

**SECTION 7.00
SANITARY SEWER**

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**SECTION 7.00
SANITARY SEWER**

7.01 GRAVITY SEWER MAINS

A. Design

Location

1. All public sanitary sewer mains shall be installed in dedicated street right of way or in dedicated utility easements. Sanitary sewer mains installed in Town of Holly Springs maintained streets shall be located in the center of travel lanes. Mains located within N.C. Department of Transportation right of way shall be placed outside of pavement limits, in accordance with NCDOT standards. See Section 2.10 for landscape plantings within Utility easements.
2. Minimum widths of public sanitary sewer easements shall be:

<u>Pipe Size</u>	<u>Pipe Depth</u>	<u>Easement Width*</u>
12" and smaller	Less than 20'	20'
12" and smaller	Greater than 20'	30'
Greater than 12", up to 24"	Less than 20'	30'
Greater than 12", up to 24"	Greater than 20'	40'
Greater than 24"	All depths	Director of Engineering Specified

- a. Additional width of easement will be required when easement contains multiple utilities.
 - b. Additional temporary construction easement may be required for any sewer not constructed at the time the easement is recorded.
 - c. Sewer mains shall be centered within their easements.
 - d. All sewer mains that extend as an outfall between residential lots shall have a minimum 30ft easement.
3. Outfalls shall require accessibility with a maximum cross slope of 6:1.
 4. Proposed sanitary sewers paralleling a creek shall be designed to a proper depth to allow lateral connections such that all creek crossings will be below stream bed elevation unless otherwise approved by the Director of

Engineering. The top of the sewer main shall have a minimum of one foot of cover between steel encasement pipe and the stream bed. In addition, the following is required:

- a. Sewer lines crossing stream beds will be required to be installed with restrained joint pipe inside a steel encasement pipe in accordance with the Standard Details section of these standards (Reference TOHS HS607).
 - b. Sewer lines crossing under storm drainage pipe containing a single pipe greater than 42 inches or multiple pipes greater than 36 inches will be required to be installed with restrained joint pipe inside a steel casing pipe. Installation may be by bore and jack or excavation which will be at the discretion of the Director of Engineering. All encasements to be extended a minimum of 10 feet beyond the stream bank and/or storm drainage pipe.
5. Sanitary sewer mains shall not be installed under any portion of water impoundments unless approved by the Director of Engineering.
 6. The following minimum separations must be maintained:
 - a) any private or public water supply source, including WS-1 waters or Class I or Class II impounded reservoirs used as a source of drinking water – 100 feet;
 - b) any waters classified WS-II, WS-III, B, SA, ORW, HQW or SB (from normal high water [or tide elevation] – 50 feet;
 - c) any other stream, lake, or impoundment – 25 feet or as required by State law.

Where the required minimum separations cannot be maintained, ferrous sanitary sewer pipe with joints equivalent to water main standards shall be used. However, in no instance may sanitary sewer lines be installed less than 25 feet from a private well or less than 100 feet from a public water supply source (or as required by State law).

7. Sanitary sewer lines shall be extended to adjacent upstream property lines, in order to serve all upstream properties. These lines shall be sized to serve all upstream tributary areas in accordance with the Master Land Use Plan or approved developments (whichever results in the larger flow).
8. All non-residential swimming pools shall be discharged into the storm sewer system after dechlorination

Size

1. The minimum size of public gravity sanitary sewer mains shall be 8”.
2. Major interceptors shall be sized in accordance with the “Master Wastewater Plan of the Town of Holly Springs.” In areas not included in the master plan, new sewer interceptors shall be designed based on the proposed land use (in accordance with the Town’s Master Land Use Plan) of the contributory area. The following flow factors shall be used:

Residential flow rates:

Use flow factors of 255 gpd/unit.

Non-Residential flow rates:

Use flow factors as required by the North Carolina Department of Environment and Natural Resources (at the time of this specification revision, these flow rates are contained in 15A NCAC 02T.0114).

3. For existing sewer systems, an additional allowance shall be made to the above flow factors where the existing flow exceeds these values and immediate remedial measures are not proposed.
4. The ratio of peak to average daily flow shall be 2.5.
5. Sanitary sewers shall be designed to carry the projected peak flow at no more than ½ full. The recommended minimum velocity for sanitary sewer lines is 2 fps. The minimum slope for the uppermost reach of a sanitary sewer line shall be 1.00%.

The minimum grades for public sanitary sewers shall be as follows:

Main Size (inches)	Minimum Slope (feet/100 feet)
8	0.40
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06

6. The maximum grade for sanitary sewers is 10%. The maximum velocity in sanitary sewers is 15 feet per second. These limits may be exceeded with the approval of the Director of Engineering and with the incorporation of the following provisions:
 - a) All sewers of greater than 10% slope shall be ductile iron pipe;
 - b) High velocity manholes, in accordance with the Standard Details Section of these Standards shall be used on all sewers with a slope greater than 10%;
 - c) Concrete anchors shall be installed on all sewers of greater than 10% slope at the following spacings:
 - i) Not over 36' center to center on grades from 10% to 25%;
 - ii) Not over 24' center to center on grades from 25% to 40%;
 - iii) Not over 16' center to center on grades exceeding 40%.
7. Sewer extensions should be designed for projected flows even when the diameter of the receiving sewer is less than the diameter of the proposed extension.
8. Pipe diameter changes shall occur in a manhole with the invert of the larger pipe lowered sufficiently to maintain the same energy gradient. An approximate method of securing these results is to place the 0.8 depth point of both sewers at the same elevation.
9. All residential subdivision lots shall be served by public gravity sanitary sewer unless otherwise approved by the Director of Engineering. If a pump is approved, it shall be privately maintained, must pump into a gravity service connection placed on the lot, and must have a note on the construction plans and recorded plat indicating a private pump may be required to serve the lot with sanitary sewer service. In instances where private pump stations are approved, the gravity service that received the force main shall be required to extend into private property so that the required private force main vent is located a minimum of 20' from public right of way.
10. Downstream receiving sewer infrastructure shall be evaluated to confirm adequate capacity by the design engineer for each project. In addition, a sewer study may be required to accompany plans submitted to the Town for consideration of impacts to downstream sewer infrastructure. Developer shall be required to upgrade insufficient infrastructure.

Installation

1. Sanitary sewer mains shall be deep enough to serve adjoining and upstream properties and allow for sufficient slope in lateral lines. All sanitary sewer mains shall have the following minimum of 4.5 feet of cover and be measured as follows:
 - a) 4.5 feet from the top of pipe to finished subgrade when under a roadway or
 - b) 4.5 feet from top of pipe to existing edge of pavement elevation when adjacent to a roadway which may be widened in the future;
 - c) 4.5 feet from top of pipe to finished grade in all other areas.

The above requirements may be waived at the direction of the Director of Engineering, in which case ductile iron pipe shall be installed.

2. The construction of all sanitary sewer lines which will be maintained by the Town must be performed by a contractor licensed in North Carolina.
3. Sewer mains from 14 to 20 feet deep shall require special bedding in accordance with the Standard Details Section of these Standards.
4. Sewers over 20 feet deep shall require ductile iron for the entire run between manholes and shall be 401 protectant lined.
5. Pipe trench excavation and backfilling shall be performed in accordance with Section 5.00 of these Standards.
6. Transitions of pipe material shall occur only at manholes.
7. Sewer mains shall be laid at least 10 feet laterally measured edge to edge from existing or proposed water mains unless it is determined that local conditions or barriers prevent a 10-foot lateral separation in which case:
 - a. The water main is laid in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer; or
 - b. The water main is laid in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
8. **Where sanitary sewers cross NCDOT roadways or major Town roads, as determined by the engineer, pipe encasement shall be required.**

9. Where sanitary sewers cross beneath water mains with a vertical separation of 18 inches or less or where water mains cross under sewer mains, the entire leg of sewer line shall be ductile iron pipe. The water line pipe shall be centered at the point of crossing and shall cross sanitary sewer lines at an approximate 90° angle.
10. Where sanitary and storm sewers cross with a vertical separation of less than 24 inches the entire leg of sanitary sewer shall be of ductile iron pipe. Sanitary sewers shall have the top of pipe at least 24 inches below the bottom of storm sewer pipe when the horizontal separation between the closest edges of the two pipes is 5 feet or less. There shall be a minimum 5-foot horizontal separation between sanitary sewer and storm sewer.
11. For sanitary sewer and reclaimed separation, see Section 11.01
12. There shall be a minimum 5-foot horizontal separation between parallel gravity and/or force mains.
13. Sewer line easements shall be completely cleared of all vegetation, graded smooth with minimum cross slope of 6:1, free from rocks, boulders, roots, stumps, and other debris, free from ponded water, and seeded and mulched upon the completion of construction.
14. The first new downstream manhole(s) of any sanitary sewer line extension under construction shall be plugged on the outlet side with a masonry wall or a wing nut plug (to be determined and inspected by the Construction Inspector) secured with a stainless steel cable with identification plate of contractor's name and secured with stainless steel cable to prevent the passage of groundwater, runoff and sediment into the existing sanitary sewer system. All water upstream of the plug shall be pumped out of the sanitary sewer line and all sediment and solids shall be removed and properly disposed of by the Contractor prior to removal. The plug shall not be removed until the line has been inspected by the Construction Inspector to insure that all possible points of inflow or infiltration have been secured. Failure to meet this requirement will result in a \$1,000 per day fine. If the plug blows out and causes equipment or material damage or spills downstream, the Contractor shall be responsible for resulting fines and costs of repairs. Authorization to remove the plug shall be required by Construction Inspector. If the Contractor fails to obtain necessary approvals and removes the plug before the system is activated, the Contractor shall be responsible for resulting State and Town fines and damages resulting.

Manholes

1. All manhole cone sections shall be the eccentric type.
2. Manholes shall be spaced at a maximum distance of 425 feet apart for lines 12 inches in diameter or less and at a maximum of 500 feet apart for lines greater than 12 inches in diameter.
3. Manholes for sewers under 21 inches in diameter shall be a minimum of 4 feet in diameter. Manholes for sewers 21 inches in diameter or greater shall be 5 feet in diameter. Manholes requiring inside drops shall be a minimum of 5 feet in diameter. When 2 or more inside drops occur at one manhole, a minimum 6-foot diameter manhole shall be used.
4. All manholes that are over 20 feet deep shall be 5 feet in diameter.
5. Manholes shall be installed at each deflection of line and/or grade. The flow channel through manholes should be smooth and shall conform to the shape of the entering/exiting sewer line. A standard 0.20-foot drop shall be provided at each manhole. Inverts "in" and "out" shall be as designated on the approved plans. Sewers shall be designed to minimize free drops in manholes.

Either precast or brick and mortar inverts may be used conforming to these Standards. The invert shall be smooth and uniform in shape along the entire length.

6. Inside drops shall be used when free drops exceed 12 inches. For inside drop manholes, the entire upstream leg of sewer must be ductile iron. For inside drop manholes, see the Standard Details Section of these Standards. Outside drops shall not be permitted except when necessary to connect to existing manholes.
7. Manholes not located in roadways shall have a top elevation a minimum of 12 inches above finished grade. Manholes located along outfalls shall have a top elevation a minimum of 24 inches above finished grade or 100 year flood plain, or 12 inches above 500 year flood plain, whichever is higher.
8. Watertight manhole rings and covers shall only be allowed upon approval by the Director of Engineering. Manholes with watertight tops shall be vented in accordance with the Standard Details Section of these Standards.
9. Manholes located within flood plain areas, on outfalls, and within any areas of high groundwater shall be waterproofed by wrapping all joints

with a minimum 8-inch width band of butyl joint wrap. Waterproofing shall be installed by mopping asphalt over the joint area, then wrapping butyl joint wrap around the joints, and finally mopping the wrap with another coat of asphalt. The total asphalt coat thickness shall be a minimum of 20 mils.

10. Manholes for sewers 12" and above shall be coated with an epoxy coating system such as Cor-Cote SC as manufactured by Sherwin-Williams, Raven 405 as manufactured by Raven Lining Systems, Sewer Kote Duramer 1030 or an approved equivalent.
11. Manholes with an exterior height of four feet or greater from finished grade shall have exterior steps.
12. Manholes on outfalls shall have frames and rotating covers as detailed in HS722 with vent holes.
13. All sanitary sewer manholes in areas of special concern shall be required to be vacuum tested in accordance with ASTM C-1244.

B. Materials

The Director of Engineering will maintain a list of approved manufacturers for all sanitary sewer collection system products. New manufacturers must submit requests for approval to the Director of Engineering. Additional information such as catalogs, lists of installations in the area or material samples may be required. A written response will be mailed to the applicant accepting or rejecting the product within 90 days of the receipt of all necessary information.

Each length of sanitary sewer pipe installed shall have plainly and permanently marked thereon the following information:

1. Pipe class or strength designation;
2. Manufacturer's name or trademark;
3. Nominal pipe size.

A.B.S. Composite (Truss) Pipe

A.B.S. composite pipe shall meet the requirements of ASTM D 2680. Pipe joints shall be chemically welded or gasket joints in accordance with ASTM D 3212. See Section 7.01-C for additional installation requirements. See the Standard Drawing Details Section of these Standards for bedding requirements.

Ductile Iron Pipe

Ductile iron pipe for gravity sewer use shall be designed and manufactured in accordance with AWWA C150 and C151 for a laying condition Type 2 and a working pressure as follows:

3" - 12"	350 psi
14" - 20"	250 psi
24"	200 psi
30" - 54"	150 psi

Pipe joints shall be of the push-on type as per AWWA C1211. Pipe lining shall be cement lined. All ductile sewer lines 12" and above shall be 401 protectant lined.

Polyvinyl Chloride (PVC) Pipe

PVC pipe shall be made of PVC plastic having a cell classification of 12454-B, 12454-C or 13364-B (with minimum tensile modulus of 500,000 psi) as defined in Specification D1784. PVC pipe shall have integral wall bell and spigot joints for the conveyance of domestic sewage. Fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C or 13343-C as defined in Specification D1784. Fittings must be manufactured by pipe supplier or approved equal, and have bell and/or spigot configurations compatible with that of the pipe. Compounds with superior properties are also acceptable.

All pipe less than 18 inches in diameter shall have a maximum Standard Dimension Ratio (SDR) of 35. Where laying conditions so warrant, and in accordance with manufacturer's recommendations, lower SDR values (stronger pipe) may be required.

PVC pipe 18 inches in diameter and larger must be SDR-35 as defined in ASTM 679. Pipe strength shall be equal to or exceed that required for pipe less than 18" in size. Pipe shall have special bedding as per Detail HS 703.

Installation shall consist of Class I bedding material (as defined in Section 7.01 C) placed 4 inches below the pipe barrel and continuing to 4 inches above the pipe barrel, as per ASTM D2321. In addition, the installation of PVC pipe shall satisfy the requirements of Section 7.01-C below. See the Standard Details Section of these Standards for bidding requirements.

PVC Composite (Truss) Pipe

PVC thermoplastic material shall be a rigid PVC plastic conforming to ASTM D-1784 for a minimum cell class of 12454-B. The Portland Cement Perlite concrete or other inert filler material shall be as described in Section 6.3 of ASTM D-2680.

Joints shall be chemical welded or gasketed in accordance with ASTM D3212. Solvent cement for joining PVC to PVC shall comply with ASTM D-2564. Pipe test specimens shall meet all the manufacturing requirements established in ASTM D-2680.

All recommendations of the manufacturer shall be followed in shipping, handling, laying, joining and backfilling of the pipe, and the pipe shall be installed in full and complete compliance with Recommended Practice D2321. In addition, the installation of PVC composite pipe shall satisfy the requirements of Section 7.01-C below. See the Standard Details Section of these Standards for bedding requirements.

Steel Encasement for water/sewer pipes are required for the following Street Classifications to avoid traffic disruption in the future:

- Controlled Access Highway

For carrier pipes that employ cathodic protection anticorrosion systems, the carrier and casing pipes shall be effectively insulated from one another. Carrier and casing shall be cathodically protected as a unit.

See Section 5.03 Boring and Jacking for more casing pipe size requirements.

C. Additional Requirements for Flexible and Semi-Rigid Sanitary Sewer Pipe

Installation of flexible and semi-rigid sanitary sewer pipe shall satisfy the requirements of the manufacturer and/or the following, whichever is more stringent:

1. Installation shall follow the recommendations of ASTM D-2321 "Underground Installation of Flexible Thermoplastic Sewer Pipe." For flexible and semi-rigid pipes, bedding and embedment material shall be Class I. In any area where the pipe will be installed below existing or future ground water levels or where the trench could be subject to inundation, additional Class I material shall be used for bedding. Refer to the Standard Details Section of these Standards for embedment requirements.

2. The manufacturer's specifications or otherwise approved method shall be used in determining the stiffness class of the pipe to be installed so as to attain the required deflection control. The class of the pipe must be approved by the Director of Engineering prior to installation.
3. The maximum allowable deflection after installation shall be less than 5% for flexible pipe and 3% for semi-rigid pipe. The mandrel (go/no-go) deflection test must be performed on each line prior to acceptance, and no less than 30 days after installation. The Contractor shall supply the mandrel used for this performance test. The mandrel device shall be cylindrical in shape having 9 possible contact points with the pipe. The mandrel's length and diameter (ID of proving ring) shall equal the dimensions in the following table, and shall be subject to the Construction Inspector's approval. A mandrel test on truss pipe shall only be required if the Construction Inspector finds a problem during the visual inspection.

For polyethylene pipe, the following shall apply:

Nominal Diameter (inches)	Mandrel Length (inches)	Mandrel Diameter (inches)
18	12 (minimum)	16.53
21	"	19.30
24	"	22.08
27	"	24.84
30	"	27.62
33	"	30.38
36	"	33.15
42	"	38.68
48	"	44.21
54	"	49.74
60	"	55.27

For other flexible pipes the following shall apply:

Nominal Diameter (inches)	Mandrel Length (inches)	Mandrel Diameter (inches)
6	6	5.65
8	8	7.40
10	10	9.31
12	10	11.22
15	12	14.09

For semi-rigid (truss) pipes the following shall apply:

Nominal Diameter (inches)	Mandrel Length (inches)	Mandrel Diameter (inches)
8	8	7.52
10	10	9.46
12	10	11.40
15	12	14.31

4. For PVC and Polyethylene pipe, the pipe shall be produced with bell and spigot end construction. Joining will be accomplished by rubber gasket in accordance with manufacturer's recommendation, unless otherwise directed or approved by the Director of Engineering. Flexible watertight elastomeric seals in accordance with ASTM D3212-81, may also be used. Each pipe length shall be clearly marked with information including pipe size, profile number, and class number.
5. Minimum trench width shall be one pipe diameter plus 9 inches on each side of the pipe.
6. Special Bedding (6-inch minimum) and embedment materials shall be per ASTM D2321. Embedment materials shall be installed from trench wall to trench wall and from 6" below the invert to a minimum of 6" above the crown of the pipe, for all pipe 14-20' deep.
7. The bedding and embedment material shall be compacted to a minimum of 90% Standard Proctor density for Class I materials.
8. If hydraulic jack shoring is utilized for trench walls where shoring is used, it shall be kept to the area just above the top of the pipe. This will ensure the embedment materials and pipe will not be disturbed when removal is made.
9. Bedding and embedment material classifications shall be defined as follows:

Class I - Angular, (¼ to 1½ inch) graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, crushed gravel, and crushed shells.

Class II - Coarse sands and gravels with maximum particle size of 1½ inch, including variously graded sands and gravels containing small

percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW and SP are included in this class.

Class III - Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil types GM, GC, SM, and SC are included in this class.

Class IV - Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil types MH, ML, CH and CL are included in this class. These materials are not recommended for embedment.

7.02 FORCE SEWER MAINS

A. Materials

PVC Pipe shall be required for all sewer force mains. Ductile iron pipe shall be designed and manufactured in accordance with AWWA C150 and C151 for a laying condition Type 2. When it is determined that ductile iron pipe is required, then must have 401 protective coating and meet the following working pressure ratings:

3" - 12"	350 psi
14" - 20"	250 psi
24"	200 psi
30" - 54"	150 psi

PVC pipe shall meet the requirements of AWWA C900. Pipe shall be Class 150, SDR 18, integral bell with strength equal to the pipe wall, cast iron O.D., 18-foot length, with a solid elastomeric ring.

PVC pipe for force mains with a diameter of 3 inches or less shall be SDR-21 or Schedule 40 in accordance with ASTM D1785. PVC pipe shall require the installation of a 3-inch wide detector tape placed a maximum of 2 feet below the covering surface.

Pipe fittings shall be compact designed and manufactured per AWWA C153. Joints for fittings shall be mechanical joint and 401 protectant coated. Combination air valves shall be Valmatic Model 802SA or an approved equal. Must be verified with Development Inspector before installation.

B. Installation

Reaction blocking for all fittings or components subject to hydrostatic thrust shall be securely anchored by the use of concrete thrust blocks poured in place. The reaction areas are shown in the Standard Details Section of these Standards. No concrete shall interfere with the future removal of fittings. Material for reaction blocking shall be 3000 psi concrete.

Force mains shall be installed with a minimum cover of 4.5 feet measured from the top of the pipe to existing edge of pavement. Force mains shall be appropriately identified upon installation so that they will not be confused with potable waterlines. The pipe material shall be designated continuously on each joint of pipe as “sewer.” Force mains shall be designed and installed to minimize high points.

Sewage combination air valves shall be installed at all the high points of all force mains in accordance with the Standard Details Section of these Standards. Manholes containing valves shall receive an epoxy coating system on the interior such as Cor-Cote SC as manufactured by Sherwin-Williams, Raven 405 as manufactured by Raven Lining Systems , Sewer Kote Duramer 1030 or an approved equivalent..

Force sewer mains shall be installed in dedicated public rights of way or in dedicated utility easements. See Section 2.10 for landscape planting requirements within easements. Easements shall have the following dimensions:

Line Size	Easement Width
12” and under	20 feet
greater than 12”	30 feet

All force mains shall have an in-line valve located 25 feet from the pump station. In addition, force main valves shall be spaced at appropriate intervals as determined by the Director of Engineering, and shall have **locking** valve box caps marked “Sewer.” Force main valves shall be resilient wedge gate type for force mains less than 12”; valves greater than 12”, shall be sewer plug valves, designed to hold a minimum 150 lbs on both sides. Pressure testing will be required.

Force mains at air release manholes shall be a minimum of 6’ deep.

The receiving manhole plus the first downstream manhole below the receiving manhole for a force main shall receive an epoxy coating system on the interior such as Cor-Cote SC as manufactured by Sherwin-Williams, Raven 405 as manufactured by Raven Lining Systems , Sewer Kote Duramer 1030 or an approved equivalent.. All nicks and scratches shall be touched up prior to

acceptance of the manhole. The force main shall discharge at the invert of the receiving manhole and shall be as close as possible to 180° from the outlet pipe.

No drop is allowed in the receiving manhole for a force main.

Locator devices as manufactured by 3M Corporation shall be placed directly on top of the sewer force mains, along major thoroughfares and cross-country installations (and as otherwise directed by the Director of Engineering) at 100 feet intervals and turns/bends. Locater tape shall also be required to be installed at 2' above the pipe.

7.03 MANHOLES

A. Materials

Manholes shall be precast concrete. No hoop steel base or riser sections are allowed. All manholes shall have eccentric cone sections.

Precast concrete manholes shall meet ASTM C478 as to design and manufacturer. The standard joint shall be sealed with a plastic cement putty meeting Federal Specification SS-S-00210, such as Ram-Nek or a butyl rubber sealant. All lift holes must be plugged with non shrinking grout after installation. For precast concrete manholes, see the Standard Details Section of these Standards.

Manhole frames and covers (including rotating covers) shall be cast in ductile iron, conforming to ASTM A-48 Class 30, with "Sanitary Sewer" stamped on the cover and two 1-inch perforated holes in roadways and four 1-inch perforated holes in outfalls unless covers required to be watertight. Castings shall be machined to give even and continuous bearing on the full length of the frame. Castings shall be Grey Iron ASTM 48, CL 35B made in the U.S.A. Manhole frames shall be bolted to the manhole as per the Standard Details Section of these Standards. All manhole rings in roadways shall be encased in a concrete collar, 18 inches by 12 inches, of 3,000 psi concrete beneath the asphalt, with the cover flush with the top of pavement and rated for an AASHTO loading Class HS-20, as shown in the Standard Details Section of these Standards.

Watertight manhole frames and covers shall have neoprene gasket, machine bearing surfaces. Bolts shall be standard hexagonal-head, countersunk such that when fully tightened bolt head is flush with the top of the cover. Castings shall be Gray Iron ASTM 48, CL 35B, made in the U.S.A., free of porosity and blow holes. Watertight manhole frames and covers shall only be permitted in lieu of elevating the manhole tops above the 100 and/or 500 year flood plain with specific approval by the Director of Engineering. Watertight manholes shall require venting per the Standard Details section of these standards.

Manhole steps shall be furnished with the precast sections. Steps shall be of polypropylene material reinforced with a half-inch diameter grade 60 reinforcing steel rod. Manhole steps shall be designed for a vertical load of 400 pounds and a horizontal pull out load of 1,000 pounds. Steps shall be set 16" on center. Holes for the installation of manhole steps shall not project through the manhole wall. There shall be a minimum of 1-inch wall thickness from the deepest penetration of the step installation hole and the outside wall. Steps shall be at least 10" clear width and shall project at least 4" from the wall into which it is embedded. Steps shall not be located over the influent or effluent pipes and shall be installed along a vertical manhole wall from the shelf to the top of cone.

All manholes shall have 6-inch, 3,000 psi concrete bottoms resting on a minimum of 6 inches of #57 stone. Sewer mains shall enter and exit radially through the manhole. Inverts shall be constructed with a width and height equal to half that of the effluent pipe and shall be so brushed and troweled that a minimum energy loss occurs in the manhole.

At each inlet and outlet of line 8 inches or greater, wastewater lines are to be connected to the manholes by means of compression connectors (flexible sleeves) cast into the manhole section. Flexible connectors are to be manufactured of high quality rubber or synthetic rubber and all strap clamps or draw bolts are to be manufactured from stainless steel.

7.04 SERVICE CONNECTIONS

A. Materials

Cast iron soil pipe shall be service weight hub and spigot meeting Federal Specifications WW-401. The joints shall be rubber type elastomeric as per ASTM C425.

PVC pipe shall be schedule 40 or greater supplied in 18 foot lengths. The pipe may be joined by elastomeric gaskets.

Ductile iron pipe shall be used for sanitary sewer services with less than 3 feet of cover or in excess of 20 feet of cover.

Services for new lines shall use in-line wyes of like material unless otherwise approved by the Director of Engineering.

Service saddles for existing PVC or ABS lines shall be of the same material as the main, solvent welded and fastened with double stainless steel bands as shown on the Standard Details Section of these Standards.

Service saddles for existing cast iron soil pipe services may be “ROMAC C” sewer saddles consisting of a virgin SBR gasket compounded for sewer service, a ductile iron saddle casting, a 304 stainless steel adjustable strap for fastening the gasket and the saddle casting to the sewer main and a 304 stainless steel adjustable circle clamp for securing the service line into the SBR gasket.

B. Installation

Individually owned structures shall require individual sewer taps to public sewer. All service connections to existing sanitary sewer mains shall be made by the Town of Holly Springs Utility Department.

Service taps into mains shall be made on the top quarter of the main with the wye angled with the direction of flow in the main. All services installed on new lines shall be inline wyes unless otherwise approved by the Director of Engineering.

All service lines shall require Class I bedding from 6 inches below service line to 6 inches above the service line. All service lines shall have a minimum of 8 inches separation from other utilities. Service lines greater than 20 feet or less than 3 feet in depth must be ductile iron.

Service connections to the main lines shall be perpendicular to the main line to the edge of the right of way or easement line. Services shall have a minimum slope of 1.0 feet per 100 feet. Cleanouts shall be required on all sewer services at a maximum spacing of 75 feet on 4-inch services and 100 feet on 6-inch services. A cleanout shall be placed on all service lines at the right of way line or at the edge of the easement. All cleanouts shall extend a minimum of 6 inches above finished grade or meet the optional installation requirements in accordance with the Standard Details Section of these Standards. Sewer cleanouts located in paved areas must have traffic load bearing mini-manhole.

All 6-inch service lines shall tie directly into a manhole.

All service lines which are connected into manholes shall be installed less than 2½ feet above the invert or shall be installed with a standard drop as shown on the Standard Details Section of these Standards. Service lines shall not be installed through manhole cone sections or manhole joints. The use of service saddles will only be permitted for connection to existing sewer lines.

Service connections made using a “ROMAC C” sewer saddle shall be made only when the service line is cast iron soil pipe and only when the sewer main is 8”, 10”, or 12” diameter concrete, ductile iron, or PVC sewer pipe. This service connection shall not be used when the sewer main material is truss sewer pipe.

The opening in the sewer main for the “ROMAC C” sewer saddle shall be cut with a hydraulically driven or a pneumatically driven circular tapping saw of the same nominal diameter as the sewer service line.

C. **Grease Interceptor**

All grease traps/interceptors shall be designed according to minimum standards of the North Carolina Plumbing Code and any requests of the Town. The Town prohibits joint use of a tap or interceptor between establishments. All coking establishments shall have grease interceptors installed and maintained at the User’s expense. Non-cooking establishments or other commercial, institutional and/or industrial establishments may also be required to install a grease-handling device(s) when deemed necessary by the Town.

The discharge from the following fixtures shall be connected to the grease interceptor: all sinks, dishwashers, floor drains in food preparation and storage areas, and any other fixtures through which grease may be discharged. See Detail HS629.

7.05 TESTING AND INSPECTION

All materials used must be inspected by the Construction Inspector before they shall be allowed to be installed. Materials rejected by the Construction Inspector shall be immediately removed from the job site.

The Contractor shall furnish all materials, labor, and equipment, and shall pay for the water used to perform all testing and inspection to the satisfaction of the Construction Inspector. The Contractor shall obtain a meter from the Town of Holly Springs for use.

Sanitary sewer lines shall be free and clean from obstructions and shall be visually inspected from every manhole to ensure all lines exhibit a fully circular pattern. Lines which do not exhibit a true line and grade or have structural defects shall be corrected. All sewer mains shall require internal visual inspection by TV Camera at the expense of the developer prior to the beginning of the one year warranty and at the end of the warranty period if deemed necessary. Sanitary sewer service connections shall be visually inspected prior to backfilling. Contractor shall supply a DVD to inspector of line camera.

See Section 7.01 C for additional testing requirements for flexible and semi-rigid pipe.

Low-pressure air testing shall be performed after all laterals or stubs are installed on the line and after the main has been backfilled to finished grade. Plugs shall be installed at each manhole to seal off the section of line to be tested. The line will

be pressurized with a single hose and monitored by a separate hose connection from the plug. Air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig. The air pressure shall then be allowed to stabilize for a minimum of 2 minutes to no less than 3.5 psig (plus groundwater pressure, if any). When the pressure reaches 3.5 psig, the time required for the pressure to drop 1.0 psi shall be observed and recorded. The line shall be termed “acceptable” if the pressure does not drop more than 1.0 psi in the time prescribed for the test in the following table:

STANDARD AIR TEST TABLE									
Specification time (min:sec) required for pressure drop from 3½ to 2½ psig when testing one pipe diameter only									
Length of Time (feet)	Pipe Diameter (inches)								
	4	6	8	10	12	15	18	21	24
25	0:04	0:10	0:18	0:28	0:40	1:02	1:29	2:01	2:38
50	0:09	0:20	0:35	0:55	1:19	2:04	2:58	4:03	5:17
75	0:13	0:30	0:53	1:23	1:59	3:06	4:27	6:04	7:55
100	0:18	0:40	1:10	1:50	2:38	4:08	5:56	8:05	10:34
125	0:22	0:50	1:28	2:18	3:18	5:09	7:26	9:55	11:20
150	0:26	0:59	1:46	2:45	3:58	6:11	8:30		
175	0:31	1:09	2:03	3:13	4:37	7:05			
200	0:35	1:19	2:21	3:40	5:17				12:06
225	0:40	1:29	2:38	4:08	5:40			10:25	13:36
250	0:44	1:39	2:56	4:35			8:31	11:35	15:07
275	0:48	1:49	3:14	4:43			9:21	12:44	16:38
300	0:53	1:59	3:31				10:12	13:53	18:09
350	1:02	2:19	3:47			8:16	11:54	16:12	21:10
400	1:10	2:38			6:03	9:27	13:36	18:31	24:12
450	1:19	2:50			6:48	10:38	15:19	20:50	27:13
500	1:28			5:14	7:34	11:49	17:01	23:09	30:14

If the section of line tested fails to meet these requirements, the source of leakage shall be determined and repaired. The section of line shall then be retested.

The Construction Inspector may require that an infiltration test be performed. Infiltration shall not exceed 100 GPD per inch per mile.

At the discretion of the Director of Engineering, sanitary sewer manholes in areas of special concern may be required to be vacuum tested in accordance with ASTM C-1244 as shown.

C 1244 – 05a ^{e1}																		
Table 1 Minimum Test Times for Various Manhole Diameters (30-120 in.) in Seconds										Table 1 Minimum Test Times for Various Manhole Diameters (30-120 in.) in Seconds (continued)								
Diameter, in.										Diameter, in.								
Depth (ft)										Depth (ft)								
	30	33	36	42	48	54	60	66	72		78	84	90	96	102	108	114	120
Time, in seconds										Time, in seconds								
<4	6	33	7	9	10	12	13	15	16	<4	18	19	21	23	24	25	27	29
6	9	10	11	13	15	18	20	22	25	6	26	29	31	34	36	38	41	43
8	11	12	14	17	20	23	26	29	33	8	35	38	41	45	48	51	54	57
10	14	15	18	21	25	29	33	36	41	10	44	48	52	56	60	63	67	71
12	17	18	21	25	30	35	39	43	49	12	53	57	62	67	71	76	81	85
14	20	21	25	30	35	41	46	51	57	14	62	67	72	78	83	89	94	100
16	22	24	29	34	40	46	52	58	67	16	70	76	83	89	95	101	108	114
18	25	27	32	38	45	52	59	65	73	18	79	86	93	100	107	114	121	128
20	28	30	35	42	50	53	65	72	81	20	88	95	103	111	119	126	135	142
22	31	33	39	46	55	64	72	79	89	22	97	105	114	122	131	139	148	156
24	33	36	42	51	59	64	78	87	97	24	106	114	124	133	143	152	161	170
26	36	39	46	55	64	75	85	94	105	26	114	124	134	144	155	164	175	185
28	39	42	49	59	69	81	91	101	113	28	123	133	145	155	167	177	188	199
30	42	45	53	63	74	87	98	108	121	30	132	143	155	166	178	189	202	213

7.06 REPAIR OF SANITARY SEWER LINES

The repair of damaged sanitary sewer lines shall be as follows:

1. PVC Pipe - Replace damaged section with PVC pipe. Install a PVC couplings or ductile sleeves and mechanical bolt at each end (encased in concrete).
2. ABS/PVC Truss Pipe - Replace damaged section with D.I.P. Install PVC couplings or ductile sleeves and mechanical bolt at each end (encased in concrete).

All repairs to damaged sanitary sewer lines shall be backfilled with ABC stone (crusher run) to a density of 95% Standard Proctor.

7.07 WASTEWATER PUMP STATIONS

A. General Requirements

In situations where gravity sewer is not feasible, the Town of Holly Springs will consider allowing the installation of a wastewater pump station and force main. Note that the following factors shall be utilized in determining where wastewater pump stations may be installed:

1. Determination of, and design to, handle the wastewater flow that would be generated by the total natural drainage basin based upon a combination of the proposed land use plan and/or approved developments, whichever flow is greater, or as directed by the Director of Engineering, with a design life as specified by the Town. The Town may require pump station to be constructed downstream to serve a larger basin.
2. Evaluation (and upgrades, if necessary) of the capacity and suitability (with respect to potential for odor problems) of the receiving sewer main at the point of discharge and points downstream to determine if the downstream infrastructure can handle the transferred sewer flow. In addition, new pump stations may not discharge upstream of other existing pump stations. The Director of Engineering has the ability to approve deviations to this requirement due to extenuating circumstances.
3. A cost analysis of the pumping versus a gravity alternative (if one is available). The estimated installed cost of the gravity alternative divided by the estimated installed cost of the pump station alternative must be equal to or greater than 3.5 for the Town to consider allowing a pumping station. The Town reserves the right to require special features and/or special components on certain pump stations per the Director of Engineering.
4. The Town reserves the right on any pump station to perform the design and/or construction inspection and administration, with the developer reimbursing the Town in full.
5. The Town reserves the right to disallow pump stations where, in the Town's opinion, it is not efficient or desirable to have another pump station.
6. New developments may be required to take downstream or upstream pump stations off line, or upgrade them per the Town's Master Sewer Plan or as directed by the Director of Engineering.

7. For any new or upgraded pump station, one spare pump of identified size and manufacturer shall be provided to the Town prior to pump station startup. The spare pump will be stored at the Public Utilities Department.

Wastewater pump stations shall meet all requirements of these standards. **The developer and the developer's engineer shall meet with the Town Directors of Engineering and Public Utilities in a "pre-design meeting" prior to preliminary plan-level submittal of a site or subdivision requiring a pump station. The meeting shall be to discuss the site layout and other details and requirements for any proposed pump station before design begins.** All pump stations shall be submersible type and all construction materials shall be suitable for exposure to wastewater. Pump stations shall meet the N.C. Building Code and shall be designed to comply with all OSHA regulations in addition to these Standards.

All stations shall have a minimum of 2 pumps of equal capacity. The pumps shall be capable of handling flows in excess of the expected peak flow. The peak flow for design shall be equal to 2.5 times the average daily flow. Where 3 or more pumps are required, they should be of such capacity that with any one unit out of service, the remaining units will have capacity to handle peak sewage flows. Pumps and the sewage force main shall be sized to provide a minimum velocity in the force main of 2.5 fps and a maximum velocity of 10 fps maximum allowable velocity is dependent upon force main material. The Town reserves the right to require a larger force main size at no cost to the Town based upon operating (power) costs.

Wastewater pump stations, all related structures and controls, shall be protected from physical damage by the 100 year and 500 year local and FEMA flood plains and shall be elevated to 2 feet above the most restrictive elevation. Flood elevations shall be supported by a flood study on the tributary basin based on future land uses in accordance with the Town's Comprehensive Land Use Plan. Stations shall be designed to remain fully operational and accessible during the 100 year flood. Both flood elevations shall be shown on all site plans.

All sewage pump stations shall be equipped with an alternate power source. Alternate power sources include on-site standby power.

Small package type pump stations or grinder pumps may be approved by the Director of Engineering for private pump stations which serve only one site. These pump stations will be allowed only if the flow rate is less than 100 GPM and the force main is less than or equal to 4 inches in diameter. Private pump stations shall meet Town and NCDENR-DWQ minimum design criteria. Documentation of future maintenance of both the station and the force main by owner of record shall be required.

B. Site Work

Pump station sites shall be conveyed to the Town via deed and/or recordation, as specified by the Town. A pump station site layout plan for all pump stations shall be laid out with the Town in a separate pre-design meeting at preliminary plan review stage of any development project requesting installation of a pump station. The site layout plan shall require Board approval simultaneous with the preliminary site plan for the development project site.

The site shall be graded generally to drain away from the pump station and to remove stormwater runoff from site in a non-erosive manner.

The site shall be designed to accommodate **both** a WB50 and an SU design vehicle in a traffic pattern as directed by the Director of Public Utilities. In certain instances, remote fill ports may be required.

All components of the pump station shall be surrounded by a concrete slab with minimum HS-20 loading flush with surrounding grade. Concrete slab and hatches shall be HS-20 loading.

Signage shall be provided on the gate which provides the name of the station, its address, and emergency number of 557-9111 (green lettering on a utility sign).

The site shall consist of a fenced-in hard surfaced area, a gravel vehicular area, plus required landscape buffers, per Standard Details. The site shall be stabilized by crushed stone, low maintenance vegetative ground cover or other suitable materials.

The site area shall be secured by a 6-foot high chain link fence topped with 3 strands of barbed wire, or of a material as approved by the Director of Engineering. Fence products shall be only new materials using hot dipped green vinyl coated galvanized iron or steel components and aluminum coated fence. Gates shall permit 180° opening and shall be located so as to provide vehicle accessibility for lifting the pumping units and any other operational tasks as required. There shall be a minimum gate opening of 12 feet to facilitate truck access. Larger gates may be required to accommodate other design vehicles' turning radii.

A 12-foot (minimum) wide access road to the site with vertical grades not to exceed 10% shall be provided. Access road shall consist of an all-weather surface (minimum of 8" ABC) with minimum 40' long paved strip from roadway. No driveways may be located off of access road. Access road shall be fully contained within a minimum 20 foot wide combined access and utility easement, platted by the Developer.

The site shall feature locks and security features as dictated by the Public Utilities Department along with all necessary OSHA signage. The site shall feature a minimum high pressure sodium vapor light of 600 watt (minimum) capacity to illuminate the pump station area. The light shall be mounted on a Class V utility pole at a height of 30 feet and controlled by means of a photo cell and an HOA switch located on the light pole, unless otherwise approved by the Director of Engineering.

C. Odor Control

Pump stations which shall be maintained by the Town of Holly Springs may be required to incorporate a chemical feed and storage facility for both downstream and proximity odor control purposes. A hydrogen sulfide generation calculation may be required.

Chemical feed facilities should consist of the following at a minimum:

- Double walled liquid chemical storage tanks with a minimum capacity of 2,500 gallons;
- Two Wallace & Tierman Model 44 chemical feed pumps, calibration chambers and valves or a packaged-type chemical feed system with duplex pumps, calibration chamber, in a heated stainless steel chamber;
- A modular building to house tanks and pumps with lights, thermostat controlled vent, heater and sump pump may be required;
- A containment system in case of tank or piping failure may be required in addition to a double-walled tank.

The Town reserves the right to require mechanical ventilation and treatment of exhaust from the wet well to address anticipated or existing proximity odors.

D. Piping and Valves

Suction and discharge piping shall be minimum Class 50 ductile iron flanged pipe and as manufactured under AWWA Specification C 141. A check valve and a gate valve shall be provided for the discharge pipe of each pump. Check valve shall be iron bodied, fully bronze mounted with bronze clapper disc and bronze seat ring, and shall have a weight loaded lever arm capable of being mounted on either side of the valve and rated for 175 psi working pressure. The gate valve shall be hand-wheel operated. Entrance velocity into the pump shall not exceed 5ft/s to prevent vortices from forming and leading to the potential for air entrapment. The invert elevations for incoming sewer lines shall be set to minimize turbulence and prevent a cascading effect.

E. Wet Well

The wet well shall be precast concrete manhole sections conforming to ASTM C-478, latest revision. Extended bases or another foundation shall be used to provide adequate bearing surface if needed. All concrete shall have a minimum 28 day compressive strength of 3,000 psi. The wet well shall be designed to prevent the formation of vortices and the floor shall have a minimum side slope of 1:1 directed to a hopper bottom. Also, buoyancy calculations will be required for the wet well, free of pumps and water, to ensure that the anti-flotation design is adequate.

The manhole sections shall have joints of a durable mastic sealing material and the joints shall be further waterproofed on the outside of the wet well by the application of asphalt, overlapped by a 12 inch wide band of butyl joint wrap, and a finish mopping of asphalt. The interior side of the joints shall be plastered smooth with portland cement grout. The interior of the wet well shall then receive two successive coats of an epoxy coating system such a Cor-Cote SC as manufactured by Sherwin Williams, Raven 405 as manufactured by Raven Lining Systems, Sewer Kote Duramer 1030 with a minimum thickness of 10 mils per the manufacturer specifications or an approved equivalent.

The wet well shall feature a 316 stainless steel or 6063 alloy aluminum screening basket in front of the influent pipe. The basket shall be rectangular in shape and formed from ¼” x 3” bars on 2½ inch centers on a channel or angle frame. Grating, wire mesh, or perforated plates are not acceptable substitutes. Baskets shall be fabricated with cross members and bracing to provide structural stability under full loading. All bolted connections in the wet well shall be made using stainless steel nuts, bolts and washers. Baskets shall be raised and lowered by means of a stainless steel chain or wire rope with rings. A specially designed hatch shall be provided that will permit the raised basket screen to be maneuvered into or out of the wet well. This access hatch shall be a square hatch of ¼” aluminum, 6063 alloy, and diamond pattern plate with steel hinges on an aluminum frame cast in place in the cover slab.

The wet well shall have a vent made from ductile iron, with flanged joint pipe fittings. An insect screen shall be included at the exposed end of the vent pipe. The insect screen shall be bronze or aluminum.

F. Electrical

Electrical service to all pump stations shall be 3 phase, 240 VAC or 480 VAC. No 208 volt stations are allowed. No open delta services are allowed. If pump motors are over 10 hp, 480 service will be required. The electrical power

entrance shall be through a meter base, followed by a NEMA 3R heavy duty, single throw, fusible safety switch with a solid neutral; followed by a NEMA 3R automatic transfer switch as specified herein. All of these electrical components shall be suitably sized to be capable of service with both sewage pumps running.

Provide a minimum of one 110-volt receptacle to be located at the pump station. All electrical components, including panel, shall be sealed off in accordance with the N.C. Electrical Code requirements for electrical service to gas pumps.

NEMA 3R Enclosure: All outdoor equipment shall be enclosed in be a NEMA Type 3R enclosure of suitable size to house all components. A locking hasp shall be provided in addition to screw clamp type latches. Enclosure shall be fabricated from 14 gauge steel. The top of the enclosure shall serve as a drip shield and the seam-free sides shall prevent rain and sleet from entering. Inner panel shall be made of 12 gauge steel and shall be painted white. The enclosure and interior panel shall be painted with heat fused modified polyester powder, electrostatically applied over a phosphatized base. Enclosure shall be ANSI/ASA 61 grey.

G. Alarm Dialer

Required on all pump stations. See Director of Engineering for these specifications.

H. Generator Sets

Required on all pump stations. See Director of Engineering for these specifications. Sound proofing shall be required for every generator. Generator shall operate all components of pump station including pole light.

I. Transfer Switch

Required on all pump stations. See Director of Engineering for these specifications.

J. SCADA

Required on all pump stations. See Director of Engineering for these specifications.

K. Pump Motor Controls

General: Pump motor control equipment shall be enclosed in a prefabricated modular building as manufactured by Bally, Inc. or approval equal. Minimum size shall be 10'x10'.

1. **Line Terminal Block:** A terminal block shall be furnished with properly sized line lugs to accept the main power source entering the control panel. Load lugs shall be adequate to accept all required load side wiring requirements. All live parts shall be fully shielded.
2. **Motor Circuit Breakers (200-240 VAC):** A properly sized, molded case, thermal magnetic circuit breaker shall be provided for each pump motor. Line and load sides shall be equipped with lugs properly sized for the horsepower and current rating of the motor(s). They shall be attached to mounting brackets which are specifically manufactured for use with the particular circuit breaker. The interrupting rating shall be 10,000 RMS symmetrical amps.
3. **Motor Circuit Breakers (440-480 VAC):** A properly sized, molded case, hydraulic-magnetic circuit breaker shall be provided for each pump motor. Line and load sides shall be provided with lugs properly sized for the horsepower and current rating of the motor(s). The interrupting rating shall be 5,000 RMS symmetrical amps.
4. **Transformer Primary Circuit Breaker (when transformer is required):** A properly sized, 2 pole, molded case circuit breaker shall be furnished ahead of the control power 120 VAC power transformer for short circuit protection and disconnecting power to the transformer. The circuit breaker shall conform to the standards for the motor circuit breaker(s).
5. **Control Power Transformer (when neutral is not available at job site - standard on 460 VAC):** An industrial quality control transformer shall be furnished to provide control voltage. The transformer shall be sized with an adequate KVA rating to provide 120 VAC power for all items required in the control and alarm circuits. Transformer shall be protected in its secondary by properly sized fuses and/or circuit breaker(s).
6. **Magnetic Contactors and Overload Relays:** A NEMA-rated across-the-line magnetic contactor shall be furnished for each motor. A separate, panel mounted, 3 overload relay shall be supplied for each motor. Each leg of the overload relay shall be equipped with a properly sized overload heater. Contactor and overload relay shall be properly sized for the required horsepower, voltage and phase. Reduced voltage auto transformer starters will be required for motor sizes over 50 hp or when the power company requires reduced voltage auto transformer starters. Solid state starters will not be allowed.
7. **Elapsed Time Meters:** Six digit, non-resettable elapsed time meters shall

be mounted in the control panel enclosure to record the running time of each pump.

8. **Condensation Strip Heater with Thermostat:** A strip heater shall be furnished to prevent condensation within the control panel enclosure. The heater shall be controlled by a panel mounted, adjustable thermostat.
9. **Phase and Voltage Monitor:** A phase failure, reversal and under voltage monitor shall be supplied to prevent the motors from running under low voltage, phase loss, or phase reversal conditions. The monitor will lock out the control circuit until the problem is corrected and the monitor automatically resets.
10. **Lightning Arrestor:** Lightning arrestors shall be provided to protect motors and control equipment from lightning-induced line surges. Lightning arrestors shall be Transient Voltage Surge Suppressors Series 57,000 as manufactured by Leviton or approved equal. Lightning arrestors shall be distribution panel-mount style in a weather tight case with hinged cover. Protection shall be via individual line replaceable modules with hybrid circuitry.
11. **Thru-Door Overload Reset Push Buttons:** Overload reset push buttons shall be provided for each overload relay. Push buttons shall be mounted so that with inner door closed, overload relays may be reset without entering high voltage compartment.
12. **Switches:** Heavy duty industrial grade oil tight switches shall be provided for each pump for “Hands-Off-Automatic” operation selection. All switch components shall be made of corrosion resistant metals and polyesters. Contact blocks shall be made of see-through polycarbonate for simplified inspection of contacts. Cams and strokes shall be Teflon impregnated for abrasion free service without lubrication. The switches required shall be as follows:

Switch Function (Name Plate)	Voltage
Manual-Off-Automatic	120 VAC

13. **Pilot Lights:** Full voltage heavy duty industrial grade oil tight pilot lights shall be provided. All pilot light components shall be made of corrosion resistant metals and polyesters. An insulated socket shall be furnished to eliminate the possibility of shock during bulb change. Lens shall be made of lexan. The pilot lights required shall be as follows:

Pilot	Light	Voltage	Lens Color
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Function (Name Plate)		
Pump 1	120 VAC	green
Pump 2	120 VAC	green

14. **Seal Failure Circuit Test Push Button (illuminated):** Heavy duty industrial grade oil tight push buttons shall be provided for each submersible pump motor. All push button components shall be made of corrosion resistant metals and polyesters. Contact blocks shall be made of see-through polycarbonate for simplified inspection of contacts. An insulated socket shall be furnished to eliminate the possibility of shock during bulb change. Lens shall be made of lexan. The push buttons required shall be as follows:

Pilot Function (Name Plate)	Light	Voltage	Lens Color
P1 Seal Fail		120 VAC	amber
P2 Seal Fail		120 VAC	amber

15. **Pump Alternator Circuit (for duplex pump operation):** The electro-mechanical alternator relay shall be of industrial design specifically for use in pump applications. It shall have single pole double throw heavy duty 10 amp silver cadmium oxide contacts enclosed in a transparent cover. The snap action contacts shall transfer when the unit is de-energized. The circuit shall never be closed or opened while current is being conducted. The alternator circuit shall alternate the lead pump position between the pumps and shall allow the lag pump to start in response to a rising water level in the wet well.
16. **Control Relay(s):** Plug-in control relays with 120 VAC coils shall be provided as required. Contact rating shall be 5 amps (minimum). Sockets shall be of the same manufacture as the relays.
17. **High Wet Well Level Alarm:** The control panel shall be provided with a suitable alarm circuit, activated by a separate level control. This alarm shall signal a high water condition in the sump. Terminals shall be furnished in the control panel for connection of an externally mounted alarm device. A red flashing light and audible alarm shall be provided as a visual alarm of the high water condition in the wet well. The alarm light must be visible from a public road.

18. **Liquid Level Controls:** Mercury level control switches shall be provided for pumps on, lead pump on, lag pump on, and high level alarm functions. The mercury switch shall be encapsulated in polyurethane foam for corrosion and shock resistance. Level switches shall be weighted to hold desired position in the sump. The cord connection for the control shall be numbered 16-2, rated for 13 amps, and shall be type SJTO. To ensure optimum longevity, contacts shall be rated for 20 amps at 115 VAC and shall be sealed in a heavy duty glass enclosure. No junction boxes or cable splices of any kind will be allowed in the wet well.
19. **High Temperature Shutdown Circuit(s):** The high pump motor temperature circuit shall provide terminals for connection of the leads from the temperature sensor provided in the pump motor windings. Upon a high temperature condition in the pump windings, the control power to the pump motor contactor shall be disconnected, thus stopping the pump motor. The pump shall automatically restart when the pump motor temperature returns to an acceptable level.
20. **Ground Lug(s):** Equipment ground lug(s) shall be provided for grounding the enclosure. The ground lug(s) shall be suitable for the service provided to the enclosure and shall be sized per table 250-95 of the N.E.C. In all cases the enclosure must be adequately grounded per article 250 of the N.E.C.
21. **Terminals:** Terminals shall be provided for connecting mercury float switch leads, temperature sensor and seal fail sensor leads. Terminal blocks shall be rated for 600 volt use and accept a wire range of #22-8. All live parts shall be fully shielded. Block shall be constructed of nylon and have insulating walls on all sides of the lug. Blocks must be UL recognized.
22. **Construction Standards:** Subpanel shall be drilled and tapped to accept machine thread bolts (self tapping screws are not acceptable). All control wiring shall be 16 AWG machine tool wire, Carol type 76512 or equal. All control wire shall be color coded or numbered in accordance with JIC standards. Power (motor) wiring shall be in accordance with the most recent National Electrical Code. Major groups of wires shall be contained in a plastic wiring trough such as Panduit type E or other approved equal.
23. **Guarantee:** The manufacturer of the control panel shall furnish a warranty for one year from the date of installation stipulating that all equipment shall be free from defects in design, materials, and workmanship. The control panel manufacturer shall furnish replacement parts for any component proven defective, whether of his or other

manufacture during the guarantee period, excepting only those items which are normally consumed in service, such as light bulbs.

L. Force Main

Force main shall be as specified as Section 7.02. All PVC force mains shall have detector tape installed a maximum of 2 feet below the ground and over the force main. The detector tape shall be a 3-inch wide tape marked "Sewage Force Main" as manufactured by Allen or approved equal. The pipe shall have "sewer" designated on each joint. Locator devices as manufactured by 3M Corporation shall be placed directly on top of sewer force mains, along major thoroughfares and cross country installations (and as otherwise directed by Director of Engineering) at 100 feet intervals and turn/bends.

M. Water Service

A minimum 1" public water service or well shall be provided to supply water at a minimum flow rate of 5 gpm with a residual pressure of 30 psi to a yard hydrant located on the pump station site. A Town water meter and an above-ground RPZ in a heated hot box shall be required.

N. Submersible Pump Stations

General: The submersible pump station structure shall consist of the wet well, duplex pumps and rails, pump controls and related appurtenances, screening baskets with hoisting cable, discharge piping, valves, valve vault, cover slabs and access hatches. A pedestal-mounted jib crane with an electric hoist and electric trolley with a minimum size of two (2) tons shall be provided. Crane shall be sized for a minimum of three (3) times the weight of the heaviest item it must lift. Jib crane must be tall enough to lift pumps so that there is a 4' minimum clearance from the bottom of the pump to the concrete slab. Jib crane must be capable of accessing and lifting both pumps and the trash basket and it must be certified to the Town to be in accordance with OSHA. Crane shall be equipped with chain buckets in accordance with OSHA. Pump lift chains are required to be stainless steel and must extend a minimum of 5 feet above normal wet well operating level.

The wet well shall have a minimum diameter of 6 feet, and shall be large enough to easily accommodate the location and removal of each pump and the basket strainer. The wet well shall be designed to have a diameter sufficient to provide storage for a pump operating cycle of at least 3 minutes without being excessively deep and to allow for 6-10 starts per hour for the pump.

Sewage Pumps and Motors: Pumps shall be submersible, non-clog centrifugal sewage pumps capable of passing a 3-inch sphere as manufactured by Flgylt,

Fairbanks-Morse, or ABS. Submersible pumps provided shall each be capable of handling raw, unscreened sewage at peak design flow. Major pump components shall be of gray cast iron devoid of burrs, pits or other irregularities. The pump motors shall be sealed submersible type, and shall be 3-phase, 60 Hertz, 240v/480v motors with a maximum speed of 1750 RPM. The motors shall meet the U.S. requirements of Class I, Division I, Group D for hazardous locations, and shall be sized to non-overloading throughout the entire operating range of the pump.

A heating sensor thermostat shall be attached to and embedded in the winding and be connected in series with the motor starter contactor coil to stop motor if temperature of winding is more than 220°F. The thermostat shall reset automatically when the motor cools to a safe operating temperature.

The pump motor shall be protected by two mechanical seals mounted in tandem with a seal chamber between the seals. Seal chamber shall be oil filled to lubricate seal face and to transmit heat from shaft to outer shell. Seal face shall be carbon and ceramic and lapped to a flatness of one light band. Lower seal faces shall be tungsten carbide.

Moisture detection in the motor shall be as recommended by the manufacturer. If moisture detection is provided, water in the chamber shall cause a red light in the control panel. This signal shall not stop the motor but shall act as a warning only.

Power cables to pumps shall be AWG (minimum) hypalon jacketed type SPC cable of 30 feet in length as a minimum. A junction box shall be provided at the top of the wet well, just outside the well.

Discharge Piping and Valves: Discharge piping shall be flanged ductile pipe (Class 50 minimum) sized to produce a minimum head loss while maintaining a minimum velocity of 2.5 feet per second. All exposed piping shall have adequately sized and located thrust rods.

The discharge connection elbow shall be a straight through fitting with no flap valve and shall be permanently installed in the wet well along with the discharge piping. The pumps shall be automatically connected to the discharge connection elbow when lowered into place. The entire weight of the pump shall bear upon the guides and base support with no part of the pump bearing directly on the floor of the sump. A stainless steel wire rope fabricated into 6-foot sections connected together with stainless steel

O-rings shall be provided for lifting each pump from the wet well. All hardware used shall be 316 stainless steel.

Gate valves and check valves on the discharge side of each pump shall be located in a valve vault separate from and adjacent to the wet well. A dresser coupling

shall be installed on each discharge main between check valve and the gate valve. The valve vault shall consist of a cast in place or a precast concrete rectangular structure at least 6 feet square, complete with a drain line (with backwater valve) into the wet well. An access ladder or manhole steps (attached to the vault wall), and an access cover shall be provided. The access cover for the valve vault shall be a square hatch of ¼” aluminum diamond pattern plate with steel hinges on an aluminum frame cast in place in the cover slab.

Each discharge line through the valve vault shall have a ¾” 316 stainless steel nipple 3” long direct-tapped into the line between the check valve and gate valve. Each of these nipples shall have a ¾” stainless steel ball valve installed. A 3” or larger pressure gauge with a stainless steel case and mechanism, liquid-filled, and 3% accuracy shall be located at each nipple. The gauge shall operate in the middle one-third of its scale with both pumps running. The gauge shall be oriented so that it is easily legible from the valve vault access.

Lift Out Rail System: The lift out rail system shall consist of a straight elbow that bolts to the bottom of the basin, a combination disconnect assembly with a seal flange that mounts to pump, rail support guides that fasten to wall of basin and guide and support brackets that mount to pump. Guide rails shall be 304 stainless steel pipe.

The discharge quick disconnect shall be tapered and have a holding groove machined into the face to hold a sealing O-ring. The tapered seat shall allow the pump to be nearly sealed to the discharge elbow before the sealing faces make contact. A guide plate and adjustable guide bar shall be fastened to top of the pump to insure good alignment and for support of the pump.

The rail support and mounting bushing shall be securely mounted to the basin wall and shall not be attached to the basin cover or cover frame. The guide rail support shall be adjustable so that a perfect vertical alignment of the rails can be obtained.

O. Landscaping and Appearance

Buffers shall be provided along both sides of the access road and surrounding the gravel vehicular area of the pump station site. Buffers shall extend 50 feet in all four directions from the required gravel vehicular area, plus a 10 foot buffer along both sides of the 20 foot access easement, and shall be included within the site dedicated to the Town for the station. Buffers shall either be supplemented to be equivalent to or planted with an C-225 opaque buffer as defined in The Town of Holly Springs UDO.

Color of crane shall be determined by the Town.

The Town shall reserve the right to establish other appearance requirements.

Buffers shall be maintained by the developer for two years from date of final (end of year) acceptance of pump station.

P. Warranties and Documentation

Warranties: In addition to the Town’s required standard one year workmanship and materials warranty, the following shall apply. The developer shall warrant all pump station equipment for one year from the date of beginning of one year warranty of the pump station, as identified in the Letter of Acceptance for the pump station. The Town reserves the right to make necessary emergency repairs and/or perform work necessary in emergency situations within this warranty period. The developer shall be responsible for reimbursement costs associated with any such work. If a non-emergency repair or other work becomes necessary within the warranty period, the Town shall provide written notice to the Owner of need for such work. If the work is not completed within the time frame specified in the written notice, the Town shall undertake the work and the developer shall be responsible for reimbursing those costs.

Pre-Construction Documentation: The following information shall be provided to the Town (for both Development projects and Town – funded projects) for review and approval by the Town prior to construction of the pump station. This review and approval shall not relieve the design engineer from the responsibility of insuring that the project meets all Town standards:

- Shop Drawings for:
 - pumps
 - jib crane
 - generator
 - control panel
 - modular building
 - odor control
 - check valves
 - Other components as directed by the Director of Engineering

Pre-Start Up Documentation: The following documentation shall be supplied to the Director of Engineering **prior** to the Operational or “start-up” test for the pump station, and must be submitted in a complete package labeled Operation and Maintenance Manuals that is signed and sealed by the design engineer.

1. Cover Sheet listing the following: Pump manufacturer; source of repair parts, complete with address and phone number; operating conditions - rated capacity and TDH of each pump; model number, serial number,

impeller diameter of each pump; all data plate information from each pump motor; data on all other equipment included as components in the pump station;

2. Pump Performance Design Curve with operating conditions indicated on it; also manufacturer's (factory) Certified Pump Curve for each pump.
3. Detailed dimensional drawings of the pump and pump base elbow;
4. Detailed dimensional drawings of the pump motor;
5. A control panel wiring diagram;
6. Pump and Motor Installation and Service Manual and specific pump parts list with part numbers.
7. Detailed information related to other components of the pump station, including but not limited to: control panel, alarm dialer, generator;
8. Mylar as-built;
9. P.E. certification;
10. Warranty letter;
11. Recorded access easement and/or right of way documentation.
12. Documentation of recorded site and access easement dedication to Town.

Q. Testing and Inspection

Hydrostatic Testing of Force Main: The force main shall be completely filled with water, all air shall be expelled from the pipe, and the discharge end of the pipeline shall be plugged and adequately blocked before the hydrostatic test begins.

The force main shall be tested to a pressure of 150 psi or 3 times the rated Total Dynamic Head of the pumps in psi, whichever is larger, as measured at the lowest elevation of the pipeline, for a duration of 2 hours. The pressure gauge used in the hydrostatic test shall be calibrated in increments of 10 psi or less. At the end of the test period, the leakage shall be measured with an accurate water meter.

PIPE SIZE ALLOWABLE LEAKAGE

Pipe size (inches)	Leakage per 1000 feet of pipe (gallons)
4	0.85
6	1.28
8	1.70
12	2.56

All visible leaks are to be repaired regardless of the amount of leakage.

Operational Test: A full operational test is required in conjunction with the punch list inspection before the pump station can be accepted by the Town of Holly Springs for routine maintenance. The Town of Holly Springs Field Inspection Test and Report (at end of Section 7.00) shall be completed during the test. The wet well shall be thoroughly cleaned to remove dirt, mud, gravel, and other foreign debris. The force main must be full and the wet well must be full to the high water alarm mark. The operational test shall check the proper functioning of the pumps, pump controls, and other pump station equipment. The pump and motor serial numbers shall be verified. All components of the pump station shall be checked to ensure that they are capable of performing the service intended. Contractor shall pull and reset both pumps in the presence of Town staff before approval of the guide rail system. The operational test shall be performed by the Town of Holly Springs. The Contractor or Developer shall ensure that a representative from the various pump station equipment manufacturers are present at the operational test to review proper operation of the equipment with the Town of Holly Springs personnel.

Contractor's Responsibility: The Contractor shall furnish all materials, labor, and equipment to perform all testing. The Contractor shall coordinate with the Town of Holly Springs for the use of water for testing.

7.8 INDIVIDUAL SEPTIC TANK SYSTEMS

Individual septic tank systems, where approved, shall be required to meet Wake County Standards and permitted through Wake County. No low pressure-type septic systems shall be allowed.

(CHECKLIST FOLLOWING)



**TOWN OF HOLLY SPRINGS
GUIDELINES FOR
PUMP STATION FINAL FIELD INSPECTION AND OPERATIONAL TEST**

Project: _____

The following items shall be provided by the Developer to the Engineering Department before the Final Field Inspection and Operational Test begins:

- Four (4) copies O&M Manuals signed and sealed by the design engineer, including:
 - Cover sheet with the following listed:
 - Pump manufacturer
 - Source of repair parts (phone and address)
 - Rated capacity (GPM) of pumps
 - Total dynamic head (TDH) of pumps
 - Model number of pumps
 - Serial number of each pump
 - Impeller diameter each pump
 - Data plate information from each motor
 - Data on all other pump station equipment
 - Pump Performance Design Curves
- CERTIFIED** pump performance curves (including pump cut-off lines) with operating conditions on it
 - As-built detailed, dimensioned drawings of pump and pump base elbow
 - As-built detailed, dimensioned drawings of pump motor
 - As-built control panel wiring diagram
 - Pump and motor Installation and Service Manual
 - Detailed information on:
 - Control panel
 - Alarm dialer
 - Generator
 - Mylar as-built one (1) copy plus three (3) blueprints
 - PE certification
 - Warranty Letter
 - Recorded Easement or Right of Way documentation for access
 - Documentation of site dedication
 - Pump Station Maintenance Agreement
 - Crane Certification will be required to document compliance with OSHA Standards
- Ownership of power with Duke Energy transferred to Town of Holly Springs
- Ensure the pump station address is the permanent address.

Date of Inspection: _____

Inspector: _____

Attendees:

2015 ED&CS

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Supp 1 2016
Supp # 2 Aug. 2017
Supp # 3 Aug. 2018
Supp # 4 May 2019

**Final Field Inspection and Operational Test-Required Inspections:
(Check off as completed/passed):**

The following items should be field inspected for compliance with approved plans and Town Standards. All employees shall conform to the Town of Holly Springs Safety Policies and Procedures in the course of making the following inspections. Attention is directed especially to the Town's existing policies pertaining to electrical systems and confined space entry. Owner shall insure that design engineer, subconsultant design professionals, equipment representatives, and labor is present for the field inspection.

Pumps

- Two pumps - field check the plates on pumps to insure conformance with design plans and O&M manuals (Manufacturer, GPM, TDH, Model Number, Serial Number, Impeller Size)
- Pump start-up (both pumps) on regular power feed
- Pump start-up (both pumps) on back-up power feed (generator)
- Verify automatic switch to back-up power source during power failure
- Verify automatic cycling between two pumps

Valve Vault

- Valve Vault
- Check valve as designed
- Gate valve as designed
- Pressure gauge
- Vault drain back to wet well with Back Flap

Site

- Positive drainage away from station
- 12' access road (min. 8" depth stone) with good drainage & cross drainage
- Adequate gravel area for vehicular turn-around installed
- 6' chain link fence with 3 strands barb wire (galvanized or aluminum)
- Signage "Town of Holly Springs _____ [station to be named by the Town] Pump Station, [address here], Emergency 557-9111" (white on blue lettering)
- Ground cover outside fence
- Vehicular accessibility to pumps
- Concrete pad inside fence area
- 12" minimum width gate with 180 degree opening (non-obstructed)
- 600 watt sodium vapor light with photocell (30' mounting height) with switch on pole
- Opaque buffers installed

Odor Control

- Chemical feed facility for odor control (if required)
- 2500 gallon liquid chemical storage tank
- 2 Wallace & Tierman Model 44 chemical feed pumps
- Modular building (neutral colors) to house tanks and pumps; with lights, heater, and

- sump pump
- Containment system in case of chemical spill
- Eye wash
- Mechanical ventilation (if required)

Crane/wrench/chain horse

- For pumps < 7hp, provide wrench
- For pumps > 7hp, provide chain horse
- Provide lifting rings every 6' on lifting chain
- Chain bucket

Wet Well

- Cleaned of all debris and filled with water
- 6' minimum diameter
- Interior joints grouted
- Koppers super service black coating (2 coats)
- Aluminum trash basket with rope chain
- All bolts stainless steel
- Independent hatch for raising basket
- Access hatch and steps (check location)
- D.I. vent with bronze insect screen
- Class 50 DIP suction discharge and piping

Electrical

- Generator-field check plate on generator to insure conformance with design plans and O&M Manual
- 3 Phase 240 VAC or 480 VAC
- Meter Base
- Nema 3R single throw safety switch
- Nema 3R double throw safety switch
- Building: electrical inspector has approved
- Automatic maintenance operation on timer (minimum weekly)

Alarm Dialer/SCADA

- Lockable Nema 4 enclosure
- 120 VAC electrical supply
- Backup battery
- Surge protectors on power and telephone lines
- Dialer programmed with emergency phone numbers
- Approved model in accordance with plans
- Telephone line installed
- SCADA installed

Pump Motor Controls

- Aluminum weatherhood 7' height with 4' overhang with severe service paint
- Nema 3R enclosure with locking hasp

- Hinged inner door with overload reset buttons, circuit breakers, switches, 2nd pilot lights as the only accessible components when closed
- Line terminal block
- Circuit breaker for each pump motor
 - 10,000 rms for 200-240 VAC
 - 5,000 rms for 440-480 VAC
- Transformer primary circuit breaker (when required)
- Control power transformer (when required)
- Magnetic contactor and overload relay for each motor
- Six-digit, non-resettable elapsed time meters
- Condensation strip heater with thermostat in control panel enclosure
- Phase & voltage monitor
- Lighting arrestor
- Thru-door overload reset push buttons
- Two “hands-off-automatic” switches
- Two green pilot lights
- Two seal failure circuit test push buttons
- Pump alternator circuit
- Control relays
- High wet well level alarm device (flashing red light)
- Aluminum float switches
- High temperature shutdown circuit
- Groundings

Force Main

- Force main including air release valves
- Force main hydrostatic testing

Development Inspector Administrator Date

Construction Inspector Date

Public Utilities Director Date

Director of Engineering Date

Owner’s Representative Date

END OF SECTION 7.00

