SECTION 6500
RECLAIMED WATER DISTRIBUTION SYSTEM

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6510 GENERAL

1. The following Standard Specifications and associated Detail Drawings shall apply to all reclaimed water system extensions and development of Cary's municipal water system. The Standard Specifications and Detail Drawings included herein shall apply to all aspects of Cary's reclaimed water system that extend into Morrisville, RTP, Wake County, Chatham County, and any other areas outside the corporate limits in which the water system is otherwise owned, operated and maintained by the Cary.

   All utility extension permits must be obtained prior to construction. Refer to General Provisions in Section 2000 for further requirements.

2. All utility crossings within Cary streets shall be made by trenchless methods. State maintained streets within the Cary ETJ should also be crossed using trenchless methods. In cases where utility conflicts, rock, or other obstructions prevent trenchless crossings, Cary may consider approving other methods.

3. All aspects of the design and construction of any portion of the reclaimed water distribution system shall, at a minimum, meet the requirements of the North Carolina Department of Environmental Quality (NC DEQ) Division of Water Resources (DWR) and the North Carolina Administrative Code Section 15A NCAC 02T 0909. Requirements presented in the Cary Standard Specifications hereunder that are more restrictive or go above and beyond the state regulated requirements are required by Cary.

4. There shall be no direct cross connections between the reclaimed water and potable water systems. In all cases where reclaimed and municipal potable water are supplied to the same structure and/or other same facility, a reduced pressure principle backflow preventer shall be provided on the municipal potable water service. The privately owned and maintained reclaimed water service piping and other appurtenances shall be identified in conformance with the North Carolina Plumbing Code. When reclaimed water distribution mains are unavailable but planned for future construction in accordance with the Reclaimed Water System Master Plan, any service lines to secondary water use facilities as defined by Policy Statement 132 (entitled Effective Utilization of Reclaimed Water System) shall be constructed in accordance with reclaimed water standards as described herein including all requirements for requisite color and text identification.

5. Extensions of the existing reclaimed water distribution system including locations and sizing shall adhere to any and all Policy Statements, including Policy Statement 132 entitled "Effective Utilization of Reclaimed Water System." Service areas and sizing of reclaimed water trunk lines shall be provided in compliance with all Master Plans pertaining to the reclaimed water distribution system, and/or other requirements as initiated by the Director of Utilities.

6. All relocations of existing or permitted reclaimed water infrastructure including service piping and meter boxes shall be permitted and inspected in conformance with Cary policies and procedures.

7. Any reclaimed water that leaves the reclaimed water distribution system other than by means of a properly permitted use must be disposed of into the Cary sanitary sewer system, unless otherwise approved by the Cary with special provisions for discharge and disposal. This includes any reclaimed water from blowoffs, testing, line flushing, and/or line breaks. In no case shall reclaimed water from blowoffs, testing, flushing, line breaks or other unpermitted uses be discharged onto the ground surface or drainage systems, stormwater ponds, streams or other non-treated systems. Any unpermitted discharge of reclaimed water shall be reported to the Cary immediately and treated as a wastewater spill in accordance with established policies by the Cary and NCDEQ.

8. In all cases where potable water is used to supplement a reclaimed water system, there shall be an approved air gap separation between the potable water system and the reclaimed water system.

9. In all cases where potable water is used to supply reclaimed water distribution mains on an interim basis until such time when reclaimed water is available, there shall be an approved reduced pressure principle backflow preventer, (RP), constructed in accordance with the Cross Connection Ordinance. The reduced pressure principle backflow preventer shall be provided on the branch supply line feeding the reclaimed water system and shall be located within 25-ft of the branch connection with the main potable water trunk line. A reduced pressure principle backflow preventer located on the branch feed to the reclaimed water system will preclude the need for individual backflow preventers on each service connection and allow all reclaimed water services to be constructed as described herein under typical reclaimed service standards and Specifications.

10. The potable water supply shall be isolated by suitable backflow prevention as required by the Cary Code of Ordinances (Chapter 36, Utilities) and the Standard Specifications and Details manual. Once reclaimed water is available to the site, permanent disconnection from the potable water system and connection to the reclaimed water system is required.

    a) RPZ BFP Abandonment Sequence
        1. Contact and coordinate with Cary Reclaimed Water System Supervisor, by dialing 311.
        2. Isolate and turn off the potable valve charging the RPZ BFP
        3. Remove the RPZ unit above ground
        4. Demolish and dispose of the concrete pad and restore the area with mulch.
        5. Cap standpipes attached to the RPZ BFP 3' below grade.

6. Abandon the potable and reclaim valves. Remove the top part of the valve box and fill bottom part of valve box with ABC stone. Repave, fill or mulch patches as needed.
7. Dispose of all removed parts and enclosures at contractor's expense.

6520 RECLAIMED WATER DISTRIBUTION PIPE

A. DESIGN

1. Location: Reclaimed water mains shall be extended along the roadway to the adjacent property line. All reclaimed water mains shall be provided within dedicated street rights-of-way or within dedicated Cary utility and pipeline easements. The minimum width of reclaimed water easements shall be 20-feet. Dedicated easements for reclaimed water mains and appurtenances shall be recorded as "Cary Utility and Pipeline Easement". Cary Utility and Pipeline easements shall contain only Cary utilities unless approved by site plan or encroachment agreement. Greater easement widths shall apply in cases where depth and/or diameter require more than 20-ft for construction, operations and maintenance as directed by the Utilities Department. No permanent structures, equipment, retaining walls, embankments, impoundments, or other elements that would inhibit maintenance operations shall be constructed within a Cary Utility and Pipeline easement. Fences may be allowed across easements provided that appropriate access gates have been installed to allow utility maintenance. Fill or cut slopes greater than 5:1 are not allowed to extend into easements. See Section 2000 for allowable landscape plantings within a Cary easement.

2. Restraint: All reclaimed water distribution mains in the Cary water system shall be restrained. The standard joint restraint shall consist of wedge action retainer glands or bell joint harnesses as approved by Cary. The reclaimed water distribution Specification is based on mechanical restraining methods provided at all joints regardless of pipe material. Typical concrete blocking and rodding shall not be utilized for the reclaimed water system. In all cases where ductile iron and PVC pipe must be joined, the connections shall be fabricated with a restrained sleeve or coupling connection approved by Cary. Direct connections of PVC and DIP piping without an engineered coupling connection shall not be permissible. All plans submitted shall include the pipe restraining plan including the restraint of all joints, fittings, valves, etc. The pipe restraining plan shall be included under the design responsibility of the NC Professional Engineer sealing the plan drawings. Restraining systems not included within this Specification shall require approval from the Cary prior to utilization.

3. Sizing: Reclaimed water mains shall be sized in accordance with good design procedures and the reclaimed water system master plan to provide adequate pressures throughout the system or as directed by the Director of Utilities. The minimum pipe size for reclaimed water mains shall be 4 inches.

4. Depth of Installation: All reclaimed water mains shall have a minimum cover of 4 feet measured from the top of the pipe to the finished grade. When reclaimed water mains are installed along a roadway, they shall be installed at sufficient depth to maintain four (4) feet of cover to the subgrade of any future road improvements including potential vertical alignment changes.

	Water	Storm water	Sewer (Gravity and Forcemain)	Reclaimed
Water	18-inches vertical	**Parallel Installations**: 10-feet horizontal **Crossings**: 18 inches vertical	**Parallel Installations:** 10 feet horizontally **Crossings:** 18-inches vertical separation water main over sewer	**Parallel Installations**: 10-feet horizontal and water line at least 18-inches above reclaimed **Crossings (water main over reclaimed water pipeline)**: Min. 18-in vertical separation
Storm water	**Parallel Installations**: 10-feet horizontal **Crossings**: 18 inches vertical		24-inches vertical	Min. 18-inches vertical.
Sewer (Gravity & Forcemain)	**Parallel Installations:** 10 feet horizontally **Crossings:** 18-inches vertical separation water main over sewer	24-inches vertical	7-feet horizontal separation, increasing with depth	**Parallel Installations:** 10-feet horizontal **Crossings (reclaimed water pipes over sewer pipes)**: 18-inches
Reclaimed	**Parallel Installations**: 10-feet horizontal and water line at least 18-inches above reclaimed **Crossings (water main over reclaimed water pipeline)**: Min. 18-in vertical separation	Min. 18-inches vertical.	**Parallel Installations:** 10-feet horizontal **Crossings (reclaimed water pipes over sewer pipes)**: 18-inches	18 inches vertical

5. Relation to Potable Water Mains and Other Utilities

a) Separation between Potable Water Mains and Reclaimed Water Mains

Parallel Installations: Preferred 10-ft horizontal separation (pipe edge to pipe edge) AND water line at least 18-inches above reclaimed water line measured

vertically from top of reclaimed water pipeline to bottom edge of water main. Because all Cary reclaimed water mains are constructed and tested in accordance with water main standards as outlined under 15A NCAC 18C, when lateral separation standards cannot be met, provide a minimum 3-ft lateral separation.

Crossings (Water Main over Reclaimed Water Pipeline): All water main crossings of reclaimed water mains shall be constructed over the reclaimed water line in conformance with Cary Specifications. At a minimum, 18-inches of clearance shall be maintained between the bottom edge of the water main and the top edge of the reclaimed water main. When the minimum 18-inch clearance cannot be maintained, both the potable water and reclaimed mains shall be constructed of ductile iron pipe in conformance with water main construction standards extending at least 10-ft on both sides of the crossing. When DIP is required for low clearance crossings, reclaimed mains shall be restrained and connected to purple PVC reclaimed main lines with restrained MJ sleeves or other approved couplings and wrapped with purple polyethylene wrap as specified herein. When less than 18-inches of separation is provided, the void space between the pipe crossings shall be filled with minimum 500-psi, quick setting, and non-excavatable flowable fill extending at least 3-ft on both sides of the crossing. Typical potable water service lines may cross above reclaimed water mains made of C-900 or C-905 PVC pipe constructed as specified herein and in general conformance with water main Specifications.

Crossings (Water Main under Reclaimed Water Pipeline): Allowed only on a case-by-case basis and design shall be approved by Cary prior to construction. At a minimum, 18-inches of separation shall be maintained and both potable water and reclaimed water mains shall be constructed of ductile iron in conformance with water main standards extending at least 10-ft on both sides of the crossing. If local conditions prevent 18-inches of clearance, the void space between the pipe crossings shall be filled with minimum 500-psi, quick setting, and non-excavatable flowable fill extending at least 3-ft on both sides of the crossing. DIP reclaimed lines used for low clearance crossings shall be restrained and connected to the typical purple PVC reclaimed main line with restrained MJ sleeve or other approved restraining coupling and shall be wrapped with purple polyethylene wrap as specified herein.

b) Separation Between Reclaimed Water and Sanitary Sewer
Reclaimed water mains shall be laid with at least 10 feet of horizontal separation from existing sanitary sewer lines, measured laterally edge to edge unless the elevation of the bottom of the reclaimed water main is at least 18 inches above the top edge of the sanitary sewer, with a horizontal separation of at least 5 feet. In cases where a reclaimed water main and a sanitary sewer main cross, the crossing shall be constructed at a 90-degree angle. In all cases where a reclaimed water main must cross within 18-inches of an existing sewer main, the reclaimed water main shall be constructed of ductile iron, with joints

in conformance with water main standards, extending at least 10-ft on both sides of the crossing. The void space between the pipes shall be filled with minimum 500-psi, quick setting, and non-excavatable flowable fill extending at least 3-ft on both sides of the crossing. When DIP is required for low clearance crossings, reclaimed mains shall be restrained and connected to purple PVC reclaimed main lines with restrained MJ sleeves or other approved couplings and wrapped with purple polyethylene wrap as specified herein.

c) Separation Between Reclaimed Water and Storm Sewer
Reclaimed water mains shall be laid above or below storm sewer mains with a minimum vertical separation of 18 inches when horizontal separation is from 5 feet to 10-ft laterally, unless otherwise approved by the Director of Utilities. Where a reclaimed water main and a storm sewer cross, the crossing shall be constructed at a 90-degree angle and the reclaimed water main shall cross at least 18-inches above or below the storm sewer. In all cases where a reclaimed water main must cross within 18-inches of an existing storm sewer main, the reclaimed water main shall be constructed of ductile iron extending at least 10-ft on both sides of the crossing with joints in conformance with water main standards. The void space between the pipes shall be filled with minimum 500-psi, quick setting, and non-excavatable flowable fill extending at least 3-ft on both sides of the crossing. When DIP is required for low clearance crossings, reclaimed mains shall be restrained and connected to purple PVC reclaimed main lines with restrained MJ sleeves or other approved couplings and wrapped with purple polyethylene wrap as specified herein.

d) Separation between Reclaimed Water and Wells. Reclaimed water distribution lines shall not be less than 100 feet from a well. Where the required minimum separation from wells cannot be met, the Director of Utilities must approve, and the piping and integrity testing procedures meet potable water main standards. In no case shall the separation be less than 25 feet from a private well or 50 feet from a public well.

6. Construction Involving Existing Mains:

a) The existing reclaimed water main must remain active and protected during all phases of construction. The contractor must provide a plan for the structural protection of the existing reclaimed water main.

b) A proposed construction sequence must be submitted for any demolition of a portion of existing reclaimed water main. The plan must be reviewed and approved by Utilities and Public Works

7. Identification of the Reclaimed Water System

a) General:
All PVC pipe shall be colored Pantone 522 purple and be integrally stamped/marked with the words “CAUTION: RECLAIMED WATER – DO NOT

DRINK". The warning shall be stamped on opposite sides of the pipe and repeated every 3-feet or less.

All new distribution piping in the reclaimed water system, including service lines, valves and other appurtenances shall be PVC pipe colored purple and embossed/marked as noted above or be ductile iron pipe installed with a purple polyethylene vinyl wrap as described below. Existing potable water or non-potable utility lines that are being converted to reclaimed water use should first be accurately located and tested in accordance with regulatory requirements. If required, the necessary actions to bring the line and appurtenances into compliance with regulatory standards should be taken. If the existing lines meet approval of the reclaimed water supplier and NCDEQ, the lines can be approved for reclaimed water distribution. If verification of the existing lines is not possible, the lines should be uncovered, inspected, and identified prior to use.

b) Polyethylene Wrap: Buried ductile iron pipe, fittings, gate valves and other appurtenances shall be painted Pantone 522 purple and/or wrapped with a Pantone 522 purple polyethylene membrane conforming to ANSI A21.5 and installed in accordance with AWWA C105. The polyethylene sheets shall be 8 mils thick, minimum.

B. MATERIALS

1. Pipe Material: All reclaimed water main distribution pipe shall be C900 or C905 PVC pipe. The Utilities Department will maintain a list of approved manufacturers for all reclaimed water distribution products. New manufacturers must submit requests for approval to the Utilities Department in accordance with Standard Procedure 120, Manufacturer and Product Approval Guidelines.

2. PVC Pipe

   a) C-900, PVC Pipe, 4 through 12 inches in diameter:
   All PVC pipe in the range of 4 through 12 inches in diameter shall be designed and manufactured in accordance with AWWA C900. The PVC pipe shall be made of virgin PVC resin that provides chemical and physical properties that meet or exceed cell class 12454 as defined in ASTM D1784. All PVC pipe shall be supplied with a minimum pressure rating of 235-psi corresponding to a diameter ratio of 18. All PVC pipe shall be supplied in standard laying lengths of 20-feet. PVC pipe shall have integral wall, bell and spigot joints fabricated with elastomeric gaskets in conformance with ASTM F477 with joints that meet or exceed the performance requirements of ASTM D3139. All PVC pipe joints shall be provided with an approved method of restraint.

C-900 PVC Pipe Sizes

Nominal Pipe Diameter	Pressure Rating	Diameter Ratio	Wall Thickness (inches)	Outside Diameter
4-inch	235	18	0.267	4.80
6-inch	235	18	0.383	6.90
8-inch	235	18	0.503	9.05
10-inch	235	18	0.617	11.10
12-inch	235	18	0.733	13.20

b) C-905, PVC Pipe, 16 through 24 inches in diameter:
All PVC pipe in the range of 16 through 24 inches in diameter shall be designed and manufactured in conformance with AWWA C905. The PVC pipe shall be made of virgin PVC resin that provides chemical and physical properties that meet or exceed cell class 12454 as defined in ASTM D1784. All PVC pipe shall be supplied with a pressure rating of 200-psi corresponding to a diameter ratio of 21. All PVC pipe shall be supplied in standard laying lengths of 20-feet. PVC pipe shall have integral wall, bell and spigot joints fabricated with elastomeric gaskets in conformance with ASTM F477 with joints that meet or exceed the performance requirements of ASTM D3139. All PVC pipe joints shall be provided with an approved method of restraint.

C-905 PVC Pipe Sizes

Nominal Pipe Diameter	Pressure Rating	Diameter Ratio	Wall Thickness (inches)	Outside Diameter
16-inch	200	21	0.829	17.40
18-inch	200	21	0.929	19.50
20-inch	200	21	1.029	21.60
24-inch	200	21	1.229	25.80

3. PVC Bell Joint Restraint: All PVC bell joints shall be restrained for both C900 and C905 PVC pipe. The bell joint restraint shall consist of an approved bell joint restraint harness assembly made of ductile iron, coated with a manufacturer applied epoxy coating or polyester powder coating, and include stainless steel bolts, nuts and rods. The bell joint restraint harness shall be manufacturer approved for use with PVC pipe and rated to the full pressure rating of the pipe with a 2:1 safety factor.

4. Pipe Fittings: Pipe fittings shall be cast or ductile iron designed and manufactured as per AWWA C110. Sizes of fittings up to and including 24 inches shall be designed for an internal pressure of 350 psi, and larger size fittings shall be designed for an internal pressure of 250 psi. Compact ductile iron mechanical joint fittings designed and manufactured as per AWWA C111 are also acceptable. Gaskets shall be provided in conformance with AWWA C111 with EPDM rubber preferred over SBR. Fittings shall have mechanical joints and be lined with cement

mortar with a seal coat of bituminous material, all in accordance with AWWA C104. All fittings shall be restrained to C900 or C905 pipe with an approved wedge action retainer gland or other approved restraining method. All DIP fittings for reclaimed water use shall be identified by painting or wrapping with polyethylene wrap in Pantone 522 purple.

5. Encasement Pipe

a) Encasement pipe shall be new and manufactured of grade 'B' steel with minimum yield strength of 35,000-psi in accordance with ASTM A139 and A283.

b) All casing pipe shall have machine cut, bevel ends that are perpendicular to the longitudinal axis of the casing.

c) Size and minimum wall thickness of smooth wall or spiral welded steel encasement pipe shall be as shown in the below table. Actual wall thicknesses shall be determined by the casing installer based on their evaluation of the required forces to be exerted on the casing when it is installed.

Minimum Wall Thickness of Steel Encasement Pipe

Encasement Pipe Outside Diameter *(inches)*	Minimum Wall Thickness *(inches)*
12-3/4	0.188
14	0.250
16	0.250
18	0.250
20	0.250
24	0.250
26	0.312
28	0.312
30	0.312
36	0.375
42	0.500
48	0.500
54	0.500
60	0.500
66	0.625

d) Encasement pipe installed for railroad bores shall meet the requirements of the American Railway Engineering Association (AREA) for boring under railroads.

e) Encasement pipe shall have the following minimum sizes:

Minimum Allowable Steel Encasement Diameter Per Carrier Size

Carrier Pipe Size Inside Diameter (inches)	Carrier Pipe Outside Bell Diameter Typ. (inches)	Steel Encasement Nominal Diameter (inches)
6	9.19	12-3/4
8	11.33	16
10	13.56	18
12	15.74	20
14	19.31	24
16	21.43	26
18	23.70	28
20	25.82	30
24	29.88	36
30	36.34	42
36	42.86	48
42	49.92	60
48	56.36	66

6. Casing Pipe Spacers and End Closures

a) The carrier pipe shall rest on steel pipe alignment spacers. The spacers shall have either a bituminous or epoxy coating. A minimum of 2 steel spacers per joint shall be required on carrier pipe less than 36-inches. Carrier pipe greater than or equal to 36-inches shall have a third spacer. The steel spacers shall be located evenly along the carrier pipe alignment in such a manner that each spacer supports the same unit weight of carrier main. The spacing interval of the steel spacers shall assure the necessary grade, clearance, and support of the carrier main. The spacers shall be manufactured for the specific carrier pipe and casing pipe diameters being used such that the risers do not allow the pipe to float within the casing.

b) In cases where the encasement pipe is installed near facilities with stray current, such as gas lines, high voltage power transmission lines, petroleum lines, railroad tracks, etc., the steel spacers shall be provided with composite contacts on the runners such as an EPDM rubber liner or an ultra-high molecular weight polyethylene plastic skid to prevent transmitting the stray current to the carrier pipe.

c) The carrier pipe bells shall not be allowed to contact the interior of the encasement pipe under any circumstances.

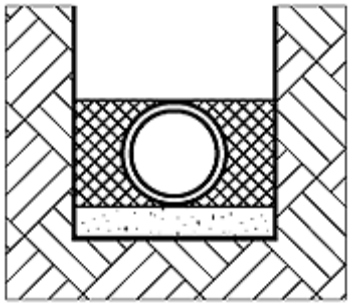
d) No blocks or temporary spacers shall be wedged between the carrier pipe and the top of the encasement pipe.

e) The ends of the encasement pipe shall be sealed using 8-inch bricks and a non-shrink grout.

f) A 2-inch galvanized vent pipe shall be provided on the upper end of the casing on all stream and railroad crossings.

C. INSTALLATION

1. Excavation and Preparation
   a) PVC pipe shall be installed in accordance with AWWA C605. At a minimum, all PVC pipe shall be installed at a Type 4 laying condition as specified by AWWA C605 for depth of installation from 4-ft to 10-ft measured from the top of the pipe. The Type 4 laying condition requires the pipe to be bedded on a minimum of 4-inches of select granular material that will conform to the bottom of the pipe. Select granular material shall consist of Class 1 or Class 2, well-graded sand or screenings, and shall contain no more than 10 percent by weight of material passing a 0.075 mm (No. 200) mesh sieve and no less than 95 percent by weight passing the 25 mm (1 inch) sieve as defined by ASTM D2321. Pipe laying on a flat bottom trench is unacceptable.



Type 4

Class 1 or Class 2 embedment material shall be compacted to the top of the pipe at 95% or greater Proctor density. Careful attention shall be placed on compacting embedment under the haunches of the pipe to prevent any potential voids. When using mechanical compactors, avoid contact with the pipe. When compacting over the pipe crown, a minimum cover of at least 8-inches or more in conformance with the manufacturer's requirements shall be maintained over the top of the pipe prior to compacting. The maximum embedment sizing shall be limited to materials passing a 3/4-inch sieve for angular materials or 1-1/2-inches for rounded rock. Embedment materials consisting of select material or native soils shall be well drained, granular, free of rocks and other foreign materials and shall be selected and placed to prevent gouges, crimping, or puncture of pipe, joints or appurtenances.

b) Materials at all times shall be handled with mechanical equipment or in such a manner to protect them from damage. At no time shall pipe and fittings be dropped or pushed into ditches.

c) Pipe and fitting interiors shall be protected from foreign matter and shall be inspected for damage and defects prior to installation. In the event foreign matter is present in pipe and fittings, it shall be removed before installation. Open ends of pipe shall be plugged or capped when pipe laying is not in progress.

d) All pipe shall be in nominal lengths of (20) twenty feet and shall be installed with at least 48 inches of cover below the finished subgrade. Pipe shall be laid on true lines as directed by the Engineer. Trenches shall be sufficiently wide to adjust the alignment. Bell holes shall be dug at each joint to permit proper joint assembly. The pipe shall be laid and adjusted so that the alignment with the next succeeding joint will be centered in the joint and the entire pipeline will be in continuous alignment both horizontally and vertically. Pipe joints shall be fitted so that a thoroughly watertight joint will result. All joints will be made in conformance with the manufacturer's recommendations for the type of joint selected. All transition joints between different types of pipe shall be made with transition couplings approved on shop drawings showing the complete assembly to scale.

e) Prior to beginning construction, the Contractor shall contact local utility companies and verify the location of existing utilities. The Contractor shall be completely and solely responsible for locating all existing buried utilities inside the construction zone before beginning excavation. The Contractor shall be solely responsible for scheduling and coordinating the utility location work. When an existing utility is in conflict with construction, it shall be exposed prior to beginning construction to prevent damage to the existing utility.

f) All valves that are under the ownership of the Cary reclaimed water system shall be operated only by trained personnel of the Cary. Existing Cary reclaimed water system valves shall not be operated without a minimum notice of 24 hours to the Engineer and the Utilities Department. Contractor's personnel shall only be responsible for operating valves within new construction areas that are not directly connected with the existing reclaimed water supply. At such time when the valves in new construction areas are connected with the reclaimed water supply, the valves shall only be operated by Cary personnel or in limited circumstances by Contractor's personnel after receiving authorization from the Cary Reclaimed Water Coordinator. For all other cases, the Contractor shall operate valves only in accordance with Cary Policy Statement No. 49, Water Valves, Control of Closing and Opening.

g) Trenching for pipelines (water, sewer, pressure, natural gas and liquid petroleum), communication and power lines and drainage and irrigation pipes shall be excavated to the required depth to permit the installation of the pipe (inclusive of pipes, wires, cables, ducts, and conduit) along the lines and grades shown on the construction drawings.

h) Prior to trenching for the construction of any utility mains or connections, the Contractor shall locate all existing utilities within the construction zone. This may include at a minimum contacting the North Carolina One Call Center at 811 or 1-800-632-4949. Where critical Cary water and sewer utilities cannot be located by traditional means, specialized utility locating, such as vacuum excavation or ground penetrating radar (GPR) may be required to locate existing utilities before excavating.

i) In all cases where trenchless methods are planned to cross an existing utility corridor with water, sewer, force main, reclaimed water and/or other Cary maintained pipelines, an SUE (subsurface utility exploration) services firm shall be contracted to verify the depths of existing utilities prior to boring. Where SUE involves survey work, the survey shall be in accordance with the requirements of Section 10050 of these Standard Specifications.

j) The Contractor shall be responsible for implementing all required safety provisions for trenching in compliance with the Occupational Safety and Health Administration (OSHA) regulations and all other applicable safety requirements and procedures.

k) Trench Dimensions

i. The minimum trench width at the top of the pipe shall be at least 24-inches greater than the outside diameter of the pipe. Rock shall be removed to a depth of at least 6-inches below the bottom of the pipe and the trench backfilled with suitable material.

ii. Open trenches shall not exceed 100-feet.

iii. All trenches shall be confined to the limits of the right-of-way or utility easement. Trenches in paved areas shall not be sloped.

iv. All trenches in or along roadways shall be properly backfilled at the end of each working day.

l) Trench Protection

i. Wet trenches shall be stabilized with a base layer of #78 M or #57 stone. The bottom of the trench shall be shaped to provide uniform support along the entire length of the pipeline. Severely unstable

trench bottoms requiring undercut excavation shall receive a foundation support system for the pipeline designed by a registered Geotechnical Engineer licensed in the State of NC.

ii. A space shall be excavated at each bell to provide ample space to join the pipes with no misalignment.

iii. The Contractor shall take all necessary measures to prevent water from entering the trench.

2. Pipe laying and backfilling

g) Open ends of pipe shall be plugged when pipe laying is not in progress to prevent trench water, soil, and debris from entering.

h) All pipe shall be laid in accordance with the manufacturer's recommendations and all applicable Cary Standards, Specifications and Details.

i) Pipe laying shall be accomplished in a manner and with the required resources to provide a properly aligned and sealed pipeline and joints.

j) Pipe deflection limits shall not be exceeded in accordance with manufacturer requirements.

k) All gravity mains shall be installed beginning with the downhill section at the lowest elevation, and advanced upgrade to the terminus of the main. All bell ends shall be oriented facing the uphill direction.

l) Backfill material shall be free from construction material, frozen material, organic material, or unstable material. Backfill with a high clay content or high shrink-swell potential that cannot meet compaction requirements shall be deemed unsuitable and replaced as directed by a professionally licensed Geotechnical engineer.

m) Backfill materials that have been allowed to become saturated or with moisture contents non-conducive to meeting compaction requirements shall be deemed unsuitable and replaced.

n) When original excavated materials have been deemed unsuitable, granular material must be imported to the site to backfill utility trenches and meet compaction requirements. The following materials shall be acceptable forms of granular backfill: aggregate base course, soil type base course, select backfill material, sand or screenings in accordance with NCDOT Specifications.

o) In all open utility trenches, backfill shall be compacted to 95% maximum dry density as measured by AASHTO method T99. The Contractor shall be responsible for verifying that compaction requirements have been met or exceeded by providing soils testing data from an approved Geotechnical Firm. The soil test results shall be certified by a licensed Geotechnical Engineer.

p) Backfill for utility trenches shall be placed in 8-inch lifts or less of uncompacted soil and compacted with a mechanical tamp before placing additional layers.

3. Pavement repairs

g) All pavement cuts shall be repaired within a maximum of three (3) days from the date the cut is made. If conditions do not permit a permanent repair within the given time limit, permission to make a temporary repair must be obtained from the Infrastructure Field Technician.

h) Pavement repairs shall be made in accordance with Cary Standard Details.

i) All asphalt pavement utilized to repair open trenches shall comply with all applicable Cary asphalt pavement material and installation Specifications.

j) All pavement patches shall be provided in such a manner that a uniform and smooth driving surface free of depressions and/or bumps is obtained. Pavement patches not meeting this standard shall be milled and replaced.

4. Trenchless pipe installation

g) The preferred trenchless method shall be auger boring. Alternate trenchless methods including microtunneling, guided boring, conventional tunneling, horizontal directional drilling or hand tunneling may be approved after thorough evaluation by the Utilities Department.

h) In addition to meeting or exceeding all Cary requirements, all trenchless crossings shall be approved by and meet the requirements of all controlling legal authorities, such as NCDOT, Norfolk Southern Railway and CSX Corporation.

i) Direct bores may be made without a casing pipe on pipelines 6-inches in diameter and smaller.

j) Encasement pipe shall be installed with all trenchless construction methods (excluding horizontal directional drilling when it is approved and as noted above). There shall be a minimum cover of 4-ft between the pavement

subgrade and the top of the casing pipe. Under no circumstances shall the pavement subgrade be disturbed.

k) Permanent easements (UPE) shall be provided at all trenchless pits to allow for future access to casing pipes.

l) All carrier pipe shall be manufacturer provided restrained joint ductile iron pipe except for reclaimed water mains in which restrained PVC C900 or C905 pipe in compliance with Section 6500 is utilized.

m) As the trenchless operation progresses, each new section of encasement pipe shall be joined using full penetration seal welds prior to installation of the casing. Joints shall be electric-fusion welded by operators qualified in accordance with the American Welding Society's standard procedure for arc welds. The welds shall be capable of transmitting all thrust and other loads across the joints.

n) If voids are encountered while installing encasement pipe thirty (30) inches and larger, 2-inch or larger grout holes shall be installed at ten (10) foot centers in the top section of the encasement pipe. The grout holes shall be used to fill the void spaces with 1:3 Portland cement grout at sufficient pressure to prevent settlement of the roadway, unless NCDOT approval stipulates otherwise. Other grout mixtures may be submitted for approval.

o) In the event that an obstruction is encountered during the trenchless operations, the equipment shall be withdrawn. The pipe shall be cut off, capped, and filled with 1:3 Portland cement grout at a sufficient pressure to fill all voids before moving to another boring site.

p) Restrained joint ductile iron carrier pipe shall be pulled into the casing pipe.

q) For all trenchless operations of 100-ft or more, the ground surface elevations shall be recorded prior to beginning work.
    i. At a minimum, survey points shall be identified with a nail or hub located as follows:
        - Road crossings: Centerline and each shoulder/curb
        - Utility and Pipeline Crossings: Directly above and 10-ft each side of the crossing
        - All locations: Points shall not exceed 50-ft spacing.
    ii. Elevations at each point shall be recorded with an accuracy of 0.01-feet.

r) Settlement observations shall be made each day until the pipe/casing is fully installed.

s) Readings shall be reported to the Infrastructure Field Technician.

t) In the case of observed settlement, the monitoring points and observation frequency shall be increased as determined by Cary.

5. External corrosion protection

g) External corrosion can occur at an accelerated rate in metallic pipelines such as steel and ductile iron when they are installed in aggressive soils or when they are installed near other structures or utilities that carry impressed currents. Such facilities that typically utilize impressed current cathodic protection are gas pipelines, such as owned by Colonial Pipeline, Cardinal Pipeline and Dixie Pipeline. Other potential sources that may create stray currents that contribute to accelerated pipeline corrosion are high voltage power transmission lines and railroad crossings.

h) In cases where metallic steel and ductile iron pipelines or encasement pipes are planned for installation in close proximity to any potential sources of stray current or aggressive soils, zinc coated pipe shall be specified and a field analysis consisting of stray current evaluation and soil testing shall be conducted by an experienced technician, as certified by the National Association of Corrosion Engineers, (NACE), to determine the potential for external corrosion and the need for additional protection measures. In cases where stray current conditions and/or aggressive soils are prevalent, a corrosion specialist certified by the NACE or other applicable certification board shall be consulted regarding the design of pipeline protection measures.

i) At a minimum, all stray current protection systems should include bonded joints and sacrificial anodes with a 50-year or longer design life and test facilities in lieu of polyethylene encasement, unless otherwise approved by Cary. The cathodic protection element of the pipeline design package shall be sealed by Professional Engineer licensed in the State of NC.

j) Full impressed current cathodic protection shall only be utilized when extreme corrosion potential has been proven and/or as otherwise directed by the Utilities Department and the certified corrosion engineer of record.

D. PIPELINE IDENTIFICATION AND MARKING

1. Marking Tape
   a) Installation: Marking tape shall be installed continuously and longitudinally along all reclaimed water mains and reclaimed water services for new construction and for any repair or retrofit construction using open trench methods. For service connections, the marking tape shall extend from the main line to the reclaimed water meter. Marking tape shall be installed directly above

the center of the pipe and at least 24-inches deep from final grade to a maximum depth of 36-inches below final grade. Any sections where tape cannot be accurately placed at time of backfilling sufficient survey data shall be collected to reestablish location for tape installation.

b) Specifications: The reclaimed water main marking tape shall be an approved product identified in the Cary Approved Products List. The marking tape shall be made of polyethylene (or approved equivalent) material, 6-inches wide and a minimum of 6 millimeters thick. The marking tape shall have detectable markers embedded in the tape and spaced adequately to provide continuous detection along the tape from above the buried pipe at final grade. The tape shall be purple (Pantone 522) in color and shall be marked with words that read "CAUTION RECLAIMED WATER LINE BURIED BELOW – DO NOT DRINK" (or an approved equivalent wording). The wording shall be repetitive along the full length of the tape.

2. Marker Balls

a) Installation: Non-programmable marker balls are required at the ends of all casing pipe, fittings and reducers. Marker balls shall be used in addition to marking tape within thoroughfares and within 100-ft of a signalized intersection. Through signalized intersections, marker balls shall be spaced at 25-ft intervals. They shall also be installed along and directly above all reclaimed water mains in conditions where marking tape cannot be installed due to restrictions or conflicts. In these conditions, non-programmable marker balls shall be placed, at all vertical and horizontal deflection points, at all tees and crosses and at a spacing along the main no greater than 100 feet apart. Each marker ball shall be installed directly above the center of the pipe and at least 24-inches deep from final grade to a maximum depth of 36-inches below final grade. A table of marker ball locations, with description, must be submitted as part of the record drawing.

b) Specifications: The Marker Ball is a non-programmable ball and shall be an approved product identified in Cary's Approved Products List. The marker ball shall be purple (Pantone 522) in color for reclaimed water and conform to APWA standards. It shall have a minimum detectable depth of 5 feet.

6530 VALVES AND APPURTENANCES

A. VALVES

1. Gate Valves

a) Valves shall be installed on all branches from feeder reclaimed water mains according to the following schedule: 4 valves at crosses; 3 valves at tees. When a loop section of reclaimed water line is connected back into the feeder

reclaimed water main within a distance of 200 feet or less, only one valve will be required in the feeder reclaimed main. In all cases where new reclaimed water mains are connected to an existing reclaimed water distribution line, valves shall be located at all end points and at intermediate points throughout the new system extension to assure testing requirements can be met without interfering with the operation of the existing system. .

b) Where no reclaimed water line intersections are existing, a main line valve shall be installed at every 100 feet per 1-inch diameter main up to a maximum distance of 2000 feet between valves.

c) Gate Valves, 4-inches to 12-inches in Diameter:
All valves for reclaimed water applications 4-inches to 12-inches in diameter shall be resilient seated wedge gate valves in conformance with the requirements of AWWA C509 (grey or ductile iron body) or AWWA C515 (reduced wall ductile iron body) and provided with a full circumferential pipe opening. All gate valves shall be designed for a working pressure of 250-psi with a minimum UL listing and FM approval rating of 200-psi. Gate valves shall be fusion bonded epoxy (FBE) coated both interior and exterior at a minimum of 10-mils and the FBE coating shall be provided in conformance with AWWA C550. All gate valves shall be assembled with stainless steel bolts.

All gate valves 4-inches to 12-inches in diameter shall be installed in the vertical position and shall be provided with mechanical joint fittings. Gate valves shall be restrained by wedge action retainer glands or other approved manufacturer provided restraining systems.

All gate valves shall open left with a non-rising stem (NRS) and be provided with a 2-inch square operating nut. All gate valves shall be constructed with triple O-ring seals in which 2 O-rings are located above the thrust collar and 1 O-ring is located below the thrust collar. The two upper O-rings shall be replaceable with the valve fully open and subjected to full rated working pressure.

The gate valve wedge shall be fully encapsulated in molded rubber and fully retractable. All valves shall be rated for bi-directional flow. All sealing gaskets shall be made of EPDM rubber materials.

d) Gate Valves, 16-inches through 24-inches:
Gate valves 16-inches through 24-inches shall be resilient seated wedge gate valves in conformance with the requirements of AWWA C515 (reduced wall ductile iron body) and comply with all Specifications outlined for gate valves 12-inches and smaller. Gate valves installed vertically shall be provided with a minimum of 2-ft of overhead clearance between the top of the operator nut and the finished grade.

All gate valves 18-inches and greater shall be provided with a geared actuator. Vertical gate valve installations shall have spur gear actuators and horizontal installations shall have bevel gears. Gate valves 18-inches in diameter shall be provided with a gear operator at a minimum 2:1 ratio. Larger valves through 24-inches shall be provided with a gear operator at a minimum 3:1 ratio.

Gate valves installed in a horizontal position shall only be provided as permitted by the Director of Utilities for special circumstances where vertical alignment is not possible. All horizontal gate valves shall meet or exceed the Specifications outlined herein including the 250-psi pressure rating.

e) Gate Valves Less than 4-inches:
Gate valves sized smaller than 4-inches, shall be resilient seated wedge type with a non-rising stem and a 2 inch operating nut in compliance with AWWA C509. The smaller diameter gate valves shall be provided with triple O-ring seals and threaded end connections in compliance with ANSI B2.1. Gate valves smaller than 2-inches shall be identified “no lead” and consist of brass components designated under UNS C89833 as per ASTM B584. The small diameter gate valves shall be rated for a minimum pressure rating of 200-psi.

f) All gate valves for reclaimed water applications shall be painted purple, Pantone 522 with approved field application paint by the Contractor prior to installation or otherwise wrapped in purple polyethylene wrap for required identification as a reclaimed water valve.

g) Valves shall be properly located, operable and at the correct elevation. All valves and reducers shall be rodded to the tee or cross if one is located within 10 feet. If reducers cannot be rodded, concrete blocking or other restraining methods will be required. The maximum depth of the valve nut shall be 8-feet. When valve extension kits are used, they must be manufactured by the same company which manufactured the valve.

2. Combination Air Valves

a) Combination air valves shall be provided to purge air from the system at startup, vent small pockets of air while the system is being pressurized and running, and prevent critical vacuum conditions during draining. Combination air valves approved for use in reclaimed water installations shall be installed at all high points of reclaimed water lines 8 inches in diameter or larger and at other locations, such as major changes in slope, as directed by Cary. A high point shall be determined as any high location where the difference between the high elevation and adjacent low elevation exceeds 10-ft unless otherwise determined by the Director of Utilities based on special circumstances. The reclaimed water main shall be installed at a grade which will allow the air to migrate to a high point where the air can be released through an air valve. A minimum pipe slope of 1 foot in 500 feet should be maintained.

b) The combination air valve shall be sized by the Engineer and approved by Cary. Combination air valves shall be of the single housing style with Type 304 or 316 stainless steel body that combines the operation of both an air/vacuum and air release valve. The valve shall conform to the requirements of AWWA C512 and be installed in accordance with the Details.
The valve shall be rated for minimum 230 PSI working pressure. The combination air valve shall be provided with cylindrical shaped floats and anti-shock orifice made of high-density polyethylene. Combination air valves with spherical floats shall not be accepted. All combination air valves shall be installed in accordance with the Details.

c) The 2-inch combination air valve shall be installed in a standard 4-foot eccentric manhole. The 2-inch valve shall have a 2-inch male NPT inlet. Connection to the main shall be with a ductile iron tapped tee fitting restrained to the PVC main with PVC approved wedge action restraints. Saddle taps shall not be permitted. The corporation stop, piping, and stainless-steel ball valve shall all be 2-inches in diameter. The isolation ball valve shall be rated for 200-psi service, provided with NPT threads and connected with "no lead" brass (meeting UNS C89833 as per ASTM B584) or bronze piping.

c) Combination air valves 3-inches and greater shall be installed in a flat top manhole sized according to the water main diameter. Mains less than or equal to 20-inches shall utilize a 5-foot diameter manhole and larger mains shall utilize a 6-foot diameter manhole. All connections shall be by flange joints. Connection to the main shall be by an MJ x FLG tee with the branch diameter equal to at least half of the main diameter. If needed due to larger diameters, a flanged reducer shall be provided prior to the flanged gate valve sized equally to the flanged combination air release valve.

d) The Contractor shall paint the inside of all manholes housing ARV's with Pantone 522 purple paint and stencil the words "CAUTION: RECLAIMED WATER - DO NOT DRINK" on the inside of the manhole in at least 2 locations on both sides of the ARV. The lettering shall be at least 3-inches in height and be painted in black visible paint that can be easily noticed from ground level.

e) Precast concrete manholes shall meet the requirements of section 7020. Manholes shall be provided with top and bottom step only.

3. Valve Boxes

a) Valve boxes shall be cast iron, screw type, with a 5-inch opening. Valve box ring adjustments will not be allowed.

b) Valve box covers shall be square in shape (NOT round) and shall be designed for AASHTO H-20 truck loadings. All valve box covers shall be of non-interchangeable shape with potable water covers and cast on the top surface

with a recognizable inscription indicating “Reclaimed Water”. All valve box covers shall be painted purple, Pantone 522.

c) The valve box shall be centered over the wrench nut and seated on compacted backfill without touching the valve assembly. All valve boxes outside of the roadway shall be encased in a trowel finished 2-foot x 2-foot x 6-inch pad of 3000-psi concrete with the valve box cover flush with the finished grade. Precast concrete valve box encasements may not be used. The maximum depth of the valve nut shall be 6 feet. When valve extension kits are used, they must be manufactured by the same company that manufactured the valve.

B. APPURTENANCES

1. Blowoffs

a) Blowoffs installed on reclaimed water mains at the end of cul-de-sacs shall be a minimum of 2 inches. Where there is not sufficient pressure to thoroughly flush the system, a larger blowoff will be required.

b) Blowoff assemblies shall be constructed as shown in the Details. Blowoff assembly sizing for distribution mains, 4-inches through 8-inches in diameter, shall be the typical 2-inch assembly as shown in the details. The 2-inch valves shall be gate type provided with threaded connections with a non-rising stem and a 2 inch operating nut, O-ring seals and screwed ends. A full size valve is required on mains that are planned to be extended. Typical 2-inch blowoff assemblies shall be provided with SDR 21 purple PVC pipe rated at 200-psi and labeled for use with reclaimed water systems. The SDR 21 PVC pipe shall be joined with bell and spigot joints restrained by solvent weld. The PVC pipe shall be joined to the threaded connections of the 2-inch gate valve with an approved brass fitting or PVC transition couplings with stainless steel threads. The transition couplings shall be connected to the gate valve with threaded “no lead” brass nipples. Threaded PVC pipe and joints with connections threaded in PVC shall not be allowed. All threaded connections shall be provided with metal threads to maintain the pressure rating of the blowoff assembly.

c) For blowoff assemblies on main lines larger than 8-inches in diameter, a blowoff assembly design including calculations for sizing shall be provided by the design engineer of record and approved by the Utilities Department.

d) All blowoffs shall be metered and drain to the nearest sanitary sewer manhole when there is a sewer manhole within 200-feet. The Type 2 Reclaimed Water Blowoff Assembly detail is the standard connection. The Type 1 Reclaimed Water Blowoff Assembly detail is only accepted in cases where a sewer manhole is not within 500-ft. The Type 2 Reclaimed Water blowoff assembly may be required at the discretion of the Director of Utilities.

e) All blowoff locations shall include a meter as part of the assembly. The size of the meter and piping shall be at least 2-inches and may need to be larger due to system requirements and location. Meter box/vault shall be per the details unless otherwise directed.

f) All blowoff assemblies for reclaimed water installations in which the system will be initially charged with potable water, shall be required to maintain an air gap separation from the blowoff discharge pipe to the sanitary sewer manhole.

g) A typical potable water blowoff assembly may be utilized in lieu of a standard reclaimed water blowoff assembly in cases where a dead-end reclaimed water main will initially be supplied with potable water and the Reclaimed Water System Master Plan calls for extending the reclaimed water line. In cases where a typical potable water blowoff is planned, see Section 6000, Water Distribution System, for further information on potable water blowoff assemblies.

2. Paint: An approved Pantone 522 purple is required to meet color identification requirements under NC ACAC 02T .0909 and referenced herein as the color code identification for reclaimed water piping, valves and other appurtenances. Field application of Pantone 522 purple to valves, fittings, manholes and other appurtenances shall be implemented in conformance with manufacturer specifications including surface preparation. In all cases a minimum film thickness of 10-mils shall be applied. There shall be a UV protective topcoat required for applications open to daylight. Paints for pipe and other metals shall be a two-part polyamide epoxy meeting the requirements of AWWA C210 and be approved for immersion service.

3. Wedge Action Retainer Glands
   All fittings, valves, blowoffs and appurtenances other than pipeline joints shall be restrained with approved wedge action retainer glands. All wedge action retainer glands shall be manufactured as a one-piece retainer gland for use with typical ductile iron mechanical joint fittings, gate valves and PVC C900 or C905 pipe. The wedge action retainer glands shall be rated to provide restraint up to the rated pipe pressure for sizes through 24-inches with a safety factor of 2:1. Approved wedge action retainer glands shall be made of ductile iron, coated with a manufacturer applied epoxy coating or polyester powder coating, including stainless steel bolts and nuts.

6540 RECLAIMED WATER TAPS AND SERVICES

A. DESIGN

1. Individual reclaimed water services and multiple branch services shall be provided from the reclaimed water main to each reclaimed water meter in accordance with the Details. Multiple branch services for reclaimed water shall not exceed 2 branch lines unless otherwise approved. All connections shall be made by wet taps. Service connections shall be made perpendicular to the reclaimed water main and shall run straight to the reclaimed water meter.

2. All reclaimed water services shall be installed with a minimum distance to adjacent infrastructure of 5-feet on either side of the service.

3. All reclaimed water meter boxes and vaults shall be located at the edge of the serviced lot's right of way or easement. Reclaimed water meter boxes shall not be placed in streets, sidewalks, parking areas or obstructed by fencing or buildings. In addition, within townhouse developments, reclaimed water services shall be located within 4-feet of driveways in order to minimize conflicts between service lines and trees.

4. Provisions for backflow prevention shall be in accordance with the NC Plumbing Code for plumbing. Normally no backflow provisions will be necessary on reclaimed water systems. Approved backflow prevention devices shall be required on the potable water system for all customers with reclaimed water service. See appropriate requirements in Section 6000.

5. The reclaimed water meter shall be sized based on applicant water budget calculations. The minimum size of reclaimed water meters and services shall be 1-inch diameter. Multiple branch service sizing shall be determined by the designer.

6. Service taps to existing reclaimed water mains shall be made by Cary. Service taps to new reclaimed water mains shall be made by the Contractor in accordance with the Specifications.

7. Service taps greater than 2 inches shall be made by a Contractor of the Developer in accordance with the approved plan.

B. MATERIALS

1. Taps: Direct taps shall not be allowed for reclaimed water mains. Service taps shall be made with an approved service saddle as described below. The maximum size for saddle taps is 2-inches in diameter.

All taps larger than 2-inches shall be installed by inline fittings or tapping sleeves. All tapping of C900 or C905 PVC reclaimed water mains shall be implemented with shell type cutting tools classified for use with PVC pipe that retains the coupon cut while penetrating the pipe wall. Twist drill bits and auger bits shall be prohibited.

2. Service Saddles: All service saddles shall be fabricated with an 85-5-5-5 waterworks brass and fabricated in a controlled diameter configuration to prevent over tightening the bolts and distorting or stressing the PVC pipe. Service saddles shall provide full support around the entire circumference of the pipe. All service saddles shall be manufacturer approved for use with C900 PVC pipe in conformance with AWWA C800. Service saddles shall be provided in a 2-piece bolted design for 4-inch through 8-inch pipe diameters and in a 3-piece assembly for 10-inch and 12-inch diameters. All service saddles shall be provided with an EPDM rubber gasket O-ring design in conformance with ASTM D2000. Service saddle outlets shall be provided with AWWA tapered threads.

3. Mechanical Joint Tapping Sleeves: MJ tapping sleeves shall be fabricated of cast iron or ductile iron construction in a two-piece assembly with mechanical joint connections to the main line and flanged connection to the tapping valve. All MJ tapping sleeves shall be rated for a working pressure of 200-psi or greater and provided with a ¾-inch test plug for testing. All tapping sleeves shall be hydrostatically tested up to 200-psi before a tap is made. Tapping sleeves shall not be air tested.

   All mechanical joint tapping sleeves shall be manufacturer fabricated and approved for installation on the specific main line pipe material, whether C900 or C905 PVC pipe. In all MJ tapping sleeve applications, the tapping sleeve and tapping valve shall be provided by the same manufacturer.

4. Stainless Steel Tapping Sleeves, 6-inch through 12-inch main lines:
   Stainless steel tapping sleeves may be used in lieu of mechanical joint tapping sleeves for C900 PVC reclaimed water mains through 12-inches in diameter at sizes shown in the table below. All stainless-steel tapping sleeves shall have a stainless-steel flange and be manufactured in conformance with AWWA C223. All stainless-steel tapping sleeves shall be provided in a two-piece assembly with a full circumferential gasket and a ¾-inch test plug. The back band shall be a minimum 14-gauge stainless steel and the front band (where the outlet is located) shall be a minimum 12-gauge stainless steel. The bolt bars shall be a minimum 7-gauge stainless steel. All stainless-steel tapping sleeves shall be manufacturer rated for a working pressure of 200-psi or greater and hydrostatically tested to 200-psi before a tap is made. Stainless steel tapping sleeves shall not be air tested.

Stainless Steel Tapping Sleeve Sizes Allowed

Nominal Main Size (inches)	Nominal Branch Size (inches)
6	4
8	4
10	4
10	6
12	4
12	6

5. Tapping Saddles: Tapping saddles shall not be used with PVC pipe.

6. Corporation Stops: Corporation Stops shall be ball type, fabricated with "no lead" brass (meeting UNS C89833 as per ASTM B584). The inlet shall have AWWA Standard threads as per AWWA C800. Taps shall be located at 10:00 or 2:00 o'clock on the circumference of the pipe. The outlet connection of the corporation stop shall be sized for IPS, Iron Pipe Size polyethylene piping and provided with a solid stainless steel insert stiffener manufactured by the same manufacturer of the corporation stop ball valve. The outlet connection to the polyethylene service piping shall be by compression connections provided with the corporation stop ball valve. Service taps shall be staggered alternating from one side of the reclaimed water main to the other and at least 12 inches apart. The taps must be a minimum of 24 inches apart if they are on the same side of the pipe. No tapping shall be made within 3-ft of the end of the reclaimed water main.

7. Polyethylene (PE) Service Piping**:** Polyethylene service piping shall be provided as minimum 1-inch to maximum 2-inch, IPS, (iron pipe size), inside diameter controlled, piping in conformance with ASTM D2239 and rated for 200-psi. All polyethylene service piping shall comply with NSF14, AWWA C901 and meet all requirements of PE 3710 code designation. The piping shall be provided with no breaks or fittings in service installation lengths of 100-ft or less. All polyethylene service piping shall be provided in purple color, Pantone 522, for reclaimed water applications with the words, "CAUTION – RECLAIMED WATER DO NOT DRINK" labeling the piping as reclaimed water service piping.

   All PE piping shall be provided with detectable marker tape as described herein. All connections to PE piping shall be provided with stainless steel insert stiffeners provided by the same manufacturer of the corporation stops and/or the meter box connection and approved by the manufacturer for use with PE piping.

8. Reclaimed Water Meters for 1-inch Services: Reclaimed water meters for 1-inch services will be provided by Cary with reverse or left-hand threads. Reclaimed water meters shall be color identified by purple Pantone 522 cover and casing.

9. Meter Boxes for 1-inch Services: Meter boxes for 1-inch reclaimed water services shall be installed as shown in the details and provided with a lockable, full port ball valve on the inlet side of the meter and an expansion connection on the outlet side

of the meter. The box shall be provided in purple color, Pantone 522 painted on the cast iron both inside and outside of the box. In addition, the meter box lid shall be round and made of grey cast iron painted purple, Pantone 522 with the words "RECLAIMED WATER- DO NOT DRINK", at least 1-inch in height embossed on the cover. The lid will also have a 2-inch diameter hole to accommodate AMI (Automated Meter Inventory) hardware. This hole shall be located 2-inches off the nearest edge. Meter boxes shall have dimensions of 15-inches at the base of the box and a total height of 13 ½-inches. The inlet fitting on the meter box shall be a 1/8 bend with left hand threads that will accommodate polyethylene tubing. The box and cover shall be load rated for a vertical load of 20,000 pounds. All fittings and connections shall be "no lead" brass conforming to UNS C89833 as per ASTM B584.

A "no lead" brass curb stop with compression connections shall be installed within 2 feet of the inlet connection. The curb stop may be buried without a box above it.

10. Meter Box Assembly and Setters for 1-½ and 2 inch services: Meter Boxes for 1-½-inch and 2-inch services shall be made of fiberglass reinforced polymer and provided with heavy duty rated polymer concrete covers as indicated in the Standard Details. All meter box covers shall be consistently color-coded purple (Pantone 522) and marked on the top surface with a recognizable inscription indicating "RECLAIMED WATER – DO NOT DRINK". Meter box covers shall be provided with a 2-inch diameter hole to accommodate AMI (Automated Meter Inventory) hardware and provided with two stainless steel bolt locks on opposite ends of the meter box cover. The stainless-steel bolts for locking the cover shall be provided in a penta head configuration.

    The box shall have an open bottom to allow drainage through a base of 12-inches of washed stone. The inside of the meter box shall be painted Pantone 522 purple, and text shall be stenciled on both sides of the interior indicating, "CAUTION RECLAIMED WATER – DO NOT DRINK" in lettering at least 1-1/2 inches in height that is clearly legible when opening the cover. The meter shall also be painted or provided in Pantone 522 purple.

    Piping for 1-1/2 and 2 inch reclaimed water meter setters shall be constructed from "no lead" brass (meeting UNS C89833 as per ASTM B584) and copper tubing and shall be equipped with a lockable by-pass flanged ball valve. The custom setter shall also have flanged angle meter ball valves. All fittings shall be made of "no lead" brass conforming to UNS C89833 as per ASTM B584.

11. Service Lines Greater than 2-Inches: Service lines greater than 2-inches shall be ductile iron or C-900 meeting all of the requirements previously identified for these materials. This includes the restraint, installation and locating provisions.

12. Meter Vaults for Services Larger than 2-inches in Diameter: Meter vaults and access doors within the street right of way shall meet HS-20 loading requirements and shall be located outside of travel areas. Pedestrian rated covers of 300-psf will not be accepted regardless of where they are located. The access door(s) shall be aluminum with a flush drop lift handle, stainless-steel hinges and bolts, a stainless-steel slam lock, an automatic hold open arm, and compression springs to allow for easy opening. The floor of the vault shall be sloped as shown in the detail drawings and any reclaimed water leakage shall be collected at the down sloping end of the vault. Positive drainage of reclaimed water meter vaults to daylight is not permitted. All meter vaults for reclaimed water services shall be color identified by painting the inside of the vault Pantone 522 purple and text identified with the words, "CAUTION RECLAIMED WATER DO NOT DRINK" stenciled on both sides of the vault. The interior piping, valves, and appurtenances shall be color identified with Pantone 522 purple to denote reclaimed water service conditions. The aluminum access doors shall be color identified with Pantone 522 purple with a paint designed to adhere to aluminum. When reclaimed service is only for irrigation and a bypass leg is not therefore required to maintain service, a smaller vault than identified in the details shall be considered.

6550 RECLAIMED WATER IRRIGATION SYSTEMS IN PUBLIC RIGHT-OF-WAY

All reclaimed water irrigation systems within public street right of way require an encroachment agreement from Cary or NCDOT prior to installation. Plans designating the location, size, material, and depth shall be submitted with the agreement application to the Inspection & Permits Department.

Pipe material for the irrigation mainline proposed to be used within the public right of way shall be Schedule 40 PVC or greater provided in Pantone 522 purple. A minimum depth of 2 feet of cover shall be provided. Typical white Schedule 40 pipe will be allowable only if the pipe is wrapped with purple polyethylene film and identified as reclaimed water piping with identification tape.

All street crossings of reclaimed water irrigation systems shall be encased in ductile iron or steel conduit.

Hose bibs will be installed and maintained on private property by private property owners in accordance with NCDEQ rules and the plumbing code. Above ground hose bibs are not allowed. Hose bibs can be located in locked, below grade vaults. All below grade vaults for hose bibs shall be consistently color-coded purple (Pantone 522) and marked on the top surface with a recognizable inscription indicating "CAUTION RECLAIMED WATER – DO NOT DRINK". The hose bib shall consist of a ¾ inch gate valve and ¾ inch cam lock type hose connection as indicated in the Standard Details.

6560 TESTING AND INSPECTIONS

A. GENERAL

1. All reclaimed water used in testing and inspection must be disposed of properly as described in Section 6510.

2. All materials must be approved by the Infrastructure Field Technician prior to installation. Materials rejected by Cary's Infrastructure Field Technician shall be immediately removed from the job site.

3. The Contractor shall furnish all materials, labor, and equipment to perform all testing and inspections to the satisfaction of Cary's Infrastructure Field Technician. Cary shall provide reclaimed water for testing purposes on reclaimed water mains in accordance with Cary Standard Procedure 4, Control and Monitoring of Water System Flow Activity.

4. In cases where the reclaimed water system will initially be supplied with potable water, all reclaimed system testing shall be conducted with potable water. No system testing shall occur with potable water until such time after the backflow preventer assembly has been inspected and made operational by Cary.

B. TESTING

1. Hydrostatic Testing

   a) No valve in Cary's reclaimed water system shall be operated without authorization in accordance with the Cary Standard Procedure 4 Control and Monitoring of Water System Flow Activity. A section of reclaimed water main which is to be hydrostatically tested shall be slowly filled with reclaimed water at a rate which will allow complete evacuation of air from the line. Hand pumps shall not be used for the pressure testing of reclaimed water mains. Taps used for testing purposes shall be removed after testing and repaired using a stainless-steel full circle repair clamp.

   b) After all air has been expelled from the water main, the line shall be tested to a pressure of 200 psi as measured at the lowest elevation of the line for a duration of 2 hours. The pressure gauge used in the hydrostatic test shall be calibrated in increments of 10 psi or less. The pressure gauge shall be liquid-filled and indexed for an operating range of 300-psi or less with a minimum dial size of 4-inches. At the end of the test period, the leakage shall be measured with an accurate water meter.

c) Any measured leakage not within the allowable limits as specified in the following table shall require repair of the reclaimed water main and additional testing until the standards are met. For pipe sizes other than those shown, the Contractor shall test within the allowable leakage amounts as specified by AWWA C605. All visible leaks shall be repaired regardless of the amount of leakage.

Maximum Leakage Allowed per AWWA C605

Pipe Size inches	Allowable Leakage at 200-psi (Gal/Hour per 1000-ft of Pipe)
4	0.38
6	0.57
8	0.76
12	1.15
16	1.53
18	1.72
20	1.91
24	2.29

2. Disinfection

a) All additions or replacements to the reclaimed water system shall be disinfected with chlorine in conformance with AWWA C651 before being placed in service under the supervision of Cary's Infrastructure Field Technician in the following manner:

i. Taps shall be made at the control valve at the upstream end of the reclaimed water main and at all extremities of the line including valves.

ii. A solution of water containing 70% HTH available chlorine shall be introduced into the reclaimed water main by regulated pumping at the control-valve tap. The solution shall be of such a concentration that the reclaimed water main shall have a uniform concentration of not less than 50-ppm and not more than 100 ppm total chlorine immediately after chlorination. The chart below shows the required quantity of 70% HTH compound to be contained in solution in each 1000 feet section of line to produce the desired concentration of 100 ppm.

Required Hypochlorite Concentration

Pipe Size (inches)	Pounds of High Test Hypochlorite (70%) to reach 50-ppm *per 1,000 feet of line*	Pounds High Test Hypochlorite (70%) to reach 100-ppm *per 1000 feet of line*
6	0.88	1.76
8	1.56	3.12
10	2.42	4.84
12	3.50	7.00
14	4.76	9.52
16	6.22	12.44
20	9.76	19.52
24	14.00	28.00

iii. The HTH Solution shall be circulated in the reclaimed water main by opening the control valve and systematically manipulating blowoffs and taps at the reclaimed water main extremities. All reclaimed water leaving the system during this test must be disposed of through either an approved use or sent to the sanitary sewer. The HTH solution must be pumped in at a constant rate for each discharge rate so a uniform concentration will be produced in reclaimed water mains.

iv. HTH solution shall remain in reclaimed water mains for no less than 24 hours or as directed by Cary's Infrastructure Field Technician.

v. Extreme care shall be exercised at all times to prevent the HTH solution from entering existing reclaimed water mains.

3. Flushing

i. At the completion of disinfection, chlorinated water flushed from the reclaimed water main shall be disposed of in conformance with all Federal, State and local regulations.

ii. In accordance with all applicable regulations, a neutralizing chemical shall be applied to minimize chlorine residual in the flushing water before discharging from the reclaimed water main, unless an alternate plan is submitted in writing and approved by Cary.

iii. Free residual chlorine after 24 hours shall be at least 10 ppm or the Infrastructure Field Technician will require that the lines be re-chlorinated.

iv. Flushing of lines may only proceed after 24 hours of disinfection contact time and as directed by Cary, provided the free residual chlorine analysis is satisfactory.

4. Bacteriological Sampling

a) Reclaimed water leaving the system because of line flushing must be returned to a sanitary sewer. Bacteriological sampling shall consist of acceptable samples taken at least 24-hours apart and collected from each 1,200-ft section of water main and all dead ends and branches. Samples for bacteriological analysis shall be witnessed by the Cary's Infrastructure Field Technician after flushing is completed. The Contractor shall furnish the sample bottles, the testing agency and shall secure these samples. The Contractor shall make arrangements with the laboratory that all test results be submitted directly to Cary's Infrastructure Field Technician or other designee. All costs for laboratory testing shall be borne by the Contractor.

b) The laboratory secured for testing shall be certified by the State Laboratory of Public Health. All sample bottles provided by the laboratory shall be sterilized and treated with a dechlorinating agent, such as sodium thiosulfate. The sample bottles shall be provided with tamper proof seals that will be adhered to the bottles by Cary's Infrastructure Field Technician. The bottles and tamper proof seals shall be accompanied by a chain of custody form provided by the certified laboratory conducting the testing. All samples shall be taken in compliance with the sampling protocols provided by the certified laboratory and processed for delivery under the direct supervision of Cary's Infrastructure Field Technician. The samples shall be kept in a cooler at approximately 40-degrees Fahrenheit or 4-degrees Celsius and delivered to the certified lab for testing as soon as possible. The time at which the sample is taken shall be recorded on the chain of custody form by Cary's Infrastructure Field Technician. Any samples processed at the laboratory more than 30-hours following collection shall be declared invalid. All samples shall therefore be submitted to the lab within 24-hours of collection.

c) When a sample has a positive hit for fecal coliform, the Contractor shall immediately re-chlorinate reclaimed water mains and proceed with such measures as are necessary to properly disinfect those reclaimed water mains again. A positive hit for total chloroform however does not require the lines to be retested.

d) The new reclaimed water system shall be valved off from the existing reclaimed water system until a satisfactory bacteriological sample has been obtained and Cary's Infrastructure Field Technician has authorized the use of the new reclaimed water system.

5.) Marker Ball and Marker Tape Testing

Testing of the marker balls and tape shall be performed by the Contractor at the completion of the project to assure they are all working properly. It is the Contractor's responsibility to provide the necessary equipment to test the markers. Any defective, missing, or otherwise non-locatable units shall be replaced.

6.) Completion of Testing

a) At the completion of testing and after reclaimed water main lines and services have been successfully inspected, reclaimed service lines shall be locked at the angle ball valve. The locks will be provided by the Infrastructure Field Technician and shall prevent any unauthorized use of reclaimed water until the meter has been set.

b) In the interim period between constructing the service line and setting the meter, any unauthorized use of reclaimed water shall be subject to fines and penalties as provided under Cary ordinances.

c) Any relocation of the reclaimed service assembly shall require a separate permit from Cary unless otherwise authorized by Cary's reclaimed water coordinator.

d) At such time when the meter is set, the lock will be removed from the meter yolk. Only after the reclaimed service installation has been confirmed by water testing, shall the meter be installed and made operational.

6570 REPAIR OF RECLAIMED WATER SYSTEM

A. Reclaimed water that leaves the system due to a leak or break in the system must be reported and handled as if it were a wastewater spill.

B. Joint leaks of Ductile Iron Pipe and PVC pipe shall be repaired by use an approved bell joint leak repair clamp approved by Cary or otherwise replacing the damaged pipe and reconnecting with a restrained mechanical joint sleeve connection.

C. Line Breaks or Punctures shall be repaired by a full circle repair clamp as approved by Cary or otherwise replacing the damaged pipe and reconnecting with a restrained mechanical joint sleeve connection.

D. Line Splits or Blow Outs shall be repaired by replacing the damaged section with a new section of C-900 or C905 PVC pipe with a restrained mechanical joint sleeve made of ductile iron used at both ends to reconnect with existing pipe. All sleeves shall be restrained by wedge action retainer glands on both sides.

E. Reclaimed Water Service Line Repairs:

1. A reclaimed water service line severed between the reclaimed water main and the reclaimed water meter shall be repaired using new polyethylene service piping and “no lead” brass unions.

2. All repairs to existing copper service tubing shall be provided in conformance with the repair Specification under Section 6000.

3. A corporation stop pulled out of a reclaimed pipe water main shall have a new service saddle and a new “no lead” corporation stop installed on the reclaimed water main.

F. Abandonment: Reclaimed service laterals shall be completely abandoned, including the corporation stop, by removing the corporation stop at the main after locating the service connection and turning off the reclaimed main. An approved repair band shall be used to repair the reclaimed main after removal of corporation stop. All service abandonments shall be coordinated with Cary Utilities and Public Works Departments a minimum of 14 days in advance of anticipated removal. A plan for the isolation of the required section of reclaimed main shall be approved by Cary prior to work proceeding. Contractor is responsible for any applicable regulatory approvals necessary to perform the reclaimed service abandonment and repair the road to regulatory standards, if applicable.

END OF SECTION 6500