CHAPTER 4 UTILITIES

General Requirements, Public Water and Sewer Main Extension Permits, Water Distribution, Sewer Collection, Sewer Pump Stations, and Sewer Force Mains, FOG (Fats, Oils, and Grease)

A. GENERAL REQUIREMENTS

1. Specifications used in addition to this manual are City of Kannapolis Water and Sewer Extension Policy, Code of Ordinances Chapter 17 – Water and Sewer, NCAC, NCDEQ, NCDOT Standard Specifications for Roads and Structures and WSACC.
2. All water and sewer permits shall be obtained prior to beginning construction. Any piping installed prior to obtaining permits will not be accepted.
3. Public water extensions shall be accepted into public service prior to any combustible materials being delivered or vertical construction beginning on new construction sites.
4. Any size service installation related to a major subdivision plat or project will be made by the developer. Reference the most recent fee schedule.
5. Master meters for water are not permitted for use at multi-family facilities. Each structure is required to have the proper backflow prevention installed and be individually metered.
6. Casing pipe for boring and jacking operations shall be steel pipe and have a minimum yield strength of 35,000 psi. The casing pipe shall be sized using the table in Appendix A.
7. Valves are required on each side of the water main at designated stream, creek, or river crossings, perpendicular roadway crossings that exceed 60’ or at any other priority location as required by the Director of Water Resources.
8. No laterals shall cross back through a utility easement or within a R/W.
9. No bends will be permitted for lateral lines between the tap and the meter location.
10. All water mains ≥ 8” in diameter will be shown in profile view.
11. All RPZ’s are to be located outdoors and within 5’ of the water meter.
12. Water meters, fire hydrants, and backflow prevention devices shall be per City standards.
13. All fire hydrants shall be public and connected to mains owned and operated by the City of Kannapolis.
14. All water mains that serve more than one structure shall be considered public and will be provided with an adequate easement to maintain the line.
15. All irrigation lines shall be metered separately.
16. All water & sewer mains shall be required within the pavement section of all roads, regardless of public or private maintenance of the roads.
17. Maximum depth of cover for PVC pipe shall be limited to 15’ Ferrous material shall be provided for all proposed water and sewer system extensions that have a depth of cover exceeding 15’ Depth over 15’ is discouraged. Depth over 18’ is prohibited within the roadway right of way within 10’ of a driveway connection.
18. Any utility cuts performed in City of Kannapolis streets shall be repaired using City of Kannapolis Standard Details.
19. All utility structures installed in existing streets shall require excavatable flowable fill concrete be used as backfill to fill the voids between the structure and the walls of the excavation.
20. Density tests shall be required on trench backfill at a frequency established in the NCDOT Specifications. Test reports shall be conveyed to the City on a weekly basis.
21. A minimum notice of 2 business days is required to schedule testing or final inspections of utilities.
22. **Easements**
    a. Minimum of 20’ wide, pipe centered in easement preferably in common open space.
    b. Width requirements based on pipe depth (see Appendix A) and must provide for 1:1 excavation,

bottom width = outside pipe diameter + 2'.

c. Shall be dedicated to the City of Kannapolis.

d. Maximum slopes for maintenance vehicles: longitudinal = 15%, cross slope = 5%.

e. See LDSM details for overlapping easements.

f. Private utilities are not allowed inside public utility easements except by Encroachment Agreement.

B. PUBLIC WATER AND SEWER MAIN EXTENSION PERMITS

All public water and sewer main extensions to the City of Kannapolis systems shall be permitted through the North Carolina Department of Environmental Quality (NCDEQ) by the City following City review. Designs shall be in accordance with The Standard Specifications for Wastewater Collection and Water Distribution for the Water and Sewer Authority of Cabarrus County (WSACC) and The City of Kannapolis Water & Sewer Standards and Policies.

Required information includes:

1. NCDEQ Fast Track Sewer System Extension Application
2. NCDEQ Application for Approval of Engineering Plans and Specifications for Water supply Systems
3. WSACC Sewer Flow Acceptance Form
4. Digital copy of design plans
5. Engineer's Report - Water Model
   a. Water models shall be required for permitting and to verify sufficient flows and pressures for the proposed extension. The following items shall be included as part of proposed water system model:
      I. Summary of the flow test data used to create model.
      II. A schematic of the proposed system with all nodes and pipes clearly labeled.
      III. Model should show that average daily use plus minimum fire flow requirements will not drop the pressure below 20 psi anywhere in the system.
      IV. To simulate the existing system, the connection to the existing system should be modeled using a reservoir and pump. Pump curve should be based on fire hydrant flow data. Pump Report should be provided.
      V. Pipe summary table should be provided that includes the following:
         a. Pipe label, length, and diameter.
         b. "C" factor (maximum allowable "C" factor = 120).
         c. Flow under average daily conditions.
         d. Hydraulic grade (upstream and downstream).
         e. Head loss per 1,000' of pipe.
   b. Junction summary table should be provided that includes the following:
      I. Junction label, elevation, and demand under average daily conditions.
      II. Static head and pressure.
      III. Residual head and pressure under average daily conditions.
   c. Fire flow summary table should be provided that includes the following:
      I. Junction label.
      II. Available fire flow.
      III. Available total flow.
      IV. Residual pressure at the fire flow node.
      V. Minimum system pressure junction.
      VI. Minimum system pressure.

C. WATER DISTRIBUTION

1. **Water Distribution Piping Materials**

   Shall be either PVC or DIP:

   a. 2” - 4” PVC SDR 13.5, Class 315, ASTM D 2241, ASTM D 1784 cell classification 12454-B, ASTM D 1869.

   b. 6” - 12” PVC C900, DR 14, Class 200. The bell of the pipe shall be an integral thickness wall made monolithically with the pipe.

   c. 3” - 12” DIP, Class 350, ANSI/AWWA C151/A21.51.

   d. 16” DIP +, Class 250, ANSI/AWWA C151/A21.51.

   e. Water service piping shall be Type K Copper tubing, per ASTM B-88.

   f. End connections shall be compression. Copper services shall conform to AWWA C-800. See Appendix A.

2. **Fittings for Water Distribution Piping**

   a. ≤ 2”, push-on PVC, ASTM D-3139, SDR-13.5, Class 315.

   b. 3” – 4”, DIP Class 250.

   c. 6” – 24” DIP Class 350.

   d. 30” + DIP Class 250.

   e. Mechanical joint fittings shall be CI or DIP and conform to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53 for compact fittings.

   f. Fittings for water services shall be red brass containing 85% copper, 5% lead, 5% tin, and 5% zinc in conformance with ASTM B-62. Fittings shall be compression in accordance with AWWA C-800 and shall utilize a compression and/or the split clamp with tightening screw. Stab type fittings are prohibited.

3. All materials shall be new, manufactured either in the year that construction begins or the previous year.

4. PVC pipe shall be shipped, stored, and strung in a manner to limit its total accumulated exposure to sunlight and UV radiation to no more than 4 weeks.

5. Tracer wire is required to be taped to all water piping, including mains and services. Tracer wire shall be #12 plastic coated solid copper wire. Non-metallic location tape is required 1’ above the water piping.

6. Water line installation requires staking for alignment, location, and elevation.

7. All mechanical joint fittings, gate valves and fire hydrants require restraining glands and appropriate thrust blocks unless otherwise noted.

8. Water mains shall be adequately anchored to resist thrusts that may develop at fittings and any other location where a change in flow direction occurs.

9. **Tapping Sleeve and Valves**

   All connections to existing mains shall require tapping sleeve and valves:

   a. Valves 2” – 12”, 200 psi working pressure, 400 psi testing pressure.

   b. Valves 14” - 24”, 150 psi working pressure, 300 psi testing pressure.

   c. Tapping sleeves shall be cast iron or stainless steel 150 psi working pressure.

   d. Split-type cast iron tapping sleeves shall be required for all taps where the new branch line is of equal diameter as the existing main being tapped. Stainless steel tapping sleeves shall be required on all existing asbestos concrete piping regardless of size.

10. Water services shall be installed 5’ from the sewer lateral, on the up-hill side of the lateral. The service shall not to exceed the center of the lot, measured equidistance between proposed lot lines. Service

lines shall not cross back over an easement for sewer or water mains.

11. Water services shall not be permitted in sidewalks or driveways or other pavements. Any services in conflict shall be capped at the main and a new service connected at the main and installed to the property line. Lateral lines shall not cross back over an easement for sewer or water mains.
12. All water services shall be installed uniformly on both sides of the street. No bends allowed in lateral line between tap and meter.
13. Water meters shall read in gallons.
14. Fire hydrants shall have integral Storz nozzles. Hydrants are to be painted Safety Red with industrial enamel paint.
15. A minimum 3' of clear space shall be maintained around the circumference of fire hydrants, unless otherwise approved.
16. Water mains installed in cul-de-sacs shall maintain a straight alignment to the back of the cul-de- sac with a blow off installed at the termination point, located behind the back of curb.
17. **Water Main Pressure Testing**
    a. All new water mains shall be pressure tested for leakage and disinfected prior to acceptance by the City of Kannapolis.
    b. Water mains shall be tested prior to placing ABC, curb and gutter or asphalt.
    c. Testing of the water main cannot be performed until the water main has been backfilled and a minimum of 7 days after the last thrust block has been poured.
    d. A representative of the City of Kannapolis shall be present for all testing.
    e. Pressure tests will be conducted without interruption for a period of 2-hr and no more than 5000' per section tested. The allowable leakage shall be in accordance with current AWWA C600 standards, as shown in the below modified formula:

       Q = 0.0068 DLN
       Where:
       Q = allowable leakage in gal/hr
       D = nominal diameter of pipe in inches
       L = length of section tested in feet, divided by 1000' N
       = square root of average test pressure in psi
18. Unless otherwise noted, fire hydrants shall be in the closed position during testing.
19. Disinfection of water mains shall conform to the requirements of ANSI/AWWA C651-92, WSACC and NCDEQ.
20. All frame and covers on manholes and valve boxes installed during construction of the water system shall be solid and state the use of system, "WATER" on the cover. Use NCDOT Standard Drawing 840.54.
21. Where corrosion is deemed to be a serious problem, DIP shall be provided with cathodic protection or an internal/external encasement, lining, or coating appropriate for the pipe material and situation. Such encasements, linings and coating shall be manufactured or applied in accordance with the appropriate ANSI and AWWA standards.
35. **Requirements for Acceptance of Water Main System**
    a. As-Built Record Drawings per submittal requirements in Chapter 6.
    b. Engineer's Certification.
    c. State approval.
    d. Easements or Rights-of-Way dedicated to the City.
36. **Mi.Net System:** Water main extensions may require installation of infrastructure to support the Mi.Net system utilized by the City of Kannapolis. The type of equipment and locations of said equipment shall

be coordinated with Director of Water resources. The City of Kannapolis shall not be responsible for the cost of the additional equipment unless otherwise noted.

D. SANITARY SEWER PIPE

1. **Sanitary Sewer Piping**

   Shall be either PVC or DIP, see Appendix A:

   a. 4" - 15" PVC shall be Solid wall ASTM D3034, SDR 35, Cell Classification 12454 B.

   b. 18" - 48" PVC shall be Profile wall ASTM F794 Stiffness PS46.

   c. All sizes DIP shall be Class 50.

2. All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 fps, based on Manning's formula using an "n" value of 0.013. Minimum slopes for piping are as follows:

Diameter of Pipe (inches)	Minimum Slope (feet per 100 feet)
6	0.60
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
36	0.05

3. PVC pipe shall be shipped, stored, and strung in a manner to limit its total accumulated exposure to sunlight and UV radiation to no more than 4 weeks.

4. All materials shall be new, manufactured either in the year that construction begins or the previous year.

5. Transitions between PVC and DIP shall be made with an Adaptor Coupling SWRxDIOD Harco PT #2834-080 or approved equal.

6. **Sanitary Sewer Pipe Testing**

   a. Sewer mains shall be tested prior to placing ABC, curb and gutter or asphalt.

   b. A representative of the City of Kannapolis shall be present for all testing.

   c. A mandrel test is required on PVC piping no sooner than 30 days after installation of the pipe.

   d. Pipe ≤ 24", low pressure air testing shall be used in lieu of exfiltration testing. Low pressure air testing shall comply with ASTM C828 for PVC pipe. See Appendix A for Air Test requirements.

7. Continuity tests shall be performed on all tracer wire installed on all utility systems.

8. **Sanitary Sewer Pipe Bedding**

   a. PVC - #57 stone 6" under the pipe to 6" over the top of pipe.

   b. DIP - #57 stone 6" under the pipe.

   c. The bedding requirements are minimum depths and unsuitable soils may require additional stone be placed in the trench. In the event the undercut extends 2' or more below the bottom of pipe, the Director of Engineering shall determine the means and methods of remediation.

9. #57 stone is required on all sewer laterals; see Kannapolis Standard Details.

10. Tracer wire is required to be taped to all sewer piping, including mains and laterals. Tracer wire shall be #12 plastic coated solid copper wire. Non-metallic location tape is required 1’ above sewer piping.
11. Laterals shall have a No-Hub cast iron cap with a stainless-steel No-Hub coupling at the clean out at the property line.
12. Laterals are to be installed uniformly on both sides of the street, and at an appropriate location to maximize the lowest elevation of the lot, but in no case, shall be installed in a location with an elevation higher than the elevation at the center of the lot. Lateral lines shall not cross back over an easement for sewer or water mains.
13. Clean outs shall not be permitted in sidewalks or driveways or other pavements. Any clean outs in conflict shall be capped at the main and a new lateral connected at the main and installed to the property line.

E. SANITARY SEWER MANHOLES

1. Manholes shall be constructed with precast bases as indicated in the details.
2. Inside drops shall be used for 8” – 12” diameter sewer unless indicated otherwise on the drawings.
3. Manhole inside diameters* shall be as follows, unless otherwise directed by the engineer or noted on the drawings, according to the largest sewer pipe connected to the manhole:

Pipe Diameter	Manhole Diameter
8” – 16”	4’
18” – 36”	5’
39” – 54”	6’
54” +	8’

*The minimum diameter of all drop manholes (inside or outside) shall be 5’.

4. Minimum invert elevation entering manhole shall be 0.20’ above exiting invert or top of invert out pipe minus diameter of the entering, whichever is greater.
5. Drop manholes shall be required on sewer entering a manhole at an elevation greater than 2’ above the manhole invert. Where the difference in elevation is less than 2’, the invert shall be filleted to prevent solids deposition.
6. The flow channel shall be made to conform as closely as possible in shape, and slope to that of the connecting sewers.
7. All connections to manholes shall require resilient connectors, conforming to ASTM C923, with stainless steel clamp, drawbolt and nut or “A” Lok. Connections to existing manholes shall be made by coring into the existing manhole wall and installation of a resilient connector.
8. The connecting pipe shall not protrude more than 2” inside the manhole wall.
9. All manhole components shall be designed to withstand an H-20 loading. All precast manholes installed in the NCDOT right of way shall be approved by NCDOT.
10. Concrete used in the manufacture of manholes shall be 4,000 psi minimum at 28 days, containing 4% minimum air content, cement at a rate of 564 #/cy minimum, and conform to ASTM C478, C890, C891, C923, C33, C494, and C260.
11. Manhole reinforcement shall conform to ASTM A615 grade 60 deformed bar, ASTM A82 or ASTM A185 welded wire fabric.
12. All joints between precast components shall be sealed with butyl rope no less than 14’ long. The external joint shall be wrapped with a polyethylene backed flat butyl rubber sheet no less than 1/16” thick and 6” wide applied to the outside perimeter of the joint.
13. Manhole steps shall be provided in all sections of the manhole and be aligned vertically on 15” centers. The bottom step shall be no more than 26” from the top of the bench in the base section. The step pull-out strength shall be 1,000 lbs. minimum in accordance with ASTM C478.
14. Manholes shall have a maximum of 12” of grade rings placed on the structure. All joints, including grade rings, shall be sealed with butyl sealant, rope, and sheet types.

15. All frames and covers on sewer manholes shall be solid and state the use of system, “SANITARY SEWER” on the cover. Use NCDOT Standard Drawing 840.54.
16. All frames shall be set on butyl sealant and wrapped with sheet butyl. All frames set outside of the roadway shall be bolted to the manhole with at least 2 bolts on opposing sides of the frame. Frames and covers located outside the roadway shall extend at least 2’ above grade unless otherwise noted. Any frames and covers located in roadways or shoulders shall conform to the slopes surrounding the frame and covers.
17. Manholes shall be protected from the 100-yr flood by either setting the frame and cover 2’ above the 100-yr flood elevation or installing a watertight frame and cover with a vent 2’ above the 100-yr flood elevation. Manholes shall be vented every 1,000’ or every other manhole, whichever is greater.
18. Vent pipes shall be Grade B, FY=35,000 psi, 3” diameter with a mesh stainless steel screen in the opening.
19. Manholes shall be installed at the end of each line, at all changes in grade, size, or alignment, at all intersections, and at distances not greater than 425’. Sewer mains greater than 425’ may be allowed at the discretion of the Director of Engineering.
20. Where corrosive conditions are anticipated, consideration shall be given to providing corrosion protection on the interior of the manhole.
21. **Sanitary Sewer Manhole Bedding**: manholes shall set on a minimum of 6” of #57 stone.

    Sanitary Sewer Manhole Vacuum Pressure Testing: Sewer manholes shall be tested prior to placing ABC, curb and gutter or asphalt. A representative of the City of Kannapolis shall be present for all testing. A vacuum of 10” of mercury shall be placed on the inside of the manhole. Vacuum testing shall be performed on 100% of the manholes installed. For a passing vacuum test on sanitary sewer manholes, the vacuum cannot drop from 10” – 9” under the following:

    a. 4’ diameter manhole, < 60 seconds.
    b. 5’ diameter manhole, < 75 seconds.
    c. 6’ diameter manhole, < 90 seconds.
    d. 7’ diameter manhole, < 105 seconds.
    e. 8’ diameter manhole, < 120 seconds.
    f. 10’ diameter manhole, < 150 seconds.
22. **Requirements for Acceptance of Sanitary Sewer System**
    a. Video of the sewer system (after installation of dry utilities but prior to acceptance).
    b. As-Built Record Drawing per submittal requirements in Chapter 6.
    c. Engineer’s Certification.
    d. State approval.
    e. Easements or Rights-of-Way dedicated to the City.

F. WASTEWATER PUMP STATIONS

1. The City of Kannapolis policy for wastewater pump stations is to minimize the need for pump stations. The additional expense of operation and maintenance, along with the environmental concerns associated with pump stations is the basis of the policy.
2. While the construction of pump stations is not viewed as the initial option for providing sewer service, there are situations that pump stations can be allowed. The following criteria will be utilized during the consideration of developer funded pump stations:
    a. The pump station can be eliminated by a project or combination of projects, all of which are included for funding in the approved 5-yr CIP. The pump station can be eliminated by a project being done under a reimbursable program and the funds have been made available to the City.
    b. The proposed pump station is at an appropriate location and has adequate capacity or expansion

capacity to serve as a permanent or long-term facility and gravity service is cost prohibitive or not possible due to other circumstances.

c. The construction of the proposed pump station would include elimination of one or more existing pump stations.

d. The construction of the proposed pump station would facilitate significant progress toward achievement of land use goals and strategies described by current, officially approved planning documents and no other reasonable options are available for service.

e. The receiving system must have available capacity to carry the proposed pump station discharge. Any upgrades required will be the responsibility of the Developer requesting the pump station.

3. All wastewater pump stations shall be designed by Professional Engineer licensed in the North Carolina, comply with the NCDEQ, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains and be permitted through NCDEQ.
4. Only non-clog pumps designed and manufactured for use in conveying raw, unscreened wastewater shall be permitted. The pumps shall be capable of handling a 3” solid and any trash or stringy material that can pass through a 4” hose. Pumps shall be designed for continuous duty.
5. The impellors shall have blades that are generally forward rounded or otherwise configured to avoid catching solids, trash, and stringy material.
6. Pumps shall have no less than a 4” diameter suction and discharge opening.
7. Multiple pumps shall be used such that the pump station is capable of conveying the peak hourly wastewater flow to its desired outfall location with the largest single pump out of service.
   a. In duplex pump stations, the pumps shall be of the same capacity.
   b. If pumps in series are required to meet capacity or total dynamic head requirement, each set of pumps in series shall be viewed as a single pumping unit.
   c. Priming pumps as well as any other auxiliary system that is required for pump functionality shall also be provided in multiple numbers.
8. Determination of pump capacity shall be based on development build out. For regional pump stations, pump capacity shall be based on the entire service area over the life of the pump station.
9. The minimum allowable design daily wastewater flow to the pump station shall be historical potable water use, wastewater flow generation data; or established long-range wastewater planning criteria.
10. The storage capacity for the pump station shall include 2-hr storage above the high-water alarm elevation at the peak flow rate.
11. Pump capacity shall also be based upon the need to maintain a minimum velocity of 2 fps.
12. Pump selection shall be based on total dynamic head versus capacity; static head requirements; friction head requirements; minor losses; pressure head at the junction of the existing force main; no cavitating; and maximized operating efficiency.
13. System curves shall be generated and evaluated not only for present day conditions, but also for conditions that may exist over the expected lifetime of the pump station.
14. The Hazen-Williams friction coefficient, C, appropriate for the force main pipe material and age of the force main shall be used, see Appendix A.
15. Consideration shall be given to minimizing motor speed and the motor horsepower shall be at least 1.15 x what is required during the entire pump performance curve.
16. Constant speed pumps shall be cycled such that the number of starts is minimized, and resting times are maximized to avoid overheating and overstressing of the pump motor.
17. All pumps shall be UL or FM listed, hermetically sealed, air-filled submersible type, electric motor for operation at 460V, 3ph, 60hz power. Pumps shall be designed for use in electrically hazardous locations, general use in pumping sewage, and be provided with thermal overload protection and moisture detection system.

18. A quick disconnect suction line shall be installed in the wet well, 1' above finished floor, extending above the finished grade of the wet well. The suction line shall be restrained joint DIP.
19. A quick disconnect pump connection shall be required at location designated by the Kannapolis Director of Water Resources.
20. For City maintained pump stations, the land shall be deeded and recorded to the City of Kannapolis. The tract shall be large enough to accommodate the pump station, structures (including a 10' x10' outbuilding), emergency generator, parking, and maneuvering of maintenance vehicles, accommodate grading, ingress/egress to the site, and a security fence.
21. All ports of entry to the pump station, structures, vaults, panels, etc. shall be lockable.
22. The lift station shall be provided with adequate indoor and outdoor lighting to facilitate normal and emergency operation and maintenance activities during daylight and non-daylight hours. Outdoor/all-weather lighting (120V) with outdoor/all-weather switch shall be provided under the weather cover for electrical and/or SCADA panels installed outside.
23. The security fence shall be chain link, 8' high, around the entire perimeter and have double-swing gates with a minimum clear opening of 18'. The size, layout, and configuration of the fenced area for the lift station site shall be sufficient to allow multiple vehicles to be at the station at the same time. The site shall be able to accommodate at a minimum a 6,000-gallon tri-axle vactor.
24. Roads for ingress/egress of pump stations shall be a minimum of 16' wide but will be evaluated on a case-by-case basis to adequately serve the pump station in any weather condition. Refer to greenway trail typical section detail for minimum pavement schedule. Surface may be asphalt or concrete.
25. All structures shall be designed and constructed in complete compliance with all applicable state, local and federal codes as well as applicable Occupational Safety and Health Administration (OSHA) and National Fire Protection Association (NFPA) standards and display all applicable safety placards.
26. Piping and valves shall be designed and installed per the NCDEQ, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains.
27. The site shall have a water supply. If municipal water is the source of potable water, a ¾" water service with a reduced pressure principle backflow prevention device is required inside the security fence and shall have 120V power provided for freeze protection. If municipal water is unavailable, a well shall be required to provide water. Wells shall be required to deliver 10 gpm at 40 psi and be marked as non-potable. A freeze-proof yard hydrant is required inside of the security fence.
28. All electrical systems and equipment shall be designed and installed meeting the standards of Underwriters Laboratories Incorporated (UL), National Electrical Manufacturer's Association (NEMA), National Fire Protection Association (NFPA), North Carolina State Building Code (NCSBC), National Electrical Code (NEC) and NCDEQ, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains (MDCPPSFM).
29. Contact Kannapolis Director of Water Resources, (704) 920-4200, to obtain the current requirements for installation of telemetry and other instrumentation.
30. Stand-by power generation is required for pump stations. The stand-by power shall be fueled by natural gas, where available, or liquid propane, where natural gas is not available. The generator shall be sized to adequately supply the pump station with consistent power enough to operate the pumps and supporting accessories throughout a power outage. The generating unit shall be located in a building structure or otherwise protected from the weather elements and meet the minimum requirements per the NCDEQ, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains.
31. Testing of all appurtenances associated with the pump station shall be performed per the NCDEQ, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains and/or local specifications.
32. 3 hard copies & 1 digital copy of the Operations & Maintenance (O&M) Manuals shall be provided to the City upon start-up of the pump station. The manual shall be prepared using the criteria in the NCDEQ, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains.

33. If the pump station will be maintained by the City, one spare pump for each type/model shall be provided for each type/model of pump installed and 4 spare floats. In addition, 1 spare ultrasonic transmitter or pressure transducer shall be provided as selected by the Director of Water Resources.
34. If the pump station will be maintained by the City and the design capacity is greater than 15,000 gal per day, a 10’ x 10’ storage outbuilding shall be provided on site within the security fenced area. The storage outbuilding shall meet all minimum respective county codes. The storage outbuilding shall have at least one standard door and one double door opening of at least 7’h x 5’w. The storage outbuilding shall be equipped with a vent ridge type vent in the roof line. The storage outbuilding shall be equipped with outdoor clasp type locks to accommodate a pad lock. The storage outbuilding shall be equipped with a fire extinguisher inside. The storage outbuilding shall have studs at least 16” on center for the walls and be constructed on slab for flooring. The storage outbuilding shall be installed as to protect against flooding and shall be out of the flood plain.
35. The 100-yr floodplain elevation shall be noted on the applicant’s drawings. All above ground equipment, electrical controls, and access hatches shall be located at least 2’ above the 100-yr floodplain.
36. Landscaping Requirements - The applicant shall provide landscaping for the lift station in accordance with the Kannapolis Development Ordinance. At a minimum, landscaping shall be compatible with the surrounding neighborhood. However, Leyland cypress and poplar trees are not allowed for pumping station sites. Holly bushes are the preferred bushes for screening. Screening is required if there are existing or proposed dwellings within 200’. Within the lift station fence line, the entire area shall be provided with an asphalt or concrete surface as shown in the greenway trail typical section detail minimum pavement schedule, unless the Director of Water Resources approves an alternative surface. City vehicles must be able to pull within 4’ of the wet well without obstruction.
37. The site shall be graded to provide positive drainage away from the lift station wet well, mechanical and electrical equipment and appurtenances.
38. All check valves shall be installed in the horizontal position in an accessible location outside of the wet well inside an epoxy coated vault or manhole with adequate clearance for its removal.
39. Stations with a permitted design flow of 0.5 MGD and larger, shall require additional solids removal. The additional removal can be achieved by using grinders or mechanical bar screen. All pump stations regardless of permitted design flow shall have a rag basket or rack screen.
40. All hatches shall be of sufficient size that the largest piece of equipment may be removed with a minimum of 6” of clearance on all sides. Hatches shall be solid aluminum diamond plate with spring assist if more than 50 lbs of lifting weight is required. Hatches shall include recessed lifting handle, security lock pin, and factory installed safety slide bars to hold vertically open. All hatches shall be anti-slam.
41. The submersible pump wet well shall be equipped with an ultrasonic transmitter or pressure transducer as selected by the Director of Water Resources to provide depth measurements to the SCADA system.
42. Permanent flow metering shall be required at all lift stations. Flow monitoring and run time reporting software and hardware will be required at all proposed lift stations. All stations shall be provided with flow meters in accordance with the following requirements:
    a. Flow meters shall be electromagnetic type with 316 stainless steel metering tube sized to maintain velocities within the recommended range provided by the manufacturer over the full range of anticipated flows.
    b. Flow meters shall be installed in an accessible location in the lift station dry well or outside within the fenced area inside an epoxy coated vault or manhole with adequate clearance for its removal.
    c. The piping installation shall provide 5 diameters of straight pipe runs upstream and 2 diameters downstream from the meter, or additional lengths if required by meter manufacturer. Bypass piping shall be provided of equal or greater size than the flow meter piping with sufficient valving to allow the flow meter to be removed for maintenance without taking the station out of service.
    d. Flow meter shall be equipped with a microprocessor based “smart” transmitter that can convert and transmit a signal from the flow tube with a 4-20 mA DC signal.

e. The flow meter shall have an integrated LCD readout capable of displaying flow rate and totalized flow. The LCD screen shall not be installed inside the confined space vault.

43. All lift station structures other than the wet well shall be provided with a means to remove accumulated water and wastewater from the structure. All floor and walkway surfaces and sloped such that water and wastewater drains to a designated sump area under the influence of gravity.

44. All structures shall have means to remove accumulated water with an appropriately sized drainage pipe draining to the wet well. The discharge for the drainage pipe shall be higher than the high-water level alarm and be equipped with a buck-bill/check valve. The drain pipe shall not allow backflow of wastewater and gasses from the wet well into the structure.

45. There shall be a spare check valve supplied for every model installed at the lift station.

46. Pump Piping Requirements - Each pump shall be provided with separate suction and discharge piping systems designed in accordance with the following minimum requirements:

    a. Suction and discharge piping shall be a minimum of 4” diameter unless approved by the Director of Water Resources.

    b. Suction and discharge piping shall be sized to maintain velocities between 2’ and 8’ per second. Suction piping shall provide a minimum 5 diameters of straight, unobstructed (ie no flow disturbing fittings) run upstream from the pump.

    c. Suction piping for all wet well mounted suction lift stations shall be schedule 40 stainless steel at a minimum.

    d. Reducers required for connection to the suction connection flange on the pump volute shall be long radius, concentric reducing elbows.

    e. The pipe and fittings shall have a minimum of 12” of clearance from any wall or floor and there shall be a minimum 36” clearance between the piping of each pump or greater if required by the pump manufacturer.

    f. All exposed fittings whether inside or outside the lift station shall be flanged joint ductile iron fittings. Applicants shall provide appropriate restraining joints for all piping.

    g. Flexible couplings shall be provided on pump discharge piping and common headers to facilitate construction as well as routine maintenance and replacement of valves, etc.

    h. Except for submersible pumps, restrained couplings shall be provided at the suction and discharge nozzles for all pumps that can accommodate both angular and parallel misalignment to prevent the transmission of pipe strain to the pump volute and limit nozzle loading in accordance with the pump manufacturer’s requirements.

    i. Wet wells shall be coated with an approved product.

47. Valve Requirements - All lift stations shall be provided with sufficient valves to allow for proper operation and maintenance of the lift station during normal, peak, and emergency bypass conditions. Valves shall be suitable for use with raw, unscreened wastewater and shall be of a design suitable for its function, its installation location, as well as the normal and maximum operating pressures expected at the lift station.

    a. A full-closing eccentric plug shut-off valve shall be provided on the suction (for wet/dry pit stations) and discharge piping of each pump.

    b. An outside-lever, swing check valve shall be provided on the discharge piping of each pump, between the pump and the shut-off valve. Check valves shall be installed in the horizontal position to prevent the accumulation of debris on the back side of the flap that may prevent the valve from opening. Check valves shall be located so that all working parts are readily accessible including the top cover that is removed periodically for maintenance.

    c. Discharge piping shall be connected to using a meg-a-flange connector in the valve vault.

    d. Valves shall not be placed inside the wet well.

    e. All valves should be individually supported from below wherever possible. The use of flange supports that bolt directly to the valve flange are discouraged unless other means of thrust restraint

are provided that limit the movement of the valve and potential damage to both the valve and support.

f. Valving shall be adequate to provide for all operating conditions, pump removal and replacement, bypassing, and equipment maintenance (i.e., flow meters, electrical components, phased construction, mechanical maintenance, etc.)

g. All valves shall open left, counter-clockwise.

48. Discharge Valve Vault Requirements for Submersible Lift Stations - Submersible lift stations shall be provided with a concrete valve vault located directly adjacent to the wet well. Valve vaults shall be provided with the following design features:

    a. Valve vaults shall be constructed of epoxy coated precast concrete. All precast structures shall comply with ASTM C-478 at a minimum.

    b. The minimum allowable interior size for valve vaults shall be 6’ x 6’ for lift stations with 4”-6” force mains and 8’ x 8’ for larger force mains.

    c. Valve vaults shall be provided with a minimum 4’ x 4’ double leaf aluminum access hatch.

    d. Manhole steps shall not be installed in valve vaults. An OSHA approved aluminum access ladder shall be installed from the access hatches to 1’ above the floor inside the vault and extend 2’ above the hatch when fully extended.

    e. Provide at least 12” of clearance between valves and the wall.

    f. Provide at least 36” of clearance between the valves for each pump discharge.

    g. When vertical clearance is required, it shall be adequate for safe worker entry and exit without crouching.

    h. All penetrations to be cast with watertight flexible boots meeting ASTM C-923.

    i. The floor shall be tapered to an 18” x 18” x 12” sump pit.

49. Lift stations shall be provided with a system that allows for the removal and installation of the pumps and grinders without requiring entry into the wet well or manhole and with clear vertical access:

    a. Each pump and grinder shall be provided with a dual-guide rail system and lift-out chain section with guide cable.

    b. Removal systems shall guide the pump or grinder system into its fully seated, operating position.

    c. Both the guide rail and the lift-out chain shall be capable of withstanding the forces required to disengage the pump or grinder from the wet well or structure.

    d. Both the guide rail and the lift-out chain shall be manufactured of type 304 stainless steel.

G. SEWER FORCE MAINS

1. Force mains shall be designed per NCDEQ, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains.

2. Pipe materials and specifications shall be selected based on the installation and operating conditions of the system and shall consider the following criteria:

    a. Installation depth and overburden pressure.

    b. Soil conditions and groundwater pressure.

    c. Corrosion resistance from both external and internal sources.

    d. Strength required withstanding internal pressures expected during normal operation as well as those resulting from hydraulic surges and water hammer.

3. Force mains shall be constructed of the following pipe:

    a. Ductile iron pipe – DIP shall conform to ANSI/AWWA C151/A21.51 “Ductile Iron Pipe, Centrifugally Cast in Metal Molds for Water or Other Liquids.”

        i. The thickness and pressure class of DIP pipe shall be determined in accordance with

ANSI/AWWA C150/A21.50 “Thickness Design of Ductile Iron Pipe.”

ii. Fittings for DIP shall conform to ANSI/AWWA C110/A21.10 “Ductile-Iron and Gray-Iron Fittings, 3” - 48” for Water and Other Liquids” or ANSI/AWWA C153/A21.53 “Ductile Iron Compact Fittings, 3” - 24” and 54” - 60” for Water Service.”

iii. DIP force mains shall have mechanical, gasketed push-on type joints. or flanged if exposed. Restrained joint DIP may be used for anchoring purposes. Gaskets shall be in accordance with ANSI/AWWA C111/A21.11 Flanged DIP shall conform to ANSI/AWWA C115/A21.15

iv. Where corrosion is deemed to be a serious problem, DIP shall be provided with cathodic protection applied in accordance with the appropriate ANSI and AWWA standards.

b. Polyvinyl Chloride (PVC) materials used in the manufacturing shall conform to ASTM D1784.

i. PVC pipe shall conform to AWWA C900 or C905. The thickness and pressure class of PVC shall be determined in accordance with AWWA C900 or AWWA C905 but shall be a minimum or Pressure Class 200, SDR 14 or less.

ii. Force mains of PVC pipe shall have elastomeric gasketed push-on type joints in accordance with ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.”

iii. Mechanical joint DIP fittings conforming to ANSI/AWWA C110/A21.10 and C116/A21.16-98 shall be used for force mains 4” in diameter and larger.

iv. PVC pipe shall be shipped, stored, and strung in a manner to limit its total accumulated exposure to sunlight and UV radiation to no more than 4 weeks.

4. All force mains shall be identified with green plastic locator tape & black lettering identifying the pipeline as sanitary sewer. The tape shall be placed approximately 1’ above the pipe.
5. Tracer wire is required to be taped to the force main. Tracer wire shall be #12 plastic coated solid copper wire.
6. Force mains shall be adequately anchored to resist thrusts that may develop at fittings and any other location where a change in flow direction occurs.
7. Testing of the force main cannot be performed until the force main has been backfilled and a minimum of 7 days after the last thrust block has been poured.
8. The hydro-static test pressure shall be 1.5 x the maximum pump operating head range, but not less than 100 psi. The test pressure shall be held a minimum of 2 consecutive hrs.
9. All valve boxes shall be labeled “Sewer”.
10. All force mains shall be installed with a corrosion resistant internal lining. Lining shall be Protecto
11. 401 ceramic epoxy or approved equal, unless otherwise approved by the Director of Water Resources. When the Director waives the force main internal lining requirement, pipes shall have a standard cement mortar lining except at the locations specified below where the corrosion resistant lining shall always be provided:
    a. At all high points for a minimum distance of 100’ in each direction.
    b. At all locations where partially full conditions may exist or where the force main may be exposed to air during static or operating conditions as determined by a hydraulic model of force main, plus an additional 40’ in each direction. Provide hydraulic model for review if requesting variance.
12. **Requirements for Acceptance of Sanitary Sewer Force Main System**
    a. Video of the sewer force main system (after installation of dry utilities but prior to acceptance).
    b. As-Built Record Drawings per submittal requirements in Chapter 6.
    c. Engineer’s Certification.
    d. State approval.
    e. Easements or Rights-of-Way dedicated to the City.

H. FATS, OILS, AND GREASE (FOG)

1. **Minimum Design Criteria for Grease Separation Devices (GSDs)**

   a. GSDs shall conform to Chapter 10, Sec. 1003 of the North Carolina Plumbing Code, the City of Kannapolis Land Development Standards Manual, and the City of Kannapolis FOG and Sewer Use Ordinances when being designed and constructed and shall be installed in accordance with the manufacturer's instructions. The designer shall contact the Cabarrus County Construction Standards Department for all applicable plumbing permit requirements.

   b. All GSD plans and specifications shall be approved by the City of Kannapolis Engineering Department prior to installation.

   c. GSDs may be used in series to meet the required capacity pending approval by the City of Kannapolis Engineering Department.

   d. Under Sink GSDs

      i. Under sink GSDs shall be permitted in instances where in-ground GSDs, whether interior or exterior, are infeasible, or when an exception has been approved by the director of water resources or his designee. Under sink GSDs may also be used in series with an in-ground GSD to provide the required capacity. Under sink GSDs shall not be used as the sole device.

   e. In-Ground GSDs

      i. Gravity GSDs must provide for a minimum hydraulic retention time of 24 min at actual peak flow between the influent and effluent baffles, with 25% of the total volume of the grease interceptor being allowed for any food-derived solids to settle or accumulate and floatable grease derived material to rise and accumulate, identified hereafter as sludge pocket and grease cap.

      ii. The formula used for calculating in-ground gravity grease interceptor size is as follows:

      Interceptor Size (gal) =

      ((gpm/fixture x total # fixture ratings of grease-laden waste streams)

      + direct flow from a dishwasher, can wash, mop sink (gpm)) x 24-min retention time

Pipe Diameter	GPM/Fixture
0.5	0.8
1.0	5.0
1.5	15
2.0	33
2.5	59
3.0	93

Fixture Ratings of Grease-Laden Waste Streams	Rating
2, 3 or 4 compartment sink	1.0
1 or 2 compartment meat prep sink	0.75
Pre-rinse sink	0.5
1 or 2 compartment vegetable prep sink	0.25

For direct flow from dishwasher, can wash, and mop sink, use the following gpm values:

Dishwasher = 10 gpm

Can wash and mop sink = 6 gpm

Example: A restaurant has the following fixtures in their kitchen:

(1) 3 - compartment pot sink, 1.5" waste drain, 1 pre-rinse sink, 1.5" waste drain

(1) 1 - compartment meat prep sink, 1.5" waste drain

(1) 1 - compartment vegetable prep sink, 1.5" waste drain

(1) can wash (use 6 gpm)

Using the formula to size exterior grease interceptors:
Gallons needed for grease interceptor

= [[15 gpm x [1 + 0.5 + 0.75 + 0.25] + 6 gpm] x 24 min

= [[15 gpm x 2.50] + 6 gpm] x 24 min

= [37.5 gpm + 6 gpm] x 24 min

= 43.5 gpm x 24 min

= 1,044 gallons

use 1,000-gal interceptor size

iii. Hydromechanical GSDs shall be sized in accordance with Section 1003.3.4 of the North Carolina Plumbing Code.

iv. GSDs greater than 500 gallons must be located exterior to the facility.

v. Metal GSDs are not permitted for all new facilities or existing facilities required to upgrade due to inadequate GSD size and/or failure.

vi. Exterior in-ground grease interceptors located in green space shall have manhole frames and covers encased in a 4' x 4' concrete pad. The concrete pad shall extend a minimum of 6" above finished grade and be maintained in such a way as to remain free of landscaping material.

vii. Cleanouts must be provided as shown in detail 350A and 350B of this document.

viii. GSDs shall not be located in ADA parking spaces.

ix. For facilities with a drive-thru service, GSDs shall not be located within the required stacking, nor shall they be located between the order box and the pickup window.

2. **Oil Separation Devices shall be sized as follows:**

Facility Category	Minimum Functional Volume (gal)
Auto Repair/Vehicle and Equipment Maintenance Facilities	1000
Automatic Car Wash with Recycling	750
Automatic Car Wash without Recycling	1000
Manual Car Wash with Recycling	1000
Manual Car Wash without Recycling	1200