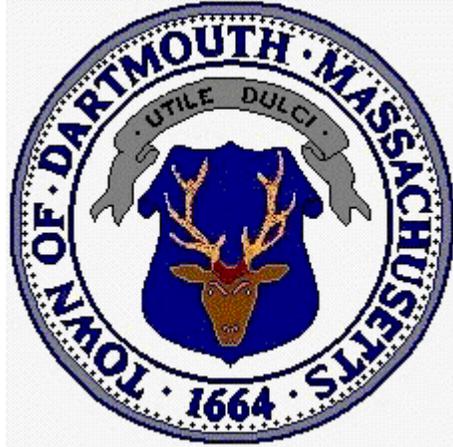


DARTMOUTH, MASSACHUSETTS



DEPARTMENT OF PUBLIC WORKS

CONSTRUCTION SPECIFICATIONS

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TOWN OF DARTMOUTH

DEPARTMENT OF PUBLIC WORKS

CONSTRUCTION SPECIFICATIONS

SECTION I - DEFINITIONS

Unless the context specifically indicates otherwise, the meaning of terms used in these Specifications shall be as follows:

- Sec. II. "Shall" and "Will" are mandatory. "May" and "Should" are permissive.
- Sec. II. "Town Engineer" shall mean the Director of Public Works or his duly authorized agents, representatives, or others having jurisdiction with regard to enforcement of the Specifications or acting for the Town of Dartmouth, Massachusetts.
- Sec. II. "Town" shall mean the duly appointed members of the Board of Public Works of the Town of Dartmouth, Massachusetts, or its duly authorized deputies, agents, representatives, or others having jurisdiction with regard to enforcement of these Specifications or acting for the Town of Dartmouth, Massachusetts.
- Sec. II. "Inspector" shall mean any person acting as a duly appointed agent of the Department of Public Works to ensure compliance with all Specifications and Rules and Regulations governing construction within the Town of Dartmouth, Massachusetts.
- Sec. IV. "Storm Drainage System" shall mean a system of piping, which carries storm and surface waters and ground water drainage, but excludes sewage and industrial wastes.
- Sec. IV. "Cellar Drains" shall mean the piping for collecting water, excluding sewage, which connects the drain main directly to the inside of a building foundation.
- Sec. IV. "Perimeter and Conductor Drains" shall mean the piping for collecting water from around the outside of a foundation or from the downspouts of a building and connecting directly to the drain main.
- Sec. IV. "Director" shall mean the Director of Public Works of the Town of Dartmouth, Massachusetts or his duly authorized assistant, agent or representative.
- Sec. IV. "Drain Services" shall mean any piping for cellar drains, perimeter or conductor drains connecting from the main to ten (10) feet from the foundation and which require a connection permit.
- Sec. V. "Water Distribution System" shall mean all piping and appurtenances for the purpose of transporting water for public use or fire protection.
- Sec. V. "Water Division" shall mean the Water and Sewer Division of the Department of Public Works of the Town of Dartmouth, Massachusetts.

- Sec. V. "Domestic Services" shall mean the piping, which connects the water main to one (1) foot inside the building foundation.
- Sec. V. "Fire Services" shall mean the piping from the water main to the building foundation including all valves, fittings and hydrants used for the purpose of delivering water for fire protection.
- Sec. VI. "Sanitary Sewer System" shall mean piping and appurtenances, which carries sewage and to which storm, surface and groundwaters are not intentionally admitted.
- Sec. VI. "Service Stub" shall mean the temporary terminus of the sewer service at the property line.
- Sec. VI. "Service Connection" shall mean the pipe, which extends from the sewer main to ten (10) feet from the building foundation.
- Sec. VI. "Cap or Plug" shall mean the cap or plug sealing the open end of a sewer line and/or any clean-outs and/or water pipes.
- Sec. VI. "Clean-out" shall mean a branched fitting inserted along the sewer service which will give access for purposes of cleaning or inspecting the inside of the service.

CONSTRUCTION SPECIFICATIONS

SECTION II - GENERAL PROVISIONS

INTENT OF THE SPECIFICATIONS

The intent of these standard specifications is to clarify and advise the Contractor of his responsibility to perform all work and services as outlined. If, for any reason, a particular phase or phases of any or all the operations has been omitted, it is not intentional, and it is to be understood that the Contractor must perform the work as fully as if it were described and delineated.

The Town Engineer shall, in the case of any discrepancies or questions, interpret the plans and details and direct the Contractor accordingly.

These regulations govern construction within the geographical limits of the Town of Dartmouth. They include, but are not limited to old and new subdivisions and where applicable, complement the "Rules and Regulations Governing the Subdivision of Land" by the Planning Board.

CONTRACTOR'S LEGAL RESPONSIBILITY UNDER STATE LAWS

Attention is hereby directed to the provisions of Section 40A, Chapter 82 of the General Laws requiring Contractors to notify public utility companies in writing at least 72 hours before excavating a public way to prevent accidental damage; and to Chapter 131, Section 40, the Wetlands Protection Act.

It shall be the Contractor's responsibility to familiarize himself with and abide by any applicable local, state and federal laws governing his intended activities.

CERTIFICATES OF COMPLIANCE

Prior to the use of any material covered by these specifications, the Contractor shall furnish the Town Engineer a statement in triplicate, certifying that all materials to be used in the work comply with the requirements of the specifications. These statements shall be prepared by the manufacturer, an approved commercial laboratory or any other agency acceptable to the Town Engineer. In case of question or failure, it shall be the responsibility of the Contractor to arrange for required sampling and testing of the materials at no additional cost to the Town.

Unless otherwise approved in writing by the Town Engineer, only new materials and equipment shall be incorporated in the work.

Construction Specifications
Section II – General Provisions

REFERENCE TO SPECIFICATIONS

Where specifications of the American Association of State Highway Officials (AASHO), the American Society for Testing and Materials (ASTM), the American Standards Association (ASA), the American Water Works Association (AWWA), the Massachusetts Highway Department (MHD), or any other agency are called for, the latest edition of these specifications shall be used, unless otherwise noted.

LAYOUT OF WORK

The Contractor shall lay out his own work and be responsible for the execution of the work to such lines and grades indicated on the drawings, prescribed in the specifications, or directed by the Town Engineer. In no case shall construction be performed without plans that have been approved by the Town Engineer. The Contractor shall furnish, at his expense, all stakes, templates, range markers and other equipment, material and labor as may be required in laying out any part of the work.

The Contractor shall maintain and preserve all stakes, monuments, bounds and other marks existing in the work area. Bounds for other marks, which have to be destroyed during construction, shall have adequate ties to facilitate replacement. Any marks, which are damaged or destroyed by the Contractor, shall be replaced by him to the satisfaction of the Town Engineer or other concerned parties.

SAFETY PRECAUTIONS

The Contractor shall provide fences, barriers, warning lights, police officers, signs and any other safety features as may be necessary for the protection of the public. These precautions shall apply particularly at open excavations.

Where the Contractor performs work on any public roads or thoroughfares, he shall first obtain a permit from the Town and then perform his work in accordance with said permit. He shall be responsible for maintaining traffic control with police officers, flagman, signs, etc. If roads are disturbed, he shall maintain the work until such time that he restores the road base and surface to the satisfaction of the local controlling government agency, in accordance with the specifications herein or as detailed on the approved plan.

Construction Specifications
Section II – General Provisions

Safety Precautions – continued.

The Contractor shall take all necessary precautions to protect his work from damage by vandalism, storms, ground water infiltration, etc. In case of damage, the Contractor shall make such repairs or replacements or rebuild such parts of the work as the Town Engineer may require in order that the finished work may be completed as required by the drawings and specifications.

INSPECTION

The Contractor shall notify the Department of Public Works at least twenty-four (24) hours prior to the construction of any public improvement so that the Town can have an Inspector present if the work requires inspection. In general, inspections will be required:

1 - For Road Construction:

- a. When the subgrade is established,
- b. while placing gravel,
- c. when final grade of the base course is established, and
- d. during paving operations.

2 . For Drainage, Water and Sewer Construction:

- a. While laying pipe, but before backfilling, and
- b. during backfilling operations. (In the case of water main installations, final pressure test will be required by the Department of Public Works to assure pipe tightness.)

The developer shall be responsible for filing an "Application for Inspectional Services" with the Department of Public Works and pay the required fees to have an Inspector present during the construction of all work requiring inspections. The Inspector will have the authority to reject any work or materials that do not constitute approval by the Town and shall not relieve the Contractor of any of his obligations to perform the work in accordance with the plans and specifications.

Construction Specifications
Section II - General Provisions

SAMPLING AND TESTING

All sampling and testing shall be done by a commercial testing laboratory approved by the Town Engineer at the Contractor's expense. Sampling and materials for tests shall be taken by the testing laboratory, under the direction of the Town Engineer. All test results shall be reported to the Town Engineer in duplicate.

ADDENDUM:

FLOOD PLAIN ZONING

All public utilities such as sewer, gas, electrical and water systems within the FEMA designated flood zones as delineated on the latest FIRM Map must be located and constructed to minimize or eliminate flood damage.

For location of flood plain zoning see map on file in the Planning Board Office.

CONSTRUCTION SPECIFICATIONS

SECTION III - ROAD CONSTRUCTION

CLEARING AND GRUBBING

The entire area of each street right-of-way shall be cleared of all stumps, brush, roots, boulders, like material and all trees not intended for preservation. Individual trees, groups of trees, and other vegetation to be left standing shall be thoroughly protected from damage incidental to construction operations.

Care shall be taken by the Contractor to protect all trees to be preserved, and adjacent trees and property of others from damage.

Where individual trees in fill areas are to be saved, the Contractor shall provide adequate tree wells or other protection so that no fill covers the original ground around the tree trunk.

EXCAVATION

General. The Contractor shall perform all excavation and grading of every description, regardless of the material encountered, within the limits of work, in conformity with the lines, grades and dimensions shown on the drawings.

Before rough grading is commenced, all trees or groups of trees, which are to-be left standing, shall be given any additional protection required to prevent damage. Care shall be taken to avoid damaging trunks, branches and roots during construction. All protection shall be removed at the time of landscaping to permit finish grading and seeding around trees.

Stripping Topsoil. All topsoil shall be stripped from areas to be paved, excavated, or filled and stockpiled for future landscaping. Care shall be taken that loam or topsoil will not be mixed with sand, gravel or clay during stripping operations.

Unsuitable Material. Unsuitable material, including peat, muck, and soft clay, shall be excavated to such widths and depths as necessary to obtain a firm and stable foundation. Unsuitable material shall be disposed of at an off-site area acquired by the Contractor for such purpose. Where surface or ground water is encountered, provisions shall be made for adequate drainage of the area. Backfilling shall consist of clean sandy material approved by the Town Engineer.

Construction Specifications
Section III - Road Construction

Rock Excavation. When rock excavation requires blasting, the Contractor shall exercise care not to overshoot, and shall remove any material outside the authorized cross section which may be shattered or loosened by such blasting. Blasting operations shall conform to the latest local, state and federal regulations and shall be done by licensed blasters after a blasting permit has been obtained from the Fire Chief having jurisdiction over the area.

Compacted Earth Fills. Materials for fill shall be obtained from roadway excavation, borrow pits or other approved sources. The material used shall be free from vegetable matter and other deleterious substances and shall not contain rocks larger than 12 inches in any direction.

Areas to be filled shall be scarified to a reasonable depth in order to insure proper bond. The fill material shall be placed in layers which, when compacted, shall not exceed 8 inches. The moisture content of the fill material shall be such that the fill can be compacted to its maximum practical density. Filled areas shall be compacted to a minimum of 95% of maximum density as defined and measured in AASHTO test T-180 Method A and certified by a commercial testing laboratory when the subgrade level is reached.

After each layer has been placed and evenly spread, it shall be thoroughly compacted to its maximum practical density. Compaction shall be by means of sheeps-foot rollers, multiple-wheel pneumatic-tired rollers or other types of rollers, which will be able to compact the fill to the desired density.

No fill material shall be placed, spread or rolled while the ground or fill is frozen or thawing or during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until the moisture content and density of the fill are as previously specified.

Dust Control. During summer months, proper dust control measures shall be taken by the Contractor to abate dust nuisance to abutting properties. Calcium Chloride shall be furnished and applied by the Contractor unless this requirement is waived, in writing, by the Town Engineer. Calcium Chloride shall be commercial grade, furnished in 100 lb., 5-ply bags, stored under weatherproof cover and stacked alternately for ventilation. Application shall be at the rate-of about one-half pound per square yard unless otherwise directed by the Town Engineer.

Construction Specifications
Section III - Road Construction

SUBGRADE PREPARATION

The subgrade shall be prepared to the full width of the road right-of-way and any adjacent bank easements, in conformity with the lines, grades, slopes and cross-section of the approved plans. Grades under paved areas shall be held to a tolerance of plus or minus one-tenth of a foot (0.1'). The shoulders shall be shaped and landscaped so that the entire right-of-way presents a neat and pleasant appearance, but shoulder loaming and seeding shall be postponed until all paving work has been done.

Soft or otherwise unsuitable material in the subgrade, under paved areas, shall be removed and replaced with approved material. All low sections, holes or other depressions shall be brought to grade. After the subgrade is properly shaped, it shall be thoroughly compacted with an approved roller weighing not less than 10 tons. Wetting or serating the subgrade by blading, required along with the rolling of the subgrade, shall be included to obtain proper compaction.

The top 6 inches of subgrade in paved areas shall be compacted to a minimum of 95% of maximum density as defined and measured in AASHO test T-180 Method A.

The finished subgrade shall pitch from the centerline of road to the edge of pavement at a rate of two percent (2 %) as shown on the typical road cross-section.

GRAVEL BASE COURSE

General. The gravel base course shall consist of a 9-inch total compacted thickness for sidewalks and a 12-inch total compacted thickness for roadway pavements. The gravel base course shall be placed only on a subgrade approved, in writing, by the Town Engineer.

The lines and grades shall be established by the Contractor, in conformity with the drawings and shall be maintained by means of grade stakes, placed in lanes parallel to the centerline of the areas to be paved, and spaced 50 feet on center so that string lines may be stretched between the stakes.

Construction Specifications
Section III - Road Construction

Gravel Base Course – continued.

Material. Gravel shall consist of inert material that is hard, durable stone and coarse sand, free from loam and clay, surface coatings and deleterious materials. The gradation shall meet Mass. Highway standard M1.03.1 with the following requirements:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
3"	100
1 1/2"	70-100
3/4"	50-85
#4	30-60
#200	0-12

Placing and Mixing. Gravel base courses shall be placed and spread uniformly in layers not exceeding 6 inches after compaction. Care shall be taken while spreading the gravel to rake forward and distribute the largest stones so that they will be at the bottom of the gravel course and be evenly distributed, but under no circumstances will stones larger than 3 inches be permitted.

The material shall be mixed evenly with blade graders until each layer of gravel is uniform throughout its depth. During this operation, water shall be added by sprinkling equipment in such amounts as are required to obtain optimum moisture for the required density. When uniform, the mixture shall again be spread smoothly to the cross-section as shown on the approved drawings.

Compaction. Immediately following final spreading and smoothing, all materials placed shall be compacted to the full width by rolling with a self-propelled, power roller, weighing not less than 10 tons, and having a minimum weight of 300 pounds per inch width of rear wheel. Rolling shall progress gradually from the sides to the center, parallel with the centerline of the road and lapping uniformly each preceding track by one-half the width of such track and shall continue until all the surface has been rolled and satisfactory compaction obtained.

Each layer of gravel base course shall be compacted to a minimum of 98% of maximum density for roadways and 95% of maximum density for sidewalks, as defined and measured in AASHO test T-180 Method A.

Construction Specifications
Section III - Road Construction

Gravel Base Course – continued.

Smoothness Test. The surface of the top layer of gravel base course shall show no deviations in excess of 3/8 inch when tested with a 10-foot straight edge applied both parallel with and at right angles to the center line of the area to be paved. Any deviation in excess of this amount shall be corrected by loosening, adding, or removing material, re-shaping, and compacting to the satisfaction of the Town Engineer. The surface of underlayers shall be finished to a reasonably even contour as approved by the Town Engineer. To accomplish a smooth and even surface, the top two (2) inches of gravel base shall be placed with processed gravel having no greater gradation than 3/4 inch stones.

SURFACE COURSE

General. The surface course shall consist of bituminous concrete for all roads in compliance with the Dartmouth Planning Board's Rules and Regulations unless otherwise waived by the Planning Board and replaced by some other surface course of lasting strength.

Bituminous Concrete. The surface shall consist of two (2) bituminous concrete layers; the first a two (2) inch binder course, and the second a one and one half (1-1/2) inch top course. Where berms are called for, they shall be either a 6" x 8" bituminous concrete machine formed berm or a monolithic finish berm one (1) foot wide x three and one half (3-1/2) inch high cape cod berm set on top of the binder course. The height of the berm shall be finish height after top course is installed. All materials and workmanship shall conform to Section 460 and/or 470 of the latest edition of Mass Highway - Standard Specifications for Highways and Bridges", for Class I Bituminous Concrete Pavement, Type I-1.

Any reference, in that book to State officials or departments shall apply to the corresponding officials or departments of the Town of Dartmouth, Massachusetts or approved substitute.

PATCHING TRENCHES

Trench Preparation. All material for backfilling the trench shall be suitable and free from organic substances, large stones, and frost. Twelve inches of processed gravel meeting the Mass Highway standard M1.03.1 specifications shall be installed as a base course and compacted to a minimum of 98% of maximum density for roadway trenches and 95% of maximum density for sidewalk trenches, before the permanent patch is applied.

Construction Specifications
Section III - Road Construction

Patching Trenches - continued.

Controlled Density Fill. Cross trenches of existing Town roadways for service connections or main extensions shall require the installation of Controlled Density Fill (flowable fill) in place of backfilled material and gravel. Controlled Density Fill material is a flowable, self consolidating, rigid setting, low density material that can substitute for compacted gravel for backfills, fills and structural fills. All materials shall meet Mass Highway standard M4.08.0, Type 1E Very Flowable (Excavatable) or Type 2E Flowable (Excavatable).

Patching Material. A temporary pavement patch shall be installed with two (2) inches of bituminous concrete binder course. A permanent trench shall be installed equal to the existing pavement thickness, but not less than three (3) inches nor greater than six (6) inches in two (2) inch lifts. Cold planing of cross trenches from curb line to curb line, one and one-half (1-1/2) inches deep and two (2) feet wider on each side of the trench, shall be done before the permanent top course of bituminous concrete is installed. Utility extensions along existing Town roadways shall be overlaid from edge of pavement to edge of pavement with a one and one-half (1-1/2) inch top course of bituminous concrete for the entire length after allowing for trench settlement over one (1) winter. In order to maintain existing curb reveal, the Town may require cold planing of the roadway before overlaying with pavement. The contractor shall be responsible for raising all structures to the proper grade and replacement of all disturbed traffic markings.

The bituminous concrete for all roadway cuts shall be Class I Bituminous Concrete Pavement, Type I-1.

CONSTRUCTION SPECIFICATIONS

SECTION IV - DRAINAGE CONSTRUCTION

SCOPE OF WORK

The Contractor shall furnish all materials and perform all work and services necessary for the complete construction of the storm drainage system, e.g.: installation or construction of all storm drains, cellar drains, perimeter and conductor drains, infiltration systems, catch basins, manholes, headwalls, stormwater treatment facilities, detention basins, etc., including all related work such as excavation, backfilling and compaction.

The Contractor shall perform his work in accordance with plans approved by the Planning Board, Conservation Commission or Department of Public Works.

MATERIALS

Pipe. The type of pipe allowable for storm drains shall be limited to:

1. Reinforced concrete pipe conforming to ASTM C-76, "Specifications for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe". The pipe shall be Class IV for diameters between 12 inches and 27 inches, Class III for diameters 30 inches and larger, unless specified otherwise on the plans.
2. Non-reinforced concrete pipe conforming to ASTM C-14.
3. Corrugated metal pipe which shall be aluminum or be coated inside and outside with asphalt cement, and shall conform to the requirements of AASHTO M-36. Perforated pipe may be used on approval of the Director.
4. High-density polyethylene pipe (HDPE) conforming to ASTM D 3350, "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials" and AASHTO M-252 and AASHTO M-294. High-density polyethylene pipe shall not be allowed for flared ends or piping exiting manholes or catch basins to flared ends or outlets.

Construction Specifications
Section IV – Drainage Construction

Materials – continued.

5. Polyvinyl Chloride Pipe (PVC pipe) shall conform to ASTM Standard D 1784 and D 3034-SDR 35.
 - a. The pipe and fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusion or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density and other physical properties.
 - b. All fittings and accessories shall have dimensions as recommended by the manufacturer and have bell and/or spigot configurations compatible with that of the pipe.
 - c. Pipe shall pass impact resistance test in accordance with ASTM D 2444 and minimum pipe stiffness test at 5% deflection in accordance with ASTM D2412.
 - d. The normal length of 12-inch size and smaller shall be 13 or 14 feet and 15-inch size shall be no longer than 20 feet.
 - e. Pipe and fittings shall be manufactured in the United States of America. and shall be accompanied by the manufacturer's certificate of compliance, in addition to meeting the performance tests specified hereinafter.

The type of pipe allowable for cellar drains, conductor or perimeter drains shall be a minimum of 4 inches in diameter and limited to:

1. Polyvinyl Chloride Pipe conforming to ASTM Standard D 1784 and D 3034-SDR 35.
2. Cast Iron Pipe, not less than Class 24, conforming to ASA A21-8.
3. Ductile Iron Pipe, not less than Class 50.
4. High-density polyethylene pipe (HDPE), conforming to ASTM D 3350, AASHTO M-252 and AASHTO M-294.

Structures. Manholes and catch basins shall be precast concrete or concrete block conforming to standard dimensions or those shown on the typical detail. Precast cones and sections shall be constructed of reinforced concrete conforming to ASTM C-478. Bricks shall conform to ASTM C-32 Grade MA. Radial concrete blocks shall be not less than 8 inches in length and of such shape that the joints can be effectively sealed and bonded with mortar. They shall conform to

Construction Specifications
Section IV - Drainage Construction

Materials - continued.

ASTM C-139. Precast concrete rings shall conform to ASTM C-14. The brickwork between the concrete cone and the metal frame shall be externally “sealed” with a filter fabric to eliminate “fines” from entering the manhole via voids.

Concrete for headwalls, footings and other structures shall have a minimum compressive strength of 2500 psi at 28 days.

Reinforcing steel shall conform to ASTM A-305 for bar reinforcement and ASTM A-185 for wire mesh.

Mortar for masonry work and pipe joints shall consist of one (1) part Portland cement to two (2) parts sand. Portland cement shall conform to ASTM C-150, Type II. Sand shall conform to ASTM C-144. The mortar shall be used within thirty (30) minutes from the time that the ingredients are mixed with water. Water shall be clean and free from impurities.

Frames, covers and gratings and hoods shall be of the type shown on the typical details. Generally, manhole frames and covers shall be East Jordan Iron Works Cat. No. LA268, LK110 or approved equal. Catch basin frames and grates shall be East Jordan Iron Works Cat. No. LF 248-2, LK 120A or approved equal. Catch basin hoods shall be East Jordan Iron Works Cat. No. L 202 or approved equal. All castings shall be true to pattern in form and dimensions, free from faults, sponginess, cracks, blowholes and other defects affecting their strength.

EXCAVATION AND BACKFILLING

Excavation. The Contractor shall excavate whatever material encountered to the depths shown on the drawings. In open cut excavation, the trench width at the top of the pipe shall be no wider than the outside diameter of the pipe, plus 1.5 feet, unless permission is granted by the inspector. The trench above the top of the pipe shall have sufficient slope so that the banks will not slide. Sheeting/shoring of trenches shall be the Contractor's responsibility and as may be required by applicable governmental laws and regulations.

Excavation for manholes, catch basins, headwalls or other structures shall be sufficient to leave at least 12 inches in the clear between their outer surfaces and the embankment or timber which may be used to hold and protect the banks. Any overdepth excavation below the footings of such structures shall be filled with concrete or as directed by the Town Engineer and will be at the Contractor's expense.

Construction Specifications
Section IV - Drainage Construction

Excavation and Backfilling - continued.

Care must be taken not to damage water pipes, storm drains, sanitary sewers, gas mains, electric conduits, or other structures encountered on the lines of the work. In case of damage to any structures, the Owner of the structures and the Department of Public Works shall be notified immediately by the Contractor so that the proper steps may be taken to repair, at the expense of the Contractor, any and all damage done.

Rock Excavation. Any required rock blasting shall be done by licensed persons only and shall be carried out in strict accordance with the existing governmental ordinances and regulations. A blasting permit must be obtained from the local Fire Chief having jurisdiction over the area. Any damage to the work or property of others caused by blasting operations shall be repaired at the expense of the Contractor.

Whenever the bottom of the trench is rock or boulders, it shall be excavated six (6) inches below grade and refilled to grade with suitable material as approved by the Town Engineer. The sides of the trench in rock shall be excavated to such width that no rock shall be closer to the pipe barrel or other structures than six (6) inches when the pipe is laid in the trench with a normal alignment.

Bedding. For drain mains, trenches shall be shaped to give the pipe a continuous and even bearing. Where the bottom of the trench has been taken out to a greater depth than above specified, it shall be refilled with earth, properly compacted and shaped. The Contractor shall undercut unsuitable material and replace it with suitable material.

For drain services, when indicated by the Town Engineer, bedding shall be comprised of a 6" layer of pea-stone, 1/2" crushed stone or sand in the case of P.V.C. for proper support and protection from settling.

Backfilling. For drain mains, all materials for backfilling the trench shall be suitable and free from organic substances, large stones and frost. No stones weighing over fifty (50) pounds shall be backfilled anywhere into the pipe trench.

For drain services, when indicated by the Town Engineer, the pipe shall be completely encased in an envelope of pea-stone, 1/2 inch crushed stone, or sand in the case of P.V.C., approximately six (6) inches on each side and six (6) inches on the top. Stones larger than three (3) inches in diameter shall not be closer than twelve (12) inches to the pipe. Over that, materials for backfilling the trench shall be suitable and free from organic substances, large stones and frost. No stone weighing over fifty (50) pounds shall be backfilled anywhere into the trench.

Construction Specifications
Section IV - Drainage Construction

Excavation and Backfilling - continued.

Compaction shall be either by puddling or by mechanical means as approved by the Director. If compaction by the puddling method is desired, the Contractor shall obtain permission from the Water Division who will install a hydrant meter. Charges for water so used shall be made by the Water Division. Care must be taken to prevent excessive run-off or silt infiltration into the pipes or below the discharge end, any materials so deposited must be removed by the Contractor at no cost to the Town. While puddling is underway and afterwards, until puddled areas have sufficiently hardened, the Contractor must protect the trench and the public with suitable barriers, lights, etc.

INSTALLATION

Pipe Laying. All pipe, before being lowered into the trench, shall be clean and free from defects. The Contractor shall remove, by pumping or other means, any water accumulated in the trench during the pipe laying period and keep the trench dry until the joints are properly connected.

The pipe shall be laid with bell ends upstream, beginning at the lower end of the pipeline. The pipeline shall be laid to the grades and alignment on the drawings.

<u>Drain Pipe Design for Self-Cleansing Velocities</u>	
<u>Drain Pipe Size</u>	<u>Minimum Slope</u>
12"	0.0080
15"	0.0060
18"to 21"	0.0050
24" to 30"	0.0025
36" to 42"	0.0015
48" +	0.0010

Joints.

a . Concrete Pipe (Bell and Spigot, or Tongue and Groove)

The interior surface of the bell (groove) shall be carefully cleaned with a wet brush, and a layer of soft mortar shall be applied to the lower half of the bell (groove). The spigot (tongue) of the second pipe shall then be cleaned carefully with a wet brush, covered with a layer of soft mortar to its upper half, and inserted in the bell (groove) end of the first pipe. Sufficient mortar shall be used to completely fill the joint and to form a bead on the outside. The interior surface at the joint shall be finished smooth and the mortar bead on the outside shall be protected from the air and sun until the

Construction Specifications
Section IV - Drainage Construction
Installation - continued.

mortar is satisfactorily cured. For a tighter joint, the Contractor shall use a jute string in each joint, unless specifically waived in writing by the Town Engineer.

b . Corrugated Metal Pipe

Joints shall be made by riveting or by means of connecting bands with bolted couplings in accordance with the recommendations of the pipe manufacturer. When the pipe laps at circumferential joints, the inner lap shall be on the downstream end of the culvert. Longitudinal laps shall be located at the horizontal axis.

c . Ductile Iron Pipe.

Joints shall be made in accordance with the latest directions and specifications of the manufacturer.

d . Polyvinyl Chloride Pipe

Joints shall be bell and spigot. The bell shall consist of an integral wall section with a solid cross section rubber ring factory-assembled, securely locked in place to prevent displacement. Joints shall conform to ASTM Standard D 3212.

e. High-Density Polyethylene Pipe (HDPE)

Joints shall be bell and spigot.

Structures. All structures shall conform to the dimensions shown on the typical details. When field conditions warrant, as determined by the inspector, manholes, catch basins, and headwalls shall be constructed on a six (6) inch slab of cast-in-place concrete placed on undisturbed earth; over-excavation shall be compensated for with additional concrete at the contractor's expense. If a six- (6) inch slab is not used four- (4) inch pre-cast sectional plates shall be used for the base and shall conform to the dimensions shown on the typical details. Walls, where not specified, shall be concrete, brick, radial concrete blocks or pre-cast concrete rings. Manholes shall have shaped channels connecting main lines.

Brick and concrete blocks shall be clean and thoroughly wetted before laying. All joints shall be completely filled with mortar and struck to a smooth finish. Brick shall be laid in stretcher courses with every sixth course laid radially. The outside of brick and concrete block structures, and the inside, if required by the Town Engineer, shall be plastered and troweled smooth with 5/8 inch of mortar.

Construction Specifications
Section IV - Drainage Construction

Installation - continued.

The bottom section of pre-cast manholes shall be jointed to the concrete footing with mortar, and successive sections shall be jointed together with mortar. The joint space shall be completely filled with mortar and finished smooth on the inside and outside. A tapered section four feet in height shall be placed on top of the uppermost straight section as shown on the typical detail.

Frame castings for catch basins and manholes shall be set in full mortar beds true to the lines and grades.

Aprons shall be provided at all headwalls and where necessary, the Contractor shall excavate a ditch, at a slope of 0.5 percent, to existing ground.

Stone for Pipe Ends and Rip-rap. Stone for pipe ends shall be sound, durable rock, which is angular in shape. Rounded stones, boulders, sandstone or similar stone or relatively thin slabs will not be acceptable. Each stone shall weigh not less than 50 pounds nor more than 125 pounds and at least 75% of the volume shall consist of stone weighing not less than 75 pounds each.

The remainder of the stones shall be so graded that when placed with the larger stones, the entire mass will be compact. No stone shall have a minimum thickness less than one-third of its length or width.

Swales. Drainage swales shall have a bottom width at least equal to the diameter of the outfall pipe, with side slopes of 1 vertical to 2 horizontal. Soil from swales shall not be deposited along the sides so as to create ponding. Care must be exercised to eliminate water pockets over and adjacent to such swales.

CONSTRUCTION SPECIFICATIONS

SECTION V - WATER MAIN CONSTRUCTION

SCOPE OF WORK

The Contractor shall furnish all materials and perform all the work and services necessary for the complete construction of the water distribution system; i.e., installation of all pipes, gate valves, fittings, hydrants, thrust blocks, etc. including all related work such as excavation, backfilling, compaction, testing and disinfecting.

The Contractor shall perform his work in accordance with the plans, approved by the Planning Board and/or the approving authority in the Department of Public Works.

Connection to Town's System. Water main connections to the town's distribution system will be inspected by the Engineering Division. The Contractor shall furnish all necessary materials and labor needed for such connection.

Whenever possible, water main connections shall be performed by professional installers equipped with a wet tapping machine that allows no interruption of service to existing water consumers.

No water supply will be shut off without giving sufficient notice to the consumers and stating the time when the supply will be turned off and turned back on. Permission to shut off water shall first be obtained from the Water Division who will shut the water off and turn it on again. Special care shall be taken so as not to damage consumers' appurtenances; if such damages occur, the Contractor shall repair such damages at his own expense.

Water main extensions will be shut off from the town's distribution system at the connection gate valve until the water main is pressure tested for leakage, chlorinated, sampled and found to be bacteria free and until the first building is to be connected with a service and the meter set. Prior to the first building being connected and the water main reactivated, the water main shall be resampled. When long main extensions are installed, activation will be allowed only to service that portion which will be utilized by connections to existing buildings or buildings under construction. Arrangements may be made with the Water Division to temporarily activate the mains for testing or other purposes.

Construction Specifications
Section V - Water Main Construction

MATERIALS

Pipe. The type of pipe allowable for water mains shall be limited to cement-lined ductile iron pipe, not less than Class 52.

Ductile Iron Pipe. Water pipe is to be Class 52 cement-lined ductile iron conforming in wall thickness to ANSI Spec. A21.51-1976, tar coated on the outside with push-on joints. Inside cement coating shall not be less than 1/8 inch thick and conform to ANSI Specs. A21.11-1972 and A21.4-1974.

Jointing material shall be solid rubber rings with wedges and shipped separately from each length of pipe. The pipe shall have normal laying lengths of at least 18 feet. The rubber rings shall be of solid cross-section. The full circumference of pipe joints shall be gaged with a feeler gage after assembly to verify proper seating of rubber rings.

Fittings. All fittings shall conform to the latest revision of the town's specifications for materials, which are used for bidding purposes.

Gate Valves and Valve Boxes. Gate valves and valve boxes shall conform to the latest revision of the town's specifications for materials, which are used for bidding purposes.

Hydrants. Hydrants shall conform to the latest revision of the town's specifications for materials, which are used for bidding purposes.

Domestic Services. Piping for domestic services shall be limited to:

1. Copper tubing, which shall be in accordance with AWWA 7S-CR, Type K or Federal Specification WWT 799, Type K. The size shall not be less than ¾ inch.
2. High Density Polyethylene copper tube size pipe #3408, SDR-9 rated for 200 psi used with compression fittings and meeting the requirements of ASTM D2737-81 (CTS). Polyethylene pipe shall be American manufactured and approved by the Town Engineer with stainless steel connecting inserts and blue color coded. For connections to water mains up to and including 2" size services, the street side installation to the curb stop shall be Type K copper only.

Corporation stops shall be brass and in accordance with AWWA C800-55. Inlet CC thread and outlet copper compression and shall conform to the latest revision of the Town's specifications for materials which are used for bidding purposes.

Construction Specifications
Section V - Water Main Construction

Materials – continued

Curb stops shall be brass and comply with all applicable parts of AWWA C800-55, inverted key, round way, combined cap and key with check, no drain, copper compression connections and shall conform to the latest revision of the Town's specifications for materials, which are used for bidding purposes.

Curb boxes shall be arch pattern base 3-1/2 x 4-1/2 foot telescoping design with 30-inch stationary stainless steel rods. Covers shall have two holes for removal with spanner wrench and have brass bushing insert tapped for 1 inch iron pipe or cone top covers with threaded brass pentagon plug for use in concrete or bituminous concrete.

EXCAVATION AND BACKFILLING

The Contractor shall excavate all encountered materials to the depths shown on the drawings. Trench depths, not shown, shall be figured to allow a minimum of 4 feet cover over the top of the pipe.

No tunneling shall be permitted in place of trench construction for the water mains, unless the road grade has been established in accordance with grade stakes previously set by a reputable engineer or surveyor at the expense of the Contractor.

In open cut excavation, the trench width at the top of the pipe shall be no wider than the outside diameter of the pipe, plus 1.5 feet, unless permission is granted by the Inspector. The trench above the top of the pipe shall have sufficient slope so that the banks will not slide. Sheeting of trenches will be at the Contractor's discretion and as may be required by applicable governmental laws and regulations.

Care must be taken not to damage water pipes, drains, sewers, gas mains, electric conduits or other structures encountered on the lines of the work. In case of damage to any structures, the owner of the structures and the Department of Public Works shall be notified immediately by the Contractor so that the proper steps may be taken to repair, at the expense of the Contractor, any and all damage done.

Rock Excavation. Any rock blasting shall be done by licensed persons only and shall be carried out in strict accordance with the existing governmental ordinances and regulations. A blasting permit must be obtained from the local Fire Chief having jurisdiction over the area. Any damage to the work or property of others caused by blasting operations shall be repaired at the expense of the Contractor.

Construction Specifications
Section V - Water Main Construction

Excavation and Backfilling - continued

Whenever the bottom of the trench is rock or boulders, it shall be excavated six (6) inches below grade and refilled to grade with fine material rammed in place. The sides of the trench in rock shall be excavated to such width that no rock shall be closer to the pipe barrel or other structures than six (6) inches when the pipe is laid in the trench with a normal alignment.

Bedding of Water Mains. Six inch dirt mounds shall be used under the pipe. The clean earth with stones no larger than three (3) inches shall be hand shoveled and properly tamped beneath the pipe so that the pipe shall have a continuous and even bearing.

Bedding of Water Services. All water services shall be bedded in sand.

The Contractor shall undercut unsuitable material and replace it with suitable material.

Backfilling. All materials for backfilling the trench shall be suitable and free from organic substances, large stones and frost. No stone weighing over fifty (50) pounds shall be backfilled anywhere into the trench.

Stones larger than three (3) inches in diameter shall not be closer than six (6) inches to the pipe.

The backfill around the pipe shall be deposited by hand evenly on both sides to the centerline of the pipe and tamped with suitable tools, then filled in by hand for one (1) foot above the pipe before backfilling with a machine. The remaining backfill shall be compacted by machines, compactors or puddling, in which case a water charge will be made. While puddling is underway and afterwards, until the puddled areas have sufficiently hardened, the Contractor must protect the trench and the public by suitable barriers, lights, etc. The water into the new mains shall not be turned on until fill material is placed to the proper grade over the pipelines and around hydrants.

INSTALLATION

Pipe Laying, All pipe, before being lowered into the trench, shall be clean and free from defects. The Contractor shall remove, by pumping or other means, any water accumulated in the trench during the pipe laying period and keep the trench dry until the joints are properly connected. Pipe shall be backfilled as necessary to prevent floating. Any pipe, which has floated, shall be removed from the trench and re-laid to the satisfaction of the Inspector. When pipe laying is not in progress, the open ends of all pipe lines shall be closed to keep out all foreign material and trench water.

Construction Specifications
Section V - Water Main Construction

Installation - continued.

Wedges supplied with the pipe shall be used according to the manufacturer's recommendation to effect electrical continuity.

Where water mains are within eighteen (18) inches of a drain or sewer line, the area surrounding all pipes shall be filled with 3/4 inch crushed stone from the bottom of the deepest newly excavated trench to one foot above the uppermost pipe.

Gate Valves and Hydrants. All gate valves and hydrants shall be set plumb. Valves, hydrants and all other fittings shall be connected with short lengths of pipe.

Hydrants shall have the steamer nozzle facing the roadway. Six (6) inch diameter ductile iron pipe shall be used for hydrant laterals. Each hydrant must be valved on the lateral with a six (6) inch gate valve, box and cover. Concrete thrust blocks shall be placed between the back of the hydrant and the undisturbed bank. The concrete must not obstruct the hydrant drain.

A pit at least twelve (12) inches in depth below the bottom of the hydrant and at least eighteen (18) inches in radius shall be dug at each hydrant. This pit and space around the hydrant shall be re-filled to within two (2) feet of the ground surface with clean stone. The backfilling around the hydrant shall be thoroughly tamped. After installation, hydrants shall be painted to match existing town-hydrants: International Orange body and caps with reflective white bonnet.

Joints. Joints in grooved rubber gasket and mechanical joint ductile iron pipe shall be made in accordance with the latest directions and specifications of the manufacturer.

Concrete Backing. The Contractor shall be responsible to supply and install concrete thrust blocks at all bends, tees, end caps and hydrants as shown on the Standard Detail. The concrete shall be composed of one part Portland cement, two parts sand and four parts coarse aggregate. The concrete shall be mixed and placed in a manner satisfactory to the Inspector. In placing the concrete, care shall be taken not to disturb the alignment of the pipes around or adjacent to the concrete being placed. Solid concrete thrust/barrel blocks or other methods may be approved by the Town Engineer. Stone shall not be allowed for thrust blocks.

Dead End Mains. All dead ends of mains without a terminal hydrant shall have a one (1) inch tap installed within two (2) feet of the end of the main with a copper flow for flushing purposes. The flow shall consist of a one (1) inch corporation stop threaded into the main and attached to a one (1) inch curb stop with copper tubing; a length of copper tubing shall lead from the curb

Construction Specifications
Section V - Water Main Construction

Installation - continued.

stop to the surface of the ground. The curb stop shall turn left 1/4 turn to open and have an Erie type curb box with two (2) hole cover. The line cap shall be held in place by a thrust block. The flow curb box shall be in the shoulder of the roadway with the outlet directed toward the street surface.

Domestic Services. When indicated by the Town Engineer, taps for all services 3/4 inch and larger shall be made with a double-strap service saddle tapped to the desired size with a corporation and a goose neck in the copper, close to the corporation stop for expansion. Taps shall be made to the upper quadrant of the pipe.

From the main to the curb stop, all services shall be copper. High density polyethylene or copper may be used from the curb stop to the meter and of one diameter. All services from the main to the foundation shall have a minimum cover of four (4) feet. Services shall enter the building at a 90 degree angle from the street directly into the front or either side.

Curb stops shall be placed one foot from the property line on the town side. Services requiring tubing in lengths longer than is commonly commercially purchased shall be connected with compression-type, three part brass couplings.

Meter pits shall not be installed except with permission from the Water Dept. Superintendent and then be constructed according to the "Meter Box Installation" specifications in the appendix to these regulations.

Meter stops, meter connections and blanks will be furnished, but not installed, by the Water Division. Requests for meters to be set and water turned on shall be made, after the Inspector has determined that the service line has been installed properly and is leak free, to the Water Division at least 24 hours in advance.

Fire Services. The tap for a fire service shall be inspected by the Inspector. The Contractor shall furnish all necessary materials and labor needed for the installation. Wet taps shall be required on existing water mains, whenever possible, with the installation of a tapping gate and sleeve.

Fire lines shall be considered extensions of the water main and require proper testing and chlorination as described in these specifications.

Construction Specifications
Section V - Water Main Construction

SPECIAL REQUIREMENTS

Hydrostatic Testing and Chlorination of Water Mains

All water mains and apparatus shall be subject to hydrostatic pressure test for leakage and upon acceptance of such test, shall be properly disinfected for bacteriological purposes. All procedures shall comply with AWWA Standards #'s ANS1/AWWAC600-82 and AWWAC651-86. All work shall be performed by workmen who are experienced and well acquainted with pressure testing and disinfection procedures.

Filling: In order to perform the strength and leakage test, the main should be filled slowly (so as not to disturb existing lines) from the low end if possible, expelling air from the hydrants and taps at the beginning and end of the line. The line shall be shut down and left filled for 24 hours.

Flushing: All new water mains, and existing water mains that have been drained and cut-into for making connections, shall be thoroughly flushed prior to pressure or leakage testing or final chlorination. Flushing shall be accomplished by partially opening and closing valves, hydrants, and blowoffs, several times, under expected line pressure, with flow velocities of not less than 2.5 feet per second, in the main(s). The size and number of hydrant outlets or main taps to provide the required flow (at 40 psi residual pressure) is as follows:

1. MINIMUM REQUIRED FLOW AND OPENINGS TO FLUSH PIPELINES
(40 psi Residual Pressure in Water Mains)

Pipe Diameter (in.)	Flow Required to Produce 2.5 fps Velocity in Main (gpm)	Minimum Size of Taps on Main (in.)	Number	Hydrant Outlets Size (in.)
4	100	15/16	1	2-1/2
6	220	1-3/8	1	2-1/2
8	390	1-7/8	1	2-1/2
10	610	2-5/16	1	2-1/2
12	880	2-13/16	1	2-1/2
16	1565	3-5/8	2	2-1/2

2. If less than a 40 psi residual is available in the main, with the size tap shown above, then a larger or more tap(s) or hydrant outlets will be required, as directed by the Town Inspector or the Water Department Representative.

Construction Specifications
Section V - Water Main Construction

Special Requirements - continued.

3. The length of time for flushing, at or above the minimum allowable velocity, shall be computed to allow a minimum of 3 times the total volume of water stored in the main(s) to be flushed to waste. Flushing shall be done in the presence of the Town Inspector or the Water Dept. Representative.

Pressure Testing:

- A. All new water mains, or any valved sections thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure that will exist at the point of testing, or the rated pressure of the pipe, whichever is greater. Test pressures shall meet the following requirements:
 1. Be of at least 2 hour duration.
 2. Be not less than 1.25 times the expected system working pressure at the highest point along the test section or 150 psi, whichever is greater.
 3. Not exceed pipe or thrust-restraint design pressures.
 4. Not vary by more than ± 5 psi for the duration of the test.
 5. Not exceed 2 times the rated pressure of the valves or hydrants when the pressure boundary includes closed gate valves or hydrants. Valves shall not be operated in either direction at differential pressure greater than the rated pressure.
 6. Not exceed 1 times the rated pressure of the valves when the pressure boundary of the test section includes closed butterfly valves or resilient seated gate valves.
- B. Air Removal. Following flushing, and before applying the specified test pressure, air shall be completely expelled from the pipes, valves and hydrants. After all air has been expelled, the air blowoffs can be closed, and the test pressure applied.
- C. Pressure Test. Each valved section of pipe shall be slowly raised to the specified test pressure for two separate periods. The first period shall be for 15 minutes, after which the pressure in the test section shall be allowed to drop slowly back to system pressure. The pressure shall then be slowly raised again to the specified test pressure and maintained for 2 hours. The test pressure shall be applied by means of a pump connected to the pipe, in a manner satisfactory to the Town Inspector or the Water Dept. Representative, and which

Construction Specifications
Section V - Water Main Construction

Special Requirements – continued.

will prevent backflow into the existing system. Valves shall not be operated in either the closing or opening direction, at differential pressure greater than the rated pressure.

- D. Examination. Any exposed pipe, fittings, valves, hydrants and joints shall be carefully examined during the test. Any damaged or defective pipe, fittings, hydrants or valves discovered following, or as a result of the pressure test shall be repaired or replaced with sound material. If faulty materials are removed and replaced, the pressure testing procedure shall be repeated until satisfactory to the Town Inspector or the Water Dept. Representative.

Leakage Test

- A. Leakage testing shall be conducted concurrently with the pressure test.
- B. Leakage Defined. Leakage shall be defined as the quantity of water that must be pumped into the new main, or any valved section thereof, to maintain pressure within ± 5 psi of the specified test pressure, after the main(s) have been filled with water and all air has been expelled. Leakage shall be recorded to the nearest one-tenth of a gallon, by means of a calibrated test meter. If allowed by the Town Inspector or the Water Dept. Representative, drawdown may be measured in a calibrated barrel. All records and charts shall become the property of the Town. The Contractor shall employ qualified personnel throughout the testing. Leakage shall not be measured by a drop in pressure over a period of time.
- C. Allowable Leakage. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD(\sqrt{P})}{133200}$$

where

L = allowable gallons of leakage per hour

S = the length of pipe tested, in feet

D = the nominal pipe diameter in inches

P = the average test pressure during the test, in psi

Construction Specifications
 Section V - Water Main Construction

Special Requirements – continued

D. The leakage formula is based on the allowable leakage of 11.65 gallons per day, per mile of pipe, per inch (nominal) of pipe diameter, at a pressure of 150 psi. Allowable leakage at various pressures, for various pipe diameters are shown below.

1. ALLOWABLE LEAKAGE PER 1000 FEET OF PIPELINE
 NOMINAL PIPE DIAMETER – (INCHES)

Average Test Pressure	6	8	10	12	16	20	24
250	0.71	0.95	1.19	1.42	1.90	2.37	2.85
225	0.68	0.90	1.13	1.35	1.80	2.25	2.70
220	0.64	0.85	1.06	1.28	1.70	2.12	2.55
175	0.59	0.80	0.99	1.19	1.59	1.98	2.38
150	0.55	0.74	0.92	1.10	1.47	1.84	2.21
125	0.50	0.67	0.84	1.01	1.34	1.68	2.01
100	0.45	0.60	0.75	0.90	1.20	1.50	1.80

2. If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.
3. When testing against closed metal seated valves, an additional leakage shall be allowed per closed valve, of 0.0078 gallons per hour, per inch of nominal valve diameter.
4. When hydrants are in the test section, the test shall be made against the closed hydrant(s) and opened gates.
5. Zero leakage will be allowed on the bridge crossings or jackings or borings.

E. Acceptance shall be determined on the basis of allowable leakage. If any test of pipe discloses leakage greater than that specified, the Contractor shall locate and make repairs as necessary until the leakage is within the specified allowance.

1. All visible leaks are to be repaired regardless of the amount of leakage.
2. All water mains shall be pressure and leakage tested in the presence of the Town Inspector or the Water Dept. Representative, in order to qualify for acceptance.

Construction Specifications
Section V - Water Main Construction

Special Requirements – continued.

Chlorination of Water Mains

- A. The method of chlorination shall be the Continuous Feed Method as described hereinafter, and as approved by the Owner and the Town Inspector or the Water Dept. Representative.
- B. Continuous Feed Method of Chlorination. The continuous feed method consists of the following steps:
 1. Upon completion of construction, fill mains with potable water and remove all air from high spots and/or pockets.
 2. Flush the completed main(s) to remove particles. Following the filling and flushing of the main(s), and before chlorination, complete all hydrostatic testing to the satisfaction of the Town Inspector or the Water Dept. Representative.
 3. Fill the main(s) with chlorinated potable water, having an initial concentration of 25 mg/l free chlorine residual in the main(s).
 - A. Water from the existing distribution system or other approved source of supply shall be made to flow at a constant measured rate, into the new main(s). In the absence of a meter, the rate may be approximated by methods such as placing a pilot gage in the discharge or measuring the time to fill a container of known volume.
 4. At a point not more than 10 feet downstream from the beginning of the new main(s), water entering the new main shall receive a dose of hypochlorite solution fed at a constant rate such that the water in the main(s) will have not less than 25 mg/l free available chlorine. To assure that this concentration is achieved, the Contractor shall measure chlorine concentration at regular intervals along the main(s), using appropriate chlorine test kits, or as otherwise described in the current edition of A.W.W.A. M12 – Simplified Procedures for Water Examination.
- C. The amount of chlorine required to obtain a concentration of 25 mg/l per 100 feet of various diameter pipes is as follows:

Construction Specifications
 Section V - Water Main Construction
Special Requirements – continued.

1. CHLORINE REQUIRED TO OBTAIN A CONCENTRATION OF
 25 MG/L PER 100 FEET OF PIPE.

PIPE Dia. (in.)	SODIUM 5% Avail. Chlorine	HYPOCHLORITE 10% Avail. Chlorine	GALLONS		CALCIUM HYPOCHLORITE OUNCES
			12 ½% Avail Chlorine	15% Avail. Chlorine	65% Avail. Chlorine
4	0.03	0.02	0.02	0.01	0.32 ounces
6	0.08	0.04	0.03	0.03	0.75 ounces
8	0.13	0.07	0.06	0.05	1.30 ounces
10	0.10	0.10	0.09	0.07	2.10 ounces
12	0.28	0.15	0.12	0.10	2.95 ounces
16	0.50	0.25	0.22	0.17	5.30 ounces
20	0.80	0.40	0.34	0.28	8.40 ounces
24	1.15	0.60	0.50	0.40	12.00 ounces

2. The above quantities are to be added to a sufficient quantity of water, dissolved, and mixed. The entire solution shall be injected into the main as specified.
 3. The quantities shown are based on concentrations of available chlorine by volume. Extended or improper storage may have caused a loss of available chlorine.
 4. For concentrations of 50 ppm, double the quantities listed.
- D. During the application of chlorine, valves shall be closed to prevent strong chlorine solution in the new main(s) from flowing into the existing system. Chlorine application shall continue until the entire main(s) is filled with water having 25 mg/l of free available chlorine. The chlorinated water shall be retained in the main(s) for at least 24 hours, during which time all valves and hydrants in the section(s) being treated shall not be operated, in order to disinfect the appurtenances. At the end of this 24 hour period, all portions of the main(s) and appurtenances being tested shall have a free available chlorine residual of at least 10 mg/l. If less than 10 mg/l free chlorine residual is measured, the main(s) shall be flushed and the entire disinfection procedure repeated.
- E. Hypochlorite solutions shall be applied to the water main(s) with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. Feed lines shall be of such material and strengths as to safely withstand corrosion caused by the concentrated chlorine solutions, and also the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the solution is applied to the main.

Construction Specifications
Section V - Water Main Construction

Special Requirements – continued.

Final Flushing

- A. After the specified retention period, the heavily chlorinated water shall be flushed from the main(s) until chlorine measurements show the concentration in the water leaving the main(s) is no higher than that generally prevailing in the system.
- B. Arrangements shall be made with the Owner to flush the main(s) of chlorinated water. Great care shall be exercised in the selection of the rate of flow and the discharge points, in order to minimize complaints, and damage to public and private property.
- C. The environment to which the chlorinated water is to be discharged shall be inspected. If it appears possible that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to thoroughly neutralize the chlorine residual remaining in the water. If necessary, state, federal, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

Bacteriological Tests

- A. Standard Conditions. After final flushing and before the water main(s) is placed in service, water samples shall be collected at each sampling point designated by the Town Inspector or the Water Dept. Representative and tested for bacteriological quality in accordance with Standard Methods. Water samples shall show the absence of coliform organisms and background bacteria. A standard plate count will be required by the Town Inspector or the Water Dept. Representative and must have at or below 50 ml before it can be accepted.
- B. Special Conditions. If during construction, trench water has entered the main(s), or if in the opinion of the Inspector or the Water Dept. Representative excessive quantities of dirt or debris have entered the main(s), bacteriological samples shall be taken at intervals of approximately 200 feet and shall be identified as to location. Samples shall be taken of water that has stood in the main(s) for at least 24 hours after final flushing has been completed.
- C. Sampling Procedure. Samples for bacteriological analysis shall be collected, by the Inspector, in sterile bottles treated with sodium thiosulfate. No hose or fire hydrant shall be used in the collection of samples. A corporation cock shall be installed in the main with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly shall be removed and replaced with a brass plug.

Construction Specifications
Section V - Water Main Construction

Special Requirements – continued.

Bacteriological Tests – continued.

- D. The Inspector shall deliver samples to a State approved laboratory for bacterial analysis. Only after each consecutive sample is approved shall the main(s) be incorporated into the water system. In the event, that positive reports of contamination are received, the main(s) shall be flushed and chlorinated as many times as may be necessary to obtain approved (negative) results.

Re-Chlorination

- A. If the initial chlorination fails to produce satisfactory bacteriological samples, the main(s) shall be flushed and resampled. If check samples show the presence of coliform organisms, then the main(s) shall be rechlorinated by the continuous feed method of chlorination, until satisfactory results are obtained. High velocities in the existing system, resulting from flushing the new main(s), may disturb sediment that has accumulated in the existing mains. When check samples are taken, the Contractor shall sample water entering the new main(s).

Chlorination Procedures When Cutting Into Or Repairing Existing Mains

- A. The following procedures apply when mains are wholly or partially dewatered. After the appropriate procedures have been completed, the main may be returned to service prior to completion of bacteriological testing, in order to minimize the time customers are out of water. Leaks or breaks that are repaired with clamping devices while the mains are full of water under pressure present little danger of contamination and require no disinfection.
1. Trench Treatment. When an old main is opened, either by accident or on purpose, the excavation will likely be wet and may be contaminated from nearby sources of sewage or other pollutions. Liberal quantities of hypochlorite tablets shall be applied to open trench areas to lessen the danger from pollution.
 2. Swabbing with Hypochlorite Solution. The interior of all pipe and fittings used in making a repair (particularly couplings and sleeves) shall be swabbed or sprayed with a 1 percent hypochlorite solution before they are installed.
 3. Flushing. If valve and hydrant locations permit thorough flushing toward the work location from both directions, it shall be done. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.

Construction Specifications
Section V - Water Main Construction

Special Requirements – continued.

Chlorination Procedures When Cutting Into Or Repairing Existing Mains – continued.

4. Slug Chlorination. Where practical in addition to the procedures above, a section of main in which the break is located shall be isolated. All service connections shall be shut off, and the section flushed and chlorinated by the slug method and the dose may be increased to as much as 300 mg/l, and the contact time reduced to as little as 1-hour. After chlorination, flushing shall be resumed and continued until discolored water is eliminated and the water is free of noticeable chlorine odor.
5. Bacteriological samples shall be taken after repairs. If the direction of flow is unknown, samples shall be taken on each side of the main break. If positive samples are recorded, daily sampling shall be continued until two consecutive negative samples are recorded. Positive samples shall be evaluated by the Town Inspector or the Water Dept. Representative for corrective action.

Special Procedures For Tapping Sleeves

- A. Before a tapping sleeve is installed, the exterior of the main to be tapped shall be thoroughly cleaned, and the interior surface of the sleeve shall be lightly dusted with calcium hypochlorite powder at the rate of approximately 150 mg per square foot of surface area. Also see (Chlorination Procedures When Cutting Into Or Repairing Existing Mains).

Other Conditions

All work, filling, testing, and sampling must be done in the presence of the Inspector or Water Division personnel at all times. The Contractor shall furnish all apparatus, material and labor necessary to perform the tests. All apparatus and materials must meet the Inspector's approval.

ALL THE WATER USED FOR FILLING, TESTING, DISINFECTING AND FLUSHING WILL BE CHARGED TO THE CONTRACTOR. APPLICATIONS AND PAYMENT OF CURRENT SET FEES MUST BE MADE BEFORE TESTING TAKES PLACE.

CONSTRUCTION SPECIFICATIONS

SECTION VI - SANITARY SEWER CONSTRUCTION

SCOPE OF WORK

The Contractor shall furnish all materials and perform all the work and services necessary for the complete construction of the sanitary sewer system, i.e., - installation or construction of all sewer mains, service connections, manholes, encasements, etc., including all related work such as excavation, de-watering, backfilling, testing and flushing of lines.

The Contractor shall perform his work in accordance with the plans, approved by the Planning Board, and/or the approving authority in the Department of Public Works.

The Contractor shall familiarize himself with and abide by all applicable sections of the current State Environmental Code - Title 5.

Connection to Town's System. Sanitary sewer main connections to the town's system shall be made either by the Town or by the Contractor at the discretion of the Director. The contractor shall furnish all necessary materials needed for such connections, including materials for construction of a required manhole.

“The requirements of this Section shall include all modifications to the existing sanitary sewer system including but not limited to the relocation of pipeline and structures, adjustment to manhole frames and covers, and all related appurtenant work.”

MATERIALS

Pipe For Gravity Mains. Pipe for sewer main construction of gravity lines including service stubs up to the property line and couplings shall be limited to:

1. Polyvinyl Chloride Pipe. PVC sewer pipe for gravity sewers and service connections shall conform to ASTM Standard D 1784 and D 3034-SDR 35, and shall meet the following specific requirements and exceptions:
 - a. The pipe and fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusion or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density and other physical properties.
 - b. Joints shall be bell and spigot. The bell shall consist of an integral wall section with a solid cross section rubber ring factory-assembled, securely locked in place to prevent displacement. Joints shall conform to ASTM Standard D 3212.

Construction Specifications
Section VI - Sanitary Sewer Construction

Materials – continued.

- c. All fittings and accessories shall have dimensions as recommended by the manufacturer and have bell and/or spigot configurations compatible with that of the pipe.
 - d. Pipe shall pass impact resistance test in accordance with ASTM D 2444 and minimum pipe stiffness test at 5% deflection in accordance with ASTM D 2412.
 - e. The normal length of 12-inch size and smaller shall be 13 or 14 feet and 15-inch size shall be no longer than 20 feet.
 - e. Pipe and fittings shall be manufactured in the United States of America and shall be accompanied by the manufacturer's certificate of compliance, in addition to meeting the performance tests specified hereinafter.
2. Ductile Iron Pipe. Piping for shallow installations, less than 3-feet of depth, shall be ductile iron pipe. No installation shall have less than 2 of cover.

Service connections shall consist of a Wye and a six (6) inch diameter pipe from the sewer main to the property line.

Pipe for services from the property line to ten (10) feet from the foundation shall be limited to:

1. Polyvinylchloride (PVC) sewer pipe to ASTM Standard D 1784 and D 3034-SDR35.

Fittings and special couplings for connecting different pipe sizes or materials shall be made by pipe manufacturers and used according to manufacturers' recommendations.

Pipe For Low Pressure Sewer Mains. Pipe for sewer main construction of low pressure sewer lines including service stubs up to the property line and couplings shall be limited to:

1. Polyvinylchloride (PVC) SDR-21 force main pipe with push-on bell and spigot joint connections.
2. Brass pipe for cleanouts at main terminal ends. All piping shall have threaded connections to fittings, which will also be brass.

Construction Specifications
Section VI - Sanitary Sewer Construction

Materials - continued.

Service connections shall consist of a wye and a one and one half (1 1/2) inch diameter pipe from the sewer main to the property line and curb stop. A check valve, provided by the Town, shall be installed within one (1) foot of the curb stop.

Pipe for services from the property line to the grinder pump shall be limited to either:

1. Polyvinylchloride (PVC) Schedule 40 pressure pipe in one and one quarter (1 ¼) IPS in 10 or 20-foot lengths having a minimum pressure rating of 370 psi with a cell class of 12454-B.
2. High Density Polyethylene pipe #3408, green coded SDR-9 rated for 200 psi.

Grinder Pumps – Grinder pumps shall be limited to the E One Extreme Series DH071. Flood zone pumps shall be limited to E One Extreme Series DH071-93.

Manholes. All manholes shall be precast concrete, conforming to standard dimensions or those shown on the typical detail. Brick and concrete block manholes.

Precast manhole cones and sections shall be constructed of reinforced concrete pipe sections, conforming to ASTM C-478.

Concrete for encasements or other uses shall have a minimum compressive strength of 2500 PSI at 28 days.

Brick for the construction of sewer inverts shall conform to ASTM C-32, grade SS. Mortar for masonry work shall consist of one part Portland Cement and two parts washed sand. Portland Cement shall conform to ASTM C-150, Type 11. Sand shall conform to ASTM C-144. The mortar shall be used within thirty (30) minutes from the time the ingredients are mixed with water. Water shall be clean and free from impurities.

Frames and covers shall have machined seats and be true to pattern in form and dimensions, free from faults and other defects affecting their strength. Covers shall have the marking "SEWER" and the YEAR of installation. Frames and covers shall conform to town specifications. Generally, manhole frames and covers shall be East Jordan Iron Works Cat. No. LT103A/24C7 with Sealtite covers or approved equal for pavement use. Manhole frames and covers within cross-country easements shall be East Jordan Iron Works Cat. No. LTW300 with locking and watertight covers or approved equal. Cross-country locking watertight frames shall be anchored to the precast concrete cone with stainless steel (306) bolts.

Construction Specifications
Section VI - Sanitary Sewer Construction

Materials - continued.

Manholes shall also be sealed between the precast concrete cone section and the metal frame with the following:

1. High density polyethylene adjustment rings as manufactured by Ladtech, Inc. or an approved equal. Material properties shall be tested and qualified for usage per the ASTM Test Methods reference in ASTM D 1248 and tested to assure compliance with impact and loading requirements per ASSHTO's Standard for Highway Bridges. Installation shall be in accordance with the manufacturer's recommendations.
2. A flexible internal rubber seal as manufactured by Cretex Specialty Products or an approved equal which, when installed, will seal and cover all the adjusting rings between the precast cone section of the manhole and the metal frame. With the use of oversized frames and covers such as the East Jordan Uron Works LTW300, a flexible internal rubber seal shall be required. Installations shall be in accordance with the manufacturer's recommendations.

All manhole sectional joints shall be installed with a full perimeter exterior joint collar to seal against infiltration as manufactured by Cretex Specialty Products or an approved equal. Installations shall be in accordance with the manufacturer's recommendations.

EXCAVATION AND BACKFILLING

Excavation. The Contractor shall excavate all materials encountered to the depths shown on the drawings. In open cut excavation, the trench width at the top of the pipe shall be no wider than the outside diameter of the pipe, plus 1.5 feet, unless permission is granted by the Inspector. The trench above the top of the pipe shall have sufficient slope so that the banks will not slide.

Sheeting of trenches will be at the Contractor's discretion and as may be required by applicable governmental laws and regulations.

Excavation for manholes shall be sufficient to leave at least twelve (12) inches in the clear between their outer surfaces and the embankment or timber which may be used to hold and protect the banks. Any over-depth excavation below the footings of such manholes shall be filled with concrete or clean selected material and will be at the Contractor's expense.

Care must be taken not to damage water pipes, storm drains, sanitary sewers, gas mains, electric conduits or other structures encountered on the lines of the work. In case of damage to any structures, the Owner of the structures and the Department of Public Works shall be notified

Construction Specifications
Section VI – Sanitary Sewer Construction

Excavation and Backfilling - continued.

immediately by the Contractor so that the proper steps may be taken to repair, at the expense of the Contractor, any and all damage done.

Rock Excavation. Any required rock blasting shall be done by licensed persons only and shall be carried out in strict accordance with the existing governmental ordinances and regulations. A blasting permit must be obtained from the local Fire Chief having jurisdiction over the area. Any damage to the work or property of others caused by blasting operations shall be repaired at the expense of the Contractor.

Whenever the bottom of the trench is rock or boulders, it shall be excavated six (6) inches below grade and refilled to grade with selected material rammed in place. The side of the trench in rock shall be excavated to such width that no rock shall be closer to the pipe barrel or other structures than six (6) inches when the pipe is laid in the trench with a normal alignment.

Bedding. The Contractor shall undercut unsuitable material and replace it with selected material composed of screen gravel with stones not larger than 1-1/2 inches.

The bedding shall be comprised of a six (6) inch layer of peastone, 1/2 - 3/4 inch crushed stone spread to give the pipe a continuous and even bearing. This bedding shall be required for both the sewer main and for all service connections.

Concrete Cradle and Encasement. Where indicated on the plans or directed by the Town Engineer, concrete cradle or concrete encasement shall be built in accordance with the typical detail. In general, concrete cradle shall be used where depth of cover over the pipe is from fourteen (14) to twenty-two (22) feet. For sewers having greater depths of cover than twenty-two (22) feet, full concrete encasement shall be used.

Backfilling. The sewer pipe shall be completely encased in an envelope of one-half to three-quarter (1/2 – 3/4) inch crushed stone six (6) inches on each side and six (6) inches on top.

No stones larger than three (3) inches in diameter shall be closer than twelve (12) inches to the pipe. Over that, materials for backfilling the trench shall be suitable and free from organic substances, large stones and frost. No stone weighing over fifty (50) pounds shall be backfilled anywhere into the trench. Compaction shall be either by machine or by the puddling method. If puddling is used, a charge for water will be made by the Water Division. While puddling is underway and afterwards, until puddled areas have sufficiently hardened, the Contractor must protect the trench and the public by suitable barriers, lights, etc.

Construction Specifications
Section VI – Sanitary Sewer Construction

INSTALLATION

Pipe Laying. The Contractor shall remove by pumping or other means any water accumulated in the trench during the pipe laying period and keep the trench dry until the joints are properly connected.

All pipe, before being lowered into the trench, shall be clean and free from defects. The pipe shall be laid to grades and alignment indicated on the approved plan by means of an interior pipe laser. Self-cleansing velocities of 2.5 feet per second shall be maintained by following the minimum grades described below. Terminal sewers require greater minimum slopes because of the low flows and velocities at the head of a terminal line.

Sewer Main Design for Self-Cleansing Velocities (2.0 ft./sec., “n” value of 0.013 of Manning’s formula)	
Sewer Size	Minimum Slope
8” (terminal sewers only)	0.008
8”	0.004
10”	0.0028
12”	0.0022
15”	0.0015
18”	0.0012

For service connections from the main to ten (10) feet from the foundation, the minimum slope shall be two (2) percent. Final location of the stub at the property line shall be located on an "as built" plan giving the station at the wye, the length of the service from the main, the depth at the property line and at least two swing ties.

Where sewer mains or services have less than a ten (10) foot horizontal separation and are closer than an 18 inch vertical separation to a water main, the sewer pipe shall be sleeved with ductile iron or PVC SDR-35 pipe of sufficient diameter for a distance of ten (10) feet away from the water main and sealed at each end with rubber couplings and stainless steel bands or an approved alternative.

When the excavation for a sewer exposes other utilities, the area surrounding all pipes shall be filled with 3/4 inch crushed stone from the bottom of the deepest newly excavated trench to one (1) foot above the uppermost pipe.

The service connection ten (10) feet from the foundation to the main should not have an angular deviation of more than 180 degrees. All deflections, with the exception of pipe joints, shall be in the form of long sweeps and not short angular fittings.

Construction Specifications
Section VI - Sanitary Sewer Construction

Installation – continued.

No cement joints shall be allowed.

Open ends of sewer pipe and cleanouts shall be sealed with caps or plugs as recommended and furnished by the manufacturer.

Clean-outs for gravity sewer services shall be in the form of a Tee of six (6) inch diameter with a straight riser to the ground to afford a visual inspection of the service flow and shall be located at the property line of each sewer service. The property line clean-out shall be installed with PVC SDR-35 pipe to within six (6) inches of the finish grade surface and provided with a threaded PVC male to female clean-out cover (plug). The threaded female fitting is to be glued to the SDR-35 cleanout riser. A ten (10) inch cast iron clean-out cover marked "SEWER" is required over the riser and shall be purchased from the Town. The cover shall be set by the Contractor so as to be flush with the final grade level of the ground or asphalt. In addition, clean-outs shall be located on long services not more than 100 feet apart. When the distance between the building and the property line is more than 100 feet, a clean-out shall be located at one-half the distance, but not more than 100 feet apart. Clean-outs on long services within the property do not have to be brought to within six (6) inches of the finish grade surface and do not require a cast iron cover.

Manholes. All manholes shall be precast concrete constructed on a base with a 5" wall and an 8" slab poured monolithically. The base shall be placed on 6" of selected material. Over-excavation shall be compensated for with additional concrete at the Contractor's expense.

The joints between sections shall be made using the approved mastic joint material.

Connections between the manhole and pipes shall be made with a synthetic flexible rubber boot and stainless steel strap for water tightness. Core drilling shall be required on any connection to existing manholes with a rubber boot inserted between the manhole and the pipe.

Lifting holes shall be filled solid with non-shrinking mortar.

The top of the cone shall have H.D.P.E. adjusting rings as manufactured by Ladtech, Inc. to allow for adjustments of the frames casting. The frame casting shall be set true to line and final grade and sealed with mortar on the outside.

Construction Specifications
Section VI - Sanitary Sewer Construction

Installation - continued.

Selected Materials. Selected material shall be screened gravel, crushed gravel, or crushed stone, consisting of hard, durable particles and shall meet the following gradation requirements:

Sieve (square openings)	Per Cent Passing (by weight)
1-1/2 inch	100
1 inch	35-70
1/2 inch	0-15
No. 4	0-5

SPECIAL REQUIREMENTS

Testing – Gravity Mains

The rate of infiltration into or leakage out of all sewers and appurtenant constructions shall be tested by the contractor and must be witnessed and approved by an authorized representative of the Town. Suitable bulkheads, weirs or other devices shall be built by the Contractor to enable the Town Engineer to make measurements of the water tightness of the sewers after their completion. It is particularly important that the sewers be built as watertight as is practicable since any infiltration into the sewers must be pumped and then treated before final disposal. Testing shall be performed as follows:

1. Leakage tests out of the sewers shall be made by filling the sewer and manholes in the section being tested with water to a level not more than six (6) feet above the center line of the main sewer pipe at the lowest point in that section. If the leakage in the sewers is found to be in excess of 150 gallons per mile of sewer per twenty-four (24) hours per inch of pipe diameter, the sewer or appurtenant structures shall be repaired by the Contractor to reduce the infiltration or leakage to the rate stated herein and additional tests shall be made.
2. Whenever sewers cannot be tested by water because of steep slopes, or for other reasons acceptable to the Town Engineer, low-pressure air tests shall be used to test the sewer lines. Leakage shall be measured in terms of time for the pressure to drop from 3.5 lbs. per square inch gage to 3.25 lbs. per square inch gage. Allowable time for different sizes or pipe shall be in accordance with current accepted standards:

6" and 8" sewer	4 minutes
10" sewer	5 minutes
12" sewer	6 minutes
15" sewer	8 minutes
18" sewer	9 minutes

Construction Specifications
Section VI - Sanitary Sewer Construction

Testing - Gravity Mains- continued.

3. Where gravity sewers are tested by air, manholes shall be tested by water and under a minimum 6-foot head above the around water table, the leakage shall not exceed 0.5 gallons per hour. Test water shall be maintained at a point at least 6 inches above the joint between the vertical wall section and the cone. In the case of a shallow manhole water shall be maintained in the circular opening of the top slab.
4. Vacuum Testing of Manholes. If a vacuum test is performed in lieu of the infiltration or exfiltration test, the Contractor shall take any and all steps necessary to assure the Engineer that the water table is below the invert of the manhole and will be at the Contractor's cost. The vacuum test shall be based on the following criteria:
 - A. 4'-0" or 5'-0" diameter manhole.
 1. Initial test pressure, 10 Hg (i.e., 20inch absolute).
 2. Test passing. A 1 inch Hg drop to 9 Hg in
 - 2 minutes minimum allowable for 0-10 foot deep manholes;
 - 2-1/2 minutes minimum allowable for 10-15 foot deep manholes;
 - 3 minutes minimum allowable for 15-25 foot deep manholes.
 - B. If the pressure drop exceeds 1 inch Hg in the allowable time, the manhole shall be repaired and retested.
 - C. If a manhole fails to meet a 1 inch Hg drop in 1 minute after repair, the manhole shall be water exfiltration tested and repaired as necessary.
 - D. Testing using either air or water shall be done whenever possible prior to backfilling to assist in locating leaks. Joint repairs by parging are to be done on both outside and inside of the joint to ensure a permanent seal. Vacuum testing draws together the joint and applies pressure to the elastomeric joint material. Properly placed and sized elastomeric joint material must be used to avoid leakage or to enable sections to be separated if necessary to effect a repair.

The Contractor shall make all necessary arrangements for securing the water and/or air for test purposes and shall stand the expense of these arrangements and of the water required for leakage tests.

Prior to acceptance of any portion of the new facilities, all pipelines and manholes must pass the leakage testing requirements and shall be thoroughly cleaned using a mandrel.

Construction Specifications
Section VI - Sanitary Sewer Construction

Testing – Gravity Mains - continued.

Cleaning Pipe Lines and Appurtenances. Upon completion of construction and testing all dirt and other foreign material shall be removed from the pipe lines and their appurtenant constructions. No materials shall be left in pipe lines to impede the normal flow through them.

CONSTRUCTION OF FORCE MAINS

Installation. Each pipe unit shall be inspected before being installed. Any pipe unit or fitting discovered to be defective either before or after installation shall be removed and replaced with a sound unit.

Each pipe unit shall be handled into its position in the trench only in such a manner and by such means as the Engineer approves as satisfactory.

The pipe shall be supported by selected material placed in a 6-inch layer to provide a cushion for the pipe. Suitable bell holes shall be provided, so that after placement only the barrel of the pipe receives bearing pressure from the supporting material.

Bedding and backfill material shall be free of large stones or clods greater than 1 ½ inch in diameter or frozen earth. Backfill shall be hand placed and carefully compacted by hand tamping to fill all space around the pipe with particular attention to the haunches and sides of the pipe. Selected backfill material shall be placed to a minimum of 12 inches over the top of the pipe.

Details of gasket installation and joint assembly shall follow the directions of the pipe manufacturer, all subject to the approval of the Engineer. Each pipe unit shall be carefully pushed into place without damage to the pipe or gasket.

The Contractor shall take all necessary precautions to prevent flotation of the pipe in the trench.

At all times when pipe installation is not in progress, the open ends of the pipe shall be closed with temporary watertight plugs or by other approved means. If water is in the trench when work is to be resumed, the plug shall not be removed until all suitable provisions have been made to prevent water, earth or other materials from entering the pipe.

Pipelines shall not be used as conductors for trench drainage during construction.

Cleaning. Care shall be taken to prevent earth, water and other materials from entering the pipeline. As soon as possible after the pipe is installed, the Contractor shall clean out the pipeline, being careful to prevent soil, water, and debris from entering the pipe.

Construction Specifications
Section VI - Sanitary Sewer Construction

Construction of Force Main Sewers - continued.

Testing. After the pipes of the force main sewers have been laid, secured in place and jointed as hereinbefore specified, the force main sewers shall be tested for strength and leakage. The tests shall be made when approved by the Engineer and shall be performed as follows:

1. Air testing of force mains will not be allowed.
2. The contractor shall furnish all apparatus, material and labor and the necessary water for making the test.
3. Before testing pipe lines having flexible joints, the contractor must make certain that the pipe lines are securely held to prevent movement.
4. The ends of the sections of force main to be tested shall be tightly closed by blank flanges or otherwise for the duration of each test.
5. Strength shall be tested at a pressure of 100 psi. The pressure for strength test shall be maintained for at least ten minutes by pumping additional water into the pipe line.
6. After passing the strength test, leakage shall be tested at 50 psi. The test for leakage shall last for at least one hour and may be required to last for two hours. The additional water needed to maintain the required pressure shall be measured accurately in a manner approved by the Engineer.
 - A. The rate of leakage for force main sewers shall not exceed one gallon per day per linear foot of joint.
 - B. The contractor shall repair all leaks discovered.

**TOWN OF DARTMOUTH
DEPARTMENT OF PUBLIC WORKS - WATER AND SEWER DIVISION
SPECIFICATIONS**

SUMMARY SHEET OF APPROVED MATERIALS

ROADWAYS

Gravel Base Course 12" meeting Mass. Highway standard M1.03.1
Bituminous Concrete Class I Bituminous Concrete Pavement, Type I-1
2" Binder Course
1 1/2" Top Course

SIDEWALKS

Gravel Base Course 9" meeting Mass. Highway standard M1.03.1
Bituminous Concrete Class I Bituminous Concrete Pavement, Type I-1
1" Binder Course
1" Top Course
Cement Concrete 4" Air-Entrained Class D, 3000 psi
6" Air-Entrained Class D, 3000 psi at Driveways

CURBING

Bituminous Concrete Berm 6"(H) x 8"(W) Machine Formed Berm
Bituminous Concrete Berm 12"(W) x 3 1/2"(H) Cape Cod Berm
Granite Curbing 5"(W) x 6"(H) Type VB (15-17" face)
Granite Curbing (Sloped) 3"-6"(W) x 6"(H) Type SB (11"-13" face)
Granite Curb Inlets 6"(W) x 6"(H) x 6"(L) (17"-19" face)

DRAINAGE

Pipe (Mains) Reinforced Concrete Class IV (12"-27")
Reinforced Concrete Class III (30" and larger)
Non-reinforced ASTM C-14
Aluminum corrugated metal AASHO M-36
Corrugated Metal –asphalt coated inside and outside
High Density Polyethylene (HDPE) ASTM D 3350
Polyvinyl Chloride (PVC) SDR-35
Pipe (Services) Polyvinyl Chloride (PVC) SDR-35
Ductile Iron, not less than Class 50
High Density Polyethylene (HDPE) ASTM D 3350
Manholes & Catch Basins Precast reinforced concrete ASTM C-478
Concrete block ASTM C-139 w/ Precast concrete rings
Manhole Frames & Covers East Jordan Iron Works Cat. No. LA268 or LK110
Catch Basin Frames & Grates East Jordan Iron Works Cat. No. LF 248-2-300 or 400 frame
w/L24SG01 grate, LK 120A frame w/L24SG01 grate, or
LK 120D-300 or LK121D-400 frame w/ L24SG18L or R
cascade grate
Catch Basin Hoods East Jordan Iron Works Cat. No. L 202

SUMMARY SHEET OF APPROVED MATERIALS (cont.)

WATER

<i>Pipe (Mains)</i>	Cement Lined Ductile Iron (CLDI) Class 52
<i>Pipe (Services)</i>	Copper tubing Type K, not less than 3/4" High Density Polyethylene SDR-9 copper tube size within the property, blue-coded
<i>Hydrants (Open Right)</i>	U.S. Pipe Metropolitan M-94 Mueller "Super Centurion 200" / A-433 American Darling B-62-B
<i>Gate Valves (Open Right)</i>	U.S. Pipe A-USPO-23 Mueller A2360-23 Resilient Seated American Flow Control Series 2500
<i>Corporation Stops</i>	Ford F-000 or Mueller 300 Ball Type
<i>Curb Stops</i>	Ford B44-333 or B44-444 or Mueller 300 Ball Type
<i>Compression Couplings</i>	Ford or Mueller
<i>Curb Boxes</i>	Extension Type Cast Iron Arch Pattern Base w/ 2 hole flat cover or Cone Top w/ Brass Pentagon Plug & Stainless Steel Rods

SEWER

<i>Pipe (Gravity Mains)</i>	Polyvinyl Chloride (PVC) SDR-35 Ductile Iron (DI), shallow depths only (2'-3')
<i>Pipe (Low Pressure F.M.)</i>	Polyvinyl Chloride (PVC) SDR-21 Brass pipe for cleanouts at terminal ends
<i>Pipe (Gravity Services)</i>	Polyvinyl Chloride (PVC) SDR-35
<i>Pipe (Low Pressure Services)</i>	Polyvinyl Chloride (PVC) Schedule 40 pressure pipe rated at 370 PSI, 1 1/4" diameter High Density Polyethylene SDR-9, 1 1/4" IPS, green-coded
<i>Curb Stops</i>	Ford, Mueller
<i>Manholes</i>	Precast reinforced concrete ASTM C-478 w/rubber boots
<i>Inverts</i>	Sewer brick ASTM C-32, Grade SS
<i>Frame & Covers</i>	East Jordan Iron Works Cat. No. LT 103A frame w/L24C7 sealtite covers, marked "SEWER" & YEAR installed East Jordan Iron Works Cat. No. LTW300 in crosscountry easements, marked "SEWER" & YEAR installed
<i>Cone to Frame Seals</i>	Cretex Specialty Products Flexible Rubber Seal (Internal or External) Ladtech, Inc. High Density Polyethylene Adjustment Rings
<i>Manhole Sectional Joint Seals</i>	Cretex Wrap by Cretex Specialty Products
<i>Cleanout Covers</i>	East Jordan Iron Works marked "SEWER" on cover, 10" dia.
<i>Low Pressure Pumps</i>	E/One Extreme Series DH071 grinder pump (Outside Unit) E/One Extreme Series DH071F-93 grinder pump for Flood Zones E/One Extreme Series DH071-44 grinder pump (Inside Unit)

**TOWN OF DARTMOUTH
DEPARTMENT OF PUBLIC WORKS - WATER AND SEWER DIVISION
SPECIFICATIONS**

GATE VALVE: Resilient Type

Gate valves shall be furnished in accordance with the requirements of the latest American Water Works Standard C509-87 for resilient seated gate valves and shall be in full compliance with the following supplementary requirements:

Valve body and bonnet shall be coated on all interior surfaces, in accordance with AWWA C550-90. Valve body exterior shall be coated with an appropriate coating of bonded epoxy or bitumastic to insure corrosion prevention.

The valve shall be designed so that during operation, or cycling of the valve, there is no friction or abrasion or rubbing together that could wear away any coating material and expose bare iron.

The interior of the valve body shall be free of pocket or ledges where sediments or debris can collect.

“O” ring seal shall be replaceable with the valve under pressure in the full-open position.

Valve shall be capable of operating through 500 full cycles with zero leakage and without regard to direction of valve discharge or operating pressures.

Gate valve shall OPEN RIGHT with a square operating nut and the ends shall have mechanical joint fittings.

Resilient seated Tapping Valves shall be furnished with the tapping flange having a raised face or lip designed to engage the corresponding recess in the tapping sleeve flange in accordance with MSS SP60. Tapping valves without the raised face on the tapping flange are not permitted since they do not assure the proper alignment required to prevent damage by a misaligned shell cutter. The interior of the waterway in the body shall be full opening and capable of passing a full sized shell cutter.

ADDITIONAL REQUIREMENTS:

For the purpose of standardization valve shall be either the U.S. PIPE A-USPO-23 GATE VALVE, the AMERICAN FLOW CONTROL SERIES 2500 GATE VALVE, or the MUELLER A2360-23 RESILIENT SEATED GATE VALVE only.

**TOWN OF DARTMOUTH
DEPARTMENT OF PUBLIC WORKS - WATER AND SEWER DIVISION
SPECIFICATIONS**

BUTTERFLY VALVES (Rubber Seated)

Butterfly valves shall be furnished in accordance with the requirements of the latest American Water Works Standard C504-Class 150-B and shall be in full compliance with the following supplementary requirements:

Valve body exterior and interior shall have a fusion bonded epoxy coating in accordance with AWWA C-555.

The valve shall be designed so that during operation, or cycling of the valve, there is no friction or abrasion or rubbing together that could wear away any coating material and expose bare iron.

The interior of the valve body shall be free of pockets or ledges where sediment or debris can collect.

“O” ring seal shall be replaceable with the valve under pressure in the full-open position.

Valve-shall be capable of operating through 500 full cycles with zero leakage and without regard to direction of valve discharge or operating pressures.

Butterfly valves shall OPEN RIGHT with a 2” square operating nut and the ends shall have mechanical joint fittings (with joint accessories).

ADDITIONAL REQUIREMENTS:

For purpose of standardization valve shall be Muller Lineseal III or approved equal. For valves up to 12” in size, gate valves shall be utilized: Above 12” size, butterfly valves shall be used. Any proposed deviation to this rule shall be submitted as a special request, in writing, to the Superintendent for review and final approval.

**TOWN OF DARTMOUTH
DEPARTMENT OF PUBLIC WORKS - WATER AND SEWER DIVISION
SPECIFICATIONS**

HYDRANTS:

Hydrants shall be furnished in accordance with the requirements of the latest American Water Works Standard C502 for Dry Barrel fire hydrants and shall be in full compliance with the following supplementary requirements:

The hydrants shall be of a dry top design with compression type main valve (opens against water pressure) and have a minimum of 5 1/4 valve opening.

The operating threads shall be protected by a lubricant chamber that is sealed from the water-way by use of "O" rings. Dry top design is to include a factory lubricated operating mechanism, which allows supplemental lubricant to be added in the field without removal of the top section. Standard lubricant where required shall be oil, which shall be suitable for human consumption and not pose a health threat if introduced into the Public Water Supply, and suitable for a temperature range of -60 to +150 degrees Fahrenheit.

The upper and lower sections of the hydrant shall be connected as such to prevent damage if struck by a vehicle (Traffic Hydrant). This design shall also permit the rotation of the hydrant to any position without excavation or disassembly of the operating components in the hydrant.

The main valve seat shall be bronze and threaded into a bronze bushing or sub-seat. The drain mechanism shall be integral with the valve assembly to provide flushing of the drain ports each time the hydrant is operated.

The hydrant inlet shall have a standard 6" mechanical joint connection complete with all accessories for connecting to Ductile Iron Pipe.

The internal parts of the hydrant shall be removable without excavating around the hydrant by use of manufacturers special hydrant tools.

Hydrant extension units shall be available in a minimum of 6 " increments complete with rod extension couplings, flanges, gaskets, and hardware to facilitate raising of the hydrant where necessary.

The hydrant shall have 2 - 2 1/2" N.S.T., (National Standard Threads) hose nozzles with caps and 1 - 4 1/2"1 N.S.T. pumper nozzle with cap. Chains for retaining caps shall not be included. All cap threads shall have a thin even application of a high temperature anti-seize and lubricating compound such as Never-Seize, or equal.

HYDRANTS - Continued:

The operating nut shall be a one-piece bronze casting. Both the operating nut and nozzle cap nuts are to be pentagon in shape, at least measure 1" (one inch) from point to flat at the base of the nut and the overall height of the nut shall be not less than 1". Caps are to be provided with rubber gaskets.

The hydrant shall OPEN to the RIGHT. The operating direction of the hydrant valve must be clearly and permanently marked on the hydrant for quick reference by an operator. The hydrant exterior above ground level shall have received on coat of rust inhibitive primer and one coat of weather and chemical resistant, high gloss Red paint with exceptional color retention such as Pennsbury "Hydrant Hyde" or equal and the bonnet section shall receive a coat of durable white reflective paint such as "Scotch-lite" or equal, over the primer.

ADDITIONAL REQUIREMENTS:

For the purpose of standardization, hydrant shall be either AMERICAN DARLING B-62-B or U.S. PIPE METROPOLITAN M-94 or MUELLER "SUPER CENTURION 200"/A-433.

**TOWN OF DARTMOUTH
DEPARTMENT OF PUBLIC WORKS - WATER AND SEWER DIVISION
SPECIFICATIONS**

DUCTILE IRON PIPE:

Water pipe is to be Class 52 cement-lined ductile iron conforming in wall thickness to ANSI Spec. A21.51-1981, and AWWA C151, tar coated on the outside with push-on joints. Inside cement coating shall not be less than 1/8 inch and conform to ANSI Specs. A21.11-72 and A21.4-1980 and AWWA C-104.

Jointing material shall be solid rubber rings with wedges and shipped separately from each length of pipe and shall conform to ANSI Spec. A21.11-1980 and AWWA C-111. The pipe shall have normal laying lengths of at least 15 feet.

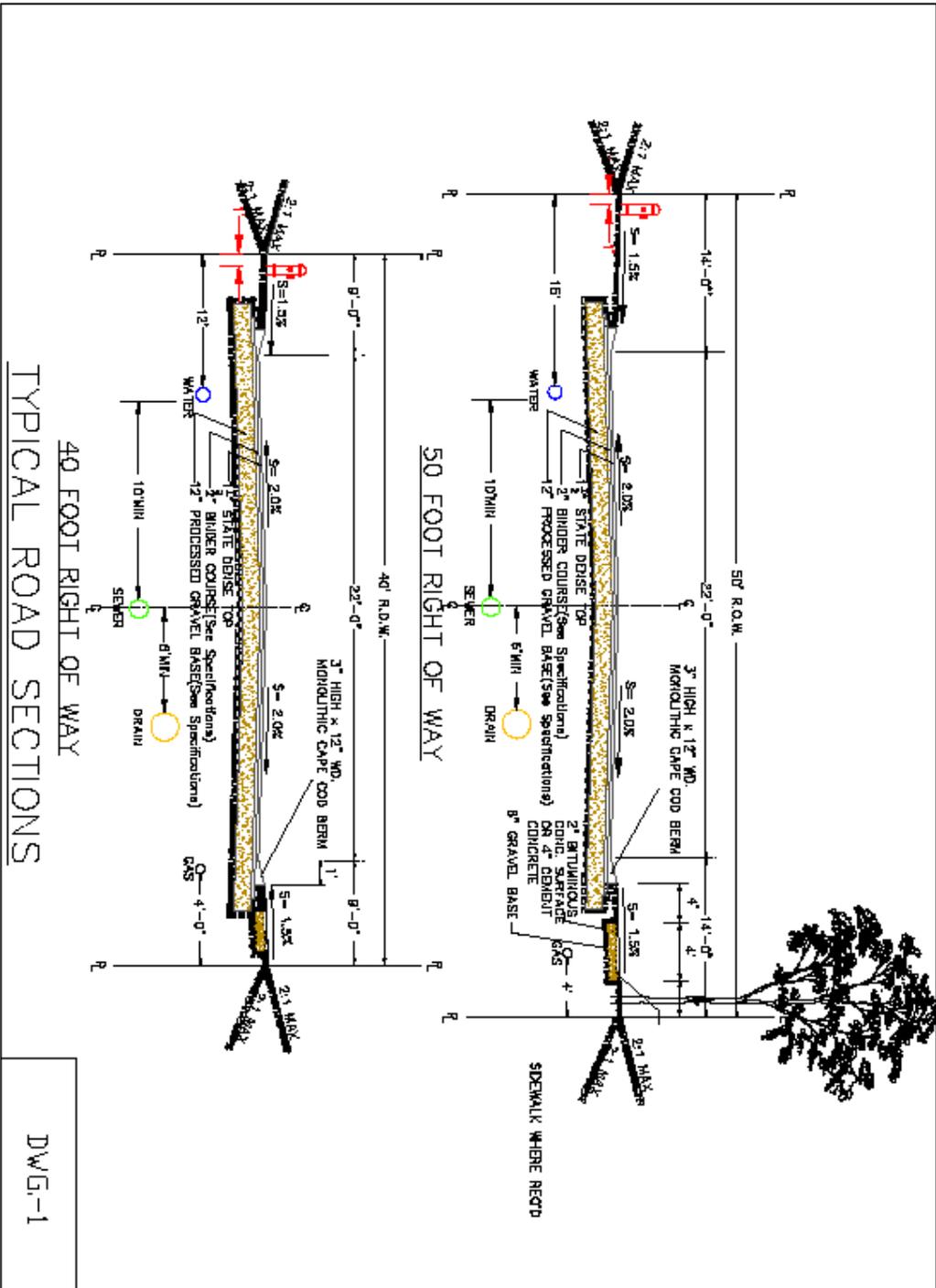
COPPER TUBING:

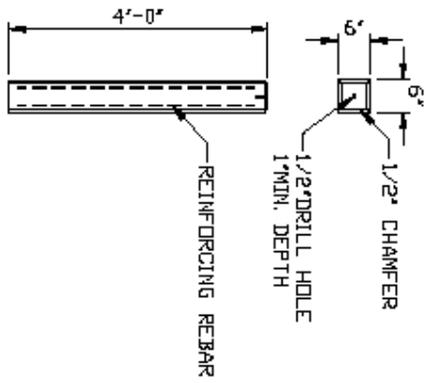
Tubing shall be in accordance with and conforming to A.W.W.A. Specifications 7S-CR Type K or Federal Specs. W.W.T. 700 Type K, as amended to 40 foot, 60 foot, or 100 foot coils, and 20 foot lengths.

WATER MAIN FITTINGS:

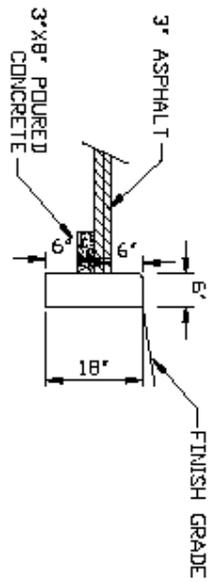
Fittings shall be either cast iron or ductile iron. Cast-iron fittings shall conform to the requirements of ANSI Spec. A21.10-1982 and AWWA C110. Fittings shall have a minimum working pressure of 150 p.s.i.

The fittings shall be cement-lined with a bituminous seal coat inside and outside in accordance with ANSI Spec. A21.11-1972 and A21.4-1980 and AWWA C104.

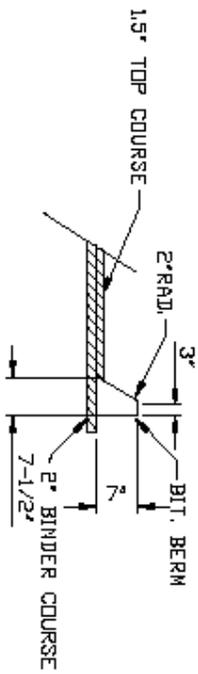




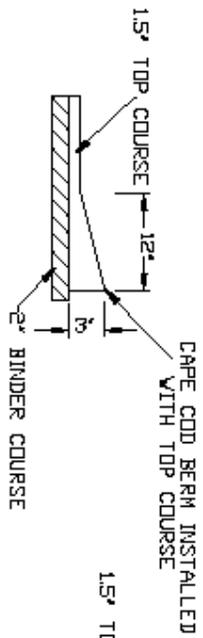
CONCRETE BOUND



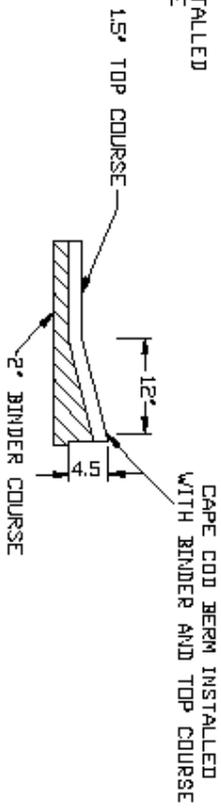
CONCRETE OR GRANITE CURB



BITUMINOUS CONCRETE VERTICAL BERM

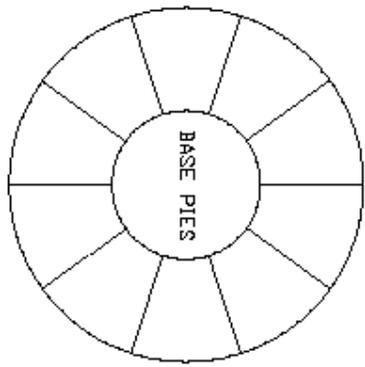
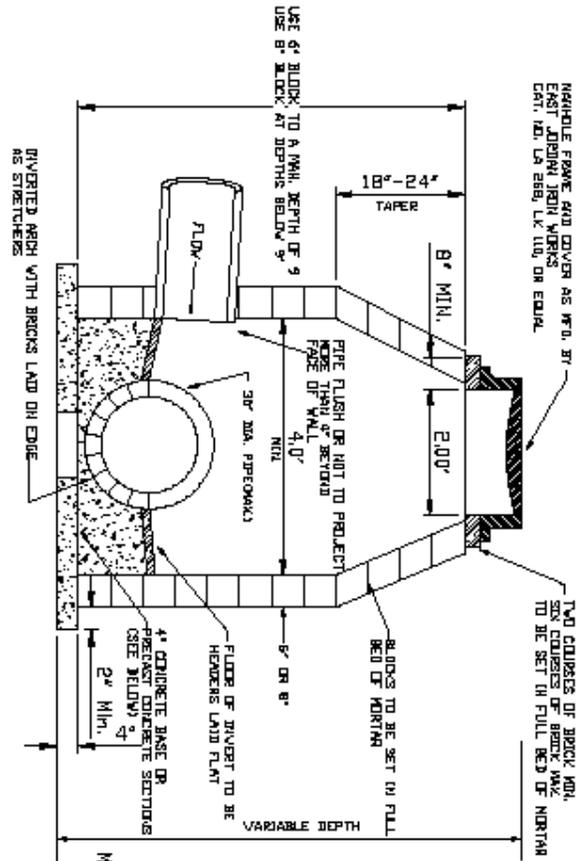


MONOLITHIC FORMED CAPE COD BERM



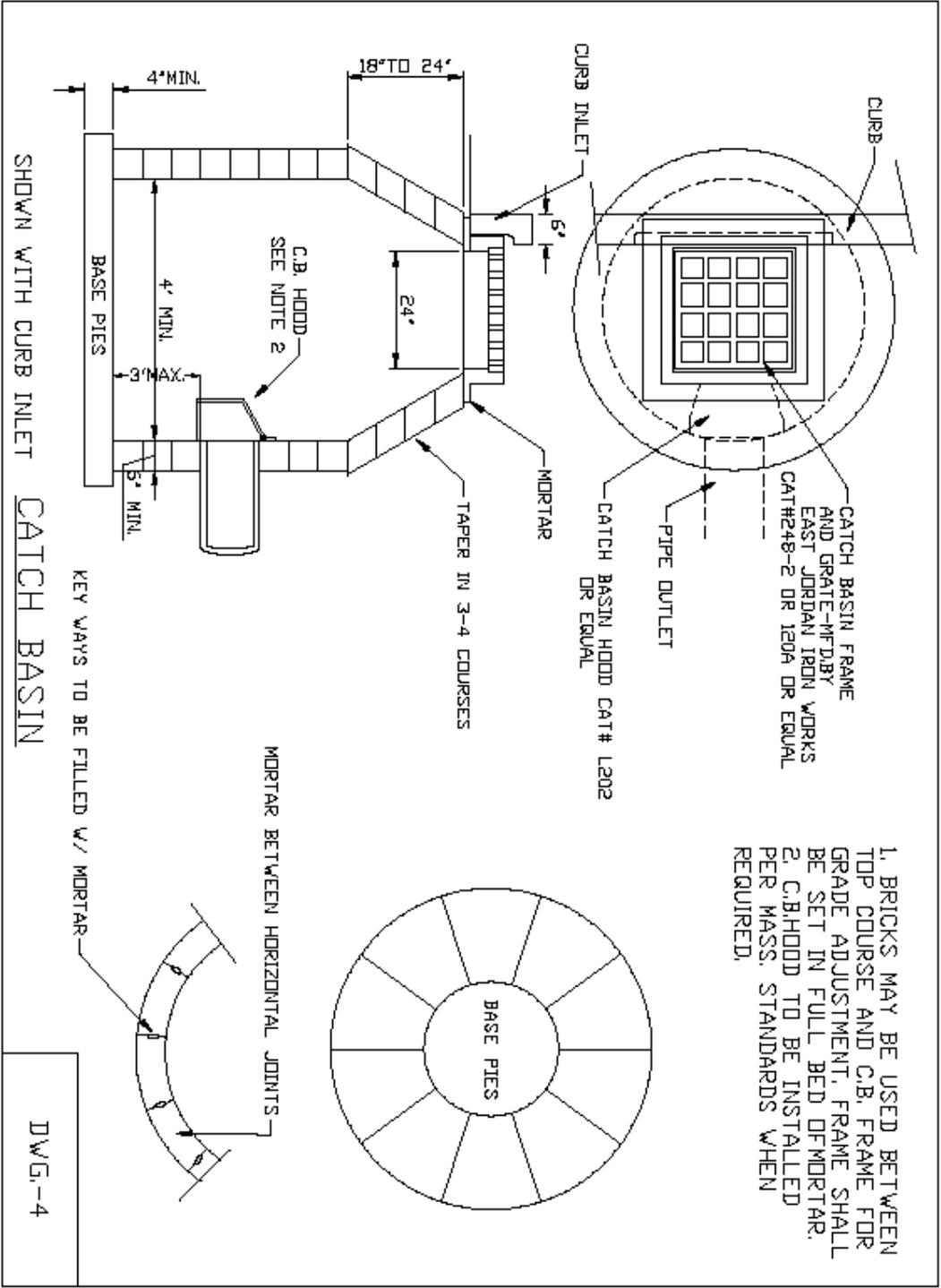
MISCELLANEOUS ROAD DETAILS

DWG.-2



DRAIN MANHOLE

DWG.-3

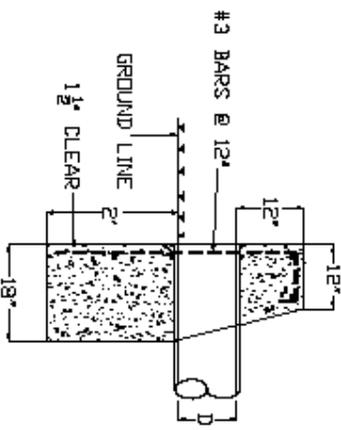
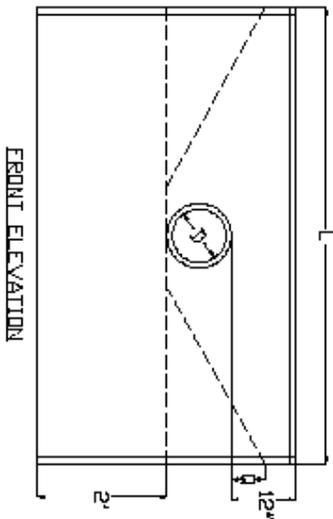


1. BRICKS MAY BE USED BETWEEN TOP COURSE AND C.B. FRAME FOR GRADE ADJUSTMENT. FRAME SHALL BE SET IN FULL BED OF MORTAR.
2. C.B. HOOD TO BE INSTALLED PER MASS. STANDARDS WHEN REQUIRED.

SHOWN WITH CURB INLET CATCH BASIN

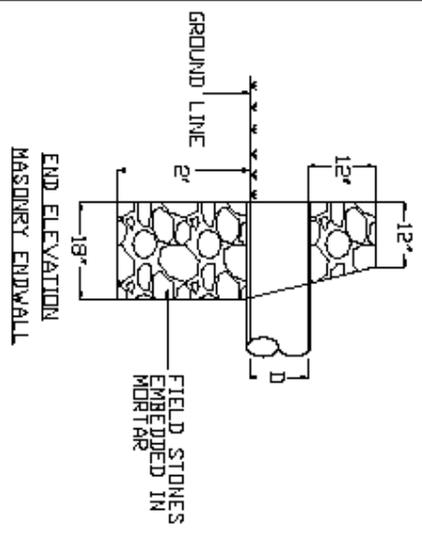
KEY WAYS TO BE FILLED W/ MORTAR

DWG-4

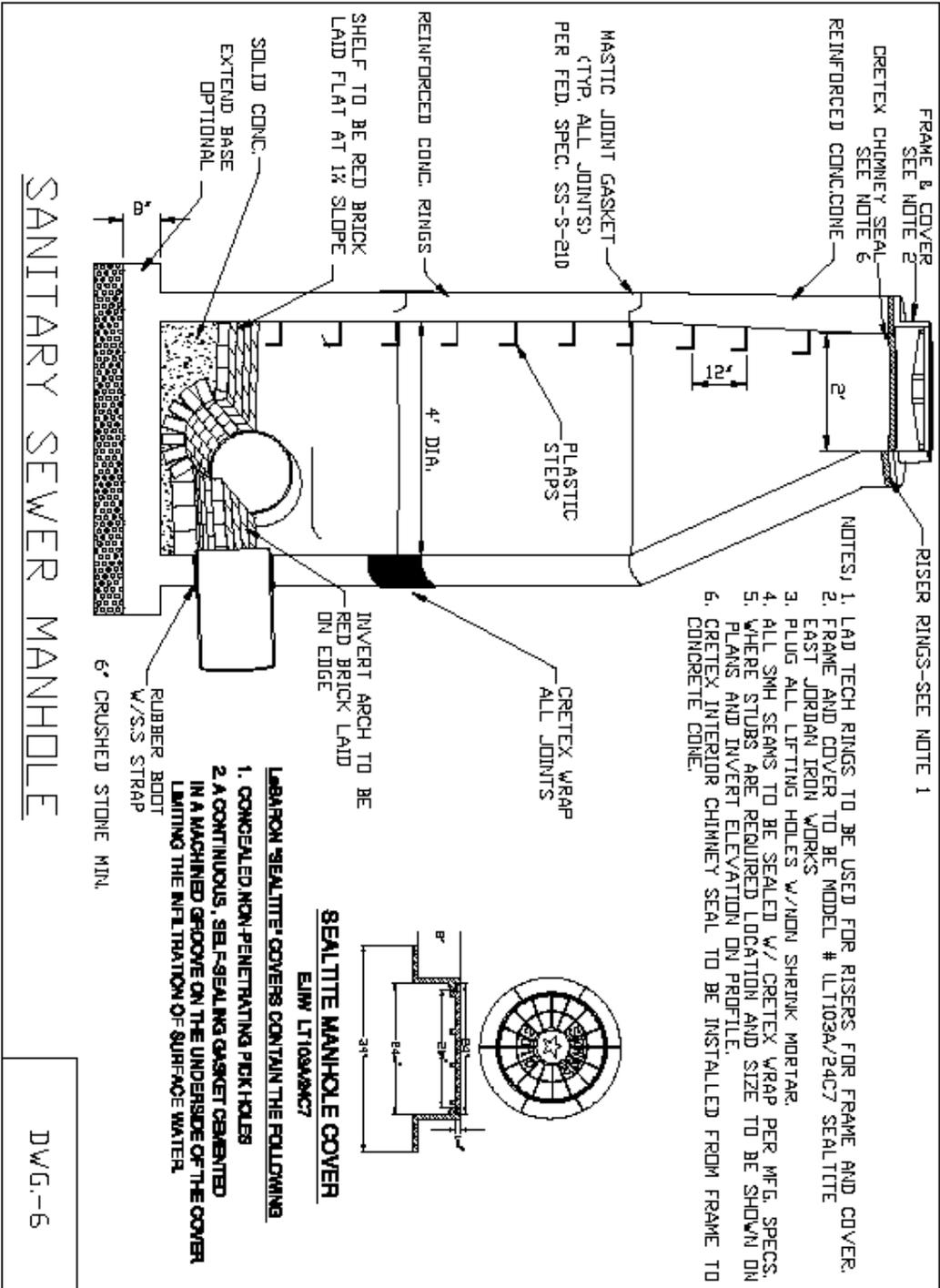


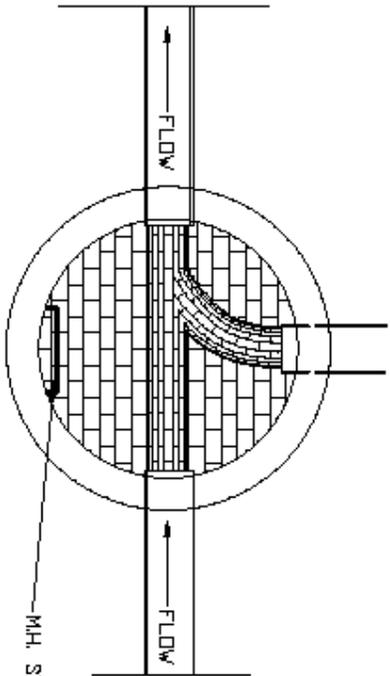
TRENCH EXCAV. I'DEPTH	PIPE DIA.	1 1/2 : 1 SLOPE			2:1 SLOPE			TRENCH EXCAV. I'DEPTH
		L	CONC. FSM CU.YDS	STEEL LBS	L	CONC. FSM CU.YDS	STEEL LBS	
21.60	8"	4'-6"	0.77	15	5-10"	1.08	21	27.40
23.91	10"	4'-10"	0.92	20	6'-8"	1.28	23	30.35
26.25	12"	5'-6"	1.08	21	7'-6"	1.49	29	33.25
29.75	15"	6'-6"	1.34	24	8'-9"	1.82	32	37.63
33.25	18"	7'-6"	1.61	30	10'-0"	2.16	39	42.00
37.35	21"	8'-8"	1.95	34	11'-6"	2.62	43	47.25
39.38	24"	9'-3"	2.16	35	15'-0"	2.97	50	50.75

END ELEVATION
CONCRETE ENDWALL



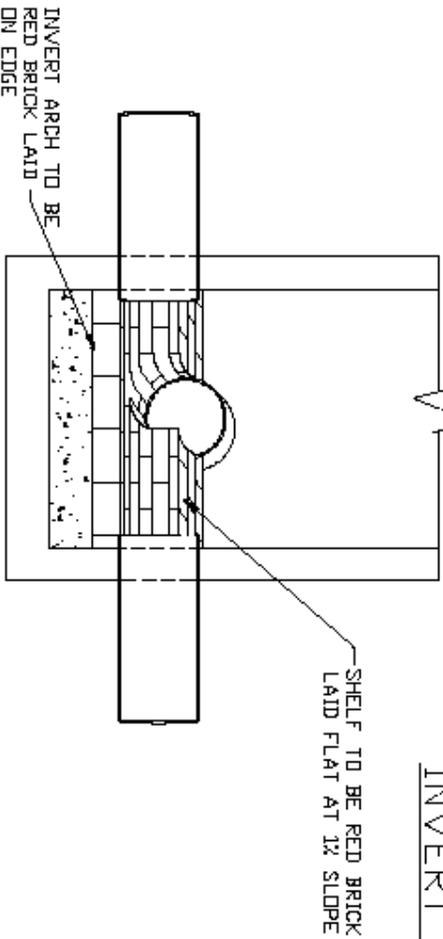
CONCRETE AND MASONRY END WALLS



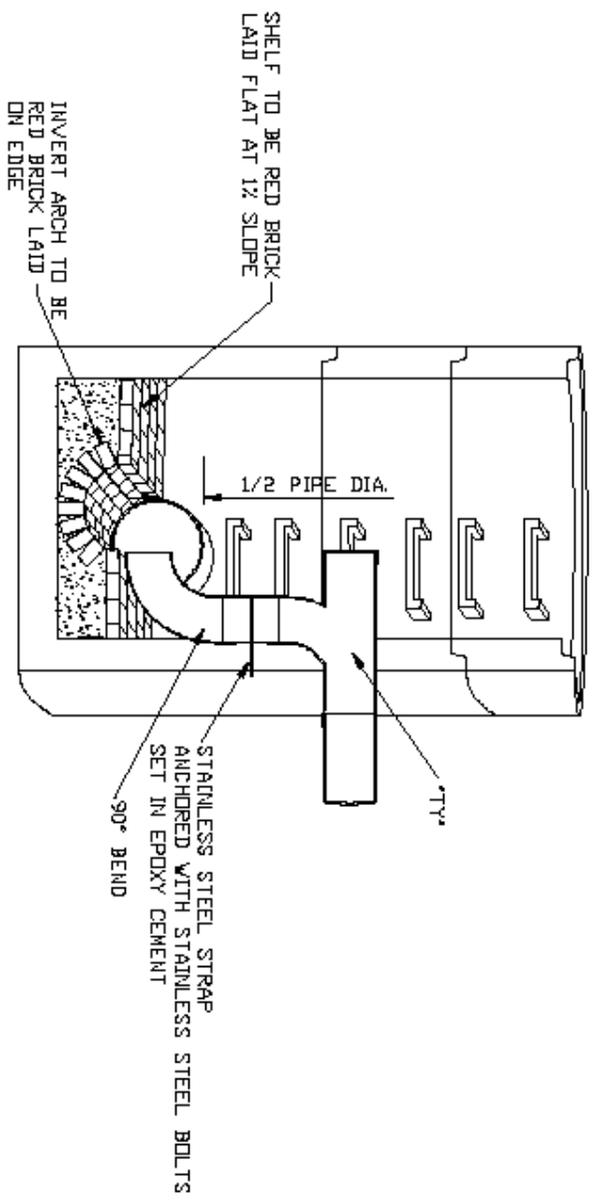


TOP VIEW

SEWER MANHOLE
INVERT CONSTRUCTION

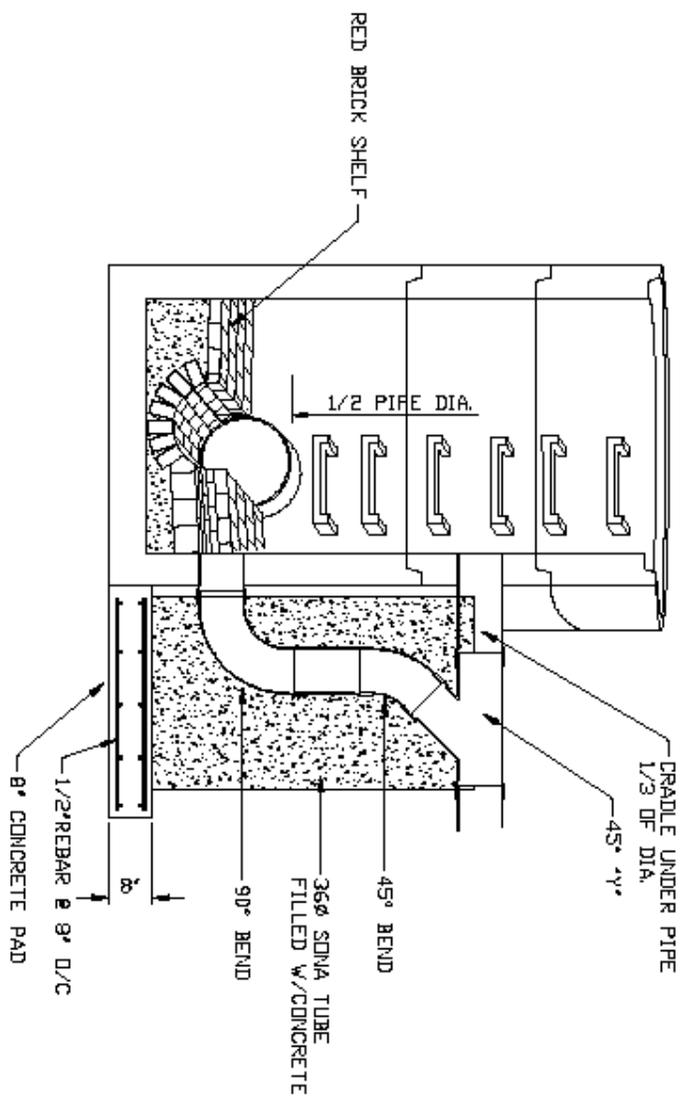


CROSS SECTION



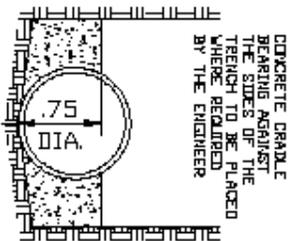
SANITARY SEWER DROP INLET
INSIDE INSTALLATION

DWG.-8

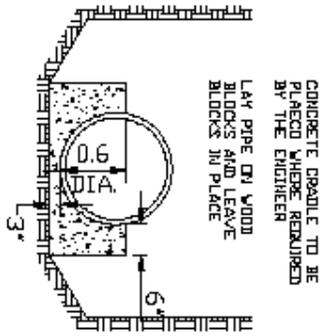


SANITARY SEWER DROP MANHOLE
OUTSIDE DROP

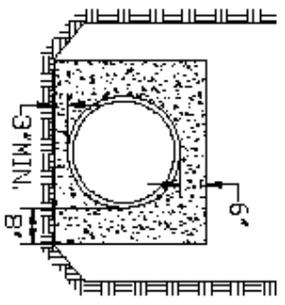
DWG.-9



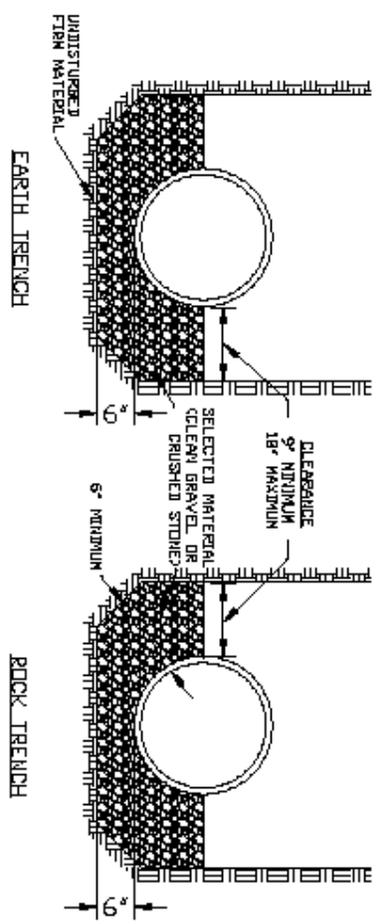
NARROW TRENCH



WIDE TRENCH
CONCRETE CRADLE



DEEP TRENCH
FULL ENCASUREMENT



SELECTED MATERIAL

SPECIAL BEDDING FOR SANITARY SEWERS

DWG.-10

NOTE
TYP. FOR WATER
SERVICE ALSO

NEW BIT. CONC.
1-1/2" BASE/1-1/2" TOP

FLOWABLE FILL

12"

UNDISTURBED
SOIL

INSTALLATION OF NEW SEWER SERVICE



6" ENVELOPE OF 3/4" CRUSHED STONE
(ENVELOPE OF SAND FOR WATER SERVICE)

REPLACE BERM OR
CURB IF NEEDED

RAMP EDGE W/ PAVEMENT

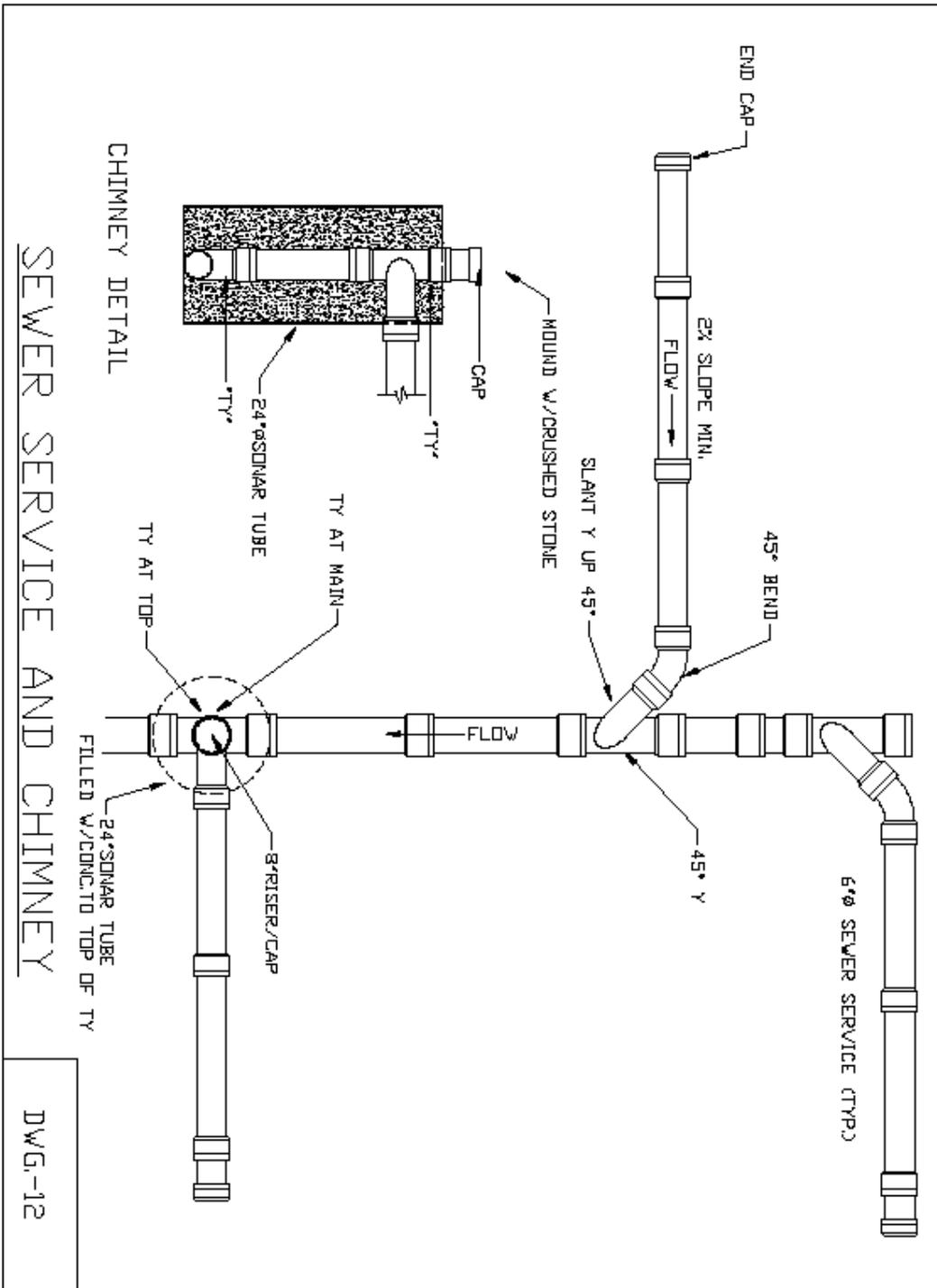
TEMPORARY STEEL PLATE
TO BE LEFT ON TRENCH
MIN. OF 24 HRS.

FLOWABLE FILL AREA

TACK 12" AREA AND EDGE PRIOR TO PAVING

12" SAW CUT PAVEMENT

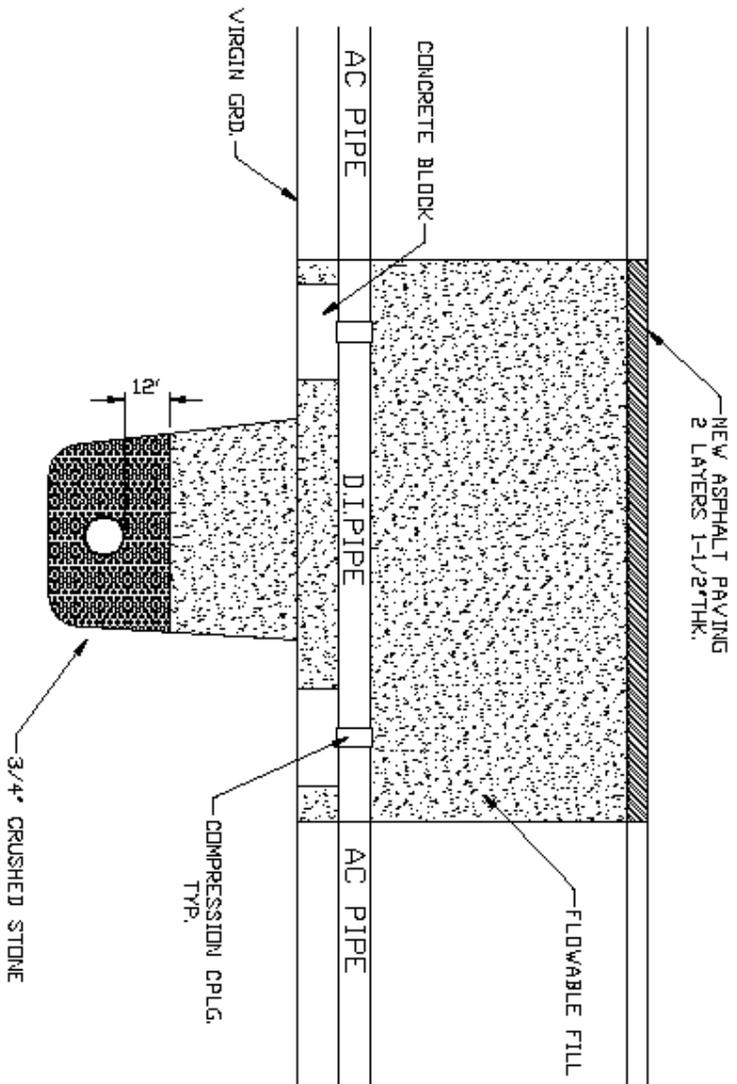
DWG.-11



SEWER SERVICE AND CHIMNEY

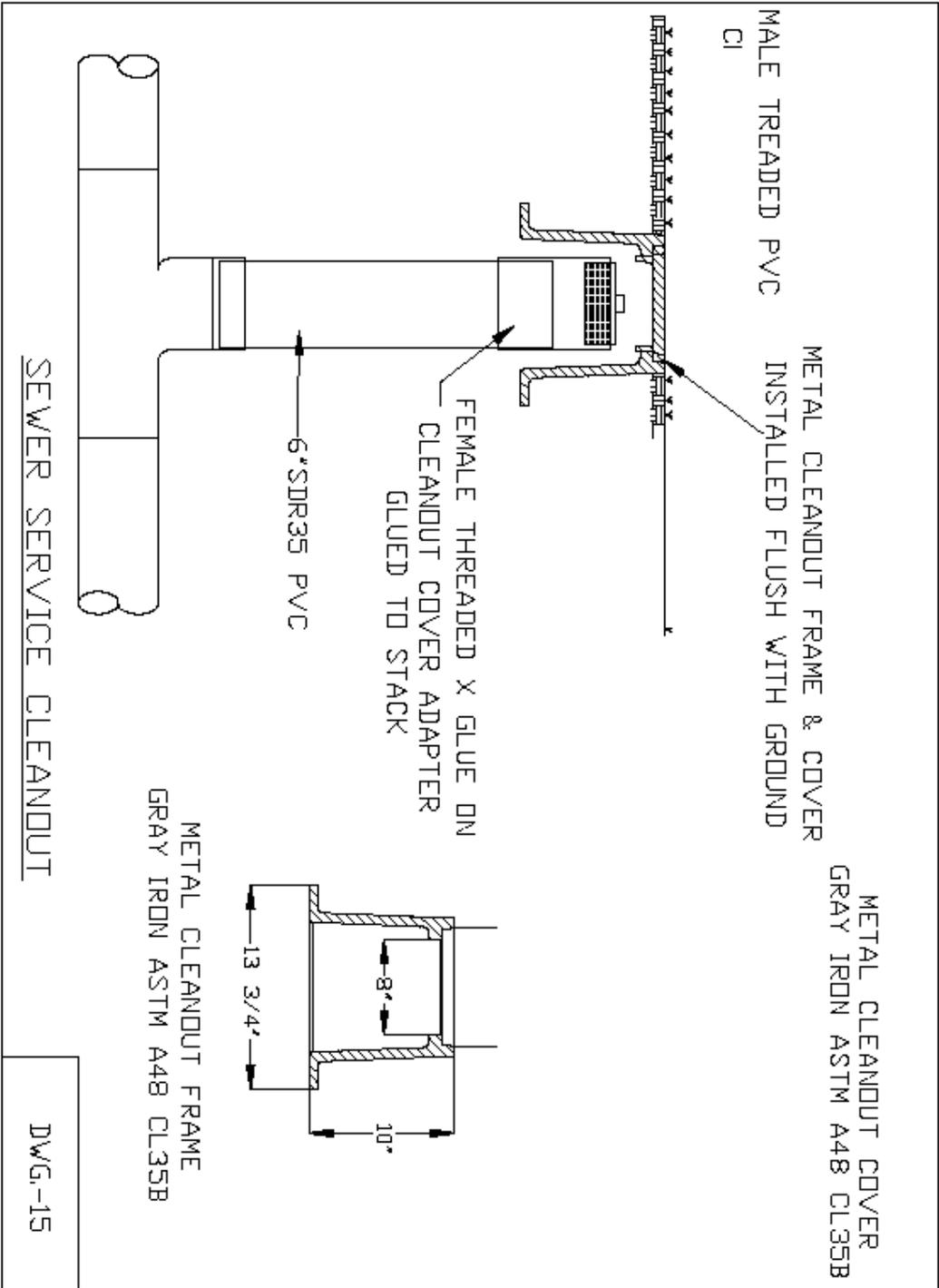
DWG-12

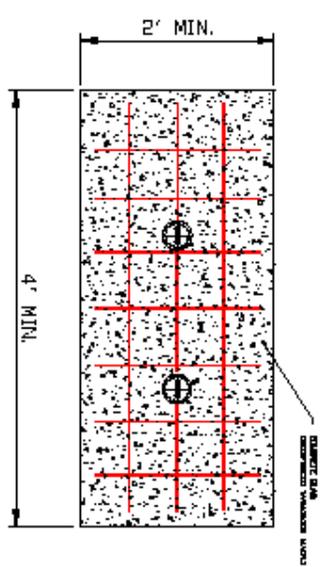
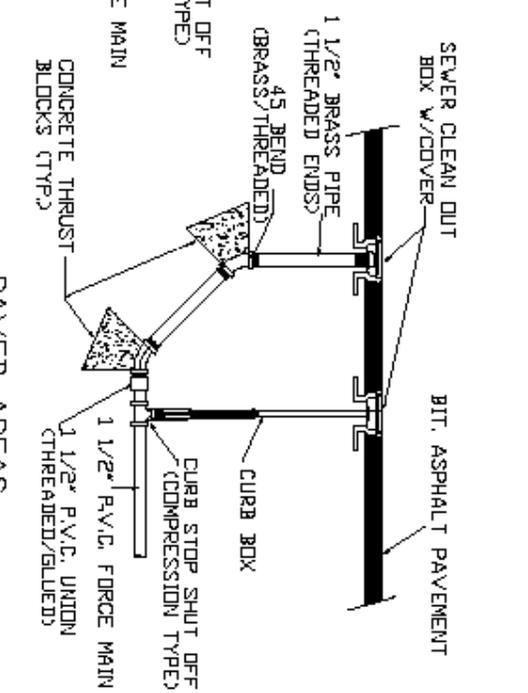
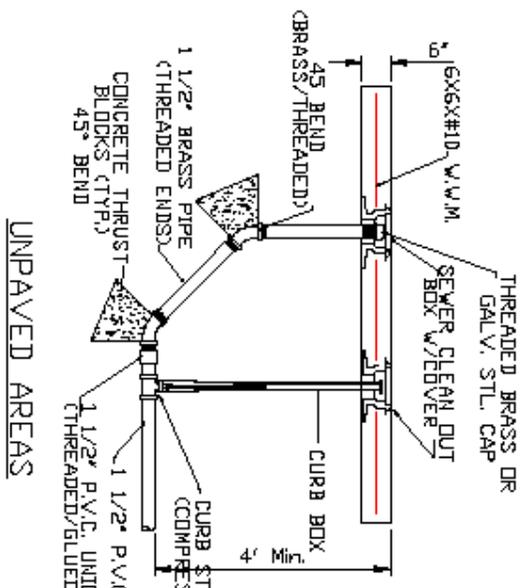
NOTE: TRENCH TO BE STEEL PLATED FOR 24 HR. MIN.



AC WATER MAIN CROSSING

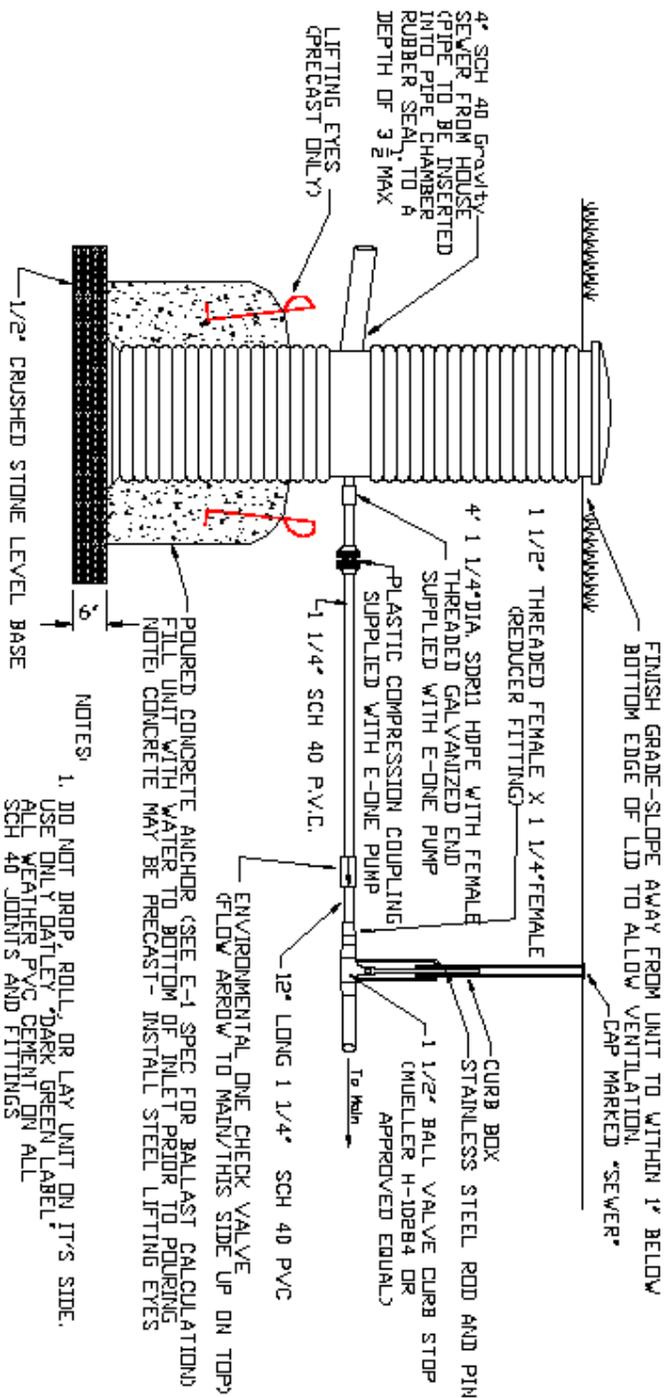
DWG-13





FORCE MAIN END LINE CLEANOUT DETAIL

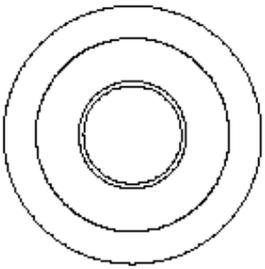
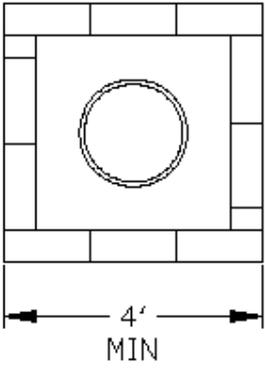
DWG-16



- NOTES:
1. DO NOT DROP, ROLL, OR LAY UNIT ON IT'S SIDE. USE ONLY DATILEY "DARK GREEN LABEL" ALL WEATHER PVC CEMENTION ALL SCH 40 JOINTS AND FITTINGS
 2. POURED CONCRETE ANCHOR (SEE E-1 SPEC FOR BALLAST CALCULATION) FILL UNIT WITH WATER TO BOTTOM OF INLET PRIOR TO POURING. NOTE: CONCRETE MAY BE PRECAST - INSTALL STEEL LIFTING EYES
 3. ALL PVC, SCH40 PIPE AND FITTINGS MUST HAVE A MINIMUM PRESSURE RATING OF 370 PSI WITH A CELL CLASS OF 12454-B

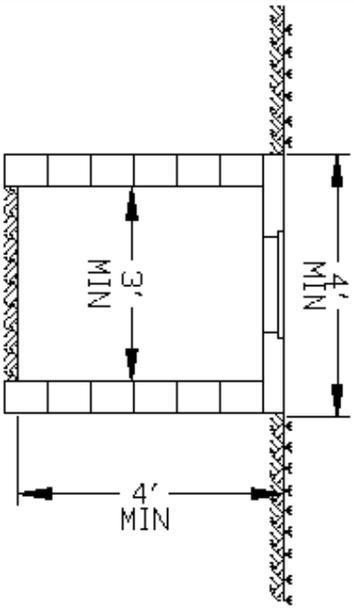
ENVIRONMENTAL ONE PUMP CONNECTION

DWG.-17



ALL METER PITS SHALL CONFORM TO DIMENSIONS & INSTALLATION AS DESCRIBED BELOW:

1. PITS MAY BE SQUARE, RECTANGULAR, OR ROUND AND SHALL BE CONSTRUCTED OF CEMENT BLOCKS OR PRECAST CONCRETE.
2. IF SQUARE, THE MINIMUM DIMENSION SHALL BE 4'-x-4'-x-4' DEEP.
3. IF ROUND, THE MINIMUM DIAMETER SHALL BE 36" INSIDE AND 4' DEEP.
4. THE RING AND COVER SHALL BE CAST IRON AND THE COVER OPENING NOT LESS THAN 20" IN DIAMETER, INSTALLED AT GROUND LEVEL.
5. ALL SERVICES SHALL ENTER THE PIT AT A 90° ANGLE TO THE STREET.
6. METER PITS FOR SERVICES LARGER THAN ONE INCH SHALL BE CONSTRUCTED LARGE ENOUGH TO ACCOMMODATE THE METER AND NECESSARY BYPASS PIPING.



METER PIT SPECIFICATIONS

DWG-18