

Utility Relocation Design Criteria City of Columbia Carolina Crossroads, Phase 1

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1. GENERAL

All submittals and information noted herein as being “to the City” are to be provided to SCDOT who will then coordinate with the City of Columbia.

The following design guidelines and standards have been developed by the City of Columbia (City) for use on the Carolina Crossroads Project. Deviations from these guidelines will require approval from the City of Columbia. These guidelines are not intended to cover every eventuality. Additional content and resources may be required. In the event of a conflict between these documents or other governing criteria, the most stringent shall prevail.

It is assumed that the work performed under this Project will be a relocation project consisting of relocating existing utilities and constructing new, similar sized facilities, in an adjacent location. The Contractor shall obtain all necessary permits to accomplish the work.

All work performed under this project shall have a warranty of 2 years after final acceptance by the City. Design documents should clearly state the warranty period.

Staff performing work on the sanitary sewer system shall be trained by City staff on the Sewer Overflow Response Program and shall follow all requirements. Contact Stephen Sealey, Wastewater Compliance Manager (803.545.0208). The Wastewater Compliance Department’s Administrative Professional can also be reached at 803.467.0882.

A template “Scope of Services” has been included in the provided information. At a minimum, work by the Contractor is required to meet the level of effort in the scope template.

Other information has been included by the City in SCDOT’s Agreement for Carolina Crossroads Phase 1 – Colonial Life Boulevard Interchange Improvement Project (Project ID P039718) to establish minimum specifications and requirements for materials, specifications, details, and other items necessary to design the relocations. The Design Build Contractor shall follow these unless approved by the City Engineer.

Sediment and erosion control is not addressed in these criteria. All permitting and requirements will be the responsibility of the Contractor.

Property acquisition of sufficient SCDOT rights-of-way to relocate or retain City water/sewer infrastructure in the right-of-way to meet these standards, or the acquisition of easements, shall be the responsibility of either the SCDOT or the Design Build Contractor (responsibility to be as set forth in the SCDOT’s Agreement for Carolina Crossroads Phase 1 – Colonial Life Boulevard Interchange Improvement Project, Project ID P039718).

Record Drawings must meet all applicable City standards for record drawing submittal which can be found here:

- <https://www.columbiasc.net/property-services/record-drawings>
- Record Drawings should also include a submittal in AutoCAD 2017 (or a more current version) format of a survey (X,Y and elevation) of all pipe bends (horizontal and vertical), fittings, valves, and at points along the pipeline no further than 100-feet apart.

- Survey standards should meet the standard described in the City's template utility relocation design scope template.

The information provided by the City and included in the SCDOT's Agreement for Carolina Crossroads Phase 1 – Colonial Life Boulevard Interchange Improvement Project (Project ID P039718) should address the appropriate design criteria, design standards, specifications, design details, plan requirements, other requirements, and direction. Only in an event where an item is not addressed in the materials provided, should the City's Engineering and Regulations Manual be used.

Design Review – Design Build Contractor shall submit for design review to the City of Columbia for comments at the 30%, 60%, and 100% design milestones as detailed below. Design Build Contractor must resolve City of Columbia comments before advancing the design plans. Plans for Utility Work shall be independent plans under separate cover from roadway plans, but utility design shall be fully coordinated with the roadway design shown in the roadway plans. Plans must meet the requirements of the City's Scope of Services document included in the SCDOT's Agreement for Carolina Crossroads Phase 1 – Colonial Life Boulevard Interchange Improvement Project (Project ID P039718). The 100% review stage shall be a 'draft final' review set for City comment. Once those comments are resolved the Project can be submitted for any applicable permitting. Any changes to the design plans beyond the 100% review shall require the approval of the City. The 30%, 60 %, and 100% submittal shall include, at minimum, the following content:

30-percent Utility plans:

- Plan set with complete horizontal alignment of proposed utility work in relation to existing and proposed roadway features, other utilities, and SCDOT right-of-way.

60-percent Utility plans:

- Plan set with complete horizontal and vertical alignment of proposed Utility Work in relation to existing and proposed roadway and storm drainage features, other utilities, and SCDOT right-of-way. Includes corrections to 30-percent plans required by Utility.
- Plan view and profile sheets with cross sections as necessary including temporary and final grades
- Design calculations, general notes, water and sewer notes, table of contents for specifications, and details

100-percent 'Draft Final' Utility plans:

- All information included in 60-percent plans with proposed utility location fully coordinated with proposed roadway and drainage features and any other proposed Utility Work for other utility owners within the project limits. Includes corrections to 60-percent plans required by Utility.
- Service line tie-in locations
- Details for all work items
- Final Design Calculations
- Final Specifications

2. DESIGN CRITERIA FOR DRINKING WATER PIPELINES AND INFRASTRUCTURE

The following water system design standards for City of Columbia are based on Federal, State, and local health requirements and engineering design criteria. “Ten States Standards” shall apply where applicable. All installations are to deliver water to the consumer which meets the bacteriological and chemical quality standards of the S.C. Department of Health and Environmental Control. Design of water and sewer infrastructure located within the SCDOT’s right of way shall comply with the SCDOT Utilities Accommodation Manual (latest version).

Water mains shall not be installed in contaminated soils or in the vicinity of contaminated waters or in an area where contaminated materials are stored. As soon as the existence of these circumstances comes to the attention of the Design Build Contractor work shall be halted, and the City Engineer informed. The Design Build Contractor shall recommend design changes to include, but not be limited to, re-routing and the use of alternate pipe and joint materials. This includes water mains that are to be located within 10 feet of a septic tank or tile field. In every event, prior written approval must be obtained from the City Engineer in advance of making design changes and proceeding with design or installation.

Pipe diameters for relocated pipelines shall be the same diameter and retain similar or greater capacity as the original pipeline that is being relocated. In the event of a new pipeline, consolidated pipeline, or pump station, sizing will be provided in a PER (preliminary engineering report).

Should a new or consolidated pipeline be necessary and agreed to by the City during the technical proposal stage, but not previously anticipated as part of a PER, design shall be performed as required by SCDHEC, described in the included scope of services, and as described in the City’s Engineering Regulation Manual.

All water and sewer infrastructure (pipelines, mains, pump stations, etc.) must meet standards established by South Carolina Department of Health and Environmental Control and State Primary Drinking Water Regulations.

Flushing, Testing, and Disinfection of Water Mains – All water main designs shall include the appurtenances necessary to allow the Design Build Contractor to perform flushing, pressure testing, leakage testing, disinfection, and bacteriological sampling in accordance with AWWA, SCDHEC, and City Standards.

2.1 Water Transmission Mains (16-inches in diameter and larger)

Water transmission mains shall be 16-inch or larger ductile iron pipe (DIP) meeting the provided standard specifications.

The City does not accept 14-inch, 18-inch, or 20-inch pipe diameters for use in its water system.

Wall thickness of ductile iron pipe will be selected in accordance with ANSI/AWWA C150/A21.50. Calculations signed & sealed by the Engineer-of-record shall be included with the 60-percent design submittal.

The City does not accept PVC, PCCP, or RCP pipe for use as transmission mains. Where special conditions exist which require the consideration of alternate pipe materials such as HDPE, the Design Build Contractor must submit a written request for consideration to the City Engineer with justification of why DIP cannot be used, why the alternate pipe material is appropriate, and specifications of the proposed pipe and installation. The Design Build Contractor will not proceed with design using alternate pipe materials without written approval of the City Engineer.

Pipe trench installation shall include a “clay bulkhead” every 300-feet to prevent water from moving along the stone bedding and backfill.

2.2 Water Distribution Mains (12-inches in diameter and smaller)

Water distribution mains shall be 4-inch, 6-inch, 8-inch, or 12-inch Class 350 ductile iron pipe per the provided standard specifications.

The City of Columbia does not accept 1-inch, 1.25-inch, 2-inch, 2.5-inch, 3-inch, or 10-inch pipe for use in its water distribution system.

In no case will water distribution main piping be less than 6-inch diameter except that 4-inch diameter ductile iron pipe may be used, when properly sized, for court and cul-de-sac streets that do not require a fire hydrant or extensions to adjacent properties. 4-inch pipe will only be allowed if specifically approved in writing by the City.

The City does not accept PVC pipe for use in SCDOT, County, or City rights-of-way.

The City does not accept asbestos-cement, RCP, or fiberglass for use in its water system. Where special conditions exist which require the consideration of alternate pipe materials such as HDPE, the Design Build Contractor must submit a written request for consideration to the City Engineer with justification of why DIP cannot be used, why the alternate pipe material is appropriate, and specifications of the proposed pipe and installation. The Design Build Contractor will not proceed with design using alternate pipe materials without written approval of the City Engineer.

Pipe trench installation shall include a “clay bulkhead” every 300-feet to prevent water from moving along the stone bedding and backfill.

2.3 Valves

Line valves in water transmission mains shall be butterfly valves which meet the requirements set forth in the attached standard specification.

Line valves in water distribution mains shall be gate valves which meet the requirements of the attached standard specifications.

Line valves shall be located at each intersection with other water mains. Minimum requirements will be two valves for a tee intersection and three for a cross intersection (crosses should be avoided if possible). Valve spacing shall not exceed 1,000 feet in any case unless approved by City.

Air Release Valves (ARV) shall be installed at each high point along the water transmission and distribution mains. Acceptable ARV models are listed in the standard specifications. ARVs shall be installed in H20 rated manholes and shall be as specified in the attached standard specification.

The sizing of ARVs shall be in accordance with AWWA M51. Calculations signed & sealed by the Engineer-of-record shall be included with the 60-percent design submittal.

2.4 Fire Hydrants

All fire hydrants shall be as specified in the attached standard specification.

Fire Hydrants shall be located at each road intersection and shall be spaced no greater than every 1,000 feet.

Fire hydrants shall be installed on all dead-end mains greater than 200 feet in length.

2.5 Thrust Restraint

Thrust restraint for all water mains shall be provided by use of restrained joint pipe, except where water main connections require the use of concrete thrust blocking (these instances must be approved in writing by City Engineer). Locations where restrained joints are required will be indicated on the plans and profiles including the minimum lengths necessary, the beginning and ending locations, and other pertinent information.

In restrained sections of pipe joints shall be locking ring type restrained joints per the pipe manufacturer's standard or approved gripper gaskets as detailed in the Owner's Standard Specifications Section 02509.

Fitting joints shall be locking ring type restrained joints per the manufacturer's standard. Mechanical joint restraint systems that utilize a wedge style gripping system or a gland/ring positive restraint system will be considered acceptable on a case by case basis as approved by the City as detailed in the Owner's Standard Specifications Section 02509.

Restrained joint lengths shall be determined by use of a thrust restraint calculator. The Ductile Iron Pipe Research Association's (DIPRA) on-line calculator is recommended. The Design Build Contractor's Engineer-of-record shall submit a signed and sealed summary of these thrust restraint calculations to include all assumptions and results with the 60-percent design submittal.

2.6 Polyethylene Wrapping of Ductile Iron Pipe

All ductile iron pipe located within 100 LF of an active cathodic protection system, such as that on steel gas lines, shall be protected by installing polyethylene encasement. When used polyethylene encasement shall be V-Bio and meet all the requirements for ANSI/AWWA C105/A21.5, Polyethylene Encasement for Ductile Iron Pipe Systems as detailed in the Owner's Standard Specifications Section 02509.

3. DESIGN CRITERIA FOR WASTEWATER PIPELINES AND INFRASTRUCTURE

The following water system design standards for City of Columbia are based on Federal, State, and local health requirements and engineering design criteria. "Ten States Standards" shall apply where applicable. All installations are to meet the requirements and standards of the S.C. Department of Health and Environmental Control. Design of wastewater infrastructure located within the SCDOT right of way shall comply with the SCDOT Utilities Accommodation Manual (latest version).

3.1 Alignments

Gravity sewers shall be laid with straight alignment between manholes.

3.2 Depth

Gravity sewer depths shall be sufficient to provide gravity sewer service to each existing customer and to each existing non-served parcel along the existing and proposed sewer alignments.

Homes along Lawand Drive and Frontage Road currently served by septic tanks may have their septic tanks impacted by SCDOT right-of-way acquisition. If this is the case, the Lawand Drive Sewer relocation shall be deep enough to provide gravity sewer service to each home.

3.3 Increasing Size

When a smaller sewer joins a larger one, the crown of the larger sewer shall match the crown of the smaller sewer.

3.4 High Velocity Protection

Design Build Contractor shall design the system to prevent velocities from exceeding 10-feet per second in the pipelines.

3.5 Materials

Gravity sewer pipes shall be PVC (SDR 26) as specified in the standard specifications unless depth of the installed line exceeds the manufacturer's recommendation. In that

event, the City will require Protecto 401 lined DIP (as specified in the provided standard specifications).

Force Main pipes shall be Protecto 401 lined DIP as specified in the provided standard specifications.

Requirements shall be set forth in the final specifications for the pipe and method of bedding and backfilling thereof so as not to damage the pipe nor its joints, impede internal cleaning operations and future tapping, nor create excessive side fill pressures nor ~~evulation~~ ovalization of the pipe, nor seriously impair flow capacity. All sewers shall be designed to prevent damage from superimposed loads (permanent or temporary).

3.6 Joints and Infiltration

Sewer joints shall be designed to minimize infiltration and to prevent the entrance of roots. Leakage tests shall be as specified. This shall include appropriate water or low-pressure air testing (see provided specifications).

Pipe trench installation shall include a “clay bulkhead” every 300-feet to prevent water from moving along the stone bedding and backfill.

Sanitary sewers shall be constructed of ductile iron at stream crossings. Top of pipe shall be a minimum of 2-feet below stream bed.

3.7 CCTV Inspection Prior to City Acceptance

The use of CCTV inspection of gravity sewer with NASSCO compliant coding and database will be required prior to placing the sewer in service. Results of such tests shall be certified to the City Engineer in writing by a registered engineer.

3.8 Force Main Valves

Force Mains shall have Air Release Valves (ARV) installed at each high point and along the force main as appropriate to remove air in the pipeline. ARVs shall be installed in H20 rated manholes and shall be ARI D-025 (manufacturer and model) and sized and located according to the manufacturer guidelines.

Force Main line valves shall comply with the requirements of the included City of Columbia Engineering Regulations Part 3.3: Design of Pump Stations (City Regulations Part 3.3).

3.9 Thrust Restraint for Force Mains

Thrust restraint for all force mains shall be provided by use of restrained joint pipe, except where connections or other circumstances require the use of concrete thrust blocking (these rare exceptions must be approved in writing by City Engineer). Locations where restrained joints are required will be indicated on the plans and profiles including the

minimum lengths necessary, the beginning and ending locations, and other pertinent information.

In restrained sections of pipe joints shall be locking ring type restrained joints per the pipe manufacturer's standard or approved gripper gaskets as detailed in the Owner's Standard Specifications Section 02615.

Fitting joints shall be locking ring type restrained joints per the manufacturer's standard. Mechanical joint restraint systems that utilize a wedge style gripping system or a gland/ring positive restraint system will be considered acceptable on a case by case basis as approved by the Owner as detailed in the Owner's Standard Specifications Section 02615.

Restrained joint lengths shall be determined by use of a thrust restraint calculator. The Ductile Iron Pipe Research Association's (DIPRA) on-line calculator is recommended. The Engineer-of-record shall submit a signed and sealed summary of these thrust restraint calculations to include all assumptions and results with the 60-percent design submittal.

3.10 Manholes

General – The City has included a Manhole Design and Style guide. Manholes shall conform to these requirements unless otherwise approved by the City in writing.

Location – Manholes shall be installed at the end of each line; at all changes in grade, size, or alignment; at all gravity pipeline intersections; and at distances not greater than 400 feet.

Material – Manholes shall be precast and shall meet the provided specifications.

Drop Type – An inside drop pipe shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert shall be filleted to prevent solid deposition.

Diameter – The minimum interior diameter of manholes shall be 48 inches. For sewer pipes in sizes eight inches up to 15 inches, manholes shall be a minimum of four feet in diameter. For sewer pipes 18 inches and larger, manholes shall be a minimum of five feet in diameter.

Manhole Depth – The four-foot diameter manhole shall have a minimum depth of four feet and a maximum depth of less than 12 feet measured from the top of pipe to the top of the ring. Manholes of greater depth shall be five feet in internal diameter.

Flow Channel – The flow channel through manholes shall be made to conform in shape and slope to that of the sewers.

Water tightness – Watertight manhole covers shall be used wherever the manhole tops may be flooded by street runoff or high water and where the manhole covers are below the 100-year flood elevation. Manholes shall be waterproofed on the exterior.

3.11 Existing 30-inch Force Main

The existing 30-inch force main is called the Saluda River Pump Station Force Main (SRFM) as it leaves the Saluda River Pump Station and passes through the CCR site. This pipeline is made of Pre-stressed Concrete Cylinder Pipe (PCCP), and is thought to be brittle if disturbed or vibrated in any way. The City is requiring that this line be relocated for the length of the CCR Project footprint. Disturbing this line in any way could cause a fracture and a major sewer spill could occur. The relocation must account for any conflicts, construction traffic, vibratory influence, and all other relocation considerations. For the portions of the 30-in pipeline not being relocated as defined in Exhibit 3 – Scope of Work, at a minimum the City requires that this existing pipeline be ~~relocated~~ protected by monitoring in accordance with Exhibit 5 Section 107: Monitoring of Constr.-Related Earthborn Vibrations anywhere the force main is within 100-feet of construction activity (Design Build Contractor would still need to assess the impact of construction activity on the existing PCCP SRFM). A new DIP force main will not require these significant setbacks, however the new DIP force main must be relocated a safe distance from construction activity to not damage the new pipe, and to allow for future access as described in later sections of this design criteria document.

The Design Build Contractor should be aware of the typical lead time required for delivery of the specially manufactured fittings required to tie to the existing PCCP force main to the new ductile iron pipe, based on the assumed tie-in approach the Contractor is likely to utilize. The Design Build Contractor is responsible to have materials on site and to make any repairs due to damage caused by construction.

Tie in of the relocated SRFM will require close coordination, planning, and approval of the City's Saluda River Pump Station operational staff. A limited amount of storage is available at the Saluda River Pump Station that may be available to assist in the switchover. Design Build Contractor to be responsible for determining if this is sufficient for switchover or if a by-pass is needed. The use of wastewater storage at the pump station will be weather and time dependent and cannot be guaranteed. Should the City be able to provide storage at the Saluda River Pump Station, the storage event will not be allowed to exceed 36 hours.

The contractor shall provide the City a plan for review and approval for connecting the new 30-inch force main and the major construction and contingency activities required during the storage and connection event.

The contractor shall provide the City a vibration monitoring plan for review and approval.

4. DESIGN CRITERIA FOR WASTEWATER PUMPING STATION

Colonial Life Pump Station has been assumed to be impacted as a result of the CCR Project. In addition to the criteria included below, a Preliminary Engineering Report (PER) is attached for information which was developed for the City of Columbia for this relocation.

An updated City Regulations Part 3.3 has been included in Attachment B. These guidelines and requirements shall be met unless otherwise approved in writing by the City. The provided City Regulations Part 3.3 version as part of the SCDOT's Agreement for Carolina Crossroads Phase 1 – Colonial Life Boulevard Interchange Improvement Project (Project ID P039718) is to be used. The on-line version on the City of Columbia's website may be an outdated version and shall not be used.

A Pump Station Equipment and System Performance and Operational Testing plan will be developed by the Design Build Contractor. A Commissioning plan must also be developed by the Design Build Contractor. City shall review and have approval authority of these plans. They must include plans for the following along with documentation of the actual performance:

- Detailed plan for the start-up, operational testing requirements, and operational switch-over.
- Performance testing and calibration plan for all electrical, mechanical, and instrumentation components.
- Design Build Contractor shall operate and maintain the pump station for one week prior to acceptance by the City for operation. All equipment and electronics shall function properly during this one-week time period. If operation does not comply with all aspects, then the one-week timeframe restarts until successfully completed and all components meet the operational requirements.

4.1 Colonial Life Pump Station Relocation

The existing Colonial Life Pump Station (Columbia Water PS #120), currently located at 499 Lawand Drive, shall be replaced by a new sewer pump station constructed at NX 421 Arrowood (Richland County Parcel Number: R07302-05-03). This parcel is owned by the SCDOT. The new pump station shall be designed and constructed per the City Regulations Part 3.3 and the other applicable design standards and requirements contained and referenced in these Project documents. Any other version of the City of Columbia Standards, other than those received with this document, are not to be used for design or construction of these utilities unless approved in writing by the City.

4.2 Force Main Connection

The new Colonial Life Pump Station shall be connected to the existing 6-inch force main along Lawand Drive by cutting in a 6" x 6" restrained joint ductile iron tee and two 6-inch restrained joint plug valves. One plug valve shall be installed on the new force main upstream of the tee connection and one upstream of the tee on the existing force main. The valves shall allow continuous operation of the existing pump station while the

proposed site is being constructed and commissioned. The valve on the existing force main shall be permanently closed and buried once the original pump station is decommissioned.

The force main shall be a minimum 6-inch diameter ductile iron force main designed in accordance with the City of Columbia Standards with a minimum flowrate of 2 feet/sec during design flow, while not exceeding 10 feet/sec. The force main shall be adequately sized to handle the designed peak flow of the selected pumps. The force main shall also satisfy a leakage test in accordance with AWWA Standard C600.

4.3 Hydraulic Design & Pump Selection

The existing Colonial Life Pump Station is a duplex pump station with 230 gpm firm capacity into the existing force main from its current location and elevation. In order to replace this facility, the new Colonial Life Pump Station shall be designed to have this same flow capacity from its new location and new elevation. The proposed new Colonial Life Pump Station shall have two identical Flygt submersible pumps that maintain an operating point at or near peak efficiency. Each pump shall be capable of conveying 230 gpm (or as required by paragraph 3.3.2.6 of the City Regulations Part 3.3, whichever is greater) through the existing force main and intermediate high points and to the discharge manhole. The discharge force main from the Colonial Life Pump Station manifolds into a common force main with the City's Three Rivers Pump Station. The relocated Colonial Life Pump Station shall be capable of meeting discharge requirements while the Three Rivers Pump Station is also in operation.

4.4 Wet Well

The pump station wet well shall be round, with a minimum 8-foot diameter.

The wet well is expected to be 20-feet deep or deeper. The lowest pipe invert emptying into the wet well shall be the controlling elevation. The pump station shall be designed to be operated at the following wet well elevations, or as required by paragraph 3.3.2.6 of the City Regulations Part 3.3, whichever is greater:

- "High Level Alarm" elevation shall be 1.0-foot below the invert elevation of the lowest pipe into the wet well.
- "Lag Pump On" elevation shall be set at a minimum 1.0-foot below "High Level Alarm" elevation.
- "Lead Pump On" elevation shall be set at a minimum 0.5-foot below "Lag Pump On" elevation.
- "Pump Off" elevation shall be set at a minimum 2.5-feet below "Pump On" elevation to provide sufficient wet well storage to ensure less than a maximum of 10 pump starts per hour (i.e. minimum 6-minute cycle time) at maximum pump station flow.
- "Low Level Alarm" elevation shall be at a minimum 0.5-foot below "Pump Off" elevation and at least 0.5-foot higher than the required minimum submergence as determined by the pump manufacturer.

- The invert of the wet well shall be at a minimum 1.5-foot below the “Low Level Alarm” elevation or greater if required by the required minimum submergence.

4.5 Construction Considerations

Trees and brush shall be cleared from the proposed Colonial Life Pump Station site and easements with additional clearing at the discretion of the SCDOT. In addition, the pump station site shall be leveled to allow equipment and truck access.

During construction of the new Colonial Life Pump Station, the existing Colonial Life Pump Station shall remain in operation. Bypass pumping or pumping and hauling may be required while making the connection to the existing force main. Bypass pumping and manhole plugs may also be used during the construction of the adjacent gravity sewer lines to divert the sewer flow temporarily. The Contractor shall provide a switch over procedure to the City for approval.

4.6 Access and O&M

Access shall be maintained by the Contractor for the City of Columbia at all times to both the new and existing pump stations during and after construction to permit any operation and maintenance needs. This includes providing enough space around the wet well to allow the installation and removal of the submersible pumps with subgrade sufficient to support a vehicle up to 36,000 lbs on the site.

All manholes shall remain accessible at all times both during and after construction. They shall not be covered with debris/dirt or left open to the elements to accumulate water or debris inside the manhole. The new gravity sewer lines, new force main, and new pump station shall be monitored and maintained by the Contractor for a minimum 30 days of successful operation. The transfer of responsibility shall occur only when stated in writing by the City of Columbia. Both the gravity sewers and the manholes shall be constructed in accordance with contract documents.

4.7 Environmental Planning and Permitting

See Exhibit 7 Section 3 for environmental planning and permitting information.

A National Pollutant Discharge Elimination System (NPDES) construction storm water permit may be required from City of Columbia if its jurisdiction as a Municipal Separate Storm Sewer System (MS4) outside the SCDOT right of way limits is impacted.

A “Permit to Construct” for Water/Wastewater Facilities shall be obtained from SCDHEC in advance of construction. Following construction, a “Permit to Place in Operation” shall also be obtained from SCDHEC in advance operating the new facility. The City of Columbia shall provide a service letter to use in procuring this permit. The City shall also provide a letter accepting responsibility for the O&M of the proposed Colonial Life Pump Station after 30 days of maintenance and successful operation from the Contractor has been accomplished as determined by the City.

4.8 Design for Relocation

Design shall comply with the City Regulations Part 3.3. Anything marked as ‘typical’ in City Regulations Part 3.3 shall be required. Any deviations shall be specifically noted by the Contractor and must be approved by the City. The City will review the plans during design prior to construction to ensure compliance with all standards. The pump station and associated components shall comply to all standards referenced in these contract documents.

4.9 Pump Station Site Layout

The new pump station shall be designed in a manner to provide the most efficiency and accessibility. See Figure 3-4 in City Regulations Part 3.3 for a schematic of the recommended replacement of the Colonial Life Pump Station. The double gates shall be positioned parallel to Lawand Drive and open to a 60-foot x 60-foot fenced pump station site. The gravity sewer shall collect inside an influent manhole within the pump station site and gravity flow into the wet well. The influent manhole is critical and cannot be removed through value engineering efforts. From the wet well, the sewage shall pump through the valve vault and into the 6-inch ductile iron force main.

4.10 Decommissioning

The existing pump station shall remain in operation until the proposed Colonial Life Pump Station is constructed and has been fully and successfully operational for a minimum 30 days as determined by the City. After this time, the existing pump station shall be shut off and the City shall be given two weeks to retrieve any equipment from the existing pump station that is salvageable. After those two weeks, any equipment left by the City shall be property of the Contractor. Further decommissioning shall be the responsibility of the Contractor.

4.11 Design Considerations of Existing Force Main and Pump Station

The existing 6-inch force main from the existing Colonial Life Pump Station is routed approximately 3,800-feet along Lawand Drive, Arrowwood Road, and Gracern Road to the Three Rivers Pump Station. From there, flow from Colonial Life Pump Station joins flow from the Three Rivers Pump Station and continues eastward through the 8-inch Three Rivers Force Main. The 8-inch force main continues along Gracern Road approximately 2,400-feet and discharges into a manhole (STA 62+67 per the SCDOT as-builts). From there, flow is conveyed through 12-inch gravity sewer.

The existing force main from the existing Colonial Life Pump Station will be utilized for the proposed relocated Colonial Life Pump Station. A new 6-inch DIP force main will travel from the valve box and tie into the existing 6-inch force main in Lawand Drive by cutting-in a tee.

The Three Rivers Pump Station also discharges to the manifold force main to which the existing and new Colonial Life Pump Stations discharge and shall be considered in the

design of the new Colonial Life Pump Station. A Pump Test Report from the Three Rivers Pump Station is included at the end of this section for that purpose.

4.12 Geotechnical Considerations

Foundation design shall be the responsibility of the Contractor. Qualifications of the individual designing the foundation shall be presented to the City in advance for approval. Geotechnical design shall include, but not be limited to, considerations for groundwater, lateral loading, and buoyancy resistance.

4.13 Concrete Design

Design of all cast-in-place, site-cast, and precast concrete structures shall be performed, except as indicated below in accordance with the governing code(s). Design of site concrete work shall be the responsibility of the Contractor. Qualifications of the individual designing the site concrete shall be presented to the City in advance for approval. Design of the precast site structures, including manholes and vaults is the responsibility of the Contractor. Qualifications of the individual designing the pre-cast concrete shall be presented to the City in advance for approval.

Concrete structures shall be designed in accordance with ACI 318 for general structures, ACI 350 for environmental engineering structures, and AWS D1.4 for reinforcing steel and welding.

Structures that convey, store or treat liquid are subjected to severe exposures, or that have restrictive leakage requirements shall be designed as environmental engineering structures.

Design shall be performed for concrete with the following minimum 28-day compressive strengths (f'_c):

Equivalent Fluid Pressures Used in Preliminary Design	
Concrete Type	Pounds per Square Inch (psi) ³
Structural Concrete	4,500
Precast Concrete	5,000
Concrete Fill	2,500 ¹
Flowable Fill - non-excavatable	300
Flowable Fill - excavatable	100 ²

An epoxy coating system shall be installed on the interior concrete walls and elevated slabs of the pump station wet well and any exposed piping. The bottom slab is not required to be coated. The epoxy coating system shall be Raven 405 applied at a minimum thickness of 125 mils DFT.

Leakage testing shall occur prior to the installation of the coating system. Any cracks exhibiting leakage shall be repaired with hydrophilic polyurethane injection.

4.14 Electrical Requirements

This new pump station requires a new service, electrical distribution equipment, emergency generator with automatic transfer switch, and control equipment. Existing Colonial Life Pump Station must remain in service until the new station has been commissioned and accepted by the City of Columbia (City) Engineer.

The electrical system must be designed and constructed meeting the minimum requirements of latest edition, unless otherwise noted, of all applicable codes and consensus standards.

The pump station primary power source shall be rated 480/277V, 3-phase, 4-wire Wye electrical service. This requires coordinating with the local electrical utility provider, securing and paying all application and permit fees and cost associated with and incurred for the pump station before final acceptance.

A natural gas standby generator unit shall be provided as the secondary standby source. Size the generator to supply sufficient power service to operate normally while under generator just as the pump station and site components would if under normal power.

An ATS (automatic transfer switch) shall be provided to perform automatic switching during unexpected loss of the primary power source. The generator and ATS shall be rated for use with 480/277V, 3-phase, 4-wire power. When there is a loss of utility power the ATS shall automatically start the generator and transfer the pump station to generator power. The generator shall be selected to meet the minimum requirements provided in City of Columbia Standards.

Contractor shall provide natural gas service to the generator. This shall be through a metered connection to the Dominion natural gas pipeline network.

Equipment, and associated components installed in the pump station are required to meet the minimum requirements of City's Standards as specified in these Project documents. All materials and equipment shall be new. Similar material and equipment shall be the product of one manufacturer and shall be UL listed.

Furnish, install, test and place into operation a solidly grounded, automatic transfer switch rated 480/277V, 3 phase, 4 wire. The automatic transfer switch shall be furnished with a NEMA 4X, 316 stainless steel enclosure.

TVSS (transient voltage surge suppressor) devices shall be provided for the electrical distribution system equipment to reduce the destructive effects of electrical transients and temporary excess voltage and/or current in the electrical circuits. The TVSS devices shall be incorporated to limit short duration events, typically lasting from a few thousandths of a second (milliseconds) to billionths of a second (nanoseconds). The electrical system equipment shall be protected by TVSS on the 480-volt line entering the submersible pump control panel. Latest UL1449 standards shall be specified.

Site grounding shall meet the minimum requirements of NEC Article 250 and the City Regulations Part 3.3.



The sites main disconnecting means shall be an enclosed circuit breaker listed as suitable for service entrance. Additional requirements to be coordinated with the electrical service provider.

4.15 Electrical Testing and Final Acceptance

During construction all electrical equipment installed as part of this pump station shall be field tested and commissioned in accordance with the latest revisions of NETA Standard ATS "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems". A typed test report, in compliance with NETA standards, shall be submitted after final acceptance for each component tested.

Prior to final acceptance, all systems must be inspected and tested for proper operation as directed by the City Engineer. Contractor shall provide all equipment, including electrician, required for this test including specifications and drawings for reference. Equipment that fails the inspection and/or testing must be corrected and/or replaced to the City's satisfaction prior to final acceptance.

Three Rivers Pump Station Pump Test Report

		Pump Startup Report Xylem Water Solutions USA Inc. 14125 South Bridge Circle Charlotte, NC 28273 Voice 704-504-8804 - - Fax 704-504-8773			
Report Date:	June 22, 2017	Purchase Order No.:	1622001	Delivery Note:	E16507
Pump Serial Numbers:	1640057, 58	Model No.:	np 3102/464		
Start-Up Date:	6/21/2017	Control Panel Mfr:	RSI		
Project Name:	Three Rivers PS	Project Location:	Columbia SC		
Start-Up Technician:	MP	FUS#	A70017		
Engineer's Contact:		Phone:		Engineer:	Weston & Sampson
Contractor's Contact:	Dean Fairweather	Phone:	803 227 1205	Contractor:	MB Khan
End User's Contact:		Phone:		End User:	City of Columbia
VOLTAGE & CURRENT CHECKS					
FLA:	14	HP:	5.0	GPM:	230
TDH:	31.6	VOLTAGE:	230	PHASE:	3
VOLTAGE UNITS OFF:					
L1-L2:	247	L1-GND:	123		
L2-L3:	247	L2-GND:	217		
L1-L3:	247	L3-GND:	123		
VOLTAGE UNITS ON:					
UNIT NO. 1:		UNIT NO. 2:		UNIT NO. 3:	
L1-L2:	245	L1-GND:	123	L1-L2:	246
L2-L3:	246	L2-GND:	216	L2-L3:	247
L1-L3:	246	L3-GND:	122	L3-GND:	124
CURRENT:					
UNIT NO. 1:		UNIT NO. 2:		UNIT NO. 3:	
L1:	12.0	L1:	12.0	L1:	
L2:	12.0	L2:	12.0	L2:	
L3:	12.0	L3:	12.0	L3:	
UNBALANCE CALCULATIONS VOLTAGE					
UNIT NO. 1:		UNIT NO. 2:		UNIT NO. 3:	
AVERAGE	245.7	AVERAGE	246.3	AVERAGE	
MAX. DEV.	0.7	MAX. DEV.	0.3	MAX. DEV.	
UNBALANCE	0.27%	UNBALANCE	0.14%	UNBALANCE	
UNBALANCE CALCULATIONS CURRENT					
UNIT NO. 1:		UNIT NO. 2:		UNIT NO. 3:	
AVERAGE	12.0	AVERAGE	12.0	AVERAGE	
MAX. DEV.	0.0	MAX. DEV.	0.0	MAX. DEV.	
UNBALANCE	0.00%	UNBALANCE	0.00%	UNBALANCE	
DRAW DOWN TEST					
MANHOLE DIAMETER =	8	FT =	375.99	GAL/FT DEPTH	
60 SEC. DRAWDOWN =	8.00	IN. = PUMP RATE OF	250.66	GPM FOR UNIT 1	9 psi
60 SEC. DRAWDOWN =	8.50	IN. = PUMP RATE OF	266.32	GPM FOR UNIT 2	9 psi
SEC. DRAWDOWN =		IN. = PUMP RATE OF	0.00	GPM FOR UNIT 3	psi
AVG PRESSURE READING	20.79	FT	STATIC HEAD MEASUREMENT	10	FT
TDH	30.79	FT			
STATION CONTROLS					
TYPE OF CONTROLLER	NONE	APP 500	APP 700	OTHER PLC	
TYPE OF LEVEL SENSOR	FLOATS	x	PROBE	U.SONIC	PRESSURE x
SENSOR(S) ACTUATE?					
CONDITION OF STATION					
CONTROL PANEL:	RSI				
GUIDE RAILS PLUMB?:	x	PUMPS RIDE RAILS:	x	PUMPS CLEAR HATCH:	x
GENERAL NOTES:					

5. RELOCATION REQUIREMENTS

Relocations shall be in accordance with the SCDOT's Utility Accommodation Manual.

Relocations for City infrastructure shall also be required to; ensure future access (for maintenance, repairs, or replacement, prevent possible damage to new or existing utilities due to construction activity, prevent the pipeline from being too shallow or deep to future final grade, remove pipe from future pavement, adjust valves/rims and other infrastructure to final grade, and ensure that a future leak or break would not risk critical roadway infrastructure.

Relocations shall not place pipelines near or under columns, MSE walls, abutments, or other transportation or utility infrastructure (mast arm foundations, electrical equipment, etc.) in a way that prevents the safe access or impedes future access of the utility by the City. These design standards include a graphic depicting a minimum guideline for future utility access. City utility infrastructure shall be located a safe distance from structural elements (columns, walls, abutments, etc.) such that excavating to the utility with a single standard trench box can be done safely and without risk to the structural element.

Should a pipeline have to be located under an embankment, it shall be placed in a casing pipe just as required by jack and bore specifications. All final pipeline locations (existing and proposed) shall allow for maintenance (digging down to) without impact to roadway or other infrastructure.

Relocations shall not leave short runs of existing pipe between relocated sections unless approved by the City. Short runs of existing pipe between relocated segments that shall also be relocated will be generally defined as a pipeline length equal to 75% of the longest segment on either side of the section recommended to remain.

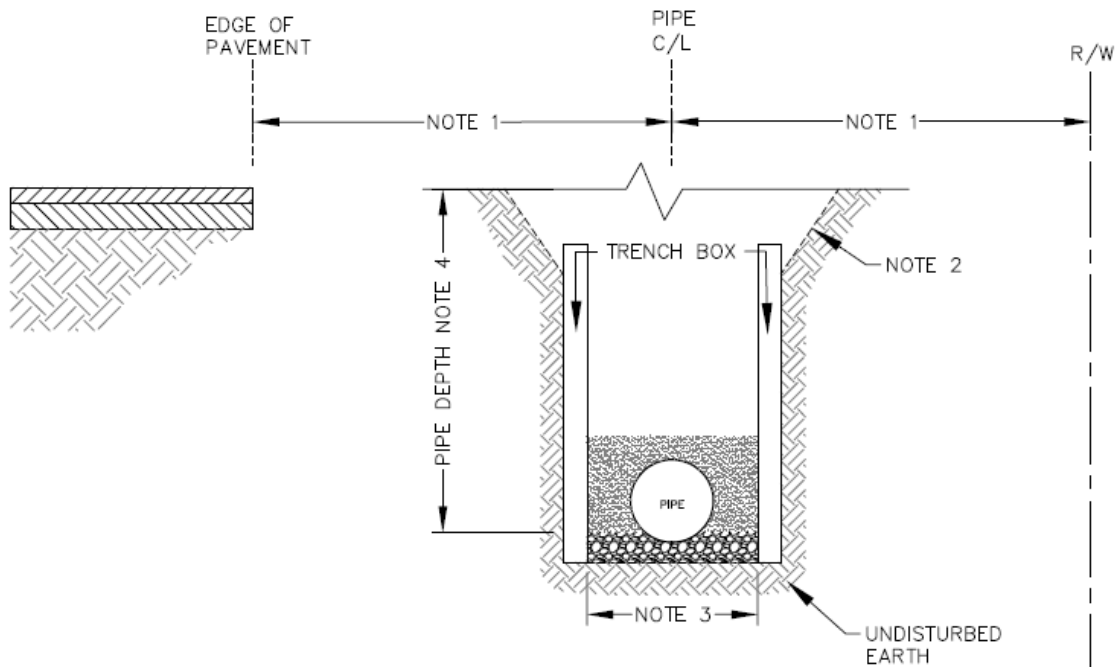
6. SCDOT'S RIGHTS-OF-WAY AND EASEMENTS

Where water distribution mains (up to 12-inch in diameter) are located in SCDOT's rights-of-way, the location shall be a minimum distance of 7.5-feet from the edge of the right-of-way as long as the bottom of the pipe trench is no deeper than 7.5-feet. Where the bottom of the trench is between 7.5-feet and 10-feet the location shall be a minimum distance of 10-feet from the edge of the right-of-way.

Where pipelines (16-inch in diameter and larger) are located in rights-of-way, the location shall be a minimum distance of 10-feet from the edge of the right-of-way as long as the bottom of the pipe trench is no deeper than 10-feet.

Water/Sewer utilities in rights-of-way must have clearances from other structures, utilities, obstacles to allow for the City to maintain and access the utility in the future. The City must be able to dig down to a Utility located in a right-of-way, while using a single trench box, without impacting other utilities, structures, or obstacles. Any exceptions to this must be explicitly approved by the City. At a minimum, other utilities shall not be located within 3 feet horizontally of the outside of a pipe wall unless approved by the City. Please see the detail below showing the minimum clear area required to access the utility. It is understood that

other utilities will need to cross this utility access envelope, but that should occur at perpendicular angles.



NOTES:

1. PIPE BURIED UP TO A DEPTH OF 7.5 FEET SHALL BE LOCATED AT LEAST 7.5 FEET HORIZONTAL DISTANCE INSIDE OF THE RIGHT-OF-WAY (R/W) LINE AND AT LEAST 7.5 FEET HORIZONTAL DISTANCE OUTSIDE THE EDGE OF PAVEMENT. PIPE BURIED UP TO 10 FEET OF DEPTH SHALL BE LOCATED AT LEAST 10 FEET INSIDE OF THE R/W LINE AND AT LEAST 10 FEET HORIZONTAL DISTANCE OUTSIDE THE EDGE OF PAVEMENT.
2. PIPELINE SHALL BE LOCATED AND ORIENTED RELATIVE TO OTHER UTILITIES AND ROADWAY RELATED INFRASTRUCTURE SUCH THAT THE CITY CAN EXCAVATE DOWN TO ACCESS AND MAINTAIN OR REPLACE THE PIPE. THE AREA WITHIN A TRENCH BOX PROFILE SHALL REMAIN CLEAR OF OBSTRUCTIONS THAT WOULD PREVENT INSTALLATION OF A TRENCH BOX, OR THAT WOULD CONFLICT, DAMAGE OR RISK OTHER UTILITIES OR ROADWAY RELATED INFRASTRUCTURE. ASSUME THE TRENCH BOX REACHES 6.5 FEET ABOVE THE INVERT OF THE UTILITY AND 1:1 SIDE SLOPES ABOVE THE TOP OF THE TRENCH BOX.
3. FOR PIPES 8"-12" IN DIAMETER, ASSUME AN INTERIOR TRENCH BOX SPREAD OF 36". FOR PIPES 16"-30" DIAMETER ASSUME AN INTERIOR TRENCH BOX SPREAD OF 60".
4. PIPE SHALL NOT BE BURIED WITH LESS THAN 3 FEET OF COVER UNLESS SPECIFICALLY APPROVED IN WRITING BY THE CITY, AND NO PIPE SHALL BE DEEPER THAN 10 FEET OF DEPTH TO THE BOTTOM OF PIPE UNLESS SPECIFICALLY APPROVED IN WRITING BY THE CITY.

PIPELINE LOCATION REQUIREMENTS

NOT TO SCALE

Any pipe depth greater than 10-feet must be approved by the City.

City utility infrastructure in SCDOT's Right-of-way must remain accessible and traversable with a standard 4-wheel drive truck. And have sufficient access points from public non-restricted roadways, to allow future access to the utility.

A buried water or sewer facility may be located under a bridge or elevated roadway structure if it crosses perpendicular to the structure and if it has a minimum of 25-feet vertical clearance

from the ground surface to the bottom of the structure to allow for City excavation equipment to access the utility for repair. If the required clearance cannot be provided the buried crossing shall be installed in a steel casing per the City's Standard Specifications. Cased crossing shall be designed with access for maintenance at the casing ends. Buried pipelines shall not be installed under and parallel to a bridge or elevated roadway structure. Any exceptions to this must be approved by the City.

Location of new water and sewer pipelines in roadways must have the advance approval of the City. If approved, the pipeline design must include bedding and backfill adequate for the loading anticipated from the roadway traffic and the depth of the pipeline and horizontal clearances must be reasonable for access for maintenance as described elsewhere in the Utility Relocation Design Criteria.

Standard Widths for Utility Easements
(8" pipe diameter and below)

UTILITY DEPTH

EASEMENT WIDTH

7.5 ft or Less	15 ft
7.6 ft - 10.0 ft	20 ft
10.1 ft - 12.5 ft	25 ft
12.6 ft - 15.0 ft	30 ft
15.1 ft - 17.5 ft	35 ft
17.6 ft - 20.0 ft	40 ft

NOTE:

All utility easements are to be located centered on and around the utility and its appurtenances.

Easement widths shall not vary between manholes.

Minimum easement width is 15 feet.

The depth of the utility is measured from the invert of the pipe at the deepest point to the finished grade.

7. SEPARATION FROM OTHER UTILITIES

Horizontal

As required in Section 6 above, water and sewer pipelines shall be located and oriented relative to other utilities and roadway related infrastructure such that the City can excavate down to access and maintain or replace the pipe. The area within a trench box profile shall remain clear of obstructions that would prevent installation of a trench box, or that would conflict, damage, or risk other utilities or roadway related infrastructure. Assume the trench box reaches 6.5 feet above the invert of the utility and 1:1 side slopes above the top of the trench box.

Based on the guidance stated in Section 6 above.

- For pipelines up to 12-inch diameter; a minimum of 30-inches of horizontal separation (outside to outside) from adjacent utilities, storm drainage, or other obstacles is required. This assumes an interior trench box spread of 36-inches, and an assumed minimum of 12-inches of clearance is needed between the trench box and adjacent utilities and storm drainage.
- For pipelines up to 30-inch diameter; a minimum of 33-inches of horizontal separation (outside to outside) from adjacent utilities, storm drainage, or other obstacles is required. This assumes an interior trench box spread of 60-inches, and an assumed minimum of 12-inches of clearance is needed between the trench box and adjacent utilities and storm drainage.

Vertical

Pipe shall not be buried with less than 3 feet of cover unless specifically approved in writing by the City, and no pipe shall be deeper than 10 feet of depth to the bottom of pipe unless specifically approved in writing by the City.

It is understood that other utilities will need to cross this utility access envelope, but that should occur at perpendicular angles.

At a minimum, sanitary sewers and water mains shall cross each other with 18-inches of separation per SCDHEC regulations. The water main should pass over the sewer whenever possible. Full pipe joints for both water and sewer shall be centered at the crossing to maximize separation as indicated in City of Columbia Water Detail #10.

At a minimum, other utilities and storm drains shall cross water and sanitary sewers with a minimum of 12-inches, however greater separation is preferred wherever possible.