



## **TOWN OF HILLSBOROUGH TECHNICAL SPECIFICATIONS FOR WATER AND SEWER SYSTEMS**

These specifications are intended to convey the Town's preferences related to water and sewer system extensions and modifications. In no manner do these specifications intend to supersede any federal or state regulations or design criteria. Where conflict may occur, the more stringent specification shall apply. Any other deviation from the specifications shall be reviewed and approved by the Utilities Director/Town Engineer preferably during the design phase but in all cases before construction.

### **1.0 GENERAL**

#### *1.1 Construction and Inspections*

48-hours' notice shall be required for utilities construction and inspections. Utilities construction activities shall normally be between 7 am and 4 pm Monday through Friday, unless otherwise approved.

#### *1.2 Blasting Operations*

Prior to any blasting operations, the contractor shall notify the Town Engineer and the Hillsborough Fire Marshal to obtain blasting permits as required. The contractor shall furnish proof (certification) of insurance specifically covering any and all obligations assumed pursuant to the use of explosives.

#### *1.3 Utility Easements*

Utility easements shall be a minimum of 20 feet wide for a single utility pipeline, and a minimum of 30 feet wide for pipes deeper than 16 feet. For multiple pipes, easement shall provide a minimum of 10 feet clearance on either side of each pipe. Easement plats shall be recorded as Town of Hillsborough Utility Easement.

#### *1.4 Utility Separations*

All utilities (electric, phone, gas, cable TV, etc.) shall be installed a minimum of three feet horizontally from all Town waterlines (existing and proposed). Where other utilities are installed closer or cross water lines, they shall be installed in rigid conduit. Electrical transformers, and cable TV & telephone distribution boxes shall not be located on the same property line as water meters. Water lines shall be a minimum of three feet deep. Sewers should be designed for at least four feet deep and below water lines. Minimum separations between sewers and water lines and sewers and storm sewers shall be as specified by the NC Department of Environmental Quality. Minimum separations and allowable alternatives are noted in the attached Town of Hillsborough Standard Details.

#### *1.5 Boring and Jacking*

When installed within a casing pipe, the carrier piping shall refer to ductile iron pipe standards, AWWA C600 and AWWA M41. Joints installed on ductile iron carrier pipes inside an encasement pipe shall use rigid restrained joints.



Steel casing pipes and joints shall be constructed so as to prevent leakage of any substance from the casing throughout its length with a minimum thickness of 0.625 inches or as required by site-specific regulatory agencies, such as NCDOT or Norfolk-Southern Railroad. Steel pipes are to be designed for the external and internal loads to which they will be subjected.

Grout between casing and adjacent soils shall consist of one part Portland cement, three parts sand and the minimum amount of water necessary to obtain the desired consistency; and all grout mixtures shall contain 2% of bentonite by weight of the cement. 2-inch diameter grout connections shall be provided and regularly spaced at 5 feet on center alternating at 30 degrees from plumb each side of the vertical centerline. For NCDOT road crossings, annular backfill between casing and carrier pipe shall be in accordance with NCDOT standards for fill inside the casing.

#### *1.6 Standard Details*

The Town of Hillsborough (TOH) has standard details for many of the specifications presented herein. The details shall be reviewed for additional specifications not stated in this document. Details shall be incorporated into the design plans as applicable. A list of the standard details available is presented below and are attached.

Where industry specifications are stated (i.e., AWWA or ASTM), the latest version of the specification at the time of construction shall be used unless special provisions on the construction plans state otherwise.



**TOWN OF HILLSBOROUGH LIST OF STANDARD DETAILS**

General		Water		Sewer	
G-01	Utility Separation	W-01	Hydrants	S-01	Air/Vacuum Release Valve for Sewer Force Main
WS-01	Valve Box Assembly and Gate Valve	W-02	Flushing Device for New Water Main Extensions	S-02	Cored Connections for Sewer Wetwell or Manhole
WS-02	Thrust Blocking	W-03	Reduced Pressure Backflow Preventer (RP)	S-03	Sewer Service and Cleanout with Collar
WS-03	Trench Details	W-04	Double Check Valve Assembly (DCVA)	S-04	Odor Control for Sewer Pumping Station
		W-05	Water Main Taps	S-05	Electrical Panel Riser Diagram (Typical)
		W-06	Residential Water Meter and Box	S-06	Pumping Station Valve Vault
		W-07	Commercial Water Meter and Vault	S-07	Pumping Station Yard Hydrant and Meter
		W-08	Backflow for Fire Line	S-08	Precast Concrete Manhole
		W-09	Water Meter Location	S-09	Frames and Cover
		W-10	Air Release Valve – Water	S-10	Outside Drop Manhole
		W-11	Blow-Off Detail	S-11	Doghouse Manhole
		W-12	Temporary Faucet	S-12	Aerial Crossing

**2.0 WATER**

*2.1 Piping, Hydrants, Valves and Other Appurtenances*

Piping shall be Ductile Iron Pipe (DIP) Pressure Class 350 cement mortar lined interior/asphaltic coated exterior, or Class K Copper (less than 3”). Bedding shall be as recommended by the manufacturer. Fittings shall be mechanical joint for all buried pipe. Pipe shall have a burial depth of 36” minimum.

DIP water main shall be installed in accordance with AWWA C600 and AWWA M41 guidance.

Polyethylene encasement shall be provided for ductile iron pipe, where necessary, to prevent contact between pipe and surrounding materials and utilities to protect from corrosive soils and stray currents from other utilities. Polyethylene encasement shall be in accordance with ANSI/AWWA C105.

Hydrants shall be 5 ¼”, dry-barrel, AWWA C502, as manufactured by Clow (Medallion), or Mueller. Alternate manufacturers and models are not acceptable without pre-approval by the Town Engineer. The hydrant pumper nozzle shall include a 5” Storz connection. Hydrant flange shall be installed between 2” and 6” above surrounding final grade (after landscaping), and hydrants shall be installed with a minimum 12” clearance between the edge of the hydrant and the sidewalk. A 350 ductile iron Gradelok hydrant leg, conforming to AWWA C153/C104, may be used for grade adjustment. Hydrants shall be located a minimum of: 6 feet behind the edge of the curb, 10 feet from the edge of pavement in locations without a drainage ditch, or behind the ditch. Spacing shall be 500 to 700 feet between hydrants. Resilient wedge gate valves shall be

required on the main line and hydrant leg at all hydrants. Hydrant legs shall be restrained joint and rodded from the main through the valve and to the hydrant. Fire Department Connection (FDC) shall be mounted between 24" and 36" above surrounding grade. Private hydrants shall be painted Safety Yellow, and shall have an RP-Detector backflow preventer installed on the customer's side of the property line near the service connection.

Clow or Mueller resilient wedge gate valves (AWWA C509) shall be used on water lines in buried service. Two valves shall be installed at all tees, and three valves at all crosses. Valves shall be installed every 1000 feet on water lines without hydrants (<6" mains).

All castings shall be made-in-USA conforming to ASTM A48, Class 35B, gray cast iron.

A #9800 Eclipse Automatic flushing device (manufactured by The Kupferle Foundry Company) shall be installed for every 2,500 feet of water line installed for all new water line extension projects. Location and need to be determined by the Town Engineer. A 2" Neptune T-10 water meter (with Auto-Detect ARB and R-900 MIU (radio read) shall be installed for each installed flushing device. A #9400 Eclipse unit may be substituted with prior approval, dependent upon specific site conditions. Blow off or flushing device must be installed on dead-end lines.

All water main taps 4" and greater require a stainless steel tapping sleeve with full circumferential seal, mechanical joint outlet, and stainless steel bolts. Taps onto asbestos-concrete (AC) or PVC mains require an extended-length sleeve on the main being tapped. Taps onto equal size mains (e.g. 8" tap on an 8" main) must be cut & sleeved with a tee and main line valve installed.

## 2.2 *Backflow and Cross Connection Control*

A Reduced Pressure (RP) backflow prevention assembly (AWWA C511) is required immediately after the meter in an above-ground ASSE 1060 compliant enclosure (Class I or II) for all commercial, industrial, institutional, or irrigation services where a severe hazard exists (as defined in NCAC 15A-18C Appendix B). A double check valve assembly (DCVA) (AWWA C510) shall be installed immediately after the meter in an above-ground ASSE 1060 compliant enclosure (Class I or II) for all commercial/industrial/institutional/irrigation services not requiring an RP (unless requirement is waived on a case-by-case basis). A Detector assembly shall be provided for all fire services (RP-D or DCDA depending on hazard level). An RP-D is required if a Fire Department Connection is installed on the fire service. The detector meter shall be compatible with the Town's radio-read system, or be purchased directly from the Town. Fire service strainers shall be installed on fire services prior to the backflow preventer.

The location of backflow preventers within the Historic District shall be determined on a case-by-case basis, in compliance with Historic District Design Guidelines. A dual check valve shall be installed on residential services at the meter yoke. RP and DCVA assemblies shall be approved by USC-FCCCHR and ASSE, shall be tested by a certified tester after installation, and test results shall be provided to the Town. Dual check valves shall be ASSE approved. RP assemblies shall have a minimum of 12" clearance on all sides. DCVA shall have adequate clearance for testing. RP and DCVA assemblies shall be installed over a concrete pad base, and all exposed (non-buried) piping through vaults shall be flanged ductile iron or copper (compression joints/fittings). Copper piping passing through concrete shall include a collar/sleeve at the concrete interface. All fire service installations shall fully comply with NFPA requirements.

### 2.3 *Flushing and Testing*

All flushing and other use of water from the Town system shall be coordinated with the Town Engineer or Utility Inspector. Contractor shall pay for all water used.

All water piping shall be pressure tested in accordance with AWWA C600 to 200 psi for a 2 hour period. Allowable leakage from the main is determined by the following formula:

$$L=(S*D*P^{1/2})/148000$$

L=Allowable leakage (gallons per hour), S=Length of pipe tested (feet)  
D=Nominal diameter of pipe (inches), P=Average test pressure (psig).

After successful pressure testing, all water piping shall be sterilized by chlorination in accordance with NCDENR and AWWA C651 (Section 4.4.3 - Continuous Feed Method) requirements. The requirements of NCAC Title 15A, Subchapter 18C, section .1003 are to be followed (50 ppm chlorine, hold for 24 hours with a minimum of 10 ppm during that period). The line shall produce two consecutive negative *bacteria* samples drawn at least 24 hours after flushing of super-chlorinated water, and at least 24 hours apart, and tested by a State-approved laboratory. A list of approved laboratories is located on the NCDEQ / DWR Public Water Supply Section website at: <http://deq.nc.gov/about/divisions/water-resources/drinking-water/drinking-water-laboratories>. If any samples fail, the sterilization procedure shall be repeated until satisfactory results are obtained. Copies of all testing results and water usage data shall be submitted to the Town Engineer or Utilities Inspector.

Chlorinated water shall be properly disposed of in accordance with NCDEQ requirements. Chlorinated water shall not be discharged to storm sewers, ditches or overland. Super-chlorinated water shall be de-chlorinated with a neutralizing chemical upon discharge from water lines and metered.

### 2.4 *Meters, Vaults and Services*

Meters shall be Schlumberger Neptune T-10 (<2"), Tru/Flo Compound (2" - 6") or Neptune HP Turbine (8" – 10") with Auto-Detect ARB and R-900 MIU (radio read). All meters shall be purchased directly from the Town. Flanged bronze strainers by Neptune shall be installed immediately before all 2" and larger meters with appropriately sized spacer installed between the strainer and meter to avoid meter inaccuracies.

All residential size meter box lids shall be cast iron with pre-drilled 2" hole for Pro-Read disk installation. Hatches for large meter boxes shall be hinged aluminum and also be drilled with a 2" hole adjacent to hinge area. Residential size meter boxes (3/4" and 1") shall be standard rectangular black plastic boxes, 12" deep, with flared bottom. Boxes for 1" meters shall be a minimum of 22" x 35" at the base. Large (>1") meter boxes/vaults shall be pre-cast concrete, with drain pipe at the bottom of the vault to daylight (and shown on the plans), unless approved otherwise.

Irrigation lines must have separate meter.

All piping (>1") through vaults shall be flanged ductile iron or copper (compression joints/fittings). Meter vaults shall be no deeper than stated on the TOH detail (from ground surface to vault bottom) with adequate personnel entry points for service. Water taps shall be a minimum of 1" from the main to the meter box.

All water meter locations shall be coordinated with the Utilities Inspector or shown specifically on the plans. Meters shall be grouped in pairs at adjoining property lines, unless approved otherwise. All water meters shall be located at the property line adjoining the public road right-of-way (unless approved otherwise), and shall be no deeper than 12" below grade for residential size meters. The domestic service may be tapped off the fire service only when the fire service is 6" or larger (NFPA 24).

Water services shall be Class K copper, or Class 350 DIP. PEXa crosslinked polyethylene (2" or smaller) may be used on a case-by-case basis as approved by the Town Engineer or Utilities Inspector, primarily due to the type of soils present. All service connections shall be backfilled properly under the corporation stop to prevent undue stress on the connection. Residential water meter boxes shall have orange temporary safety fencing (or other Town-approved barrier) installed around the meter area to protect the installation during home construction activities.

Temporary faucets installed for construction shall be a minimum of 10 feet from the meter box. Temporary faucets shall be removed before occupation of the structure. Refer to the TOH Temporary Faucet detail for additional requirements.

### 2.5 *Fire Sprinkler Systems*

Residential fire sprinkler systems shall be designed to NFPA 13D requirements (multipurpose systems). Sprinklers shall share the home plumbing system and be looped to minimize dead ends. No additional backflow prevention device/assembly shall be required. The Town Engineer shall be notified when residential fire sprinklers are proposed, to coordinate special metering requirements (standard residential meter will not provide sufficient flow for system).

## 3.0 **SEWER**

### 3.1 *Piping, Manholes, Valves and Other Appurtenances*

Gravity sewer piping shall be Ductile Iron Pipe (DIP) Pressure Class 350 epoxy lined interior/asphaltic coated exterior (Conforming to AWWA C150 and AWWA C151 and with rubber jointed gaskets conforming to AWWA C111), or SDR 35 PVC (pipe and fittings meeting ASTM 3034; gaskets conforming to ASTM F477). Eight inch gravity sewers shall be designed with a minimum slope of 0.5%. Other sized sewer slopes shall be in accordance with the state minimum design criteria.

Sewer force main piping shall be green PVC DR14 Class 200 or Schedule 40 or 80 (conforming to AWWA C150 and AWWA C151, with combination air & vacuum valves at all high points (see standard detail for valve information). Force main shall be installed in steel casing pipe where installed under roads in accordance with NCDOT specifications.

Trace wire shall be installed over force main piping, and shall be #12 AWG Copper Clad Steel, High Strength with minimum 450 lb. break load, with minimum 30 mil HDPE insulation thickness colored green. Direct bury wire connectors shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion, and shall be installed in a manner so as to prevent any uninsulated wire exposure. Non locking friction fit, twist on, or taped connectors are prohibited. All termination points shall utilize an approved trace wire access box, specifically manufactured for this purpose, and shall include a manually interruptible conductive/connective link between the terminal(s) for the trace wire connection and the terminal for the grounding anode wire connection. Trace wire must be properly grounded at all dead ends/stubs with a drive-in magnesium grounding anode rod with a minimum of 20 feet of #14 red HDPE insulated copper clad steel wire connected to the anode (minimum 0.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the utility.

Piping deeper than 16 feet shall be DIP for the entire length between manholes, with 5 foot diameter manholes required. Manholes 20 feet deep or deeper shall be 6 foot diameter, and are approved on a case-by-case basis. Pipe bedding shall be as recommended by the manufacturer, with crushed stone bedding required for PVC pipe.

Manholes shall be pre-cast concrete with cast-in-place or pre-cast inverts. All castings shall be made-in-USA conforming to ASTM A48, Class 35B, gray cast iron. Manhole tops shall be a minimum of 18" above grade in unpaved areas not adjacent to public roads (grade rings not allowed in unpaved areas). No more than 12" of concrete grade rings will be allowed from the top of the cone to the bottom of the manhole ring (including 2' diameter sections cast into the manhole sections above the cone). When situated in floodplains, manhole covers shall be water tight and vented above the 100-year floodplain every 1000 feet. Conseal CS-212 Polyolefin backed exterior joint wrap or approved equal shall be used on all manhole and pump station joints, including grade rings. Cored holes with rubber boots shall be required for manholes and pump stations where pipes are inserted.

Doghouse manholes should be avoided by specifying full replacement of the manhole and a stub of at least five feet of sewer with a connector piece to the existing sewers. Should the Utilities Director/Town Engineer approve doghouse manholes, refer to the TOH standard detail.

### 3.2 *Testing*

All PVC gravity sewer mains shall be air tested in accordance with ASTM F 1417 – "Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air". For ductile iron pipelines, test in accordance with the applicable requirements of ASTM C924. Tests shall be performed after services are installed. Plugs shall be secured to prevent blowouts and all pressure released before removal of plugs. A mandrel (95% of base ID) shall be pulled through all PVC gravity mains to test for unacceptable deflection. Deflection, tested 30 days after backfill, shall not exceed 5%. An alternative to waiting 30 days is to submit a certification from a soil sampling firm indicating that backfill was compacted to 95% maximum density. All gravity sewer mains and services (to the customer cleanout) shall be smoke-tested and TV inspected in the presence of Town personnel after all other utilities have been installed, and at the end of the warranty period, and DVD disks of the inspection and smoke-test reports shall be provided to the Town prior to acceptance.



Force mains shall be pressure tested to 50 psi above maximum system pressure (AWWA C600). Allowable leakage shall be as determined by the formula listed previously in the water piping pressure testing requirements.

Deficiencies shall be corrected prior to acceptance and operation. Copies of all testing results shall be submitted to the Town Engineer.

All new manholes shall be vacuum tested before and after backfilling according to ASTM C1244. Manholes that fail the test according to ASTM C1244 shall be brought to a passing condition.

### 3.3 *Services and Taps*

An individual sewer service shall be provided for each property from the property line to the sewer main, unless approved otherwise on a case-by-case basis. Sewer services for new construction shall be installed with an in-line wye fitting. Saddles are not acceptable for new construction. Services to be tapped into existing iron or PVC sewer mains shall use Romac CB-4.80UN saddles, or SDR35 saddle tee with gasketed skirt for existing PVC mains, or pre-approved equal, and shall have precision-cut entries into the sewer main that match the saddle used (no sharp or protruding edges). Services shall be constructed with Schedule 40 PVC or DIP. Services shall have cleanouts installed at all changes in direction. A pre-cast concrete ring or 2' x 2' cast in place concrete pad shall be installed around all cleanouts at the property line and within the road right-of-way or sewer easement. Concrete shall be level with finished grade, and top of cleanout 2" above the concrete.

## 4.0 **SEWAGE PUMP STATIONS**

The design engineer shall make all attempts to avoid the need for a pumping station. When required, sewage pump stations shall be duplex submersible or suction-lift style, unless approved otherwise. Motors shall be minimum of 5 hp, and must be 3 phase, 480V, 60 Hz, 1800 rpm maximum. Pumps shall be non-clog centrifugal pumps, unless approved otherwise. Grinder pumps shall only be approved when conditions preclude other selections. Pumps shall be as manufactured by ABS, Fairbanks Morse, Flygt, Smith & Loveless, or Gorman Rupp. One spare pump and motor shall be provided that is identical to the pumps installed in the station.

Pump station wet wells shall be round pre-cast concrete, 6 feet inside diameter minimum, and complying with Section 3.1 of these specifications. Top shall be pre-cast concrete, with cast-in hatch. A 1,000 gallon odor control chemical tank and chemical feed metering pump (adjustable and sized for manufacturer's recommended application rate), piped to a point just below the wet well hatch, shall also be provided, and shall be filled with calcium nitrate tetrahydrate, or chemical specified by the Town Engineer, prior to operation. Refer to the TOH standard detail for odor control.

Pump station electrical panels shall be NEMA 4X, UL listed, with alarm horn/light with silence switch, pump alternator & switch, pump run-time hour meters, contacts for RTU/SCADA, heater/thermostat, phase monitor, and run lights. An MJK 704 Level/Pump Controller/Transmitter/Flowmeter/Datalogger with Model 2100 Pressure Transmitter & mounting bracket shall be installed to control the pump operation. Two level control floats shall be provided for low level alarm and high level alarm as backup units, tied-into the power control panel (separate from the pump controller).



All electrical panels shall be mounted to an aluminum or 0.4 pressure treated lumber backboard with 4" diameter aluminum or 6"x6" 0.4 PTL posts, with aluminum rain cover (or other pre-approved material) extending 36" from backboard over panels. A 4 foot dual fluorescent tube light with switch shall be mounted under rain cover. A 110V GFCI power outlet shall be installed in the electrical panel. See TOH detail for layout and additional requirements.

Resilient wedge gate valves shall be installed on the influent piping and force main piping. Force main gate and check valves shall be in a separate vault next to the wet well. Gate valves shall be installed on each pump line and on the force main, and check valves on each pump line. A tee (with the leg facing up), gate valve, and quick-connect fitting shall be installed on the discharge side of one check valve as a "pump-around" connection inside the valve vault. An equal size blind flange shall also be provided for maintenance purposes.

All guide rails, fasteners, and miscellaneous metals inside the wet well shall be stainless steel. Access ladders shall be aluminum or stainless steel. Piping inside the wet well shall be flanged ductile iron or stainless steel. Wet well vent shall be flanged ductile iron pipe with a screened outside end. A yard hydrant and water meter connected to potable water shall be installed at the pump station site, unless approved otherwise.

Access hatches shall be hinged and lockable, with stainless steel or aluminum frame, and ¼" thick aluminum diamond plate door(s). All hardware and hinges shall be stainless steel.

All new pump stations shall have permanent on-site standby power with auto transfer switch and highest level sound-attenuating enclosure, and Mission M110 RTU telemetry equipment with wet well module installed with the first year of service pre-paid. Generators shall be as manufactured by Generac, Kohler, Caterpillar/Olympian, or pre-approved equal. Generator shall operate on natural gas (or diesel fuel only if natural gas is unavailable to the site). Generator shall be sized to operate both pumps simultaneously and start the lag pump while the lead is operating. If diesel fuel is required, a double-walled tank with 24-hours of storage shall be provided.

Pump station sites shall be at least 50 feet square, have 4" depth (minimum) of ABC stone covering entire site underlain with geotextile fabric (to prevent weed growth), and include perimeter black plastic-coated chain link fencing (6 feet high, topped with 3 strands of barbed wire, and 16 foot wide double leaf gate), and dusk-to-dawn high-pressure sodium area light with independent circuit breaker (or switch) in main electrical panel. Alternate fencing materials may be required based on individual site conditions. Padlocks shall be provided for the gate, electrical panels, and access hatch(es) and shall be keyed to the Town's system.