100% PROJECT MANUAL

COMMERCE 2.0 MGD GROVE CREEK WPCP

COMMERCE, GEORGIA

for

CITY OF COMMERCE

BID DOCUMENTS

March 2025

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GEORGIA
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No. PE051452
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03.19.2025
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COMMERCE 2.0 MGD GROVE CREEK
WATER POLLUTION CONTROL PLANT

FOR

CITY OF COMMERCE

COMMERCE, GEORGIA

GMC PROJECT NO. CATL230033

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SECTION 33 01 30.13 - SEWER AND MANHOLE TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing of Gravity Sewer Piping:

    a. Low pressure air testing.
    b. Joint Testing
    c. Infiltration testing.

2. Testing for Water Retaining Structures
    a. Exfiltration Testing

3. Testing of pressure piping.
4. Deflection testing of plastic gravity sewer piping.
5. Testing of Manholes:

    a. Vacuum testing.
    b. Exfiltration testing.

B. Related Requirements:

1. Section 33 01 30.61 - Sewer and Pipe Joint Sealing
2. Section 33 01 30.62 - Manhole Grout Sealing
3. Section 33 31 00 - Sanitary Utility Sewerage Piping

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C1103 – Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
2. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
3. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
4. ASTM D2122 - Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
5. ASTM F1417 – Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air.
6. ASTM F2164 – Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure.

B. American Water Works Association:

1. AWWA C600 - Installation of Ductile Iron Mains and Their Appurtenances.

C. PVC Pipe Association

1. UNI-B-06-Recommended Low-Pressure Air Testing of Installed Sewer Pipe.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Submit following items prior to start of testing:

1. Testing procedures.
2. List of test equipment.
3. Testing sequence schedule.
4. Provisions for disposal of flushing and test water.
5. Certification of test gage calibration.
6. Deflection mandrel drawings and calculations.
7. Testing Safety Plan describing safety precautions to be taken during testing.

C. Test and Evaluation Reports: Indicate results of manhole and piping tests.

PART 2 - PRODUCTS

2.1 VACUUM TESTING

A. Equipment:

1. Vacuum pump.
2. Vacuum line.
3. Vacuum Tester Base:

a. Compression band seal.
b. Outlet port.

4. Shutoff valve.
5. Stopwatch.
6. Plugs.
7. Vacuum Gage: Calibrated to 0.1 in. Hg.

2.2 JOINT TESTING

1. Vacuum pump.
2. Vacuum line.

3. Joint Tester
4. Shutoff valve.
5. Stopwatch.
6. Plugs.
7. Vacuum Gage: Calibrated to 0.1 in. Hg.

2.3 EXFILTRATION TESTING

A. Equipment:

1. Water
2. Plugs.
3. Pump.
4. Measuring device.

2.4 AIR TESTING

A. Equipment:

1. Air compressor.
2. Air supply line.
3. Shutoff valves.
4. Pressure regulator.
5. Pressure relief valve.
6. Stopwatch.
7. Plugs.
8. Pressure Gage: Calibrated to 0.1 psi.

2.5 INFILTRATION TESTING

A. Equipment: Weirs.

2.6 HYDROSTATIC TESTING

A. Equipment:

1. Hydro pump.
2. Pressure hose.
3. Water meter.
4. Test connections.
5. Pressure relief valve.
6. Pressure Gage: Calibrated to 0.1 psi.

2.7 DEFLECTION TESTING

A. Equipment:

1. "Go, no go" mandrels.
2. Pull/retrieval ropes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that manholes and piping are ready for testing.

C. Verify that trenches are backfilled.

D. Verify that pressure piping thrust restraint system is installed.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for preparation.

B. Lamping of Gravity Pipe:

1. Lamp gravity piping after flushing and cleaning.
2. Perform lamping operation by shining light at one end of each pipe section between manholes.
3. Observe light at the other end showing at least 90% of the full circle pipe from manhole to manhole without obstruction.
4. Pipe not installed with uniform line and grade will be rejected.
5. Remove and reinstall rejected pipe sections.
6. Reclean and lamp until pipe section is installed to uniform line and grade.
    a. All additional cleaning and lamping water will be supplied by the Contractor at no additional cost to the Owner

C. Plugs:

1. Plug outlets, wye branches, and laterals.
2. Brace plugs to resist test pressures.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Deflection Testing of Plastic Sewer Piping:

1. Conduct deflection test prior to low pressure air test.

2. Perform vertical ring deflection testing on non-rigid piping (thermoplastic, FRP, and acrylonitrile butadiene styrene) after backfilling has been in place for at least 30 days but not longer than 12 months.
3. Allowable maximum deflection for installed plastic sewer pipe is no greater than five percent of original vertical internal diameter.
4. Perform deflection testing using properly sized rigid ball or "go, no go" mandrel.
5. Furnish rigid ball or mandrel with diameter not less than 95 percent of base or average inside diameter of pipe, as determined by ASTM standard to which pipe is manufactured; measure pipe diameter in compliance with ASTM D2122. The minimum diameters of mandrels used for the corresponding pipe sizes are: 8" line = 7.6", 10" line = 9.5", 12" line = 11.4".
6. The critical dimensions of the rigid ball or mandrel shall have a +/- 0.01 inch tolerance.
7. Perform testing without mechanical pulling devices.
8. Locate, excavate, replace, and retest piping that exceeds allowable deflection at no additional cost to the Owner.

D. Low-Pressure Air Testing:

1. Test each reach of gravity sewer piping between manholes in accordance with ASTM F1417 and UNI B-6-90.
2. Introduce air pressure slowly to approximately 4 psig.
3. Determine ground water elevation above spring line of piping.
4. For every foot of ground water above spring line of piping, increase starting air test pressure by 0.43 psi.
5. Do not increase pressure above 10 psig.
6. Allow pressure to stabilize for at least five minutes.
7. Adjust pressure to 3.5 psig or to increased test pressure as determined above when ground water is present.
8. Do not make allowance for laterals.
9. The time elapsed for a 0.5 psi drop in air pressure shall be not less than 10 minutes or as specified in ASTM F1417 or UNI B-6-90 whichever is greater.
10. Record drop in pressure during testing period.
11. If air pressure drops more than 1.0 psi during testing period, piping has failed.
12. If 1.0 psi air pressure drop has not occurred during testing period, piping is acceptable; discontinue testing.
13. If piping fails, test reach of piping in incremental stages until leaks are isolated, repair leaks, and retest entire reach between manholes.

E. Joint Testing of Pipes Larger than 27" in Diameter
1. For pipes large enough to enter (27" in diameter or larger), individual joints may be pressure tested with a portable tester to 5 psi maximum, with air or water in lieu of low pressure air testing.
2. Joint Testing shall be performed in accordance with ASTM C1103.

F. Exfiltration Testing of Water Retaining Structures:

1. Perform exfiltration testing not exceeding 100 gal. for each inch of pipe diameter for each mile per day for each reach of piping undergoing testing.
2. Perform testing with minimum positive head of 2 feet.

G. Infiltration Testing:

1. All lines below the water table shall be checked for infiltration
2. If at any time prior to expiration of the correction period stipulated in the General Condition, infiltration exists, that is any inflow, and the pipe fails.
3. The Contractor shall locate the leaks and make repairs as necessary to remove the infiltration.

H. Testing of Pressure Piping:

1. PE and HDPE pipe will be tested in accordance with ASTM F2164.

2. Test all other pipe material systems according to AWWA C600 and following:

   a. Hydrostatically test each portion of pressure piping, including valved sections, at 1.5 times working pressure of piping, based on elevation of lowest point in piping corrected to elevation of test gage.
   b. Conduct hydrostatic testing for at least two hours.
   c. Slowly fill with water portion of piping to be tested, expelling air from piping at high points.
   d. Install corporation cocks at high points.
   e. Close air vents and corporation cocks after air is expelled.
   f. Raise pressure to specified test pressure.
   g. Observe joints, fittings, and valves undergoing testing.
   h. Remove and replace cracked pipes, joints, fittings, and valves that show visible leakage.
   i. Retest.
   j. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
   k. Maintain pressure within plus or minus 5.0 psi of test pressure.
   l. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of testing.
   m. Compute maximum allowable leakage using following formula:

      1) L = [**SD x sqrt(P)**]/C.
      2) L = testing allowance, gph.
      3) S = length of pipe tested, feet.
      4) D = nominal diameter of pipe, inches.
      5) P = average test pressure during hydrostatic testing, psig.
      6) C = 148,000.
      7) If pipe undergoing testing contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each pipe size.

3. If testing of piping indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within acceptable limits.
4. Correct visible leaks regardless of quantity of leakage.

I. Manhole Testing:

1. Perform vacuum testing of all manholes. If air testing, test whenever possible prior to backfilling in order to more easily locate leaks.
2. Test manholes with manhole frame set in place.
3. Vacuum Testing:

a. Comply with ASTM C1244.
b. Plug pipe openings; securely brace plugs and pipe.
c. Inflate compression band to create seal between vacuum base and structure.
d. Connect vacuum pump to outlet port with valve open, then draw vacuum to 10 in. Hg.
e. Close valve.
f. Manhole Test Duration in Seconds shall be a minimum of 60 or according to ASTM C1244 Table 1a, whichever is longer.
g. Record vacuum drop during test period.
h. If vacuum drop is greater than 1 in. Hg during testing period, repair and retest manhole.
i. If vacuum drop of 1 in. Hg does not occur during test period, manhole is acceptable; discontinue testing.
j. Elapsed time for a pressure change/drop of 1 inch of Hg for a 4ft. diameter manhole shall be: 60 seconds for 10ft. or less in height, 75 seconds for greater than 10ft. but less than 15ft., and 90 seconds for greater than 15ft. but less than 25ft.
k. If vacuum test fails to meet 1 in. Hg drop in specified time after repair, repair and retest manhole at no additional cost to the Owner.
    1) Repair both outside and inside of joint to ensure permanent seal.

J. Water Retaining Structure Testing

1. Exfiltration Testing:

    a. Exfiltration testing shall be performed prior to any specified backfill placement at the footing or wall.
    b. Plug pipes in manhole or structure excluding overflow.
    c. Remove water from manhole or structure.
    d. Observe plugs over period of not less than two hours to ensure that there is no leakage into manhole or structure.
    e. Fill manhole or structure with water within 4 inches of top of cover frame or overflow.
    f. Prior to testing, allow manhole to soak from minimum of four hours for manholes and 24 hours for other structures to maximum of 72 hours.
    g. Inspect the exterior of the wall and footing for damp spots. Damp spots shall be defined as spots where moisture can be picked up on a dry hand, the source of which is from inside the manhole or structure.
    h. After soak period, adjust water level inside the structure to within 4 inches of top of cover frame or overflow.
    i. Measure water level from top of manhole frame or access point.
    j. At end of the 24 hour testing period, again measure water level from the same point; compute drop in water level during testing period.
    k. The exfiltration test is considered satisfactory when drop in water level is less than 0.00947 gallons per foot diameter per foot of depth.

2. If unsatisfactory testing results are achieved, repair manhole and retest until result meets criteria.
3. Repair visible leaks regardless of quantity of leakage.

END OF SECTION 33 01 30.13

SECTION 33 01 30.51 – PUMPING AND BYPASSING

PART 1 - GENERAL

1.1 SUMMARY

A. Under this item, the Contractor is required to furnish all materials, labor, equipment, power, maintenance, fuel, etc. to implement a temporary pumping system for the purpose of diverting flow around the work area throughout the required duration.

B. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

C. Schedule and perform work in manner that does not cause or contribute to incidence of overflows, releases or spills of sewage from sanitary sewer system or bypass operation.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Section 33 01 30.13 – Sewer and Manhole Testing

C. Section 33 05 13 – Manholes and Structures

D. Section 33 31 00 – Sanitary Utility Sewerage Piping

1.3 QUALITY ASSURANCE

A. Follow national standards and as specified herein.

B. Perform leakage and pressure tests on discharge piping using clean water, before operation.

C. Keep and maintain spare parts for piping on site, as required.

D. Maintain adequate hoisting equipment and accessories for the pump on-site.

1.4 SUBMITTALS

A. The Contractor shall submit to the Engineer a detailed plan and description outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing wastewater flows in all locations requiring bypass pumping. This plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to insure proper protection of the facilities, including protection of the access and bypass pumping locations from damage due

to the discharge flows, and compliance with the requirements and permit conditions specified in these Contract Documents. No construction shall begin until all provisions and requirements have been reviewed by the Engineer.

B. The plan shall include but not be limited to details of the following:

1. Staging areas for pumps;
2. Sewer plugging method and types of plugs;
3. Number, size, material, location and method of installation of suction piping;
4. Number, size, material, location and method of installation of discharge piping;
5. Bypass pump sizes, capacity, number of each size to be on site and power requirements;
6. Calculations of static lift, friction losses, flow velocity (pump curves showing pump operating range shall be submitted), and bypass pump pipe size;
7. Downstream discharge plan;
8. Thrust and restraint block sizes and locations;
9. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill;
10. Method of noise control for each pump and/or generator;
11. Any temporary pipe supports and anchoring required;
12. Design plans and computation for access to bypass pumping locations indicated on the drawings;
13. Schedule for installation of and maintenance of bypass pumping lines; and
14. Plan indicating selection location of bypass pumping line locations.

1.5 DELIVERY, STORAGE AND HANDLING

A. Transport, deliver, handle, and store pipe, fittings, pumps, ancillary equipment and materials to prevent damage and following manufacturer's recommendations.

1. Inspect all material and equipment for proper operation before initiating work.

B. Material found to be defective or damaged due to manufacturer or shipment shall be repair as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

A. Bypass Pumping System

1. The Contractor shall provide all pipeline plugs and temporary discharge piping to ensure that the total flow of the main can be safely diverted around the section to be repaired.
2. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.

3. Bypass pumping system shall be capable of bypassing the flow around the work area and of releasing any amount of flow up to full available flow into the work area as necessary for satisfactory performances of work.
4. The Contractor shall make all arrangements for bypass pumping during the time when the main is shut down for any reason. System must overcome any existing force main pressure on discharge.
5. Provide pipeline plugs of adequate size to handle peak flow/head.

B. Performance Requirements

1. It is essential to the operation of the existing sewerage system that there be no interruption in the flow of sewage throughout the duration of the project. To this end, the Contractor shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (back-up units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with his work, carry it past his work and return it to the existing sewer downstream of his work.
2. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.
3. The Contractor shall provide all necessary means to safely convey the sewage past the work area. The Contractor will not be permitted to stop or impede the main flows under any circumstances.
4. The Contractor shall maintain sewer flow around the work area in a manner that will not cause surcharging of sewers, damage to sewers and that will protect public and private property from damage and flooding.
5. The Contractor shall protect water resources, wetlands and other natural resources.
6. Pumps shall be capable of meeting noise requirements imposed by Owner or governing agency.

2.2 MATERIALS

A. Discharge and Suction Pipes

1. To prevent the accidental spillage of flows, all suction/discharge systems shall be temporarily constructed of rigid pipe with positive, restrained joints. Under no circumstances will aluminum "irrigation" type piping or glued PVC pipe be allowed. Discharge hose will only be allowed in short sections and by specific permission from the Engineer.

B. Polyethylene Plastic Pipe

1. High density solid wall and following ASTM F714 Polyethylene (PE) Plastic Pipe (SDR-DR) based on Outside Diameter, ASTM D1248 and ASTM D3550.
2. Homogenous throughout, free of visible crack, discoloration, pitting, varying wall thickness, holes, foreign materials, blisters, or other deleterious faults.

C. High-Density Polyethylene (HDPE)

1. Homogenous throughout, free of visible crack, discoloration, pitting, varying wall thickness, holes, foreign materials, blisters, or other deleterious faults.
2. Assembled and joined at site using couplings, flanges or butt-fusion method to provide leak proof joint. Following manufacturer's instructions and ASTM D 2657.

    a. Threaded or solvent joints and connections are not permitted.

3. Fusing shall be conducted by personnel certified as fusion technicians by manufacturer of HDPE pipe and/or fusing equipment.
4. Butt-fused joint shall be truly aligned and contain uniform roll-back beads resulting from use of proper temperature and pressure.

    a. Allow adequate cooling before removal of pressure.
    b. Watertight and have tensile strength equal to that of pipe.

D. Flexible Hoses and Associated Couplings and Connectors

1. Abrasion resistant.
2. Suitable for intended service.
3. Rated for external and internal loads anticipated, including test pressure.

    a. External loading shall incorporate anticipated traffic loadings.

4. When subjected to traffic loading, compose system, such as traffic ramps or covers.

    a. Install system and maintain H-20 loading requirements while in use.

E. Valves and Fittings

1. Determined according to flow calculations, pump sizes previously determined, and system operating pressures.

F. Plugs

1. Plugs shall be selected and installed according to size of line to be plugged, pipe, and manhole configurations, and based on specific site.

2.3 EQUIPMENT

A. Pumps

1. All pumps used shall be fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in the priming system. The pumps may be electric or diesel powered. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows.

B. Controls

1. The Contractor shall provide the necessary stop/start controls for each pump.

PART 3 - EXECUTION

3.1 PREPARATION

A. Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate his bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the Owner and the Engineer. All costs associated with relocating utilities and obtaining all approvals shall be paid by the Contractor.

B. During all bypass pumping operation, the Contractor shall protect the main and all local sewer lines from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to the Pumping Station and main and all local sewer lines caused by human or mechanical failure.

3.2 INSTALLATION AND REMOVAL

A. The Contractor shall remove manhole sections or make connections to the existing sewer and construct temporary bypass pumping structures only at the access location indicated on the Drawings and as may be required to provide adequate suction conduit.

B. Plugging or blocking of sewage flows shall incorporate a primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance of work, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.

C. When working inside manhole or force main, the Contractor shall exercise caution and comply with OSHA requirements when working in the presence of sewer gases, combustible or oxygen-deficient atmospheres, and confined spaces.

D. The installation of the bypass pipelines is prohibited in all saltmarsh/wetland areas. The pipeline must be located off streets and sidewalks and on shoulders of the roads. When the bypass pipeline crosses local streets and private driveways, the contractor must place the bypass pipelines in trenches and cover with temporary pavement. Upon completion of the bypass pumping operations, and after the receipt of written permission from the Engineer, the Contractor shall remove all the piping, restore all property to preconstruction condition and restore all pavement. The Contractor is responsible for obtaining any approvals for placement of the temporary pipeline within public ways from the County.

END OF SECTION 33 01 30.51

SECTION 33 01 30.61 - SEWER AND PIPE JOINT SEALING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe cleaning and flushing.
2. Plugging.
3. Bypassing sewage.
4. Joint testing.
5. Joint sealing.

B. Related Requirements:

1. Division 3 – Concrete
2. Division 33 – Utilities

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C33 - Standard Specification for Concrete Aggregates.
2. ASTM C150 - Standard Specification for Portland Cement.

1.3 SCHEDULING

A. Furnish Work schedule seven (7) days in advance of when sewer piping section is out of service for joint sealing.

1.4 SEQUENCING

A. Sequence for cleaning of sanitary sewer lines shall be as specified on the plans or as directed by Owner/Engineer prior to televising sanitary sewer lines.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit sealant and root growth inhibitor data.

C. Reports:

1. Submit weekly report with daily entries showing:

    a. Location of joints sealed and successfully tested.
    b. Results of air or liquid joint tests before and after sealing joints.
    c. Volume of joint sealant or joint sealant/root treatment additive pumped.
    d. Pounds of acrylamide and N,N'-methylenebisacrylamide mixture used.
    e. Poundsof ammonium persulfate used.
    f. Gallons of root treatment additive material used each day, including gallons of triethanolamine.
    g. Elevation of ground water.
    h. Location of pipe fractures and misalignment.
    i. Location of leaking joints, including non-leaking joints failing air test.
    j. Location of connections discharging continuous flow or incorrectly connected to sewer main.

2. Submit weekly reports on form approved by Architect/Engineer prior to start of testing and sealing.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Prior to starting Work, submit certifications attesting to:

1. Composition and manufacturer of joint sealing material and root treatment additive.
2. Chemical compatibility of sealant material and root treatment additive material.
3. Calibration of meters used to measure joint sealant and root treatment additive and pressure gages are accurate to within 10 gpm and 5 psi respectively.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Qualifications Statements:

1. Submit qualifications for manufacturer and applicator.
2. Submit manufacturer's approval of applicator.
3. Submit qualifications for Contractor

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for closeout procedures.

B. Project Record Documents: Record actual locations of repaired joints.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 5 years' documented experience.

B. Applicator: Company specializing in performing Work of this Section with minimum 5 years' documented experience and approved by manufacturer.

C. Contractor: Shall have a minimum 3 year's continuous experience in performing the work described in these specifications.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Protect materials from damage by storing in secure location.

PART 2 - PRODUCTS

2.1 GROUT SEALANT

A. Chemical Grout:

1. Mixture of dry acrylamide and dry N,N'-methylenebisacrylamide in proportions capable of diluting aqueous solutions and, when properly catalyzed, forming stiff gels.
2. Chemical grout capable of tolerating ground water dilution and reacting in moving water.
3. Viscosity of less than 0.0000418 lbf-s/sq. ft., remaining constant until gelation concurs.
4. Reaction time controllable from 10 seconds to 1 hour.

B. Catalyst:

1. Ammonium persulfate.
2. Use in combination with activator.
3. Use of catalyst containing (dimethylamino)propionitrile is prohibited.

C. Activator: Triethanolamine or other compounds of equivalent properties.

D. Inhibitor: Potassium ferricyanide.

E. Root Growth Inhibitor:

1. Dichlorobenzonitrile meeting recommendations of grout manufacturer.
2. Root treatment additive capable of remaining active for minimum of two years.
3. Active ingredient for destroying root intrusions: Sodium methyldithiocarbamate.
4. Root Cell Inhibiting Agent:

a. 2,6-dichlorobenzonitrile (dichlobenil).
b. For each application, disperse root control agent into clear, cool water free of acid, alkali, oxidizing agents, or large amounts of oil or other organic compounds or materials.

c. Use tanks for transportation or storage of makeup water free of material listed above.
d. The Contractor at no additional cost to the Owner shall replace any damaged vegetation so designated by the Engineer. All safety precautions as recommended by the manufacturer shall be strictly adhered to concerning handling and application of the herbicide.

F. Portland Cement: ASTM C150, Type II.

G. Fine Aggregate: ASTM C33 gradation.

H. Packer for Joint Sealing:

1. Bladder:

a. Provide air-impervious, pneumatically inflatable bladder on each end of mounting cylinder.
b. Seal ends of each bladder to cylinder by broad, confining bands.

2. Connect at each end by winch-powered cables.
3. Form positive seal between inflated bladders and interior periphery of sewer pipe and form annular void between inflated end bladders.
4. Design to allow restricted quantity of sewage flow through packer at designated times.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for application examination.

B. Verify which sewer pipes require joint sealing.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for application preparation.

B. Pipe Cleaning and Flushing:

1. Perform cleaning of pipe interior to extent necessary to pass equipment and materials required for joint sealing. The Contractor shall clean all sewer segments designated for inspection and/or rehabilitation prior to performing any work. The Contractor shall be solely responsible for his means and methods of sewer cleaning. Cleaning of the sewers shall consist of the dewatering, by-pass pumping, removal of all grease, sand, silt, solids, tuberculation, rags, roots, cut protruding laterals and other debris from each sewer segment, including sags within any sewer segment and including manholes. Selection of cleaning equipment and the method for cleaning shall be based on the condition and/or pipe material

of the sewer segment at the time work commences, and shall comply with this specification.

2. The Contractor shall be solely responsible for safety during the performance of all work. The Contractor shall take satisfactory precautions to protect the sewer segments and appurtenances from damage that might be inflicted upon them by the use of cleaning equipment. Any damage inflicted upon a sewer segment or other public or private property as a result of the Contractor's cleaning operations, regardless of the cleaning method used and regardless of any other circumstance which may contribute to the damage, shall be repaired by Contractor at his sole expense.
3. The Contractor shall not enter into any sewer segment where hazardous conditions may exist until such time as the source of those conditions is identified and eliminated by Contractor and/or Owner. The Contractor shall perform all work in accordance with the latest OSHA confined space entry regulations. The Contractor shall coordinate his work with local fire, police and emergency rescue units.
4. Dumping of raw sewage on private property, in city streets, or into surface or groundwater is not permitted.
5. Passing material from sewer segment to sewer segment shall not be permitted. In the event that sludge, dirt, sand, rocks, grease, roots and other solid or semisolid material or debris resulting from the cleaning operations are observed and/or detected by the Owner/Engineer as passing to downstream sewer segment(s), The Contractor shall be responsible for cleaning such downstream sewer segment(s) at no additional cost to the Owner.
6. The Contractor shall be responsible for the handling, hauling and disposal of all debris, silt, and accumulated solids removed from the sewer. All debris, silt and solids removed by the Contractor shall be disposed of at a facility licensed for the handling and disposal of such materials in accordance with all appropriate codes, rules and regulations for the handling and disposal of such materials. Under no circumstances shall the removed sewage or solids be dumped onto streets or into ditches, catch basins, storm drains, sanitary or combined sewer manholes, or otherwise improperly disposed. If sewage is unintentionally spilled, discharged, leaked or otherwise deposited in the open environment, The Contractor shall be responsible for any clean-up and disinfection of the affected area(s). The Contractor shall comply with all Local, State and Federal regulatory requirements regarding spills. Improper disposal of sewage or solids removed from the sewers may subject the Contractor to fines imposed by the OWNER or other regulatory entities. In addition, the Contractor may be subject to civil and/or criminal penalties for improper disposal of removed materials under the law.
7. If the cleaning of an entire sewer pipe section cannot be successfully performed from one manhole, the equipment shall be re-setup on the other manhole and cleaning again attempted. If successful cleaning still cannot be performed or the equipment fails to traverse the entire manhole section, the cleaning effort will be abandoned at the Owner's and/or Engineer's approval. Sewer line repairs shall then be made at the discretion of the Engineer.

C. Plugging:

1. Conditions Requiring Plugging of Pipes:

    a. Depth of flow within sewer pipe is greater than 20 % of inside diameter of sewer pipe.
    b. Exposing complete inside periphery of sewer pipe is required to conduct inspection, sealing, or testing.

2. Repair damage resulting from plugging sewer piping.

D. Bypassing Sewage:

1. Bypass sewage when plugging cannot control flows.
2. Install and operate pump to manage bypassing of peak sewage flow rate.
3. Provide standby pump of equal or greater capacity at bypass location.
4. Provide safety precautions including barricades, lights, and flaggers as specified in Section 01 50 00 - Temporary Facilities and Controls.

3.3 APPLICATION

A. Root Control:

1. Roots shall be removed in the sections where root intrusion is a problem. Special precautions should be exercised during the cleaning operation to assure complete removal of visible roots from the joint area. All roots shall be removed.
2. Apply chemical root control agent by foaming or soaking according to conditions in piping under treatment.
3. Foam Application:

   a. Agent: Solution containing not less than 24 % by weight of anhydrous vapam (sodium methyldithiocarbamate) and not less than 1.7 % by weight of dichlobenil (2,6-dichlorobenzonitrile); containing surfactant capable of producing foam able to transmit pressure of 30 psig and yielding 20 gal. of foam for each gallon of solution.
   b. Foam Concentration: Deliver foam to pipe to yield approximately 20 gal. of foam for each gallon of 5 % solution.

4. Soaking Application:

   a. Agent: Aqueous solution containing 28 % by weight or more of anhydrous vapam (sodium methyldithiocarbamate) and 1 % by weight or more of dichlobenil (2,6-dicholorobenzonitrile) active layer of foam on contacted surfaces.
   b. Application:

      1) Fill entire pipe with freshly prepared and well-mixed solution containing not less than 1 percent by volume of chemical agent specified above.
      2) Fully charge for soaking period of 1 hour or not less than 30 minutes and replenish solution to maintain its level above upper end of section under treatment and concentration at 1 % by volume of root control agent.
      3) Following specified soaking period, pass solution downstream to treat additional segments of piping, add additional root control agent to maintain concentration of solution at 1 %, and charge each segment for designated soaking period by addition of solution.

B. Joint Sealing:

1. Seal joints that fail pre-sealing test.
2. Monitor and record actual maintenance pressures when grouting and testing joints.

3. Pass sealing materials from dual independent pumping system through instantaneously controlled system and read flow meter to annular void in packer through dual hose systems.
4. When sealant material injected into joint exceeds 15 gal. in 8 inch pipe, stop injection. Do not resume sealing of joint until other joints in manhole run are sealed.
5. Reclean and repeat sealing process until positive seal is achieved.
6. Clean joint after sealant material has set.
7. Examine joint repair for visible defects using TV camera and fix defects prior to testing of post-joint seal.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Pre-Sealing Joint Test: Air test each joint between manholes as follows:

1. Conduct pre-sealing test as specified for post-sealing test.
2. Record failure of pre-sealing test in weekly report.
3. Notify Architect/Engineer when pre-sealing test passes. Record passing tests in weekly report and discontinue joint sealing and post-sealing test sequence for passed joint.
4. Use pressure meters accurate to within 5 psi.
5. Use flow meters accurate to within 10 gpm.

D. Post-Sealing Joint Test:

1. Perform visual inspection of joint.
2. Apply positive air pressure in void area to raise void pressure 150% psig above maximum ground water pressure and allow to stabilize due to temperature effect.
3. Complete air pressure stabilization.

    a. Test Pressure: Not less than maximum ground water pressure nor more than 7.5 psig above maximum ground water pressure at initiation of test procedure.

4. Record initial test pressure, stabilized test pressure, and period of time required to have 1.0 psig pressure drop from stabilized test pressure.
5. Minimum Test Duration:

    a. Pipe Diameter 8 inches: Zero minutes, 18 seconds.
    b. Pipe Diameter 10 inches: Zero minutes, 28 seconds.
    c. Pipe Diameter 12 inches: Zero minutes, 40 seconds.
    d. Pipe Diameter 15 inches:1 minute, 3 seconds.
    e. Pipe Diameter 18 inches:1 minute, 31 seconds.
    f. Pipe Diameter 21 inches:2 minutes, 4 seconds.
    g. Pipe Diameter 24 inches:2 minutes, 16 seconds.
    h. Pipe Diameter 27 inches:2 minutes, 42 seconds.

6. When pressure drop exceeds 1.0 psi from stabilized test pressure during minimum time specified above, joint has failed.
7. Discontinue test when minimum time has been completed and 1.0 psi pressure drop has not occurred from stabilized test pressure; in this circumstance, joint has satisfactorily passed test.
8. Use the following procedure for sealed joint failing air test:

    a. Visually inspect.
    b. Reseal.
    c. Visually inspect.
    d. Retest until successful test is obtained or sealant limit is attained.

E. Final Acceptance:

1. Acceptance of this portion of the work shall be made upon the successful completion of the television inspection and shall be to the satisfaction of the Engineer's representative.
2. If cleaning is deemed unsatisfactory, the Contractor shall re-clean and re-inspect the sewer line until cleaning is shown to be satisfactory.

END OF SECTION 33 01 30.61

SECTION 33 01 30.62 - MANHOLE GROUT SEALING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manhole interior cleaning.
2. Manhole sealing.

B. Related Requirements:

1. Section 33 01 30.61 - Sewer and Pipe Joint Sealing: Testing and sealing of sewer pipe joints.

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C33 - Standard Specification for Concrete Aggregates.
2. ASTM C150 - Standard Specification for Portland Cement.

1.3 SCHEDULING

A. Schedule Work of this Section to coincide with joint sealing.

B. Furnish Work schedule when sewer piping section is out of service for joint sealing.

1.4 SEQUENCING

A. Section 01 10 00 - Summary: Requirements for sequencing.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit product data on grout or sealant.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements

D. Test and Evaluation Reports: Indicate vacuum and exfiltration testing results.

E. Manufacturer Instructions: Submit detailed instructions on application requirements, including storage and handling procedures.

F. Qualifications Statements:

1. Submit qualifications for manufacturer and applicator.
2. Submit manufacturer's approval of applicator.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for closeout procedures.

B. Project Record Documents: Record actual locations of sealed manholes.

1.7 QUALITY ASSURANCE

A. Perform Work according to this specification and those referenced herein and/or federal, state, local, or other controlling regulations.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three (3) years documented experience.

B. Contractor: Company specializing in performing Work of this Section with minimum three (3) years documented experience and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products per manufacturer.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Protect materials from damage by storing in secure location.

PART 2 - PRODUCTS

2.1 GROUT SEALANT

A. Chemical Grout:

1. Mixture of dry acrylamide and dry N, N-methylenebisacrylamide in proportions capable of diluting aqueous solutions and, when properly catalyzed, forming stiff gels.
2. Make solution at concentrations as recommended by manufacturer.
3. Able to tolerate ground water dilution and react in moving water.
4. Viscosity of less than 0.000041771 lbf-s/sq. ft., remaining constant until gelation concurs.
5. Reaction time controllable from 10 seconds to 1 hour.

B. Catalyst: Use ammonium persulfate in combination with activator; use of catalyst containing (dimethylamino) propionitrile is prohibited.

C. Activator: Triethanolamine or other compounds of equivalent properties.

D. Inhibitor: Potassium ferricyanide.

E. Root Growth Inhibitor:

1. Dichlorobenzonitrile meeting recommendations of grout manufacturer.
2. Root treatment additive capable of remaining active for minimum of two years.
3. Active ingredient for destroying root intrusions: Sodium methyldithiocarbamate.
4. Root Cell Inhibiting Agent:

a. 2,6-dichlorobenzonitrile.
b. For each application, disperse root control agent into clean, cool water free of acid, alkali, oxidizing agents, or large amounts of oil or other organic compounds or materials.
c. Use tanks for transportation or storage of makeup water free of material listed above.

F. Portland Cement: ASTM C150, Type II.

G. Fine Aggregate: ASTM C33 gradation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for application examination.

B. Verify which manholes require grouting.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for application examination.

B. Manhole Interior Cleaning:

1. Clean each defective or fouled manhole interior with high-velocity water jet to remove grease, dirt, sludge, and roots.
2. Cut remaining roots flush with manhole interior.
3. Flush foreign material cleaned from interior of manhole; remove and properly dispose of material off Site.
4. If leaks are not readily identifiable upon completion of cleaning operation, use blower to dry manhole interior for positive identification of leaks and sweep areas.

3.3 APPLICATION

A. Grout Sealing:

1. Drill hole at each identifiable leakage point from inside manhole extending through sidewall of manhole.
2. Insert metal rod through hole to determine if exterior void space exists.
3. Fill exterior void spaces with chemical grout mix, pumping into void space until refusal is recorded by rise in pressure on pump pressure gauge.
4. Ensure that hole through manhole wall is kept open and free of chemical grout; plug hole and allow one hour for chemical grout to set.
5. Upon completion of grouting, pump manhole sealant until refusal at minimum pressure of 3.0 psig through probe-type injection equipment.
6. Deposit sealant from interior surface of set chemical grout through drilled hole to inside surface of manhole.
7. Upon setting of manhole sealant, remove excess material protruding into interior of manhole.

B. Testing:

1. Perform manhole testing per Section 33 01 30.13 - Sewer and Manhole Testing.

END OF SECTION 33 01 30.62

SECTION 33 05 05.31 - HYDROSTATIC TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Hydrostatic testing of pressure piping.

B. Related Requirements:

1. Section 33 31 00 - Sanitary Utility Sewerage Piping: Pipe materials and accessories normally encountered with municipal sanitary sewage force mains.

1.2 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Submit following items prior to start of testing:

1. Testing procedures.
2. List of test equipment.
3. Testing sequence schedule.
4. Provisions for disposal of flushing and test water.
5. Certification of test gage calibration.

C. Test and Evaluation Reports: Indicate results of piping tests.

D. Qualifications Statement:

1. Submit qualifications for applicator.

1.4 QUALITY ASSURANCE

A. Perform Work according to applicable standards.

1.5 QUALIFICATIONS

A. Applicator: Company specializing in performing Work of this Section with minimum three years' experience.

PART 2 - PRODUCTS

2.1 HYDROSTATIC TESTING

A. Equipment:

1. Pressure pump.
2. Pressure hose.
3. Water meter.
4. Test connections.
5. Pressure relief valve.
6. Pressure Gage: Calibrated to 0.1 psi.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that piping is ready for testing.

C. Verify that trenches are backfilled.

D. Verify that pressure piping thrust restraints have been installed.

3.2 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Testing of Pressure Piping:

1. Test system according to AWWA C600 and following:

a. Hydrostatically test each portion of pressure piping, including valved section, at 1.5 times working pressure of piping, based on elevation of lowest point in piping corrected to elevation of test gage.
b. Conduct hydrostatic testing for at least two hours.
c. Slowly fill with water portion of piping to be tested, expelling air from piping at high points.
d. Install corporation cocks at high points.
e. Close air vents and corporation cocks after air is expelled.
f. Raise pressure to specified test pressure.
g. Observe joints, fittings, and valves undergoing testing.
h. Remove and renew cracked pipes, joints, fittings, and valves that show visible leakage.

i. Retest.
j. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
k. Maintain pressure within plus or minus 5.0 psi of test pressure.
l. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of testing.
m. Compute maximum allowable leakage using following formula:

1) L = [**SD x sqrt(P)**]/C.
2) L = testing allowance, gph.
3) S = length of pipe tested, feet.
4) D = nominal diameter of pipe, inches.
5) P = average test pressure during hydrostatic testing, psig.
6) C = 148,000.
7) If pipe undergoing testing contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each pipe size.

2. If testing of piping indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within acceptable limits.
3. Correct visible leaks regardless of quantity of leakage.

END OF SECTION 33 05 05.31

SECTION 33 05 13 - MANHOLES AND STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete and modular precast concrete for manholes and structures, cover rings or frames, covers, anchorage, and accessories for sanitary sewer or storm sewer.
2. Masonry work as required for installation of manhole cover rings and inverts.
3. Doghouse manhole connections to existing sanitary sewer or storm sewer lines.
4. Bedding and cover materials.

B. Related Specification Sections:

1. Section 03 30 00 - Cast-in-Place Concrete
2. Section 31 05 16 - Aggregates for Earthwork
3. Section 31 20 00 – Earth Moving
4. Section 33 01 30.62 - Manhole Grout Sealing
5. Section 33 05 16.13 - Precast Concrete Utility Structures
6. Section 33 41 13 - Public Storm Utility Drainage Piping

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale).
4. ASTM C55 - Standard Specification for Concrete Building Brick.
5. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
6. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
7. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
8. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for manhole covers, component construction, features, configuration, and dimensions.

C. Shop Drawings:

1. Indicate manhole or structure locations and elevations.
2. Indicate sizes, penetrations, and elevations of piping.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Design Data: Submit load calculations for buoyancy forces as required for Restrained Precast Manholes, data shall include the footing for restrained manholes.

1.4 QUALITY ASSURANCE

A. Perform Work according to NPCA (National Precast Concrete Association) standards or NRMCA standards for cast in place concrete.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Comply with precast concrete manufacturer's instructions and ASTM C913 for unloading, storing, and moving precast manholes and drainage structures.

D. Storage:

1. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property.
2. Repair property damaged from materials storage.

1.7 AMBIENT CONDITIONS

A. Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry Work.

B. Cold Weather Requirements: Comply with ACI 530/530.1 when grouting or pouring concrete.

PART 2 - PRODUCTS

2.1 MANHOLES AND STRUCTURES

A. Manufacturers:

1. Armorcast Products Company
2. Hanson Pipe & Precast
3. Monarch Products, Inc.
4. Oldcastle Precast, Inc.
5. Or approved equal.

B. Manhole and Structure Sections:

1. Description: Reinforced precast concrete conforming to ASTM C478 with gaskets conforming to ASTM C923.

2. Manhole bottom sections shall be precast by the manufacturer and shall be supplied with a rubber gasket joint by which the base section is connected to the slab or the manhole bottom may be cast monolithically with the base section.
3. Joints for Precast Manholes and Structures:

    a. Joints between manhole sections shall be provided with a double joint sealant. An O ring rubber gasket meeting all requirements of ASTM C443. A flexible plastic butyl sealant in rope form, Sherman M-30 Flex Tyte, shall also be installed as recommended by the manufacturer Joints shall be water tight.
    b. Leakage Testing: Shall be conducted for each precast structure or manhole in accordance with ASTM C1244 – Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test prior to backfill.

C. Cast-in-Place Manhole and Structure Sections: Provide concrete and reinforcing steel as specified in Section 03 30 00 - Cast-in-Place Concrete

D. Clay Brick Units:

1. ASTM C32, Grade SS or SM solid units for use in building inverts and adjusting manhole top ring and cover.

E. Mortar and Grout:

1. Shall be a 3:1 sand-cement (Type S) mix
2. Use non-shrink grout for grouting ends of pipe into and out of the manhole

F. Reinforcement:

1. As specified by ASTM C478 for precast manholes and structures.
2. As specified in Specification Section 03 30 00 for cast-in-place manholes and structures.

G. Construction:

1. The base and vertical sections shall be cylindrical with tongue and groove joints.
2. Top cone sections shall be concentric or eccentric with tongue and groove joints.

H. Clear Inside Dimensions:

1. Diameter: 48 inches or as indicated on the plan drawings

I. Design Depth:

1. As specified or shown on the plan drawings

J. Clear Cover Opening Top of Cone Section:

1. Diameter: 24 inches or as indicated on the drawings

K. Invert: Each precast concrete manhole shall have the invert monolithically with the base section unless shown or called for otherwise. The invert channel and benches shall be formed with smooth surfaces and have a pocket at each end of the invert for the pipe to enter the manhole and butt up against the flow channel of the invert. The invert slope through the manhole shall be a minimum 1.2 inch drop across the manhole unless shown or called out otherwise on the plan drawings.

L. Pipe Entry: Furnish openings as shown on the drawings.

1. Manufacturers:
   a. Fernco
   b. Or Approved Equal
2. All manholes shall be provided with a flexible sleeve through which all pipe connections are made into the manhole. Each flexible sleeve shall consist of a high quality synthetic rubber terminating in a flange cast into the manhole walls or by a compression joint made in the manhole wall. The flexible sleeves shall protrude out from the manhole and shall be of adequate size to accommodate the sewer pipe. After installation of the pipe within the sleeve, a watertight joint shall be made by securing the sleeve over the pipe with a stainless steel strap, clamp, draw bolt and nuts. The banded boot connections shall be installed to provide compliance with ASTM C923. The couplings shall be tightened by use of a 60 in/lb. torque wrench.

M. Steps:

1. Manufacturers:
   a. M. A. Industries
   b. Or Approved Equal
2. Rungs/Safety Steps: Shall be 1/2 inch diameter grade 60 steel rod encased in copolymer polypropylene and withstand a load of 800 lbs and pull-out force of 400 lbs and meet OSHA requirements
3. Formed integral with manhole sections
4. Diameter: 1 inch or approved equal
5. Width: Tread 16 inches and spaced at 15 inches on center vertically, set into manhole or structure

N. Intermediate Platforms: As required by Federal, State, or Local codes or shown on the plan drawings.

1. Construction:

a. Shall consist of a standard precast concrete flat top section with 2' diameter opening that aligns with the lower manhole section steps, platform shall include tongue and grove configuration on both sides to allow for installation of the manhole sections

2.2 RINGS/FRAMES AND COVERS

A. Manufacturers:

1. Neenah Foundry, U.S. Foundry, Castings Inc.
2. McKinley Iron Works, Inc.
3. Or Approved Equal

B. Description:

1. Construction: ASTM A48, Class 30B cast iron.
2. Ring/Frame:

a. Cast iron ring shall be heavy duty having a machined flat bearing surface with integral lip that fits down into the manhole cone section. Ring shall have a minimum of four bolt holes in the base flange for anchoring to the cone section.
b. Ring and cover shall be bolt down type where called for and/or as shown on the plan drawings.
c. Beneath the manhole frame shall be installed a flexible plastic butyl gasket meeting all requirements of AASHO-M198.
d. Ring shall have a minimum clear opening of not less than 22 inches.

3. Cover Design: Cast into the top of the manhole cover shall be the name of the city and state where it is to be installed, the words "SANITARY SEWER", and the year of installation. Details of the casting shall be submitted for approval by the ENGINEER. Cover shall have the same heavy duty rating as the ring/frame.

2.3 RISER RINGS

A. Manufacturers:

1. Parson Environmental Products, Inc.
2. Turner Manhole Risers
3. Or Approved Equal

B. Riser Rings:

1. Thickness: 4 inches to 6 inches

a. Material: Precast concrete.

b. Comply with ASTM C478

2. Thickness: less than 4 inches

a. Material: Cast iron.
b. Comply with AASHTO M306.

3. Rubber Seal Wraps:

a. Wraps and Band Widths: Conform to ASTM C877, Type III.
b. Cone/Riser Ring Joint: Minimum 3 inches overlap.
c. Frame/Riser Ring Joint: 2 inches overlap.
d. Additional Bands: Overlap upper band by 2 inches

C. Accessories:

1. Joint Sealant: Comply with ASTM C990
2. Bolts:

a. Stainless Steel: Comply with ASTM F593.
b. Galvanized: Comply with ASTM F1554.

2.4 MATERIALS

A. Cover and Bedding:

1. Bedding: Fill Type as specified in Section 31 05 16 - Aggregates for Earthwork
2. Cover: Fill Type as specified in Section 31 05 16 - Aggregates for Earthwork

2.5 ACCESSORIES

A. Foundation Slab: For manhole depths greater than 15 feet or as indicated on the plan drawings.

1. Cast-in-place concrete as specified in Section 03 30 00 - Cast-in-Place Concrete
2. Top Surface: Level or as shown on the plan drawings.

B. Strap Anchors: For manhole inside drop pipe or other purpose as shown or called out for on the plan drawings

1. Shape: Bent stainless steel 304L.
2. Size: As shown or called for on the plan drawings
3. Anchor Bolts: stainless steel 316L, size as shown or called for on the plan drawings.

C. Interior Manhole Coating System

1. Abrasive all sand blast areas to be coated to a minimum CSP5

2. Active leaks to be corrected via injection of resin and coatings manufacturer representative to confirm adequate conditions prior to coating interior.

3. Coatings system to conform to the following schedule:
   a. High Risk Locations-
   - Prime coat-Tnemec Series 218 applied up to ½" OR Series 217 applied ½" to 4"

     1)

D. Bituminous Exterior Manhole Coating:

1. Description: Coating shall be a two-part component, self-priming, chemically cured, coal tar epoxy protective coating. Coating shall from the bottom slab or base section to the surface grade elevation, unless shown otherwise.

E. Geotextile Filter Fabric:

1. AASHTO M288, for subsurface drainage.
2. Fabric:

   a. Class 1 for Non-woven, non-biodegradable.
   b. Class 2 for Woven, non-biodegradable

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that items provided by other Sections of Work are properly sized and located.

B. Verify that built-in items are in proper location and are ready for roughing into Work.

C. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

A. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers as indicated on Drawings to indicate its intended use.

B. Coordinate placement of inlet and outlet pipe or duct sleeves required by other Sections.

C. Do not install manholes and structures where Site conditions induce loads exceeding structural capacity of manholes or structures.

D. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.

3.3 INSTALLATION

A. Excavation and Backfill:

1. Excavate for manholes and structures as specified in Section 31 20 00 - Earthmoving
2. Provide clearance around sidewalls of manhole or structure for construction operations
3. If groundwater is encountered, provide dewatering procedures/measures as necessary for installation of manhole or structure in a compacted excavation not holding water. Place geotextile fabric and stone as required.
4. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation, as approved by Engineer.
5. All manholes shall be vacuum tested prior to backfill as required in Part 3 of this section. After a satisfactory vacuum test has been completed, the manhole shall be backfilled. Another visual inspection of the manhole shall then be conducted to verify that no damage occurred during the backfilling.

B. Foundation Slab:

1. Place foundation slab and trowel top surface level.
2. Place manhole sections plumb and level and anchor to foundation slab when shown on the drawings or as required for buoyant force resistance.

C. Install manholes and structures supported at proper grade and alignment on crushed stone bedding (minimum 8 inch thickness) or as indicated on Drawings.

D. Backfill excavations for manholes and structures as specified in Section 31 20 00 - Earthmoving.

E. Form and place manhole or structure plumb and level, to correct dimensions and elevations.

F. Paint exterior with two coats of bituminous interior coating at rate of per coating manufacturer.

G. Set cover frames and covers level to correct elevations without tipping.

H. Precast Concrete Manholes and Structures:

1. Lift precast components at lifting points designated by manufacturer.
2. When lowering manholes or structures into excavations and joining pipe to units, take precautions to ensure that interior of pipeline and structure remains clean.
3. Set precast structures, bearing firmly and fully on crushed stone bedding, compacted as specified in Section 31 05 16 - Aggregates for Earthwork or on other support system as indicated on the plan drawings.
4. Assembly:

    a. Assemble multi-section manholes and structures by lowering each section into excavation.
    b. Install rubber gasket and butyl sealant rope in the joints between precast sections.
    c. Lower, set level, and firmly position base section before placing additional sections.

5. Remove foreign materials from joint surfaces and verify sealing materials are placed properly.
6. Verify that installed manholes or structures meet required alignment and grade.
7. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe; fill annular spaces with non-shrink grout using hydraulic cement.

I. Cast-in-Place Concrete Manholes and Structures:

1. Prepare crushed stone bedding or other support system as indicated on Drawings to receive base slab as specified for precast structures.
2. Place and cure concrete as specified in Section 03 30 00 - Cast-in-Place Concrete.
3. Set frames and covers to correct elevations shown on the plan drawings and properly anchor to manhole or structurer top. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be set such that the top surface of the cover conforms to the exact slope, crown, and grade of the existing or proposed pavement.

J. Doghouse Manholes and Structures:

1. Stake out location and burial depth of existing sewer line in area of proposed manhole or structure.
2. Carefully excavate around existing sewer line to adequate depth for foundation slab installation.
3. Protect existing pipe from damage.
4. Remove unsuitable material as necessary and replace with granular fill compacted to 95 percent maximum density, compaction shall be 100% maximum dry density if manhole is located in a pave roadway.
5. Prepare crushed stone bedding or other support system, as indicated on Drawings, to receive foundation slab as specified for precast manholes and structures.
6. Install doghouse manhole or structure around existing pipe according to applicable Paragraphs in this Section.
7. Grout pipe entrances as specified in this Section.
8. Saw cut top half of pipe flush with interior of manhole or structure.
9. Build invert by grouting base of manhole or structure to achieve a sloped bench to top edge of cut pipe and trowel smooth.

K. Sanitary Manhole Drop Connections:

1. Drop connections shall be constructed as shown on the plans and consist of a "Memphis" tee, or tee with a spigot on the branch, drop pipe extending from the sewer to the invert of the manhole, and an elbow at the base. The drop connection shall be encased in concrete or in a brick box filled with sand.

L. Castings:

1. Set frames using mortar and masonry and/or as indicated on the drawings.
2. Lay concrete brick in full bed of mortar and completely fill joints.
3. If more than one course of concrete brick is required, stagger vertical joints.
4. Set frame and cover to the grade or elevation as shown or called for on the plan drawings.

3.4 FIELD QUALITY CONTROL

A. Test concrete manhole and structure sections as specified in Division 33.

B. Vertical Adjustment of Existing Manholes and Structures:

1. If required, adjust top elevation of existing manholes and structures to finished grades as indicated on Drawings.
2. Frames, Grates, and Covers:

    a. Carefully remove frames, grates, and covers cleaned of mortar fragments.
    b. Reset to required elevation according to requirements specified for installation of castings.

END OF SECTION 33 05 13

SECTION 33 05 16.13 - PRECAST CONCRETE UTILITY STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast concrete utility structures.
2. Drainage system catch basins.
3. Drainage system inlets.
4. Pipe Headwalls.
5. Pipe Flare End Section
6. Frames and covers.
7. Access hatches.

B. Related Requirements:

1. Section 03 30 00 - Cast-in-Place Concrete
2. Division 31 – Earthwork
3. Division 33 – Utilities

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO HB-17 - Standard Specifications for Highway Bridges.
2. AASHTO M306 - Standard Specification for Drainage, Sewer, Utility, and Related Castings.

B. American Concrete Institute:

1. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
2. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

C. ASTM International:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A48 - Standard Specification for Gray Iron Castings.
3. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
4. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

6. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
7. ASTM A497 - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
8. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
9. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
10. ASTM A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
11. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
12. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
13. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
14. ASTM C33 - Standard Specification for Concrete Aggregates.
15. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
16. ASTM C138 - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
17. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete.
18. ASTM C150 - Standard Specification for Portland Cement.
19. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
20. ASTM C192 - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
21. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
22. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
23. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
24. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
25. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
26. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
27. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
28. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
29. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
30. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.
31. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
32. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
33. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars.
34. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

35. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
36. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
37. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
38. ASTM C1433 - Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers.
39. ASTM C1504 - Standard Specification for Manufacture of Precast Reinforced Concrete Three-Sided Structures for Culverts and Storm Drains.

D. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.
2. AWS D1.4 - Structural Welding Code - Reinforced Steel.

E. National Precast Concrete Association:

1. NPCA Plant Certification Program.
2. NPCA Quality Control Manual for Precast and Prestressed Concrete Plants.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit data for frames and covers, steps, component construction, features, configuration, and dimensions.

C. Shop Drawings:

1. Indicate structure locations, elevations, sections, equipment supports, piping, conduit, sizes and elevations of penetrations, and block-outs/knockouts.
2. Indicate design, construction and installation details, typical reinforcement and additional reinforcement at openings.

D. Submit concrete mix design for each different mix.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for custom fabrications.

G. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

H. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

I. Qualifications Statements:

1. Submit qualifications for manufacturer.

1.4 QUALITY ASSURANCE

A. Obtain precast concrete utility structures from single source.

B. Perform structural design according to ACI 318.

C. Perform Work according to NPCA Quality Control Manual for Precast and Prestressed Concrete Plants.

D. Conform to following material and fabrication requirements:

1. Single Cell Box Culverts: ASTM C1433.
2. Other Structures: ASTM C913.

E. Perform welding according to following:

1. Structural Steel: AWS D1.1.
2. Reinforcing Steel: AWS D1.4

F. Perform Work according to National Precast Concrete Association (NPCA) standards.

G. Design precast concrete members under direct supervision of a Professional Structural Engineer experienced in design of precast concrete. Drawings shall bear the stamp of the P.E.

1.5 QUALIFICATIONS

A. Manufacturer: Certified by NPCA Plant Certification Program prior to and during Work of this Section.

B. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years' documented experience.

C. Welders and Welding Procedures: AWS qualified within previous 12 months for employed weld types.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Do not deliver products until concrete has cured **5** days or has attained minimum **75** percent of specified 28-day compressive strength.

C. Inspection: Accept precast structures on Site in manufacturer's original packaging and inspect for damage.

D. Comply with precast concrete manufacturer instructions for unloading, storing, and moving precast structures.

E. Lift structures from designated lifting points.

F. Storage:

1. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property.
2. Repair property damaged from materials storage.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

A. Design structures for minimum loads conforming to ASTM C857 and ASTM C890.

B. Roof Live Load: Comply with following loading conditions, including impact load:

1. Heavy Traffic:

a. ASTM C857, A-16.
b. Maximum 16,000 lb. each wheel.

2. Medium Traffic:

a. ASTM C857, A-12.
b. Maximum 12,000 lb. each wheel.

3. Light Traffic:

a. ASTM C857, A-8.
b. Maximum 8,000 lb. each wheel.

4. Walkway Traffic:

a. ASTM C857, A-0.3.
b. Maximum 300 psf.

2.2 PRECAST CONCRETE UTILITY STRUCTURES

A. Manufacturers:

1. Armorcast Products Company
2. Hanson Pipe and Precast
3. Manarch Products, Inc.
4. Old Castle Precast, Inc.
5. Or Approved Equal

B. Precast Concrete Utility Structures: Reinforced precast concrete.

1. As shown on the Drawings

2.3 FRAMES AND COVERS

A. Manufacturers:

1. Barry Pattern & Foundry Company
2. EJ Iron Works
3. Neenah Foundry, U.S. Foundry, Castings Inc.
4. McKinley Iron Works, Inc.
5. Or Approved Equal

B. Description:

1. Construction: ASTM A48, Class 30B cast iron or other material as shown on the plan drawings.
2. Frame for cover: Shall be cast in place by the precast concrete manufacture or blocked-out for field installation of frame per dimensions required for the opening.

2.4 ACCESS HATCHES

A. Manufacturers:

1. The Bilco Company.
2. U.S.F. Fabrication.
3. Halliday Products.
4. Or Approved Equal.

B. Access Hatch:

1. All access hatches shall be double or single leaf as shown on the drawings. Automatic doors shall be equipped with a minimum of two stainless steel hinges with stainless steel pins. Each door leaf shall also have spring operators with a positive hold open arm that engages automatically in full open position, and a non-corrosive release handle. Doors shall open with a maximum lift force of 9 lbs. When closed, doors shall not protrude above the operating surface in which they are installed. Include slam lock feature with removable key.
2. When subject to vehicular traffic, cover shall be reinforced to support an AASHTO H-20 wheel load with a maximum deflection of $1/150^{th}$ of the span.
3. Door leaves shall be 1/4-inch aluminum checkered plate reinforced with structural aluminum channels, capable of withstanding 300 pounds per square foot uniform load with minimal deflection for non-vehicular loading service. When subject to vehicular traffic, cover shall be reinforced to support an AASHTO H-20 wheel load with a maximum deflection of 1/150th of the span.
4. The gutter frame provided shall be of 1/4-inch aluminum with an anchor flange around the perimeter. Frame shall incorporate a 1 ½" threaded drain fitting and neoprene gasket.

5. The drain coupling shall be located in an appropriate corner of each channel frame away from the access steps. Contractor shall attach and route Sch 80 PVC pipe from drain port to daylight away from structure. If daylight is not ready accessible within 10-ft, then contractor shall terminate piping into ½ cubic yard of #57 stone wrapped with filter fabric. Piping shall project through walls with sleeve and Link-Seal in a water-tight (leak-proof) installation.
6. Factory finish shall be mill finish.
7. Hardware shall be stainless steel.
8. Any surface or portion of the frame contacting concrete shall receive a bituminous coating.
9. The door shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be provided to release and close the cover with one hand.
10. Doors, which are to receive flooring, shall be smooth plate. Doors which will not receive flooring shall be checkered plate

2.5 MATERIALS

A. Concrete: As specified in Section 03 30 00 – Cast-In-Place Concrete.

B. Admixtures: As specified in Section 03 30 00 – Cast-In-Place Concrete.

C. Concrete Reinforcement: As specified in Section 03 30 00 – Cast-In-Place Concrete.

2.6 FABRICATION

A. Fabricate precast concrete utility structures conforming to ACI 318 and NPCA Quality Control Manual for Precast and Prestressed Concrete Plants.

B. Fabricate precast concrete utility structures with knock-out panels, embedded items (frames, etc.), and openings to size and configuration as indicated on Drawings.

C. Construct forms to provide uniform precast concrete units with consistent dimensions.

D. Clean forms after each use.

E. Reinforcing:

1. Install reinforcement by tying or welding to form rigid assemblies.
2. Position reinforcement to maintain minimum ½ inch cover.
3. Secure reinforcement to prevent displacement while placing concrete.

F. Position and secure embedded items to prevent displacement while placing concrete.

G. Deposit concrete in forms and consolidate concrete without segregating aggregate.

H. Provide initial curing by retaining moisture using one of following methods:

1. Cover with polyethylene sheets.
2. Cover with burlap or other absorptive material and keep continually moist.

3. Apply curing compound according to manufacturer instructions.

I. Provide final curing according to manufacturer's standard.

J. Remove forms without damaging concrete.

K. Tension reinforcement tendons as required to achieve design load criteria.

L. Exposed Ends at Stressing Tendons: Fill recess with non-shrink grout, trowel flush.

2.7 MIXES

A. Concrete:

1. Design Mix shall be as specified in Section 03 30 00 – Cast-In-Place Concrete.

2.8 FINISHES

A. Reinforcing Steel, Wire and Wire Fabric, Concrete and Steel shall be as specified in Section 03 30 00 – Cast-In-Place Concrete.

2.9 ACCESSORIES

A. Membrane Curing Compound: ASTM C309, Type 2, Class A.

B. Steps:

1. Formed steel-reinforced polypropylene rungs.
2. Diameter: 3/4 inch.
3. Width: 10 inches, minimum.
4. Spacing: 15 inches o.c. vertically or as indicated on Drawings.

C. Inserted and Embedded Items:

1. Structural Steel Sections:

a. Comply with ASTM A36.
b. Finish: As shown or called for on the plans or in related specification sections

D. Bearing Pads:

1. High density plastic, Vulcanized elastomeric compound molded to size, Neoprene (Chloroprene), or Tetrafluoroethylene (TFE); Shore A Durometer; 1/8 inch (3 mm) thick, smooth both sides.

E. Joint Sealants and Joint Gaskets:

1. Gasket Joints for Circular Concrete Pipe:

a. ASTM C443.
b. Gaskets: Oil-resistant rubber.

2. External Sealing Bands:

a. Comply with ASTM C877.
b. Material: Type I, rubber and mastic.

3. Preformed Joint Sealants for Concrete Pipe and Box Sections: Comply with ASTM C990
4. Elastomeric Joint Sealants:

a. Comply with ASTM C920.
b. Material: Polyurethane.
c. Grade NS, Class 35.

F. Pipe Entry Connectors: Comply with ASTM C923.

G. Grout:

1. Cement Grout: Portland cement, sand, and water mixture with stiff consistency to suit intended purpose.
2. Non-Shrink Grout:

a. Description: Premixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing agents.
b. Conform to ASTM C1107.
c. Minimum Compressive Strength: 2,400 psi in 48 hours, and 7,000 psi in 28 days.

H. Bituminous Coating:

1. Manufacturers:

a. Carboline Company; a subsidiary of RPM International
b. Duron, Inc.
c. Laurence, C.R. Co., Inc.
d. Or Approved Equal

2. Description: Provide damproofing on the exterior side of structures in the field where structure will be below grade. Coating shall be a two-component, self-priming, chemically cured, coal tar epoxy protective coating.

I. Touch-Up Primer for Galvanized Surfaces:
1. As specified in Section 09 96 00 – High-Performance Coatings

2.10 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Testing:

1. Perform following tests for each 100 cu. yd. of concrete placed with minimum one set of tests each week:

    a. Slump: Comply with ASTM C143.
    b. Compressive Strength: ASTM C31 and ASTM C39.
    c. Air Content: Comply with ASTM C231 or ASTM C173.
    d. Unit Weight: Comply with ASTM C138.

2. Make test results available to Engineer/Owner upon request.

C. Inspection:

1. Visually inspect completed precast structures for defects.
2. Repair defects on surfaces exposed to view to achieve uniform appearance.
3. Repair honeycomb by removing loose material and applying grout to produce smooth surface flush with adjacent surface.
4. Repair of major defects not allowed

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that items provided by other Sections of Work are properly sized and located.

C. Verify correct size and elevation of excavation.

D. Verify that subgrade and bedding are properly prepared, compacted, and ready to receive Work of this Section.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Mark each precast structure by indentation or using waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

C. Coordinate placement of inlet and outlet pipe or duct sleeves required by other Sections.

D. Do not install structures if Site conditions induce loads exceeding weight capacity of structures.

E. Inspect precast concrete structures immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.

3.3 INSTALLATION

A. Install underground precast utility structures according to ASTM C891.

B. Lift precast concrete structures at lifting points designated by manufacturer.

C. When lowering structures into excavations and joining pipe to units, take precautions to ensure that interior of pipeline and structure remains clean.

D. Install precast concrete base to elevation and alignment as indicated on Drawings.

E. Install precast concrete utility structures to elevation and alignment as indicated on Drawings.

F. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members

G. Maintain temporary bracing in place until final support is provided. Protect members from staining

H. Provide temporary lateral support to prevent bowing, twisting, or warping of members

I. Adjust differential camber between precast members to tolerance before final attachment

J. Install bearing pads

K. Level differential elevation of adjoining horizontal members with grout to maximum slope of 1:12

L. Assembly of Multi-section Structures:

1. Lower each section into excavation.
2. Clean joint surfaces.
3. Install watertight joint seals according to manufacturer instructions using gasket joints, external sealing bands, preformed joint sealants, elastomeric joint sealants, grout, as required.

M. Remove knockouts or cut structure to receive piping without creating openings larger than required to fit pipe; fill annular space with grout.

N. Pipe Connections:

1. Connect pipe to structure and seal watertight.
2. Cut pipe flush with interior of structure.

O. Base/Foundation slab:

1. Grout to achieve slope to exit piping.
2. Trowel smooth.
3. Contour to form continuous drainage channel as indicated on Drawings.

P. Paint exterior with two coats of bituminous interior coating at rate of per coating manufacturer for each coat.

Q. Frame and Cover and Access Hatch:

1. Set level, without tipping, to elevations as indicated on Drawings.
2. Set cover and access hatch 3 inches above finished grade for structures located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.
3. Connect drain from access hatch frame to storm drainage system.

R. Touch up damaged galvanized coatings.

S. Backfill excavations for structures as specified in Division 31.

3.4 ERECTION TOLERANCES

A. Erect members level and plumb within allowable tolerances

B. Conform to PCI MNL-116S.

C. Design and erect to the following tolerances:

1. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch/10 feet and 3/8 inch in 100 feet, non-cumulative.
2. Maximum Offset from True Alignment between Members: 1/4 inch.
3. Maximum Variation from Dimensions Indicated on Reviewed Shop Drawings: Plus or minus 1/8 inch.

D. Exposed Joint Dimension: 3/8 inch plus or minus 1/4 inch.

E. When members cannot be adjusted to conform to design or tolerance criteria, cease work and advise. Execute modifications as directed

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Perform vacuum test and exfiltration test as specified in Division 33.

3.6 WATER RETAINING STRUCTURE TESTING

1. Exfiltration Testing:

a. Exfiltration testing shall be performed prior to any specified backfill placement at the footing or wall.
b. Plug pipes in manhole or structure excluding overflow.
c. Remove water from manhole or structure

d. Observe plug over a period of time not less than two (2) hours to ensure there is not leakage into the manhole or structure.
e. Fill manhole or structure with water within 4 inches of top of cover frame of overflow.
f. Prior to testing, allow manhole to soak from a minimum of four hours for manholes and 24 hours for other structures to a maximum of 72 hours.
g. Inspect the exterior of the wall and footing for damp spots. Damp spots shall be defined as spots where moisture can be picked up on a dry hand, the source of which is from inside the manhole or structure.
h. After soak period, adjust water level inside the structure to within 4 inches of top of cover frame or overflow.
i. Measure water level from top of manhole frame of access point.
j. At end of the 24-hour testing period, again measure water level from the same point; compute drop in water level during testing period.
k. The exfiltration test is considered satisfactory when drop in water level is less than 0.00937 gallons per foot diameter per foot depth.

2. If unsatisfactory testing results are achieved, repair manhole or structure and retest until results meet criteria.
3. Repair visible leaks regardless of quantity of leakage.

END OF SECTION 33 05 16.13

SECTION 33 05 26 - UTILITY IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipeline marker posts.
2. Ribbon tape for placement above direct-buried utility.
3. Trace wire for placement above direct-buried utility.

B. Related Requirements:
1. Section 33 31 00 - Sanitary Utility Sewerage Piping

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer's catalog information for each product required.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of tagged valves.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance materials.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

PART 2 - PRODUCTS

2.1 PIPELINE MARKER POSTS

A. Description:

1. Material: High-density polypropylene.
2. Diameter: 3-1/2 inches.
3. Length: 72 inches.
4. Color: White.
5. Embedment: T-anchor.

B. Visibility Enhancer:

1. Material: Polyethylene.
2. Length: 24 inches.
3. Diameter: 3-3/4 inches.
4. Color: As required by utility.
5. Text: As required by utility.

2.2 RIBBON TAPE

A. Description:

1. Reef Industries Terra Tape Standard
2. Material: 100% virgin pigmented polyolefin film, brightly colored, continuously printed.
3. Minimum Size: 6 inches wide by 4 mils thick.
4. Manufactured for direct burial service.
5. Imprint: In large letters with message printed at least every 30 inches; Sanitary Sewer Gravity **"CAUTION SEWER LINE BURIED BELOW"**; Reuse Water Lines **"CAUTION REUSE WATER LINE BURIED BELOW"**; Sewer Force Main Lines **"CAUTION SEWER FORCE MAIN BURIED BELOW"**

2.3 TRACE WIRE

1. Description:

a. Conductor: No.12 AWG HS-CCS high strength copper clad steel tracer wire.
b. Covering: 30 mils of Green HMWPE insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pipeline Marker Posts: As recommended by manufacturer.

B. Ribbon Tape:

1. Tape shall be installed a minimum of 24 inches above the top of the pipe for its full length.
2. If multiple pipes occur in common trench, locate ribbon tape above centerline of trench.

C. Trace Wire:

1. Attach locator wire to the top of pipe every 5 feet with duct tape.
2. All wire splices shall be made using copper wire “U” bolt assemblies and then wrapping with electrical tape.

END OF SECTION 33 05 26

SECTION 33 31 00 - SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. PVC Pipe
2. Ductile Iron Pipe
3. Ductile Iron Fittings
4. Concrete Pipe
5. HDPE Pipe
6. HDPE Fittings
7. Plug Valves
8. Gate Valves
9. Accessories

B. Standards

1. Standards: Supply all products and perform all work in accordance with applicable American Society of Testing and Material (ASTM), American Water Works Associations (AWWA), American National Standards Institute (ANSI), or other recognized standards.
2. Latest revisions of all standards are applicable.

C. Related Sections

1. Division 01 Specifications
2. Section 31 23 16.13 Excavation & Trenching
3. Section 33 01 30.13 Sewer and Manhole Testing
4. Section 33 05 13 Manholes and Structures

1.2 SUBMITTALS

A. Product Data: Manufacturer information indicating pipe material to be used, and pipe accessories.

B. Manufacturer's Certificate: Products meet or exceed specified requirements.

C. Certified mill certificate showing conformance to all requirements specified herein.

D. Manufacturer Instructions: Special procedures required to install specified products.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. General arrangement and dimensional drawings.

G. Laboratory Approval – Ductile Iron Pipe shall be tested by an independent laboratory, approved by the Engineer, in accordance with AWWA C151.

1.3 QUALITY ASSURANCE

A. Perform Work according to applicable GAEPD, OSHA, AWWA, and ASTM standards.

B. All pipes shall be first quality, with smooth interior and exterior surfaces, free from cracks, blisters, "honeycombs," and other imperfections, and true theoretical shapes and forms throughout the full length.

C. All pipes shall be subject to the inspection of the Engineer at the pipe plant, trench, or other points of delivery, for the purpose of culling and rejecting pipe, independent of the laboratory test which does not conform to the requirements of these specifications. Such pipe shall be marked by the Engineer, and the Contractor shall remove it from the project site upon notice of its rejection being received.

PART 2 - PRODUCTS

2.1 PVC PIPE

A. General

1. All PVC pipe and fittings shall be clearly marked as to size, ASTM, Company, SDR or DR, and date of manufacture. No pipe shall be accepted that is more than 120 days old when delivered to the job site.
2. Pipe shall be manufactured of PVC having a cell classification of 12454 for pressure service, 12454 or 12364 for gravity service as defined in ASTM D 1784. Additives and fillers including but not limited to stabilizers, antioxidants, lubricants, colorants, etc. shall not exceed 10 parts by weight per 100 parts of PVC resin in the compound.
3. A certified mill certificate showing conformance to all requirements specified above shall be provided to the Engineer with each shipment of pipe delivered to the job site.
4. All PVC pipe shall be green in color and stenciled "SANITARY SEWER."
5. PVC pipe shall not be used in locations where the pipe has a cover less than four feet, where crossing creek or ravine bottoms where the pipe may be exposed, or where sewers are laid under railroads, powerline easements, or roadway rights of way unless noted in Drawings.

B. PVC Pipe for Gravity Sewers

1. PVC pipe for gravity sewers shall be manufactured in accordance with ASTM D 3034 for 4" through 15" SDR 35 minimum and F679 for 18" through 36" 46PS/115PS sewer pipe as indicated on the drawings.
2. Joints shall be of the rubber gasket slip on type conforming to ASTM D 3212 under both pressure and vacuum. The bell shall be an integral part of the pipe with the same strength. Spigot ends shall be beveled.
3. Elastomeric gaskets shall meet the requirements of ASTM F477. Gaskets shall be locked in, NAPCO, HARCO, or approved equal.

4. PVC pipe material at different depth of burial, as defined from the final ground surface to the bottom of the pipe, shall conform to the following schedule:

    a. 4’ to 15’ SDR 35 with a minimum pipe stiffness of 46 PSI
    b. 15’ to 20’ SDR 26 with a minimum pipe stiffness of 115PSI
    c. > 20’ use Ductile Iron or other alternate material, as directed by the Engineer.

5. Transitions from PVC pipe to Ductile Iron pipe shall be made only at manholes unless noted on Drawings.

C. PVC pipe for Low Pressure Sewer (less than 4”)

1. PVC Pipe shall conform to ASTM D1785, Schedule 80, fitting to ASTM D2467, Schedule 80.
2. Pipe and fittings shall be manufactured as a system and bet the product of one manufacturer.
3. Joints: will be solvent-welded per ASTM D2855 or threaded or flanged if later removal is required.

D. PVC Pipe for Low Pressure Sewer (4” through 60”)

1. PVC pipe for force mains shall conform to the requirements of AWWA C900 4” through 60”. Pipe shall be green in color and marked with the nominal pipe size, PVC dimension ratio, AWWA pressure class, AWWA designation number (AWWA C900), manufacturer’s name and labeled “Sewer Force Main”.
2. The pressure rating shall be selected based upon the design requirements of the system. The minimum wall thickness shall be DR 18, Class 150.
3. Pipe shall be Type I, Grade I and shall be manufactured from virgin material.
4. All gaskets shall meet ASTM F477 standards.
5. PVC joints shall be restrained where specified on the drawings.

    a. Restrained joints shall be provided by a clamping ring and an additional ring designed to seat on the bell end of the pipe. The rings shall be connected with T-Head bolts or rods.
    b. Restraining devices shall provide full (360°) support around the circumference of the pipe. No point loading shall be permitted. Restraint of mechanical joint fittings shall be provided by a clamping ring installed on the PVC pipe and connected to the mechanical joint fitting with T-Head bolts or rods.
    c. Restraining devices shall be EBAA Series 1600 or approved equal.
    d. For PVC lines smaller than 4 inches, use thrust blocks or additional restraint as shown on Drawings.
    e. The use of solvent weld PVC pipe and fittings in low pressure sewer mains 4” to 60” is prohibited.

2.2 DUCTILE-IRON PIPE

A. General

1. Pipe laying lengths shall be provided in 18 or 20 feet nominal lengths with allowable trim pipe lengths in accordance with AWWA C151 and special shorter lengths provided as required by the Drawings.
2. All ductile iron pipes and fittings, installed in a trench conditions shall receive a shop-applied bituminous coating 1-mil thick, minimum in accordance with AWWA C151/ANSI A21.51.
3. All exposed pipe and fittings shall be provided with a shop prime and painted as specified.
4. Where flexible joint iron pipe is called for on the plans, it shall conform to the same specifications as ductile iron. The joints shall be of the ball and socket type either bolted or keyed and, if of the bolted type, the bolts and nuts shall be made of stainless steel. The trench in which this pipe is installed shall be excavated to a depth that will provide a cover of not less than 3' over the top of the pipe when it is in place.
5. All ductile iron sewer main pipes shall be color coded green by painting a 3" green stripe along the crown of the pipe barrel.

B. Joints:

1. Provide ductile iron pipe with push-on joints conforming to ANSI A21.11/AWWA C111, latest revision.
2. Joints shall be restrained where indicated on the drawings. Use American Fast-Grip® Gaskets, or approved equal for restrained joints. Provide a boltless, integral restraining system rated for the design pressure in accordance with the performance requirements of ANSI/AWWA C111/A21.11, unless noted otherwise on the Drawings.
3. Gauge pipe ends (spigot end, bell, and socket) for all pipe with suitable gauges at sufficiently frequent intervals to ensure compliance to the standard dimensions of ANSI/AWWA C151/A1.5, latest addition. Manufacturer must have a recommended ovality tolerance for 18 inches and larger size pipe. Each end of each pipe 18 inches and larger shall be measured and approved by manufacturer's quality assurance inspector to meet such out of round tolerances. Provide manufacturer's certification that ovality has been measured and controlled in accordance with manufacturer's standard.

C. Flanged Joint Pipe

1. Provide flange fittings as required for above ground applications or exposed piping in vaults.
2. Flanges conforming to AWWA C110 can be joined with Class 125 B16.1 flanges shown in ANSI B16.1 but not with Class 250 B16.1 flanges.
3. Flange joints should be fitted so that the contact faces bear uniformly on the gasket. The joint should be made with relatively uniform bolt stress.
4. Bolts and nuts shall be type 316 stainless steel, conforming to ASTM A 193, Grade B8M, for bolts and ASTM A 194, Grade 8M, for nuts.
5. Set flange bolts beyond finger tightness with an indicating torque wrench to insure equal tension in all bolts. Tighten bolts such that those 180 degrees apart or directly opposite are torqued in sequence.
6. Provide at minimum one (1) restrained dismantling joint or flange coupling adaptor for disassembly in each linear run of flanged piping.

2.3 DUCTILE-IRON FITTINGS

A. Ductile iron fittings shall be provided in locations as shown on the plans or in locations deemed necessary by the Engineer. Ductile iron fittings 12" and smaller shall be rated for 350 psi working pressure and fittings larger than 12" shall be rated for 250 psi working pressure.

B. Fittings shall be manufactured in accordance with AWWA C153 and provided with mechanical joints. All fittings shall be provided with a thin cement lining in accordance with AWWA C104 unless noted otherwise on plans. If DIP is to be epoxy lined, all fittings shall be epoxy lined in lieu of cement lining.

C. Use Tee-head or non-hex head bolts and hex head nuts for joint makeup and gasket seating, bolts and nuts shall be carbon steel coated with corrosion inhibiting fluoropolymer composite material. Mechanical joint fittings shall be furnished with sufficient quantities of accessories as required for each joint. All mechanical joints shall be restrained.

D. Ductile Iron fittings with retainer glands shall be provided.

E. Concrete thrust block/restraints shall be 2500 psi concrete poured in place against undisturbed soil at each fitting location.

F. Where 90 degree deflections occur along the route of the force main, two (2) 45 degree bends shall be used where possible.

2.4 POLYETHYLENE PIPE

A. All polyethylene pipe and fittings shall be molded from Virgin PE4710 High Density Polyethylene Pipe (HDPE) resins in accordance with the requirements of ASTM D3035 and manufactured to comply with ASTM F714.

B. Unless otherwise specified, the nominal size and DR shall be as shown on the Drawings. HDPE fittings shall be fully pressure rated.

C. Gravity Sewer - Profile wall polyethylene pipe and fittings for gravity sewers shall be of the spiral wound type. The pipe shall be made of high density, high molecular weight polyethylene pipe material meeting the requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D-1248. The pipe shall be provided with rubber gasket joints that meet the non-pressure requirements of ASTM F477. Special heavy wall pipe sections having a smooth outside wall shall be supplied for all manholes and connections to other types of pipe.

D. Pressure Mains – HDPE pipe and fittings shall have a nominal DIPS (ductile iron pipe size) outside diameter per ASTM F714. Pipe sections shall be joined on the job site above ground into continuous length by the butt-fusion method in accordance with ASTM F2620, and be performed in strict accordance with the manufacturer's recommendations. Butt-fusion fittings shall comply with ASTM D3261.

E. HDPE pipe shall be joined to ductile iron valves and fitting with a DIPS size MJ adapter kit. Pipe stiffeners shall be used to maintain roundness of the pipe. MJ adapter and stiffeners shall be installed in strict accordance with the manufacturer's recommendations.

F. Pipe shall be supplied in lengths not less than 40 feet long, of the size and wall thickness as shown on the plans. The combined soil pipe system shall be reviewed and approved by the pipe manufacturer to ensure an installation limiting maximum deflection of the pipe to less than five percent of base diameter, when both soil and maximum water loads are applied. The pipe shall be handled and installed in strict accordance with the recommendations of the manufacturer.

2.5 VALVES

A. Gate Valves

1. Manufacturers:

a. Mueller Co
b. American
c. Or Approved Equal

2. Description:

a. Comply with AWWA C509.
b. Body: Ductile iron.
c. Seats: Resilient.
d. Style:

1) Buried service: Mechanical joint ends in accordance with AWWA C111.
2) Above ground service: Flanged ends with 125 lb. flanged ends faced and drilled per ANSI B16.1 standard for cast iron flanges.

e. Stem:

1) Type: Non-rising.
2) Material: Bronze.

f. Operation:

1) 2-inch operating nut for buried applications
2) Handwheel for above ground applications
3) Opening Direction: Counterclockwise.

3. Provide gate valves smaller than 3 inches in diameter that are all bronze, threaded, meeting the requirements of Federal Specification WW-V-54C, as manufactured by Crane, or Walworth, or equivalent, and suitable for the service required.

B. Plug Valves

1. Manufacturers:

a. Milliken
b. Henry Pratt Company
c. DeZurick
d. Val-Matic
e. Or Approved Equal

2. Description:

    a. Type:

        1) Non-lubricated
        2) Eccentric
        3) 90 Degree Turn
        4) Resilient faced Plug

3. Working Pressure: 175 psig for valves through 12" and 150 psig for valves for 14" through 72".
4. Ports:

    a. Configuration: Rectangular.
    b. Minimum Port Area: 100 percent of nominal pipe area for valves.

5. Stem Bearings: Self-lubricating.
6. Stem Seals:

    a. Type: V-ring.
    b. Material: Neoprene.

7. Packing and Gland: Accessible and externally adjustable.
8. End Connections:

    a. Buried service: Mechanical joint ends in accordance with AWWA C111.
    b. Above ground service: Flanged ends with 125 lb. flanged ends faced and drilled per ANSI B16.1 standard for cast iron flanges.

9. Operation:

    a. 2-inch operating nut for buried applications.
    b. Handwheel for above ground applications.
    c. Opening Direction: Counterclockwise.

10. Materials:

    a. Body:

        1) Cast iron, ASTM A126 Class B.
        2) Lining: As recommended by valve manufacturer for service conditions.

    b. Plug:

        1) Ductile iron, ASTM A126 Class B.
        2) Lining: Synthetic viton compound of a minimum of 70 durometer hardness.

    c. Seats: 1/8", welded, 90% pure Nickel.
    d. Stem: Type 316 stainless steel.
    e. Stem Bearings: Type 316L stainless steel.
    f. Seals: Buna-N.

g. Connecting Hardware: Type 316 stainless steel.
h. Plugs shall be on top when open and on pressure side when closed.

C. Check Valves

1. Manufacturers:

a. GA Industries, Inc.
b. Henry Pratt Company
c. Kennedy Valve Company
d. Or Approved Equal

2. Description:

a. Comply with AWWA C508.
b. Minimum Working Pressure: 200 psig for 2" - 12" and 150 psig for 14" - 30".
c. Check valves 6 inches and larger: Furnish with adjustable air cushion chambers.
d. Type: Swing, resilient seated with outside lever and adjustable weight.
e. Mounting: Horizontal or vertical.
f. End Connections: Integral flange ends shall be ANSI B16.1 Class 125, suitable for horizontal or vertical installation.

3. Materials:

a. Body and Cover: Ductile iron, ASTM A536.
b. Disc, Disc Arm: Ductile iron, ASTM A536
c. Body Seat: Replaceable, Type 316 ASTM A276 with Buna-N renewable seat ring
d. Shaft: Type 303 Stainless Steel ASTM A582
e. Disc Seat: Buna-N
f. Lever and Counterweight: Ductile Iron, ASTM A536
g. Hinge Pin and Key: Type 316 Stainless Steel
h. Rubber Components: Buna-N
i. Connecting Hardware: Type 304 stainless steel.

4. Finishes: As specified in Section 09 96 00 High-Performance Coatings.

D. Air Vacuum Valves

1. Manufacturers:

a. ARI Flow Control Accessories
b. Or Approved Equal

2. All air release and vacuum valves shall be sized per the manufacturer and approved by the engineer prior to installation based on the owner's preferences and the anticipated line pressures.
3. Wastewater air and vacuum valves shall permit unrestricted passage of air during filling of the distribution piping. The valve body shall be stainless steel with stainless steel screws, unless indicated (stainless steel) in the plan set. The float and all internal metal parts shall be stainless steel, and the valve shall be designed so that the venting mechanism does not come into contact with sewage. The air and vacuum combination

valves for sewage shall be ARI Model D-020 or equal. The valve shall have a NPT inlet sized by the manufacturer and shall be fitted with a back flushing device.

4. The air release valve shall be installed as shown in details.
5. No galvanized nipples shall be used.
6. Install Air Vacuum valves as shown on plans.

2.6 MATERIALS

A. Bedding and Cover:

1. Bedding:

   a. Ductile Iron Pipe – Type 2 or Type 3 Trench per AWWA C151 as required.
   b. PVC/HDPE – Type 2 Trench per AWWA C151

2. Cover: Provide a minimum of 4 feet of cover unless shown otherwise on Drawings.
3. Soil Backfill from Above Pipe to Finish Grade:

   a. Subsoil with no rocks greater than 6 inches in diameter, frozen earth, or foreign matter.
   b. Back-fill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe.

2.7 ACCESSORIES

A. Polyethylene Encasement

1. Where indicated on the drawings ductile iron pipe shall be wrapped in 6 mil polyethylene encasement in accordance with AWWA C105. All fittings shall be wrapped in 6 mil polyethylene encasement extending 6" beyond the connection.

B. Zinc Coating: Where indicated on the drawings, ductile iron pipe for buried service shall be coated with a layer of arc-sprayed zinc. The mass of the zinc applied shall be 200 g/m^2 of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils.

1. The zinc coating system shall conform to ISO 8179 standard.
2. All pipe shall be manufactured and zinc coated in the United States at the pipe manufacturer's facility.

C. Protective Lining: The Contractor shall provide interior protective lining where indicated on the drawings or specified below.

1. Ductile iron pipe and fittings shall receive an epoxy lining of the interior surface where indicated on the drawings. The interior protective liner shall be an amine cured novalac epoxy applied to a dry film thickness of 40 mils minimum, and shall be Protecto 401™ Ceramic Epoxy or approved equal. Ductile iron pipe to be lined shall not be cement mortar lined.

D. Pipe Weights

1. Unless otherwise noted in the Specifications, all gravity sewer pipe installed with less than three diameters of cover over the top of the pipe barrel shall be provided with concrete weights to prevent flotation.
2. The weights shall be spaced at ten feet centers, with each weight weighing not less than 800 pounds. The weights may be constructed of a cast iron bolt on design, or they may be of the concrete cast in place type for below ground installations. Cast in place weights shall each contain two No. 3 rebars bent over and around the pipe barrel to provide adequate tensile strength to the upper part of the weight. Above ground portions of concrete weights shall be neatly formed and rubbed upon completion of the work.

E. Trench Plugs

1. Provide trench plugs where shown on drawings and at all creek crossings.
2. Trench plug consists of an impervious clay or concrete ditch check installed on the downstream side of all stream crossings. Ditch check shall be constructed for a length of 3 feet as measured along the centerline of the pipe and the full width of the trench excavation.
3. Backfill shall exhibit the characteristics of a “GC” soil rating as classified by the unified soil classification system (ASTM D2487) and shall have a coefficient of permeability no greater than .001 cm/sec.
4. The material utilized may vary from the above requirements if approved by Engineer; however, in any case the contractor shall furnish an approved independent testing facility utilizing the above methods.
5. The minimum percentage of compaction for the backfill shall be 95% proctor density (ASTM D1557).

F. Tracer Wire

1. Insulated copper wire shall be installed on all non-metallic pipe force mains. The wire shall be 10 gauge stranded type TW copper marker wire with electronically continuous joints with blue or purple thermoplastic insulation recommended for direct burial. The marker wire shall be brought up to all in-line valves and at 500’ increments along the force main alignment to be readily available to system operators. All wire connections and splices shall be connected with underground wire nuts, tied, and tightly taped with insulated electrical tape. All costs associated with the installation of the marker wire shall be included in the price bid for the pipe.

G. Detection Tape

1. Green metallic detection tape shall be provided for all PVC pipes.
2. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tape shall be marked “CAUTION SEWER MAIN BURIED BELOW.”
3. Tape shall be permanently printed with no surface printing allowed. Tape width shall be a minimum of 3-inches and have a minimum thickness of 5 mil.
4. Tape shall be marked “CAUTION SEWER MAIN BURIED BELOW.”
5. All tracer wire termination points will use a test station. Test stations shall be Lite Duty Snakepit test station (LD14*TP) green in color, as manufactured by Copperhead industries LLC, Rhino TracerPed Triview Green (P692TGI), or equal.

H. Valve Boxes

1. Manufacturers:

a. Mueller Co
b. Ford Meter Box Company, Inc.
c. Sigma
d. Or Approved Equal

2. Description

a. Material: Cast iron
b. Type: One Piece

1) Material: Cast iron.
2) Provide 6-inch Class 200 PVC riser

c. Installation: Support valve box and PVC riser on minimum of 2 cement bricks. Install tracer wire on outside of riser pipe and loop inside of valve box.

3. Lid Inscription: SEWER

I. Pressure Gauges

1. Gauges shall be furnished as shown on the drawings. Gauges shall be bourdon tube type, with bronze movement, plexiglass covers and shall be 4½ inches in diameter with not less than 90 percent glycerin filled cast phenolic cases. Each gauge shall have a range such that the normal operating pressure shall be approximately at half the range. The gauges shall be provided with diaphragm protectors and ¼ inch NPT liquid flushing connection with brass lever handle blow-off pet cock. The diaphragm and surfaces exposed to the liquid shall be of stainless steel. Gauges shall be calibrated in pounds per square inch.

PART 3 - EXECUTION

3.1 GENERAL

A. Watertight Construction – It is imperative that all sewers and manholes be built watertight and that the Contractor rigidly adheres to the specifications for material and workmanship. After completion, the sewers or section thereof will be tested and gauged; and if infiltration is observed, the sewer will be rejected.

B. Inspection – All work done and materials furnished shall be subject to the inspection of the Engineer and the Inspector, and all improper work shall be reconstructed. All materials which do not conform to the requirements of the specifications shall be removed from the worksite upon notice being received from the Engineer of the rejection of such materials. The Engineer shall have the right to mark rejected materials and to distinguish them as such.

3.2 EXAMINATION

A. Verify that trench cut is ready to receive Work.

B. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.3 PREPARATION

A. Perform trenching operations per Section 31 23 16.13 - Excavation & Trenching

B. Protect and support existing sewer lines, utilities, and appurtenances in accordance with Section 31 23 16.13 and the Occupational safety and health act (OSHA) of 1970 (PL 91-596), as amended.

C. Utilities:

1. Coordinate with other utilities and the Engineer to eliminate interference.
2. Notify Engineer if crossing conflicts occur.

3.4 INSTALLATION

A. The Contractor shall assume responsibility for all materials and equipment stored, protection of his product and compliance with all federal, state and local safety regulations.

B. Care shall be takin in loading, transporting, and unloading to prevent damage to pipe or fittings. Pipe or fittings shall not be dropped. All pipe and fittings shall be examined before laying, and the Engineer notified of any defect. No piece shall be installed which is defective. Only outside slings shall be used for lifting. Under no conditions shall lifting be from interior surfaces. The Contractor shall be responsible for all materials furnished by him and shall replace all such material found defective in manufacture of damaged in handling after deliver at no additional cost to the Owner.

C. Gravity sewer pipes, structures and manholes shall be installed and tested as specified to the grades, elevations, alignments, and orientations shown on the drawings within the following tolerances:

1. Pipe center line horizontal position at any point:	±0.50 feet
2. Pipe center line horizontal position difference between any two joints (maximum):	0.10 feet
3. Elevations of bases, openings, appurtenances, and tops of any structure or manhole (except pipe invert elevations):	±0.10 feet
4. Horizontal orientation (rotation) of any structure or manhole or any pipe penetration face:	±2.0 degrees

D. Under no circumstances should installation of sewer pipes, structures, and manholes to the tolerances specified herein results in a reverse grade. Any pipe, structures, and manholes outside of these tolerances or at an inverse grade shall be removed and replaced with correct work. Materials may be reinstalled only as approved in writing by the Engineer. Otherwise,

removed pipe and manholes shall be removed from the site and replaced at no additional cost to the Owner.

E. All PVC gravity sewer pipe shall be laid in strict accordance with ASTM 2321, and only crushed stone bedding as described elsewhere in these specifications shall be used

F. All HDPE Force mains shall be installed in accordance with the requirements of ASTM D2321. Class IV and Class V materials shall not be used in the pipe zone.

G. All ductile iron pipe and fittings shall be installed in conformance with AWWA C600.

H. A laser beam device shall be used to ensure correct horizontal and vertical alignment for all gravity sewer pipe. The laser beam shall be of a type approved by the Engineer. Each laser beam shall be calibrated at the factory before being used for this work. At 30 day intervals, each laser beam device shall be field checked and recalibrated if necessary by the manufacturer and a certificate authenticating its accuracy provided to the Engineer.

I. Before the pipe is placed in position, the bottom of the trench shall be uniformly graded and bedding stone placed so that the pipe will have a bearing for its full length. As each section of pipe is set in place a small excavation shall be made to provide a place for the bell.

J. All sewer pipe shall be laid upgrade with the spigots pointing downgrade. The pipe and specials shall be so laid in the trench that after the sewer is completed the interior surface shall conform on the bottom accurately to the grades and alignment fixed or given by the Engineer.

K. All pipe shall be carefully examined for cracks or other defects, and no pipe shall be laid which is found defective. If any pipe is found to be defective after being laid, it shall be removed and replaced with sound pipe without further charge.

L. The interior of the pipe shall be carefully freed of all dirt and superfluous material of every description as the work proceeds.

M. No pipe shall be laid on blocking of any kind except by express permission of the Engineer, and then only at manholes or other structures where temporary blocking may facilitate installation of the pipe. After installation of the pipe, such blocking shall be carefully removed, and all voids left by the blocking shall be filled with selected materials and tamped.

N. The bell of each joint shall be wiped clean before the gasket is inserted in it and the gasket covered with lubricant meeting the requirements of AWWA C111 before the pipe sections are jointed together.

1. No joints shall be made where surfaces of pipe and bell to be joined have been soiled by earth in handling until such soiled surfaces are so thoroughly cleaned by brushing and wiping that all traces of the earth are removed.
2. The surfaces of pipe to be joined, as well as the gaskets, shall be cleaned and lubricated. Whatever lubricating agent is used, it shall not be injurious or detrimental to the gasket.

O. After each joint is installed, the gasket shall be checked for proper position prior to installation of the succeeding length of pipe.

P. Where pipe laying is suspended at the lunch hour, at night, during inclement weather or at any other time, the open end of the pipe line shall be provided with a tight-fitting plug-in order to prevent the entrance of dirt, mud and animals.

Q. The Contractor shall be responsible for removing and cleaning any foreign debris that enters the sewer system.

R. Wye-branches shall be installed in the line opposite every house, and in other locations if so directed by the Engineer. Any omission of these appurtenances shall be corrected by the Contractor without additional cost to the Owner. The Contractor shall maintain a complete and accurate record showing the location of each wye-branch installed. The locations will be given as a distance upgrade from each manhole. The written record may be kept on the cut sheet provided by the Engineer and shall be given to him on completion of each line. The record shall state whether the wye-branch is facing right or left when looking up grade and if riser pipe is installed, the amount shall be recorded. In each instance the Contractor will make every effort to install the wye-branch at the location requested by the property owner.

S. Backfill trench as shown on the Drawings and in accordance with Section 31 23 16.13 of these specifications.

1. Unless otherwise shown on the Drawings, ductile iron pipe shall be installed in a Type 4 standard laying condition per AWWA C151.

T. All disturbed areas along the pipeline shall be grassed as soon as possible after backfilling operations have been completed.

1. The maximum length of area disturbed before soil stabilization techniques will be required shall be 500 feet.
2. Seeding and Restorations shall be per Section 32 92 19 - Seeding and Restoration of these specifications.

3.5 OBSTRUCTIONS

A. Each building, wall, fence, pole, bridge, railroad, driveway or other property or improvement encountered is to be carefully protected from all injury, and in the event that any of the foregoing are damaged or removed during the progress of the work the same shall be repaired or replaced within a reasonable time, and before final acceptance of the work shall be returned to as good condition as before the work started. Special care must be exercised in trenching under or near railroads in order to avoid or minimize delays and the danger of injury resulting therefrom, and the Contractor must use care in all phases of the construction work, for he will be held liable for damages caused by carelessness.

B. In excavating, backfilling and laying pipe care must be taken not to remove, disturb or injure any water or sewer pipes or other conduits or structures. If necessary, the Contractor, at his own expense, shall sling, shore up and maintain such structures in operation, and within a reasonable time shall repair any damage done to them. Before final acceptance of the work, he shall return all such structures to as good condition as before the work started.

C. Unless otherwise specifically addressed on the drawings, sewers shall be laid at least ten (10) feet horizontally from any existing or proposed potable water main. The distance shall be measured edge to edge.

D. Sewers crossing potable water mains shall be laid to provide a minimum vertical separation of eighteen (18) inches between the outside of the potable water main and the outside of the sewer. This shall be the case where the potable water main is either above or below the sewer. Whenever possible, the potable water main shall be located above the sewer main. Where a new sewer line crosses a new potable water main, a full length of pipe shall be used for both the sewer line and potable water main and the crossing shall be arranged so that the joints of each line shall be as far as possible from the point of crossing and each other. Where a potable water main crosses under a sewer, adequate structural support shall be provided for the sewer line to prevent damage to the potable water main while maintaining line and grade.

E. When necessary, the Contractor shall give sufficient notice to the interested utility of his intention to remove or disturb any pipes, conduits, etc., and shall abide by their regulations governing such work. In the event that any subsurface structure becomes broken or damaged in the prosecution of the work, the Contractor shall immediately notify the proper authorities, and shall be responsible for all damage to persons or property caused by such breaks. Failure of the Contractor to promptly notify the affected authorities shall make him liable for any needless loss or for interference with the normal operation of the utility.

F. When pipes or conduits providing service to adjoining buildings are broken during the progress of the work, the Contractor shall repair them at once at his own expense, or if required by the utility involved, shall pay the utility the proper charges for having such repairs made by the utility's own forces. Delays, such as would result in buildings being without service overnight or for a needlessly long period during the day, will not be tolerated, and the Owner reserves the right to make repairs at the Contractor's expense without prior notice. Should it become necessary to move the position of a pipe, conduit or structure it will be done by the Contractor in strict accordance with the instructions given by the Engineer or utility involved.

G. The Contractor shall notify all utilities involved of his intention to excavate in the locations specified and request that any underground utilities be located in advance of the construction work. Where ordered by the Engineer, the Contractor shall uncover subsurface obstructions in advance of construction so that the method of avoiding them may be determined before pipe laying reaches the obstruction.

3.6 CONNECTIONS TO EXISTING SANITARY SEWERS OR MANHOLES

A. Connections to gravity sewers shall be made by core drilling a hole (no sledge hammer) in the wall of the existing structure of the proper size to insert the required rubber boot, and a length of sewer pipe into the hole, filling around pipe and boot with non-shrink vinyl-based grout or water plug, and troweling the inside and outside surfaces of the joint to a smooth finish. The bottom of the manhole shall be rebuilt and formed as necessary to fit the invert of the sewer as shown on the drawings for new manholes. High-early strength cement mortar mixed with an approved non-shrink epoxy grout shall be used to minimize interruptions in sewer service. The Contractor shall perform any work needed to temporarily block or divert waste flows to complete the connection without spillage of the waste.

B. All existing connections to shall be tightly plugged and blocked to prevent the entrance of construction debris (cement, rocks, mud, silt, flushing water, etc.). The discharge of these materials to the Sanitary Sewer System during construction is prohibited. It is the Contractor's responsibility to secure and plug the system during the construction period to prevent entrance of unexpected rainwater, mud, and silt.

3.7 PIPELINES UNDER PAVEMENT

A. Where sewers are to be laid under pavement, and the installation of casing pipe or the use of cast iron pipe inserted in a bored hole is not required or specified, the Contractor will be permitted to cut and replace this pavement. In the event that subsurface operations result in injury or damage to the pavement, the necessary repairs shall be made by the Contractor at no additional cost to the Owner. In the event of the pavement on either side of the pipe line cracking or otherwise becoming disturbed or broken due to Contractor's operations, he shall repair or replace same at his own expense and without additional compensation.

B. In the event of the State Highway Department requiring a bond or certified check to guarantee the replacement of highway paving, the Contractor shall furnish this security at his own expense.

C. Where pipelines are to be laid underneath paved sidewalks, the Contractor will be required to install them by; means of tunneling, and where it becomes necessary to cut and replace the sidewalk it shall be replaced as soon as practicable after the trench has been backfilled and tamped. The replaced surface shall be 12 inches wider than the width of the trench; the excess width being equally distributed on both sides.

D. The Contractor will receive no additional compensation for laying sewers under pavement unless this item of work is set up as a separate item in the Proposal.

3.8 TRAFFIC CONTROL

A. It shall be the responsibility of the Contractor for all traffic control along any portion of the job. Where required, all necessary flagmen, traffic cones and traffic control plans shall be in place on both County roads and State highways to meet road department specifications.

B. Traffic control plan shall be in conformance with the Manual on Uniform Traffic Control Devices. In the event actual physical conditions warrant additional traffic control devices, they shall be installed in conformance with the M.U.T.C.D. as directed by the Georgia Department of Transportation District Engineer.

C. It should be noted that work for this project takes place along a very busy section of four-lane highway. The contractor shall be familiar with the project area prior to bid and implement an effective traffic control plan in accordance with the M.U.T.C.D.

3.9 FIELD QUALITY CONTROL

A. Test Pipe per Section 33 01 30.13 - Sewer and Manhole Testing

B. Compaction Testing per Section 31 23 16.13 - Excavation & Trenching

C. As each section of the work is completed it shall be thoroughly cleaned and all excess mortar, earth, brick or other foreign matter removed. Before acceptance of the work the system as a whole shall be cleaned and inspected and a full circle of light shall show in all sewer between manholes.

D. The Contractor will be responsible for supplying the Engineer with accurate record drawings per Section 01 78 39 at the conclusion of the project. The Contractor will be responsible for keeping "asbuilt" drawings current throughout the duration of the project. Pay requests will not be approved unless "asbuilt" drawings are accurate and are kept current with the work that has been performed.

E. Final CCTV Inspection: The Contractor shall perform a detailed closed-circuit television inspection in accordance with ASTM standards, in the presence of the Owner after installation of all new sewer pipes. A digital copy of the final inspection shall be provided to the owner and to the engineer. All costs associated with the final CCTV Inspection shall be included in the price bid for pipe.

3.10 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

B. Wherever possible, topsoil shall be removed from all areas to be disturbed by construction, and stockpiled. Land exposure shall be minimized in terms of area and time. All exposed areas subject to erosion shall be covered as quickly as possible by the grassing and seeding specified elsewhere or by mulching or vegetation. Natural vegetation shall be retained whenever possible.

C. Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

END OF SECTION 33 31 00

SECTION 33 41 13 - PUBLIC STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storm drainage piping.
2. Piping accessories.
3. Drainage structures.
4. Bedding and cover materials.
5. Pipe support systems.
6. Concrete encasement and cradles.

B. Related Requirements:

1. Section 03 30 00 - Cast-in-Place Concrete
2. Section 03 60 00 - Grouting
3. Division 31 – Earthwork.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO M36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
2. AASHTO M86 - Standard Specification for Nonreinforced Concrete, Sewer, Storm Drain, and Culvert Pipe.
3. AASHTO M170 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
4. AASHTO M196 - Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains.
5. AASHTO M206 - Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe.
6. AASHTO M207 - Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
7. AASHTO M252 - Standard Specification for Corrugated Polyethylene Drainage Pipe.
8. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
9. AASHTO M294 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.
10. AASHTO T180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM A123 - Standard Specification for Zinc Hot-Dip Galvanized Coatings on Iron and Steel Products.
2. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.
3. ASTM B745 - Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains.
4. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
5. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
6. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
7. ASTM C506 - Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe.
8. ASTM C969 - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
9. ASTM C1103 - Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
10. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
11. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
12. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
13. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
14. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
15. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
16. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
17. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
18. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
19. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
20. ASTM F405 - Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings.
21. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
22. ASTM F667 - Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with termination of storm sewer, trenching, connection to public storm sewer.

1.4 PREINSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum seven days prior to commencing Work of this Section.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data indicating pipe size, pipe material, pipe accessories, storm drain structures, and location as shown on the plan drawings.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

E. Field Quality-Control Submittals: Submit results of Contractor-furnished tests and inspections for storm sewer installation as shown on the plan drawings.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of storm sewer installation.

C. Identify/note uncharted utilities.

1.7 QUALITY ASSURANCE

A. Perform Work according to the contract specifications for this project and as shown on the plan drawings.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:

1. Store materials according to manufacturer instructions.
2. Block individual and stockpiled pipe lengths to prevent moving.
3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
4. Do not place pipe flat on ground; cradle to prevent point stress.

D. Protection:

1. Keep UV-sensitive materials out of direct sunlight.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 STORM DRAINAGE PIPING

A. Ductile-Iron Piping:

1. Pipe:

a. Comply with ASTM A746, Class 52 or above.
b. Type: Extra heavy Service.
c. Inside Nominal Diameter: As shown on the plan drawings
d. Ends: Bell and spigot, Plain, and as shown on the plan drawings.

2. Fittings: Ductile iron.
3. Joints:

a. Comply with ASTM A746.
b. Joint Devices: Rubber gasket.

B. Concrete Piping:

1. Pipe:

a. Comply with ASTM C14, AASHTO M86, Class 3.
b. Material: Nonreinforced concrete.
c. Inside Nominal Diameter: As shown on the plan drawings.
d. Ends: Bell and spigot, Plain, as shown on the plan drawings.

2. Fittings: Concrete.
3. Joints:

a. Comply with ASTM C443.
b. Gaskets: Rubber compression.

C. Reinforced Concrete Piping:

1. Pipe:

a. Comply with ASTM C76, AASHTO M170, ASTM C506, AASHTO M206, AASHTO M207, Class III, with Wall Type A or B.
b. Reinforcement: Mesh.
c. Inside Nominal Diameter: As shown on the plan drawings.
d. Ends: Bell and spigot.

2. Fittings: Reinforced concrete.
3. Joints:

a. Comply with ASTM C443.
b. Gaskets: Rubber compression.

D. Plastic Piping:

1. Pipe:

a. Material: PVC.
b. Comply with ASTM D2729, D2680.
c. Inside Nominal Diameter: As shown on the plan drawings.
d. Ends:

1) Style: Bell and spigot.
2) Type: Solvent sealed.

2. Fittings: PVC.
3. Joints:

a. Type: Solvent weld.
b. Comply with ASTM D2855.
c. Solvent Cement: Comply with ASTM D2564.

E. Plastic Piping:

1. Pipe:

a. Material: PVC.
b. Comply with ASTM D3034 SDR 35 & SDR 26: 4” – 15”, ASTM F679 PS46 & PS115: 18” – 36”.
c. Inside Nominal Diameter: As shown on the plan drawings.
d. Joints: Comply with ASTM D3212
e. Style: Bell and spigot with rubber-ring sealed gasket joint.
f. Lengths: 14 and/or 20 feet

2. Fittings: PVC.
3. Joints:

a. Comply with ASTM D3212.
b. Gaskets: Rubber-ring tight.

F. Plastic Piping:

1. Pipe: Polyethylene Single Wall

    a. Material: Corrugated polyethylene.
    b. Comply with AASHTO M252 Pipe: 3" – 10", AASHTO M294 Pipe: 12" – 60".
    c. Type: Perforated: Class I, Class II, or Smooth interior.
    d. Inside Nominal Diameter: 4" – 60".
    e. Laying Lengths: Per manufacturer

2. Fittings: Polyethylene.
3. Joints: Comply with ASTM D3212.
4. Gaskets: Comply with ASTM F477

G. Plastic Piping:

1. Pipe: Polyethylene Dual Wall

    a. Comply with ASTM F2648, AASHTO M252 pipe sizes 4" – 10", AASHTO M294, ASTM F2306 and ASTM F2648 pipe sizes 12" – 60".
    b. Material: Corrugated polyethylene.
    c. Type: Perforated: Class I, Class II, or Smooth interior.
    d. Inside Nominal Diameter: **4" – 60".**

2. Fittings: Polyethylene.
3. Joints: Comply with ASTM **D3212.**
4. Gaskets: Comply with ASTM F477

2.2 DRAINAGE STRUCTURES

A. Description: As specified in Section 33 05 13 Manholes and Structures

B. Materials: Precast concrete; Cast-in-place concrete.

C. Manholes:

1. Size: 48, 60, or 72 inch inside diameter as shown on the plan drawings.
2. Concentric or Eccentric conical top, or Flat top; as shown on the plan drawings**.**
3. Covers: Water tight, Cast iron, or HDPE Plastic inscribed with STORM SEWER as shown on the plan drawings or specified herein.

D. Inlets Drop, Yard, Curb & Gutter:

1. Size: As shown on the plan drawings and/or specified herein
2. Grating:

    a. Cast iron ASTM A48.

2.3 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. Description: Reinforced concrete, as specified in Section 03 30 00 - Cast-in-Place Concrete.
2. Compressive Strength: 4,000 psi at 28 days, reinforced concrete, and air-entrained, rough-troweled finish or as called for on the plan drawings.

2.4 MATERIALS

A. Bedding and Cover:

1. Bedding: as specified in Section 31 05 16 - Aggregates for Earthwork, or as shown on the plan detailed drawings.
2. Cover: as specified in Section 31 05 16 - Aggregates for Earthwork, or as shown on the plan detailed drawings.
3. Soil Backfill from above Pipe to Finish Grade: as specified in Section 31 05 13 - Soils for Earthwork.

B. Subsoil: No rocks more than 6 inches in diameter, no frozen earth, or foreign matter.

2.5 MIXES

A. Grout: As specified in Section 03 60 00 – Grouting.

B. Concrete Encasements and Cradles:

1. As specified in Section 03 30 00 - Cast-in-Place Concrete or called for on the plan drawings.

2.6 FINISHES

A. Steel: As called for on the plan drawings or specified in these contract specifications.

B. Galvanizing:

1. Comply with ASTM A123.
2. Hot-dip galvanized after fabrication.

C. Galvanizing for Nuts, Bolts, and Washers: Comply with ASTM A153.

2.7 ACCESSORIES

A. Pipe Support Brackets: Galvanized, Unfinished structural steel coated with bituminous paint, or 304 Stainless Steel as shown or called for on the drawings.

B. Geotextile Filter Fabric:

1. Comply with AASHTO M288 for subsurface drainage.
2. Class 2, non-biodegradable.
3. Non-woven

4. 7 ounce fabric as manufactured by US Fabrics.

C. Pipe Markers: As specified in Section 33 11 13 – Site Water Utility Distribution Piping.

D. Drainage Structures:

1. Catch Basins, Inlets, Manholes, Headwalls, and End Sections: As specified in Section 33 05 13 - Manholes and Structures, Section 33 05 16.13 - Precast Concrete Utility Structures.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that trench cut or excavation base is ready to receive Work.

C. Verify that excavations, dimensions, and elevations are as indicated on the plan drawings.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Correct over-excavation with compacted fine aggregate, coarse aggregate, or lean concrete. Notify Inspector or Engineer prior to filling over-excavation.

C. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

A. Excavation and Bedding:

1. Excavate pipe trench as specified in Division 31.
2. Hand trim excavation for accurate placement of piping to indicated elevations.
3. Dewater excavations to maintain dry conditions to preserve final grades at bottom of excavation.
4. Provide sheeting and shoring as specified in Division 31.
5. Level materials in continuous layers not exceeding compacted depth of 8 inches.
6. Maintain optimum moisture content of bedding material to attain required compaction density.
7. Install pipe on compacted subgrade meeting bedding requirements.
8. Cradle bottom 20 percent of diameter to avoid point load.
9. Compact subgrade and backfill as specified in Division 31.
10. Place geotextile fabric as indicated on Drawings

B. Piping:

1. Install pipe, fittings, and accessories according to ASTM D2321.
2. Seal joints watertight.
3. Place pipe on minimum -deep bed of compacted subgrade meeting bedding requirements.
4. Lay pipe to slope gradients as indicated on Drawings.
5. Connect piping to drainage structures.
6. Install aggregate at sides and over top of pipe.
7. Backfilling and Compaction:

    a. As specified in Division 31.
    b. Do not displace or damage pipe while compacting.

8. Pipe Markers: As specified in Section 33 11 13 – Site Water Utility Distribution Piping.

C. Drainage Structures:

1. Catch Basins, Inlets, Manholes, and: As specified in Section 33 05 16.13 - Precast Concrete Utility Structures

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Indicated Pipe Slope: 1/8 inch in 10 feet.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Request inspection by Engineer prior to and immediately after placing aggregate cover over pipe.

D. Testing:

1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
2. Compaction Tests:

    a. Comply with ASTM D1557, ASTM D698, AASHTO T180, ASTM D6938.
    b. Testing Frequency: Every 3 feet of vertical elevation at 100 feet horizontal intervals, or as stipulated by the Engineer.

3. Infiltration Test:

    a. As specified in Section 33 01 30.13 - Sewer and Manhole Testing.

4. Deflection Test:

a. As specified in Section 33 01 30.13 - Sewer and Manhole Testing.

3.6 PROTECTION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 41 13