SECTION 33 30 00

SANITARY SEWERAGE UTILITIES

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Sanitary sewage system piping, structures and appurtenances as indicated on the Contract Documents.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 312000 – EARTH MOVING for excavation, backfill, and compaction required for sanitary sewerage system piping and structures.

1.3 SUBMITTALS

A. Refer to Section 013300 – SUBMITTAL PROCEDURES for submittal provisions and procedures.

1. Descriptive literature showing pipe dimensions, pipe and joint materials and dimensions, and other details for each class or type of pipe or product to be furnished for this contract. All pipe furnished under the contract shall be manufactured in accordance with these Specifications.

2. Product Data: Submit manufacturer's technical product data and installation instructions for pipe fittings, couplings, and appurtenances.

3. Shop Drawings: The precast concrete structure shop drawing submittals for the manholes, septic tanks, tight tank, and grease trap shall contain erection drawings showing connections, cast-in items, waterproofing details, lifting hooks, and production drawings showing elevations, sections and details indicating sizes and quantities of reinforcement. For manholes, shop drawings shall indicate orientation, size, and elevation of openings. Submit shop drawings for structure frames and covers.

4. Material Certificates: Provide copies of material certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified

requirements.

5. Record Drawings: Prior to the acceptance of the sanitary sewer system, the Contractor shall submit to the Engineer, for review and approval, As-Built Drawings that indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built Drawings shall include a minimum of three (3) ties to each structure from fixed permanent objects. As-Built drawings shall be stamped and signed by a Massachusetts Licensed Land Surveyor and Licensed Professional Engineer. The as-built plans shall also be submitted electronically as an AutoCAD drawing file (release 2010 or higher) within 90 days of project completion.

1.4 REFERENCE STANDARDS

A. The following standards are applicable to the work of this Section to the extent referenced herein:

1. ASTM: American Society for Testing and Materials.

2. ANSI: American National Standards Institute.

3. AASHTO: American Association of State Highway and Transportation Officials.

4. Reference is made herein to the Commonwealth of Massachusetts, Department of Transportation (MassDOT), Formerly Massachusetts Highway Department (MHD) *Standard Specifications for Highways and Bridges*, latest edition, hereinafter referred to as the "Standard Specifications". All references to method of measurement, basis of payment, and payment items in the "Standard Specifications" are hereby deleted. References made to particular sections or paragraphs in the "Standard Specifications" shall include all related articles mentioned therein.

5. Commonwealth of Massachusetts, Massachusetts Highway Department, Construction Standards, latest Edition with amendments, hereinafter referred to as the “Construction Standards.”

6. Environmental Compliance: Comply with applicable portions of local Environmental Agency regulations pertaining to storm drain systems.

7. City of Lowell Regulations: New castings provided shall meet the requirements of the City of Lowell standards.

8. Commonwealth of Massachusetts Plumbing Code, latest edition.

9. Commonwealth of Massachusetts State Environmental Code Title V, 310 CMR 15.00, latest revision.

1.5 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from

observation of the site.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.6 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to sanitary sewerage systems.

B. Utility Compliance: Comply with local utility owner's regulations and standards pertaining to sanitary sewerage system installation and inspection.

1.7 PROJECT CONDITIONS

A. Site Information: Perform site inspection and survey, research utility records, and verify existing utility locations and elevations. Verify that sewerage system piping may be installed in compliance with Contract Drawings and referenced standards.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate with interior building sanitary sewerage system piping.

B. Coordinate with other utility work.

C. The Contractor is responsible for developing a sequence of work to maintain existing services in operation until the new services are operational.

D. The Contractor is responsible for coordinating and scheduling the inspection of the work by the jurisdictional authority. All permits and inspection costs and fees shall be included in the bid prices and no additional costs will be paid to the Contractor.

PART 2 – PRODUCTS

2.1 MANHOLES

A. General: Provide precast reinforced concrete structures as indicated and complying with ASTM C 478.

B. Manhole Top: Precast concrete, of concentric cone, eccentric cone, or flat slab top type, as indicated in the Contract Drawings. Tops shall be designed to meet H20 loadings.

C. Base and Riser Sections: Precast concrete, with base riser section with integral floor. Diameter, base and riser thicknesses shall be as indicated on the Contract Drawings.

D. Cement: Type II.

E. Concrete strength: 4,000 psi minimum.

F. Horizontal Joints: Joints between sections of concrete structures shall be sealed with a self-sealing butyl rubber based flexible joint sealant gasket complying with ASTM C443. Sealant shall be installed in accordance with the manufacturer's written instructions.

G. Manhole Steps and 1/2-inch grade 60 steel reinforcing rod conforming to ASTM A615 encapsulated with molded copolymer polypropylene. Rungs shall have a 14-inch-wide stepping surface and protrude no more than 6 inches from the wall, M.A. Industries type PS-2-PR-SL or equal. Copolymer polypropylene shall be type II, grade 16906, meeting ASTM specifications D 4101. The portion of the legs to be embedded in the precast section shall have fins and be tapered to ensure a secure bond. Steps shall start a foot above the shelf of the manhole floor and continue twelve inches on center spacing up through the complete height of the unit. The steps shall finish no lower than twenty-four (24)-inches below the rim elevation.

H. Pipe Connections: Sewer manhole pipe openings shall have integral flexible rubber sleeves capable of accepting the pipe connection.

I. Bituminous Dampproofing: Sewer manholes shall receive two coats of bituminous dampproofing, which complies with Federal Specification SS-A-701. Each coat shall be applied at a rate of 65-square feet per gallon.

J. Sanitary Sewer Brick Masonry: Bricks shall be sound, hard, uniformly burned, regular, and uniform in shape and size. Underburned or salmon brick shall not be acceptable. Only whole brick shall be used.

1. Bricks for channels and shelves shall conform to ASTM C32, Grade SS except that the mean of five tests for absorption shall not exceed 8 percent and no individual brick exceed 11 percent.

2. Bricks for raising manhole frames to finished grade shall conform to ASTM C62.

3. Mortar shall be composed of one part Portland cement, two parts sand, and hydrated lime not to exceed 10 lbs. To each bag of cement. Portland cement shall be ASTM C150, Type II; hydrated lime shall conform to ASTM C207.

4. Sand shall be washed, cleaned, screened, well-graded with all particles passing a No. 4 sieve, and conform to ASTM C33.

K. In sewer manholes, the invert channel within the structure shall be an inverted arch with bricks laid as stretchers and on edge and so constructed as to conform in shape to the lower half of the pipe. The shelf in manholes shall consist of bricks laid flat and the top of the shelf shall be at the elevation of the top of the pipe, as indicated on the Contract Drawings, and shall be sloped to flow toward the channel.

L. Inverts in sewer manholes shall conform accurately to size of the adjoining pipe. Side inverts and main inverts where the direction changes shall be laid out in smooth curves of the longest possible radius which is tangent, within the manhole, to the centerline of the adjoining pipe lines.

M. When installing manholes on existing lines and when flows cannot be diverted, drop-over manholes shall be used. Drop-over manholes shall be precast with opening cast in the sidewalls of sufficient size to fit over the existing line(s) to remain in service. Drop-over manholes shall be set on a precast or cast-in-place concrete base slab. Drop-over manholes shall be manufactured to the same requirements and dimensions as standard manholes.

2.2 CONCRETE BLOCK MANHOLES

A. Concrete block manholes shall only be utilized when it is not feasible to utilize a precast concrete manhole and then only with written approval from the Owner's Representative.

B. Concrete block manholes shall be minimum 48 inches inside diameter and built of standard solid manhole barrel blocks set on a concrete or precast sectional plate base. The upper 2 feet of masonry shall be built using batter blocks. All joint spaces shall be completely filled, horizontal and vertical. All block to be thoroughly wet before jointing. A leveling course of two bricks at the top shall be used to meet proper grade. Cement concrete blocks shall be machine-made solid segments conforming to the requirements for Concrete Masonry Units for Construction of Catch Basin and Manholes, ASTM-C-139. Blocks shall be 6 inches in width with the inside and outside surfaces curved to the necessary radius and so designed that the interior surfaces of the structures shall be cylindrical. The top batter courses shall be designed to reduce uniformly the inside section of the structure to the top size and shape. The blocks used in the top courses shall be designed to produce a surface 8 inches in width upon which to seat the frame.

2.3 MANHOLE FRAMES AND COVERS

A. Frames and covers shall be of cast iron conforming to the requirements of ASTM A48, Class No. 30 and shall be manufactured by East Jordan Iron Works Brockton, Massachusetts, Neenah Foundry Company, Neenah, Wisconsin, Mechanics Iron Foundry Company, Roxbury, Massachusetts, or equal. Manhole covers shall be machined to fit securely and evenly on the frame. Frames and covers shall be designed to accept H20 loads, have a diamond surface finish, and frame height of 6 to 9-inches. Covers shall bear the word "SEWER" in 3-inch-high letters.

2.4 PVC PIPE

A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.

B. PVC SEWER PIPE

1. PVC (Polyvinyl Chloride) Gravity Sewer Pipe: ASTM D3034, SDR 35, for elastomeric gasket joints. Pipe 18 to 27 inches in diameter shall conform to ASTM F679, T-1 heavy wall.

a. Fittings: Elastomeric joints complying with ASTM D3212 using elastomeric seals complying with ASTM F477.

2.5 IDENTIFICATION

A. Detectable Underground Warning Tapes: Acid and alkali-resistant polyethylene plastic film warning tape, 6-inches wide by 4-mils minimum thickness, with continuously printed caption in black letters "CAUTION - xxxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5-feet deep.

Color	Utility
Safety Red	Electric
High Visibility Safety Yellow	Gas, Oil, Steam
Safety Alert Orange	Telephone, Communications, Cable Television
Safety Precaution Blue	Water System, Irrigation
Safety Green	Sanitary Sewer, Storm Sewer
White	Proposed Excavation

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION

A. General Locations and Arrangements: Contract Drawings indicate the general location and arrangement of the underground sanitary sewer system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical. Any modifications to the layout of the sewer system shall be submitted to the Engineer for review and approval at least five days prior to the start of the affected work.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations, accepted practices, and utility owner’s requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use manholes for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.

D. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited without the written approval of the Engineer.

E. Install piping pitched down in direction of flow, at minimum slope of 1/4-inch per foot, except where indicated otherwise on the Contract Drawings.

F. Extend sanitary sewerage system piping to connect to building sanitary drains, of sizes and in locations indicated on the Contract Drawings.

3.2 CONCRETE STRUCTURES

A. The bases shall be supported on a compacted level foundation of gravel borrow a minimum 12 inches thick. Crushed stone may be substituted for gravel borrow if field conditions at the bottom of the excavation are wet.

1. Manhole risers and tops shall be installed using approved butyl-rubber type gasket for sealing joints of manhole risers and tops; jointing shall be performed in accordance with the manufacturer's recommendations. Manhole risers and tops shall be installed level and plumb. Water shall not be permitted to rise over newly made joints, nor until after inspection as to their acceptability. All jointing shall be done in a manner to ensure watertight joints. Openings shall be provided in the precast concrete manhole risers to receive entering pipes and these openings shall be made at the place of manufacture. Connection of sanitary pipes to manholes shall be made by means of a flexible rubber sleeve/boot cast integral with the structure sidewall.

2. Care shall be taken to ensure the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Manhole risers and tops shall be installed so the manhole steps shall be in alignment.

3. All holes used for handling shall be thoroughly plugged with non-shrink grout.

4. Cutting or tampering in the field, for purpose of creating new sidewall openings or altering existing openings, will not be permitted without approval of the Engineer.

5. Clean all debris, mortar, and soil from the bottom of all structures prior to final acceptance of the project.

3.3 STRUCTURE REBUILT

A. When in the opinion of the Engineer or Owner's Representative, an existing masonry structure walls show deterioration, the structure shall be rebuilt. The casting and deteriorated masonry shall be removed in a careful and neat manner until only a sound condition remains. Concrete blocks shall be used to rebuild the structure. The new masonry construction, replacing of the casting, and other incidental work shall be performed as specified above.

1. The Contractor's base bid shall include rebuilding [20] vertical linear feet of existing manhole structures.

3.4 SETTING MANHOLE FRAMES AND COVERS

A. Manhole frames shall be set with tops conforming accurately to the grade of the pavement or finished ground surface as indicated on the Contract Drawings or as directed. Frames shall be set concentric with the top of the manhole on a minimum of two courses of brick and a maximum of four courses in a full bed of mortar so the space between the top of the brick and mortar 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 concrete shall be placed all around the bottom flange. The mortar shall be smoothly finished to a height of 5 inches above the flange.

1. Only clean bricks shall be used in brick work to adjust frame elevations. The brick shall be moistened by suitable means.

2. Manhole covers shall be left in place in the frame until completion of other work at the manholes.

3. Frame castings for catch basins shall be set on a minimum of two courses of brick and a maximum of four courses in full mortar beds true to line and grade. Frames shall be set in a grout bed and the cement mortar shall be brought up to a height of not less than 5 inches above the bottom of the frames and made watertight. The castings of structures located within the pavement area shall not be completely set to the established grade until the bottom course of pavement has been laid. The final setting of all casting shall be performed at the proper stage of construction as required by the Contractor's operations. No additional payment will be made for adjusting and resetting of any casting.

3.5 PVC PIPE

A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.

B. PIPE HANDLING

1. All pipe and fittings shall be carefully handled from the truck onto the ground and into the trench or excavation so as to prevent damage to the pipe. Pipes shall be kept free of dirt and foreign material especially on the inside. Joint ends of pipe shall especially be kept clean.

2. Pipe stored on site shall be protected from direct sun light and suitably ventilated.

3. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective.

C. ALIGNMENT AND PLACEMENT OF PVC PIPE

1. Bedding material for the pipe must be installed with care in the area around the pipe. Bedding material must be placed to provide uniform and adequate support under pipe. Do not use blocking to bring pipe up to grade.

2. Provide bell holes at each joint to permit joint to be assembled properly while maintaining uniform pipe support.

3. Place and consolidate the bedding material under the pipe haunch to provide adequate side support while avoiding both vertical and lateral displacement of pipe.

4. Initial backfill must be completed to a point at least 12-inches over the top of the pipe and be hand placed. Use little or no tamping of initial backfill directly over the top of pipe. Compaction methods may be utilized during final backfilling.

5. Jointing of PVC sewer pipe and fittings shall be done in accordance with the printed

recommendations of the manufacturer and as specified. The bell end of the pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be lubricated prior to making up the joint. The position of the gasket shall be checked to insure the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.

6. When jointing PVC conduit pipe, it shall be cut square, conduit ends cleaned, an even coating of solvent cement applied to the pipe end and socket, and the conduit firmly pushed together until the conduit bottoms in the socket. The conduit shall be rotated 1/4 turn immediately after bottoming in the socket to ensure even spread of the cement.

7. Detectable warning tape shall also be installed 2-feet below the existing ground surfaces for later use in locating the pipe's exact position.

3.6 TAP CONNECTIONS

A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work.

B. Make branch connections from side into existing piping by installing a saddle or wye as indicated on the Contract Drawings.

C. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.

3.7 INSTALLATION OF IDENTIFICATION

A. Install continuous plastic underground warning tape during back-filling of trench for underground sanitary sewerage system piping. Locate tape two-feet below finished grade, directly over piping.

3.8 FIELD QUALITY CONTROL

A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction and the following:

1. Testing shall be witnessed by the Owner’s Representative and the local authority.

2. All sewers shall be tested for leakage by an infiltration test if the groundwater level is a minimum of two feet above the crown of the pipe for the full length of the section to be tested.

3. Where sewers cannot be tested by an infiltration test as specified above, they shall be tested by an exfiltration test using air as specified in a document entitled, "Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe”, by UNI-BELL PVC Pipe Association dated July, 1998 (UNI-B-6-98).

B. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.

2. Place plugs in ends of uncompleted pipe at end of day or when work stops.

3. Flush piping between manholes to remove collected debris.

C. Interior Inspection: If deemed necessary by the Owner's Representative inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after pipe between manholes has been installed and approximately 2 feet of backfill is in place, and again at completion of project.

2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, the Contractor shall correct such defects and reinspect.

D. Prior to acceptance of the sanitary sewerage system the Contractor shall submit to the Engineer for review a system As-Built Plan stamped by a Professional Land Surveyor Registered in the Commonwealth of Massachusetts and the results of the leakage tests. Prior to putting the system into service all structures shall be inspected, with the Owner's Representative present, to insure that no debris or other contaminants are present. If necessary clean structures and flush piping.

3.9 BACKFILLING

A. General: Conduct backfill operations of open-cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing are completed, all in accordance with local requirements and the contract documents.

B. Initial backfill shall be placed evenly on both sides of the pipe to distribute the load and not to cause movement or deflection of the pipe.

3.10 FINAL INSPECTION

A. Final inspection and acceptance of pipe, valves, appurtenances, hydrants and precast concrete structures shall be made by the Owner's Representative and the utility owner having jurisdiction of the particular system. Prior to placing the systems in service all components shall be inspected, with the Owner's Representative present, to insure that no debris or other contaminants are present. If necessary, the Contractor shall clean the structures and flush piping.

B. The Contractor is responsible for coordinating and scheduling the inspection of the work by local jurisdictional authorities. No additional payment will be made for inspections and permits required in the performance of the work.

END OF SECTION 33 30 00