SECTION 600 – INSPECTION, TESTING AND ACCEPTANCE

601. INSPECTION

1. Inspection will be done by the Authority. Inspections will be scheduled as received by the Authority. The Authority must be notified 24 hours prior to any construction.

2. The Authority shall be notified when specific inspections are required so that the inspection time can be scheduled.

3. The contractor shall present the following when requesting a project inspection:
   
   A. The size and length of all lines installed including services
   B. Cost of the system installed by line size.
   C. As-built plans showing the location of all lines, valves, fire hydrants, and any other special appurtenances installed. All manholes, services and other fixtures shall be located by station number along the main line. The length and approximate depth of services shall be shown and the distance to the nearest property corner shall be given.

4. In no circumstances shall any buildings and plumbing fixtures be connected to the line, until inspected and approved by the Authority.

5. Upon request, the contractor shall furnish the Authority with appropriate copies of the manufacture’s certification that the materials to be used meet the materials requirements of these specifications. The Authority may reject any materials not meeting specifications or any faulty or damaged materials. Any materials so rejected must be removed from the project immediately and must be prominently marked so that they can be spotted on this or any other project.

6. Authorized representatives of the Authority, which may include appropriate state or federal agencies, shall have access to the site for inspection at any time.

7. The Authority shall be notified by 8:30 A.M. when specific inspections are required so that the inspection time can be scheduled.

8. The Authority may at any time direct that its authorized representative(s) be allowed to see any pipe work, bedding, fire hydrant, tee, valving or other appurtenance.
9. Manholes and lines shall be clean and free of all mud and debris at the time of inspection. The contractor shall furnish adequate personnel to open manholes and to provide whatever assistance needed.

10. The contractor shall complete the project and shall have cleaned up the job site prior to requesting a final inspection. The authority or its representative(s) may terminate the inspection and direct further work at any time he feels that the project is not substantially complete and ready for inspection. The contractor shall furnish adequate personnel to check for open valves and give assistance needed by the Authority.

11. The representative of the Authority will normally visually inspect all water and sewer lines and appurtenances for conformance to the specification and will check the measurements shown on the “As-Builts” for accuracy. The representative will witness pressure and leakage test to insure all lines are watertight and sealed. The representative shall also supervise a disinfection test. Any of the following tests may also be required at the discretion of the representative:

   A. Fire Hydrant /Hammer Test (See Section 403)
   B. Trench compaction test
   C. Measurement of infiltration
   D. Smoke test
   E. Mandrel test
   F. Velocity test
   G. T.V. Inspection
   H. Compaction test
   I. Ball test

   Any defects found by these tests must be corrected before construction may proceed.

12. The Authority shall not perform the contractor’s work by finding all of his problems before the project is reasonably complete.

602. WATER SYSTEM TESTING

1. General

   All lines designed to operate under pressure shall be successfully tested. Test of installed piping shall consist of pressure and leakage test and a disinfection test.

   All piping to be tested must satisfactorily comply with these tests before being eligible for acceptance. In general, test shall be conducted in
accordance with AWWA C600 and C651 except as otherwise herein specified.

2. Pressure and Leakage Testing

A. After all piping has been placed, each section between line valves shall be tested by the Developer’s Contractor in the presence of the Authority’s representative and test shall be continued until all leaks have been made tight to the satisfaction of the Authority’s Representative. The contractor shall furnish all necessary meter, pumps, gauges, bulkheads, and other materials and appliances necessary to conduct the test as herein required. Every precaution must be taken to valve-off or otherwise protect control equipment in or attached to the pipe to prevent damage thereto.

B. Before applying the specified test pressure, all air shall be expelled from the pipe. If hydrants, blow-offs or air release valves are not available at the high places, the Contractor shall make the necessary taps at points of highest elevation before the test is made and insert plugs before the test has been completed.

C. Prior to the pressure test, pipe laid in trenches shall be backfilled adequately to secure the pipe during the test. Any observed leakage shall require corrective measures to pipe lines and/or joints to the satisfaction of the Authority.

D. The Authority will furnish the necessary water for testing and disinfection of the line; however, any water lost through breakage of lines or unnecessary or excessive flushing of lines will be charged to the Contractor at the current residential rate. All lines shall be tested to a pressure of 250 PSI for a minimum time of two (2) hours. The Authority or its representative may require a twenty-four (24) hour test, if so desired. Test pressure shall not vary by more than ±5 PSI for the duration of the test which may require periodic pumping (in which case the added water will be counted as part of the leakage). Lines shall be tested in sections between the valves. The rate of leakage shall not exceed 13.5 gallons per 24 hours per inch diameter per mile of water main. (See Table below.)

E. All visible leaks shall be repaired regardless of volume.
## LEAKAGE TABULATION

<table>
<thead>
<tr>
<th>SIZE OF PIPE</th>
<th>GALLONS/HOUR/100FT</th>
<th>GALLONS/DAY/100FT</th>
</tr>
</thead>
<tbody>
<tr>
<td>16”</td>
<td>.170</td>
<td>4.080</td>
</tr>
<tr>
<td>12”</td>
<td>.128</td>
<td>3.072</td>
</tr>
<tr>
<td>10</td>
<td>.106</td>
<td>2.544</td>
</tr>
<tr>
<td>8”</td>
<td>.085</td>
<td>2.040</td>
</tr>
<tr>
<td>6”</td>
<td>.064</td>
<td>1.536</td>
</tr>
</tbody>
</table>

3. **Disinfection**

After leakage testing, all necessary repairs have been made; the lines shall be flushed clean and then disinfected in strict accordance with the AWWA Standard for Disinfecting Water Mains, C 651, latest revision, subject to the following special conditions:

A. The method of disinfection shall be the Continuous Feed Method as per AWWA C651, latest revision, Section 5.2. The potable water shall be chlorinated so that after a 24 hour holding period in the main, there will be a free chlorine residual of not less than 10 mg/L at all points in the system when tested with standard orthotolindine solution.

B. The form of chlorine shall be a 1 percent made either sodium hypochlorite or calcium hypochlorite which shall be measured and pumped into the pipeline. Water must be flowing during the feeding operation and the injection point must be located so that the flow of water will disperse the chlorine throughout the pipeline. AWWA C651 requires the injection point be located at a point not more than 10 feet from the point of connection to the existing water supply. The chlorine should be fed at a constant rate such that the water will have not less than 25 mg/L free chlorine. The table below gives the amount of chlorine required for each 100 feet of pipe various diameters to produce a 25 mg/L concentration.
Chlorination Tabulation

<table>
<thead>
<tr>
<th>Pipe Diameter (in.)</th>
<th>100% Chlorine (lb.)</th>
<th>1% Chlorine Solution (gal.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0.030</td>
<td>0.36</td>
</tr>
<tr>
<td>8</td>
<td>0.054</td>
<td>0.65</td>
</tr>
<tr>
<td>10</td>
<td>0.085</td>
<td>1.02</td>
</tr>
<tr>
<td>12</td>
<td>0.120</td>
<td>1.44</td>
</tr>
<tr>
<td>16</td>
<td>0.217</td>
<td>2.60</td>
</tr>
</tbody>
</table>

C. After 24 hours, the line shall be flushed until the chlorine content is not more than 2.0 parts per million. When this step is completed, the Authority will complete a bacteriological test after the 24 hour period. If the test fails, the chlorination must be completed once again in the same manner as stated earlier. If the samples show evidence of contamination upon testing, the above procedure of disinfection shall be repeated until approved samples are obtained. No connections shall be made to the existing system until all of the samples have been tested and approved by the Authority.

D. The Contractor has the option of discharging the highly-chlorinated water being flushed from the pipeline to the existing sewers (if available) or to open areas where the discharge will not damage the roadbed or adjacent property. Dechlorinating this water prior to discharge may be required. If there is any possibility that the chlorinated discharge will cause damage to the environment, then a neutralizing chemical shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water. The highly chlorinated water shall not be discharged near any streams, ponds, lakes or other bodies of water without being dechlorinated.
The chlorine residual of water being disposed may be neutralized by treating the water with one of the chemicals listed in the table below:

<table>
<thead>
<tr>
<th>Residual Chlorine Concentration (Mg/L)</th>
<th>Sulfur Dioxide (SO_2^-)</th>
<th>Sodium Bisulfite (NaHSO_3^-)</th>
<th>Sodium Sulfite (Na_2SO_3^-)</th>
<th>Sodium Thiosulfate (Na_2S_2O_3.5H_2O)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.8 (0.36)</td>
<td>1.2 (0.54)</td>
<td>1.4 (0.64)</td>
<td>1.2 (0.54)</td>
</tr>
<tr>
<td>2</td>
<td>1.7 (0.77)</td>
<td>2.5 (1.13)</td>
<td>2.9 (1.32)</td>
<td>2.4 (1.09)</td>
</tr>
<tr>
<td>10</td>
<td>8.3 (3.76)</td>
<td>12.5 (5.67)</td>
<td>14.6 (6.62)</td>
<td>12.0 (5.44)</td>
</tr>
<tr>
<td>50</td>
<td>41.7 (18.91)</td>
<td>62.6 (28.39)</td>
<td>73.0 (33.11)</td>
<td>60.0 (27.22)</td>
</tr>
</tbody>
</table>

Amounts of chemicals required to neutralize various residual chlorine concentrations in 100,000 gal (378.5 m³) of water.

4. All trenches shall be subject to compaction testing after backfilling and shall meet the compaction requirements set forth in Section 510. All trenches failing to meet compaction requirements shall be excavated and recompacted and retested. This process shall continue until a passing test is achieved. All cost of compaction testing shall be the responsibility of the Developer.

5. Bacteriological Testing: After final flushing and before the main is placed into service, the Contractor shall assist the owner in collecting samples from the line to have tested for bacteriological quality. Testing shall be performed by the owner at a laboratory certified by the State of Georgia. Re-chlorinate lines until the required results are obtained. Provide the owner a minimum 24 hours notice to take samples. Weekends and recognized holidays shall not be included as part of the 24 hour notice. Contractors shall open all valves being a part of said system being tested upon approval of bacteriological testing.

6. Guarantee Against Taste, Odor Or Color: The Contractor shall guarantee for a period of one year against taste, odor, or color caused by pipe lining materials. The Contractor shall, at his own expense, provide all necessary treatment to counteract any such taste, odor or color. Bona fide complaints of taste, odor, or color in the area served by the new mains shall be deemed caused by pipe lining materials.
603. **SEWER SYSTEM TESTING**

All sanitary sewer lines, including both gravity sewer and force mains, shall be successfully tested before eligible for acceptance by the Authority. Any of the following tests may be run at the discretion of the Authority. All sewer mains shall also be subject to the materials-specific test listed in Section 400, “Materials for Sanitary Sewers”, under each type of pipe material acceptable for sanitary sewers.

1. **Low Pressure Test**

   After completing backfill of a sewer line section, conduct a low pressure air test of all pipe constructed, using methods and devices acceptable to the Authority. Perform such tests using the following general procedure:

   A. Temporarily plug line segment between two manholes using plugs having air tight fittings through which low pressure air can be introduced into the pipe segment being tested.
   B. Introduce low pressure air into the test pipe segment until the internal air pressure reaches 4.5 PSI above ground water pressure, if any.
   C. Wait at least two minutes for air temperature in the test segment to stabilize while internal air pressure remains no less than 3.5 PSI above ground water pressure.
   D. Bleed internal air pressure to exactly 3.5 PSI above ground water pressure.
   E. Accurately determine the elapsed time for internal pressure to drop to 2.5 PSI above ground water pressure.
   F. The air test is acceptable if elapsed time is no less than shown by the following table.

<table>
<thead>
<tr>
<th>Inches</th>
<th>100 Ft of Pipe</th>
<th>Inches</th>
<th>100 Ft. of Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>11</td>
<td>27</td>
<td>77</td>
</tr>
<tr>
<td>6</td>
<td>17</td>
<td>30</td>
<td>85</td>
</tr>
<tr>
<td>8</td>
<td>23</td>
<td>36</td>
<td>102</td>
</tr>
<tr>
<td>10</td>
<td>28</td>
<td>42</td>
<td>119</td>
</tr>
<tr>
<td>12</td>
<td>34</td>
<td>48</td>
<td>136</td>
</tr>
<tr>
<td>15</td>
<td>43</td>
<td>54</td>
<td>153</td>
</tr>
<tr>
<td>18</td>
<td>51</td>
<td>60</td>
<td>170</td>
</tr>
<tr>
<td>21</td>
<td>60</td>
<td>66</td>
<td>187</td>
</tr>
<tr>
<td>24</td>
<td>68</td>
<td>72</td>
<td>204</td>
</tr>
</tbody>
</table>
Air leakage time is based on pipe being damp. If pipe and joints are dry, dampen line if helpful in meeting air test time requirement.

Permanently correct excessive leakage determined by air testing, and repeat operations until Inspector witnesses a successful test on each line segment; then remove nipple through manhole wall without disturbing adjacent grout. Permanently caulk resulting hole watertight.

2. Mandrel Test

The mandrel testing shall be performed in accordance with ASTM F 679. Procedure for testing PVC sewer pipe for maximum allowable deflection:

A. The mandrel deflection test shall be conducted at the end of the one year maintenance period.
B. Completely flush the line making sure the pipe is clean of any mud or trash that would hinder the passage of the mandrel.
C. During the final flushing of the line, attach a floating block or ball to the end of the mandrel pull rope and float the rope through the line. (A nylon ski rope is recommended).
D. After the rope is threaded through line, connect the pull rope to the mandrel and place the mandrel in the entrance of the pipe.
E. Connect a second rope to the back of the mandrel. This will enable the mandrel to be retrieved if excessive deflection is encountered.
F. Remove all slack in the pull rope by gently pulling the rope at the far manhole. After the slack has been removed, place a tape marker on the rope, close to the pipe opening where the mandrel will exit. If mandrel encounters excessive deflection, the marker will provide a means of measuring the travel distance of the mandrel so that the deflected area can be located.
G. Draw mandrel through the sewer line.
H. An increasing resistance to pull is an indication of excessive deflection. If this occurs measure the distance from the beginning marker on rope to manhole. Locate section and replace bedding or pipe if visual examination reveals damage.
I. Retest until acceptable.

3. Velocity Test

On lines installed at minimum grade at any time the Authority suspects that a problem with flow will occur, we may ask for a velocity test of the suspect section.

The contractor will add sufficient water at a point upstream of the suspect section. After flow has reached a steady state, dye or some type of floating object such as a ping pong ball, or fishing float, will be passed through the
line. The float will be timed as it passes through the section. Any line in which a velocity of 2.0 feet per second cannot be obtained will not be acceptable.

4. T.V. Inspection

In the event that the Authority cannot see through the line properly or conditions cause him to suspect that the line may be settled or broken or that joints may not be made properly, he may direct that a T.V. camera be passed through the line. A film of the inspection will be made and submitted to the Authority.

Any discrepancies noted such as sagged pipes, broken pipes, bad joints, etc., will be dug up and will be corrected. Internal grouting to repair new lines will not be allowed. After correction of the discrepancies, the line will be reinspected.

5. Infiltration Test

Infiltration of ground water into sewer lines shall not exceed 25 gallons per inch of diameter per 24-hour day per mile of sewer.

Sewers shall be tested for infiltration in accordance with the requirements of ASTM C969 or in the following manner, whichever is more stringent: Following a period of heavy rain, a test for infiltration into the sewers shall be made using suitable weirs in manholes selected by the Authority with upstream sewers plugged as directed. Three measurements shall be made at one hour intervals, and the average of three measurements shall be used to compute the amount of infiltration. The Authority shall determine whether the ground is sufficiently saturated and whether the amount of rainfall is of sufficient quantity to permit the making of the test. In the event that sufficient rain does not occur before the date set for the final inspection, the Contractor will be required to conduct tests at any time during the one year maintenance period.

6. Exfiltration Test

When weather conditions will not permit infiltration testing due to low ground water table, exfiltration tests may be used. Leakage, under a 5 feet head, shall not exceed 25 gallons/day per inch of pipe diameter per mile.

The exfiltration test may be required by the Authority instead of or in addition to the infiltration test.

Manholes, which have been backfilled around, shall be tested for exfiltration. The minimum test time duration is 1 hour. Manholes shall be
filled with water to the top of the ring. The maximum allowable exfiltration rate is two gallons/foot of depth/24 hours/foot of manhole diameter.

7. Compaction Test

All trenches shall be subject to compaction testing after backfilling and shall meet the compaction requirements set forth in Section 510. All trenches failing to meet compaction requirements shall be excavated and recompressed and restored. This process shall continue until a passing test is achieved. All cost of compaction testing shall be the responsibility of the Developer.

8. Force Main Pressure and Leakage Test

A. After all piping has been placed, the main shall be tested by the Developer’s Contractor in the presence of the Authority or his designated representative and test shall be continued until all leaks have been made tight to the satisfaction of the Authority. The Contractor shall furnish all necessary meters, pumps, gauges, bulkheads, and other materials and appliances necessary to conduct the test as herein required. Every precaution must be taken to valve-off or otherwise protect control equipment in or attached to the pipe line to prevent damage thereto.

B. Before applying the specified test pressure, all air shall be expelled from the pipe. If air release valves are not available at the high places, the Contractor shall make the necessary taps at points of highest elevations before the test is made and insert plugs before the test has been completed.

C. Prior to the pressure test, pipe laid in trenches shall be backfilled adequately to secure the pipe during the test. Any observed leakage shall require corrective measures to pipe lines and/or joints to the satisfaction of the Inspector.

D. The Authority will furnish the necessary water for the testing of the force mains; however. Any water lost through breakage of lines or unnecessary or excessive flushing of lines will be charged to the Contractor at the current residential rate. All lines shall be tested to a pressure of 250 PSI. Test duration shall be two (2) hours. However, test pressure shall not exceed pipe, valve and/or thrust-restraint design pressure. Test pressure shall not vary by more than +5 PSI for the duration of the test which may require periodic pumping (in which case the added water will be counted as part of the leakage). The rate of leakage shall not exceed 15 gallons per 24 hours per inch diameter per mile of force main. (See Table below)
LEAKAGE TABULATION

SIZE OF PIPE          GALLONS/HOUR/100 FT  GALLONS/DAY/FT

16”                   .189                        4.545
12”                   .142                        3.409
10”                   .118                        2.841
8”                    .095                        2.273
6”                    .071                        1.705
4”                    .047                        1.136
3”                    .035                        0.846

Any section of the line not meeting the above test shall have the leaks found and corrected at once and re-tested until the leakage falls within the limits specified above. Leakage testing must be witnessed and approved by the Authority.

604. ACCEPTANCE

1. The Authority may issue a conditional approval letter certifying the completion of the water and sewer system when the contractor has completed the work items shown on the plans to the satisfaction of the Authority and to the satisfaction of any applicable test directed. The conditional approval letter shall signify the beginning of the 12 month warranty/maintenance period for the contractor and/or the developer. Additional phases of the existing development or brand new development by the developer will not be approved for construction until the conditional approval letter is issued. In no case will the conditional approval letter be considered as final acceptance of the project, nor will the contractor and developer be relieved of their responsibility to protect and maintain the system until final acceptance is given.

2. Upon completion of all work items in a private development including water and sewer lines, storm drains and all other utilities, the Authority will reinspect all phases of the development. During this inspection, the water/sewer mains and appurtenances will be checked for any cuts lines, shifted hydrants, adjustment of valve boxes and meter boxes, damaged manholes, and any damage by other construction. The curbs will be checked for markings of line valves and meters. Upon satisfactory completion of any discrepancies noted during this inspection, the developer will begin the 12 month warranty/maintenance period.

3. At the beginning of the 12 month warranty/maintenance period, all utility accounts associated with any pump and/or lift stations installed for the development shall be transferred to the Authority.
4. At the end of 12 months, the Authority will again re-inspect the entire development. When all discrepancies have been corrected, the Authority will issue an acceptance letter and will begin perpetual maintenance of the water and sewer system.

5. At the end of the 12 month warranty/maintenance period, all warranties associated with pump and/or lift stations shall be transferred to the Authority.

6. At the end of the 12 month warranty/maintenance period, a 24 month extended warranty will be required of the development owner. It shall be the responsibility of the owner to ensure that all items associated with the water and/or sewer system installation remain safe from harm from any entity working within the development. In the event of any damage and/or failure to the water and/or sewer system within the 24 month extended warranty period, the development owner must pay for the item(s) replacement or repair.

7. The development owner will be notified in writing in 12 month intervals as to the status of the water and/or sewer system within the development.

8. At the end of the 24 month extended warranty period, additional inspections and maintenance will be required. Gravity sewer mains will be required to be cleaned. A T.V. Inspection will be required for all gravity sewer mains. A mandrel test will be required for all PVC gravity sewer mains. A re-disinfection will be required for all water mains.

605. “AS-BUILT” RECORD DRAWINGS

At the completion of the water/sewer lines and before the final construction inspection, the contractor will furnish 2 black line copies of “As-Built” drawings of the project. The copies must be run from tracings which have been corrected to show all field changes made to the approved drawings. In the event that the design engineer does not perform the field staking, the contractor must furnish certification from a licensed engineer or surveyor attesting to the accuracy of all valve, hydrant, bend and tee locations and all elevations, grades, manhole locations and service locations. This certification and the certification of the engineer preparing the “As-Builts” must be shown on the drawings. Hand marked copies prepared by the contractor will not be accepted for “As-Builts”. The copies must be sharp, clear, clean and legible and must be suitable for filming as permanent records.

“As-Built” drawings shall include a site plan, construction plan sheets, and any supplementary drawings and shop drawings. The “As-Built” drawings shall meet the same requirements as plans for review. SEE SECTIONS 107 AND 205 FOR MORE DETAILED INFORMATION.
GUIDELINES FOR AS-BUILT DRAWINGS

1. Sewer “As-Built” should be a separate plan.

2. No contour lines.

3. Approximate depth of lateral should be shown.

4. Any lateral that does not come out at 90 degrees should show its distance from property pin.

5. Road names should be on the plan.

6. All measurements of laterals should be kept between manholes and both sides should add up to the distance between manholes.

7. Invert elevations should be put on manholes.

8. All lots are to be numbered.

9. Black lines are to be clear and legible.

10. Profiles are to be included on all “As-Builts”.

11. “As-Built” drawings are to be stamped in large clear print on the plan.

12. Sheets should be no larger than 24” x 36”.

13. Roads and road names shall be drawn on all plans.

14. Scale no larger than 1”=20’, no smaller than 1”= 100’ for cross-country lines and 1”=50’ for congested areas.

15. When a phase of a subdivision is completed, a location sketch of entire subdivision with said phase outlined shall appear on plans.

16. Line designation shall be used for correlation between profiles and plan view.

17. Ground water encountered during construction will be noted on “As-Builts”.

The Authority shall have the right to withhold water meters until the “As-Builts” have been submitted as required.