

Disinfection and Testing can be added at the end of the technical spec if preferred by the Town.

APPENDIX B

System Disinfection and Testing

I. System Testing General Requirements

A. Tests that Require the Use of Qualified Laboratory

1. The developer shall employ and the developer will pay for the services of a qualified independent testing laboratory to conduct the tests for:
 - a. Soil compaction.
 - b. Cast-in-place concrete.
 - c. Pavement placement, repair and resurfacing.
 - d. Bacteriologic Tests.
 - e. Bituminous concrete paving.

B. Contractor Testing and Town Inspector Observed Tests

1. The contractor shall conduct the following tests under the observation of and to the satisfaction of the Town:
 - a. Pipe alignment tests.
 - b. Sewer infiltration tests.
 - c. Sewer exfiltration or air tests.
 - d. Pipe deflection tests.
 - e. Pressure and leakage tests.
 - f. Proof rolling
2. Inspection will be completed by the Town for all proposed developments under construction. If a problem involving materials or workmanship is encountered, the Town reserves the right to request testing be conducted.
3. Prior to placement of any curb, gutter, sidewalk or pavement, the subgrade shall be properly compacted, tested and then proof rolled. Proof rolls shall be performed in the presence of the Town Inspector and/or Town Representative.

C. Independent Testing Laboratories Qualifications:

1. The Contractor must submit the following qualifications: to the Town for prior approval:
 - a. Name and address of proposed testing laboratory.
 - b. Qualification of personnel.
 - c. Description of facilities and equipment.
 - d. Certificate of calibration of applicable testing equipment made by an accredited calibration agency within 12 months prior to the submittal date.

D. Test Reports

1. Instruct the testing laboratory to submit, directly to the Town, two copies of all reports of tests or inspections made showing:
 - a. Project identification.
 - b. Date of test.
 - c. Location of test in the project.
 - d. Applicable specification section and standard for compliance.
 - e. Indication of compliance, irregularities or deficiencies.
 - f. Observations relating to compliance.
 - g. Name and signature of observer.

II. Pavement Testing**A. Material Testing**

1. All materials used for infrastructure construction onsite are subject to testing at the discretion of the Town. In the case of testing failures, the specific material and corresponding structure will be removed and replaced.
2. All testing must be done based on ASTM or AASHTO standards.
3. The developer is responsible for all costs associated with the testing of materials and the scheduling of such testing.

III. Aggregate Base Course**A. Submit test results for each source of material.**

1. Provide for the following:
 - a. Gradation.
 - b. Los Angeles wear test.
 - c. Aggregate quality.
 - d. Liquid limits.
 - e. Plasticity index.
2. Perform soil compaction tests, ASTM D698 or AASHTO T99, Standard Method of Test for Moisture Density Relations of Soils using a 5.5 lb. Rammer and a 12" drop.
 - a. Use method A, B, C or D as appropriate, based on soil condition and judgement of the testing laboratory.
 - b. Sample tests will be representative of materials to be placed.
 - c. Determine and provide maximum density curve for each type of material encountered or utilized.
 - d. Include Atterberg Limits, gradation and specific gravity.
3. Provide a density test of a typical sample. 4. Test results will be basis for field quality control.

IV. Storm Sewer System Testing**A. General**

1. This section outlines the procedures required for the testing of storm sewer trunk lines, laterals, manholes, and appurtenances.
2. The Developer shall be responsible for all costs associated with testing.

B. Cleaning

1. Clean all manholes, pipes, and structures by removing sheeting, bracing, forms, soil sediment, concrete waste, and other debris.
2. Do not discharge soil sediment or debris to drainage channels or existing storm sewer.
3. Dispose of properly in a waste containment site that is acceptable to the Town.

C. Visual Inspection

1. Examine structures and pipes for:
 - a. Damage.
 - b. Indication of displacement of reinforcement, forms, pipes, or bedding. .
 - c. Porous areas or voids.
 - d. Proper placement of seals, gaskets, and embedment.
 - e. Visible infiltration.
2. Verify that structures and pipes are set to true line, grade, and plumb.
3. Verify structure and pipe dimensions and thickness.
4. Measure actual inside dimensions of all flexible pipe prior to installation. Use these dimensions when sizing the mandrel should deflection testing be required.
5. Storm sewer shall be inspected by flashing a light between manholes or by physical passage where space permits.
 - a. Lamping shall be done after pipe trench backfill is compacted and brought to grade or pavement subgrade.
 - b. Full pipe diameter ("full moon") shall be visible for grade alignment.
 - c. No less than half pipe diameter ("half-moon") shall be visible for horizontal alignment.

D. Video Recording

1. The Contractor shall be responsible to video record the entire newly installed storm sewer system at least 30 days after completion of backfill and one month before the Town gives final acceptance for the two-year warranty.
 - a. The video recording inspection shall be performed by an outside independent testing agency acceptable to the Town.
2. The recording shall be made using a color camera, self-propelled or other, having sufficient light to show detail of problem areas and joints.
3. Camera speed shall not exceed 3 feet per second. If problems or concerns are seen by the operator, then the camera shall be reversed and an extended look at the area will be recorded.
4. All recordings will have time, date, and footage displayed. Supplement the video recording with a written log or orally recorded tape log noting observations, findings, and deficiencies shown on the video tape.
5. The video tape and log will be given to the Inspector for review. If the Town finds any problems with the storm sewer, the Contractor will repair the problem and re-camera that area before final acceptance will be approved at no added cost to the Town.
6. Video recording of storm sewer may be waived if pipe diameter is sufficient for man access, as determined by the Public Works Director or designee, but a log shall be developed.
7. One copy of the video tape and log will become permanent Town property and record.

E. Manhole Testing

1. The finished manholes are expected to be as watertight as the pipe system in which it is incorporated.
2. Observed leaks (infiltration or exfiltration) at any time within the warranty period shall be cause for rejection.

F. Stormdrain Pipeline Air Testing

1. If after the visual inspection and video recording of the storm trunk or lateral lines, the Town’s Inspector finds that there is a potential joint tightness problem (or excessive deflection) air testing of the line may be required.
 - a. A test section shall not be any longer than the length of pipe between adjacent manholes. Air testing applies to only circular pipe and not elliptical, arch or box sections.
 - b. Reference ASTM C1214, latest revision.
 - c. The low-pressure air test shall occur at least 30 days after completion of the backfilling and compaction.
 - d. If the Inspector determines that reliable and uniform results are produced by the Contractor’s construction techniques, the air test may occur after initial backfill and compaction.
2. The Contractor shall provide all equipment and personnel to perform the tests.
3. The Inspector shall record times and pressure and vacuum readings during the test period.
4. Pressure testing may be waived in lieu of individual joint testing.
5. The ends of the storm sewer pipe being tested shall be plugged and braced.
6. It is recommended that the inside of the pipe be wetted prior to testing.
7. The length of pipe being tested shall be pressurized to 4.0 psi, allow the air to stabilize, then drop pressure to 3.5 psi.
8. The pressure pump shall be turned off and the time monitored.
9. The pressure must not drop more than 1 psi, for the amount of time indicated by using the following formula:

$$T = \frac{LD^2 \cdot 0.00037 D^2 \times L}{Q}$$

Where: T = time of test (in seconds),

L = length of pipe (in feet),

D = diameter of pipe (in inches).

Q = allowable air loss (see Table 1: Stormdrain Air Testing)

10. Sections of the pipe which fail the air test, shall have the defects repaired, and the test shall be repeated.
11. The initial air testing, repair and repeat testing of the failed section of pipe shall be repeated at no added cost to the Town until the testing requirements are met.

Table 1: Stormdrain Air Testing		
PIPE DIAMETER (inches)	TEST DURATION (Minutes per 100 feet)	Q (Ft ³)
18	2.4	5
21	3.0	5.5
24	3.6	6
27	4.0	6.8
30	4.4	7.5
33	4.9	8.3
36	5.3	9
42	6.2	10.5
48	7.1	12
54	8.0	15
60	8.9	13.5
66	9.8	16.5
72	10.7	18

G. DEFLECTION TEST - FLEXIBLE PIPE

1. If after the visual or video inspection of the storm trunk or lateral lines, the Town’s Inspector finds that there is “egging or deflection” of a section of pipe, a deflection test shall be performed on that section of pipe installed. Test shall be performed using an odd-legged mandrel pulled through the pipe without mechanical assistance or by laser profiling. The mandrel size shall be the actual inside diameter of the subject pipe (manufacturer’s submittal, field verified) minus 5% of that diameter. The mandrel shall have no less than nine legs.
2. Any pipe failing any deflection test shall be removed, replaced, and retested.
3. At the end of the two-year warranty period, the flexible storm pipe will be visually inspected for “egging or deflection”. If excess deflection is observed, the Owner/Warranty Holder will, at his/her expense, retest questionable portions per this section.

H. REPAIR

1. Repair or replace any unacceptable work at no additional cost to the Town.
2. Repair all visible leaks.
3. Remove any concrete webs or protrusions.
4. Remove form ties and repair tie holes.

II. Water System Disinfection

A. Disinfection of Domestic Water Lines

1. The developer shall employ and pay for a water quality lab to perform all of the testing required by this section.
2. The Developer shall be responsible for all costs associated with water quality testing.
3. The Contractor shall contact both the Town and the Town's water quality lab to arrange for testing at least 48 hours prior to testing.

B. General

1. Flush and satisfactorily disinfect new water lines prior to placing in service in accordance with AWWA C651-86.
2. Clean and swab the interior of the pipe, fittings, valves, or appurtenances with a 5 percent (50,000 ppm) hypochlorite disinfecting solution if dirt, trench water, or other contaminants enter the pipe or will not be removed by flushing operations.
3. Manipulate valves to prevent the disinfection solution from flowing back into the line supplying the water or into adjacent parts of the in service distribution system.
4. Operate valves and appurtenances while the lines are filled with chlorinated water.

C. Flushing

1. Preliminary flushing: Flush pipelines at a minimum velocity of 2.5 ft/sec to remove foreign material prior to disinfection.
 - a. Do not use preliminary flushing if the tablet method of disinfection is approved by Town Engineer.
2. Final flushing: Flush chlorinated water from the lines after chlorination until the chlorine concentration is no higher than that prevailing in the system, or less than 1 mg/l, whichever is higher.

D. Methods

1. In general, apply chlorine using the continuous feed method.
 - a. Slug method may be used on large diameter pipe where continuous feed is not practical.
 - b. Tablet method may be used on a short extensions up to 2500 feet of water lines 20 inch and smaller.
2. Continuous Feed Method
 - a. Introduce chlorinated water into the lines at a constant rate so that the chlorine concentration in the water lines is maintained at a minimum of 50-mg/l available chlorine.
 - b. Fill the entire main with the chlorine solution.
 - c. Retain the chlorinated water in the main for at least 24 hours at which time the treated water shall contain no less than 25 mg/l chlorine throughout the length of the main.
3. Slug Method
 - a. Introduce chlorinated water into the lines at a constant rate so that the chlorine concentration in the water lines is maintained at a minimum of 300-mg/l available chlorine.
 - b. Apply for a sufficient period of time to develop a solid column of chlorinated water that will expose all interior surfaces for a period of at least 3 hours.
 - c. Measure chlorine residual at the upstream end of the line.

4. Tablet Method
 - a. Do not use if trench water or foreign material has entered the line or if the water temperature is below 5° C (41° F).
 - b. Use only when scrupulous cleanliness has been exercised due to the fact that preliminary flushing is not possible with this method.
 - c. Place tablets in each section of pipe, hydrants, hydrant leads, and other appurtenances in sufficient number to produce a minimum chlorine concentration of 50 mg/l. Reference Table 4, AWWA C651-86.

III. Water System Testing

A. Hydrostatic Testing

1. This section covers the hydrostatic testing of water distribution and transmission lines.

B. Timing of Tests

1. Conduct pressure test and leakage test concurrently.
2. Do not test until at least 7 days have elapsed after the 1st concrete thrust restraint has been cast.
 - d. 36 hours minimum shall elapse if high-early-strength cement is used.
3. Conduct tests in increments not to exceed 2 miles of pipe as construction progresses.
4. No allowance shall be made for pressure reductions accomplished by means of pressure reducing valves or other mechanical means.
5. Prior to tests Contractor and Engineer shall inspect valves within the test section to make sure they are fully open.

C. Hydrant Tests

1. Test with the hydrant main valve closed and the auxiliary line valve open.

D. Pressure Tests

1. Preparation:
 - e. Slowly fill pipe with water.
 - f. Remove all air.
 - g. Install corporation cocks at high points to evacuate the air if permanent air vents are not located there.
2. Leave pipe filled with water at working pressure for a minimum of 24 hours prior to the hydrostatic pressure test.
3. Test Pressure:
 - a. For steel pipe, ductile iron pipe and PVC pipe, use a test pressure of 1½ times the working pressure measured at the lowest elevation of the pipeline test section or the working pressure plus 50 psi, whichever is greater.
 - b. Maintain the test pressure within + 5 psig of the test pressure for at least 2 hours.

E. Leakage Test

1. Leakage is the quantity of water that must be added to the pipeline to maintain pressure within 5 psi of the specified test pressure after the air has been expelled and the pipe is filled with water.
2. Maximum allowable leakage:

- a. For ductile iron pipe and PVC pipe:

$$L = ND (P^{1/2}) H 7400$$

Where:

- L = Maximum allowable leakage in gallons.
- N = Number of joints in the length of pipeline tested.
- D = Nominal pipe diameter in inches.
- P = Average test pressure during the leakage test in psig.
- H = Number of test hours.

Table 2: Gallons of Allowable Leakage per 100 Couplings per Hour*									
PIPE DIAMETER	AVERAGE TEST PRESSURE AT LOWEST POINT IN LINE -PSI								
	50	75	100	125	150	175	200	225	250
4	0.71	0.87	1.00	1.12	1.23	1.32	1.42	1.51	1.58
6	1.06	1.29	1.51	1.68	1.84	1.98	2.12	2.25	2.37
8	1.42	1.72	2.00	2.24	2.45	2.64	2.84	3.00	3.16
10	1.77	2.15	2.50	2.79	3.07	3.40	3.54	3.75	3.95
12	2.12	2.58	3.00	3.35	3.68	3.96	4.24	4.52	4.74
14	2.48	3.01	3.50	3.91	4.28	4.62	4.96	5.26	5.50
16	2.83	3.44	4.01	4.47	4.89	5.27	5.68	6.00	6.32
18	3.18	3.87	4.52	5.02	5.52	5.93	6.37	6.75	7.11
20	3.54	4.30	5.00	5.58	6.12	6.58	7.08	7.51	7.90
21	3.73	4.54	5.24	5.88	6.40	6.92	7.42	7.86	8.28
24	4.24	5.16	6.00	6.69	7.34	7.91	8.50	9.01	9.47
27	4.77	5.83	6.74	7.56	8.23	8.90	9.54	10.12	10.66
30	5.30	6.45	7.51	8.37	9.18	9.88	10.62	11.26	11.84
33	5.83	7.13	8.24	9.25	10.06	10.88	11.67	12.36	13.02
36	6.37	7.75	9.01	10.07	11.02	11.88	12.71	13.50	14.22
39	6.88	8.42	9.74	10.83	11.90	12.96	13.79	14.61	15.40
42	7.42	9.08	10.48	11.78	12.82	13.85	14.86	15.74	16.58
* Data is based on 150 psi and represents a leakage of approximately 30 gpd per mile of pipe, per inch of pipe diameter—for pipe placed in 13-foot lengths.									

- 3. When testing against closed metal-sealed valves, an additional leakage per closed valve of 0.0078 gal/hour/inch of nominal valve size will be allowed.
- 4. Acceptance
 - a. Acceptance shall be on the basis of maximum allowable leakage.
 - b. Locate and repair defective materials and joints if the tests disclose leakage greater than that specified.
 - c. Repeat tests until the leakage is within the permitted allowance.

V. Sewer System Testing

A. Scope

1. All sanitary sewer pipelines shall be air tested per these specifications.
2. All sanitary sewer manholes shall be vacuum tested per these specifications.
3. All sanitary sewer collection systems shall be video inspected per these specifications.

B. Quality Assurance

1. Standards (as applicable).
 - a. ASTM C1244, Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum), latest revision.
 - b. ASTM F1417, Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air, latest revision.

C. General

1. Testing shall be conducted when:
 - a. Backfill and compaction has been completed but before street improvements are installed.
 - b. Main and manholes have been thoroughly cleaned of all foreign material.
 - c. The Contractor shall furnish all equipment, labor, and incidentals necessary to perform tests.
 - d. The maximum allowable pressure gauge shall be 0.1 psi.
2. The Town shall witness tests and record times, leakage readings, and pressure over the test period.
 - a. Contractor shall provide the Town a minimum 48 hours advance notice of any tests.
3. All tests shall occur after completion of backfilling and compaction but prior to paving unless otherwise stated in these specifications.

D. Alignment Test

1. Video each section of sanitary sewer between manholes to determine whether any displacement of pipe has occurred.
 - a. Videoing shall be done after pipe trench is compacted and brought to grade or pavement subgrade and submitted to the Town.
 - b. "Full moon" shall be visible for grade alignment.
 - c. No less than "half moon" shall be visible for horizontal alignment.
 - d. Repair poor alignment, displaced pipe, or other defects discovered.

E. Pipe Deflection Test

1. Each section of sanitary sewer shall be tested for deflection by an independent testing firm as hired by the Contractor prior to Town acceptance and as deemed necessary within the warranty/construction period by the Town.
 - a. The maximum allowable deflection for Town acceptance is 5% of the base internal diameter.
 - b. The maximum allowable deflection at the end of the warranty period shall be 7.5% of the base internal diameter.
2. Mandrel outside diameters in inches, see Table 3: Mandrel OD's.

Table 3: Mandrel OD's			
Pipe Size	Base I.D.	5% Deflection Mandrel	7.5% Deflection Mandrel
6	5.742	5.455	5.311
8	7.665	7.282	7.090
10	9.563	9.085	8.846
12	11.361	10.793	10.509
15	13.898	13.203	12.856
18	16.976	16.127	15.703
21	20.004	19.004	18.504
24	22.480	21.356	20.794
27	25.327	24.061	23.427

F. Air Testing Sanitary Sewer Mains

1. Conduct tests in conformance with ASTM F1417, Time Pressure Drop Method, and these specifications.
2. Preparation for tests:
 - a. Flush and clean the sewer line prior to testing in order to wet the pipe surfaces and produce more consistent results.
 - b. Provide a relief valve on the pressuring equipment to avoid over-pressurizing and damaging an otherwise acceptable line. a. Set relief valve at 5 psi.
 - c. Plug and brace all openings in the main sanitary sewer line and the upper connections.
 - d. Check all pipe plugs with a soap solution to detect any air leakage.
 - e. If leaks are found, release the air pressure, eliminate the leaks and start the test procedures over again.
3. Test Procedure
 - a. Add air until the internal pressure of the sewer line is raised to approximately 40- psi gage.
 - b. Maintain the air pressure between 3.5 psig and 4.5 psig until the air temperature in the pipe is stabilized with the pipe/ground temperature.
 - c. Disconnect the air supply and reduce the air pressure to 3.5 psig before starting the test.
 - d. If the groundwater is higher than the top of the pipe, the test pressure shall be adjusted to account for the high groundwater. The test pressure shall be increased by 0.43 psi per foot of ground water up to five feet (5') of ground water. For ground water over five feet (5') in depth, an infiltration test shall be conducted in place of the air test. Contact the JWWD for infiltration testing procedure and criteria.
 - e. Determine the time required for the air pressure to drop from 3.5 psig to 2.5 psig.
 - f. The time elapsed shall not be less than:

$$(DK) T=0.085 (Q)$$

Where:

- T = Shortest time (s) allowed for the air pressure to drop 1.0 psig
- K = 0.000419 DL but not less than 1.0
- Q = leak rate in cubic feet/minute/square feet of internal surface = 0.0015 CFM/SF
- D = measured average inside diameter of pipe (in)
- L = length of test section (ft)

4. Example calculation for an 8-inch diameter sanitary sewer pipe with a test section 400 feet long:

$$T = 0.085 [8\text{in}(0.00419)(8\text{in})(400\text{ft})] 0.0015\text{CFM/SF}$$

$$T = 608 \text{ seconds or } 10 \text{ minutes } 08 \text{ seconds (10:08)}$$

5. The Table 4: Test Durations for Length of Pipe Indicated contains the test durations for pipe diameters between four (4") and fifteen (15") inches, for pipe lengths up to 500 feet. The test durations for pipe larger than fifteen inches (15") shall be calculated using the formula given above.

Table 4: Test Durations for Length of Pipe Indicated (duration shown in <i>minute:second</i>)							
PIPE DIAMETER	PIPE LENGTH						
	0-150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	500 ft.
4"	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6"	5:40	5:40	5:40	5:40	5:40	5:42	7:07
8"	7:34	7:34	7:34	7:36	8:52	10:08	12:38
10"	9:26	9:26	9:53	11:52	13:51	15:49	19:45
12"	11:20	11:24	14:15	17:05	19:56	22:47	28:26
15"	14:10	17:48	22:15	26:42	31:09	35:36	44:26

6. If lateral or service lines are included in the test, their length may be ignored for computing required test time if the test time requirements are met. If the test section fails, time shall be recomputed to include all the lateral lengths using the following formula:

$$T = 0.085 \left(\frac{D_1^2 L_1 + D_2^2 L_2 + \dots + D_n^2 L_n}{D_1 L_1 + D_2 L_2 + \dots + D_n L_n} \right) \frac{K}{Q}$$

Where:

T = Shortest time (s) allowed for the air pressure to drop 1.0 psig

K = 0.000419 DL but not less than 1.0

Q = leak rate in cubic feet/minute/square feet of internal surface = 0.0015 CFM/SF

D₁, D₂, etc. = measured average inside diameter of pipe (inches)

L₁, L₂, etc. = length of test section

- a. If the recomputed test time is short enough to allow the section tested to pass, then the test section meets the requirements of this specification.
7. Sections of the pipe that fail the air test shall have the defects repaired and the test repeated.

G. Vacuum Testing Manholes

1. Manholes shall be tested before the ring and cover and grade adjustment rings are installed, and after backfilling and compaction is complete.
2. Conduct tests in conformance with ASTM C1244 and these specifications.
3. Preparation for tests:
 - a. All lift holes, joints, and other imperfections shall be filled with an approved non-shrink grout, to provide a smooth finish appearance.
 - b. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manholes.
4. Test Procedure:
 - a. The test shall be placed at the top of the manhole in accordance with the manufacturer’s recommendation.
 - b. A vacuum of 10-inches mercury shall be drawn in the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off.
 - c. The time shall be measured for the vacuum to drop to 9-inches mercury.
 - d. The manhole shall pass if the time for the vacuum reading to drop from 10-inches mercury to 9-inches mercury meets or exceeds the values indicated in the following table.
5. If the manhole fails any test, necessary repairs shall be made by an approved method and the manhole shall be retested until a satisfactory test is obtained.

Table 5: Minimum Test Times for Manholes (Duration show in <i>minutes</i>)			
DEPTH (feet)*	MH DIAMETER		
	48"	60"	72"
8	<i>20</i>	<i>26</i>	<i>33</i>
10	<i>25</i>	<i>33</i>	<i>41</i>
12	<i>30</i>	<i>39</i>	<i>49</i>
14	<i>35</i>	<i>46</i>	<i>57</i>
16	<i>40</i>	<i>52</i>	<i>67</i>
18	<i>45</i>	<i>59</i>	<i>73</i>
20	<i>50</i>	<i>65</i>	<i>81</i>
22	<i>55</i>	<i>72</i>	<i>89</i>
24	<i>59</i>	<i>78</i>	<i>97</i>
26	<i>64</i>	<i>85</i>	<i>105</i>

*Round actual depth of manhole to next depth up in table (e.g., 11 foot depth manhole, use depth of 10 feet)

H. Televising Sanitary Sewer Main

1. All sanitary sewer lines shall be televised three (3) months prior to the end of the warranty period or as deemed necessary within the warranty/construction period by the Town. The televising shall be made by the Contractor or a Sub-consultant to the contractor and the recording shall be submitted to the Town for acceptance.
 - a. The recording shall be made using a color camera, self-propelled or other having sufficient light to show detail of problem areas and joints.
 - b. Camera shall have a swivel head capable of looking up each service connection.
 - c. Camera speed shall not exceed three feet (3') per second.

- d. If problem areas or concerns are seen by operator, then the camera shall be backed up and an extended look at the area will be recorded.
 - e. All recordings will have location (i.e., manhole # to manhole #), time, date, and footage displayed.
2. The warranty period for the sanitary sewer collection system WILL continue to be in effect for the time specified in Town of Johnstown DESIGN STANDARDS Volumes I and II, latest edition, or until the Town has received and approved the video recordings, whichever is longer.

END OF SECTION