SECTION 33 40 00

STORMWATER UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Storm sewer pipe, manholes, catch basins, fittings, and miscellaneous appurtenances.
2. The Contractor shall, unless specified otherwise, furnish all materials, equipment, tools and labor necessary to do the work required under the contract and unload, haul and distribute all pipe, castings, fittings, manholes, catch basins, and accessories. The Contractor shall excavate the trenches and pits to the required dimensions; sheet, brace and support the adjoining ground or structures where necessary; handle all drainage or ground water; lay and test the pipe, castings, fittings, manholes and accessories, backfill and consolidate the trenches and pits.
3. The Contractor shall also furnish all equipment, tools, labor and materials required to re-arrange sewers, conduits, ducts, pipes or other structures encountered in the installation of the work. All the above work to completely construct the sewer facilities shall be done in strict accordance with the project's contract documents to which these Specifications are a part thereof.

B. Related Sections:
1. Section 33 05 17 – Adjust Miscellaneous Structures.
2. Section 31 23 00 – Excavation and Fill.
3. Section 33 05 05 – Trenching and Backfilling.
4. Section 32 11 23 – Aggregate Base Courses.
5. Section 32 16 13 – Concrete Curbs and Gutters.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. Storm Sewer Pipe:
   a. Sewer pipe shall be paid for at the contract price per lineal foot, which shall include the cost of furnishing all pipe, pipe bend sections, jointing material, bedding material and other material and of delivering, handling, laying, dewatering, trenching, sheeting and backfilling, restoring of the surface, necessary permits, and all material or work necessary to install the pipe complete in place at the depth specified. The length of pipe for which payment is made shall be the actual overall length measured along the axis of the pipe without regard to intervening manholes, tee sections or bend sections. Lengths of branches will be measured from the center of manhole to the center of manhole. All lengths will be measured in a horizontal plane unless the grade of the pipe is more than fifteen (15) percent. The depth of cut for payment shall be defined as the distance between the invert of the pipe at a particular point and the intersection of a vertical or plumb line extended from the said point to the point of intersection of the line with the ground surface as it exists at time of construction.
   b. Pipe bedding will be in accordance with Section 33 05 05.
   c. Improved pipe foundation shall be per Section 33 05 05.
2. Drainage Structures: Measurement will be based upon lineal feet according to type and size, for furnishing and installing structures complete, including temporary covers, casting frame and cover, and adjusting rings in place as specified.

3. Connect to Existing Pipe: Measurement shall be per each connection made of specified size of pipe regardless of type of existing bulkhead or plug. Payment shall include all costs of the work including removal and disposal of bulkhead or plug, and construction of concrete collar if necessary.
4. Connect to Existing Structure: Measurement shall be per each connection made, regardless of size of opening or type of existing structure. Saw cutting of the pipe installed in the opening if necessary shall be considered incidental. Core cutting for connections and reconstruction of existing structure invert if necessary shall also be considered incidental.
5. Rip Rap: Measurement will be based on units of cubic yards placed according to class. Payment shall include placement of geotextile fabric.
6. Flared End Section Including Trash Guard: Measurement will be based on units of each size installed complete in place as specified. Payment shall include trash guard, excavation, backfilling and compaction.
    a. Where a sewer line is terminated with a flared end section, tying the last 3 joints as specified is considered incidental to the installation of the pipe.
7. Piling Foundation for Manholes: will be paid at the unit price bid and shall include steel reinforcement of the base, together with four twenty foot piles each. Piling over twenty feet in length will be paid for at the contract unit price per linear foot for each foot of length over twenty feet driven in place below cut-off.
8. The furnishing and installing of specific items and/or performance of work under certain circumstances shall not be individually paid. The costs shall be included in the unit price bid for the storm sewer items, as indicated. Such items of work include but are not limited to:
    a. The wood and/or metal parts necessary to identify the ends of unattached laterals, include in the price bid for storm sewer services.
    b. If a separate bid item for bypass pumping is NOT included in the *Schedule of Unit Prices,* providing temporary bypass pumping / control of sanitary and storm water flows around the construction zone, include in the price bid for the associated sewer items.
    c. Locating and connecting to an existing storm sewer, include in the price bid for storm sewer.
    d. Use of geotextile fabric to wrap pipe joints in lieu of using mastic, include in the price bid for storm sewer.
    e. Maintenance of an appropriate storm water outlet during construction, include in the price bid for storm sewer.
    f. The cost of all labor, equipment and materials necessary for testing of storm sewer, if required, included in the price bid for storm sewer.

1.03 REFERENCES

A. Minnesota Department of Transportation "Standard Specifications for Construction" 2018 Edition (MnDOT Spec.):
    1. 2511 - Random Rip Rap
    2. 2511 - Hand Placed Rip Rap
    3. 2511 - Grouted Rip Rap
    4. 3601 - Rip Rap Materials
    5. 3733 - Geotextile Filter

1.04 SUBMITTALS

A. Submit Shop Drawings for storm sewer structures consistent with Section 01 33 30.

B. Submit Manufacturer's Certificate of Compliance for the following items:
    1. Gray iron castings
    2. Precast manhole sections

3. Rip Rap

PART 2 PRODUCTS

2.01 SOLID WALL POLYVINYL CHLORIDE (PVC) PIPE

A. 4" THROUGH 6" Diameters: Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ration (SDR) of 26, unless otherwise specified on the plans.

B. 8" through 15" Diameters: Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ratio (SDR) of 35, for depths of less than 18 feet, unless otherwise specified on the plans. The SDR for depths exceeding 18 feet shall be 26, unless otherwise specified on the plans.

C. Over 15" Diameters: Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM F679 with a minimum wall thickness for a minimum pipe stiffness of 46.

D. The connection shall be push-up with elastomeric gasket joints, which are bonded to the inner walls of the gasket recess of the bell socket.

E. The pipe grade used shall be resistant to aggressive soil and corrosive substances in accordance with the requirements of ASTM D-543.

F. Polyvinyl chloride pipe joints shall be rubber gasketed push-on type joints conforming to ASTM D-1784. Joints supplied by the pipe manufacturer shall be installed according to their instructions.

2.02 HIGH DENSITY POLYETHEYLENE (HDPE)

A. Corrugated polyethylene pipe and fittings shall be manufactured from high-density polyethylene (HDPE) virgin compounds.

B. Clean reworked HDPE materials from the manufacturer's own production may be used by the manufacturer of HDPE pipe, provided that the pipe and fittings produced meet all requirements of these special provisions and in AASHTO M294 and Design Section 18 of the AASHTO Standard Specifications for Highway Bridges.

C. The polyethylene compounds shall conform to the requirements of ASTM D 3350 Cell Class 335420C.

D. HDPE shall be used only with site specific bedding requirements and written permission from the Engineer.

2.03 REINFORCED CONCRETE PIPE (RCP)

A. Reinforced concrete pipe and fittings including bends, tee sections and specials shall conform to:
   1. Standard Specification for Reinforced Concrete Sewer Pipe
   2. ASTM Designation C76 Wall B with circular reinforcing for the class of pipe specified.

B. Reinforced concrete pipe joints shall be Type R-4 meeting the requirements of ASTM C443.

C. Concrete pipe to be jacked shall be Class V or greater.

D. Pipe required for piling shall be reinforced concrete pipe furnished in (8) foot lengths and shall be of special design in accordance with Section 10, ASTM Designation C76, latest revision.

E. Concrete pipe bends called for on the plans shall be 7 1/2° pipe bends with a 4'-0" center line laying length and a 30.5' radius of curve, and with wall thicknesses and steel reinforcing in accordance with ASTM Specifications C76.
   1. Bends shall be of the same pipe class as the pipe on either side of the bend.
   2. Joints shall be tongue and groove with rubber gaskets meeting the requirements of ASTM C443.

2.04 SUBSURFACE DRAIN PIPE / CONDUITS

A. 4" Perforated PE Pipe Drain (no sock)

2.05 MORTAR

A. Mortar shall consist of a mixture of one part Portland Hydraulic Cement and two parts of clean washed sand by volume.

B. The quantity of Mortar in the mixture shall be sufficient to produce a stiff workable mortar, but in no case shall exceed five and one-half (5 1/2) gallons of water per sack of cement.

C. Sand shall conform to ASTM C-144.

D. Portland Cement shall conform to ASTM C-150.

2.06 CONCRETE

A. Concrete to be used shall be composed of a mixture of fine and coarse aggregate and a Portland Hydraulic Cement conforming to the ASTM Specification Designation C-150, Type 1, with the proper water-cement ratio to obtain a concrete testing not less than 3,000 pounds per square inch in 28 days.

B. The fine aggregate for concrete shall be composed of a clean washed sand of hard, sharp, durable particles.

C. Coarse aggregate for concrete shall be composed of a gravel uniformly graded 3/4 inch maximum size to #4 sieve.

D. Coarse aggregate shall be composed of hard durable particles free of shale, chert, flat or elongated pieces.

E. Mixing water shall be suitable for drinking purposes, containing no acids, alkalies, oils or other deleterious materials.

F. Concrete shall be mixed in a mechanically operated mixer so controlled that the drum shall operate a minute and one-half after all materials including water are in the drum.

2.07 STEEL REINFORCING BARS

1. Steel reinforcing bars shall be deformed steel bars with approved casting for concrete reinforcement in conformance with ASTM Designation A-305 and ASTM Designation A-15 Intermediate Grade Billet Steel.

2.08 MANHOLE AND CATCHBASIN - FRAMES AND COVERS

A. Cast iron for both manholes and catchbasin frames and covers shall be of the best grade of cast iron, free from all injurious defects and flaws, and shall conform to the following Specifications: Federal AA-1-652 ASTM A48-56, A.A.S.H.O. M105-49 and ASA 6.25101948.

B. The standard manhole casting shall be Neenah Foundry No. R1642-B, or equal, as shown on the Standard Plate and shall have two concealed pick holes. The minimum allowable weight shall be 360 pounds.

C. Lettering on the manhole castings shall be as shown on the Standard Plate.

D. Storm sewer inlet castings shall be as specified on the plans and shown on the Standard Plate.

E. All castings shall conform to the requirements and dimensions shown on the drawings. All covers must fit closely in the rings in any and all positions and, when placed in the rings, must fit the ring solidly in all positions so that there will be no rocking from pressure on any point of the cover.

2.09 STORM MANHOLES AND CATCH BASINS

A. General Requirements: ASTM C478 and details on the Drawings.

B. Structures and bases shall be of precast concrete.

C. Manhole Joints: Rubber o-ring gasket type meeting ASTM C443.

2.10 STEPS

A. Manhole steps shall be in accordance with the Standard Plate for Manhole Steps and shall be spaced 16" on centers, on the downstream face of the manhole, unless specified otherwise.

B. All Storm Manholes shall have all steps turned 1/8th of a turn clockwise from the downstream invert.

C. Vinyl or rubber coated cast iron manhole steps shall be manufactured from hi-test metal having a minimum tensile strength 35,000 pounds per square inch.

D. All manhole steps shall be Neenah Foundry Step No. R-1981J, Badger F-15 or equal.

2.11 DRAINTILE

A. Geo-textile fabric sock shall <u>not</u> be installed.

B. Inspection tees shall be installed flush with the finished boulevard grade.

C. Where subdrains are connected to catch basins or manholes, rodent protection shall be installed.

2.12 TRASH GUARDS

A. General Requirement: ASTM A153.

B. Materials: Galvanized steel rods meeting the requirements in ASTM A153.

C. Bar size and configuration as shown on the Drawings.

D. Securely attached to end section.

2.13 RIP RAP

A. The riprap material shall conform to Section 3601 of the Minnesota Department of Transportation Standard Specifications. The stone shall be durable field or quarry stone of approved quality, sound, hard, and free from seams, cracks or other structural defects. Unless otherwise specified, the stone may be round, flat, or other shapes in between.

B. Class or Size of Random Riprap Rock
1. Unless otherwise specified, Class III rock shall be used for all installation and shall conform to MnDOT Spec. 3601.

C. Class or Size of Hand Placed and Grouted Riprap
1. The individual stones, except those used for chinking, shall not weigh less than 50 pounds each.

D. Size of Rock Versus Weight
1. As a guide, the following table is included which compares the approximate average diameter with the various weights of round stone. Of course, flat stones of an equivalent weight would have a greater diameter.

Weight (lbs.)	Avg. Dia. (Inches)	Weight (lbs.)	Avg. Dia. (Inches)
10	6	150	15
30	9	180	16
50	10	250	18
80	12	300	19
110	14	400	21

2.14 LINER MATERIAL

A. Erosion control liner material shall be placed beneath the filter blanket material at each storm sewer outlet as described on the standard plate.

B. The liner shall be Staff Permaliner plastic filter material #Mll95, or equal.

2.15 SOIL MATERIALS

A. Normal "Fill Material"
1. Is defined under the Sewer Specification 33 31 00 - 2.11.

B. Granular Selected Material
1. Mn/DOT Specification 3149 aggregate shall be used for granular selected material as shown and specified under the pipe bedding classification or an equivalent natural granular soil.

C. Fine Granular Fill Material
1. This material shall consist of sound durable particles without cohesion of clean sand and/or well rounded gravel.
2. The largest size of gravel which may be used shall be dependent upon the size of the pipe used.

3. A maximum of 3/8 inch gravel may be used when the pipe diameter exceeds 24 inches.

D. Class 4 and Class 5 Sand and Gravel
   1. Class 4 and Class 5 sand and gravel shall be in conformance with Mn/DOT Specification 3138.

E. Crushed Rock
   1. Material shall consist of durable crushed quarry rock of which 100% passes a 2" sieve and of which 95% is retained on a #4 sieve size.
   2. Material shall not contain soil overburden, sod, roots, plants, and other organic matter, or any other materials considered objectionable by the Engineer.

F. Pit Run Gravel
   1. The material shall consist of sound, durable particles of gravel and sand with which may be included limited amounts of fine soil particles as binding material, and of which 100% passes a 2" sieve and of which 90% is retained on the #200 sieve size.
   2. It shall not contain sod, roots, plants, and other organic matter, or any other objectionable materials.

G. Rock Stabilization
   1. Rock stabilization shall consist of 3/4 inch minus rock installed in the trench bottom at the direction of the Engineer.

H. Course Filter Aggregate
   1. Coarse filter aggregate material, to be used as granular foundation per CEAM Spec. 2621.2F or to be used beneath sanitary sewer and storm sewer structures or to be used as the gravel pit material below hydrants, shall be per Mn/DOT Spec. 3149.2H as determined by the Engineer.
   2. Course filter aggregate material shall also be used for surfacing due to wet conditions or other such uses.
   3. The use of course filter aggregate will be considered incidental to the utility being installed.

I. Aggregate Bedding
   1. The aggregate bedding material to be used for granular bedding and granular encasement purposes as defined by CEAM Spec. 2621.2F, shall be per Mn/DOT Spec. 3149.2G.

2.16 INSPECTION AND TESTING OF MATERIALS

A. Shop Inspections and Testing
   1. All materials furnished by the Contractor are subject, at the discretion of the Engineer, to inspection and/or testing by accepted methods at the plant of the manufacturer.
   2. This inspection and/or testing is to be made at the cost of the Owner.
   3. The material supplier shall provide the City with copies of test results on materials that are furnished to the Contractor.

B. Field Inspection and Testing
   1. All materials furnished by or for the Contractor for incorporation into the work under contract shall, at the discretion of the Engineer, be subject to inspection and/or testing by methods acceptable to the Engineer and at the expense of the Owner.

C. Disposition of Defective Material
   1. All material found during the process of inspecting and testing to be defective, or defective material encountered at any time during the progress of the work, will be rejected by the Engineer and the Contractor shall promptly remove from the site all such material.

D. Concrete Test Cylinders
   1. On all type of concrete construction, up to 4 test cylinders may be taken from each section of the structure cast in one operation.
   2. The City shall, within seven (7) days of their origin, deliver all cylinders to an approved testing laboratory.
   3. The cost of testing shall be paid by the Owner.

2.17 CONTRACTOR'S RESPONSIBILITY FOR MATERIALS

A. Material Furnished by Contractor
   1. The Contractor shall be responsible for all material furnished by the Contractor, and the Contractor shall replace at the Contractor's own expense all such material that is found to be defective in manufacture or that has become damaged in handling after delivery by the manufacturer.
   2. This shall include the furnishing of all material and labor required for the replacement of installed material discovered defective prior to the final acceptance of the work or during the warranty period.

B. Material Furnished by Owner
   1. The Contractor's responsibility for material furnished by the Owner shall begin at the point of delivery by the manufacturer, or Owner, and upon acceptance of the material by the Contractor.
   2. The Contractor shall examine all material furnished by the Owner at the time and place of delivery and shall reject all defective material.
   3. The point of delivery shall be stated in the "Special Provisions".

C. Replacement of Damage Material
   1. Any material furnished by the Owner that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at the Contractor's own expense.

D. Responsibility for Safe Storage
   1. The Contractor shall be responsible for the safe storage of material furnished by or to the Contractor, and accepted by the Contractor, and intended for the work, until it has been incorporated in the completed project.
   2. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times.

E. Material Handling
   1. Pipe and other accessories shall, unless otherwise directed in the Special Provisions, be unloaded at the point of delivery, hauled to and distributed at the site of project by the Contractor.
   2. Materials shall at all times be handled with care to avoid damage.
   3. In distributing the material at the site, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.
   4. Pipe shall be so handled that the coating and lining will not be damaged.
   5. If any part of the lining or coating is damaged, the repair shall be made by the Contractor at the Contractor's expense in a manner satisfactory to the Engineer.

PART 3 EXECUTION

3.01 PREPARATION

A. Trench Excavation and Backfill shall conform to Section 33 05 05.

B. By-Pass Pumping: Contractor responsible for all items required to maintain sewer flows during construction of the new storm sewer. All Work and costs for by-pass pumping is considered incidental to the Project, unless otherwise specified.

3.02 INSTALLATION

A. GENERAL
1. Manholes and catchbasins shall be set and jointed to the line in the manner specified for laying and jointing pipe.

B. LOCATION
1. Manholes, catchbasins and clean-outs shall be located as shown on the plan or as directed by the Engineer and all changes in direction, changes in pipe size, dead ends, or every 400 feet.

C. TYPE OF CONSTRUCTION
1. Unless otherwise specified, the manholes and catchbasins shall be constructed of precast sections.
2. Where standard sections cannot be used, sections may be constructed of block concrete.
3. Unless otherwise specified, the manholes and catchbasins if necessary shall be constructed with steps in accordance with the Standard Plate of this Specification.

D. CONSTRUCTION DETAILS
1. The details of construction of each individual structure shall conform to the drawings and specifications as designated.
2. Frames and covers shall be set to the designated elevation in a full mortar bed.
3. The bottom of all manholes shall be constructed of half section of equivalent size pipe shaped to conform to the inlet and outlet pipe so as to allow a free, uninterrupted flow.
4. All inverts shall have a 0.10 foot drop across the manhole unless otherwise stated in the plans and specifications.
5. Any manhole invert not within 0.04 feet of the specified 0.10 foot drop shall be rejected.

E. ADJUSTING RINGS AND BLOCKS
1. A minimum of two (2) and a maximum of four (4) adjusting rings shall be provided between the cast iron frame and the top concrete manhole section.
2. The rings shall provide between 4” and 12” of adjustment.
3. Adjusting rings shall be 2”, 4”, or 6” and be implemented so the fewest number of rings are used.

F. WATERPROOFING AND PRECAST SECTION JOINT CONSTRUCTION
1. Manholes and catchbasins shall be constructed in such a manner that they are waterproof.
2. Joints between manhole sections shall be made using confined 0-ring rubber gaskets as specified previously.

G. LIFTING HOLES
1. Not more than two (2) lifting holes will be allowed in any precast manhole section.
2. All lifting holes shall be plugged with non-shrinking grout to ensure a waterproof installation.

H. MANHOLE AND CATCHBASIN BASES
1. The concrete base shall be of size and depth as shown on the drawings.
2. Concrete used shall have a 28-day compressive strength of at least 3,000 pounds per square inch.
3. Precast concrete bases shall be used unless prior written approval by the Engineer allows poured bases.

a. Precast bases must be placed on a minimum of six inches of granular material which has been thoroughly compacted and leveled off across the entire width of the base.

4. Where the foundation is unstable, the Engineer may order the Contractor to install manholes on piling.
   a. Manhole base reinforcement and timber piles shall be as shown on the drawings.

I. MANHOLE CASTINGS
1. Manhole castings for storm sewer manholes shall have temporary structure covers.
   a. The temporary structure covers shall remain covered until just prior to the placement of the final wearing course of bituminous asphalt.

J. CLEAN-OUTS
1. Clean-outs shall conform to the design shown in the Standard Plates.

K. WEEP HOLES
1. The Contractor shall provide weep holes, as required by the City Engineer, for catch basin locations where water sits due to the wear course not being placed.
   a. Generally, this will apply to low points where the wear course is being placed the next construction season.
2. The weep holes shall consist of core drilling a hole in the adjusting rings to allow water to drain into the structure.
3. After placement of wear course, the Contractor shall grout the hole and back plaster as required.
4. All costs associated with the weep holes shall be considered incidental.

L. Connect to Existing Structure
1. Connect to existing structure at location shown on the Drawings.
2. Core the hole in the structure and saw cut the pipe flush with the inside wall of the structure.
3. Bulkhead void between outside wall of pipe and edge of opening with mortar and brick.
4. Reconstruct manhole bench/invert.

3.03 PIPE INSTALLATION

A. Trench Excavation and Backfill: Conform to Section 33 05 05.
1. Prior to the laying of the pipe, the trench shall be excavated and prepared in accordance with the previous specifications and the class of bedding specified.

B. All pipe shall be laid and maintained to the required lines and grades, with manholes, catch basins and fittings at the required locations.
1. The owner will furnish one set of line and grade stakes necessary for the work.
2. It shall be the Contractor's responsibility to preserve these stakes from loss or displacement.
3. The Engineer may order the replacement of any stakes deemed necessary for the proper installation of the work. Any replacements shall be at the Contractor's expense.
4. All pipes shall be laid to the grade shown on the contract drawings.
5. No deviation shall be made from the required line or grade except with the written consent of the Engineer.
6. The Contractor shall maintain the line and grade of the pipe in the trench by means of the grade or batter board method or laser.

C. The type, size and class of pipe installed shall be in conformance with that specified.

D. The class of bedding shall be in conformance with that specified in the project specification or on the Standard Plates.

E. Pipe Jointing
   1. Pipe laying shall proceed upgrade with the tongue or spigot ends pointed in the direction of flow.
   2. Pipe joints shall be made using the materials specified under Part 2. All sliding surfaces of the joint shall be cleaned and lubricated immediately before the pipe is brought home.
   3. The outside of the tongue or spigot end of the pipe shall be wire brushed and wiped clean and dry and free from oil and grease before the pipe is laid.
   4. Joints for concrete pipe shall be made by wiping the joints clean, applying the manufacturer's recommended lubricant compound over the entire joint surface and then inserting the spigot end into the bell with sufficient force to properly seat the pipes.
   5. Joints for polyvinyl chloride pipe shall be made by the use of push-on rubber gaskets. All jointing procedure shall be in accordance with the recommendations of the pipe manufacturer.

F. All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying.

G. The interior of the sewer shall be carefully cleaned from all dirt, cement, or superfluous material of every description as the work progresses. If necessary, pipe shall be thoroughly flushed at the completion of the work at the expense of the Contractor as directed by the Engineer.

H. If an existing utility is shown on the plans and there is no bid item for removing and restoring, or working around the utility, the Contractor shall be required to remove and restore, or protect the utility.

I. The inverts of existing storm sewers, culverts, subdrains, etc. shall be protected during construction. The Contractor is responsible to inspect and clean, if necessary, all lines which have become compromised by the construction operations.

J. The trench for all flexible pipe shall be undercut six-inches below the pipe barrel to permit the installation of granular bedding or foundation material.

K. The trench for all rigid pipe shall be undercut three-inches below the pipe barrel to permit the installation of granular bedding or foundation material.

L. The Contractor shall install and operate a dewatering system to maintain all trenches free of water wherever necessary. The Contractor shall make his own subsurface investigations and determine what dewatering methods to utilize to prevent such damage.
   1. Pipe shall not be laid in water, or when the trench conditions are unsuitable for such work except by written permission of the Engineer.

M. The Contractor shall be responsible for any damage to adjacent structures or buildings caused by the dewatering operations.

N. Use of granular foundation material in lieu of performing dewatering is permitted.

O. Connect to End of Existing Pipe
   1. Connect to existing pipe at locations shown on the Drawings.
   2. Locate and expose end of existing pipe.
   3. Remove existing bulkhead or plug and dispose of off site:
      a. Take care not to damage existing pipe.
      b. Any segment of pipe damaged by Contractor shall be replaced with new materials at no expense to the project.
   4. Utilize standard bell and spigot joint with rubber o-ring gasket if possible.

5. If butt connection must be made to existing pipe, construct reinforced concrete collar around joint. Collar shall be minimum 12 inches thick in all locations and shall extend a minimum of 12 inches each way of the joint.

P. Rip Rap
   1. General: Conform to MnDOT Spec. 2511.
   2. Type I filter blanket material that meets MnDOT Specification 3601.2B shall be placed beneath the riprap material at each storm sewer outlet as described on the standard plate.

3.04 FIELD QUALITY CONTROL

A. Scope:
   1. All pipeline testing is considered incidental to the Bid cost of the pipe.
   2. Engineer to observe and verify that all test and visual inspections have been completed prior to final acceptance.

B. Cleaning:
   1. Consists of Cleaning the Pipe and Structures:
      a. If newly installed mains and structures are kept clean during construction, cleaning will not be required.
      b. If newly installed mains and/or structures become dirty due to negligence of the Contractor, cleaning will be performed at the sole expense of the Contractor.
   2. The bailing or flushing method of cleaning pipe is acceptable only if adequate provisions acceptable to the Engineer for keeping dirt and debris out of the existing sewer system or ponds are employed. Jetting may be required.
   3. Complete prior to final inspection for acceptance.

C. Required Tests and Inspections:
   1. Lamping:
      a. Verify installation is to true line and grade.
      b. Verify installed pipe is structurally sound.
      c. Verify there are no broken or deflective pipes.
      d. Verify that joints are all home.
      e. Verify structures conform to specified requirements.

3.05 PROTECTION

A. Plug all entrances and openings to the system promptly and before suspension of operations at the end of working day.

B. Secure manholes and structures immediately after completion or before suspension of operations at the end of working day with castings or suitable alternative device.

C. Mark all structures to avoid being hit by construction or vehicular traffic.

D. Establish erosion control measures as per Section 01 57 13.

END OF SECTION