

APPENDIX B:

ACCEPTANCE OF UNDERGROUND FACILITIES

**DESIGN AND CONSTRUCTION STANDARDS FOR POTABLE WATER, RAW,
RECYCLED WATER AND WASTEWATER INFRASTRUCTURE**

Global Water Resources

GLOBAL WATER RESOURCES (GWR)**DESIGN STANDARD****ACCEPTANCE OF UNDERGROUND FACILITIES****BACKGROUND**

This Design Standard details the requirements for acceptance of builder/contractor-deployed infrastructure into the Utility's inventory.

Reference to MAG Specification is based on MAG January, 2020 Revision. Newer MAG specifications and details should be used when available.

GENERAL

No new utility improvements shall serve a customer until Global Water is satisfied that all of the facilities have been properly installed, constructed and/or disinfected.

No untreated sewage or inadequately treated wastes to a ditch, stream or lake without a written permit from the applicable regulatory agencies prior to the time of discharge.

No other utility lines or systems are to be placed in the same trench as sewer lines, reclaimed water lines or potable water lines without the prior written authorization from Global Water.

No person shall install, permit to be installed or maintain an interconnection or other connection between any part of the sewerage or reclaimed water systems and a potable water supply or a public water supply in such manner that sewage, reclaimed or waste may find its way into or otherwise contaminate any potable or public water supply. The developer shall provide an approved backflow prevention device for any water connection to the potable water system that will be used for any construction purposes. The contractor/developer will be required to secure the meter and the backflow prevention assembly from Global Water. The backflow prevention assembly shall be tested by a certified backflow prevention professional prior to start of operation and at any time it has been physically disconnected and reconnected. The number of connection points shall be determined by Global Water. Any other connections will not be allowed until all on-site facilities have been tested. Upon acceptance of the water facilities, the meter and backflow prevention assembly shall be removed, and all temporary connections completed.

An air gap between the potable water supply and any water or wastes on site shall always be maintained.

Testing Requirements

All ADEQ or its delegated authorities required testing shall be accomplished in the presence of the Engineer of Record or his authorized representative. All testing shall also include the Global Water inspector or his/her representative. Global Water shall be notified at least 48 hours in advance of the testing. Weekend and holidays are not considered as part of the notification period.

FINAL APPROVAL/ACCEPTANCE OF UTILITIES

No new utilities will be accepted by Global Water until the following has occurred:

1. All installed facilities have been inspected, tested and accepted,
2. A video of all sewer infrastructure has been completed.
3. A copy of all test reports, including trench compaction tests, and inspections has been provided to Global Water.
4. All punch list items required by the Global Water inspector have been addressed.
5. A signed ADEQ or its delegated authorities "Certificate of Approval of Construction" has been provided to Global Water.
6. A letter of "Provisional Completion" has been issued by the Global Water Inspector.
7. Record drawings (as-builts) have been supplied to Global Water by the engineer of record including AutoCAD files.
8. The developer has furnished copies of the contract, and unconditional liens waivers from the contractor.
9. Any other outstanding issues have been addressed.

Three 11x17 half sized black-line sets of as-built drawings, one full-sized set and one electronic set shall be provided with at least two points referenced to Global Water's GIS system. Drawings shall be supplied in a file format compatible with AutoCAD, ESRI and PDF.

Three hard copy set of as-built drawings and one electronic set on CDR disk shall be provided with at least two points referenced to Global Water's GIS system. Drawings shall be supplied in a file format compatible with AutoCAD.

CRITERIA

The Design Standard is divided into four Sections:

- I. Inspection, Testing and Acceptance of Gravity Flow Sanitary Sewers
- II. Inspection, Testing and Acceptance of Manholes
- III. Inspection, Testing and Acceptance of Sewer Force Mains
- IV. Inspection, Testing and Acceptance of Water Mains

Section I: INSPECTION, TESTING, APPROVAL AND ACCEPTANCE OF GRAVITY FLOW SANITARY SEWERS

APPLICATION

This section applies to the inspection, testing and acceptance of gravity flow sanitary sewers, including appurtenances normally installed as part of the system. The work includes leakage testing, deflection testing of flexible pipe system and video inspection of the interior of the finished sewer system.

MATERIALS

Equipment necessary for any of the tests shall be of the type, quality and capacity to perform the operations required and to execute the tests specified, and shall be furnished by the Contractor, including all labor and materials.

INSPECTION

Global Water's Inspector shall inspect and accept all work accomplished.

CLEANING

Prior to testing any section of sewer, the Contractor shall remove all foreign matter from the interior of the system. Flushing a cleaning ball, pressure jetting or other appropriate cleaning method approved by Global Water's Inspector may be used. Watertight plugs or other methods approved by Global Water's Inspector shall then be used to prevent dirt or debris from entering the system.

The material jetted downstream shall be intercepted and removed by the hydrovac truck. Under no circumstances shall material be allowed pass into the Utility's backbone infrastructure.

TESTING

Testing shall be conducted by the Contractor and at its own expense. Testing shall be conducted after the backfilling has been completed but prior to the placement of the finished surface material. The following tests are required:

1. Deflection Test
2. Watertight Integrity Test
3. Video Survey

All testing shall be accomplished in the presence of the Engineer of Record or its authorized representative and the Global Water Inspector or its authorized representative.

All Test shall be performed per MAG specifications and the following requirements. In case of difference between MAG specifications and Global Water Standards, the most stringent requirement shall apply.

Global Water shall be notified 48 hours in advance of the testing.

Testing shall not commence on any portion of the pipeline, until all field placed concrete in contact with the pipe, fittings or appurtenances is adequately cured.

Engineer of Record shall review all testing records, identify deficiencies if any, recommend mitigations as appropriate and certify to the implementation of mitigations and the correction of deficiencies. Copies of testing results, recommendations and mitigations report certified by Engineer of Record shall be submitted and accepted by Global Water as part of the acceptance submittal.

DEFLECTION TEST

All sewer pipe made of flexible materials shall be subjected to a deflection test as per MAG 611.4.C. Deflection tests shall be conducted in the presence of the Engineer of Record or its authorized representative and the Global Water's Inspector or its designate and after the pipe has been installed and backfilled.

The deflection test shall be conducted by pulling a mandrel (go-no go device) through the pipe. The mandrel shall be designed and sized for each size of pipe and shall be at least 1.5 pipe diameters in length. The mandrel shall be constructed with an odd number of runners placed parallel to the pipe centerline and equally spaced around the perimeter of the mandrel. Mandrels for 8 inch pipe shall be constructed with at least 9 runners, and more runners shall be utilized for larger pipe sizes. Test mandrel shall be furnished by the Contractor. All test equipment, calibration data and procedures shall be subject to the approval of Global Water's Inspector.

Criteria

Ring or diametric deflection of the installed pipe shall not exceed 5% of the design internal diameter of the pipe. Pipe sections that restrict free passage of the mandrel shall be removed and replaced or excavated, re-bedded, backfilled and retested.

All such repairs, replacement, remedial work and retesting performed by the Contractor shall be at its expense.

The deflection test may be conducted concurrently with the video inspection of the pipe interior, subject to approval by Global Water.

Engineer of Record shall review all testing records, identify deficiencies if any, recommend mitigations as appropriate and certify to the implementation of mitigations and the correction of deficiencies. Copies of testing results, recommendations and mitigations report certified by Engineer of Record shall be submitted and accepted by Global Water as part of the acceptance submittal.

VIDEO INSPECTION

The sewer shall be inspected by video camera prior to final acceptance of the pipeline as per MAG 611.4.D. The costs incurred in making inspections by video camera prior to acceptance of pipes shall be borne by the Contractor.

Video equipment expressly designed for pipeline inspection purposes and operated by experienced and qualified personnel shall be pulled through the entire pipeline. The video operator shall maintain a log of all inspections and note location, type and extent of any deficiencies. The video operator shall also photograph all deficiencies.

The Contractor shall bear all costs incurred in correcting deficiencies found during the video inspection, including cost of additional video inspection required to verify correction of noted deficiencies.

The video shall verify the uniform slope of the entire system length, including any installed laterals.

Video inspection conducted solely for the Contractor's benefit shall be at the Contractor's expense.

Engineer of Record shall review all testing records, identify deficiencies if any, recommend mitigations as appropriate and certify to the implementation of mitigations and the correction of deficiencies. Copies of testing results, recommendations and mitigations report certified by Engineer of Record shall be submitted and accepted by Global Water as part of the acceptance submittal.

A hardcopy and electronic copy of the video shall be furnished to the Global Water.

WATERTIGHT INTEGRITY

The Contractor shall test the sewer line for leakage using MAG Specification 611.4.A and B and the applicable method below and record the results:

1. Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air (ASTM F 1417-92)
2. Standard Practice for Testing Concrete Pipe Sewer Lines by Low Pressure Air Test Method (ASTM C 924-89)
3. Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines (ASTM C 828-98)

ACCEPTANCE

The Contractor shall remedy, at his own expense, any poor alignment or any other defects in workmanship or materials revealed by final inspection. Final acceptance will be based on Engineer of Record certification and the re-inspection of the sewer after the appropriate repairs and corrections are completed.

Flow of any kind into the existing sewerage system shall not be allowed until the sewer has been satisfactorily completed and accepted for use by Global Water.

Portions of the work completed may be placed in operation after all cleaning, testing and inspection requirements have been fulfilled. Such partial use or partial acceptance shall be subject to approval of Global Water's Inspector.

Under no circumstances shall any portion of the sewer collection system be placed in operations unless the pipeline is able to discharge directly to the Utility's backbone system. Upstream collection, hauling/pumping of raw wastewater will not be allowed.

SECTION II: INSPECTION, TESTING, APPROVAL AND ACCEPTANCE OF MANHOLES**APPLICATION**

This section applies to the inspection, testing, approval and acceptance of manholes. The work includes leakage testing.

MATERIALS

Water used for watertight integrity tests shall be potable water, reclaimed water or as otherwise accepted by the Global Water Inspector.

Equipment necessary for any of the tests shall be of the type, quality and capacity to perform the operations required and to execute the tests specified and shall be furnished by the Contractor including all labor and materials (including water).

INSPECTION

Global Water's Inspector shall inspect and accept all work accomplished.

CLEANING

Prior to testing any manhole, the Contractor shall remove all foreign matter from the interior of the manhole. Chunks of concrete, mortar or other debris (including dirt that may have intruded into the interior of the manholes) shall be removed by mechanical means. Small gravel or grit may be removed by flushing, pressure jetting or other appropriate cleaning methods accepted by Global Water. After cleaning, the manhole cover shall be positioned to prevent dirt or debris from entering the manhole. Other means of preventing intrusion of dirt or debris may be employed if accepted by Global Water.

Any material jetted downstream shall be intercepted and removed by a hydrovac truck. Under no circumstances shall material be allowed to pass into the Utility's backbone infrastructure.

TESTING

1. Testing shall be conducted by the Contractor at its own expense. Testing shall be conducted after the asphalt has been laid, and the final adjustments have been made in manhole heights. The following tests are required:
2. All testing shall be accomplished in the presence of the Engineer of Record or its authorized representative and Global Water Inspector or its authorized representative.
3. Global Water shall be notified 48 hours in advance of the testing.
4. Testing shall not commence until all field placed concrete in contact with the pipe, fittings or appurtenances is adequately cured.

WATERTIGHT INTEGRITY

The Contractor shall test manholes using one of the following test protocols:

1. Watertight testing by filling the manhole with water. The maximum acceptable water drop is 0.001 of the total manhole volume in one hour.

2. Air pressure testing using the "Standard Test Method for Concrete Sewer Manholes by Negative Air Pressure (Vacuum) Test (ASTM C 1244-93). Air pressure testing requirement maybe waived if manhole(s) passes a spark testing at Global Water discretion.
3. SPARK TESTING: All coated manholes shall be spark tested prior to being placed in service. Spark testing shall be required of the entire surface area of the manhole (field and joint) and shall be conducted in accordance with the liner manufacturer's recommendations.

Manhole testing shall be completed after the installation of the manhole cone to verify the watertight integrity of the manhole from the top of the cone down. Upon satisfactory completion of the test results, the Contractor shall install the manhole ring and any spacers, complete the joints and seal the manhole to a watertight condition.

If the manhole cone, spacers and ring can be installed to final grade without disturbance or adjustment by later construction, the Contractor may perform the testing from the top of the ring down. In the event an "accepted" manhole is disturbed during follow-on construction activities, the Contractor shall re-test the manhole at Global Water's discretion.

ACCEPTANCE

The Contractor shall remedy, at his own expense, any poor alignment or any other defects in workmanship or materials revealed by final inspection. Final acceptance will be based on the Engineer of Record certification and the re-inspection of the sewer after the appropriate repairs and corrections are completed.

Flow of any kind into the existing sewerage system shall not be allowed until the sewer has been satisfactorily completed and accepted for use by Global Water.

Portions of the work completed may be placed in operation after all cleaning, testing and inspection requirements have been fulfilled. Such partial use or partial acceptance shall be subject to acceptance of Global Water's Inspector. Portions of the work to be placed in operation shall proceed from the connection to the Utility's backbone collection system moving upstream.

SECTION III: INSPECTION, TESTING, APPROVAL AND ACCEPTANCE OF SEWER FORCE MAINS**APPLICATION**

This section applies to the inspection, testing, approval and acceptance of sewer force mains, including appurtenances normally installed as part of the system. The work includes pressure and leakage testing.

MATERIALS

Water employed in testing of sewer force mains shall be potable water, reclaimed water or raw water as determined by Global Water's Inspector.

Equipment necessary for any of the tests shall be of the type, quality and capacity to perform the operations required and to execute the tests specified, and shall be furnished by the Contractor, including all labor, materials and water.

INSPECTION

Global Water's Inspector shall inspect and accept all work accomplished. All tests and inspections shall be made prior to backfilling of the open trench.

CLEANING

Prior to testing any section of sewer force main, the Contractor shall remove all foreign matter from the interior of the system. Flushing a cleaning ball, pig, pressure jetting or other appropriate cleaning method accepted by Global Water's Inspector may be used. Watertight plugs, isolation valves or other methods accepted by Global Water's Inspector shall then be used to prevent dirt or debris from entering the system.

The material jetted downstream shall be intercepted and removed by a hydrovac truck. Under no circumstances shall material be allowed pass into the Utility's backbone infrastructure, including lift stations and receiving manholes.

TESTING

Testing shall be conducted by the Contractor at its own expense. The following tests are required:

1. Pressure Test
2. Leakage Test

Testing shall be performed per Global Water requirements and MAG 611.2 specifications. In case of difference between Global Water requirements and MAG specifications, the more stringent requirement shall be applied.

All testing shall be accomplished in the presence of the Engineer of Record or its authorized representative and the Global Water Inspector or its authorized representative.

Global Water shall be notified 48 hours in advance of the testing.

Testing shall not commence on any portion of the pipeline, until all field placed concrete in contact with the pipe, fittings or appurtenances is adequately cured.

PRESSURE TEST

The line shall be tested at a pressure of 50 psi (or more) above the design working pressure for the pipeline.

The duration of each pressure test shall be as directed by the Global Water Inspector.

Each valved section of pipe shall be slowly filled with water at the specified test pressure measured at the point of lowest elevation. Pressure shall be applied and maintained by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, and all necessary apparatus except meters shall be furnished by the contractor, and the contractor shall furnish all necessary labor for connecting the pump, meter, and gages.

As the line is being filled and before applying the test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, if necessary, at points of highest elevation. After the test, the taps shall be tightly plugged.

During the time the test pressure is on the pipe, the line shall be carefully checked at regular intervals for breaks or leaks. Any joints showing appreciable leaks shall be repaired and any cracked or defective pipes or fittings shall be removed and replaced with sound material in the manner provided and the test shall be repeated until satisfactory results are obtained.

LEAKAGE TEST

After all defects have been satisfactorily repaired and all visible leaks stopped, a leakage test shall be made on each valved section of the lines to determine the quantity of water lost by leakage. The contractor shall furnish all labor, material, and equipment required for making the test. The leakage shall be determined by measuring the quantity of water supplied to each valved section of the lines, during the test period, when the various sections of the lines are under pressure. No pipe installation will be accepted until or unless the leakage as determined by above test is less than the amount set forth below.

The allowable leakage (gallons per hour) shall not be greater than determined by the following formula:

$$A = \frac{LD \sqrt{P}}{148,000}$$

Where:

A = testing allowance (makeup water), gallons per hour.

L = length of pipe tested, feet

D = nominal diameter of pipe, inches.

P = test pressure, pounds/square inch

If individual sections show leakage greater than the limits specified above, the contractor shall, at its own expense, locate and repair the defective joints until the leakage is within the specified allowance.

ACCEPTANCE

The Contractor shall remedy, at its own expense, any poor alignment or any other defects in workmanship or materials revealed by final inspection. Final acceptance will be based on re-inspection of the sewer after the appropriate repairs and corrections are completed.

Flow of any kind into the existing sewerage system shall not be allowed until the inspection and testing of force mains has been satisfactorily completed and accepted for use by Global Water.

Portions of the work completed may be placed in operation after all cleaning, testing and inspection requirements have been fulfilled. Such partial use or partial acceptance shall be subject to approval of Global Water's Inspector.

SECTION IV: INSPECTION, TESTING, APPROVAL AND ACCEPTANCE OF WATER MAINS**APPLICATION**

This section applies to the inspection, testing, approval and acceptance of water distribution mains, including appurtenances normally installed as part of the system. The work includes leakage testing and super-chlorination requirements.

MATERIALS

Water employed in testing of water mains shall be potable water only.

Equipment necessary for any of the tests shall be of the type, quality and capacity to perform the operations required and to execute the tests specified, and shall be furnished by the Contractor, including all labor, materials, chemicals and water.

INSPECTION

Global Water's Inspector shall inspect and accept all work accomplished.

CLEANING

Prior to testing any section of water main, the Contractor shall remove all foreign matter from the interior of the system. Flushing a cleaning ball, pig, pressure jetting or other appropriate cleaning method approved by Global Water's Inspector may be used. Watertight plugs, isolation valves or other methods accepted by Global Water's Inspector shall then be used to prevent dirt or debris from entering the system.

TESTING

Testing shall be conducted by the Contractor and at this own expense. The following tests are required:

1. Pressure Test
2. Leakage Test
3. Fire Flow Test

Testing shall be performed per Global Water requirements and MAG 611.2 specifications and fire department of jurisdiction requirements. In case of difference between Global Water requirements and MAG specifications, the more stringent requirement shall be applied.

All testing shall be accomplished in the presence of the Engineer of Record or its authorized representative and Global Water Inspector or its authorized representative.

Global Water shall be notified 48 hours in advance of the testing.

Testing shall not commence on any portion of the pipeline, until all field placed concrete in contact with the pipe, fittings or appurtenances is adequately cured.

PRESSURE TEST

The line shall be tested at a pressure of 50 psi (or more) above the design working pressure for the system. Pressure testing will be done prior to trench backfill.

The duration of each pressure test shall be as directed by the Global Water Inspector.

Each valved section of pipe shall be slowly filled with water at the specified test pressure measured at the point of lowest elevation. Pressure shall be applied and maintained by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, and all necessary apparatus except meters shall be furnished by the contractor, and the contractor shall furnish all necessary labor for connecting the pump, meter, and gages.

As the line is being filled and before applying the test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, if necessary, at points of highest elevation. After the test, the taps shall be tightly plugged. All fire hydrants within the test section shall be opened to expel any air in the hydrant barrel.

During the time the test pressure is on the pipe, the line shall be carefully checked at regular intervals for breaks or leaks. Any joints showing appreciable leaks shall be repaired and any cracked or defective pipes or fittings shall be removed and replaced with sound material in the manner provided and the test shall be repeated until satisfactory results are obtained.

LEAKAGE TEST

After all defects have been satisfactorily repaired and all visible leaks stopped, a leakage test shall be made on each valved section of the lines to determine the quantity of water lost by leakage. The contractor shall furnish all labor, material, and equipment required for making the test. The leakage shall be determined by measuring the quantity of water supplied to each valved section of the lines, during the test period, when the various sections of the lines are under pressure. No pipe installation will be accepted until or unless the leakage as determined by above test is less than the amount set forth below.

The allowable leakage (gallons per hour) shall not be greater than determined by the following formula:

$$A = \frac{LD \sqrt{P}}{148,000}$$

Where:

A = testing allowance (makeup water), gallons per hour.

L = length of pipe tested, feet

D = nominal diameter of pipe, inches.

P = test pressure, pounds/square inch

If individual sections show leakage greater than the limits specified above, the contractor shall, at his own expense locate and repair the defective joints until the leakage is within the specified allowance.

Fire Flow Test:

A fire flow test shall be performed at the developer/contractor expense by a licensed third party. Test shall be performed in accordance with fire department of jurisdiction requirement.

DISINFECTION OF PIPELINES

On completion of the leakage test and the pressure tests, all water mains are required to be super-chlorinate and tested prior to acceptance.

The contractor shall furnish all labor, equipment and material necessary for the chlorination of the new pipelines which shall be disinfected before being placed in service. The lines shall be disinfected by the application of the NSF certified chlorinating agent. The chlorinating agent may be a liquid chlorine, liquid chlorine gas-water mixture, or a calcium hypochlorite solution, which shall be fed into the lines through a suitable solution-feed device, or other methods approved by the engineer. The chlorinating agent shall be applied at or near the point from which the line is being filled, and through a corporation stop or other approved connection inserted in the horizontal axis of the newly laid pipe. The water being used to fill the line shall be controlled to flow into the section to be disinfected very slowly, and the rate of application of the chlorinating agent shall be in such proportion of water entering the pipe that the chlorine dose applied to the water entering the line shall be at least 50 parts per million (ppm) but shall not be more than 100 parts per million (ppm). The treated water shall be retained in the pipelines for a period of not less than twenty-four (24) hours.

If chlorine in the pipe is greater than 100 ppm, the pipe shall be flushed immediately to reduce the chlorine level to less than or equal to 100 ppm and re-tested. In addition, Global Water may require a certification by the Engineer of Record that pipe and its lining material integrity was not compromised by the elevated chlorine level.

After the 24-hour period, the chlorine level shall be at least 10 ppm. If the chlorine level is 10 ppm or greater, then the system shall be flushed to a chlorine residual of less than 1 ppm or current Global Water distribution system chlorine level, and sampled and analyzed for microbiological growth by an Arizona certified laboratory. Global Water may opt to collect water samples for its own evaluation and satisfaction. On receipt of acceptable microbiological analysis, Global Water may accept the line to be brought into service.

The sampling risers shall be located at representative locations within the water network being tested including the point farthest from the point of chlorination. The risers shall be above ground and equipped with a faucet for control of flow during sampling.

ACCEPTANCE

The Contractor shall remedy, at its own expense, any poor alignment or any other defects in workmanship or materials revealed by final inspection. Final acceptance will be based on Engineer of Record certification and reinspection of the waterline after the appropriate repairs and corrections are completed.

Connection of any end-user shall not be allowed until the water and sewer has been satisfactorily completed and accepted for use by Global Water.

Portions of the work completed may be placed in operation after all cleaning, testing and inspection requirements have been fulfilled. Such partial use or partial acceptance shall be subject to acceptance of Global Water's Inspector.

