

Suggestions for customizing this Special Provision to fit your project needs:

- Read through first.
- Determine what applies to your project.
- If there is a section that does not apply to the project, leave the section in. It will be there in case something comes up during construction where it might be needed.
- Modify sections that are in conflict with Town requirements.
- If a section will adversely affect the Town requirements or is inappropriate, replace the wording for the section with the word **Blank**; then sections that follow will not need to be renumbered.
- At the end of the document is a key for the NHDOT standardized item numbers and descriptions. Please leave the key intact, as this will allow access to other items that may come up during construction. Use this key to prepare item numbers/descriptions for the purposes of the estimate of quantities and costs.
- If there is a special sewer item that is not in the list, contact the NHDOT Utility Coordinator to determine what the item number and description should be.
- If you need items for other work activities like common structure excavation-exploratory, pipe jacking, concrete pipe or others that are not part of this specification please contact the NHDOT Utility Coordinator for assistance. There are provisions already written for use and, as in the case of pipe jacking on NHDOT projects, we would like to keep them as separate special provisions.
- If your project must include proprietary items, please send the Department a justification letter explaining why you need those specific items. The Department will use that letter in the filling out of a Request for Approval of Public Interest Finding form (PIF).
- Please preserve the formatting of the document to maintain conformity with the NHDOT Standard Specifications.
- This Special Provision was written in dual units so that it could be used with either imperial or metric. Leave it that way, it won't hurt a thing.
- This document should be set to 'track changes' while editing. Any changes you make will be highlighted, making reviewing much easier. If you have problems working with the edit tracking, contact the NHDOT Utility Coordinator for help.

**PROJECT NAME
NUMBER**

Date

SPECIAL PROVISION

SECTION 612 -- SANITARY SEWER INSTALLATION

Description

1.1 General Description of Work. This work shall consist of furnishing and installing [*Describe the work (size, length, structures, location, etc.) in general terms—two or three sentences*] ductile iron gravity sanitary sewer main, sewer services, sewer manholes, allowing the continuance of sanitary sewer service, excavation, bedding, backfill, as shown on the plans and specified herein. The CONTRACTOR shall be responsible for supplying and installing the new sewer main piping and appurtenances in accordance with the sewer plans and specifications or as ordered by the Engineer.

1.1.1 The [*Town of . . .*] or its Designated Representative, hereinafter called OWNER, together with the ENGINEER, will inspect, accept, and/or reject work related to the sanitary sewer installation herein specified.

1.1.2 The CONTRACTOR shall furnish all materials, labor, tools, and equipment and perform all operations, testing, and incidentals necessary for a complete sewer installation as shown on the plans and specified herein.

1.2 Sequence/Maintenance of Service. The CONTRACTOR shall provide a bypass pumping system as necessary to maintain continuous sewer service. The CONTRACTOR shall be responsible for providing whatever is necessary to allow for continuation of sewage flow from residences upstream of, and adjacent to, the construction of the replacement sewer. The flow shall be maintained in whatever manner the CONTRACTOR chooses; however, the method chosen must provide for round-the-clock fail-safe sewer service which shall not result in any spills. Should pumps be employed by the CONTRACTOR to maintain flow, the pumps shall be electrically driven and powered by electrical drops from power companies during non-working hours. The CONTRACTOR shall submit the proposed plan to maintain sewage flow to the OWNER for review and approval a minimum of 10 days prior to start-up of the bypass system.

1.3 Reference Drawings and Information. The plans indicate, in general, the alignment and finished grade elevation and underground utility and piping invert grades. The ENGINEER may make such adjustments in grade and alignment, as are necessary, in order to avoid interference and to adapt the piping to other special conditions encountered. All locations of existing pipes, utilities, etc., shall be verified by the CONTRACTOR with the proper authority. Neither the NHDOT nor the OWNER guarantees the accuracy or completeness of the existing conditions shown on the construction plans. Cover over pipes shall conform to requirements of the New Hampshire Department of Environmental Services (NHDES).

1.3.1 Sufficient investigations shall be made by the CONTRACTOR so that the CONTRACTOR is knowledgeable about existing conditions prior to tendering a bid.

1.4 Submittals

1.4.1 Shop Drawings are required for each and every element of the sewer facilities installation work. _____ copies of shop and working drawings for sewer facilities shall be submitted to the City/Municipality Sewer Division or its Designated Representative, together with the ENGINEER for approval in accordance with 105.02. Each shop drawing shall be assigned a sequential number for purposes of easy identification, and shall retain its assigned number, with appropriate subscript, on required resubmissions.

1.4.2 Shop Drawings are generally defined as all fabrication and erection drawings, diagrams, brochures, schedules, bills of material, manufacturers data, spare parts lists, and other data prepared by the CONTRACTOR, his subcontractors, suppliers, or manufacturers which illustrate the manufacturer, fabrication, construction, and installation of the work, or a portion thereof.

1.4.3 Shop Drawings shall be submitted as a complete package by Special Provision section, unless otherwise reviewed and approved by the ENGINEER. It is the intent that all information, materials and samples associated with each specification section be included as a single submittal for the ENGINEER's review. Any deviation from this requirement, such as submitting miscellaneous metals grouped by structure, shall be requested in writing prior to any associated submittal.

1.4.4 The CONTRACTOR shall be responsible for the prompt and timely submittal of all shop and working drawings so that there shall be no delay to the work due to the absence of such drawings.

1.4.5 No material or equipment shall be purchased or fabricated specifically for the Contract until the required shop and working drawings have been submitted as hereinabove provided and reviewed for conformance to the Contract requirements. All such materials and equipment and the work involved in their installation or incorporation into the Work shall then be as shown in and represented by said drawings.

Materials

2.1 Earthwork Materials

2.1.1 Common Backfill. Common backfill shall be granular material consisting of hard sand and gravel so graded that, of the material passing the No. 4 (4.75 mm) sieve, not more than 35% shall pass the No. 200 (0.075 mm) sieve. Common backfill shall be free of organic matter, trash, roots or other deleterious material and shall contain no stone measuring greater in any dimension than two-thirds of the loose lift thickness, or 8 inches (200 mm), whichever is smaller. Common backfill material shall be capable of forming a firm, stable base when spread and compacted in accordance with this specification. In addition, common backfill shall be non-

plastic (plasticity index zero, defined as liquid limit minus plastic limit). Common backfill materials may be obtained from either on-site excavations or from off-site sources. Any materials excavated from the trench and not conforming to this specification shall be properly disposed of as specified and replaced with approved material, as required, at no additional cost to the OWNER or DEPARTMENT.

2.1.2 Sand Blanket Material. Sand blanket material required for installation of the sewer mains, services, and appurtenances shall meet the following gradation requirements, 100% passing the ½ inch (12.5 mm) sieve and, of the material passing the #4 (4.75) sieve, no more than 12% passing the #200 (0.075 mm sieve).

2.1.3 Gravel Fill. Gravel fill shall consist of hard, durable gravel free from trash, organic matter, clay, surface coatings, and other deleterious materials. Gravel fill shall have a maximum stone size of two-thirds of the loose lift thickness, or 6 inches (150 mm), whichever is smaller. That portion passing the 4 inch (100 mm) sieve shall meet the following gradation requirements, as determined by ASTM C 136 and ASTM C 117:

<u>Sieve Size</u>	<u>Percent Passing</u>
6 inch (150 mm)	100
No. 4 (4.75 mm)	25-70
No. 200 (0.075 mm) *	0-12

* Based on fraction passing the No. 4 (4.75 mm) sieve.

2.1.4 Crushed Gravel. Crushed gravel shall consist of hard durable sand and gravel, free from trash, organic matter, clay, surface coatings, and other deleterious materials. Crushed gravel material shall meet the following gradation requirements, as determined by ASTM C 136 and ASTM C 117:

<u>Sieve Size</u>	<u>Percent Passing</u>
3 inch (75 mm)	100
2 inch (50 mm)	95-100
1 inch (25 mm)	55-85
No. 4 (4.75 mm)	27-52
No. 200 (0.075 mm)*	0-12

* Based on fraction passing the No. 4 (0.075 mm) sieve.

2.1.5 Bedding. Bedding shall be crushed stone conforming to ASTM C 33 stone size No. 67 gradation requirements.

2.2 Sanitary Sewer. All products and materials shall conform to the latest ASTM, ANSI or other appropriate standards and as otherwise specified herein.

2.2.1 Gravity Polyvinyl Chloride Pipe shall be SDR-35, push-on joint conforming with ASTM D 3034. Fittings shall comply with ASTM D 3034. Joints shall comply with ASTM D 3212.

2.2.1.1 Each length of pipe shall have an integral bell and shall be supplied in 12.5 foot (3.81 m) lengths.

2.2.1.2 Joint shall be push-on type using elastomeric gasket designed to prevent slipping during jointing. The gaskets shall be factory installed and secured in place prior to delivery to the job site.

2.2.1.3 Wye branch connections shall be supplied for service connections.

2.2.1.4 All pipe, fittings, gasket material, and lubricant shall be supplied by the same manufacturer. Petroleum base lubricants shall not be used.

2.2.1.5 Physical and chemical properties of pipe couplings shall be equal to those properties of the pipe.

2.2.2 Mechanical Joint (MJ) Ductile Iron Pipe for use on bridge crossings shall conform to ANSI A21.51/AWWA C151 Class 52. MJ fittings for bridge crossings shall be ductile iron conforming to ANSI A21.10/AWWA C110. Other pipe installations and mechanical fitting joints shall meet ANSI A21.11/AWWA C111 standards and shall include plain rubber gaskets. Pipe and fittings shall be double cement lined and seal coated inside and outside in accordance with ANSI A21.4/AWWA C104. All pipe and fittings shall be furnished with ductile iron retainer glands.

2.2.3 Push-On Type Ductile Iron Pipe shall be ductile iron complying with ANSI A21.51 and AWWA C151, Class 52. Pipe shall be double cement-lined $\frac{1}{8}$ inch (3 mm) thick and seal coated inside and out in accordance with ANSI A21.4 and AWWA C104. Joints shall be rubber gasket, push-on type in accordance with ANSI A21.11 and AWWA C111. Use only lubricant that is specified by the pipe manufacturer.

2.2.4 Flexible Couplings and Transition Couplings for non-pressure sewer pipe shall be resilient elastomeric plastic with recessed stainless steel bands at each end for fastening.

2.2.5 Couplings used to join plain ends of PVC pipes shall be PVC double bell couplings, which shall conform to ASTM D 3034 for materials and ASTM D 3212 for joints.

2.2.6 Identification. Each pipe length and fitting shall be clearly marked with:

2.2.6.1 Manufacturer's name and trademark.

2.2.6.2 Nominal pipe size with sidewall dimension ratio.

2.2.6.3 Material designation.

2.3 Precast Concrete Manholes

2.3.1 Materials

2.3.1.1 Cement shall conform to ASTM C 150, Portland Type II.

2.3.1.2 Fine and coarse aggregates shall conform to ASTM C 33.

2.3.1.3 Water shall be fresh, clean and potable.

2.3.1.4 Reinforcing steel shall conform to ASTM A 615, Grade 60.

2.3.1.5 Welded wire fabric shall conform to ASTM A 185.

2.3.2 Precast Manhole Sections

2.3.2.1 Precast manhole structures shall be capable of supporting H-20 loads.

2.3.2.2 Cone sections shall be eccentric.

2.3.2.3 In lieu of a cone section, when manhole depth is less than 6 feet (1.8 m), a reinforced concrete slab cover shall be used; having an eccentric entrance opening.

2.3.2.4 The base section shall be monolithic to a point at least 6 inches (150 mm) above the openings cast to receive the sewer lines. For drop manholes, any opening shall be a minimum of 6 inches (150 mm) away from any joint.

2.3.3 Manhole Joints and Pipe Seals

2.3.3.1 Horizontal joints between precast manhole sections shall be tongue and groove as shown on the Drawings and shall have a mastic-like sealant such as Ram-Nek, Kent Seal No. 2 or a butyl rubber joint gasket (O-ring) conforming to ASTM C 443. All horizontal joints shall be watertight in accordance with the testing requirements of this Section.

2.3.3.2 Pipe to manhole joints shall be an embedded flexible rubber boot or as shown on the plans. Non-shrinking mortar or grout is not acceptable. Pipe to manhole connections and joints shall be watertight in accordance with the testing requirements of this Section.

2.3.4 Waterproofing

2.3.4.1 All manholes shall be waterproofed, at the factory, with two seal coats applied to the exterior of the manhole in accordance with the seal coating manufacturer's recommendations. Waterproofing shall be masonry seal MSP-1 waterproofing material as made by the Masonry Seal Corporation, 7500 West Ridge Road, Elyria, Ohio, or Foundation Coating 47-461 as made by TNEMEC, 6800 Corporate Drive, Kansas City, Missouri, or approved equal.

2.3.4.2 Exterior of all joints shall be filled with hydraulic cement and then coated with waterproofing after setting.

2.3.5 Brick Masonry for inverts and grade adjustment shall conform to ASTM C 32, Grade SS.

2.3.6 Mortar

- 2.3.6.1** Masonry Cement shall conform to ASTM C 150 (Type II).
- 2.3.6.2** Aggregate for Masonry Mortar shall conform to ASTM C 144.
- 2.3.6.3** Hydrated Lime for Masonry purposes shall conform to ASTM C 207.
- 2.3.6.4** Mortar for Unit Masonry shall conform to ASTM C 270, Type S.
- 2.3.6.5** Premixed Materials shall conform to ASTM C 387.

2.4 Sewer Manhole Frames and Covers

2.4.1 General

- 2.4.1.1** Castings shall be at least Class 30 conforming to ASTM A 48.

2.4.1.2 The castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sand holes and defects of every nature which would render them unfit for the service for which they are intended.

2.4.1.3 Contact surfaces of covers and frame seats shall be machined at the foundry, before shipment to prevent rocking of covers in any orientation.

2.4.1.4 All castings shall be thoroughly cleaned and subject to a careful hammer inspection.

2.4.2 Manhole frames and covers shall provide a 30 inch (750 mm) diameter clear opening. The cover shall have the word "SEWER" in 3 inch (75 mm) letters cast into a diamond design top surface.

2.5 Casing pipe for highway crossing shall be steel and shall be in accordance with AP1 STD.5L, Grade B, X-42, ASTM A 139.

2.5.1 Casing Pipe:

<u>Description</u>	<u>8" (200 mm) Carrier Pipe</u>
Nominal Casing Size	24 in (600 mm)
Outside Diameter	24 in (600 mm)
Wall Thickness (min)	0.375 in (9.52 mm)
Weight (Mass) per Foot (Meter) (min)	94.62 #/ft (141 kg/m)
Yield Strength (min)	35,000 psi (241 MPa)
Type of Joint	Butt Welded
Type of Coating	None

2.5.2 Tolerance. Out-of-round tolerance shall not exceed 0.50 inch (12.5 mm).

2.5.3 Pipe Spacers shall be a two-piece 14-gauge T-304 stainless steel assembly with stainless steel bolts. Assembly shall be the restrained positioning type. The runners shall be a ultra high molecular weight polymer with a maximum coefficient of friction of 0.12. The assembly shell liner shall be 0.090 inch (2.3 mm) ribbed PVC with 85-90 durometer. Spacer assembly shall be as manufactured by Cascade Waterworks MFG. Co. or approved equal.

2.5.4 Carrier Pipe shall be mechanical joint ductile iron per section 2.2.2.

2.5.5 Bulkhead Materials shall be one of the following (see plan for type):

2.5.5.1 Brick and Mortar. Brick for bulkheads shall be sound, uniformly burned and shall comply with ASTM C 32, Grade SA. Mortar shall consist of one part cement, one-quarter part lime, and two parts sand. Sand shall comply with ASTM C 144; lime shall comply with ASTM C 207, Type S; cement shall comply with ASTM C 150, Type II.

2.5.5.2 Rubber Seal. Rubber shall have one adhesive side for initial attachment to the pipe. Bonding agent shall be as recommended by the seal manufacturer. Three-quarter-inch stainless steel bands shall be used to secure the rubber seal to the casing and carrier pipes. Rubber seal shall be Model CCES as manufactured by Cascade Waterworks MFG or approved equal.

Construction Requirements

3.1 General. The CONTRACTOR shall furnish all sanitary sewer pipe, fittings, services and related material and appurtenances, labor, tools and equipment, granular material, and concrete; and perform all operations and incidentals necessary for complete excavation, installation, backfill and testing, as outlined herein and on the plans; and maintaining service at all times.

3.1.1 The CONTRACTOR shall be responsible for the layout of the work. The DEPARTMENT will provide control points as described in Section 105.08. The sanitary sewer

and appurtenances shall be built at the locations indicated on the plan to facilitate reconstruction of other facilities within this area of the project.

3.1.2 The CONTRACTOR shall be responsible to field locate all existing sewer service laterals for the purpose of connecting them to the proposed sewer. This may involve exploratory test pits of which payment will be made under Item 206.19 – Common Structure Excavation Exploratory.

3.1.3 Consequential damages resulting from the CONTRACTOR not locating the facilities as shown on the plan are the responsibility of the CONTRACTOR.

3.1.4 Location of new sewer services for all lots throughout the project area as part of the new sewer line shall be as determined by the OWNER and ENGINEER.

3.1.5 The CONTRACTOR, at the completion of each part of the work, shall furnish the as-built locations of the sewer main, and appurtenances referenced to the DEPARTMENT's Construction Base Line and Benchmarks. The as-built locations shall be to an accuracy of plus or minus 0.10 feet (0.03 m) in plan and elevation.

3.1.6 Any deviations from the locations shown on the plans require the OWNER's and ENGINEER's approval. Any discrepancies with locations shown on the plans shall be brought to the ENGINEER's attention and subsequently resolved between the OWNER, the ENGINEER and the CONTRACTOR.

3.2 Trench Excavation

3.2.1 General - Excavation, dewatering, sheeting, and bracing shall be carried out in such a manner as to eliminate any possibility of undermining or disturbing the foundations of any existing structure, utilities or any work previously completed under this contract.

3.2.2 On paved surfaces that will not be resurfaced under this contract, the CONTRACTOR shall not use or operate tractors, bulldozers, or other power-operated equipment with treads or wheels which are so shaped as to allow cutting or damage of such surfaces during excavation or other phases of the work.

3.2.3 All lawns, paved surfaces, roadways, and structures which have been damaged or disturbed by the CONTRACTOR's operations outside of the project work areas shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of operations or as specified on the plans.

3.2.4 The CONTRACTOR shall provide trench shoring and dewatering, if necessary, to provide a stable and dry trench at all times. The pipe trench must be dewatered to 1 foot 6 inches (0.5 m) below the invert of the new sewer pipe. Trench width shall be 2 feet (0.6 m) plus the diameter of the pipe or a minimum of 3 feet (1 m), whichever is greater. Cover on the gravity sewer pipe shall be a minimum of 6 feet (1.8 m) or as shown on the contract drawings. Trench depth shall extend to 6 inches (150 mm) below the invert of the pipe.

3.2.5 As the excavation approaches pipes, conduits, or other underground structures, digging by conventional trenching machine methods shall be discontinued. Only manual methods of excavating shall be employed around buried utilities.

3.2.6 Prior to doing any work outside the right-of-way line on private property or disturbing private property, the CONTRACTOR shall advise the property owner of the work and/or disturbance of the person's property that shall be performed, and the restoration thereof.

3.2.7 The CONTRACTOR shall maintain utilities, utility services and water pipe encountered in the excavation, and repair or replace them to their owner's satisfaction and be responsible for consequential damages thereof.

3.2.8 The CONTRACTOR shall not be compensated for any additional work required in working in close proximity to a utility line, water or underground structure in the trench line above or below the sewer pipe, except for common structure excavation (if required).

3.2.9 Excavations shall be kept dry until the pipes and appurtenances to be built therein have been completed to such extent that they shall not be damaged.

3.2.9.1 Provide, operate and maintain any dewatering system required to lower and control groundwater levels and groundwater hydrostatic pressure during the construction of the Work as required by this Section and the Contract Documents. The CONTRACTOR shall assume full responsibility and expense for the adequacy of the dewatering system with no additional time for performance.

3.2.9.2 The dewatering system shall be capable of developing an excavated subgrade relieved of any hydrostatic pressure that could cause a decrease in the stability of the excavated subgrade and which shall provide the necessary groundwater control for the proper performance required for completion of the Work.

3.2.9.3 Properly dispose of subsurface water collected in a manner which conforms to all applicable local and state ordinances, statutes and laws. Obtain all permits required for operation of the dewatering system.

3.2.9.4 Maintain continual and complete effectiveness of the dewatering system operation to provide a firm, stable, excavated subgrade at all times as required for proper performance of the Work.

3.2.9.5 Provide dewatering necessary to maintain the groundwater table 18 inches (450 mm) below the base of the proposed structure and/or pipe at all times.

3.2.9.6 Erosion Control. Provide adequate protection from erosion from any of the dewatering operations utilized during the course of the construction. Any damage, disruption or interference to newly constructed work or existing properties, buildings, structures, utilities and/or other work resulting directly or indirectly from dewatering operations conducted under

this Contract shall be remedied by the CONTRACTOR, at no cost to the OWNER or DEPARTMENT.

3.2.9.7 Treatment of Dewatering Operations Discharges. Provide such additional treatment devices as may be required to meet the provisions of the Contract. This may include the construction of sumps and/or settling basins, stone rip-rap, silt fences or other requirements. The treatment devices shall be later removed and/or filled in with acceptable backfill material, and restored to original conditions once they are no longer needed, at no additional cost to the OWNER or DEPARTMENT.

3.2.10 Over-Excavation. If, in the opinion of the ENGINEER together with the OWNER, the material at or below the depth of the trench is unsuitable for foundation, it shall be removed to such depths as directed by the OWNER and ENGINEER and shall be replaced with Granular Backfill (Sand), conforming to 209.2.1.1, and placed as provided in Section 209.3.

3.2.10.1 If the bottom of the excavation is deeper than the depth shown on the plans, by error of the CONTRACTOR, the condition shall be corrected by refilling to the proper grade with compacted Granular Backfill (Sand), conforming to 209.2.1.1. All costs shall be borne by the CONTRACTOR.

3.2.11 Rock and Boulder Excavation. Rock and boulder excavation shall be in accordance with Section 206.

3.2.12 Excess and Unsuitable Excavation. Excavation not used for backfill, and unsuitable excavation shall be removed from the site and disposed of by the CONTRACTOR in accordance with local, State or Federal regulations.

3.3 Trench Backfill

3.3.1 General. After the pipe has been placed and has been inspected by the OWNER together with the ENGINEER, backfilling shall be performed without delay.

3.3.2 Bedding shall extend the full width of the trench from 6 inches (150 mm) below the pipe invert, to the springline (horizontal centerline) of the pipe. Compact the bedding material to 95% Modified Proctor in accordance with ASTM D 157 and ASTM D 2922 prior to placement of the pipe and blanket material.

3.3.3 Blanket Material shall be placed from the springline of the pipe to a minimum of 12 inches (300 mm) above the pipe crown. The trench shall be backfilled by placing and compacting the blanket material in lifts of 6 inches (150 mm) or less to 95% Modified Proctor in accordance with ASTM D 157 and ASTM D 2922. The filling shall be carried up evenly on both sides of the pipe with care being taken not to raise or otherwise disturb the pipe. Backfill to this depth shall be thoroughly compacted with approved hand-operated devices.

3.3.4 Backfill shall be placed from 12 inches (300 mm) above the pipe crown to the underside of the pavement select material profile, or to the underside of gravel and loam areas, with common backfill described herein and as approved by the ENGINEER.

3.3.4.1 Backfill shall be placed and compacted in layers of 6 inches (150 mm) or less. Compact the backfill material to 95% Modified Proctor in accordance with ASTM D 157 and ASTM D 2922. Compaction shall be by hand-operated compactors or other approved method.

3.3.4.2 Jetting and bucket compaction are not acceptable means of compaction.

3.3.4.3 Trench areas improperly backfilled or having excessive settlement, as determined by the ENGINEER, shall be reopened to the required grade, backfilled using proper techniques, and repaved as necessary. The CONTRACTOR shall receive no additional compensation for repair of trenches constructed under this Contract.

3.3.5 Trench Pavement Patch. All pavement patching of sewer pipe-related trenches shall be in accordance with Section 401.3. The sewer main trench pavement limits shall be saw cut prior to patching.

3.4 Pipe Installation

3.4.1 General

3.4.1.1 Pipe and fittings shall be handled with care to ensure that the pipe and fittings are in sound, undamaged condition. Particular care shall be taken to prevent damage to pipe coating and lining (if any).

3.4.1.2 The CONTRACTOR shall furnish slings, straps and/or other approved devices to support the pipe when it is lifted. Pipe and fittings shall not be dropped from trucks onto the ground or into the trench. Transporting pipe and fittings from storage areas shall be restricted to operations which shall not cause damage to the pipe or lining (if any).

3.4.1.3 All pipe and fittings shall be examined before laying, and no pipe or fittings shall be installed which are found to be defective. Damaged pipe coatings and/or lining (if any) shall be repaired as approved or directed by the ENGINEER at no additional cost to the OWNER or NHDOT.

3.4.1.4 Any pipe showing a distinct crack with no evidence of incipient fracture beyond the limits of the visible crack, if approved, may have the cracked portion cut off by, and at the expense of, the CONTRACTOR before the pipe is laid so that the pipe used is sound. The cut shall be made in the sound portion of the barrel at least 12 inches (300 mm) from the visible limit of the crack.

3.4.1.5 If any defective pipe is discovered after it has been laid, the CONTRACTOR shall remove the defective pipe and replace it with sound pipe at no additional cost to the OWNER or DEPARTMENT.

3.4.1.6 In general, gravity pipe laying shall proceed upgrade with spigot ends pointing in the direction of the flow.

3.4.1.7 Flow from existing service connections and main lines shall be maintained at all times by pumping or other methods approved by the ENGINEER. Under no circumstances will the dumping of raw sewage on private property, in municipal streets or into waterways, be allowed.

3.4.2 Control of Alignment and Grade

3.4.2.1 Easement and property and other control lines necessary for locating the Work, as well as elevations and benchmarks used in the design of the Work, are shown on the Plans. The CONTRACTOR shall use this information to set line and use a level or transit to set grade.

3.4.2.2 The CONTRACTOR shall use laser equipment to assist in setting the pipe and casing and must demonstrate satisfactory skill in its use.

3.4.2.3 The use of string levels, hand levels, carpenter's levels or other similar devices for transferring grade or setting pipe will not be permitted.

3.4.2.4 During construction provide the OWNER, upon request, all reasonable and necessary materials, opportunities, and assistance for setting stakes and making measurements, including the furnishing of one or two rodmen as needed at intermittent times.

3.4.2.5 The CONTRACTOR shall not proceed until he has made timely request of the ENGINEER for, and has received, such controls and instructions as may be necessary as Work progresses. The Work shall be done in strict conformance with such controls and instructions.

3.4.2.6 The CONTRACTOR shall carefully preserve benchmarks, reference points and stakes, and in case of willful, careless, or accidental destruction by his own workers, he shall be responsible for the resulting expense to re-establish such destroyed control data and shall be responsible for any mistakes or delay that may be caused by the loss or disturbance of such control data.

3.4.2.7 Maintain good alignment while laying pipe. The deflection at joints shall not exceed the manufacturer's recommended limit. Provide fittings, if required, in addition to those shown on the Drawings when pipe crosses utilities encountered when excavating the trench. Use solid sleeves only where shown on the plans unless otherwise approved by ENGINEER.

3.4.3 Installing Pipe and Fittings

3.4.3.1 The CONTRACTOR shall have on the job site with each pipe laying crew, all the proper tools to handle and cut the pipe.

3.4.3.2 All pipe and fittings shall be thoroughly cleaned before laying, and shall be kept clean until installed.

3.4.3.3 Pipe shall be laid in the dry trench conditions. At no time shall water in the trench be permitted to flow into the pipe. At any time that work is not in progress, or the trench is

unattended, the end of the pipe in the trench shall be suitably closed to prevent the entry of animals, earth, water, etc. using watertight expandable plugs.

3.4.3.4 Lay PVC pipe and fittings in accordance with the requirements of AWWA C900, except as provided herein. PVC pipe shall not be installed when temperatures are below 32 ° F (0 ° C) unless approved by the ENGINEER.

3.4.3.5 Lay ductile iron pipe and fittings in accordance with the requirements of AWWA C600, except as provided herein.

3.4.3.6 Excavation shall conform to the Trenching Section shown on the plans.

3.4.3.7 As soon as excavation has been completed to the proper depth place and compact bedding materials, as specified in the Trenching Section, to the elevation necessary to bring the pipe to grade. The compacted material shall be shaped so that the bottom quadrant of the pipe rests firmly on the bedding for the entire length of pipe barrels. Suitable holes shall be dug for bells or couplings to provide ample space for jointing pipe.

3.4.3.8 Each pipe section shall be placed into position on the pipe bed in such a manner and by such means required to avoid injury to all persons, property and pipe involved.

3.4.3.9 Permanent blocking under the pipe is not permitted, except where a concrete cradle is required, in which case precast concrete blocks shall be used.

3.4.3.10 Jointing shall conform to the manufacturer's instructions and appropriate ASTM Standards.

3.4.3.11 Any debris, tools, etc. shall be removed from the pipe.

3.4.3.12 After placing the pipe on the bedding, the bedding material shall be placed and compacted to the springline of the pipe.

3.4.3.13 Following placement of the bedding material, the blanket material shall be placed and compacted from the springline to 12 inches (300 mm) above the crown of the pipe.

3.4.3.14 After placement of the blanket material the pipe shall be checked for alignment and grade. If the pipe has been properly installed, the CONTRACTOR may refill or backfill the remainder of the trench in conformance with the Trenching Section, and details shown on the plans.

3.4.3.15 At the end of each day's work, or more frequently, the ENGINEER will view the pipe installation with the CONTRACTOR. Unsatisfactory work shall be dug up and reinstalled to meet the requirements of the Contract Documents with no additional time allowed for completion of the Work and at no additional cost to the OWNER or DEPARTMENT.

3.4.3.16 When cutting of pipe is required, the cutting shall be done by machine (power cutter) without damage to the pipe or cement lining (if any). Cut ends shall be smooth and at right angles to the long axis of the pipe. Pipe ends to be used with a rubber gasket joint shall be beveled and filed or ground smoothly to conform to a manufactured spigot.

3.4.4 Protection of Water Supplies

3.4.4.1 There shall be no physical connection between a public or private potable water supply system and a sewer, or sewer appurtenance, which would permit the passage of any sewage or polluted water into the potable supply. No water pipe shall pass through or come in contact with any part of a sewer manhole.

3.4.4.2 Sewers shall be located outside a 400 foot (125 m) radius centered at a municipal well; a 200 foot (60 m) radius centered at a small public well; and a 75 foot (25 m) radius centered at a private well.

3.4.4.3 Sewers shall be located during design with at least 10 feet (3 m) of horizontal separation distance from any existing or proposed water main; except in cases to avoid subsurface structures, including telecommunication chambers, interference of building foundations shall be allowed, provided that the sewer is constructed as follows:

3.4.4.3.1 Sewer pipe shall be class 52 ductile iron for a minimum distance of 75 feet (25 m) each side of the obstruction.

3.4.4.3.2 Joints shall be mechanical type water pressure rated with zero leakage when tested at 25 psi (172 kPa) for gravity sewers and 1-1/2 times working pressure for force mains.

3.4.4.4 Whenever sewers must cross water mains, the sewer shall be constructed as follows:

3.4.4.4.1 Vertical separation of the sewer and water main shall not be less than 18 inches (450 mm).

3.4.4.4.2 Sewer pipe shall be class 52 ductile iron for a minimum distance of 9 feet (2.75 m) each side of the crossing.

3.4.4.4.3 Joints shall be mechanical type water pressure rated with zero leakage when tested at 25 psi (172 kPa) for gravity sewers and 1-1/2 times working pressure for force mains and joints shall not be located within 9 feet (2.75 m) of the crossing.

3.4.5 Service Connections

3.4.5.1 House service lines shall be laid from the wye connection on the main line sewer to the property line, as directed by the ENGINEER.

3.4.5.2 All new service connections shall be 6 inch (150 mm) PVC.

3.4.5.3 New services shall terminate as shown on the plans, be capped with a watertight cap, and the end shall be marked with a ferrous metal rod or pipe terminating at finish grade.

3.4.6 Testing

3.4.6.1 General

3.4.6.1.1 Leakage tests under the direction of the ENGINEER shall be conducted on all pipes installed under this section of the Work. Deflection tests shall be conducted on PVC pipe as ordered by the ENGINEER. The ENGINEER will witness all tests. The CONTRACTOR shall supply all plugs, pumps, weirs, gauges, water, water trucks, mandrels, etc., necessary to conduct the tests. Should the Work fail the leakage or deflection tests, corrective action shall be taken by the CONTRACTOR in a manner approved by the ENGINEER and, if directed by the ENGINEER, the CONTRACTOR shall dig up and relay the failed section with no additional time allowed for completion of the Work and at no additional cost to the OWNER or DEPARTMENT.

3.4.6.1.2 The use of sealants, applied from the inside of the pipe, is not acceptable.

3.4.6.1.3 Flush all piping systems with water prior to testing.

3.4.6.1.4 Testing forms which indicate all testing information and results shall be submitted to the ENGINEER.

3.4.6.2 Gravity Sanitary Sewer Pipe Testing

3.4.6.2.1 Air Test: Leakage testing shall be by means of low-pressure air in accordance with the procedures described in UNI-B-6 with all service connections capped. The maximum allowable pressure drop from the test pressure shall be 1.0 psig (6.89 kPa) during the minimum holding time.

Test pressure psi (kPa) shall be calculated using the following equation:

(ENGLISH)	(METRIC)
$P = 3.5 + (H/2.31)$	$P = 24.1 + (H/0.102)$
P = Test pressure (max. = 9 psi) H = Height (ft) of groundwater above invert.	P = Test pressure (max. = 62.0 kPa) H = Height (m) of groundwater above invert.

Minimum holding time required for a 1.0 psig (6.89 kPa) maximum pressure drop shall be calculated using the following chart:

(ENGLISH)

Length Time

Pipe Dia. (in.)	Min. Time (min:sec)	For Min. Time (ft)	For Longer Length (sec)	Time (min:sec) for Length (L) Shown					
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29

(METRIC)

Pipe Dia. (mm.)	Min. Time (min:sec)	Length For Min. Time (m)	Time For Longer Length (sec)	Time (min:sec) for Length (L) Shown					
				30 m	45 m	60 m	75 m	90 m	105 m
100	3:46	182	1.24 L	3:46	3:46	3:46	3:46	3:46	3:46
150	5:40	121	2.80 L	5:40	5:40	5:40	5:40	5:40	5:40
200	7:34	91	4.99 L	7:34	7:34	7:34	7:34	7:36	8:52
250	9:26	73	7.789 L	9:26	9:26	9:26	9:53	11:52	13:51
300	11:20	61	11.21 L	11:20	11:20	11:24	14:15	17:05	19:56
375	14:10	48	17.526 L	14:10	14:10	17:48	22:15	26:42	31:09
450	17:00	41	25.236 L	17:00	19:13	25:38	32:03	38:27	44:52
525	19:50	35	34.350 L	19:50	26:10	34:54	43:37	52:21	61:00
600	22:40	30	44.862 L	22:47	34:11	45:34	56:58	68:22	79:46
675	25:30	27	56.778 L	28:51	43:16	57:41	72:07	86:32	100:57
750	28:20	24	70.098 L	35:37	53:25	71:13	89:02	106:50	124:38
825	31:10	22	84.816 L	43:05	64:38	86:10	107:43	129:16	150:43
900	34:00	20	100.945L	51:17	76:55	102:34	128:12	153:50	179:29

3.4.6.3 Deflection Test for Flexible Pipe: Optional devices for testing include calibrated television, photography, properly sized "GO-NO-GO" mandrel, sewer ball or deflectometer. Maximum allowable pipe deflection shall be five percent (5%). The deflection test shall be performed no sooner than thirty (30) days after installation.

3.4.6.4 Force Mains shall be tested for pressure and leakage in accordance with AWWA C600, except as amended or added below:

3.4.6.4.1 Water shall be furnished by CONTRACTOR.

3.4.6.4.2 Test Duration shall be two (2) hours.

3.4.6.4.3 Test Pressure shall be one hundred and fifty percent (150%) of maximum operating pressure, or 100 psi (690 kPa), or the greater of the two, as determined by the ENGINEER.

3.4.6.4.4 Allowable Pressure Loss. Pressure shall not vary more than ± 5 psi (34 kPa) for the duration of the pressure test.

3.4.6.4.5 Allowable Leakage. Allowable leakage shall be determined by the following formula:

ENGLISH	METRIC
$L = \frac{SD(P)^{0.5}}{133200}$	$L = \frac{SD(P)^{0.5}}{715317}$
L = allowable leakage, in gallons per hour. S = length of pipe tested, in feet. D = nominal pipe diameter, in inches. P = average test pressure, in psi (gauge).	L = allowable leakage, in liters per hour. S = length of pipe tested, in meters. D = nominal pipe diameter, in mm. P = average test pressure, in kPa.

Allowable leakage, in gallons (liters) per hour, per 1,000 feet (100 m) of pipe line can be determined from the following chart (see next page).

(ENGLISH)

Nominal Pipe Diameter-in.

Avg. Test Pressure psi	Nominal Pipe Diameter-in.										
	3	4	6	8	10	12	14	16	18	20	24
450	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82
400	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60
350	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37
300	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12
275	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80

(METRIC)

Nominal Pipe Diameter-mm.

Avg. Test Pressure kPa	Nominal Pipe Diameter-mm.										
	75	100	150	200	250	300	350	400	450	500	600
3100	0.60	0.79	1.18	1.58	1.97	2.37	2.77	3.17	3.56	3.95	4.74
2750	0.56	0.75	1.12	1.49	1.86	2.24	2.61	2.98	3.35	3.73	4.47
3400	0.52	0.70	1.04	1.39	1.74	2.10	2.45	2.79	3.14	3.49	4.19
2050	0.48	0.65	0.97	1.29	1.61	1.94	2.26	2.58	2.91	3.23	3.87
1900	0.46	0.62	0.93	1.24	1.53	1.85	2.16	2.47	2.78	3.09	3.71
1700	0.45	0.58	0.88	1.18	1.48	1.76	2.06	2.36	2.66	2.94	3.54
1550	0.42	0.56	0.84	1.12	1.40	1.68	1.96	2.24	2.52	2.79	3.35
1400	0.40	0.53	0.79	1.06	1.32	1.59	1.83	2.11	2.37	2.63	3.17
1200	0.37	0.50	0.73	0.99	1.23	1.48	1.73	1.97	2.22	2.46	2.96
1050	0.35	0.46	0.68	0.92	1.14	1.37	1.60	1.83	2.06	2.28	2.75
850	0.31	0.42	0.62	0.83	1.04	1.25	1.47	1.66	1.88	2.09	2.50
700	0.29	0.37	0.56	0.74	0.93	1.18	1.30	1.49	1.68	1.86	2.24

3.4.7 Casing Installation

3.4.7.1 Casing pipe shall be installed by open cut, with bedding and cover material as shown on the plans.

3.4.7.2 Casing pipe ends shall be beveled with a single V-groove for field welding. Pipe joints shall be butt welded and shall be a full penetration on the outside circumference of the pipe. The single V-groove butt weld shall conform to the latest AWS Welding Code. All joints of the casing pipe shall be butt welded by a welder certified by the State of New Hampshire for the specific application.

3.4.8 Carrier Pipe Installation - After casing pipe has been installed and cleaned of dirt and debris, pipe spacers shall be attached to carrier pipe as shown on the plans. As carrier pipe is jointed, it shall be pushed into position inside the casing pipe. After the carrier pipe has been tested for leakage, bulkheads shall be constructed at each end of the casing pipe.

3.4.8.1 On brick bulkheads, a "one brick" opening shall be left in the bulkhead at the top of the casing pipe at each end and covered with polyethylene to prevent entry of backfilling materials. The portion of the carrier pipe passing through the brick bulkhead shall be wrapped with three layers of fifteen pound asphalt-impregnated felt before the bulkhead is constructed.

3.4.8.2 On rubber sealed bulkheads, apply bonding agent to seal the two ends of the rubber seal. Three-quarter inch stainless steel bands shall secure the rubber seal to the casing and carrier pipes.

3.5 Manhole Installation

3.5.1 Installation of Manhole Bases and Sections

3.5.1.1 Precast bases shall be placed on a 1 foot (0.3 meter) layer of compacted bedding material. The excavation shall be properly dewatered to allow placing of bedding material and setting the manhole base on completely drained subgrade.

3.5.1.2 Inlet and outlet stubs shall be connected and sealed in accordance with the manufacturer's recommended procedure, and as shown on the Drawings.

3.5.1.3 Barrel sections and cones of the appropriate combination of heights shall then be placed, using manufacturer's recommended procedure for sealing the horizontal joints.

3.5.1.4 A leakage test shall then be made as described below in this section.

3.5.1.5 Upon successful completion of the leakage test all joints shall be pointed.

3.5.1.6 The exterior waterproofing coat shall be touched up after installation and shall be applied to the exterior of all joints in accordance with manufacturer's recommendations.

3.5.1.7 The inverts and the shelf shall be constructed of brick.

3.5.1.8 The frame and cover shall be placed on the top of the manhole or some other approved means shall be provided to prevent accidental entry by unauthorized persons, children, animals, etc., until the CONTRACTOR is ready to make final adjustment to grade.

3.5.2 Mixing Mortar shall be mixed in accordance with ASTM C 270 or the recommendations of the manufacturer.

3.5.3 Brick Masonry

3.5.3.1 Only clean bricks shall be used in brickwork for grade adjustment and manhole inverts. The bricks shall be moistened by suitable means, until they are in a surface dry, saturated condition.

3.5.3.2 Each brick shall be laid in full bed and joint of mortar without requiring subsequent grouting, flushing, or filling; and shall be thoroughly bonded.

3.5.3.3 Brick masonry shall be protected from drying too rapidly. Use an approved cover and protect from the weather and frost.

3.5.3.4 All masonry joints which are exposed to view shall be examined to locate cracks, pointed up and filled with mortar. Where necessary, in the opinion of the ENGINEER, the joints shall be cut out and repointed with mortar.

3.5.3.5 All brick masonry inverts shall allow unimpeded flow. Steps or puddles will be basis for rejection.

3.5.4 Setting Frames and Covers

3.5.4.1 Frames shall be set with the tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the Drawings. Frames shall be set concentric with the top of the masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the masonry shall be placed all around and on the top of the bottom flange. The mortar shall be smoothly finished and have a slight slope to shed water away from the frame.

3.5.4.2 Manhole covers shall be left in place in the frames on completion of other work at the manholes.

3.5.5 Leakage Tests for Sewer Manholes

3.5.5.1 Leakage tests shall be made and observed by the ENGINEER on each manhole. The test shall be a vacuum test made as described below.

3.5.5.2 Vacuum test

3.5.5.2.1 The vacuum test may be performed on manholes, completely constructed, with inlet and outlet pipes in place. Test shall be conducted before any backfilling begins. Any material around the base section shall be removed to expose the entire side of the manhole. Plug pinholes and horizontal seams with a non-shrinking mortar.

3.5.5.2.2 Brace the inlet and outlet pipes/plugs to prevent movement during the test. Use air inflated plugs in good condition.

3.5.5.2.3 The vacuum test shall be performed using equipment approved by the ENGINEER. The equipment shall be in good operating condition. No gauges are to have any broken glass or other visible abnormalities. The test shall be performed by trained personnel familiar with the equipment and the test.

3.5.5.2.4 The test shall have a minimum duration of two minutes. The vacuum shall be pumped down to 10 inches (250 mm) of mercury on an approved gauge, and held. At the time the removal of air is stopped, the test time shall begin.

3.5.5.2.5 Any manhole that has a vacuum drop to nine inches (225 mm) of mercury or less, within the following time intervals, shall have failed the test.

0 – 10 ft. (3.0 m) deep: less than 2 minutes.
 10 ft. (3.0 m) – 15 ft. (4.5 m) deep: less than 2-1/2 minutes.
 15 ft. (4.5 m) – 20 ft. (6.0 m) deep: less than 3 minutes.
 over 20 ft. (6.0 m) deep: less than T.

T Calculations for manholes deeper than 20 feet (6.0 m).

$$\mathbf{T = 0.085 DK/Q}$$

T = Time of pressure drop in seconds
 K = 0.000419 DL; but not less than 1.0
 Q = 0.0015 ft³/min/ft² of area
 D = Nominal manhole diameter in .
 L = Depth of manhole in feet .

$$\mathbf{T = 2.159 DK/Q}$$

T = Time of pressure drop in seconds
 K = 0.003244 DL; but not less than 1.0
 Q = 0.00046 m³/min/m² of area
 D = Nominal manhole diameter in mm
 L = Depth of manhole in meters

Method of Measurement

4.1 Sanitary gravity sewer and sewer service pipe of the kind, type and size specified will be measured by the linear foot (linear meter) to the nearest 0.1 foot (meter) for the furnished, installed and operational sewer pipe to the inside face of manholes.

4.2 Sanitary sewer force main and sewer service pipe of the kind, type and size specified will be measured by the linear foot (linear meter) to the nearest 0.1 foot (meter) for the furnished, installed and operational sewer pipe from the pump or structure connection to the inside face of manholes or sanitary gravity sewer main.

4.3 Encased pipe including encasement of the kind, type and size specified will be measured by the linear foot (linear meter) to the nearest 0.1 foot (meter).

4.4 Sewer service wyes will be measured as each wye furnished and installed.

4.5 Sewer manholes will be measured by the vertical foot (meter) to the nearest 0.1 foot (meter) from invert to bottom of frame and cover.

4.6 No separate measurement will be made for any removal of existing sewer manholes or sewer pipe or bypass system or plugging of abandoned sewers.

4.7 Insulation will be measured by the square yard (square meter) to the nearest .01 of a square yard (square meter) of area covered. When more than one 2 inch (50 mm) layer is specified, each layer will be measured.

4.8 Temporary sewer system will be measured by the unit of furnished, installed, operational, and removed temporary pipe.

4.9 The ENGINEER must be involved in and approve the measurement of any pay item.

Basis of Payment

5.1 The accepted quantity of sanitary sewer pipe pipe of the kind and type specified (including temporary pipe and service pipe) will be paid for at the contract price per linear foot (linear meter) complete in place as shown on the plans and specified herein with the following stipulations:

5.1.1 Common structure excavation required for the removal of unsuitable material below the typical trench section will be paid for as provided in Section 206.

5.1.2 Rock structure excavation and common structure excavation exploratory will be paid for as provided in Section 206.

5.1.3 Granular backfill (sand) to replace material excavated under 5.1.1 will be paid for as provided in Section 209.

5.2 The accepted quantity of encased pipe, including encasement, will be paid at the contract price complete in place as shown on the plan and specified herein, and shall include furnishing and installing carrier pipe, assembly of carrier pipe, excavation, bedding, blanket, backfill, furnishing and installing carrier pipe, pipe spacers, bulkheads and appurtenances, furnishing and installing grout and all other work required for, or incidental to, the completion of this item, except as noted below.

5.3 The accepted quantity of sewer service wyes will be paid at the contract unit price and shall include furnishing and installing the wyes and all other work required or incidental to the completion of this item.

5.4 The accepted quantity of sewer manholes will be paid for at the contract unit price per vertical foot (meter) and shall include furnishing and installing manhole base, riser and cone sections, frames and covers, installing inside drop connections where required, furnishing and installing pipe stubs and couplings for "cut-in" manholes where required, brick channel and table, all brick work to adjust frames, testing, and all other work required or incidental to the completion of this item.

5.5 Bituminous pavement incorporated into the final pavement structure, or remaining over a winter maintenance season, will be paid for under Item 403.12 – Hot Bituminous Pavement, Hand Method.

5.6 Any work not specifically having a pay item and necessary for a complete and operational sanitary sewer, as herein specified and called for on the plans, shall be considered incidental and subsidiary to the pay item work specified herein. The work considered as subsidiary and not separately paid for shall include but not be limited to the following:

5.6.1 Pipe material handling and storage on site.

5.6.2 Excavation, bedding, blanket and backfill.

5.6.3 Sheeting, shoring, and dewatering of trenches (if applicable).

5.6.4 Maintaining existing sewer service.

- 5.6.5 Removal and decommissioning of temporary sewer system.
- 5.6.6 Restoration of property including loam and seed, utilities, and water lines (if applicable).
- 5.6.7 Pressure testing and lamping.
- 5.6.8 Restoration of and connections to existing sewers including couplings.
- 5.6.9 Plugging abandoned sewers and removal and disposal of existing manholes.
- 5.6.10 Temporary bituminous pavement for the temporary trench patch.
- 5.6.11 Saw cutting of existing pavement.
- 5.6.12 Record plans.

Pay items and units (ENGLISH):

.0		
.1	System	
.11	Temporary	
.1111	Temporary Sewer System	Unit
.1112	Temporary Sewer System	Day
.1121	Temporary Diversion	Unit
.1122	Temporary Diversion	Day
.1131	By-Pass Pumping	Unit
.1132	By-Pass Pumping	Day
.114XX	Temporary Sewer Pipe	Linear Feet
XX	Size (Inches)	
.115XX	Temporary Air Release Valve	Each
XX	Size (Inches)	
.12	Pump Station	
.121	Grind Sewer Pump Station	Unit
.122	Submersible Sewer Pump Station	Unit
.141	Force Main System Connection	Unit
.15	Sewer Lining	
.151XX	Cured In Place	
XX	Pipe Size (Inches)	

.18	Septic System	Unit
.2	Casing/Supported	
<u>.2X</u>	Trenching Method	
X		
1	Direct Buried/Open-Cut	
2	Jacking	
3	Supported (w/Support Assemblies)	
9	Contractor's Option?	
<u>.2XY</u>	Encasement Material	
2	Steel	
4	Ductile Iron (DI)	
5	Ductile Iron – Mechanical Joint (DI-MJ)	
6	Polyvinyl Chloride (PVC)	
7	High Density Polyethylene (HDPE)	
9	Insulation w/Jacketing	
	Carrying Pipe	
<u>.2XYZ</u>	Pipe Material	
Z	Gravity	
1	Ductile Iron (DI)	
2	Ductile Iron – Mechanical Joint (DI-MJ)	
3	PVC	
4	HDPE	
	Forcemain	
5	DI	
6	DI-MJ	
7	PVC	
8	HDPE	
	Carry Pipe Size	
<u>.2XYZ</u>	Size (Inches)	
1	6"	
2	8"	
3	10"	
4	12"	
5		
6		
7		
8		
9		

Examples:

612.22233 - ___" jacked steel casing w/10" Restrained PVC Sewer Pipe
 612.2283 - 24" Steel Casing Pipe with 10" HDPE Sewer Force Main Carrier Pipe

NOTE: Size of casing determined by designer for the different types and sizes of carrier pipe and spacers to fit. Paid complete installation – carrier, casing, supports etc.

.3 Manholes

.30 Frame & Cover

.30024	24" Sewer Manhole Frame & Cover	Each
.30030	30" Sewer Manhole Frame & Cover	Each
.30036	36" Sewer Manhole Frame & Cover	Each

.301	Adjust Sewer Manhole Frame & Cover	Each
.302	Replace Sewer Manhole Frame & Cover	Each
.3021	Replace Sewer Manhole Frame & Cover (supplied by others)	Each

*USE 604.51 – Reconstruct Adj ___ Manhole

.31 Sewer Manhole

X Diameter (feet) Vertical Feet

.3104	Sewer Manhole 4' Dia. Incl. Frame & Cover	VF
.3105	Sewer Manhole 5' Dia. Incl. Frame & Cover	VF
.3106	Sewer Manhole 6' Dia. Incl. Frame & Cover	VF
.3107	Sewer Manhole 7' Dia. Incl. Frame & Cover	VF
.3108	Sewer Manhole 8' Dia. Incl. Frame & Cover	VF

EA? Reconstruct invert, etc "not" VF?

.32 Reconstruct Sewer Manhole

.3204	Reconstruct Sewer Manhole 4' Dia	VF
.3205	Reconstruct Sewer Manhole 5' Dia	VF
.3206	Reconstruct Sewer Manhole 6' Dia	VF
.3207	Reconstruct Sewer Manhole 7' Dia	VF
.3208	Reconstruct Sewer Manhole 8' Dia	VF

.33 Modify Sewer Manhole

.34 Rehabilitation

.351_	Drop Connection Sewer Manhole	VF
.352	Air Release Valve Sewer Manhole	VF*
.353	Cleanout Sewer Manhole	VF

.354 Blow-Off Sewer Manhole

VF

* See also .83 (Valves)
(Do we need these at all?)

Pipe

- .4 Ductile Iron (DI)
- .5 Ductile Iron Mechanical Joint (DI-MJ)
- .6 Polyvinyl Chloride (PVC)
- .7 High Density Polyethylene (HDPE)
- ._1 Gravity
- ._2 Force Main (FM)
- ._3 Fittings
- ._ _ X Class/SDR (see below) (varies with pipe material)

Linear Feet
Linear Feet
Each

	DI	PVC	HDPE
1	Class 51	SDR 21	9
2	Class 52	SDR 25	11
3	Class 53		13.5
4	Class 54		17
5		SDR 35	21
6	Class 56		SDR 26
7		Sch 40	
8		Sch 80	

- ._ _ _ X X Size (Inches)
- 0 4 4"
- 0 6 6"
- 0 8 8"
- 1 0 10"
- 1 2 12"
- 1 5 15"
- 1 8 18"
- 2 4 24"
- 3 0 30"
- 3 6 36"

Ex: 612.72410 – 10” HDPE Force Main, SDR 17

Ex: 612.73410 – 10” HDPE Fittings, SDR 17

.8 Wyes, Cleanout, Valves

._ 1 Wyes

._ _ X Material
4 DI

5 DI - MJ
 6 PVC
 7 HDPE

._ _ _ X Main Size
 1 2"
 2 4"
 3 6"
 4 8"
 5 10"
 6 12"
 7 15"
 8 18"

._ _ _ _ X Secondary Size
 1 2"
 2 4"
 3 6"
 4 8"
 5 10"
 6 12"
 7 15"
 8 18"

._ 2 Cleanouts Each

._ _ X Material
 4 DI
 5 DI - MJ
 6 PVC
 7 HDPE

._ _ _ X X Size (Inches)
 0 2 2"
 0 4 4"
 0 6 6"
 0 8 8"
 1 0 10"
 1 2 12"
 1 5 15"
 1 8 18"

._ 3 Valves Each

._ _ X Type
 1 Air Release
 2 Blow-Off

3 Check

<u> </u> <u>XX</u>	Size (Inches)
0 2	2"
0 4	4"
0 6	6"
0 8	8"
1 0	10"
1 2	12"
1 5	15"
1 8	18"

<u>_</u> 4	Temporary Valves	Each
<u> </u> <u>X</u>	Type	
1	Air Release	
2	Blow-Off	
3	Check	

<u> </u> <u>XX</u>	Size (Inches)
0 2	2"
0 4	4"
0 6	6"
0 8	8"
1 0	10"
1 2	12"
1 5	15"
1 8	18"

_ 5 Expansion Joint

_ 6 Couplings

- _ 4 DI
- _ 5 DI-MJ
- _ 6 PVC
- _ 7 HDPE

- 02
- 4
- 6
- 8
- 10
- 12
- 15
- 18

.9 Insulation + Misc

.95 Insulation

.951	<u>X</u> <u>X</u>	Board Insulation	Linear Feet
	<u>X</u> _	Thickness (Inches)	
	_ <u>X</u>	Width (Feet)	

.952	<u>X</u> <u>X</u>	Round Insulation	Linear Feet
	<u>X</u> _	Thickness (Inches)	
	_ <u>X</u>	Width (Feet)	
	1	2"	
	2	4"	
	3	6"	
	4	8"	
	5	10"	
	6	12"	
	7	15"	
	8	18"	

.953	<u>X</u> <u>X</u>	Round Insulation w/Jacketing	Linear Feet
	<u>X</u> _	Thickness (Inches)	
	_ <u>X</u>	Diameter (Inches)	
	1	2"	
	2	4"	
	3	6"	
	4	8"	
	5	10"	
	6	12"	
	7	15"	
	8	18"	

612.2212	12" R.C. SEWER PIPE, 2000D, WITH NEOPRENE GASKETS	LF
612.2215	15" R.C. SEWER PIPE, 2000D, WITH NEOPRENE GASKETS	LF
612.2324	24" R.C. SEWER PIPE, 3000D, (6000 PSI), W/ NEOPRENE GASKETS	LF
612.2330	30" R.C. SEWER PIPE, 3000D, (6000 PSI), W/ NEOPRENE GASKETS	LF
612.2415	15" R.C. SEWER PIPE, 3750D, (6000 PSI), W/ NEOPRENE GASKETS	LF
612.2418	18" R.C. SEWER PIPE, 3750D, (6000 PSI), W/ NEOPRENE GASKETS	LF
612.31XX	SEWER MANHOLE, XX FOOT DIAMETER	VF
612.43018	18" DUCTILE IRON SEWER PIPE, CLASS 50	LF
612.43106	6" DUCTILE IRON SEWER PIPE, CLASS 51	LF
612.43312	12" DUCTILE IRON SEWER PIPE, CLASS 53	LF
612.43604	4" DUCTILE IRON SEWER PIPE, CLASS 56	LF
612.43606	6" DUCTILE IRON SEWER PIPE, CLASS 56	LF
612.912	REMOVING AND RELAYING 12" SEWER PIPE	LF
612.924	REMOVING AND RELAYING 24" SEWER PIPE	LF

Pay items and units (METRIC):

612.2230	300 MM R.C. SEWER PIPE, CLASS III, WITH NEOPRENE GASKETS	LM
612.2238	375 MM R.C. SEWER PIPE, CLASS III, WITH NEOPRENE GASKETS	LM
612.2360	600 MM R.C. SEWER PIPE, CLASS IV, (41.4 MPA) W/ NEOPRENE GASKETS	LM
612.2375	750 MM R.C. SEWER PIPE, CLASS IV, (41.4 MPA) W/ NEOPRENE GASKETS	LM
612.2438	375 MM R.C. SEWER PIPE, CLASS V, (41.4 MPA) W/ NEOPRENE GASKETS	LM
612.2445	450 MM R.C. SEWER PIPE, CLASS V, (41.4 MPA) W/ NEOPRENE GASKETS	LM
612.43045	450 MM DUCTILE IRON SEWER PIPE, CLASS 50	LM
612.31XX	SEWER MANHOLE, X.X METER DIAMETER	VM
612.43115	150 MM DUCTILE IRON SEWER PIPE, CLASS 51	LM
612.43330	300 MM DUCTILE IRON SEWER PIPE, CLASS 53	LM
612.43610	100 MM DUCTILE IRON SEWER PIPE, CLASS 56	LM
612.43615	150 MM DUCTILE IRON SEWER PIPE, CLASS 56	LM
612.930	REMOVING & RELAYING 300 MM SEWER PIPE	LM
612.960	REMOVING & RELAYING 600 MM SEWER PIPE	LM