

SECTION 33 41 00

STORM SEWER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Work
 - 1. Section 31 20 00 Earthwork
 - 2. Section 32 12 18 Bituminous Asphalt Pavement - Standard Duty
 - 3. Section 33 44 13 Manholes and Catch Basins

1.2 SCOPE OF WORK

- A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary for a new storm system as specified herein and indicated on plans.
- B. All attempts shall be made by this contractor to verify all existing lines within the project limits with the Owner. All trenches and pits shall be protected at all times.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM C14 – Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe
 - b. ASTM C76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe
 - c. ASTM C443-11 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
 - d. ASTM D2680 – Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping
 - e. ASTM D2751-05 – Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
 - f. ASTM D3034 – Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - g. ASTM D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
 - 2. American Association of State Highway and Transportation Officials (AASHTO):
 - a. AASHTO M 294 – Standard Specification for Corrugated Polyethylene Pipe, 12 to 60 inches in diameter

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pipe – Note: N-12 polyethylene pipe is acceptable in lieu of RCP.
 - 1. ABS braced double wall truss pipe and ABS solid wall pipe composed of virgin ABS compound, conforming to ASTM D2680, Type IV and to SDR-35 in accordance with ASTM D2751-05.
 - 2. PVC. SDR 35, ASTM D3034 Ring-Tite joints.

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3. The storm water piping shall be the size shown on the plans and shall be either Schedule 40 PVC or corrugated polyethylene pipe. The corrugated polyethylene pipe shall meet the requirements of AASHTO DESIGNATION: M 294-881. The corrugated polyethylene pipe shall have a smooth interior and shall be N-12, Type S, as manufactured by Advanced Drainage Systems, Inc., or approved equal.

B. Joints

1. Joints for six inch to ten inch diameter concrete sewer pipe shall be of Tylox Type CR rubber gasket or equal using bell and spigot design and shall conform to current specification ASTM C-443.
2. Joints for concrete sewer pipe of twelve inch diameter through twenty-four inch diameter shall be round rubber gasket, using a modified bell and spigot design.
 - a. The spigot shall have an external groove accurately sized to receive the gasket, so that when the pipe is laid and the joint completed, the gasket shall be enclosed on all four surfaces.
 - b. Joints and gaskets shall conform to the current ASTM C443.
 - c. The durometer hardness of rubber gaskets shall be 45 plus or minus 5 and the gaskets shall have a circular cross-section.

C. Joints for concrete sewers twenty-seven inches and larger shall be made with cement mortar.

1. After each section of pipe is laid, the lower portion of the bell shall be filled with mortar and the succeeding section shall be laid in place so that the inner surfaces of the abutting sections are flush.
2. The remainder of the joint shall then be filled with additional mortar to form a bead around the joint, which shall be flush with the outside diameter of the bell.
3. The inside of the joint shall be wiped clean and smooth.
4. The ends of concrete pipe shall be thoroughly wet before the mortar is placed.
5. The mortar shall be made with one part Portland Cement and two parts masonry sand.

D. Joints for ABS truss pipe and ABS solid-wall pipe shall be chemically welded or shall be of the elastomeric gasket seal (O-ring), ASTM D3212.

2.2 END SECTIONS

- A. End sections shall be pre-cast or prefabricated units equal to the size, strength and material of the pipe to which it is joined.
- B. Sizes and locations are shown on the plans.

2.3 PIPE MARKING

- A. Pipe shall have the markings which are required by the governing standard specification.
- B. Additionally, each pipe, fitting and special section shall have plainly and permanently marked thereon:
 1. Pipe class.
 2. Date of manufacture.
 3. Manufacturer's name or trademark.
 4. On bends, the angle turned thereby.
 5. Marking shall be indented in the pipe or painted thereon with waterproofed paint.

2.4 UTILITY SLEEVES

- A. Backfill shall be sand compacted to one hundred percent (100%). Any settlement shall be the responsibility of the contractor to correct.

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PART 3 - EXECUTION

3.1 SEWER INSTALLATION

A. Laying Sewer Pipe

1. The construction shall begin at the outlet end and proceed toward the upper end.
2. The pipe shall be carefully laid in the prepared trench to the line and grade shown on the plans, with the spigot end downstream.
3. The bottom of the trench shall be so shaped to permit a firm and even bearing along the barrel of the pipe.
4. The pipe shall be fitted close and tight and with smooth inverts.
5. Unless otherwise shown on the plans, all pipe shall be laid straight between changes in alignment and at a uniform grade between changes in grade.
6. Except where bends are installed adjacent to manholes, all lines shall be laid so that each section between manholes will lamp.
7. Pipe shall be protected from lateral displacement by means of pipe embedment.
8. Under no circumstances shall pipe be laid in water and no pipe shall be laid in unsuitable weather or trench conditions.
9. When jointed in the trench, the pipe shall form a true and smooth line.
10. Pipe shall not be trimmed, except for closures, and pipe not making a good fit shall be removed.
11. While pipe laying is in progress, not less than three unfilled joints shall be in place ahead of any joint filling or sealing work, so that the sealed joints will not be disturbed by pipe laying operations.

B. Pipe Handling

1. Pipe, fittings, and accessories shall be handled in a manner that will insure their installation in the work in sound, undamaged condition.
2. Equipment, tools and methods used in unloading, reloading, hauling, and laying pipe and fitting shall be such that they are not damaged.
3. Hooks inserted in ends of vitrified clay pipe shall have broad, well padded contact surface.
4. Care shall be taken to avoid dragging the spigot ring on the ground or allowing it to come in contact with hard objects.
5. Joint rings which have been damaged in any way will not be accepted and shall not be incorporated in the work.
6. Concrete pipe and fittings shall be handled with suitable slings and lifting hooks.
 - a. No hooks shall be permitted to come in contact with joint surfaces.
 - b. Pipe units shall be kept form contact with adjacent units during handling and storage.

C. Pipe Cleaning

1. The interior of all pipe and fittings shall be thoroughly cleaned of all foreign matter before being installed and shall be kept clean until the work has been accepted.
2. All joint contact surfaces shall be kept clean until the joining is completed.
3. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being installed.
4. No debris, tools, clothing or other materials shall be placed in the pipe.
5. Whenever pipe laying is stopped, the end of the pipe shall be closed with an end board closely fitting the end of the pipe and having a number of small holes drilled near the center, to prevent the trench from filling with water and to keep sand and earth out of the pipe.

D. Pipe Inspection

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1. Each piece of sewer pipe shall be tested for soundness, after it delivery.
2. All pipe shall be subject to rejection on account of failure to conform to any requirements of the governing ASTM Standard Specification.
3. All accepted pipe and fittings shall be installed in such a manner, that the acceptance marks or symbols will be plainly visible after installation in the trench.
4. Rejected pipe and fittings shall be marked and shall be removed from the site.

3.2 SEWER ALIGNMENT

A. Batter Boards

1. The Contractor shall always check the lines and grades from three consecutive stakes and any irregularity thus discovered shall be corrected before proceeding with the work.
2. The Contractor shall set batter boards at three consecutive stakes at intervals of not more than 30 feet.
 - a. Batter boards shall be not less than 1" x 4" lumber, supported by steel stakes or
 - b. 2" x 4" wood stakes.
 - c. The batter boards at three consecutive stakes shall be set at a uniform distance above the sewer grade.

B. Laser

1. The Contractor may use a laser beam to maintain line and grade for sewer construction.
2. The Contractor shall submit evidence to the Landscape Architect that a qualified operator will handle the laser beam equipment during the course of construction.

3.3 SEWER APPURTENANCES

A. Cut-Ins

1. When cutting-in to a larger sewer, the opening in the larger sewer shall be no larger than is necessary to admit the new sewer.
2. When the larger sewer is of reinforced concrete construction, the reinforcing steel shall be carefully cut off to the proper distance to avoid spalling the concrete.
3. All broken or surplus material shall be removed from both sewers.
4. A T-saddle or other approved connection shall be installed.
5. The cut-in pipe shall not extend beyond the inner wall of the existing pipe.
6. The joint shall be sealed with 1:2 mortar, and with a sufficient bead or fillet of such mortar to insure a solid connection.
7. When so directed by the Landscape Architect, the Contractor shall place such a bead or fillet on the inside as well as on the outside of the larger sewer.

B. Manholes

1. All manholes shall be constructed to conform to the requirements of Section 33 4413.

C. Catch Basins

1. All catch basins shall be constructed to conform to the requirements of Section 33 4413.

3.4 ACCEPTANCE

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- A. Acceptance tests will be conducted by the Landscape Architect to determine the acceptability of the sewers as constructed. The Contractor shall furnish suitable assistants to help the Landscape Architect during the conduction of tests.
- B. Each section of sewer line between manholes is required to be straight and uniformly graded. Each section shall be lamed.
- C. All defects in the sewers shall be repaired to the satisfaction of the Landscape Architect.

END OF SECTION 33 4100

SECTION 33 44 13

MANHOLES AND CATCH BASINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 03 3010 Portland Cement Concrete
 - 2. Section 04 0513 Mortar
 - 3. Section 31 2000 Earthwork
 - 4. Section 33 4100 Storm Sewer System
 - 5. Section 33 4600 Subdrainage System

1.2 SCOPE

- A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary to furnish and install manholes and catch basins as indicated on Contract Documents and specified herein.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM A48 – Standard Specification for Gray Iron Castings
 - b. ASTM C139 – Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
 - c. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar
 - d. ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections
 - 2. Michigan Department of Transportation (MDOT)

1.4 SUBMITTALS

- A. Manufacturer's Literature: Furnish to Landscape Architect copies of manufacturer's specifications, maintenance and installation instructions for each of the items specified herein. Include photographs, catalogue cuts, and other data as may be required to show compliance with these specifications.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Concrete to be 3500 psi at 28 days.
- B. Masonry sand for mortar shall conform to ASTM C144.
- C. Steel reinforcement to be as per manufacturer's recommendations.

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MANHOLES AND CATCH BASINS

2.2 CASTINGS

- A. All castings shall be of cast iron, conforming to ASTM A48 unless indicated otherwise. Conform to details and notes indicated on plans.
- B. Manhole frames and covers: Material shall be MDOT Type A with perforated covers.
- C. Catch basins and inlet castings: Catch basin and inlet castings shall be MDOT Type K when located in curbs and gutter, MDOT Type E in non-paved locations, and MDOT Type A when located in paved areas.

2.3 MANHOLE SECTIONS

- A. Manhole Walls
 - 1. Standard manhole walls shall be precast concrete units conforming to ASTM C478, or be concrete block masonry.
- B. Manhole Bases: Manhole bases shall be precast concrete units of the dimensions indicated on drawings.

2.4 MANHOLE STEPS

- A. Manhole steps shall be of cast iron conforming to ASTM A48 or equal, and shall meet pertinent safety rules and regulations.

2.5 CATCH BASINS AND INLETS

- A. Construct catch basins and inlets of brick, block, masonry, or precast units. Precast concrete catch basin units, if used, shall have reinforcing steel conforming to ASTM C799 II, Wall B.

2.6 MORTAR

- A. Mortar for brick masonry or plastering manholes shall be made of one part Portland cement to two parts sand. Mortar shall conform to Specification Section 04 0513.

2.7 BRICK

- A. Brick work shall meet the requirements of Medium Brick, ASTM C13

2.8 CONCRETE BLOCK MASONRY

- A. Concrete block masonry shall meet the requirements of ASTM C139.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavation shall be of sufficient dimensions to provide ample space for sheathing and bracing is required and ample space for the workmen to perform their work in a satisfactory manner.
- B. Refer to requirements of Section 31 2000 Earthwork.
- C. All structure shall be backfilled and tamped in lifts not greater than 8". Contractor shall have on site al

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MANHOLES AND CATCH BASINS

necessary power equipment to achieve 95% compaction.

3.2 BRICK AND BLOCK CONSTRUCTION

- A. Laying of brick or block units shall be performed in such a manner that the courses will be true to line and the joints fully bonded.
1. In a structure of cylindrical design, the bricks shall be laid with the long dimension radially in the structure.
 2. In a structure of rectangular design, the bricks shall be laid in alternate courses of headers and stretchers.
 3. Structures
 - a. Manholes shall be constructed of brick, concrete masonry units, precast reinforced concrete pipe, or monolithic concrete or as detailed.
 - b. All manholes shall be constructed to conform to the details shown on drawings.
 - i. Openings shall be provided in the manholes for future connections as shown on the plans or as ordered by the Engineer, of such size and at such elevation as directed and shall be considered incidental to the construction of the manhole.
 - ii. All such openings shall be closed with concrete or vitrified clay stoppers or brick bulkheads, to prevent infiltration or leakage.
 - c. The outside surface of all brick or masonry manholes on sanitary sewers shall be plastered one-half inch with mortar.
 - d. Cast iron manhole steps shall be set in a full mortar bed in the masonry.
 - e. Tops shall be tapered to receive the casting.
 - f. The manhole castings shall be set in a full mortar bed with the top at the required elevation and treated directly in line with the steps.
 - g. Manholes shall have flow lines shaped with concrete up to the spring line of the lines passing through.
 4. Catch basins shall be constructed of brick, concrete masonry units, precast reinforced concrete pipe, or monolithic concrete, and shall conform to details shown on drawings.
 - a. The inside surface of all brick or block catch basins shall be plastered one-half inch thick from the bottom to the corbel. The joints between the sections of precast pipe catch basins shall be plastered one-half inch thick and six inches wide, and no other plastering is required on such catch basins.
 - b. Catch basins which have lines of 30" diameter or larger entering, or four (4) or more lines entering, shall have an inside diameter of five feet.
 - c. Catch basins shall have a two (2) foot deep sump.
 - d. Tops shall be tapered to receive the casting.
 - e. Catch basins castings shall be set in a full mortar bed on top of the masonry. The castings shall be set with the top at the required elevation.

3.3 ADJUSTING EXISTING STRUCTURES

- A. Whenever existing manholes, catch basins, valve chambers, or similar structures occur, the tops of such structures shall be adjusted or rebuilt so that the top of the casting will fit the crown and/or grade of the finished surface.
- B. Raising castings shall be accomplished by use of precast adjusting rings and/or brick set in a full mortar bed with the casting re-set in accordance with preceding requirements for new construction.
- C. Lowering castings shall be accomplished by removing a sufficient amount of the existing structure to allow for reconstruction of the taper section and re-setting the casting in accordance with the preceding requirements for new construction.

END OF SECTION 33 4413

SECTION 33 44 16

POLYMER CONCRETE TROUGH DRAIN SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 03 30 10 Portland Cement Concrete
 - 2. Section 33 44 13 Manholes and Catch Basins
 - 3. Section 33 46 00 Subdrainage Systems - Sand

1.2 SCOPE

- A. The work under this section of the specifications shall include all materials, labor and equipment necessary to install a pre-cast, chemical-resistant polyester concrete trough drainage systems as specified, and as shown on the Contract Documents.

1.3 QUALITY ASSURANCE

- A. Manufacturer shall certify that the polymer concrete used meets the strength values of Section 2.1 B.

1.4 SUBMITTALS

- A. Manufacturer will submit, when required, shop drawings showing a schematic plan of the total drainage system listing all parts being provided with exact center-line dimensions suitable for installation. Copies of the manufacturer's recommended method of installation, and assembly shall be submitted for review. Contractor shall obtain arc radius units where they apply.
- B. Manufacturer shall submit a list of projects installed locally during the past five years.

PART 2 - PRODUCTS

2.1 TROUGH DRAIN

- A. Manufacturer shall be one of the following or (approved equal):

Manufacturer:

Model:

- | | |
|--|------------------------------------|
| 1. ACO Polymer Products, Inc.
Chagrin Falls, Ohio
(216) 247-2033 | System 4000*
Grate Color: Black |
| 2. SportsField Specialities
Delhi, NY
(888) 975-3343 | Sport 4000*
Grate Color: Black |

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POLYMER CONCRETE TROUGH DRAIN SYSTEM

- B. Product shall be a one piece polymer concrete grated drain incorporating anti-slip, ADA compatible locking grate. Trench drain channels shall be pre-cast, and interlocking, incorporating either polyester or vinyl ester resins and formulated aggregate.

Overall Width	-	6.1 in
Internal Width	-	4.0 in
Unit Depth	-	6.0 in (nominal)
Compressive Strength	-	14,000 - 14,500 PSI
Flexural Strength	-	3,600 - 4,500 PSI
Tensile Strength	-	1,500 PSI

PART 3 - EXECUTION

3.1 SITE PREPARATION

- A. Excavate the area for channel placement wide and deep enough to accommodate the channel size and a minimum of 4 inch concrete encasement (channels require a minimum of 4 inches of concrete support and top of grate must be evenly aligned to the surface of the surrounding slab) on both sides as well as underneath the channel.

3.2 INSTALLATION

- A. Channel sections are installed from the outlet end of the system, working from either catch basins or other outlets. Insert channels to interlock ends. Channel sections shall be placed on brick, rebar basket, or low slump concrete slurry, to obtain correct finished elevation. Cutting will be made if required, by masonry or concrete saw. Saw cut relief joints at every third (3rd) section channel (± 10). Install drain system in strict accordance with manufacturer's recommendations and shop drawings.

3.3 CONCRETE PLACEMENT

- A. Protect the top of the channel against the concrete or other abutting materials during setting. Place concrete in a manner that will not dislodge the channels. Concrete shall be at finished level with the top of the grate to ensure efficient drainage and adequate grate edge protection.

3.4 FINISHING AND CLEAN-UP

- A. Following final set of concrete, remove channel protection, if used.

END OF SECTION 33 44 16