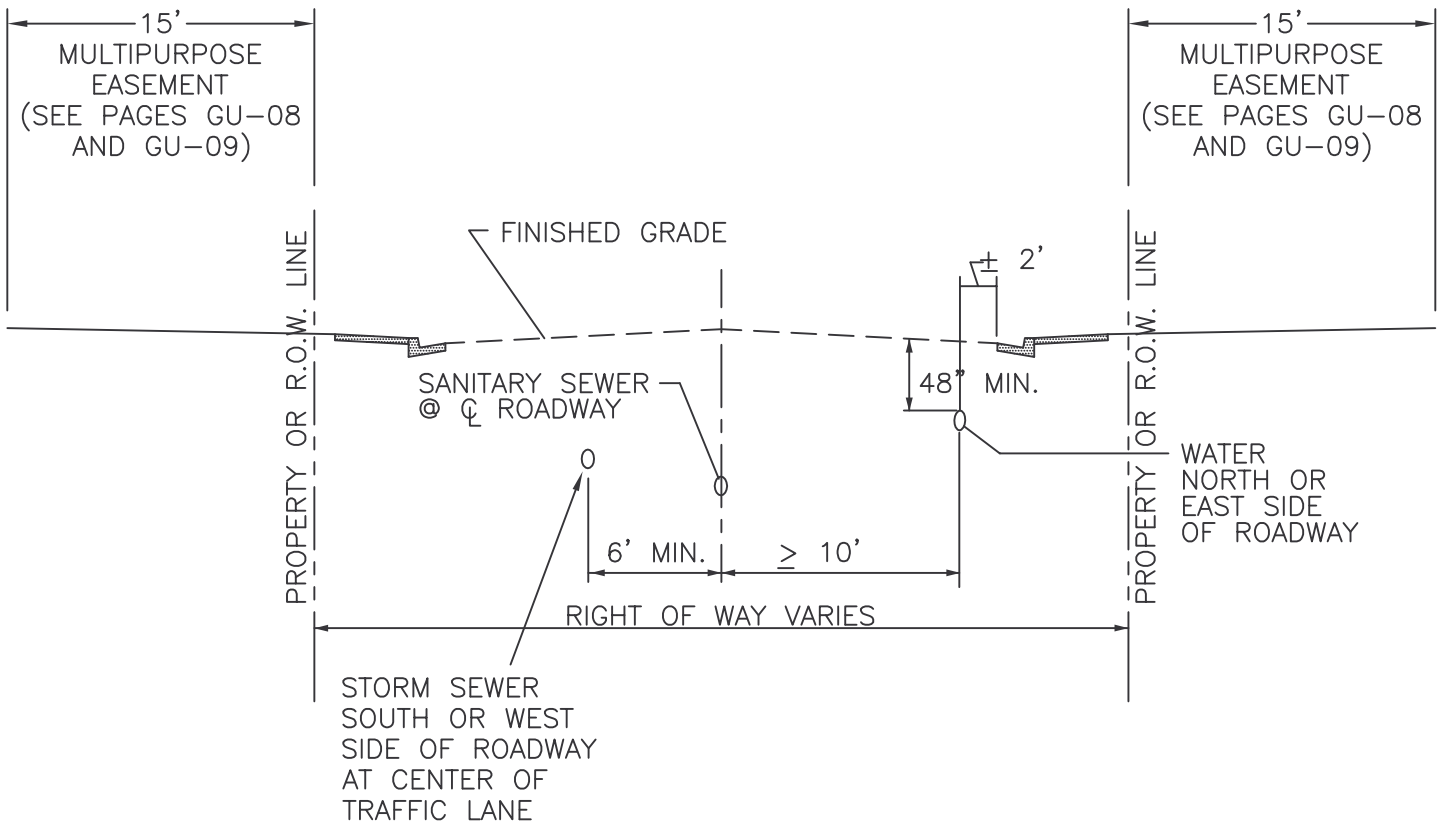


CLIFTON SANITATION
DISTRICT

GENERAL UTILITY
DETAIL

APPROVED: DN
DATE: FEB. 2006
DRAWN: CM

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TYPICAL STREET CROSS SECTION / UTILITY LOCATIONS

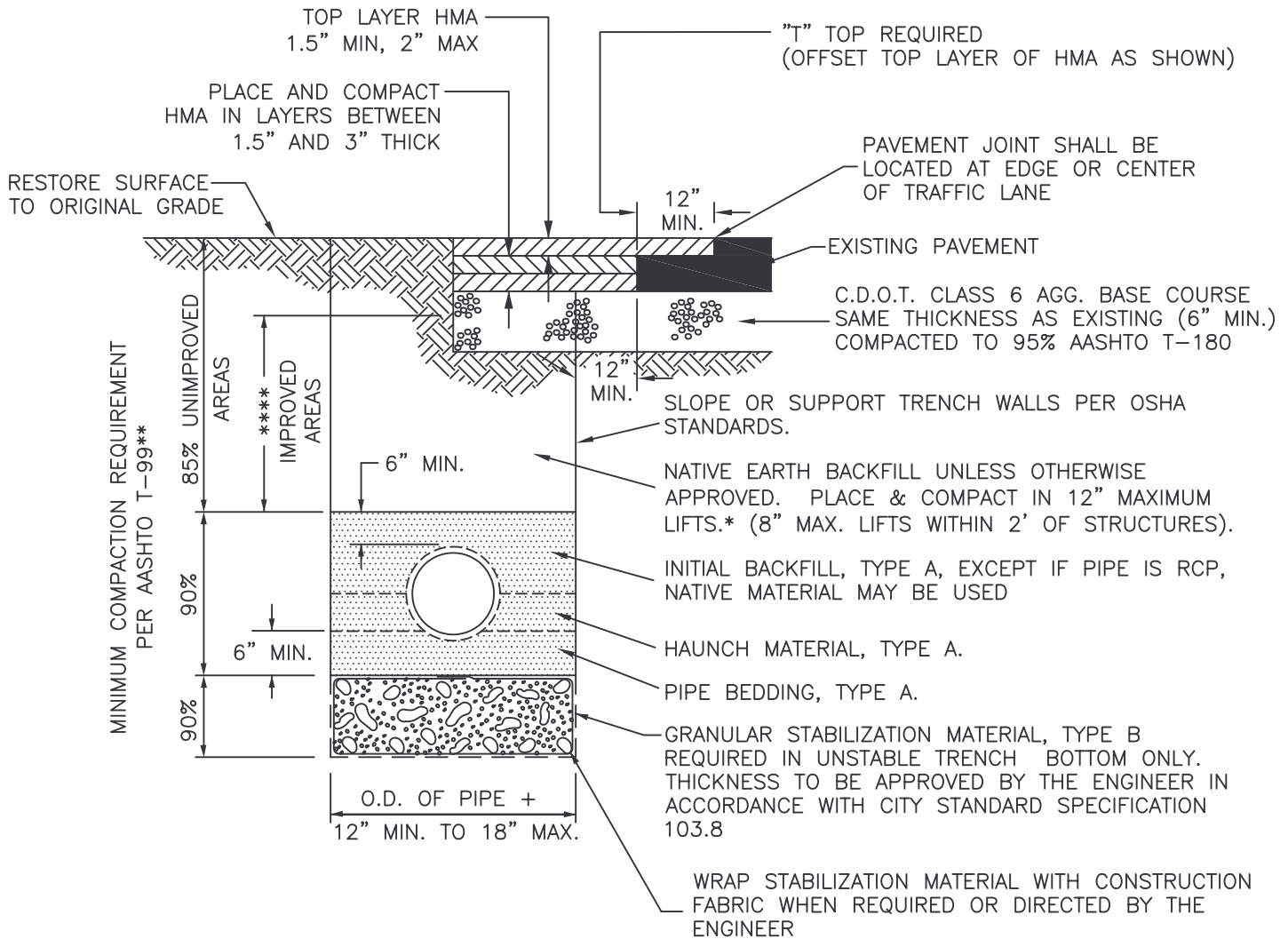


CLIFTON SANITATION DISTRICT

GENERAL UTILITY DETAIL

APPROVED: DN
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MAXIMUM PERCENT BY WEIGHT PASSING SQUARE MESH SIEVES			
SIEVE SIZE	PIPE BEDDING, HAUNCH & INITIAL BACKFILL MATERIAL (CRUSHED ROCK, TYPE A)	GRANULAR STABILIZATION MATERIAL (SCREENED OR CRUSHED ROCK, TYPE B)	IMPORTED BACKFILL MATERIAL (USE ONLY WHERE SPECIFIED OR DIRECTED BY THE ENGINEER)
12 INCH	---	---	100
2 INCH	---	100	---
1 INCH	100	---	---
NO 4	---	15 MAX	---
NO 200	20 MAX ***	---	3% - 20% ***

* 24" COMPACTED BACKFILL REQUIRED OVER ALL PLASTIC PIPE PRIOR TO VEHICLE OR HEAVY EQUIPMENT LOADING.

** COMPACT PER AASHTO T-180 WHEN SPECIFIED, DIRECTED OR APPROVED BY THE ENGINEER.

*** PLASTIC INDEX (PI) SHALL NOT BE MORE THAN 7.

**** TRENCH BACKFILL UNDER ASPHALT OR CONCRETE PAVEMENT SHALL BE COMPACTED PER SECTION 103.14 AND TABLE 101 IN THE SSFUU (STANDARD SPECIFICATIONS FOR UNDERGROUND UTILITIES).

ALL BACKFILL MATERIAL SHALL BE UNIFORMLY ADJUSTED TO WITHIN 2% OF THE OPTIMUM MOISTURE CONTENT PRIOR TO PLACEMENT AND COMPACTION.

TYPICAL TRENCH DETAIL

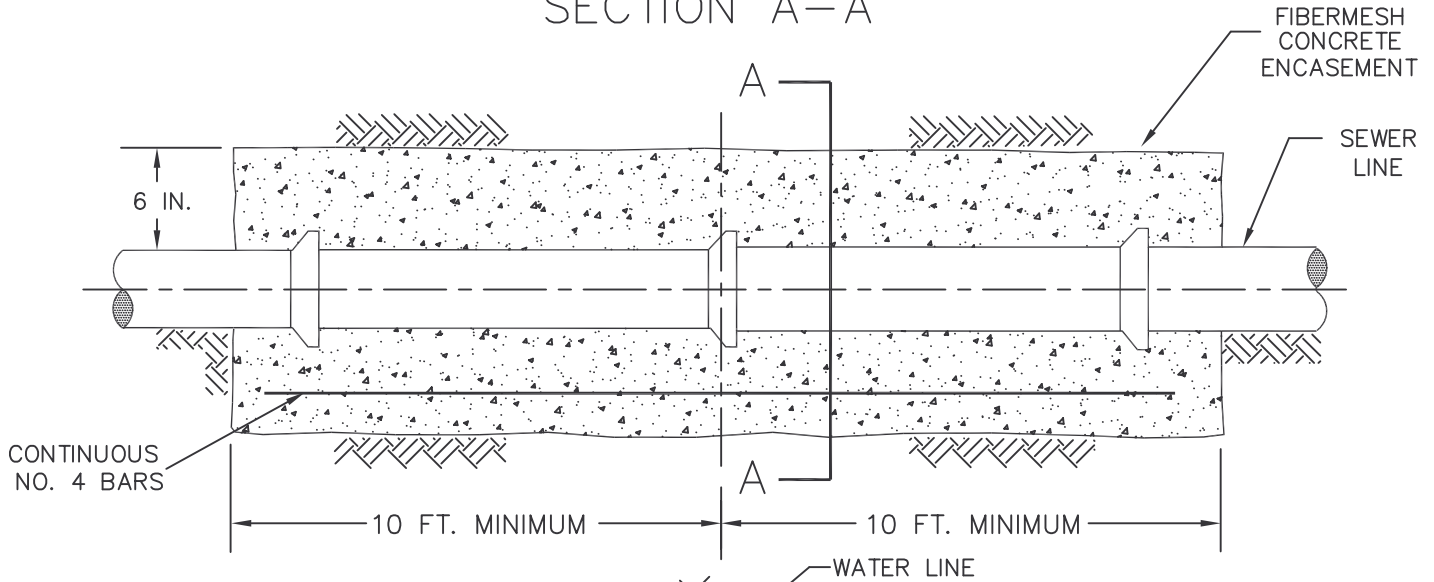
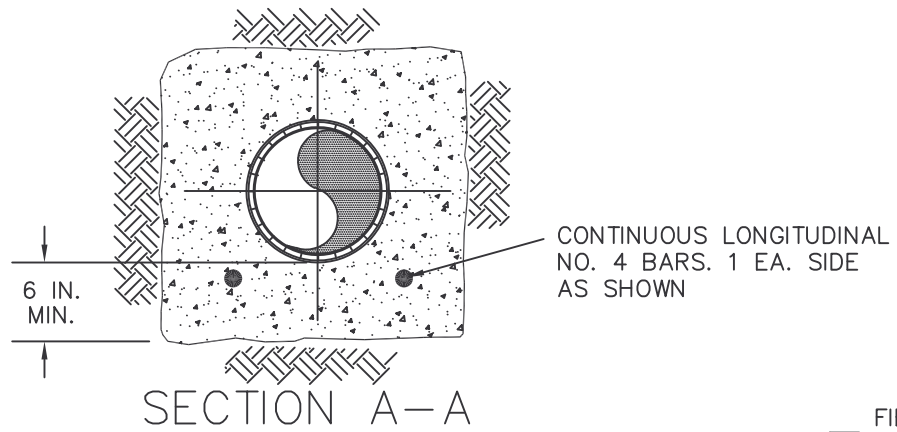


CLIFTON SANITATION
DISTRICT

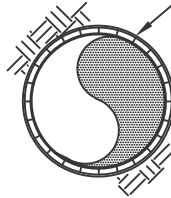
GENERAL UTILITY
DETAIL

APPROVED: DN
REVISED: FEB. 2007
DRAWN: TLT

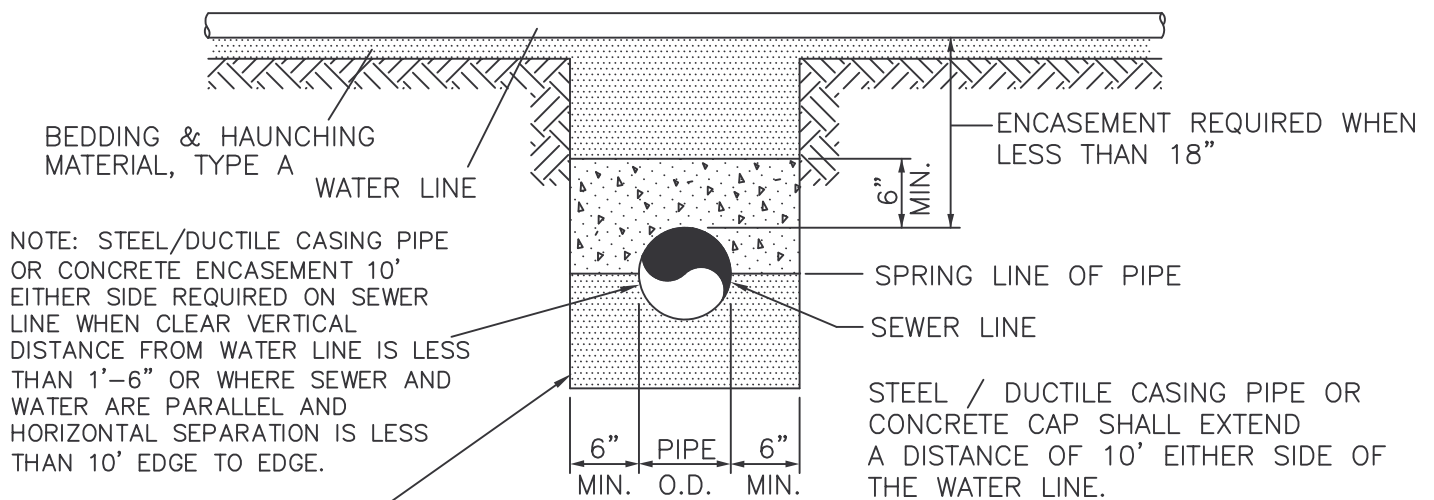
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GU-03



STEEL/DUCTILE CASING PIPE OR CONCRETE ENCASEMENT REQUIRED IN ALL CASES WHERE SEWER LINE IS ABOVE WATER LINE OR IS UNDER WATERWAY CROSSING.



WATER LINE BELOW SEWER LINE



BEDDING & HAUNCHING MATERIAL, TYPE A

WATER LINE ABOVE SEWER LINE

TYPICAL WATER AND SEWER LINE CROSSINGS

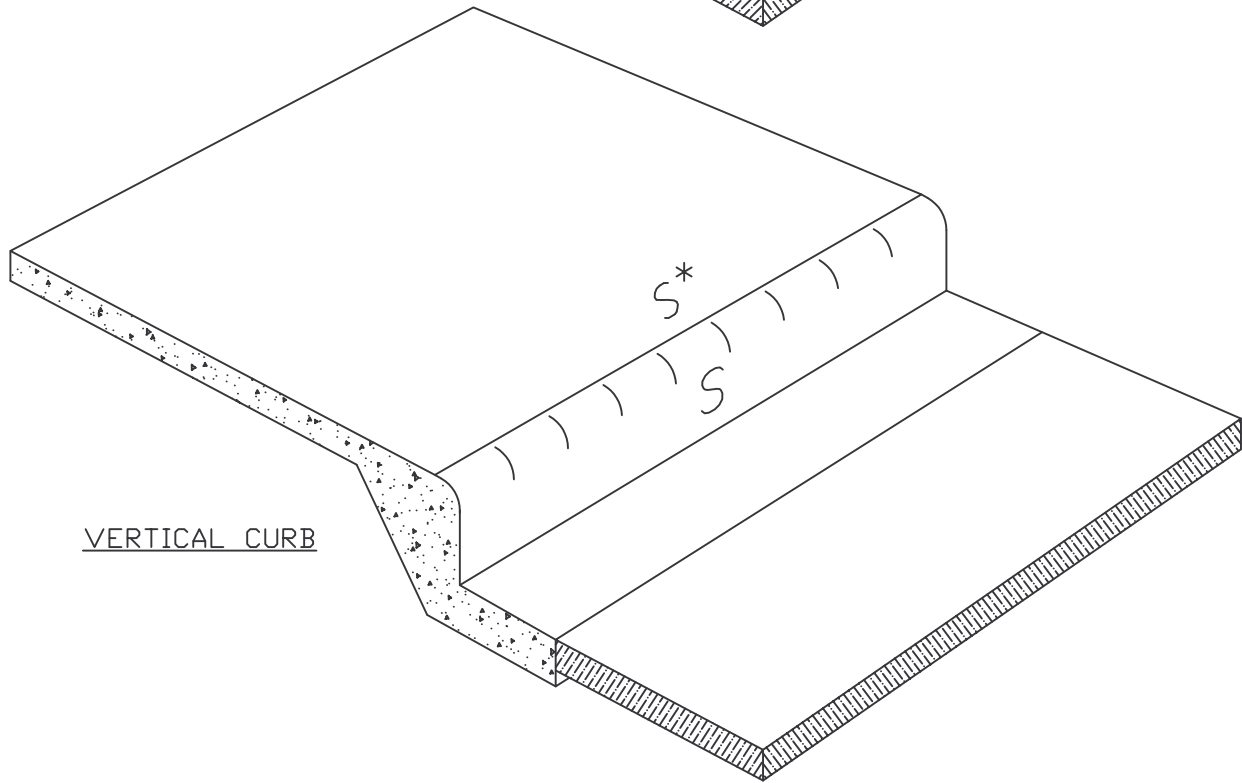
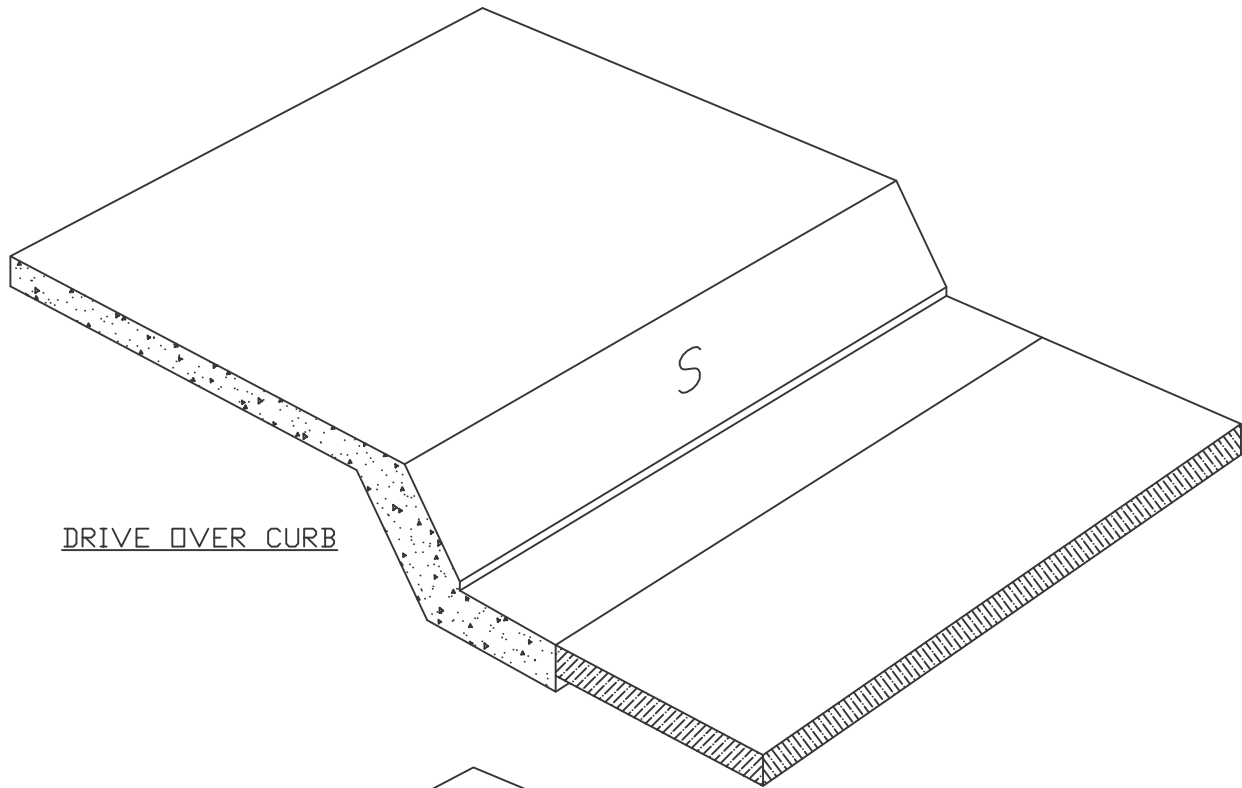


CLIFTON SANITATION DISTRICT

GENERAL UTILITY DETAIL

APPROVED: DN
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1. SEWER SERVICE LOCATION TO BE STAMPED IN CURB FACE MARKED "S".
2. LETTER HEIGHT SHALL BE 4 INCHES.
3. STAMP TO BE PLACED BY CONCRETE CONTRACTOR.

* ALTERNATE LOCATION FOR FORMED CURB.

CURB STAMP FOR SEWER SERVICE LOCATION



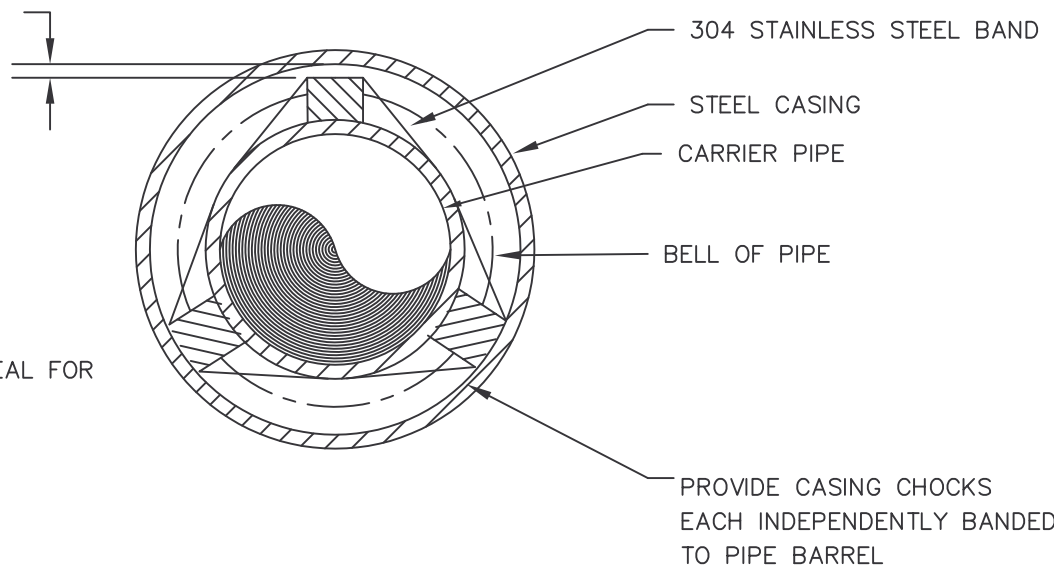
CLIFTON SANITATION
DISTRICT

GENERAL UTILITY
DETAIL

APPROVED: DN
DATE: FEB. 2005
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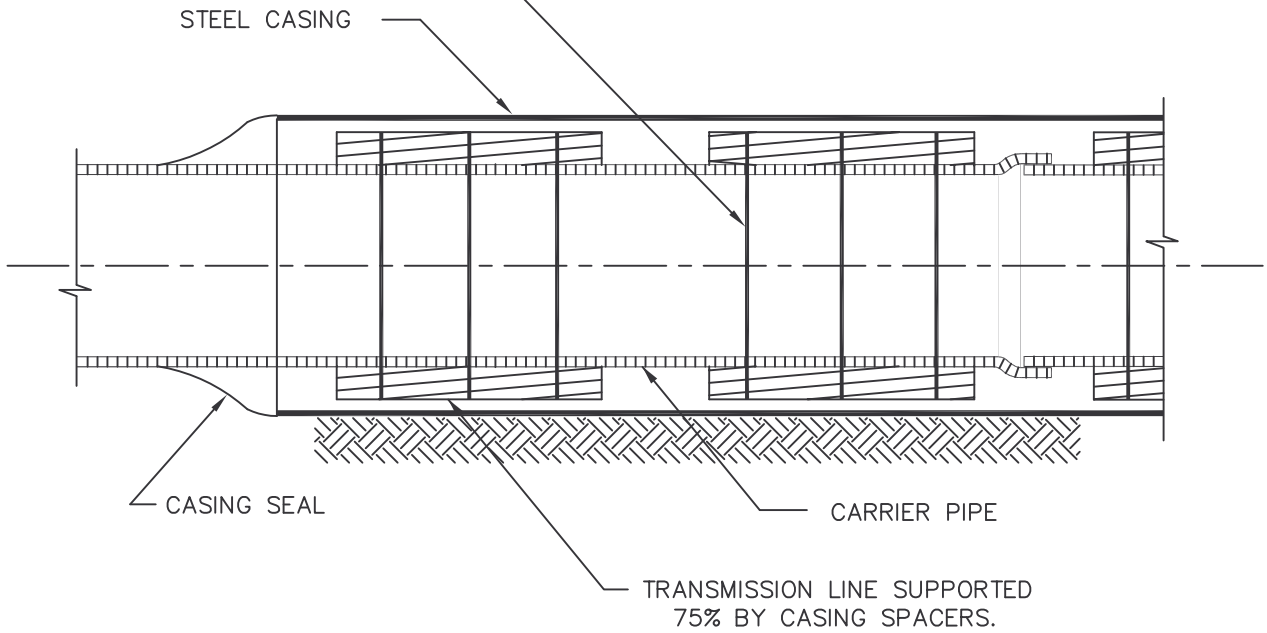
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1/2" MAXIMUM



NOTE:
PROVIDE CAP OR SEAL FOR
OPEN END OF CAP.

0.015 304 STAINLESS STEEL STRAPS
(TO BE USED WITH REDWOOD SKIDS)



NOTE: CASING SPACERS MAY BE EITHER REDWOOD OR STAINLESS
STEEL PIPE INSULATORS WITH POLYMER RUNNERS.

STANDARD PIPE CASING / NON-RESTRAINED JOINTS

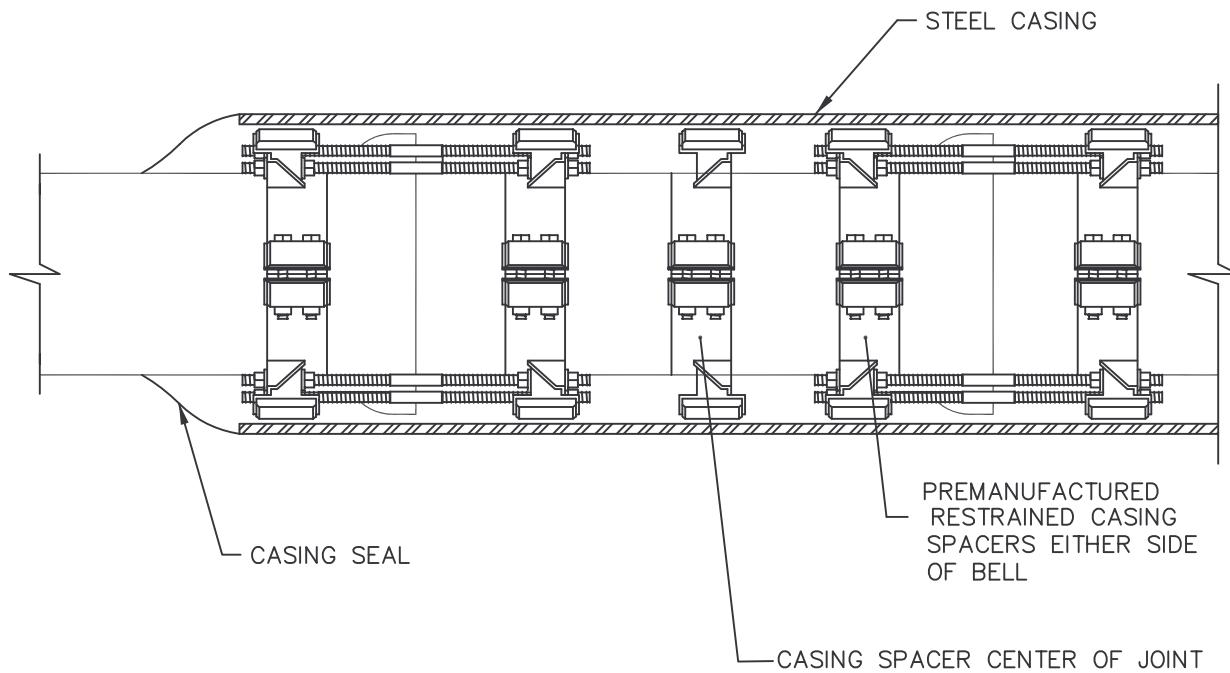
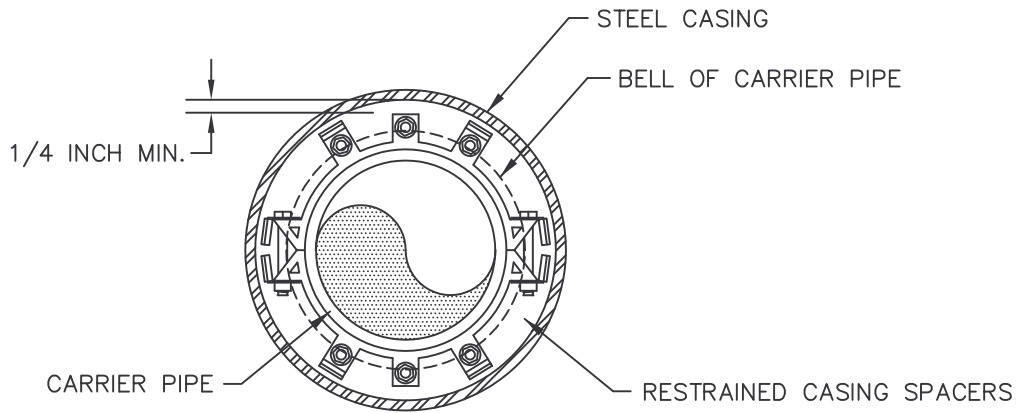


CLIFTON SANITATION
DISTRICT

GENERAL UTILITY
DETAIL

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STANDARD PIPE CASING / RESTRAINED JOINT



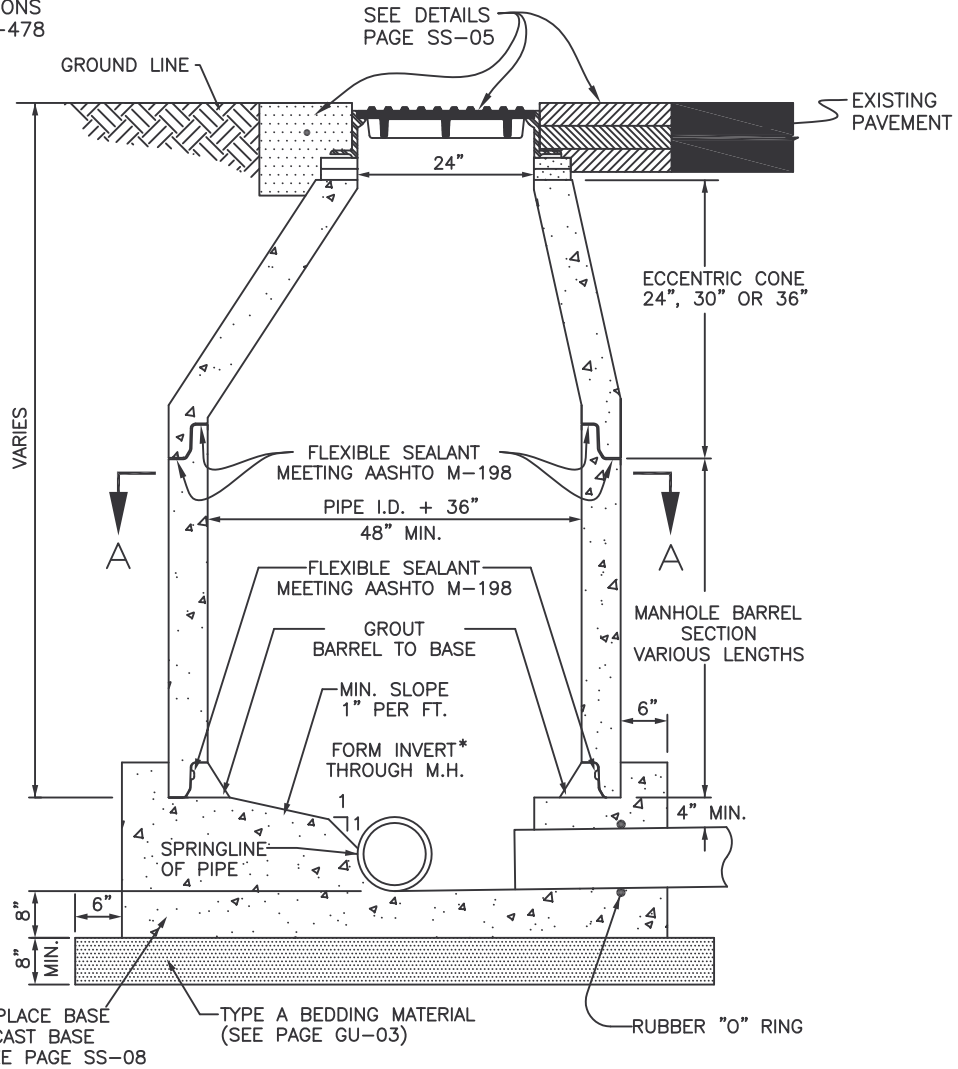
CLIFTON SANITATION
DISTRICT

GENERAL UTILITY
DETAIL

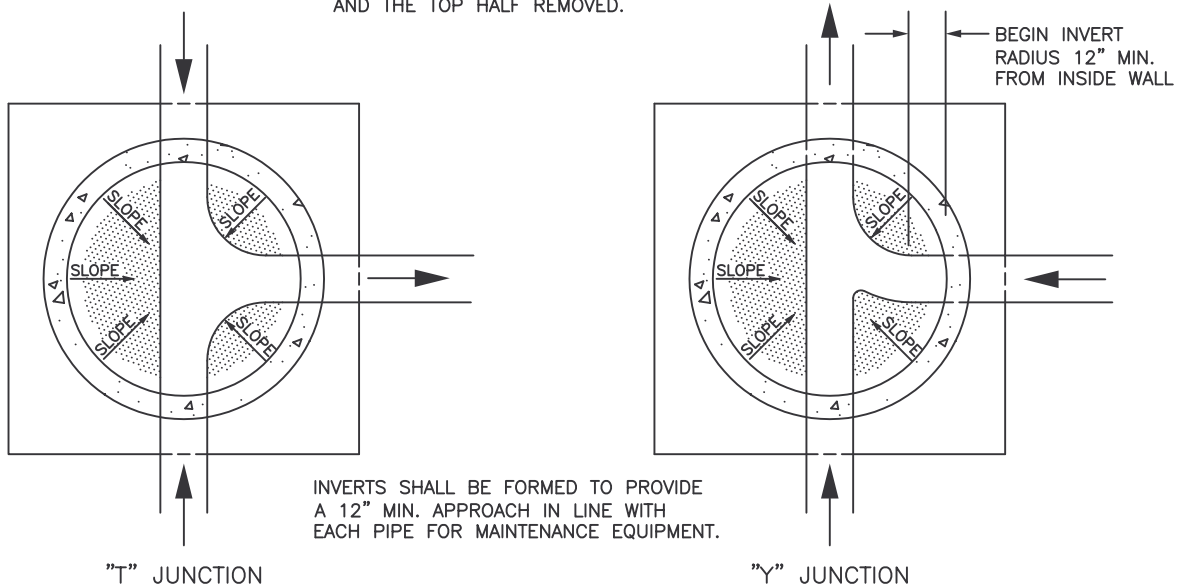
APPROVED: DN
DATE: FEB. 2005
DRAWN: TCP/DPW

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GU-07

ALL PRECAST MANHOLE SECTIONS SHALL CONFORM TO ASTM C-478 OR AASHTO M-199



* FOR IN LINE MANHOLES THE PIPE MAY BE INSTALLED THROUGH THE MANHOLE BASE AND THE TOP HALF REMOVED.



SECTION A-A

STANDARD MANHOLE - CAST IN PLACE BASE



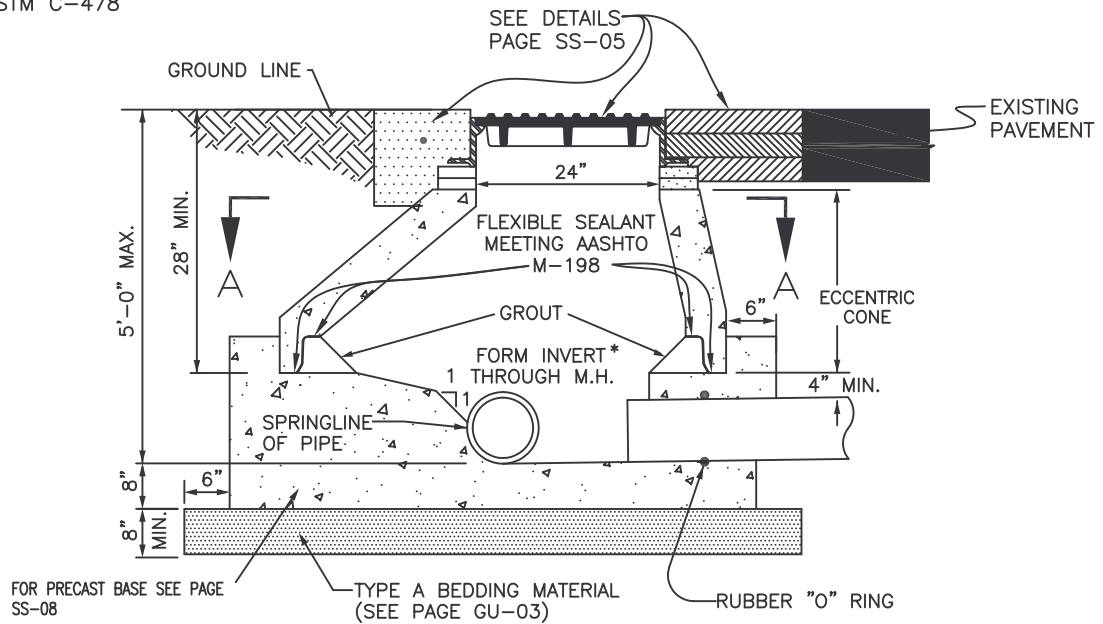
CLIFTON SANITATION DISTRICT

STANDARD SANITARY SEWER DETAIL

APPROVED: DN
 REVISED: FEB. 2007
 DRAWN: TLT

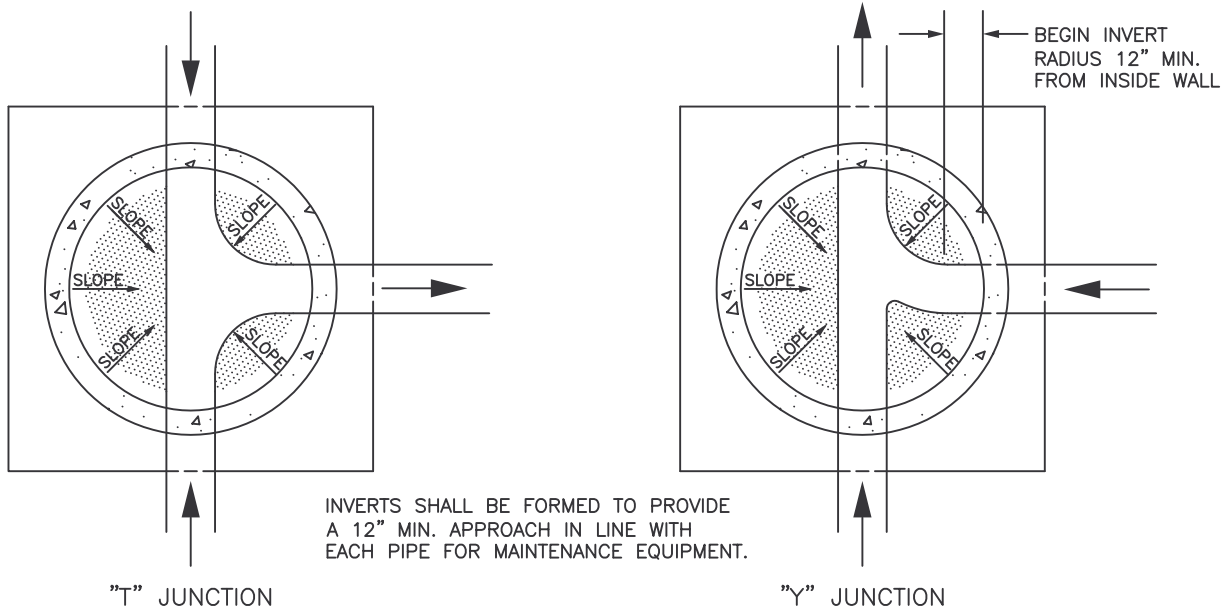
PAGE SS-02

ALL PRECAST MANHOLE SECTIONS SHALL CONFORM TO ASTM C-478 OR AASHTO M-199



* FOR IN LINE MANHOLES THE PIPE MAY BE INSTALLED THROUGH THE MANHOLE BASE AND THE TOP HALF REMOVED.

NOTE:
MANHOLES SHALLOWER THAN SHOWN ABOVE SHALL BE APPROVED BY THE CITY UTILITY ENGINEER.



SECTION A-A

STANDARD SHALLOW MANHOLE - CAST IN PLACE BASE



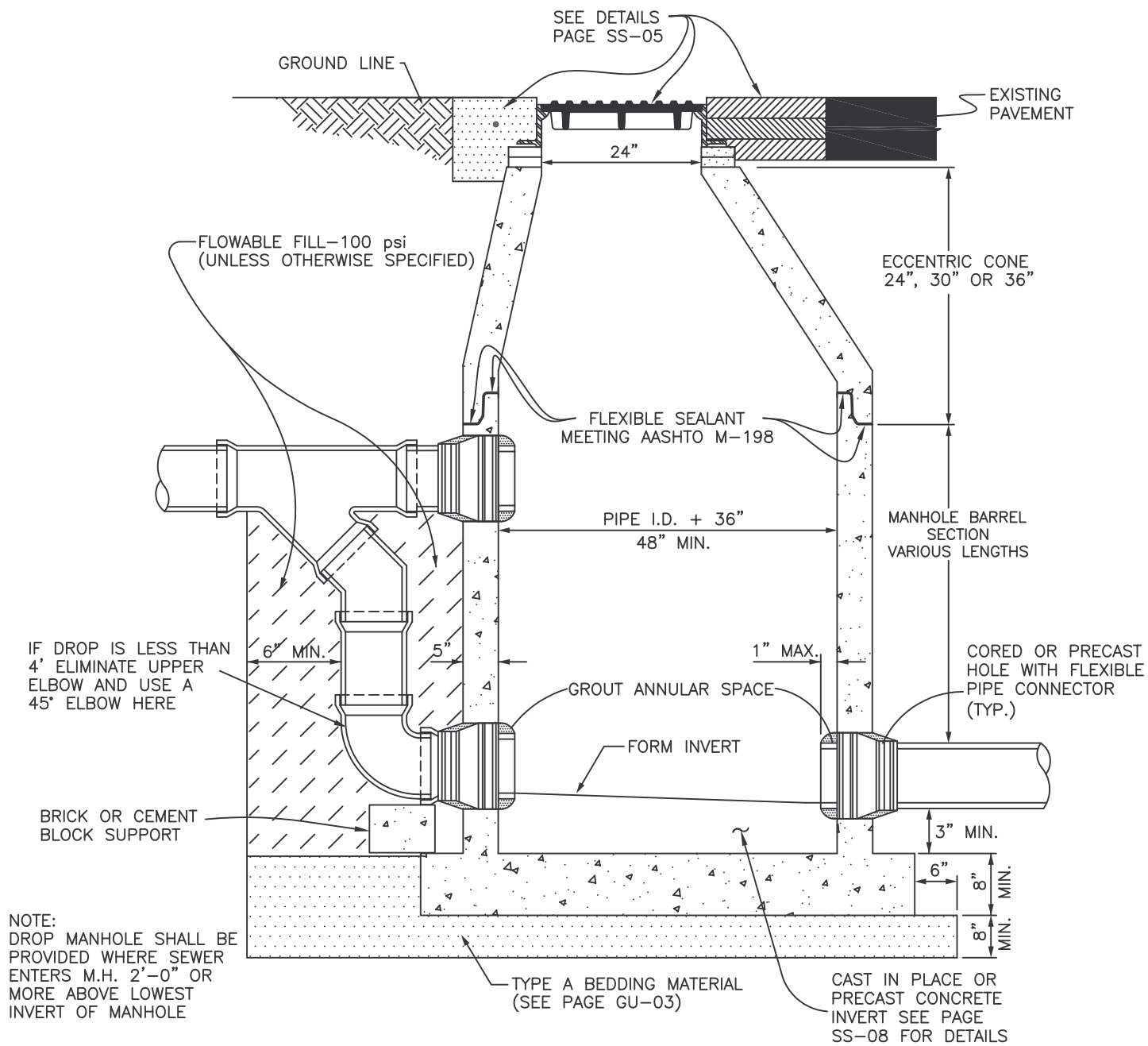
CLIFTON SANITATION
DISTRICT

STANDARD SANITARY SEWER
DETAIL

APPROVED: DN
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SS-03

ALL PRECAST MANHOLE SECTIONS
SHALL CONFORM TO ASTM C-478
OR AASHTO M-199



DROP MANHOLE



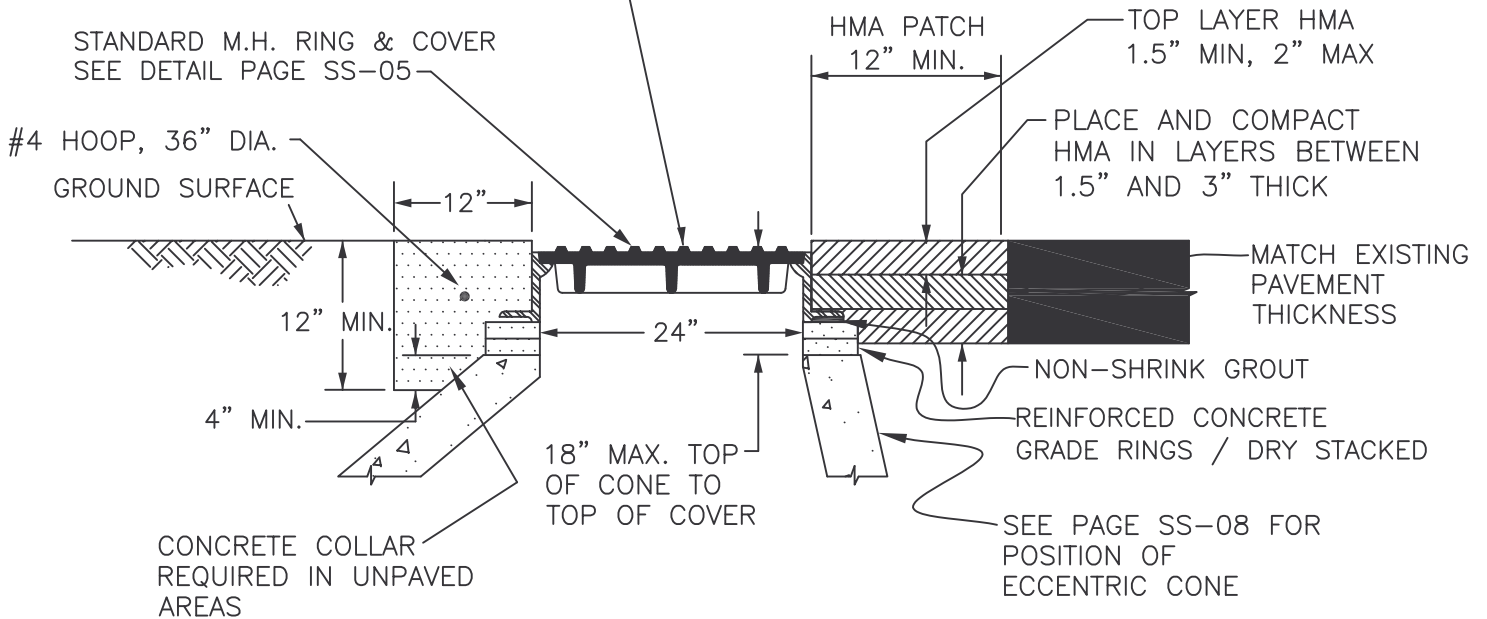
CLIFTON SANITATION
DISTRICT

STANDARD SANITARY SEWER
DETAIL

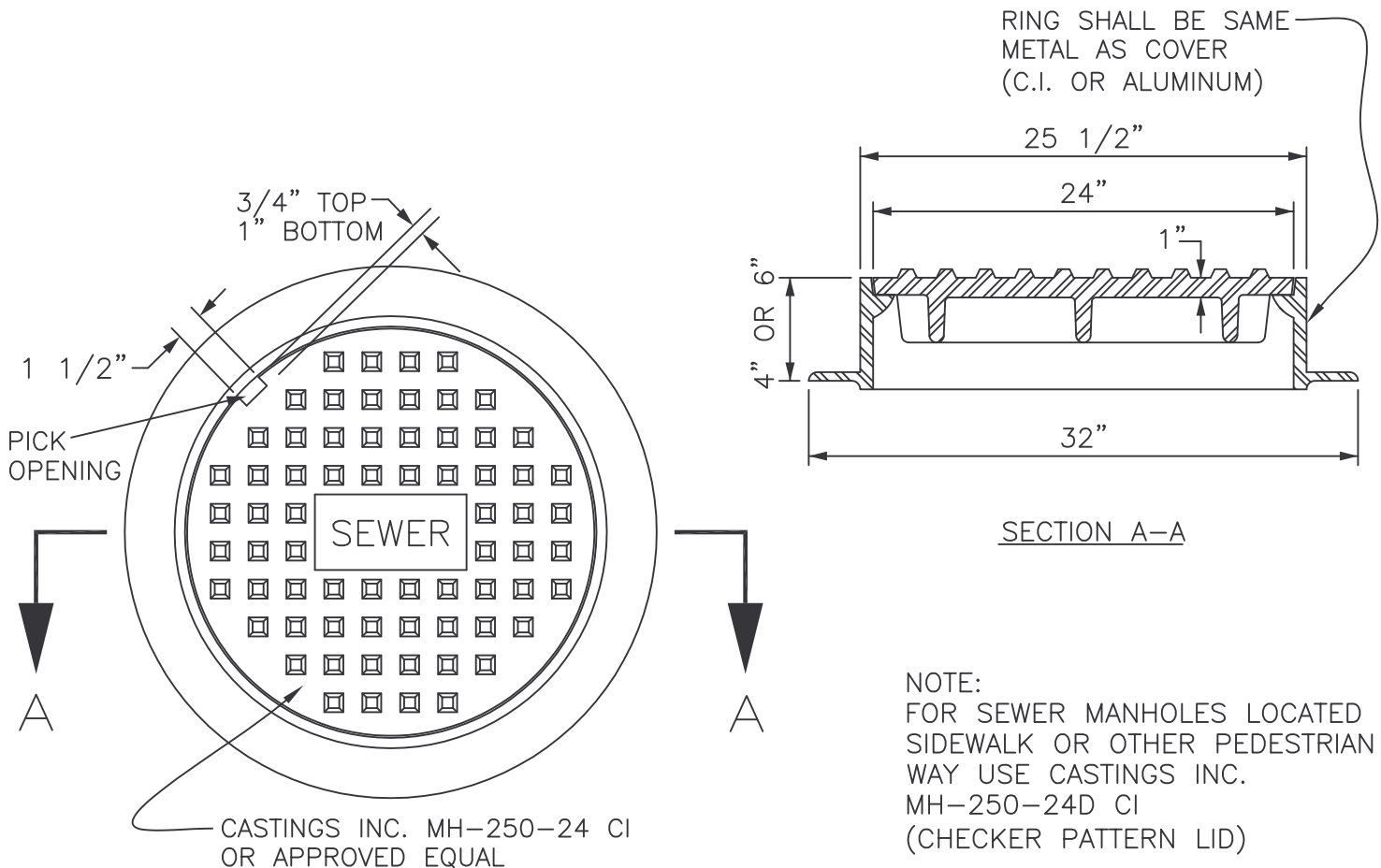
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REVISED: FEB. 2007
DRAWN: TLT

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SS-04

ADJUST MANHOLE RING AND COVER TO MATCH SLOPE OF PAVEMENT. TOP OF KNOBS ON MANHOLE LID SHALL BE FLUSH WITH, OR NO MORE THAN 1/8" BELOW TOP OF PAVEMENT.



DETAIL A



STANDARD MANHOLE RING AND COVER

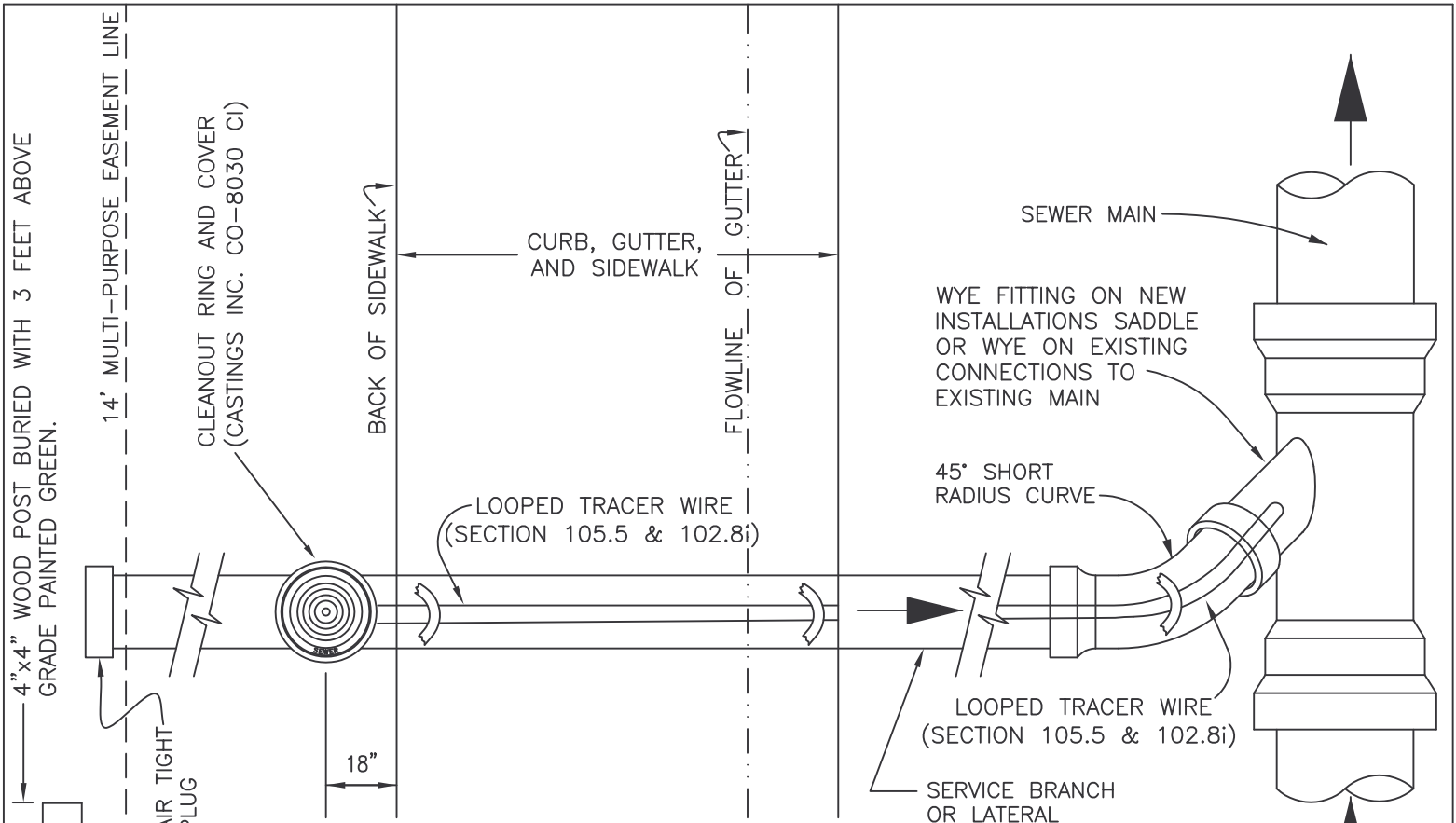


CLIFTON SANITATION
DISTRICT

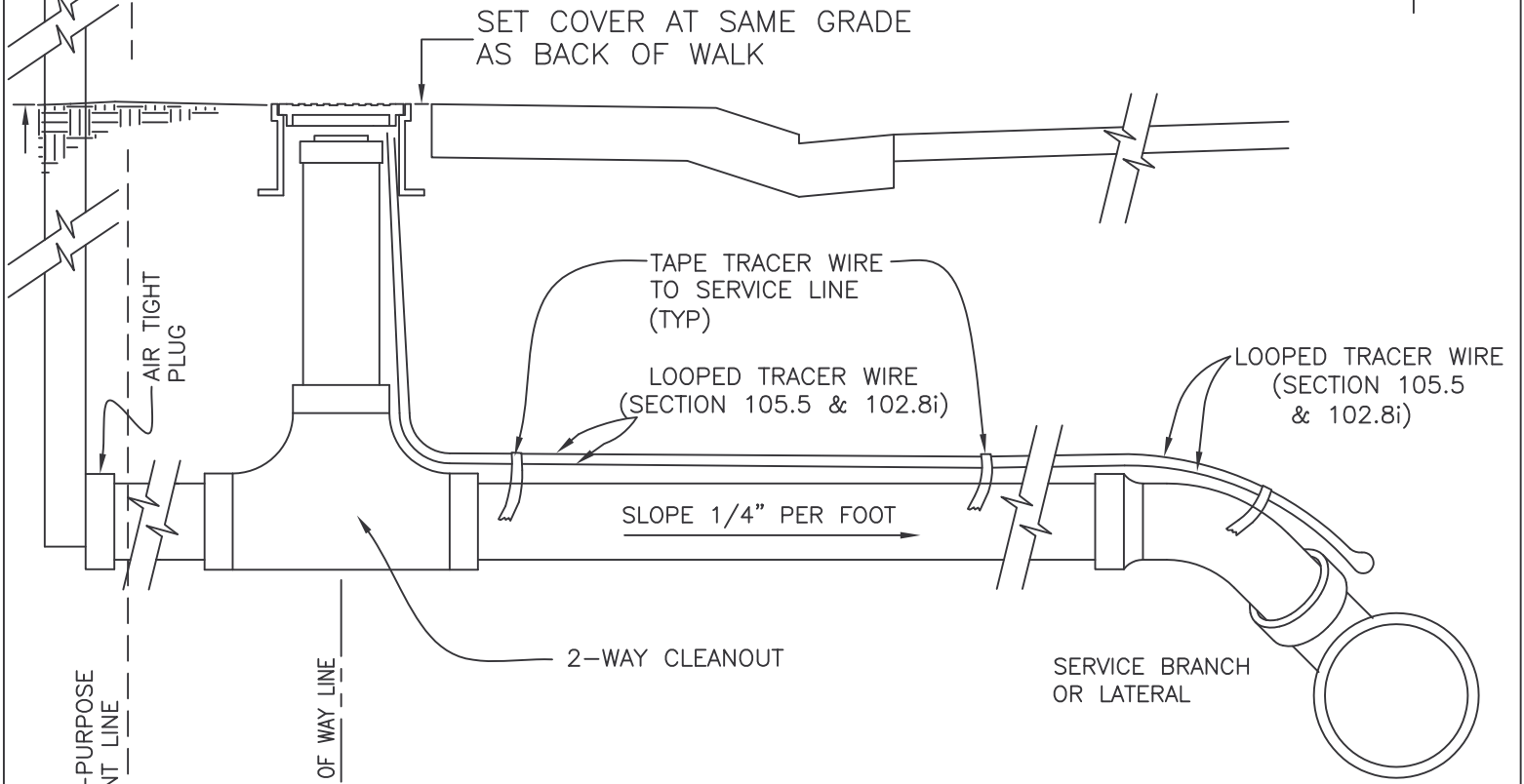
STANDARD SANITARY SEWER
DETAIL

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PLAN



ELEVATION

TYPICAL SERVICE "Y" CONNECTION

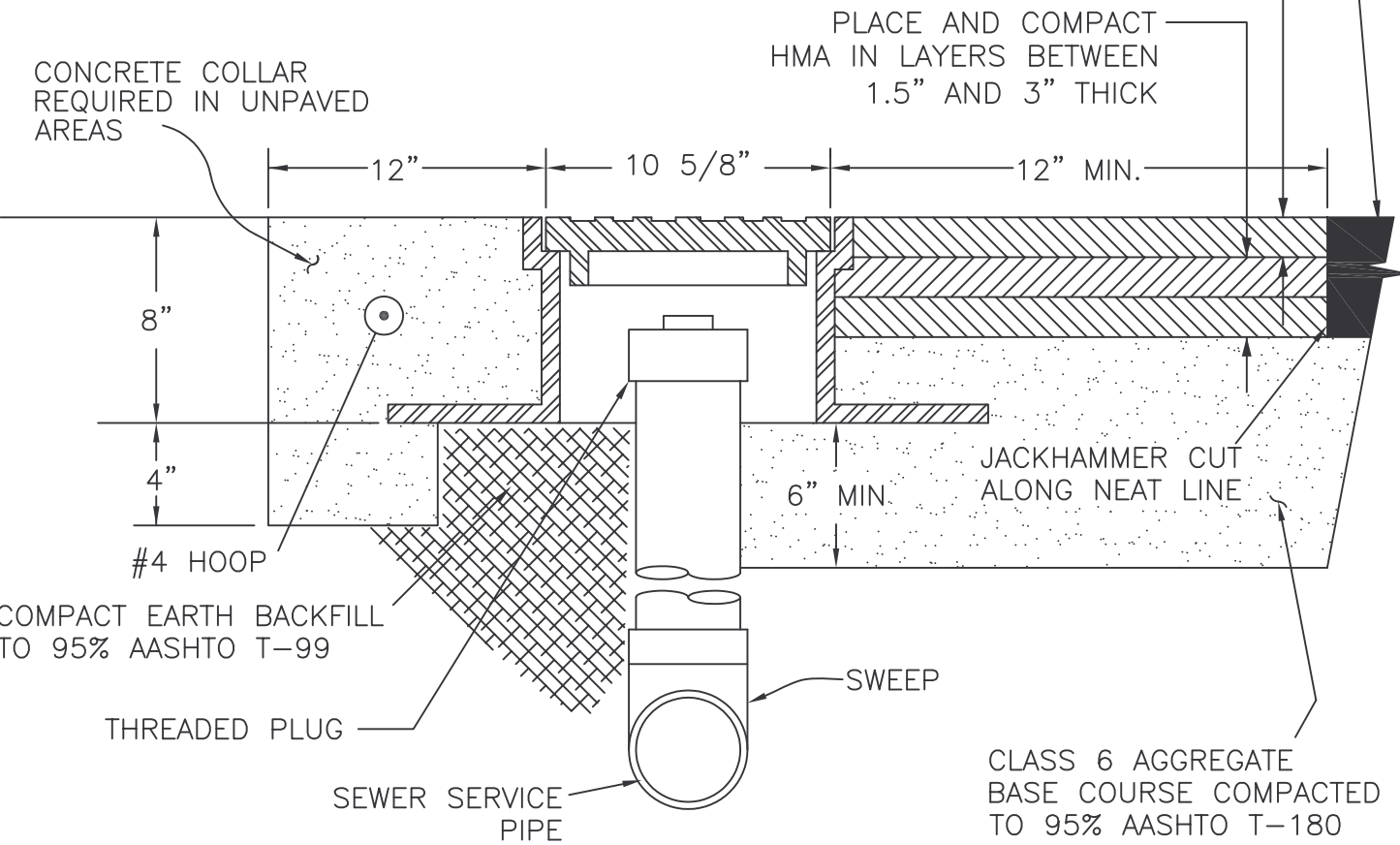
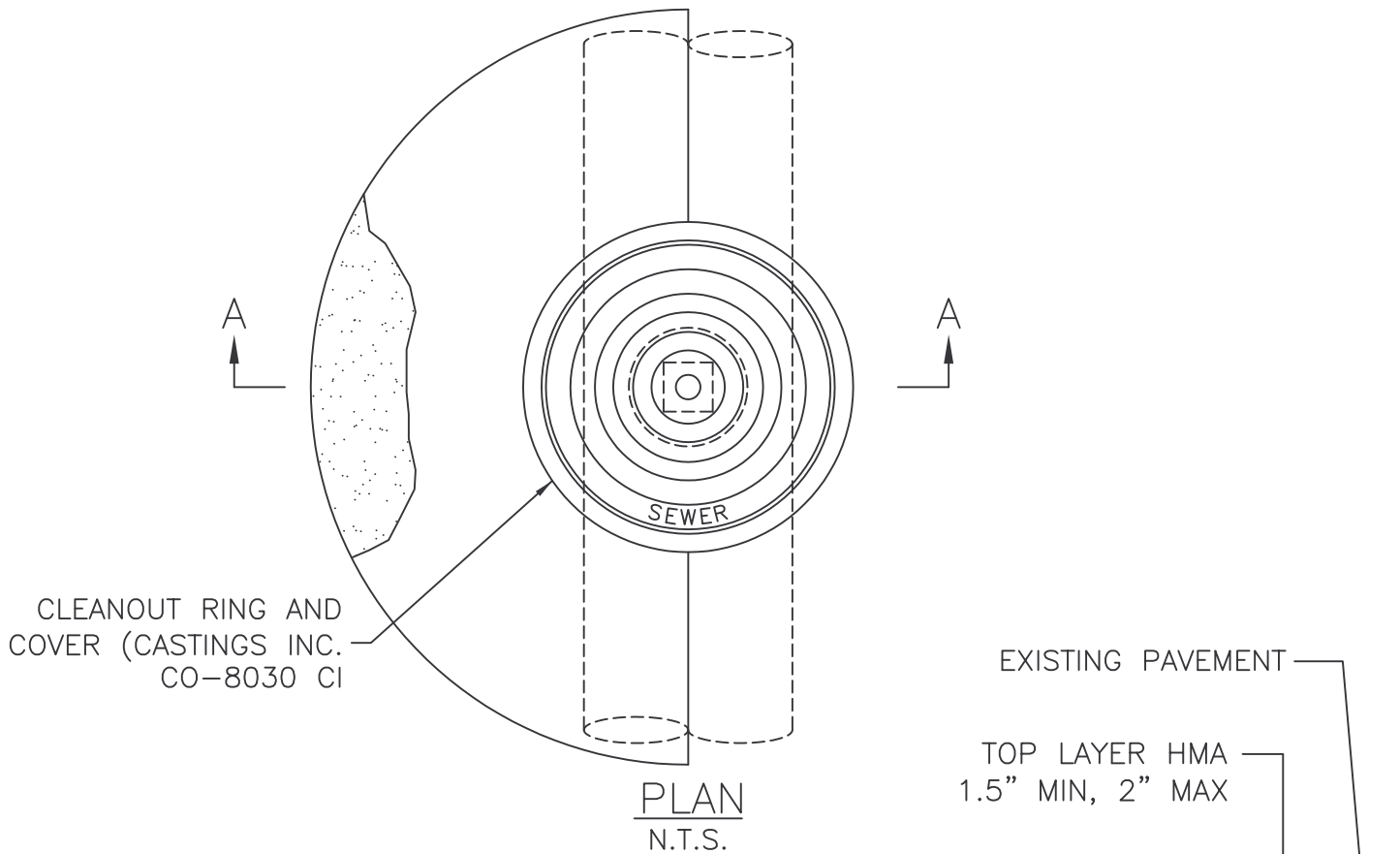


CLIFTON SANITATION DISTRICT

STANDARD SANITARY SEWER SERVICE DETAIL

APPROVED: *BG*
 REVISED: *FEB. 2007*
 DRAWN: *TCP/DPW*

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SECTION A-A
N.T.S.

SEWER SERVICE CLEANOUT WITHIN RIGHT-OF-WAY



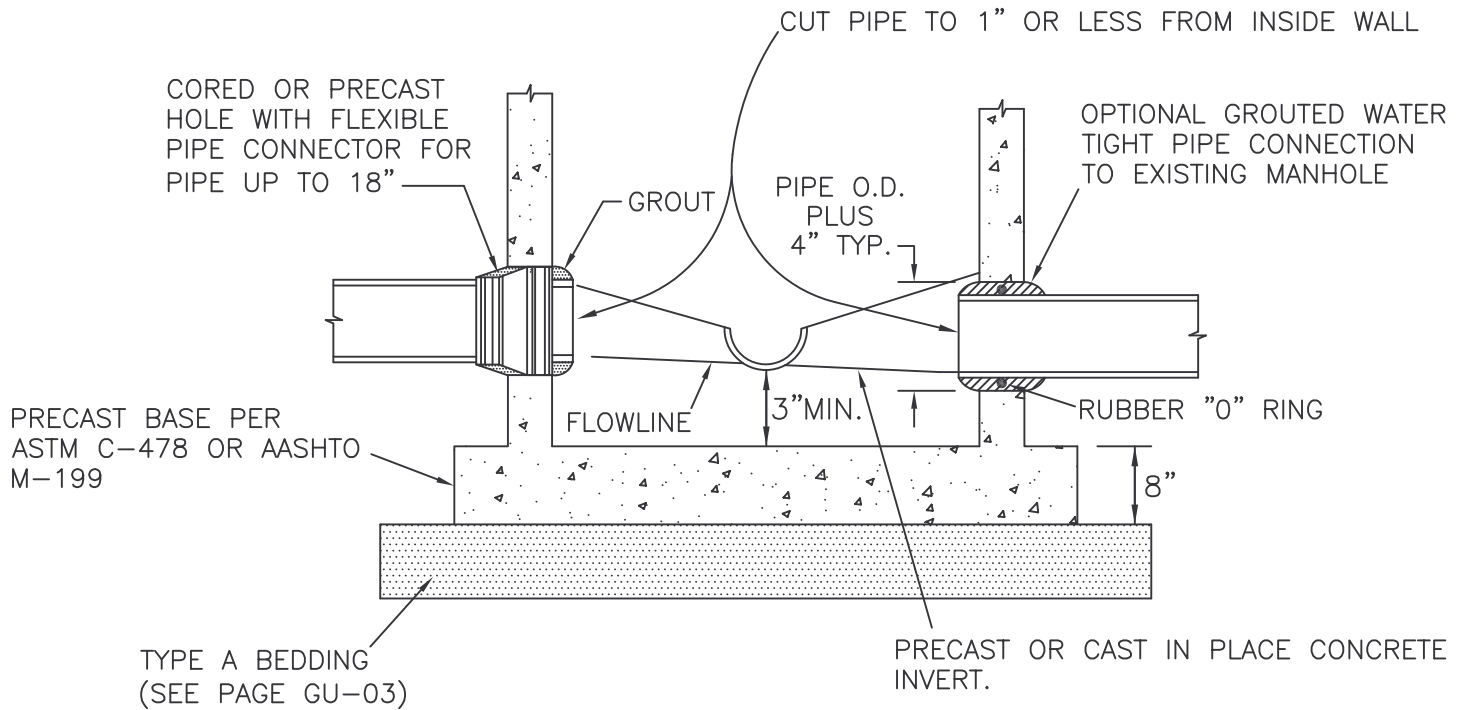
CLIFTON SANITATION
DISTRICT

STANDARD SEWER LINE
DETAIL

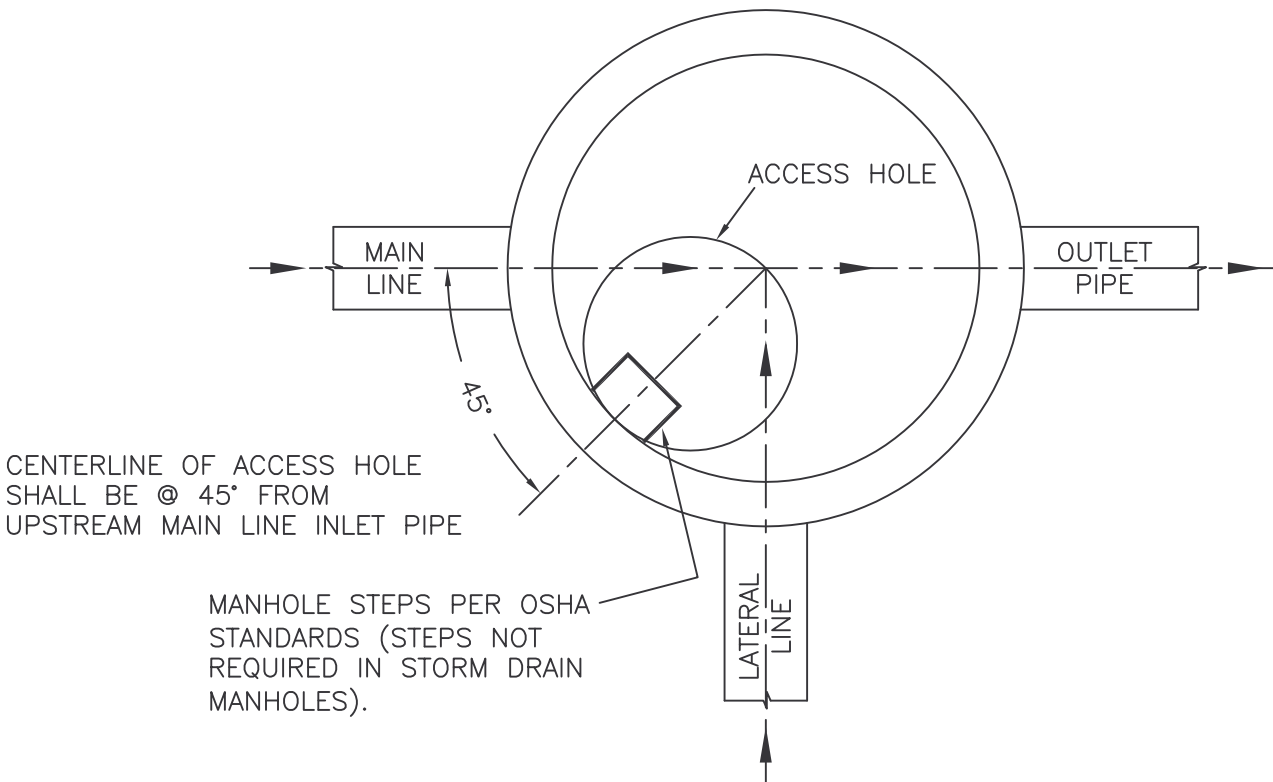
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REVISED: FEB. 2001
DRAWN: TLT

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SS-07

GROUT FOR PIPE CONNECTIONS SHALL BE ALL-CRETE (5 OR 20 MINUTE SET) MANUFACTURED BY FOSROC INC. OR AN APPROVED SUBSTITUTE.



PRECAST MANHOLE BASE/TIE TO EXISTING MANHOLE WITHOUT BOOT



MANHOLE ACCESS LOCATION

PRECAST MANHOLE BASE, PIPE CONNECTIONS AND ACCESS HOLE LOCATION



CLIFTON SANITATION DISTRICT

STANDARD SANITARY SEWER DETAIL

APPROVED: DN
 DATE: JULY 2005
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