

**CHAPTER 17**  
**TEMPORARY BYPASS PUMPING SYSTEMS FOR GRAVITY SEWER**  
**PIPE DIAMETERS GREATER THAN 24-INCH IN DIAMETER**

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## **PART 1 - GENERAL**

### **1.1 DESCRIPTION AND SCOPE**

- A. The Contractor shall furnish, construct, maintain and operate bulkheads, containment system, plugs, hoses, piping, and pumps to bypass sewage flow around the project area for the duration of the project. The bypass system shall, at all times, prevent backup or overflow onto streets, yards and unpaved areas or into buildings, adjacent ditches, storm sewers, and waterways. The Contractor shall design and provide the bypass system with sufficient firm pumping capacity to pump the existing sewer being bypassed flowing full and/or to convey the flows specified further herein. Firm capacity is defined as the capacity of the pumping system when the largest pump is out of service. The Contractor is advised that during rain events the flow in the existing sewers will increase rapidly and will fill the pipe and, in many cases, surcharge the pipe.
- B. Spills of any type, including but not limited to all spills and/or leaks caused by the operation of bypass pumps or other operations of the Contractor, are strictly prohibited at all times; notwithstanding such prohibition, any such occurrence shall be reported to Charlotte Water immediately after discovery and all costs, associated with the overflow and overflow clean up, including any fines and legal costs incurred by Charlotte Water and costs associated with property damage as a result of the overflow, shall be paid for solely by the Contractor. Costs of damage to real or personal property as a result of an overflow, and any other direct, indirect, incidental or consequential damages resulting therefrom or related thereto, shall be the sole responsibility of the Contractor, for which the Contractor will defend, indemnify and hold Charlotte Water harmless. In addition to these responsibilities of the Contractor, any spill that reaches a natural stream caused by the negligent operations of the Contractor may be deemed to be a substantial violation of the Contract Documents and a basis for termination under the General Conditions of this Contract.
- C. The Contractor is forewarned of the potential for sewer surges which cause rapid increases in sewer discharges, in particular during rain events and from upstream pump station on/off operations. The Contractor's bypass equipment and set up shall be adequate to prevent overflows under these surge conditions. The Contractor shall provide ample free board and wet well volume as required to contain the sewage. If risers to assist with sewage containment are proposed by the Contractor, the risers shall be coordinated with the upstream system to prevent any backups, overflows, or any other problems.

### **1.2 RELATED DOCUMENTS**

- A. Charlotte Water Water and Sewer Design and Construction Standards and Standard Details.

### **1.3 DEFINITIONS AND ABBREVIATIONS**

- A. See Sections iii and iv of the Charlotte Water Water and Sewer Design and Construction Standards for common abbreviations and definitions.

#### 1.4 BYPASS PUMPING SYSTEM – DESIGN REQUIREMENTS

- A. The bypass pumping systems shall have sufficient capacity to pump a peak flow of the line segment to be bypassed as specified herein. The Bypass Contractor shall provide all pipeline plugs, pumps of adequate size to handle peak flow during a 10-year storm event, and temporary discharge piping to ensure that the total flow of the main can be safely diverted around the project area. The bypass pumping system will be required to be operated 24 hours a day.
- B. The Contractor shall provide back-up pump(s) equal in capacity to the largest primary pump. Back-up pumps shall be on-line but isolated from the primary system by a valve. Contractor and pump supplier shall determine system pressure requirements based on proposed bypass piping size and layout and shall submit the proposed system curve for the pumping system as designed.
- C. The bypass pumping system shall pump the following flows:
  - 1. The pumping system shall meet the firm capacity as defined as the capacity of the pumping system when the largest pump is out of service. This flow represents the peak flow during a 10-year rain event measured in the upstream sewer system over the last several years per flow metering data. If flow monitoring for the upstream sewer system is not available, it is the responsibility of the contractor to perform flow monitoring for a duration of up to 3 months minimum to size the pumping system. Flow projections shall be developed by licensed NC PE and submitted to Charlotte Water for review and approval.
- D. If multiple force mains are used, the discharge piping shall be manifolded so the flow can be diverted to each specific pipe or any combination of pipes by quickly opening and/or closing valves. This will also allow a pipe to be isolated to make any necessary repairs.
- E. The Bypass Contractor shall have adequate standby equipment available and ready for immediate operation and tied into the bypass system for use in the event of an emergency or breakdown.
- F. Flow from all connecting sewers must be accommodated. Connecting sewers larger than 24" shall utilize hard piping and must have primary and standby sound-attenuated diesel auto-priming pumps. If connecting to the main bypass discharge line, the connection must have an isolating gate valve.
- G. Suction and Discharge Manholes: Existing manholes to be used as suction manholes and discharge manholes shall be modified by the Contractor as required. The suction manholes are subject to flooding during rain events - all modifications shall provide a leak tight manhole to prevent inflow into the manholes during flood conditions. The discharge manholes shall be sealed and protected per Paragraph 2.4C.
- H. Plugging of Flows: A minimum of two (2) plugs shall be used at each location where sewers are being plugged for bypass operations, meaning one plug shall be installed in the outgoing pipe of the manhole where the plugging occurs and then a second plug installed in the next downstream manhole in the incoming pipe. This will provide redundancy in the plugging operation for added safety. All plugs shall be restrained and reinforced to prevent movement and blowouts. The

contractor shall tie-off and/or anchor plugs such that in a blowout event, the plug cannot be transported downstream.

- I. A light tower shall be provided at each suction manhole/pump setup for pump watch during overnight hours.

## **1.5 QUALITY ASSURANCE**

- A. Any violations resulting from sewage spills shall be the sole responsibility of the Contractor.

## **1.6 QUALIFICATIONS**

- A. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The Bypass Contractor (bypass pumping system contractor) shall demonstrate to the Engineer that they specialize in the design and operation of temporary bypass pumping systems. The Bypass Contractor shall provide a minimum of five references of temporary bypass pumping projects of at least 30 million gallons per day (mgd) with at least one of the projects over 50 mgd, of a similar size and complexity as this project, performed by their firm within the past five years. The references shall include project scope of work and contact numbers and names for the Charlotte Water and General Contractor if the work was performed as a subcontractor. Charlotte Water reserves the right to approve or disapprove of a bypass pumping contractor based on experience or performance on other similar projects.

- B. The Bypass Contractor must have a physical location and service facility within 60 miles of the project site.

- C. All bypass pumping equipment shall be owned and maintained by the Bypass Contractor. No subleasing of bypass pumps or piping shall be allowed, approved or acceptable. Proof of ownership shall be submitted to the Engineer for review and verification. Charlotte Water will not approve the Bypass Contractor if he/she does not own the bypass pumping equipment being furnished for this project.

In addition, all pumps set up and tear down and piping installation and removal shall be performed by employees of the Bypass Contractor as documented by employee records. Subcontracting of the set up and tear down shall not be allowed.

Further, all pump and piping maintenance, repairs, pump watch (manning of pumps 24 hours per day), etc. shall be performed by employees of the Bypass Contractor as documented by employee records. Subcontracting of these duties (and any other duties related to the bypass pumping system) shall not be allowed.

## **1.7 SUBMITTALS**

- A. The Contractor shall coordinate with the Engineer to determine the required Bypass System and the type and number of pumps to be used. For bypass pumping systems, Contractor shall submit, prior to installation, a detailed plan and description outlining all details and provisions of the temporary bypass pumping system. The plan shall be specific and complete, including such items as schedules, locations, elevations, type of plugs, plug restraints and blocking, temporary piping, capacities of equipment, instrumentation and controls, alarm systems, communication systems, soundproof enclosures, materials,

precautions taken regarding handling the wastewater flow, and all other incidental items necessary and/or required to ensure proper operation of the bypass pumping system, including protection of the access and bypass pumping locations from damage due to the discharge flows, ability to pump dry weather and wet weather flows, and compliance with the requirements and permit conditions specified in these Contract Documents. No bypass pumping shall begin until all provisions and requirements have been reviewed and approved by Charlotte Water.

B. The design of the temporary bypass system shall be sealed by a North Carolina licensed Professional Engineer. The bypass pumping plan shall include, but not be limited to, the following:

1. Overall sequence of construction for bypass pumping system.
2. General layout for the bypass pumping system including locations and staging areas for pumps and piping locations/routes.
3. Modifications to existing sewer manholes and structures to perform the bypass pumping and restoration to such structures upon completion.
4. Modifications to existing sewer manholes and structures such that the manhole covers are elevated to the 100-year base flood elevation plus 1-foot.
5. Suction and Discharge Piping:
  - a. Drawings showing the alignment of the bypass pipes.
  - b. Flow stoppage system, including pipe and channel plugging method, types of plugs, plug materials, size of plugs, plug restraints and blocking, location and number of proposed tie-off and/or anchors used to prevent movement or blowouts for plugs.
  - c. Details of suction piping including number, size, materials, fittings including quick disconnects, connections to other piping, method of installation, and all other details related to the pump suction piping.
  - d. Details of discharge piping including number, size, materials, fittings including quick disconnects, connections to other piping, method of installation, details of the discharge location and piping arrangement at that location, and all other details related to the pump discharge piping.
  - e. Sections showing suction and discharge piping depth, embedment, select fill and special backfill.
  - f. Restraint systems for piping including thrust and restraint block sizes and locations and/or retraining systems on the piping.
  - g. Any temporary pipe supports, and anchoring required.
  - h. Show force main pipe material and thickness can withstand all normal operating and surge pressures with a safety factor of 2.0.
  - i. Protection against main breaks and damage.

j. Method of protecting discharge manholes or structures from erosion and damage.

k. Schedule for installation of and maintenance of bypass pumping lines.

6. Bypass Pumps

a. Bypass pump sizes, capacity, number of each size to be on site, basis of selection (calculations), and power requirements.

b. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted) for each set up.

c. Size and location of standby power generators and diesel storage and access plan if engine driven equipment is to be provided, or plan for suitable connection to existing electrical gear, if electrical power is to be provided.

d. Elevation of bypass pumps, standby power generators and diesel storage base compared to the 100-year flood base elevation.

e. Design plans for access to bypass pumping locations.

f. Method of noise control for each pump and/or generator including primary sound enclosures and sound blankets.

g. Fuel tank location, size, and containment systems.

h. Fuel consumption rate information (include for proposed pumps, at full capacity, include breakdown for one pump running, two pumps running, etc.).

i. Instrumentation and control system to determine flow levels and to eliminate the risk of spills due to improper installation and operations. The instrumentation and control system submitted by the Contractor for approval by Charlotte Water shall include all equipment proposed (including redundant instrumentation and control equipment) and sequences of instrumentation activation as well as all alarms and fail-safe provisions.

7. Continuous on-site monitoring plan.

8. Traffic control requirements and measures are to be employed throughout the project.

9. General contact and emergency contact information for all personnel responsible for the operations and maintenance of the bypass pumping operations.

**1.8 PLAN APPROVAL**

A. Completed Bypass Pumping Plans shall be submitted to Charlotte Water for review and approval 30 days prior to any proposed bypass pumping operations.

B. Contractor shall provide full list of employees on watch, schedule, and contact information for each. The list shall include a hierarchy of who is to be notified in the event of an emergency.

## **PART 2 - PRODUCTS**

### **2.1 BYPASS PUMPING EQUIPMENT**

- A. The pumps used must be manufactured by a company that is ISO 9001 registered with a RAB (registration accreditation board) accredited third party registrar. The pump manufacturer shall also be ISO 9001 certified for Engineering Design Services and After Market Service. A copy of the ISO 9001 certificate shall be included with the bypass pump submittal to the Engineer.
- B. Pumps shall be dry self-priming type, in good working order, with a working pressure gauge on the discharge. All pumps used shall be fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in the priming system. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of wastewater flows. The pumping equipment shall be sound attenuated as specified herein and be mounted on an environmental skid which has the capacity of containing any and all hazardous fluids utilized within the engine compartment. All diesel-driven engines must be Tier 3 or newer.
- C. Pumps may either be engine driven equipment or electrically driven equipment. Contractor shall be responsible for all power costs associated with provision and operation of engine driven equipment including but not limited to purchase and delivery of fuel. Contractor shall be responsible for providing all equipment and connections required to provide electrically driven equipment and for protecting the power feed. If diesel powered pumps are provided, Contractor shall store sufficient fuel on site to allow for 72 hours of continuous operation without fuel delivery. 72 hours of continuous operation shall be based on 24 hours of operation at the system's firm capacity. The fuel shall be stored responsibly above the 100-year base flood elevation with self-containment and where possible shall not be located in a floodplain.
- D. Pumps shall meet the requirements of the governing municipality's noise ordinance. All pumps shall be Quiet Flow™, Critically Silenced™ or sound attenuated to 68 dBA at 23 feet. Pumps shall be provided with a pre-engineered sound attenuation enclosure. Sound blankets shall not be acceptable for primary noise attenuation, but sound blankets may also be required around the entire bypass pumping system if noise becomes an issue. If required, the sound blankets shall be free standing and 12-ft high minimum, shall have Class 1 flammability per ASTM E-84 and shall reduce sound by at least 10 dB at 125 Hz.
- E. Contractor shall provide the necessary stop/start controls for each pump. The stop/start control shall be an integral part of the engine control panel. For bypassing sewers greater than 24" and when using 6-inch pumps and larger, transducers are required to maintain the proper surcharge levels in the sewer line.
- F. Contractor shall provide level control device to allow pumps to ramp up and down in response to incoming sewage flow. Provide standby level control device to alarm high liquid level and to start pumps. The level control devices shall be designed to operate for a minimum of 24 hours on battery backup in the event of power failure.
- G. All pumps shall be manned 24 hours per day when operational. The Engineer will not consider allowing the use of auto dialers to report pumping system emergency

conditions. Full time telemetry is required, and interface with Charlotte Water may be required. All proposed auto-dialer information is to be submitted to Charlotte Water for review and approval.

H. Alarm systems shall be local (flashing light) and shall also activate the auto dialer. At a minimum, the following alarms shall be reported:

1. High liquid level in the bypass pumping suction manhole with level control device.
2. Engine failure
3. Power failure

I. Charlotte Water shall be notified immediately if the bypass pumping system is unable to keep up with the incoming flow, regardless of the reason.

J. The local alarm and level control devices shall be designed to operate for a minimum of 24 hours on battery backup in the event of power failure.

## **2.2 FORCE MAIN PIPING**

A. All discharge piping shall be rigid piping with positive, restrained joints. Allowable piping materials shall be fused, high-density polyethylene pipe (HDPE) as manufactured by Phillips Driscopipe, Inc. or equal, with a minimum wall thickness equaling SDR26 or PVC Pressure Pipe as manufactured by Certa-Lok or approved equal. Under no circumstances will aluminum "irrigation" type piping, glued PVC pipe or soft (lay-flat) hose be allowed.

All fused joints shall be performed by a certified operator (certified by a manufacturer of pipe fusion equipment). An appropriately sized fusion machine shall remain on site throughout the duration of the project to address any emergency pipe repair issues.

B. The force main piping shall be designed and rated for at least 1.25 times the maximum system pressure. The maximum velocity in the suction and discharge piping shall be 10 feet per second. The Contractor shall be responsible for all design calculations and shall be responsible for securing and protecting all force main piping in any manner required by Charlotte Water, Engineer or other controlling agency. The discharge piping shall be protected from pedestrian and vehicular traffic. Contractor shall add additional protection as deemed necessary to fully protect the piping at no additional cost to Charlotte Water. Design of the force main piping in accordance with these specifications shall be documented, including calculations, and submitted to Charlotte Water for approval.

C. Contractor shall provide a temporary cast iron or steel cover over the bypass pumping suction manhole and discharge manhole to safeguard the manholes, to prevent inflow and to minimize odors. At the discharge manhole, the Contractor shall route the discharge piping down into the manhole and shall install 90-degree bends on the end of the piping to direct the flow out of the discharge manhole and heading downstream. The piping arrangement shall be such that the flow is not vertically directed. This piping arrangement will help to direct the flow and minimize turbulence (and odors) in the discharge manhole.

D. A flow meter shall be installed on the discharge piping to continuously document the flow rate being pumped. The flow meter shall be continuously reviewed by the Contractor and compared to the pump curves submitted by the Contractor to



confirm that the bypass pumping system is operating as designed and expected. If the bypass pumping system is not pumping as designed and submitted, the Contractor shall take immediate actions to modify and correct the situation in manner approved by the Engineer. If at any time the bypass pumps are not keeping up with the flow and the specified pumping rate is not being achieved and the situation cannot be immediately resolved, the Contractor shall cease all pumping operations, return the flow to gravity through the existing sewer, and re-design the pumping system.

## **PART 3 - EXECUTION**

### **3.1 BYPASS SYSTEM**

- A. Charlotte Water shall have the authority to increase normal working hours of the Contractor during bypass pumping operations.
- B. Bypass System shall be comprised of a bypass pumping system combined with temporary piping to convey flow in the existing sewers.
- C. It is essential to the operation of the existing sewerage system that there is no interruption in the flow of sewage throughout the duration of the project. To this end, the Contractor shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as required), piping, all necessary power, and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with the work, carry it past the work, and return it to the existing sewer downstream of the work.
- D. The Bypass Contractor shall provide all necessary means to safely convey the sewage past the work area. The Bypass Contractor will not be permitted to stop or impede the main flows under any circumstances. The Bypass Contractor shall maintain sewer flow around the work area in a manner that will protect public and private property from flooding and damage.
- E. The Bypass System shall be leak free and shall (at a minimum) maintain the required firm pumping capacity. The Bypass System shall provide reliable and trouble-free pumping of the existing wastewater flow. All local alarms shall be readily visible to and accessible by Charlotte Water.
- F. If, at any time during construction, effluent from the existing sewer is not fully contained by the bypass system and/or the bypass system is not keeping up with the flow, gravity service shall be restored immediately, and work shall be suspended until the problem is resolved to the satisfaction of the Engineer. Sewer system overflows will not be tolerated. All fines imposed on Charlotte Water associated with overflows caused by the Contractor's work shall be paid by the Contractor.
- G. Odor Issues: If odor complaints occur at any time during the Contract, the Contractor shall take immediate measures to minimize the odor. It will be the Contractor's sole responsibility and cost to do all that is necessary to resolve the odor issues, including revising any bypass pumping layouts/configurations and adding odor control measures (such as chemical additions).

### **3.2 FIELD QUALITY CONTROL AND MAINTENANCE**

- 1 A. The Contractor shall provide at least one (1) trained employee to man the bypass  
2 pumping system continuously while the pumps are in use to monitor the system  
3 and check for alarms and leaks. At no time during the bypass pumping operations  
4 shall the system be unmanned.
- 5 B. System Testing:
- 6 1. The Bypass Contractor shall perform leakage and pressure tests of the  
7 bypass pumping discharge piping using clean water prior to actual  
8 operation. The Engineer shall be given 24 hours' notice prior to testing.
- 9 2. Test pressure shall be 1.25 times the maximum system operating pressure.  
10 The test must hold pressure for a minimum of 1 hour.
- 11 3. The bypass design operating pressure must not exceed 10 PSI below the  
12 max pressure rating of the HDPE.
- 13 C. Contractor shall inspect the bypass discharge piping system a minimum of every  
14 two (2) hours to ensure no damage or leaks. All leaks must be addressed  
15 immediately. Flow shall be diverted off of the leaking piping immediately until  
16 repairs are made. The Contractor shall document each inspection and shall submit  
17 the inspection logs to the Engineer at the end of each week (or more frequently as  
18 required by the Engineer).
- 19 D. Contractor shall inspect the pump operation a minimum of every two (2) hours to  
20 ensure trouble-free and leak free operation. A monitoring log shall be maintained  
21 by the Contractor and available for observation by the Engineer/Charlotte Water  
22 upon request. All systems, piping, pumps, air vents, monitoring equipment, valves,  
23 plugs, security measures, level indicating devices and all related appurtenances  
24 associated with the bypass system shall be continuously and regularly monitored  
25 for proper and leak free operation.
- 26 E. Contractor shall record the following information every ½ hour in the monitoring log:
- 27 1. System Discharge Pressure
- 28 2. Pump RPM
- 29 3. Suction Manhole surcharge level
- 30 4. Plug Pressure
- 31 5. Fuel levels
- 32 6. Flow
- 33 F. Any time the bypass pumping system is operating, the Contractor shall  
34 continuously perform the following maintenance services:
- 35 1. The Bypass Contractor shall insure that the temporary pumping system is  
36 properly maintained. At least one (1) trained pump watch employee (with  
37 a fully stocked service vehicle) shall be onsite 24/7 when pumps are  
38 operating.
- 39 2. The trained employee shall be full time employees of the bypass contractor  
40 with at least one year experience with bypass pumping. No temporary  
41 employees are permitted to operate or watch the bypass.
- 42 G. Spare Parts and Extra Materials:

1. Spare parts for each type of pump and piping shall be kept on site.
  2. HDPE repair bands for each size HDPE shall be kept on site.
  3. At least one (1) extra plug of each size utilized in the bypass pumping setup.
  4. At least one (1) fuel filter.
  5. At least one (1) pipe repair clamp shall be on site at all times.
- H. In the event of accidental spill or overflow, Contractor shall take all necessary actions immediately to stop the spill or overflow and take action to clean up, disinfect the spill and immediately notify Charlotte Water. Disinfection shall include, but is not limited to, removal of all debris, pumping of any excess overflow back into the system, neutralization by raking and liming. Charlotte Water will provide the Contractor with a call-down emergency list for contacts in the event of a spill or overflow. All bypass system abnormalities, operational changes, maintenance, and repairs shall be reported immediately to the Engineer and Charlotte Water. All alarms shall be responded to in person by qualified Contractor's personnel immediately.

### **3.3 INSTALLATION AND REMOVAL**

- A. Contractor shall locate the bypass pipelines to minimize any disturbance to existing utilities and site areas (such as trees) and shall obtain approval of the pipeline locations from the Engineer.
- B. The Contractor shall remove manhole sections or make connections to the existing sewer and construct temporary bypass pumping structures only at access locations as approved by the Engineer and as may be required to provide adequate suction conduit.
- C. Plugging or blocking of sewage flows shall incorporate a primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance or work, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.
- D. During all bypass pumping operation, the Contractor shall protect existing structures, equipment and piping from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to the existing structures, equipment and piping caused by human or mechanical failure.
- E. When working inside existing structures, the Contractor shall exercise caution and comply with all federal, state, and local occupational safety and health standards when working in the presence of gases, combustible or oxygen-deficient atmospheres, and confined spaces.
- F. The Contractor shall notify the Engineer at least 48 hours prior to initial startup and/or to any significant changes to the bypass system. This includes moving pumps and/or piping, installing or removing plugs, starting a new bypass location, ceasing an existing bypass location, reestablishing gravity flow, etc. The Engineer must inspect and approve the existing layout and all pumping equipment at each significant change to the bypass system. A bypass pumping checklist addressing all relevant features of the bypass system shall be generated by the Contractor and approved by the Engineer. The bypass pumping checklist shall be completed

1 by both the Contractor and Engineer prior to the startup of any bypass pumping  
2 operations and/or to any significant changes to the bypass system.

3 G. When the bypass piping crosses local streets and private driveways, the  
4 Contractor must bury the bypass pipelines in trenches, cover with flowable fill or  
5 ABC stone, and install asphalt patches per the Standard Specifications and  
6 Details. Steel road plates may be used for short periods of time until the asphalt  
7 can be installed. Bypass road ramps will only be allowed if specifically approved  
8 by the Engineer. Upon completion of the bypass pumping operations, and after  
9 the receipt of written approval of the Engineer, the Contractor shall remove all the  
10 piping, restore all property to pre-construction condition and restore all pavement  
11 in accordance with the standard specifications and details.

12 H. When bypass pumping operations are complete, piping shall be drained and  
13 flushed into the sewer system prior to disassembly. The piping shall be flushed  
14 for a period long enough to ensure that all piping is clean and free from wastewater.  
15 All pumps, piping, fittings, thrust blocks, etc. shall be removed from the site upon  
16 project completion.

17  
18 END OF SECTION