Section 02704 – PIPELINE PRESSURE AND LEAKAGE TESTING, CLEANING, AND DISINFECTION

1. SCOPE. This section covers field hydrostatic pressure and leakage testing of the pipelines set forth herein. Cleaning of wastewater force mains and cleaning and disinfection of potable water lines are also described in this section.

Testing of sewer systems is covered in the sewer pipe installation and testing section.

2. GENERAL. Unless otherwise specified, testing of pipelines shall be completed prior to disinfection and shall be in conformance with AWWA specifications C-600, section 4, latest revision.

The Engineer shall be present during the performance of all testing work and shall be notified of the time and place of testing at least 3 days prior to commencement of the work. All work shall be performed to the satisfaction of the Engineer.

2.01. Testing Schedule and Procedure. A testing schedule and test procedure shall be submitted to the Engineer for review and acceptance not less than 21 days prior to commencement of testing work. The schedule shall indicate the proposed time and sequence of testing of each pipeline. The testing procedure shall establish the limits of each pipeline to be tested, the position of all valves during testing, the location of temporary bulkheads, and all other procedures to be followed in performing the required testing work.

2.02. Special Testing Requirements. Unless otherwise permitted, pressure and leakage tests shall be made against closed hydrants.

The maximum length of line to be tested is approximately 5,000 feet. All valves shall be tested with pressure against one side to verify they are operating properly.

2.03. Water. Water used for testing shall be furnished as stipulated in the temporary facilities section. Water shall be conserved through collection and reuse in subsequent testing work. Following completion of testing work, the water shall be disposed of in a manner acceptable to the Engineer. Unless otherwise permitted, the water shall not be allowed to enter other parts of the system.

2.04. Filling and Venting. When filling the line with water, care shall be taken to ensure that all air release valves and other venting devices are properly installed and in the open position. Hand-operated vent valves shall not be closed until water flows in an uninterrupted stream from each valve. Care shall be taken to ensure that the rate at which each line is filled with water does not exceed the venting capacity of the installed air vent valves and devices.

In addition to all air release valves shown on the Drawings, the Contractor shall install, at no additional cost to the Owner, air release valves at all high points.

Refer to Standard Details for additional information on connection to existing mains.

If there are highpoints on the line that are not vented, Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the test, the corporation cocks shall be removed and plugged or left in the line at the discretion of the Observer.

2.05. Blocking and Backfilling. Piping shall be adequately blocked, anchored, and supported before the test pressure is applied.

2.06. Test Equipment. All necessary piping connections between the line to be tested and the water source, together with pumping equipment, water meter, pressure gauges, and all other equipment, materials, and facilities required to perform the specified tests, shall be provided. All flanges, valves, bulkheads, bracing, blocking, and other sectionalizing devices required shall also be provided. Vents shall be provided in test bulkheads where necessary to expel air from the line to be tested.

Test pressures shall be applied by means of a force pump sized to provide and maintain the required pressure without interruption during the test.

Water meters and pressure gauges shall be accurately calibrated and shall be subject to review and acceptance by the Engineer.

Drilling and tapping of pipe walls will not be permitted. Upon completion of testing work, each gauge connection shall be fitted with a removable plug or cap acceptable to the Engineer.

3. PRESSURE AND LEAKAGE TESTING. After the section of line to be tested has been filled with water, the test pressure shall be applied and maintained without interruption for 2 hours plus any additional time required for the Engineer to examine all piping undergoing the test and for the Contractor to locate all defective joints and pipe materials.

3.01. Test Pressure. Unless otherwise noted, each designated piping system shall be subjected to the following test pressure measured at the lowest point in the line:

Piping System Designation	Test Pressure psi
New water lines	200
New wastewater force mains	1.5 x maximum pump operating head range but not less than 100 psi.

3.02. Leakage. In conjunction with pressure testing and acceptance by the Engineer, each section of the pipeline shall be checked for leakage.

3.03. Leakage Measurement. Measurement of leakage shall not be attempted until all trapped air has been vented and a constant test pressure has been established. After the pressure has stabilized, line leakage shall be measured by means of a suitable water meter installed in the pressure supply piping on the pipeline side of the force pump.

3.04. Allowable Leakage. The term "leakage", as used herein, shall be the total amount of water which must be introduced into the line at the completion of the test to return the pressure to the initial test pressure.

No pipeline or section thereof will be accepted if and while it exhibits a leakage rate in excess of that determined by the following formula:

$$Q = 0.0075\ DLN$$

where

Q = allowable leakage in gallons per hour

D = nominal diameter of pipe in inches

L = length of section tested in thousand feet

N = square root of average test pressure in psi

Whenever the pipeline to be tested contains pipe of different diameters, the allowable leakage shall be calculated separately for each diameter and corresponding length of line. The resulting allowable leakage rates shall be added to obtain the total allowable leakage for the entire pipeline.

All joints in piping shall be watertight and free from visible leaks during the leakage test. Each leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of the Contractor regardless of any amount that the total line leakage rate, during the leakage test, may have been below the specified allowable leakage rate.

If the leakage test indicated a line leakage rate exceeding the allowable, the Contractor shall locate and repair leaking joints and other defective items of work to the extent necessary to reduce the line leakage to an acceptable amount.

3.05. Cleaning and flushing of Pipelines. All water and sewer lines installed under this contract, including all associated valves and fittings, shall be flushed or cleaned to the satisfaction of the Engineer. Cleaning of water lines shall be completed prior to disinfection.

All 12 inch and smaller pipelines shall be flushed with water at the maximum velocity which can be developed, but not less than 2.5 feet per second, unless otherwise permitted by the Engineer. Flushing shall be accomplished through the installed valves or fittings, or through corporation cocks furnished and installed for the purpose.

Booster pumps shall be used if required to obtain the necessary volume or velocity of water.

3.06. Disinfection of Mains. All of the water mains installed shall be thoroughly flushed and disinfected before being placed in service. All disinfection work shall conform to the requirements of ANSI/AWWA C651-92 and the requirements of the North Carolina Department of Environment, Health, and Natural Resources. This work shall be observed by the Engineer. The Contractor shall supply all labor, equipment, and materials necessary for carrying out this work. After a thorough flushing and cleaning out, sufficient chlorine compounds shall be introduced in the lines to produce a chlorine concentration of at least 50 parts per million. The chlorine solution shall be retained in the lines for at least twenty-four (24) hours. At the end of this period, the chlorine residual shall be at least 20 parts per million. The lines will then be flushed sufficiently to clear them of chlorine exceeding two parts per million. At least two samples of water from the mains will then be taken by the Owner and analyzed for bacteriological purity by a certified testing lab. If the initial bacterial tests fail, Contractor shall reimburse Owner for all additional sampling. Contractor shall pay for all cost associated with testing. If the mains fail to meet the bacteriological standard for purity, disinfecting and flushing will be repeated until such standards have been met.

Drainage of mains and disposal of chlorinated water shall be in accordance with all Federal, State, and local laws, ordinances, and regulations. Mains shall be drained to sanitary sewers, where available. If highly chlorinated water is discharged to the sanitary sewer, the Contractor shall notify the operations manager at the Rocky River Regional Wastewater Treatment Plant prior to discharging. The chief operator will stipulate time and rate of discharge into the sanitary sewer. Drainage directly to surface waters (creeks, rivers, streams, lakes, ponds, etc.) will not be allowed. Drainage branches, blow-offs, air vents and appurtenances shall be provided with valves and shall be located and installed as shown on the Plans and Standard Details. Drainage of mains will be accomplished in such a manner as to minimize erosion and siltation to adjoining properties. Water velocity from drainage and/or blow-off will be dissipated as necessary to prevent erosion.

Drainage branches or blow-offs shall not be connected to any sewer, submerged in any streams, or installed in any other manner that will permit back siphonage into the distribution system.

End of Section