02500 Site Utilities

Part 1: General

1.01 The University is responsible for the operation and maintenance of most site utilities associated with project development. Consequently, connections, attachments, extensions, or other modifications necessary for a project must be planned, budgeted, designed, and constructed by the project.

1.02 Centralized thermal, electrical, and communication utilities are currently being constructed or extended on each of the main campuses. New or renovated facilities will connect to these central utilities. Additional information is contained within or in Divisions 15, 16, and 17.

Part 2: Design Guidelines - Storm Water

2.01 The goal of stormwater management design at NC State University is to manage stormwater to prevent downstream flooding and stream bank erosion, to prevent pollution of waters, and to comply or exceed current stormwater management regulations. The NC STATE campus in Raleigh is located in the Neuse River Watershed and is subject to the Neuse River Buffer Rules. These regulations can be found at http://h2o.ehnr.state.nc.us/nps/neuse.htm

The University operates its stormwater system under a system-wide Municipal Separate Storm Sewer System permit, as defined by federal and state requirements. Design of stormwater devices for specific projects is determined by an integrated system-wide model. Determination of devices and mechanisms which are best suited for a project is an interactive process and must be coordinated with the Environmental Health and Safety Center - Environmental Affairs group. Under the NC STATE permit, the Environmental Health and Safety Center - Environmental Affairs group must approve the stormwater design proposal for all projects.

2.02 Campus stormwater management is managed as an integrated systems approach. Stormwater management for each project site must be studied in context with the entire watershed and subsequent impacts downstream. Each campus development project must incorporate a combination of methods to minimize the production of stormwater runoff and to slow and infiltrate water near the source rather than relying on one large device to control stormwater for the entire watershed. Stormwater devices will be incorporated into the landscape development plan to minimize negative impacts on humans and the environment in a cost-effective manner and to maximize limited land resources. Maintenance access is to be provided to all stormwater management devices.

2.03 Designs that minimize erosive grades and large contiguous areas of impervious surface, and employ Best Management Practices (BMP's) that infiltrate or retain and filter the first inch of runoff on the site should be the first "line of defense" for controlling stormwater. Due to local soil conditions (high clay content), grading and appropriate soil preparation may be required to construct effective stormwater BMP's.

2.04 Effective BMP's for campus are:

a.) Wet Ponds - Wet ponds with forebay and a vegetated aquatic bench control storm water before reaching nearby waterways. All ponds shall be off-line of existing streams and creeks.

The aquatic wetland bench shall be a minimum of 12' in width and water depth of 6" or less. Safety, esthetics, and available land are issues to evaluate before implementing a wet pond.

b.) Stormwater Wetlands - Stormwater wetlands can be created as an amenity as well as an infiltration device. Enhance the appearance and function of the wetland with diverse wetland plantings and utilize in areas where traffic through the wetland can be avoided.

c.) Bio-retention/Raingardens - Depressed, vegetated areas with amended soils, and bottom drains increase opportunities for runoff to be infiltrated and velocity reduced. These can be in areas of low pedestrian use or incorporated into planting beds using grass and ornamental plantings suitable for the conditions and use of the site.

d.) Sand Filters - Sand filters can be used to collect water from paved areas such as parking lots. They should not be implemented until the upstream watershed area is stabilized.

e.) Vegetative and Riparian Buffers - Delineate landscape buffers along creek beds, draws, and swales create opportunities for water to infiltrate into soils before reaching streams. Enhance plantings in this area as necessary with native plants that will filter and infiltrate water as well as provide food and cover for wildlife.

f.) Level Spreaders - Stormwater can be spread, rather than collected with the use of level spreaders. Level spreaders can be accomplished in lawn and areas to be planted by grading earth shapes to disperse water with sheet flow rather than collect it. They can be created with earth shapes, treated wood, or rock lined trenches. Level spreaders may also be used to disperse storm water, creating overland flow through riparian buffers. The slope of level spreaders must be tightly controlled to prevent localized erosion and may require additional detailing for proper construction.

g.) Grassy Swales - Grassy swales can be designed to slow stormwater leaving the site by undersizing culverts and the use of grass check dams across swales. Use of appropriately designed turf mat swales can provide stability to swales.

h.) Stream Repair - Adding sinuosity to streams adds length thus increasing the retention time stormwater remains on site and provides opportunities for infiltration. Increasing floodplain areas also improves filtration of stormwater runoff. Stream restoration can also reduce streambank erosion, which can contribute significant volumes of sediment to downstream waters.

i.) Overland Flow - Overland flow, rather than piping improves the removal of particulates, increases the time of water on site, and therefore, increases the opportunity for water to infiltrate.

j.) Cisterns - Cisterns may be employed to temporarily store storm water for irrigation.

(More information about stormwater BMP's can be found through NCSU Biological and Agricultural Engineering department online courses).

Part 3: Design Guidelines - Domestic Water & Sewer

3.01 Domestic water and fire service is provided through a private (university-owned) distribution system connected to the City of Raleigh. Design and installation should comply with the City of Raleigh *Public Utilities Standards and Handbook*.

3.02 Individual metering and cross-connection protection is required for each individual building. Intra-building cross-connection protection should follow ASPE cross-connection prevention

guidelines. Building meters may be inside the building but must be accessible to maintenance personnel. Main backflow preventors shall be located inside the building.

3.03 Sanitary Sewer - Sanitary sewer service is provided through a private (university-owned) collection system connected to the City of Raleigh Sewer System. Design and installation should comply with the *City of Raleigh Public Utilities Handbook*. Buildings with separate lab waste systems should include a sampling manhole outside of the building prior to combination with the normal building waste stream.

Part 4: Design Guidelines- Steam and Condensate

4.01 The standard design manual for steam, water, and gas piping is the *American Society of Plumbing Engineers Data Book* and associated supplements.

4.02 On-campus design professionals and Facilities Operations personnel can provide further information on specific sites. Facilities Planning and Design has detailed location information on many underground utility sites.

4.03 Also, please refer to the *North Carolina Construction Manual*, section 112.3, for specific information on State Construction Office requirements.

4.04 Documentation of designs should include detailed information on as-built existing conditions of distribution systems being connected to, and should provide the same level of detail on new installations. Profile drawings of underground utilities are required, as are locations of existing utilities, which may be disturbed or encountered during excavation. Designers are required to update drawings to reflect as-built conditions upon completion of construction.

4.05 All steam, condensate, and domestic water lines within the building envelope shall be insulated. Uninsulated mains or run-outs shall not be used as heat sources. Chases and stack areas carrying heating lines in the building should be adequately ventilated to prevent overheating due to piping losses.

4.06 All connections to mains shall be valved, both at the connection to the main and at the building.

4.07 All services to new buildings are to be metered as described below.

4.08 All new piping shall conform to the color scheme sited in section 15075 or be stenciled with type of service and direction of flow.

4.09 North/Central Campus Steam Distribution - Steam is generated and distributed through university-owned facilities at up to 150 psig for process/transmission lines and up to 30 psig for heating mains. Only 150 psig mains that provide steam for heating and process serve some areas. Process steam is available year round, but the pressures may vary up to 20% during peak loads. Steam from 30 psig mains is available only during heating season. The low-pressure heating mains will normally maintain a minimum of 18 psig at the buildings, but may be increased to as much as 35 psig during extremely cold weather. The pressure will vary depending upon heating demand. Many campus buildings use 3-5 psig steam for heating.

4.10 The heating system should not be depended upon to provide process steam.

4.11 Central steam distributions are currently scheduled for construction or expansion on the Centennial and CVM campuses. Coordinate with Facilities Planning and Design for the most recent information on operating pressures and services to these buildings.

4.12 Piping and Connections - All new buildings are required to be provided with steam meters. Steam should be metered directly, unless specific prior approval from the Facilities Planning and Design Office is obtained for condensate metering. Condensate meters should be placed on the discharge side of the condensate pump. A three-valve bypass around meters should be provided. Where condensate return is by gravity, a gravity type meter may be considered. Where ever possible, steam and condensate piping shall be installed in such a manner as to allow for gravity return of condensate. The designer is to provide drip lines and air vents as needed to assure ease of operation. The Construction Management Office shall coordinate all connection of new services to the steam mains with Facilities Operations personnel.

4.13 Campus Steam Distribution –

- Exterior steam and condensate lines shall be installed in semi-accessible precast concrete tunnels or fully accessible walkable concrete utility tunnels.
- Expansion loops shall be used for expansion compensation. Expansion joints will be reviewed on a case-by-case basis.
- Steam pipe shall be schedule 40 black steel pipe with 250 pound rated fittings in the distribution to the first pressure reducing station in the building. Steam piping shall be all welded construction.
- Condensate pipe shall be schedule 80 black steel pipe with schedule 80 fittings. Condensate piping shall be all welded construction to the first valve in the drip leg. Threaded fittings are permitted for use on the drip leg after the first valve.
- Pre-insulated piping systems will be reviewed on a case-by-case basis, typically for service from the first manhole to the building. Carrier pipes will be separately cased. Multiple carrier pipes in a single casing shall not be used.

4.14 Steam Manholes –

- Minimum manhole size shall be eight feet by eight feet by eight feet. Manhole sizes will increase from the minimum size to allow for adequate clearance and service space around piping, valves, fittings, traps, etc. Construction shall be poured in place concrete. Pre-cast manholes are not acceptable. Manhole base slab shall be waterproofed with a water seal at the key joint.
- Manholes shall not been used for anchor points unless specifically designed for such use.
- Two manhole covers shall be provided and shall be located diagonally across the manhole from each other. One cover shall be 24 inches in diameter for personnel access. Personnel access into the manhole will be by the way of a welded steel ladder securely anchored to the top, wall and floor of the manhole. Plastic or steel rungs mounted in the manhole wall are not acceptable. The second cover shall be 30 inches in diameter and will be located over a sump pit. The 30 inch diameter manhole will be used for ventilation and storm water removal. All manhole covers will be cast with “STEAM”. Piping, valves, traps, etc. shall not be located below either manhole.
- Manhole sump pits shall be 24 inch by 24 inch and 24 inches deep. Sumps should drain by gravity to the campus storm sewer system for removal of ground and storm water infiltration. Where the use of gravity drains is not feasible, the sump pit shall remain only a pit. Facility operations will remove water by the use of portable, not permanent, sump pumps. Sump drain piping shall be cast iron with bell and spigot fittings. PVC shall not be used for sump drain piping.

4.15 Drip Legs –

- Inverted bucket traps shall be specified for use on drip legs.
- Each trap will be sized based on the amount of condensate calculated for the distribution.
- High-pressure condensate from the drip legs shall not be introduced to the pumped wet condensate return system. A high pressure drip line shall be used where available.

4.16 Insulation –

- Insulation material on steam and condensate piping in tunnels and manholes shall be calcium silicate. Insulation thickness shall be as required by ASHRAE Standard 90.1 for buildings, but applied to utility construction.
- Insulation in manholes shall be provided on all piping, flanges, valves, etc. to reduce heat gain in the manhole.
- Aluminum jacket shall be used in manholes on all piping, fittings, etc. Aluminum jacket shall be provided on valve bodies up to the flanges for the gland packing to allow for service of the gland.
- Use 30-pound asphalt-impregnated felt jacket or other suitable material to protect insulation of pipes in concealed spaces from abuse during construction and from future deterioration. In high traffic areas, where insulated pipes are subject to mechanical abuse, metal covering or structural protection shall be provided. Wire used for securing pipe coverings shall be solid copper, stainless steel, or other non-ferrous material with a long service life.

Part 5: Design Guidelines - Chilled Water

5.01 See Section 15535 for information on chilled water piping.

Part 6: Design Guidelines - Medium Voltage Electric Distribution

6.01 See Section 16300 for information on the campus medium voltage electrical distribution systems.

Part 7: Design Guidelines - Natural Gas

7.01 Natural gas is available throughout most of the campuses from PSNC Energy.

7.02 Natural gas is available on the North Campus and is generally distributed through a university-owned system. Remaining campus locations are served directly from PSNC Energy company lines. Metering and lateral piping into each new building should be included in the contract. The Gas Company should perform tapping of mains. The Gas Company should supervise all work on main lines.

7.03 Gas Distribution Piping - Any gas distribution network must include a pressure-reducing station that is valved on both sides. Any gas meters should be located on the outside of the building. A 3-valve bypass piping arrangement should be supplied around the meter

Part 8: Design Guidelines - Electric Power

8.01 The university is the principal provider of electric power throughout the campuses. Some facilities, located on the perimeter of existing infrastructure systems, may be served directly by Carolina Power & Light Company. The designer must include provisions for underground duct bank, manholes, padmounted transformers, switching devices, cables and standby generation to be included in the construction. See Division 16 - Electrical for additional information.

Part 9: Design Guidelines - Telecommunications

9.01 The university is the primary provider of voice and data services throughout the Campuses. The designer must include provisions for raceways, wiring, and patch panels to be included in the construction. See Division 17 - Telecommunications for additional information.

Part 10: Design Guidelines - Identification of Underground Utilities and Piping

10.01 General

All underground piping and utilities (both metallic and non-metallic), except lawn irrigation lines, shall have two stages of identification and/or warning by a combination of non-detectable and detectable warning tapes.

10.02 Identification Tape (non-detectable warning tape)

The 1st stage of identification shall be a buried non-detectable warning tape. This tape shall provide an early warning at shallow depth excavation. The tape shall be 6" wide, and buried approximately 18" to 30" above the service pipe, but a minimum of 10" below finished grade. It shall consist of multiple layers of polyethylene with an overall thickness of 3 to 5 mils. It shall be installed continuous from valve box to valve box or manhole to manhole, and shall terminate just outside of valve box or manhole wall. The black colored lettering on the warning tape shall be abrasion resistant and be imprinted on a color-coded background that conforms to APWA color code standards.

10.03 Warning Tape (detectable warning tape)

The 2nd stage of identification shall be a detectable warning tape. This tape shall provide pipeline identification, be fully detectable from above grade utility locators, and be able to provide a depth reference point to top of pipe. It shall be 6" wide, installed directly on top of the pipeline and permanently secured to the pipeline at 10' intervals. The tape shall consist of aluminum foil core or stainless steel tracer wires laminated between multiple layers of polyethylene tape with an overall thickness of 4 to 6 mils. Detectable core or tracer wire "circuit" shall be continuous from valve box to valve box or manhole to manhole for complete pipeline detection and location. Tape manufacturers' approved splice kits shall be used for long runs. Warning tape shall terminate just inside of valve box cover or manhole ring cover and be easily accessible for "clip-on" type utility location meters. The black colored lettering on the warning tape shall be abrasion resistant and be imprinted on a color-coded background that conforms to APWA color code standards.

10.04 Tracer Wire

All non-metallic pipe, including lawn irrigation lines, and metallic pipe with compression gasket fittings installed underground shall have a tracer wire installed along the length of the pipe. The wire shall be taped to the bottom of the pipe at a maximum of 10' intervals and not allowed to "float freely" within the backfill. Tracer wire shall be single-conductor, 10 gauge minimum, copper single-conductor wire with type "UF" (Underground Feeder) insulation, and shall be continuous along the pipeline passing through the inside of each valve box.