PART 1 GENERAL

1.1 SCOPE

A. This item shall include the work necessary for the installation of sanitary sewer line construction.

B. Reference Section 3800 “Trenching and Backfill” and the General Conditions, specifically, but not limited to, Articles E8, E9, E10, H3, H4, H5 and H6.

PART 2 PRODUCTS

2.1 GENERAL:

A. Contractor shall furnish, to the Engineer, all materials certifications available from the manufacturer for all required materials.

B. All material shall be new and of U.S. manufacture including valves, pipe, fittings and etc. unless approved prior to installation through the submittal process.

2.2 BEDDING AND BACKFILL MATERIAL:

A. Aggregates imported for trench bedding and backfill shall conform to Section 2300 of these Specifications.

2.3 SANITARY SEWER PIPE:

A. Sanitary sewer pipe and service laterals shall be of the type specified in Section 2600.

PART 3 EXECUTION

3.1 HANDLING AND STORAGE:

A. All material (pipes, fittings, and etc.) shall be handled with care to avoid damage. Material shall not be dropped, bumped, or allowed to impact on itself.

B. The Contractor shall provide safe storage for material until it has been incorporated into the work. The Contractor, at no expense to the Owner, shall replace damaged materials.

C. While cleaning pipe and fittings, wire brush if necessary and wipe clean, dry and free from oil, dirt, grease, and other foreign matter before the pipe is laid.

D. All pipes and fittings shall be carefully inspected before being laid and no cracked, broken, or defective pipe or fitting shall be used in the work.

3.2 TRENCH EXCAVATION, BACKFILL, AND BEDDING:

A. Trench excavation shall conform to Section 3800 of these Specifications.

3.3 PIPE ALIGNMENT AND GRADE:

A. All pipe shall be laid to and maintained at the lines and grades required by the Plans. All fittings and valves (for pressure sewers) shall be installed at the required locations with joints centered, spigots home, and plumb.

B. Every fourth section of pipe 10-foot and over shall be checked for depth of cover or every 50-foot for pipe sections under 10-foot.

C. When a section or sections are found to be out of alignment or grade they shall be removed and placed at the correct alignment and/or grade. If fill is required to readjust use 1-inch minus aggregate, conforming to Section 2300, thoroughly compacted to the satisfaction of the Engineer.

D. Maximum deviation from horizontal line, as established by the Engineer, shall not exceed ½-inch.

E. Maximum deviation from vertical line shall not exceed 1/32-inch per diameter-inch of the pipe constructed. Pipes having bellies in excess shall be removed and replaced at no expense to the Owner.

3.4 PIPE INSTALLATION:

A. Prior to excavation Contractor shall call for utility locating services of all existing utilities. Care shall be exercised during excavation to avoid damage to existing structures and utilities.

B. Obstructions encountered shall be handled in accordance with Article E (8) of the General Conditions.

C. Under no circumstance shall pipe be place in standing water.

D. Extreme care shall be exercised to insure that the inside surfaces of the bell are smooth and free from any projections which would interfere with the assembly or watertightness of the joints. Every precaution shall be taken to prevent foreign materials from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.

E. Prior to installing rubber gasket type joints, the end of the pipe to be joined, the inside of the joint, and the rubber ring shall be thoroughly cleaned by scrubbing with a brush and washing with water or other approved method. The method of installing rubber ring gaskets varies slightly with products of a different manufacturer and no standard instructions are applicable. Gaskets furnished under this specification shall be installed in strict accordance with the manufacturer's recommendations and as approved by the Engineer.

F. A pipe soap type lubricant or other type approved by the pipe manufacturer shall be mopped on the inside surfaces of the bell and on the rubber gasket immediately prior to forcing the pipe home. Approved jacking devices shall be employed as required.

G. Cast iron pipe shall be used for a distance of 10-feet on either side of a crossing of an existing water main, when the sewer line is less than 3-feet below the water main.

3.5 MAXIMUM ALLOWABLE JOINT DEFLECTION:

A. DUCTILE IRON PIPE - Maximum allowable joint deflection shall conform to that which is indicated in AWWA C 600, Table-4.

B. PVC PIPE – Maximum allowable joint deflection shall conform to Uni-Bell PVC handbook formula.

C. CONCRETE PIPE – Maximum allowable joint deflection shall conform to the published data provided from the manufacturer.

3.6 SERVICE TEES AND WYES:

A. Service tees and wyes shall be installed in accordance with the recommendations of the manufacturer and as shown on the Standard Details bound herewith.

3.7 PRESSURE MAIN THRUST RESTRAINT:

A. Thrust blocks for pressure mains shall be constructed upon and against firm, consolidated native soils.

B. Wrap fittings with black plastic to protect coverage of joints and bolts on pipe for future maintenance.

C. Construct thrust blocks with 3,500-psi redi-mix concrete that conforms to Section 2000 of these Specifications.

3.8 DISSIMILAR PIPE CONNECTIONS:

A. Install Romac or Fernco couplers when connecting two pipes of differing materials, and outside diameters, in accordance with the manufacturers directions.

B. Concrete closures collars shall be used only when approved, and then only to make connections between dissimilar pipe or where Romac and Fernco joints are impractical. The collars shall be placed using an approved commercial concrete bonding agent applied to all surfaces in contact with the collar. Where concrete closure collars are necessary to join PVC pipe, the PVC surface shall first be prepared for bonding to the concrete by applying a dense coating of clean mortar sand to the pipe using PVC solvent cement. After the cement has cured, an approved commercial concrete bonding agent shall be applied to the surface prior to placement of the concrete.

3.9 MARKERS:

A. New pipe line and service line ends shall be marked in accordance with Standard Detail No. 6200-3.

B. In new subdivisions and undeveloped areas, after the service line pipe is installed, block the capped or plugged end and install 2 x 4 marker**.** Extend markers at least 36-inches above the ground surface. The lower end of the marker shall be placed above the plugged end of the pipe to prevent damage to the sewer. Paint the top portion of the marker after its installation with first-quality "GREEN", quick drying enamel. After the paint has dried, use black, quick-drying enamel and neatly indicate the distance from the natural ground surface to the top of the service line pipe in feet and tenths of feet.

C. Take precautions during the backfilling operation to ensure the position and location of the marker. If the marker is broken or knocked out of vertical alignment during the backfilling operation, reopen the trench and replace the marker. Omit markers in developed areas where installing the marker is not feasible, as determined by the Engineer.

3.10 CLEANING OF SEWER SYSTEMS:

A. Before final acceptance of the completed sewer line, the entire system shall be flushed and cleaned with water and appropriately sized balling device. This does not apply to the service laterals. The solid debris material obtained from flushing and cleaning shall not be allowed to enter any existing sewer system.

3.11 BY-PASS PUMPING:

A. In the event that project requirements are for installing and/or replacement of an existing system the Contractor shall provide for by-pass pumping around the work limits so as not to inhibit service to customers.

B. Contractor shall furnish all equipment, labor and materials to place and maintain continuous operation of by-pass pumping for sewer mains and service connections.

C. Equipment shall be approved by the Engineer to be of size and type capable of adequately handling bypassing requirements.

3.12 MEASUREMENT AND PAYMENT:

A. PIPE: Pipe will be measured and paid for on a lineal foot basis, to the nearest 0.1-foot, for the types and sizes listed in the bid schedule. No reduction in length will be made for valves and fittings.

B. FITTINGS: Fittings shall be incidental to unit price for pipe at a linear foot for each diameter of each type and class of pipe.

C. THRUST BLOCKS: Thrust blocks, for pressure sewers, will be measured and paid for at the

unit price per each listed in the bid schedule.

D. SERVICE LINES: Service lines shall be measured and paid at the unit price to the nearest 0.1 lineal foot for each diameter as listed in the bid schedule.

E. BY-PASS PUMPING: BPP shall be paid for at the unit price as scheduled in the Bid.

F. VALVES: Valves on pressure sewers (gate, ball, swing check, double check, EPV, Air/vacuum, and etc.) shall be measured and paid at the unit price for each as specified in the Bid.

PART 4 TESTING

4.1 AIR TESTING – NON DUCTILE IRON PIPES:

A. GENERAL

1. The pressure gauge used in air testing shall have minimum divisions of 0.10-psi and have an accuracy of 0.0625-psi (one ounce per square inch). All air shall pass through a single control panel.

2. The Contractor shall furnish all necessary testing equipment and perform the test in manner satisfactory to the Engineer. Any arrangement of testing equipment which will provide observable and accurate measurements of either air leakage under the specified conditions will be permitted. Gauges shall be calibrated and certified. The certification shall be available with the gauge.

3. Prior to the testing and inspection of the system the Contractor shall flush and clean all parts of the system and remove all debris.

4. Contractor shall provide skilled labor and technicians, which are experienced in air testing operations for sewer systems.

B. METHOD

1. All air testing shall be by the Time Pressure Drop Method. The Contractor may wet the lines prior to testing. Determine the average height of the ground water over the line. The test pressures required shall be increased 0.433-psi for each foot of average water depth over the exterior crown of the pipe. Add air slowly to the section of system being tested until the internal air pressure is raised to 4.0-psig greater than the average backpressure. Then bleed off to 3.5-psi over external static pressure. After the test pressure is reached, allow at least two minutes for the air temperature to stabilize adding only the amount of air required to maintain pressure. After the temperature stabilization period, disconnect the air supply. Record the time in seconds that is required for the internal air pressure to drop from 3.5-psig to 3.0-psig greater than the average backpressure due to ground water. Compare the time recorded with the timetable as follows:

TABLE D-1

AIR TESTING TIME REQUIREMENTS 0.5 PSIG PRESSURE DROP

Pipe Diameter (inch)	Minimum Time (min:sec)	Length for Min. Time (feet)	Time for Longer Lengths (time in sec., L in feet)
4	1:55	597	0.190 L
6	2:50	398	0.427 L
8	3:50	298	0.760 L
10	4:45	239	1.187 L
12	5:40	199	1.709 L
18	8:30	133	3.846 L
24	11:20	99	6.837 L
30	14:10	80	10.683 L
36	17:00	66	15.384 L

C. ACCEPTANCE:

1. The tested section shall not lose more then 0.5-psi within the allotted time as indicated in Table D-1.

4.2 HYDROSTATIC TESTING – DUCTILE IRON PIPES:

A. PRESSURIZATION.

1. After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of 150-psi. Each valved section of pipe shall be slowly filled with potable water, and the specified test pressure shall be applied by means of a pump connected to the pipe. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. The test system shall be allowed ten minutes to stabilize prior to moving to the next step.

2. Hydrostatic test shall be a 2-hr duration, min., unless changed by the Engineer.

3. Test pressure shall not vary by more than 5.0-psi for the duration of the test.

B. AIR REMOVAL.

1. Before applying the specified test pressure, air shall be expelled completely from the section of piping under test. If permanent air vents are not located at all high points,

corporation cocks shall be installed at such points so that air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be left in place for disinfection sampling points or removed and plugged as directed by the Engineer.

C. FIELD EXAMINATION.

1. All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until satisfactory results are obtained.

D. LEAKAGE DEFINED.

1. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5-psi of the specified test pressure after the pipe has been filled with water and the air has been expelled.

2. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

E. ALLOWABLE LEAKAGE.

1. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

In inch-pound units,

$$L = \frac{SD(P)^{0.5}}{133{,}200}$$

L = allowable leakage, in gallons per hour*
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
P = average test pressure during leakage test, in pounds per square inch (gauge)

**L is in gph and as test is a 2-hr duration total results from field test must be divided by time (hrs) to compare to max allowable to formula. Each hour shall be evaluated separately.*

F. When testing against closed metal-seated valves, and additional leakage per closed valve of 0.0078 gal/hr/in. on nominal valve size shall be allowed.

4.3 MANDREL:

A. GENERAL:

1. Conduct deflection testing of all sewer pipes constructed of flexible pipe by use of mandrel method.

2. Contractor shall pull an approved mandrel, having at least 6 vanes and a diameter of 95-percent of the pipe's initial diameter, completely through the completed sewer line.

3. A section of pipe not allowing the mandrel to pass shall be located and dug up for inspection. Section shall be replaced or repaired as directed by the Engineer.

4.4 TELEVISION INSPECTION

A. Contractor shall provide the Owner one (1) copy of a TV inspection. The TV inspection shall be reviewed by the Engineer and evaluated for conformance to these specifications. Once the Engineer approves this video inspection City Maintenance crews will be scheduled for a final video inspection. The sewer will not be accepted until the City has made this final video inspection and punch list items are completed.

B. Should the inspection video record be of inadequate quality or coverage, as determined by the Engineer, the Contractor shall have the system or selected portions re-televised at no addition cost to the City.

END OF SECTION