3.04 CLEANING AND ADJUSTING
A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.
B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

END OF SECTION 02520

SECTION 02525 CURBS AND SIDEWALKS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Preparation and placement of combination portland cement concrete curb and gutter.
B. Preparation and placement of portland cement concrete curb.
C. Preparation and placement of portland cement concrete sidewalk.

1.02 RELATED SECTIONS
A. Section 02100 -- Site Preparation
B. Section 02200 -- Earthwork
C. Section 02227 -- Aggregate Material
D. Section 02505 -- Paving Base Course
E. Section 03300 -- Cast-in-place Concrete (See Architectural/Building Specifications)
F. State Highway Department Standard Specifications
G. Construction Drawings

1.03 REFERENCE STANDARDS
A. American Concrete Institute (ACI) latest edition
304R Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete
308 Standard Practice for Curing Concrete
B. American Society for Testing and Materials (ASTM) latest edition
A 615 Deformed and Plain Billet-Steel for Concrete Reinforcement
C 33 Concrete Aggregates
C 94 Ready-Mixed Concrete
C 150 Portland Cement
C 260 Air-Entraining Admixtures for Concrete
C 309 Liquid Membrane-Forming Compounds for Curing Concrete
C 494 Chemical Admixtures for Concrete
D 1751 Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
C. FS TT-C-800 -- Curing Compound, Concrete, for New and Existing Surfaces.

1.04 QUALITY ASSURANCE
A. Establish and maintain required lines and elevations.
B. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable work as directed by Owner.

1.05 SUBMITTALS
Submit materials certificate to the independent testing laboratory which is signed by materials producer and Contractor, certifying that materials comply with, or exceed, requirements specified herein.

1.06 PROJECT CONDITIONS
Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 PRODUCTS

2.01 MATERIALS
A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Forms shall be of depth equal to depth of curbing or sidewalk, and so designed as to permit secure fastening together at tops. Coat forms with nonstaining type of coating that will not discolor or deface surface of concrete.
B. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40.
C. Concrete Materials: Comply with requirements of Section 03300 for concrete materials, admixtures, bonding materials, curing materials, and others as required.
D. Joint Fillers: Resilient premolded bituminous impregnated fiberboard units complying with ASTM D 1751; FS HH-F-341, Type II, Class A.
E. Joint Sealers: Non-priming, pourable, self-leveling polyurethane. Acceptable sealants are Sonneborn "Sonolastic Paving Joint Sealant" Sonneborn "Sonomeric CT 1 Sealant", Sonneborn "Sonomeric CT 2 Sealant", Mameco "Vulkem 245", or Woodmont Products "Chem-Caulk".

2.02 MIX DESIGN AND TESTING
A. Concrete mix design and testing shall comply with requirements of Section 03300.
B. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:
1. Compressive Strength: 3,500 psi, minimum at 28 days, unless otherwise indicated on Construction Drawings.
2. Slump Range: 2 to 5-in. at time of placement
3. Air Entrainment: 5 to 8 percent

PART 3 EXECUTION

3.01 PREPARATION
A. Proofroll prepared base material surface to check for unstable areas. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving.
B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.02 INSTALLATION
A. Form Construction
1. Set forms to required grades and lines, rigidly braced and secured.
2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
3. Check completed formwork for grade and alignment to following tolerances:
Top of forms not more than 1/8-in. in 10'-0"
Vertical face on longitudinal axis, not more than 1/4-in. in 10'-0"
4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.
B. Concrete Placement
1. Place concrete in accordance with requirements of Section 03300.
2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structures until they are at required finish elevation and alignment.
3. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place construction joint. Automatic machine may be used for curb and gutter placement. Machine placement must be at required cross section, line, grade, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified herein.
C. Joint Construction
1. Contraction Joints: Concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, shall be constructed in uniform sections of length specified on Construction Drawings. Joints between sections shall be formed either by steel templates, 1/8-in. in thickness, of length equal to width of curb and gutter, and with depth which will penetrate at least 2-in. below surface of curb and gutter; or with 3/4-in. thick preformed expansion joint filler cut to exact cross section of curb and gutter; or by sawing to depth of at least 2-in. while concrete is between 4 and 24 hours old. If steel templates are used, they shall be left in place until concrete has set enough to hold it's shape, but shall be removed while forms are still in place.
2. Longitudinal Construction Joints: Concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, shall be tied to concrete pavement with 1/2-in. round deformed reinforcement bars of length and spacing shown on Construction Drawings.
3. Transverse Expansion Joints: Concrete curb, combination concrete curb and gutter, or concrete sidewalk shall have filler cut to exact cross section of curb, gutter, or sidewalk. Joints shall be similar to type of expansion joint used in adjacent pavement.
D. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2-in. or more than 1-in. below finished surface where joint sealer is indicated. Furnish joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip joint filler sections together.
E. Joint Sealants: Joints shall be sealed with approved exterior pavement joint sealants and shall be installed in accordance with manufacturer's recommendations.

3.03 CONCRETE FINISHING
A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.
B. Work edges of sidewalks, gutters, back top edge of curb, and formed joints with edging tool, rounding edge to 1/2-in. radius. Eliminate tool marks on concrete surface. After completion of floating and troweling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
Curbs, gutters, and sidewalks: Broom finish by drawing fine-hair broom across surface perpendicular to flow of traffic. Repeat operation as necessary to produce fine line texture.
C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects, as directed Owner.
D. Protect and cure finished concrete paving using acceptable moist-curing methods, more particularly described in "water-curing" section of ACI 308.

3.04 BACKFILL
After concrete has set sufficiently, spaces on either side of concrete curb, combination concrete curb and gutter, or concrete sidewalk shall be refilled to required elevation with suitable material compacted in accordance with Section 02200.

3.05 CLEANING AND ADJUSTING
A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.
B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

END OF SECTION 02525

SECTION 02584 PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Preparation and application of painted pavement markings.
B. Preparation and application of paint on curbs, guard posts, and light pole bases.

1.02 RELATED SECTIONS
A. Section 02200 -- Earthwork
B. Section 02505 -- Paving Base Course
C. Section 02511 -- Asphaltic Concrete Paving
D. Section 02520 -- Portland Cement Concrete Paving
E. Section 02525 -- Curbs and Sidewalks
F. Construction Drawings

1.03 REFERENCE STANDARDS
FS TTP-85E

1.04 PROJECT CONDITIONS
Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs, and warning lights as required.

PART 2 PRODUCTS

2.01 MATERIALS
A. Paint shall be non-bleeding, quick-drying alkyd petroleum base paint suitable for traffic-bearing surface and shall meet FS TTP-85E, and be mixed in accordance with manufacturer's instructions before application.
B. Preformed pavement markings shall be Stamark Intersection Grade Tape Series 4420 as manufactured by 3M Traffic Control Materials Division or approved equal.

PART 3 EXECUTION

3.01 PREPARATION
A. Sweep and clean surface to eliminate loose material and dust.
B. Where existing pavement markings are indicated on Construction Drawings to be removed or would interfere with adhesion of new paint, motorized abrasive devices shall be used to remove markings. Equipment employed shall not damage existing paving or create surface hazardous to vehicle or pedestrian traffic. Within public rights-of-way, method of marking removal shall be approved by appropriate governing authority.

3.02 APPLICATION
A. Apply 2 coats of paint at manufacturer's recommended rate, without addition of thinner, with maximum of 100 sq. ft per gal. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use straightedge to ensure uniform, clean, and straight strips.
B. Install preformed pavement markings according to manufacturer's recommended procedures for the specified material.
C. Following items shall be painted with colors noted below:
1. Pedestrian Crosswalks: White
2. Exterior Sidewalk Curbs, Light Pole Bases, and Guardposts: Yellow
3. Fire Lanes: Red or per local code
4. Lane Striping where separating traffic moving in opposite directions: Yellow
5. Lane Striping where separating traffic moving in the same direction: White
6. Handicap Symbols: Blue or per local code
7. Parking Stall Striping: Yellow, unless otherwise noted on Construction Drawings

END OF SECTION 02584

SECTION 02605 SEWER STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Monolithic concrete manhole barrel with either monolithic concrete or masonry transition to lid frame.
B. Modular precast concrete manhole barrel with tongue-and-groove joints with either precast concrete or masonry transition to lid frame.
C. Masonry manhole barrel with masonry transition to lid frame.
D. Precast polyethylene manhole assemblies.
E. Preparation and installation of lid frame, covers, anchorage, and accessories.

1.02 RELATED SECTIONS
A. Section 02200 -- Earthwork
B. Section 02720 -- Storm Sewer Systems
C. Section 02730 -- Sanitary Sewer Systems
D. Section 03300 -- Cast-in-Place Concrete (See Architectural/Building Specifications)
E. Construction Drawings
F. Geotechnical Investigation.

1.03 REFERENCE STANDARDS
A. American Society for Testing and Materials (ASTM) latest edition
A 48 Gray Iron Castings
C 55 Concrete Building Brick
C 478 Precast Reinforced Concrete Manhole Sections
C 923 Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes
D 1248 Polyethylene Plastics Molding and Extrusion Materials
B. International Masonry Industry All-Weather Council (IMIAC) latest edition
Recommended Practices and Guide Specification for Cold Weather Masonry Construction

1.04 SUBMITTALS
A. Shop Drawings: Indicate reference to Construction Drawings of manhole locations, elevations, piping with sizes, locations, and elevations of penetrations.
B. Product Data: Provide data for manhole covers, manhole steps, component construction, features, configuration, and dimensions.

PART 2 PRODUCTS

2.01 MATERIALS
A. Manhole Barrel: Nonreinforced cast-in-place concrete in accordance with Section 03300.
1. Cast-in-place manholes shall be constructed of 3500 psi concrete.
2. Forms shall be made of steel sheets accurately shaped and fabricated of sufficient strength to form dense watertight walls to true dimensions.
3. Concrete shall be deposited in evenly distributed layers of about 18 in., with each layer vibrated to bond to preceding layer.
B. Manhole Barrel: Reinforced precast concrete in accordance with ASTM C 478 with gaskets in accordance with ASTM C 923.
Construct manholes of precast concrete sections as required by Construction Drawings to size, shape, and depth indicated, but never less than 4'-0" inside diameter.
C. Concrete Brick Units: ASTM C 55, Grade N Type I-moisture controlled, normal weight, of same grade, type and weight as block units, nominal modular size of 3 5/8-in. x 7 5/8-in. x 2 1/4-in.
D. Manhole Barrel: Precast polyethylene in accordance with ASTM D 1248. Manholes shall be manufactured with factory-molded steps. Nominal cylinder internal diameter shall be 48-in. and shall be designed to accept concrete filled polyethylene manhole lids and standard cast iron frames with lid or grate. Manholes shall have compressive strength which meets ASTM D 2412 standards. Acceptable Manufacturers: Advanced Drainage Systems (ADS) or approved equal.
E. Mortar and Grout: Mortar for finishing and sealing shall be Class "C". Honeycombing less than 2-in. deep shall be repaired using Class "D" mortar.
F. Brick Transition Reinforcement: Formed steel 8 gauge wire with galvanized finish.

2.02 COMPONENTS
A. Lid and Frame: ASTM A 48, Class 30B heavy duty cast iron construction, machined flat bearing surface, removable lid, closed or open as indicated on Construction Drawings, sealing gasket manufactured by Neenah Foundry Company or approved equal.
B. Manhole Steps: Neenah Foundry Company catalog No. R-1982-F for precast or catalog No. R-1980-0 for brick/cast-in-place manholes or M.A. Industries PS-1 or approved equal
C. Base Pad: Cast-in-place concrete as specified in Section 03300.

2.03 CONFIGURATION
A. Barrel Construction: Concentric with eccentric cone top section.
B. Shape: Cylindrical
C. Clear Inside Dimensions: 48-in. diameter or as indicated on Construction Drawings
D. Design Depth: As indicated on Construction Drawings
E. Clear Lid Opening: 22-in. minimum
F. Pipe Entry: Provide openings as indicated on Construction Drawings
G. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of manhole or inlet where they enter structure walls. Point up irregularities and rough edges with nonshrinking grout.
H. Inverts: Shape inverts for smooth flow across structure floor as indicated on Construction Drawings. Use concrete and mortar to obtain proper grade and contour. Finish surface with fine textured wood float.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify items specified by other Sections are properly sized and located.
B. Verify that built-in items are in proper location and ready for roughing into work.
C. Verify that the excavation for manholes is correct.

3.02 PREPARATION
Coordinate placement of inlet and outlet pipe or duct sleeves as indicated on Construction Drawings.

3.03 PLACING PRECAST MANHOLE BARREL SECTIONS
A. Place base pad to proper elevation and location and trowel top surface level for placement of manhole barrel.
B. Place manhole barrel plumb and level to correct elevations and anchor to base pad.
1. After completion of slab foundation, first joint of manhole barrel shall be lowered into position, grooved and first, and set level and plumb on concrete base. Align and adjust to proper grade prior to placing and forming invert which shall be poured immediately after setting of first section of manhole barrel.
2. Prior to setting subsequent manhole barrel sections, apply primer to tongue and groove ends and allow to set in accordance with manufacturer's recommendations. Place "Ram-nek", or equivalent, plastic rope on tongue end. Lower next section into position, and remove excess material from interior of structure. Add additional material on exterior of joint, if necessary, for completely watertight joint.

3.04 MASONRY MANHOLE BARREL CONSTRUCTION
A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
B. Lay masonry units in running bond. Course 3 brick units and 3 mortar joints to equal 8-in.
C. Form flush mortar joints.
D. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
E. Install joint reinforcement 16-in. o.c.
F. Place joint reinforcement in first and second horizontal joints above base pad and below lid frame opening.
G. As work progresses, build-in fabricated metal items.
H. Cut and fit masonry for pipes as specified herein.
I. Set cover frames and covers level without tipping, to correct elevations.

END OF SECTION 02605

SECTION 02660 WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Site water piping and fittings including domestic waterline and fire sprinkler system waterline, valves, and fire hydrants.
B. Connection of site water system to municipal water systems.

1.02 RELATED SECTIONS
A. Section 02200 -- Earthwork
B. Section 15300 -- Fire Protection (See Architectural/Building Specifications)
C. Local Governing Authority and Code Requirements
D. Construction Drawings
E. Geotechnical Investigation.

1.03 REFERENCE STANDARDS
A. American Society of Mechanical Engineers (ASME) latest edition
B 16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
B. American Society for Testing and Materials (ASTM) latest edition
B 88 Seamless Copper Water Tube
D 1784 Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
D 2241 Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series)
D 2564 Poly(vinyl Chloride) (PVC) solvent cement
D 2672 Poly (vinyl Chloride) (PVC) integrally molded bell ends for solvent cemented pipe joints.
D 2855 Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
D 3139 Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals
F 477 Elastomeric gaskets and lubricant
F 656 Poly (vinyl chloride) (PVC) cement Primer
C. American National Standards Institute (ANSI) latest edition
A21.8
D. American Water Works Association (AWWA) latest edition
C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
C105 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
C110 Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
C111 Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
C151 Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
C500 Gate Valves for Water and Sewage Systems
C502 Dry-Barrel Fire Hydrants
C504 Rubber-Seated Butterfly Valves
C508 Swing-Check Valves for Waterworks Service, 2 In. Through 24 In. NPS
C509 Resilient-Seated Gate Valves for Water and Sewage Systems
C600 Installation of Ductile-Iron Water Mains and Their Appurtenances
C606 Grooved and Shouldered Joints
C651 Disinfecting Water Mains
C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution
E. Underwriters Laboratories (UL) latest edition
246 Hydrants for Fire-Protection Service

1.04 QUALITY ASSURANCE
A. Perform installation in accordance with utility company or municipality requirements.
B. Valves: Manufacturer's name and pressure rating marked on valve body.
C. Compaction testing of trench backfill shall be performed in accordance with Section 02222.
D. Water distribution system pipe installed below grade and outside building shall be tested in accordance with the following procedures:
1. Perform testing of pipe materials, joints, and other materials incorporated into construction of water mains and force mains to determine leakage and watertightness. Pressure pipeline shall be tested in accordance with Section 4 of AWWA C600. In event state or local code requires more stringent test, more stringent shall apply.
2. Pressure Test:
After pipe has been laid, newly laid pipe or valved section thereof shall be subjected to hydrostatic pressure of at least 1.5 times working pressure at point of testing and not less than 1.25 times working pressure of highest point along test section.
3. Leakage Test:
Leakage test shall be conducted concurrently with pressure test. Leakage is defined as quantity of water that must be supplied into newly laid pipeline or valved section thereof to maintain pressure within 5 psi of specified test pressure after air in pipeline has been expelled and pipeline has been filled with water. Leakage shall not be measured by drop in pressure in test section over period of time.
No pipeline installation will be accepted if leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133200}$$

L = allowable leakage, (gallons per hour)
S = length of pipe tested, (feet)
D = nominal diameter of pipe, (inches)
P = average test pressure during test, (psig)
4. Visible Leakage:
Visible leaks shall be repaired regardless of amount of leakage measured.
5. Acceptance of Installation:
If test of pipe laid in place discloses leakage greater than that specified, Contractor shall, at his own expense, locate leak and make repairs as necessary until leakage is within specified allowance.
Supply water for testing at no expense to Owner.

1.05 SUBMITTALS
A. Product Data: Provide CEC with data on pipe materials, pipe fittings, hydrants, valves, and accessories.
B. Manufacturer's Certificate: Certify that products meet or exceed state or local requirements.
C. Furnish 1 copy of results of meter test and hydrostatic pressure test to Owner and utility company upon completion of water distribution backfilling operations.

1.06 PROJECT RECORD DOCUMENTS
A. Accurately record actual locations of piping mains, valves, connections, and top of pipe elevations.
B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

PART 2 PRODUCTS

2.01 PIPE
A. Pipe sizes less than 3-in. that are installed below grade and outside building shall comply with one or combination of following:
1. Seamless Copper Tubing: Type "K" soft copper to comply with ASTM B 88 and installed with wrought copper (95-5 Tin Antimony solder joint) fittings in accordance with ASME B 16.22.
2. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall conform to ASTM D 2241 with SDR 21 rating and shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 1784 material classification. Pipe joints using solvent cement shall be integrally molded bell ends in accordance with ASTM D 2672. Cement primer shall comply with ASTM - F656 and solvent cement shall comply with ASTM - D 2564.
B. Pipe sizes 3-in. and larger that are installed below grade and outside building shall comply with one or combination of following:
1. Gray Cast Iron Water Pipe: In accordance with ANSI A21.6, thickness class 22, and pressure class 150. Fittings shall be either mechanical joint or push-on joint and shall comply with AWWA C110 or AWWA C111. Elastomeric gaskets and lubricant shall comply with ASTM -- F477.
2. Ductile Iron Water Pipe: In accordance with AWWA C151, thickness class 50. Fittings shall be either mechanical joint or push-on joint complying with AWWA C110 or AWWA C111. Elastomeric gaskets and lubricant shall comply with ASTM -- F477.
3. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall meet the requirements of AWWA C900, rated DR 18 (Class 150). Pipe shall be continually marked as required Elastomeric gaskets and lubricant shall comply with ASTM -- F477 for smaller pipes. Pipe joints shall be integrally molded bell ends in accordance with ASTM D3139.

2.02 GATE VALVES -- 2-in. and Larger
A. Manufacturers:
Mueller Resilient Seat Gate Valves or approved equal.
B. AWWA C509, iron body, non-rising stem with square nut, single wedge, resilient seat, flanges or mechanical joint ends, control rod, post indicator where indicated on Construction Drawings, extension box and valve key.

2.03 BALL VALVES -- 2-in. and Smaller
A. Manufacturers:
Mueller Oriseal or approved equal.
B. Brass body, teflon coated brass ball, rubber seats and stem seals. Tee stem pre-drilled for control rod, AWWA compression inlet end, compression outlet with electrical ground connector, with control rod, extension box and valve key.

2.04 BUTTERFLY VALVES -- From 2-in. to 24-in.
AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, infinite position lever handle.

2.05 CHECK VALVES, POST INDICATOR VALVES, and BACKFLOW PREVENTORS
Refer to Section 15300 -- Fire Protection in Architectural/Building Specifications

2.06 FIRE HYDRANTS
A. Fire Hydrants: Type as required by utility company and as shown on Construction Drawings.
B. Hydrant Extensions: Fabricate in multiples of 6-in. with rod and coupling to increase barrel length.
C. Hose and Steamer Connections: Match sizes with utility company, with two hose nozzles, one pumper nozzle.
D. Finish: Apply primer and 2 coats of enamel or special coating to color as required by utility company.

2.07 ACCESSORIES
A. Thrust Blocking: Place 2,500 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 lb per sq. ft when water main pressure is 100 psi.

MINIMUM THRUST BLOCKING BEARING AREAS

Pipe Dia.	Tees Sq. Ft	90 Bend Sq. Ft	45 Bend Sq. Ft	22½ Bend Sq. Ft.	11¼ Bend Sq. Ft.	5 5/8 Bend Sq. Ft	Cap/Plug Sq. Ft
3"	1.0	1.0	1.0	1.0	1.0	1.0	1.5
4"	1.0	1.0	1.0	1.0	1.0	1.0	2.0
6"	1.5	2.0	1.0	1.0	1.0	1.0	3.0
8"	2.5	3.5	1.8	1.0	1.0	1.0	4.0
10"	4.0	5.5	2.8	1.5	1.0	1.0	6.0
12"	6.0	8.0	4.0	2.0	1.5	1.0	8.5
14"	8.0	11.0	5.5	3.0	2.0	1.5	12.0
16"	10.0	14.2	7.0	4.0	3.0	2.5	15.0
18"	21.0	21.0	12.0	6.0	4.0	3.5	24.0

B. Locked mechanical joint fittings shall be installed where vertical changes in direction are required and, if approved by Owner and governing authority, can be installed in lieu of above thrust blocking requirements.

PART 3 EXECUTION

3.01 EXAMINATION
Verify that building service connection and municipal utility water main size, location, and depth are as indicated on Construction Drawings.

3.02 PREPARATION
A. Ream pipe and tube ends and remove burrs.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare pipe for connections to equipment with flanges or unions.
D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.03 BEDDING
A. Excavate pipe trench and place bedding material in accordance with Section 02222.

3.04 INSTALLATION -- PIPE AND FITTINGS
A. Maintain separation of water main from sanitary and storm sewer piping in accordance with state and local codes.
B. Install pipe and fittings in accordance with AWWA C600.
C. Install pipe to allow for expansion and contraction without stressing pipe or joints, as specified by pipe manufacturer.
D. Install access fittings in accordance with local codes to permit disinfection of water system performed under this Section.
E. Connections with Existing Pipelines: Where connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions with least interference with operation of existing pipeline and in accordance with local utility company.
F. Form and place concrete for thrust blocks or other specified methods at fittings at each change of direction or end of pipe main.
G. Establish elevations of buried piping in accordance with Section 02222.
H. Backfill trench in accordance with Section 02222.

3.05 INSTALLATION -- VALVES AND HYDRANTS
A. Install gate valves as indicated on Construction Drawings and set on concrete pad with valve stem vertical and plumb. Install valve boxes in manner that will not transmit loads, stresses, or shock to valve body. Center valve box over operating nut of valve vertical and plumb. Secure valve box together setting cover flush with finished surface.
B. Install fire hydrant assemblies as indicated on Construction Drawings in vertical and plumb position with steamer/pumper nozzle painted perpendicular to travel where hydrant is adjacent to street, roadway, or parking lot drive or toward protected building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly brace on side opposite inlet and against undisturbed soil and concrete block. Place minimum of 8 cu. ft of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so plumb vertical position will not be altered.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM
Disinfect distribution system with chlorine before acceptance for domestic operation. Amount of chlorine shall be such as to provide dosage of not less than 50 parts per million. Thoroughly flush lines before introduction of chlorinating materials and after contact period of not less than 24 hours, system shall be flushed with clean water until residual chlorine content is not greater than 1.0 part per million. Open and close valves in lines being disinfected several times during contact period. After disinfection, take water samples and bacteriologically test in accordance with AWWA C651. Do not place distribution system in service until approval is obtained from local governing authorities.

3.07 SERVICE CONNECTIONS
Provide water service connection in compliance with utility company requirements including reduced pressure backflow preventer if required and water meter with by-pass valves and sand strainer.

END OF SECTION 02660

SECTION 02587 SITE GAS LINES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Pipe and fittings for site utility natural or propane gas distribution.
B. Propane storage tanks and appurtenances.
C. Connection of site natural gas system and private utility company system.

1.02 RELATED SECTIONS
A. Section 02200 -- Earthwork
B. Section 02222 -- Excavation, Backfill, and Compaction for Utilities
C. Section 03300 -- Cast-In-Place Concrete (See Architectural/Building Specifications)
D. Construction Drawings

1.03 REFERENCE STANDARDS
A. American Society of Mechanical Engineers (ASME) latest edition
B 16.18 Cast Copper Alloy Solder Joint Pressure Fittings
B 16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
B 16.26 Cast Copper Alloy Fittings for Flared Copper Tubes
Sec. 8D Pressure Vessels
Sec. 9 Welding and Brazing Qualifications
Boiler and Pressure Code
B. American Society for Testing and Materials (ASTM) latest edition
A 120 Pipe, Steel, Black and Hot-Dipped, Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses
A 234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperature
B 32 Solder Metal
B 75 Seamless Copper Tube
B 88 Seamless Copper Water Tube
D 2513 Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
D 2517 Reinforced Epoxy Resin Gas Pressure Pipe and Fittings
D 2683 Socket-Type Polyethylene Fittings For Outside Diameter-Controlled Polyethylene Pipe and Tubing
F 678 Polyethylene Gas Pressure Pipe, Tubing and Fittings
C. American Welding Society (AWS) latest edition
A 5.8 Brazing Filler Metal
E. American Water Works Association (AWWA) latest edition
C105 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
F. American National Standards Institute (ANSI) latest edition
B16.3 Malleable Iron Threaded Fittings
B16.11 Forged Steel Fittings, Socket Welding and Threaded
B31.2 Fuel Gas Piping
B31.8 Gas Transmission and Distribution Piping Systems
G. National Fire Protection Agency (NFPA) latest edition
54 National Fuel Gas Code

1.04 QUALITY ASSURANCE
A. Perform installation in accordance with utility company requirements.
B. Gas Cock: Manufacturer's name and pressure rating marked on valve body.
C. Welding Materials and Procedures: Conform to ASME Boiler and Pressure Vessel Code and applicable state regulations.
D. Welders Certification: In accordance with ASME Sec 9.
E. Conform to NFPA 54, ANSI B31.2, or ANSI B31.8.

1.05 SUBMITTALS
A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories.
B. Manufacturer's Certificate: Certify that products meet or exceed specified local requirements.

1.06 PROJECT RECORD DOCUMENTS
A. Accurately record actual locations of pipe mains, valves, connections, and top of pipe elevations.
B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle products to be included.
B. Deliver and store valves in shipping containers with labelling in place

PART 2 PRODUCTS

2.01 PIPE
A. Steel Pipe Below Ground: ASTM A 120, Schedule 40 black:
1. Fittings: ANSI B16.11, forged steel, or ASTM A 234 forged steel welding type.
2. Joints: Welded and seamless.
3. Jackets: AWWA C105 polyethylene jacket, Double layer, half lapped, 10 mil polyethylene tape.
B. Steel Pipe Above Ground: ASTM A 120, Schedule 40 black:
1. Fittings: ANSI B16.3, malleable iron, ANSI B16.11, forged steel, or ASTM A 234, forged steel welding type.
2. Joints: Threaded.
C. For Propane Systems: Copper tubing below ground: ASTM B 88, Type K , internally tinned:
1. Fittings: ASME B 16.18 cast copper, or ASME B 16.22, wrought copper; internally tinned.
2. Joint: AWS A5.8 BCuP silver brazed.
D. For Propane Systems: Copper tubing above ground: ASTM B 88, Type K, L or ASTM B 75, Type GP ; internally tinned:
1. Fittings: ASME B 16.18 cast copper, ASME B 16.22, wrought copper, or ASME B 16.26, cast copper, internally tinned.
2. Joint: ASTM B 32, Solder, Grade 95TA or AWS A5.8, Bcon silver brazed.

E. Polyethylene Pipe: ASTM D 2513, SDR 11.5 or ASTM F 678 Series 125:
1. Fittings: ASTM D 2513
2. Joints: Mechanical or Compression fit.
3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters.
F. Reinforced Epoxy Resin Piping: ASTM D 2517:
1. Fittings: ASTM D 2517.
2. Joints: Bell and spigot with epoxy resin.
3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters.
2.02 GAS COCKS
A. 2-in. and Smaller: 150 psig (1,040 kPa) WOG, bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends with cast iron curb box, cover, and key.
B. 2-in. and Larger: 125 psig (860 Kpa) WOG, Steel or Cast Iron body and tapered plug, non-lubricated, Teflon packing, threaded ends, with cast iron curb box, cover, and key.
C. For Applications with Line Pressure Greater than 60 psig (415 KPA): Over 2-in. (50 mm): Cast iron body and plug, pressure lubricated, Teflon packing, flanged ends, with cast iron curb box, cover, and key.

2.03 PRESSURE REGULATING VALVES
A. Valves: Single stage, malleable iron body, corrosion-resistant, pressure regulator with atmospheric vent, elevation compensator, with threaded ends for 2-in. and smaller or flanged ends for larger than 2-in.
B. Capacity: For inlet and outlet gas pressures, specific gravity, and flow rate indicated.

2.05 PROPANE STORAGE TANKS
A. Construction: Closed, welded steel, tested and stamped in accordance with ASME Section 8D, minimum 250 psig (1,700 Kpa) rating, cleaned, prime coated, and painted with 2 coats of silver anti-rust paint, and supplied with steel support saddles, pressure gage, tapping for installation of piping and accessories.
B. Vaporizer: 1,000 watts, heating cable belted in 1-in. of glass fiber insulation and covered by flexible stainless steel plate, with thermostat in weatherproof box set to turn on at -13 degrees Fahrenheit with manual off-on switch.
C. Capacity: Diameter and length as shown on Construction Drawings

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify existing conditions.
B. Verify that building service connection and utility gas main size, location, and depth are as indicated on Construction Drawings.

3.02 PREPARATION
A. Ream pipe ends and remove burrs. Bevel plain end ferrous pipe over 2-in. diameter or thread ferrous pipe 2-in. diameter and under.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections with flanges or threading and unions.

3.03 BEDDING
A. Excavate pipe trench and place bedding material in accordance with Section 02222.

3.04 INSTALLATION -- PIPING
A. Maintain separation of gas line from sewer, water, or storm water piping in accordance with state and local code.
B. Install piping to conserve space and not interfere with use of site space.
C. Install piping to allow for expansion and contraction without stressing pipe or joints.
D. Install cocks and other fittings as required.
E. Establish elevations of buried piping in accordance with Section 02222.
F. Wrap couplings and fittings of steel pipe with polyethylene tape and heat shrink over pipe.
G. For Nonmetallic Pipe: Install trace wire continuous over top of pipe.
H. Backfill trench in accordance with Section 02222.
I. Center and plumb valve box over valve. Set box cover flush with finished ground surface. Prevent shock or stress from being transmitted through valve box to valve.
J. Wrap valve and valve box with polyethylene tape and heat shrink, wrap fittings and valve boxes with red oil primer and 1 coat of epoxy paint.

3.05 SERVICE CONNECTIONS
A. Provide sleeve in foundation wall for gas service main. Caulk enlarged sleeve watertight.
B. Anchor service main to interior surface of foundation wall.
C. Install service regulator adjacent to building wall in indicated location.
D. Install service regulator and riser pipe to prevent undue stress on service pipe. For plastic service pipe, use steel pipe riser from below ground to regulator.
E. Provide regulator vent with rain and insect proof opening, terminating not less than 5-ft away from building openings.

3.06 PROPANE TANK INSTALLATION
A. Place tank legs on concrete footings, level within tolerance of 1/4 in. maximum. Provide footings in accordance with Section 03300.
B. Prepare and grade an area outside the tank perimeter, for distance of 6-ft. Grade, place, and compact gravel fill to compacted depth of 3-in. minimum. Compact in accordance with Section 02200.
C. Provide tank with relief valve, shutoff valve, pressure regulator, pressure gauge, and removable protection cover. Install piping, shutoff valve, and pressure gauge to underground piping.
D. Install tank regulator to outlet piping as indicated on Construction Drawings.
E. Install vaporizer to under side of tank and secure to tank with aluminum tray and two stainless steel straps.
F. Install weatherproof control box to vaporizer 40-in. above ground surface. Install on 4-in. x 4-in. cedar post, driven into ground 40-in.
G. Install control wire from vaporizer to control box 20-in. below ground surface. Install service wiring 24-in. below ground from control box to building.

END OF SECTION 02587

SECTION 02720 STORM SEWER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Site storm sewer drainage piping, fittings, accessories, and bedding.
B. Connection of building storm water drainage system to municipal storm sewers.
C. Catch basins, paved area drainage, site surface drainage, and stormwater detention facilities.

1.02 RELATED REQUIREMENTS
A. Section 02000 -- Earthwork
B. Section 02605 -- Sewer Structures
C. Section 03300 -- Cast-in-Place Concrete (See Architectural / Building Specifications)
D. Local governing authority and code requirements
E. Construction Drawings
F. Geotechnical Investigation.

1.03 REFERENCE STANDARDS
A. American Association of State Highway and Transportation Officials (AASHTO) latest edition
M 36 Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains
M 198 Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
M 252 Corrugated Polyethylene Drainage Tubing
M 294
B. American Society for Testing and Materials (ASTM) latest edition
A 760
C 14 Concrete Sewer, Storm Drain, and Culvert Pipe
C 76 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
C 443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
D 2321 Underground Installation of Flexible Thermoplastic Sewer Pipe
D 3034 Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
F 794

1.04 SUBMITTALS
A. Product Data: Provide data on pipe materials, pipe fittings, and accessories.
B. Manufacturer's Certificate: Certify that products meet or exceed specified local requirements.

1.05 PROJECT RECORD DOCUMENTS
A. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.06 PROJECT CONDITIONS
Coordinate work with termination of storm sewer connection outside building including connection to municipal storm sewer system.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS AND ACCESSORIES
A. Reinforced Concrete Pipe: Comply with requirements of ASTM C 76, Class III unless another class type is indicated on Construction Drawings, installed with flexible plastic, bitumen gaskets at joints. Gaskets shall comply with AASHTO M 198 75I, Type B, and shall be installed in strict accordance with pipe manufacturer's recommendations.
B. Spiral Rib Metal Pipe Type 1R: Galvanized, aluminized, or bituminous coated as specified on Construction Drawings. Pipe ends shall be re-corrugated and installed with semi-corrugated Hugger-type bands and "O" ring gaskets in accordance with pipe manufacturer's installation requirements. Spiral Rib metal pipe must comply with ASTM A 760 Type 1R. Acceptable manufacturer: CONTECH, INC "ULTRA FLO or ULTRA FLO II", Coldwell Culvert Co. "Smooth Rib", or approved equal.
C. Polyvinyl Chloride (PVC) Pipe: Pipe and Fittings shall comply with ASTM D 3034, rated SDR 35. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant.
D. Corrugated Polyethylene Pipe (CPP) Smooth Interior: Shall conform with AASHTO Designation M 252 and M 294. Pipe must be installed in accordance with pipe manufacturer's installation Guidelines for Culvert Storm Drainage Applications. Acceptable manufacturers: Advanced Drainage Systems, Inc. "ADS N-12", HANCOR, INC. "Hi-Q", or approved equal.
E. Polyvinyl Chloride (PVC) large diameter closed profile gravity sewer pipe, UNI-B-9: Pipe and fittings shall comply with ASTM F 794. Pipe must be installed in accordance with pipe manufacturer's installation guidelines. Acceptable manufacturer: Carlon "Vylon H.C." or approved equal.
F. Polyvinyl Chloride (PVC) 8-in. through 30-in. diameter, smooth interior, open profile gravity sewer pipe. Pipe and fittings shall comply with ASTM F 794 and Uni-Bell UNI-B-9. Pipe must be installed in accordance with pipe manufacturer's installation guidelines. Acceptable manufacturer: Extrusion Technologies, Inc. "Ultra-Rib" or approved equal.

2.02 INLETS, CATCH BASINS AND JUNCTION BOXES
A. Lid and frame per details shown on Construction Drawings.
B. Structure construction in accordance with details shown on Construction Drawings and in accordance with Section 02605.

PART 3 EXECUTION

3.01 EXAMINATION
Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Construction Drawings.

3.02 PREPARATION
A. Hand trim excavations to required elevations. Correct over excavation with bedding material.
B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.
C. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.03 BEDDING
A. Excavate pipe trench and place bedding material in accordance with Section 02222.

3.04 INSTALLATION -- PIPE
A. Install pipe, fittings, and accessories in accordance with ASTM C 14, ASTM D 2321, or manufacturer's instructions and state or local requirements.
B. Install pipe on bedding in accordance with Section 02222.
C. Lay pipe to slope gradients noted on Construction Drawings.
D. Refer to Section 02222 for trenching requirements. Do not displace or damage pipe when compacting.

3.05 INSTALLATION -- CATCH BASINS, INLETS, AND JUNCTION BOXES
A. Form bottom of excavation clean and smooth to correct elevation.
B. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe to be placed at proper elevation.
C. Form and place cast-in-place concrete walls, sleeved at proper elevation to receive storm sewer pipe in accordance with details shown on Construction Drawings.
D. Form and place cast-in-place top of structure in accordance with details shown on Construction Drawings.
E. Refer to Section 02605 for structure requirements.

END OF SECTION 02720

SECTION 02730 SANITARY SEWER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Sanitary sewer drainage piping, fittings, accessories, cleanouts, and bedding.
B. Connection of site sanitary sewer system to municipal sanitary sewer.

1.02 RELATED REQUIREMENTS
A. Section 02000 -- Earthwork
B. Section 02605 -- Sewer Structures
C. Local governing authority and code requirements
D. Construction Drawings
E. Geotechnical Investigation.

1.03 REFERENCE STANDARDS
A. American Society for Testing and Materials (ASTM) latest edition
A 74 Cast Iron Soil Pipe and Fittings
A 746 Ductile Iron Gravity Sewer Pipe
C 12 Practice for Installing Vitrified Clay Pipe Lines
C 14 Concrete Sewer, Storm Drain, and Culvert Pipe
C 76 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
C 425 Compression Joints for Vitrified Clay Pipe and Fittings
C 443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
C 564 Rubber Gaskets for Cast Iron Soil Pipe and Fittings
C 700 Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
D 1785 Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
D 2321 Underground Installation of Flexible Thermoplastic Sewer Pipe
D 3034 Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
F 477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
F 949
B. American Association of State Highway and Transportation Officials (AASHTO) latest edition
M 252 Corrugated Polyethylene Drainage Tubing
M 294
C. American Water Works Association (AWWA) latest edition
C111 Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings

1.04 QUALITY ASSURANCE
A. Compaction testing will be performed in accordance Section 02222.
B. Test sanitary sewer pipe system installed below grade and outside building in accordance with the following procedures:
1. Perform testing of manhole construction, pipe materials, joints, and other materials incorporated into construction of sanitary sewer system to determine leakage and watertightness. In event state or local code requires more stringent test, more stringent shall apply.
2. Manhole Testing:
Owner or Governing Agency shall determine method of testing set forth below. Method selected will be determined by depth of each manhole, groundwater level, presence of honeycombing, or other conditions which make selected test suitable for determining physical condition and watertightness of manhole.
2.1 Manhole Exfiltration Testing:
Incoming and outgoing sewer lines shall be plugged and manhole filled with water up to top of poured concrete or above highest precast barrel joint. Manhole fails if water loss exceeds maximum allowable shown below:
Depth of Manhole Maximum Allowable Water Loss
0 - 8-ft 1-in. per 30 minutes
greater than 8-ft 1/8-in. gal/vertical ft over 5 minutes
2.2 Manhole Vacuum Testing:
Test shall be performed with suitable apparatus made for such purpose and shall draw vacuum of 10-in. of Mercury (Hg). Test passes if vacuum remains at 10-in. Hg or drops to not less than 9-in. of Hg in 1 min.
3. Flexible Pipe Deflection Testing:
3.1 Allowable Deflection:
Maximum allowable pipe deflection shall not exceed 5 percent of nominal inside diameter.
3.2 Mandrel:
Mandrel go/no-go device shall be cylindrical in shape and constructed with either 9 or 18 evenly spaced arms or prongs. Mandrels with less arms will be rejected as not sufficiently accurate. Contact length of mandrel's arms shall equal or exceed nominal inside diameter of sewer to be inspected. Critical mandrel dimensions shall carry tolerance of 0.01-in. maximum. Mandrel and necessary equipment for mandrel test shall be provided by Contractor.
3.3 Procedure:
Mandrel shall be hand-pulled through flexible pipe sewer lines no earlier than 30 days after trench has been completely backfilled. Sections of sewer not passing mandrel shall be uncovered and rebedded, recounded, or replaced to satisfaction of Owner or Governing Agency. Repaired section shall be retested.
3.4 Mandrel O.D. (outside diameter):
Outside diameter of mandrel shall be set according to the following table:

Nominal Diameter, in.	Mandrel O.D., in.
6	5.40
8	7.12
10	8.87
12	10.35
15	12.69
18	15.30

3.5 Contractor's Warranty:
Owner or Governing Agency reserves right to mandrel test flexible pipe sewer line before acceptance, and also prior to expiration of first year of operation. If previously accepted line fails mandrel test performed during first year of operation, defects must be corrected at Contractor's expense.
4. Air Testing of Gravity Sewers:
4.1 Procedure:
4.1.1 Plug pipe outlets with suitable test plugs. Brace each plug securely.
4.1.2 Pipe air supply to pipeline to be tested in such manner that air supply may be shut off, pressure observed, and air pressure released from pipe without workmen entering manhole.
4.1.3 Add air slowly to portion of pipe under test until internal pressure of line is raised to approximately 4 psig, but less than 5 psig.
4.1.4 Shut air supply off and allow at least 2 minutes for air pressure to stabilize.
4.1.5 When pressure has stabilized and is at or above starting test pressure of 3.5 psi, start test.
4.1.6 Determine time in seconds with stopwatch for pressure to fall 0.5 psig so that pressure at end of time is at or above 3.0 psig.
4.1.7 Compare observed time with minimum allowable times in chart below for pass/fail determination.

Pipe Diameter	4	6	8	10	12	15	18	21	24	27	30	33	36
Minimum Time	1:53	2:50	3:47	4:43	5:40	7:05	8:30	9:55	11:20	12:45	14:10	15:35	17:00
Length for Minimum Time	597	398	298	239	199	159	133	114	99	88	80	72	66
Time for longer lengths	.190L	.427L	.760L	1.187L	1.709L	2.671L	3.846L	5.235L	6.837L	8.653L	10.683L	12.926L	15.384L

SPECIFICATION TIME FOR LENGTH (L) SHOWN (MIN:SEC)

Length	4	6	8	10	12	15	18	21	24	27	30	33	36
100 ft	1:53	2:50	3:47	4:43	5:40	7:05	8:30	9:55	11:24	14:25	17:48	21:33	25:39
150 ft	1:53	2:50	3:47	4:43	5:40	7:05	9:37	13:05	17:57	21:38	26:43	32:19	38:28
200 ft	1:53	2:50	3:47	4:43	5:42	8:54	12:49	17:27	22:48	28:51	35:37	43:56	51:17
250 ft	1:53	2:50	3:47	4:57	7:08	11:08	16:01	21:49	28:30	36:04	44:31	53:52	64:06
300 ft	1:53	2:50	3:48	5:56	8:33	13:21	19:14	26:11	34:11	43:16	53:25	64:38	76:55
350 ft	1:53	2:50	4:26	6:55	9:58	15:35	22:26	30:32	39:53	50:30	62:18	75:24	89:44
400 ft	1:53	2:51	5:04	7:54	11:24	17:48	25:38	34:54	45:35	57:42	71:13	86:10	102:34
450 ft	1:53	3:12	5:42	8:54	12:50	20:02	28:51	39:16	51:17	46:54	80:07	96:57	115:23

4.2 Safety Precautions:
Low pressure air test may be dangerous to personnel if, through lack of understanding or carelessness, line is overpressurized or plugs are installed improperly. It is extremely important that various plugs be installed so as to prevent the sudden expulsion of poorly inflated plug. As example of hazard, force of 250-lb is exerted on 8-in. plug by internal pressure of 5 psi. Observe following safety precautions:
4.2.1 No person shall be allowed in manholes during test or when plugged pipe is under pressure.
4.2.2 Gauges, air piping manifolds, and valves shall be located at top of ground
4.2.3 Install and brace plugs securely.
4.2.4 Do not overpressurize lines.
4.3 Groundwater Elevation:
If pipeline to be tested is below groundwater level, starting test pressure shall be increased by 0.433 psi for each foot groundwater level is above invert of sewer pipe. In no case shall starting test pressure exceed 9.0 psig.
4.4 Acceptance of Installation:
No gravity sewer or manhole will be accepted that does not comply with minimum requirements of tests described in herein.
4.5 Test Equipment:
Necessary equipment to perform air test in accordance with Specifications shall be provided by Contractor. Test gauge shall preferably have incremental division of 0.10 psi and have accuracy of at least 0.04 psi. In no case shall test gauge be used which has incremental divisions of greater than 0.25 psi. Gauge shall be of sufficient size in order to determine this accuracy.
4.6 Furnish 1 copy of gravity sewer and manhole test results to Owner and Governing Agency upon completion of gravity sewer system backfilling operations.

1.05 SUBMITTALS
A. Product Data: Provide data of pipe materials, pipe fittings, and accessories.
B. Manufacturer's Certificate: Certify that products meet or exceed specified local requirements.

1.06 PROJECT RECORD DOCUMENTS
A. Accurately record actual locations of pipe runs, connections, cleanouts, and invert elevations.
B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.07 PROJECT CONDITIONS
Coordinate work with termination of sanitary sewer connection outside building and connection to municipal sewer utility service.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS
A. Polyvinyl Chloride Sanitary Sewer
1. Pipe and fittings shall comply with ASTM D 3034, rated SDR 26 unless otherwise specified by the utility company. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.
2. Pipe joints shall be integrally molded bell ends per ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant.
B. Ductile Iron Sanitary Sewer
1. Ductile Iron Pipe: ASTM A 746, Extra Heavy type, inside nominal diameter as specified on Construction Drawings, bell and spigot end.
2. Ductile Iron Pipe Joint Device: AWWA C111, rubber gasket joint devices.

2.02 PIPE ACCESSORIES
A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.
B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps, etc.

2.03 CLEANOUTS
A. Lid and Frame: Heavy Duty cast iron construction, manufactured by Mueller. Lid Design: Closed Lid.
B. Shaft Construction: Cast iron shaft of internal diameter as specified on Construction Drawings with 2500 psi concrete collar for cleanouts.

PART 3 EXECUTION

3.01 EXAMINATION
Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Construction Drawings.

3.02 PREPARATION
A. Hand trim excavations to required elevations. Correct overexcavation with bedding material.
B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.03 BEDDING
A. Excavate trench and place bedding material in accordance with Section 02222.

3.04 INSTALLATION -- PIPE
A. Install pipe, fittings, and accessories in accordance with ASTM C 12, ASTM C 14, ASTM D 2321, or manufacturer's instructions and local requirements.
B. Lay pipe to slope gradients noted on Construction Drawings.
C. Install pipe on bedding in accordance with Section 02222.
D. Refer to Section 02222 for trenching requirements. Do not displace or damage pipe when compacting.
E. Refer to Section 02605 for manhole requirements.
F. Connect to building sanitary sewer outlet and municipal sewer system as indicated on Construction Drawings.

3.05 INSTALLATION -- CLEANOUTS
A. Form bottom of excavation clean and smooth to correct elevation.
B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe to be installed to proper elevations.

END OF SECTION 02730

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LOVE'S TRAVEL STOP
I-75 EXIT 310 @ UNION GROVE ROAD
CALHOUN, GEORGIA

GEORGIA REGISTERED No. 026522 PROFESSIONAL ENGINEER ROSS G. GRIMBALL
5-22-18

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SITEWORK SPECIFICATIONS C-11

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