
ARTICLE 3. WASTEWATER FACILITIES

3.0 GENERAL PROVISIONS.

3.0.1 APPLICABILITY. All wastewater main construction within the Authority system and all wastewater service line construction connecting to the Authority's wastewater mains shall be completed in accordance with these Standard Specifications and the approved plans. These Standard Specifications shall cover new construction and repairs to existing facilities.

3.0.2 APPROVAL PROCESS. As described in Section 1 of these Standards, the Authority shall review all construction plans for conformance with these Standard Specifications. Engineering design shall remain the responsibility of the design engineer.

- A. **Owners or authorized representatives of any development except a single family residence shall submit a letter to the Authority outlining the proposed development, number of units, projected daily sewage flow in gallons per day, instantaneous peak flow in gpm, peak factor and other data as may be necessary for the Authority to understand the nature and impact of the proposed development on the Authority's system. This shall apply to all developments. Commercial/Industrial developments shall follow the requirements of the Authority's Industrial Pretreatment Program located in Appendix A.**
- B. Three (3) copies of preliminary plans showing the type of development, location and general plan for sewer lines and other appurtenances must be submitted to the Authority. The minimum finished floor elevation must be indicated on each lot.
- C. For pump stations and forcemains, site development plans must show:
 - 1. **Plan of the entire sub-basin which drains to the lift station, to include contours and projected flow calculations of the entire sub-basin. Include proposed locations of sewer access by adjoining properties within the sub-basin to the sewer system via easement. Reference *Residential Sewer Easement, Easement Sewer Line, and Sewer Capacity Upgrade Policy* in Appendix F.**
- D. Comments will then be addressed to the developer by the Authority.
- E. **As described in Section 1, within six (6) months of the date of Preliminary Application approval, the developer must then submit five (5) copies of construction plans as outlined in these Standard Specifications to the Authority for review. These plans must carry the stamp of a professional engineer licensed in the State of Georgia and duly qualified and capable of designing sewer systems and computing flows. Land surveyors are only permitted to seal sanitary sewer plans specifications for work within a subdivision.**
- F. If approved as submitted, two (2) copies of plans stamped approved will be returned to the developer.
- G. If changes are required, a checklist will be returned to the developer.

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- H. After the changes have been made, the developer must submit five (5) additional copies of construction plans to the Authority for review. This process will continue until plans are acceptable to the Authority.
 - I. If all changes have been properly made, two (2) copies stamped, "Approved" will be returned to the developer.
 - J. Copies of permits or approvals from other appropriate regulatory agencies must be submitted to the Authority prior to the beginning of construction. This includes erosion and sediment control permits, Georgia DOT permits, county road permits, railroad permits, etc.
 - K. One copy of "As-Built" plans shall be submitted to the Authority immediately after construction completion. These plans shall be submitted in both hard copy and digital format.

3.0.3 CONSTRUCTION PLANS. In addition to the general plan requirements listed in Section 1.4 and 3.0.2.C, Sewer Construction Plans shall include the following:

- A. All erosion control measures.
- B. NPDES storm water permit compliance requirements including a copy of the erosion control approval and the NOI sent to EPD.
- C. Comprehensive Monitoring Program.
- D. EPD Stream Buffer Encroachment Permit, that specifically includes sewer crossings as applicable.
- E. Landfill certification letter.
- F. Sanitary sewer mains.
 - 1. Diameters.
 - 2. Materials.
 - 3. Slopes.
 - 4. Length between manholes.
- G. Manholes and cleanouts.
 - 1. Stationing and number designation.
 - 2. Elevation of inverts in and out of manhole.
 - 3. Elevation of manhole rim.
- H. Manhole stub-outs.
- I. Proposed future extensions.
- J. Wye and riser connection for services.
- K. Standard bedding cross-section
- L. Concrete encasement, locations.

M. Bore and Jack locations.

N. Pump station and forcemain submittals shall also include the following:

1. Pump submittal with shop drawings and specifications including Wetwell Elevations.
2. Valve information and shop drawings.
3. Generator submittal with specifications and shop drawings, along with automatic transfer switch specifications and shop drawings.
4. Telemetry equipment submittal.
5. Single line electrical drawing showing power distribution for station.
6. Forcemain plan and profile.
7. Any additional items that demonstrates compliance with Section 3.6, Pump Stations or items that may be required by.

3.0.4 TRENCHING, BACKFILLING AND COMPACTING. Trenching, backfilling and compacting shall be performed in accordance with Article 4.6, Trenching, Backfilling and Compacting, of these Standard Specifications.

3.0.5 PRESERVATION OF MONUMENTS. Monuments which are moved or disturbed will be replaced by a licensed professional land surveyor at the contractor's expense.

3.0.6 CONNECTION TO AUTHORITY WASTEWATER SYSTEM. The Authority shall not allow flow of any kind into the existing wastewater system until final acceptance of the wastewater lines.

3.0.7 CONNECTION TO AUTHORITY WASTEWATER SYSTEM FROM AN OUTSIDE ENTITY. The Authority shall not allow flow of any kind into the existing wastewater system without Authority approval. Wastewater flow entering the Authority system from an outside entity shall be monitored flow. Prior meeting and approval with Authority Staff is required.

3.1 DESIGN CRITERIA

3.1.1 DESIGN FLOW. The design shall include consideration of providing service for the entire area tributary to the outfall point. The following wastewater flow rates shall be used:

Wastewater Flow Rates by User Type

<i>User Type</i>	<i>Unit Wastewater Flow Rate</i>
Residential	300 gallons/ERU/day
Commercial ¹	1,500 gallons/acre/day
Industrial ¹	1,300 gallons/acre/day
Park/Recreation	50 gallons/acre/day
Elementary Schools	15 gallons/student/day
Jr. & Sr. High Schools	20 gallons/student/day

¹Numbers shown for planning purposes only. Developer's engineer must provide site specific calculations to justify large residential, commercial, or industrial flows.

Wastewater peaking flows shall be computed using the following equation:

$$PF = 3.5 \times ADF$$

Where ADF = average daily flow

3.1.2 HYDRAULIC DESIGN. Wastewater mains less than fifteen inches (15") in diameter shall carry the peak design flow at a maximum flow depth of fifty percent (50%) of the pipe diameter. Wastewater mains fifteen inches (15") in diameter and larger shall carry the peak design flow at a maximum flow depth of seventy-five percent (75%) of the pipe diameter.

The minimum velocity at the average design flow rate shall be two (2) feet per second. Where actual flow will be considerably below the design flow for several years, the Authority may require that the minimum velocity be attained by suitable grades at the partial peak design flow rate. Maximum allowable velocity shall not exceed ten (10) feet per second at seventy-five percent (75%) flow depth in the pipe.

Care shall be taken to design invert elevations at manholes in such a manner that the energy gradient is consistently falling in the direction of flow. In addition, when the velocity of an upstream wastewater line entering a manhole at peak flow is above critical velocity, the hydraulic gradient shall be computed to insure that a surcharge will not occur at a service connection, and that the energy gradient will remain level across the manhole.

3.1.3 WASTEWATER MAINS SLOPE REQUIREMENTS. Wastewater mains shall be eight inch (8") diameter or larger. Wastewater service connections shall be four inch (4") diameter or larger. The following minimum grades (based on a Mannings formula $n = 0.015$) shall apply:

Minimum Grades for Sewers

<i>Sewer Diameter</i>	<i>Absolute Minimum Grade</i>	<i>Recommended Minimum Grade</i>
4" lateral	2.0% or 1/4 inch/foot	-
6" lateral	2.0% or 1/4 inch/foot	-
6" Service Stub	1.0% or 1/8 inch/foot	-
8"	0.40%	0.70%
10"	0.33%	0.50%
12"	0.22%	0.40%
15"	0.15%	0.30%
16"	0.15%	0.30%
18"	0.12%	0.24%
21"	0.10%	0.20%
24"	0.08%	0.16%
27"	0.07%	0.14%
30"	0.06%	0.12%
36"	0.05%	0.10%

3.1.4 COVER. Wastewater mains shall ordinarily have a minimum of eight feet (8') of cover to finished ground surface. Where cover is less than 7 feet underneath paved areas the

pipe must be ductile iron pipe (DIP). Where pipe has less than feet (4') of cover, provisions shall be made to protect the pipe from impact and loading.

Sewer lines must avoid passing through a detention pond. In the event that it can not be avoided the pipe must be a ductile iron pipe and have a minimum of 4 feet (4') of cover. Any sewer line that passes under a detention pond must be concrete encased between manholes. Pipe shall not be located within the dam or outlet structure. All manholes must be located outside the detention pond.

- 3.1.5 SEWER LINE PARALLEL TO CREEK.** In the event that a sewer line runs parallel to a creek or lake the sewer must be placed so that there is a 25' undisturbed buffer along the edge of the bank as measured from the top of bank as states under the Official Code of Georgia Annotated (Volume 10, Title 12, Georgia Erosion and Sedimentation Act, 12-7-6-16).

Exceptions to the EPD buffer requirement can only be granted by the EPD through their formal variance process.

Any sewer line parallel to a creek, stream, or lake shall be designed such that the top of the proposed pipe is 1 foot below the bottom of the creek bed. The elevation of the creek bed must be indicated on the plans. Creek crossings shall be made only when absolutely necessary and should be nearly perpendicular. Creek crossing shall be DIP, concrete encased, and stabilized with riprap and/or other stabilizing material upon completion as directed by the Authority. Sewer lines shall be designed to cause minimum impact on waters of the United States.

- 3.1.6 WASTEWATER MAIN EXTENSION.** Wastewater mains shall be extended at least ten feet (10') uphill from the lowest lot corner of the uppermost lot to be served. Wastewater mains shall terminate in a manhole. Service connections shall not be made at manholes, but shall be provided above or below the manhole. Manholes shall be stubbed out and plugged with suitable size pipe wherever future extension of the wastewater main is anticipated.

- 3.1.7 MANHOLES.** Manholes shall have a minimum diameter of forty-eight inch (48") and shall be provided at every change in direction, grade, or at connections with intersecting sewer mains. Maximum spacing between manholes shall be four hundred feet (400') for lines fifteen inches (15") diameter or smaller or five hundred feet (500') for lines eighteen inches (18") diameter or larger. Wastewater lines between manholes shall be straight in line and grade.

Outside drop manholes shall be provided for a wastewater line entering a manhole at an elevation eighteen inches (18") or more above the manhole invert. Where the difference in elevation is less than eighteen inches (18"), the invert shall be filleted to prevent solids deposition. Inside drop manholes shall not be allowed, except by written permission of the Authority.

Manhole steps shall be twelve inches (12") on center. The first step shall be a maximum of eighteen inches (18") below finished grade.

- 3.1.8 WASTEWATER SERVICE CONNECTIONS.** Wyes shall be provided in the wastewater main for service stub in connections at each lot or building site. Fittings shall be angled upwards so that the upper invert of a one-eighth bend connected to the fitting will have an elevation equal to or higher than the inside crown of the wastewater main. Riser

connections shall be installed where the elevation of the top of the fitting is more than twelve feet (12') below finished ground. Riser connections shall ordinarily reach to a grade ten feet (10') below finished ground surfaces.

Wastewater service lines shall not be located closer than three feet (3') to a side property line, and shall not be constructed through or in front of an adjoining property. Wastewater service lines shall be located a minimum of ten feet (10') to the low side of the water service. Reference the Standard Details and the Jackson County UDC for additional details regarding utility location requirements.

When required by the Authority, a manhole shall be installed instead of a wastewater service connection when a greater than 4" connection is to be made to an eight-inch (8") or smaller main serving a commercial or industrial facility.

Buildings constructed as a shell, with the intention of being used for subdivided suites for commercial purposes, shall have wastewater service connections extending a minimum of six feet (6') outside of the building with a clean out for each set of proposed bathrooms or suites. All commercial and industrial facilities shall have a clean out on the outside of the building, located a minimum of three feet (3') from the building, on the wastewater service connection. Commercial and Industrial Facilities may be required to install a manhole if the Authority deems it necessary to have a sampling point in accordance with its Industrial Pretreatment Program.

Rainwater leaders, roof drains, surface drains or ground water drains shall not be connected to the wastewater system. Each wastewater service system shall be separate from the drainage system.

3.1.9 LOCATION DETAILS. Wastewater mains installed in local or collector streets and shall be located on the centerline of the street. Mains installed in easements shall be located in the center of the easement. Mains and manholes shall be located to provide reasonable access for maintenance crews. Reference the Standard Details and the Jackson County UDC for additional details regarding utility location requirements.

3.1.10 RELATION TO WATER MAINS. Wastewater lines shall be located a minimum of ten feet (10), horizontally, from existing or proposed water mains (centerline distance). Where wastewater lines cross water mains, the wastewater line shall be a minimum of eighteen inches (18"), clear, below the water main. If this clear distance is not feasible, the crossing shall be designed and constructed so as to protect the water main. The Authority shall approve the crossing design.

Minimum protection shall consist of the installation of a ductile iron pipe wastewater line. The wastewater line shall be encased in concrete if above the waterline. The encasement shall be at least six inches (6") thick around the entire pipe and shall extend a distance of ten feet (10') on either side of the water main.

3.1.11 GREASE INTERCEPTORS. Grease interceptors shall be installed in all food serving, food preparing, food catering, or other establishments capable of discharging large amounts of grease into the wastewater system. Grease interceptors shall be located outdoors, on private property, within thirty feet of the facility served, and shall be easily accessible at all time for maintenance and examination. Grease interceptors shall comply with the requirements of the most current Uniform Plumbing Code. See Standard Details and Appendix F for sizing criteria of grease interceptors.

3.1.12 SAND AND OIL TRAPS. Sand and oil traps shall be installed at all service stations, truck or car wash facilities, vehicle maintenance facilities, machine shops and other establishments capable of discharging large amounts of sand and oil into the wastewater system. Sand and oil traps shall be located outdoors, on private property, within thirty feet of the facility served, and shall be easily accessible at all time for maintenance and examination. Sand and oil traps shall comply with the requirements of the most current Uniform Plumbing Code and the Standard Details of these Standard Specifications.

3.1.13 GRINDER PUMPS. Grinder pump installations will not be allowed.

3.2 MATERIALS.

3.2.1 WASTEWATER PIPE.

A. Ductile Iron Pipe

1. Pipe shall be designed in accordance with AWWA/ANSI Specification C150/A21.50. Pipe shall be Pressure Class 150 minimum.
2. Pipe shall be manufactured in accordance with AWWA/ANSI Specification C151/A21.51-86.
3. Pipe shall be standard cement lined and seal coated with approved bituminous seal coat in accordance with ANSI Specification A21.4 (AWWA C104), latest revision.
4. Push-on joints shall conform to ANSI Specification A21.11 (AWWA C111), latest revision.
5. Flanged joints shall conform to ANSI Specification A21.15 (AWWA C115), latest revision.
6. Fittings shall be furnished in accordance with ANSI Specifications A21.10 (AWWA C153 or C110 as appropriate), latest revision, and shall be a minimum of the pressure rating of the joining pipe. Joints shall be mechanical joint conforming to latest ANSI and AWWA Specifications. Cement mortar or epoxy coated lining, shall be furnished for all fittings.
7. Ductile Iron Pipe shall be used where the vertical distance between sewer line and underground utilities is less than 4 feet.
8. For sewer mains (8" or greater), DIP is required at all crossings above water mains or drainage pipes and for all crossings below water mains or drainage pipes unless sewer main is more than 4 feet below other pipe. DIP shall extend a minimum of 10 feet on either side of the crossing. DIP is not required when crossing water mains less than 2 inches in diameter.
9. DIP is required when crossing any open stream, bodies of water or retention pond.

10. DIP is required when depth of cover exceeds 15 feet.
11. DIP is required inside of bored and jacked casing pipe.
12. DIP is required in the right-of-way of all state highways and is required in the right-of-way of commercial and industrial streets.

B. PVC Sewer Pipe (up to 24-inch diameter)

1. All PVC sewer pipe and fittings shall be manufactured in accordance with ASTM D3034, with a minimum SDR 35. The design engineer shall provide calculations justifying the proposed SDR of new pipe based on the depth of cover and laying conditions.

C. Steel Pipe

1. Steel pipe shall be utilized for aerial spans and bored and jacked casing.
2. Pipe shall conform to ASTM A-139, Grade B, electric fusion welded steel pipe.
3. The interior and exterior of the carrier pipe shall be coated with coal-tar enamel. Casing pipe may be uncoated on the interior and shall have a bituminous coating on the exterior.
4. Field welded joints of carrier pipe shall be field coated.
5. Minimum wall thickness for casing pipe shall be 0.25 inches up to 24-inch.
6. Provide stainless steel casing spacers with polymer skids, minimum 2 per joint.

3.2.2 PLUGS. A compression stop as recommended by the pipe manufacturer shall be provided to seal the end joint of stub in connections and dead-end stubs.

3.2.3 MANHOLES & RISER RINGS. Manholes shall be constructed of precast concrete per ASTM C-478. Cones shall be of the eccentric type. Precast manhole sections shall be sealed with O-ring rubber gaskets or Ram-Nek type flexible joint sealant.

Manhole steps shall be one-half inch (1/2") diameter, grade 60, steel-reinforcing rod completely encapsulated in Copolymer Polypropylene as manufactured by M.A. Industries, Inc., or equal.

Connection of pipes to precast manholes shall be accomplished using grout in place, flexible sleeves, or integrally cast compression gaskets. For grouting, a waterstop gasket shall be installed on plastic pipes prior to the space between the pipe wall and the edge of the block out being grouted, inside and outside, with non shrink grout. Flexible sleeves shall be KOR-N-SEAL®, Lock Joint®, or equal. Compression gaskets shall be A-Lok®, or approved equal.

Mortar for manholes shall be mixed in the following proportions by volume: One (1) part Portland cement; one-half (1/2) part hydrated lime; and two (2) parts sand. The cement, lime, and sand shall be thoroughly mixed dry and only enough water added to form a mortar of proper consistency. Mortar shall be used within one (1) hour after mixing with no retempering permitted. Mortar that has taken a partial set shall not be used.

Riser Rings shall be precast concrete, and in total shall not exceed 6 inches in total height without prior approval of the Authority.

3.2.4 MANHOLE BASE SLABS AND BASE BEAMS. Manhole base slabs may be poured in place or precast. The slab shall be designed to uniformly support the earth load and any other reasonable loads that may occur. The minimum slab thickness shall be six inches (6"). The minimum reinforcement shall be welded wire fabric, 4x4/W4xW4. Splicing of the welded wire fabric shall be by lapping one space and securing the wire mesh together. All wire fabric shall conform to the requirements of the "Wire Reinforcement Institute, Inc."

3.2.5 CONCRETE. Concrete shall conform to Article 5, Concrete Work, of these Standard Specifications. Type II cement shall be used.

3.2.6 MANHOLE RINGS AND COVERS. Cast iron manhole ring and covers shall conform to ASTM A-48 with a minimum tensile strength of 25 KSI (Class 25) and designed for AASHTO H-20 loads. The quality shall be such that a blow from a hammer will produce an indentation on a rectangular edge of the casting without flaking the metal. Pamrex covers with Cretex chimney seals shall be allowed as an alternate type.

Standard manhole covers shall be furnished with two (2) three-quarter (3/4) inch vent holes and shall be as shown in the appropriate detail in these Standard Specifications.

Manhole covers within the 100 year flood plain shall be of watertight, bolt down construction.

Pamrex hinged manhole covers are required where the elevation of the cover is equal to or greater than 12 inches above grade.

3.2.7 BEDDING MATERIALS. Bedding materials shall be in conformance with Article 4.2.1, Pipe Bedding Materials, of these Standard Specifications.

3.2.8 STEEL CASINGS FOR BORES. Steel casing pipe for bores shall be seamless welded steel tubing having an inside diameter of at least four inches (4") greater than the outside diameter of the bell or joint of the carrier pipe to be installed therein. The minimum wall thickness of the tubing shall be 1/4" for casings up to 24 inch in diameter as shown in the Standard Details. In all cases, the design engineer shall indicate proposed casing dimensions based on engineering factors.

3.3 WASTEWATER MAIN INSTALLATION.

3.3.1 GENERAL. Installation of PVC wastewater main shall conform to ASTM D-2321, "Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe". Ductile Iron Pipe shall be installed per AWWA C600. All work shall conform to the accepted plans, specifications, special provisions and the above designation, except as modified herein.

3.3.2 ALIGNMENT AND GRADE. Wastewater mains, structures and appurtenances shall be constructed accurately to the line and grade as shown on the approved plans. Construction stakes shall be placed by field parties under the direct supervision of a Registered Professional Land Surveyor licensed to practice in the State of Georgia.

The grade and alignment be maintained by use of suitable surveying instruments (checking the invert of each piece of pipe) or laser equipment, operated continuously during the construction.

3.3.3 HANDLING PIPE AND FITTINGS. All pipe, fittings, and specials shall be unloaded, stockpiled, hauled, distributed, installed and otherwise handled in a manner that will prevent breakage or other damage thereto and which will insure delivery and installation in a sound and acceptable condition. PVC pipe shall be stored or covered in a manner to protect against direct sunlight exposure.

3.3.4 WASTEWATER LINE INSTALLATION. Wastewater lines shall be constructed continuously upgrade from an existing wastewater line except when otherwise approved by the Authority. Special care shall be taken to lay wastewater pipe to exact line and grade with spigot ends pointing in the direction of flow.

Bedding material shall be placed per the standard detail. A continuous trough shall be excavated in the bedding to receive the bottom quadrant of the pipe barrel. Bell holes shall be excavated so that after placement, only the barrel of the pipe bears on the bedding.

Prior to making pipe joints, all surfaces of the joint shall be clean and dry. Lubricants shall be used as recommended by the pipe manufacturer. The joint shall be carefully pushed home using approved methods of leverage. Care shall be taken to prevent pinching or rolling of the gasket. Adjustment to final line and grade shall then be made. PVC wastewater pipe shall be secured in place by installation of bedding material tamped under and along it up to a level of twelve inches (12") over the top of the pipe.

Wastewater lines shall be kept thoroughly clean and free of gravel, dirt and debris. Whenever work ceases for any reason, the unfinished end of the pipe shall be securely closed with a temporary plug. Pipe trenches shall be continuously dewatered as required by Section 4 of these Standard Specifications.

Pipe shall not be covered until a representative of the Authority has inspected it.

3.3.5 CONNECTIONS TO EXISTING MANHOLES. Wastewater pipe connections to existing manholes, where there is no pipe stubbed out, shall be made in such a manner that the finished work will conform as nearly as practicable to the essential requirements specified for new manholes. The contractor shall break out as small an opening in the existing manhole as necessary to insert the new wastewater pipe. The existing concrete foundation bench shall be chipped to the cross-section of the new pipe in order to form a smooth continuous invert similar to what would be formed in a new concrete base. Non-shrink grout shall be used as necessary to smoothly finish the new invert. Rubber boots, gaskets, and/or non shrink grout shall be used to seal the new line so the junction is watertight. The bypassing of raw wastewater onto the ground or into a receiving stream is prohibited.

- 3.3.6 CONSTRUCTION OF MANHOLES AND CLEAN-OUTS.** Concrete bases shall extend at least six inches (6") below the bottom of the pipe and shall be benched up to at least two inches (2") over the top of the pipe (See Details). The shape of the invert shall conform exactly to the lower half of the pipe it connects. Side branches shall be constructed with as large a radius of curvature as possible (See Details). Inverts shall be plastered with cement mortar and left smooth and clean.

Precast manhole sections shall not be placed on the foundation until after it has reached sufficient strength to provide support without damage. The top of the bench shall be thoroughly cleaned. Sealant shall be applied to the precast section bearing seat. The first precast section shall be carefully lowered onto the bench so that the sealant is forced out from under the section evenly on all sides. Each succeeding precast section shall be jointed in a similar manner. Sealant shall be raked back in all joints to a minimum depth of one half inch, and all joints shall be grouted, inside and outside the manhole. All lifting holes and other imperfections in manhole walls shall be filled with non-shrink grout.

The top of the manhole vault shall be a minimum of twelve inches (12") and a maximum of eighteen inches (18") below the finished street or ground surface elevation. Concrete extension risers or collars shall be used to bring the manhole ring and cover up to finished street or ground surface elevation.

- 3.3.7 STEEL CASING AND CARRIER PIPE INSTALLATION.** Pits shall be excavated such that the timber blocking can be installed to give an unyielding backing for the hydraulic boring machine or jacks and to prevent sloughing of the header face. Sub grade on which rails or guides are to be set shall be stabilized with washed rock where soft or springy ground is encountered.

Sections of the steel casing shall be trimmed, beveled and aligned in the pit so that when welded together the thrust of the boring machine will be uniformly transmitted through the casing in a horizontal plane. Welds shall be made to provide a solid firm watertight connection without the use of butt straps.

The casing pipe shall be installed by boring or jacking upgrade from the outlet end. When the carrier pipe to be installed is for gravity flow, the horizontal and vertical alignments of the casing pipe, when in place, shall not vary from those called for on the accepted plans.

If requested by the Authority, following installation of the carrier pipe, the void between the carrier and the casing shall be filled with concrete or clean sand. Sand or concrete under pressure shall be blown or pumped into the void until the entire void is filled.

- 3.3.8 WYES AND RISERS FOR SERVICE CONNECTIONS.** Wyes, stubs, and risers shall be placed where shown on the accepted plans. Wyes shall be angled upwards so that the upper invert of a one-eighth (1/8) bend connected to the fitting shall have an elevation equal to or higher than the inside crown of the wastewater main.

- 3.3.9 TESTING AND INSPECTION.** The Authority shall visually inspect all wastewater lines for cleanliness and accurate alignment. Discrepancies noted during visual inspection shall be corrected prior to further testing. Prior to final acceptance, the contractor shall conduct, at his own expense, tests for water tightness for all new wastewater line construction. Tests shall be completed under the direction of the Authority. The Authority may require that the first two (2) manholes, including the main between them, of all wastewater line projects be tested before further construction to permit initial observation of the quality of construction workmanship. The Authority may require additional testing

during the course of construction if infiltration appears to be excessive or the quality of workmanship is questionable.

All pipelines shall be tested for excessive deflection. Deflection testing shall be performed by pulling a properly sized mandrel through the pipeline.

Low pressure air testing shall be performed on all wastewater lines. Vacuum testing of manholes is required by the Authority for all new manholes. Air and vacuum testing shall be completed in accordance with ASTM F- 1417 and as described herein. The Authority shall record times and pressure and vacuum readings during the test period. A test section shall not be longer than the length of pipe between adjacent manholes.

The low-pressure air test for wastewater lines and the vacuum test for manholes shall be performed after completion of backfilling and compaction.

- A. Air Testing Procedure - The ends of the sewer pipe being tested shall be plugged and braced and the test section shall be pressurized to four (4) psi. The pressure pump shall be turned off and the air in the pipe allowed to stabilize for a minimum of two (2) minutes. The time shall be monitored as the line either holds pressure or drops no more than one (1) psi (if the ground water is higher than the top of the pipe, the test pressure shall be increased to account for the high groundwater). The pressure shall remain within the allowable limits for the time indicated by using the following formula:

$$T = 0.0237 (L) (D^2)$$

where:

- T = time of test (in seconds)
- L = length of pipe being tested (in feet)
- D = diameter of pipe (in inches)

or as indicated in the following table:

Specified Test Duration for Length of Pipe Indicated (min:sec)

Pipe Diameter	Pipe Length (Feet)						
	0-150	200	250	300	350	400	500
4"	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6"	5:40	5:40	5:40	5:40	5:40	5:42	7:07
8"	7:34	7:34	7:34	7:36	8:52	10:08	12:38
10"	9:26	9:26	9:53	11:52	13:51	15:49	19:45
12"	11:20	11:24	14:15	17:05	19:56	22:47	28:26
15"	14:10	17:48	22:15	26:42	31:09	35:36	44:26

Sections of pipe that fail the air test shall have the defects repaired and the test shall be repeated. Repair and repeat testing shall be continued until the testing requirements are met.

- B. Vacuum Testing Manholes - Manholes shall be tested before the ring and cover and grade adjustment rings have been installed. All pipes entering the manhole shall be plugged and braced and a vacuum of ten inches (10") of mercury shall be drawn. The vacuum pump shall be turned off and the time monitored as the vacuum drops one inch (1"). The vacuum shall not drop more than one inch (1") for the duration of the time indicated in the following table.

Specified Test Duration for Diameter of Manhole

<i>Manhole Diameter (inches)</i>	<i>Test Duration (min:sec)</i>
48	1:00
60	1:15
72	1:30

Manholes that fail the vacuum test shall have the defects located and repaired and the test shall be repeated. Repair and repeat testing shall be continued until the testing requirements are met.

When required, infiltration tests shall be conducted by placing an approved, calibrated V-notch weir in the line and measuring infiltration flow. Successive readings shall be taken until consistent results are attained. Infiltration shall not exceed 50 gallons per inch of pipeline diameter per mile per day.

When required, exfiltration tests shall be conducted by plugging the section of line to be tested, filling the line and manholes with water to a depth of four feet in the upper manhole. If groundwater is present above the elevation of the pipe, the water level in the upper manhole shall be increased by the height of the groundwater surface above the pipe. The water shall be allowed to stand for a minimum of eight (8) hours to allow absorption to take place in the walls of the manhole and pipe. If required, water shall be added to bring the water surface back to a depth of four feet in the upper manhole. The drop in elevation of the water surface in the upper manhole shall be monitored over a 60 minute period, and converted to an exfiltration rate. Exfiltration testing shall not be used if the hydraulic head in the lower part of the test section would exceed 25 feet. Exfiltration shall not exceed 50 gallons per inch of pipeline diameter per mile per day.

3.4 WASTEWATER SERVICE LINES.

- A. A Wastewater Service Stub In is defined as that portion of wastewater service pipe between the wastewater main and a minimum of 5' outside the right of way. Wastewater service stub ins are required for all lots and shall become the property of the JCWSA upon final acceptance.
- B. A Wastewater Service Lateral is defined as that portion of the wastewater service pipe on private property between the new building and the connection to the Wastewater Service Stub In. Wastewater service laterals remain the property of and shall be maintained by the owner of the property being served.

3.4.1 WASTEWATER SERVICE LINE GENERAL REQUIREMENTS.

- A. Location and Alignment of Wastewater Services - Wastewater service lines shall be constructed in the shortest and straightest route possible.

- B. Wastewater Service Stub In Connections to Mains - Wastewater service stub in connections to the wastewater main shall be positioned at either the 2 o'clock or the 10 o'clock position on the circumference of the wastewater main. On new installations, either wye or tee fittings shall be used. When tapping into an existing wastewater main, a saddle connection and approved coring method shall be used. The minimum distance between service connections made along the pipe shall be 3 feet. The minimum distance from either the bell or spigot end of a pipe shall be 3 feet. The minimum distance from the center of a manhole to a service connection shall be either 5 feet or the transition point from the manhole trench to the normal pipe trench, whichever is greater. A maximum of 4 wastewater service stub in connections shall be allowed per 20-foot length of main.
- C. Wastewater Service Stub Ins To Property Line - Wastewater Service stub-ins shall be extended to at least 5' outside of the right of way. The minimum size for service stubs shall be 6". Stub end locations shall be marked by a minimum 6 foot length of Schedule 40 PVC pipe, painted safety day-glow green per OSHA Spec. 1910.144. Where necessary, wastewater service stub ins shall be extended past any other utilities such as gas, electric, etc that have been installed behind the sidewalk. Service stub-ins shall have a minimum depth of 5-1/2' at curb and 4' at end of stub-in. Service stub ins shall have a cleanout installed at the property line. The ends of service stub-ins shall be plugged with a compression stop. Service stub ins shall have #6 tracer wire taped to the pipe at 4' intervals and shall have marking tape installed 12 to 18 inches above the pipe.
- D. Wastewater service laterals shall be a minimum of 4" diameter pipe for residential and 6" diameter pipe for commercial customers. When 4" pipe is used, a 4"x6" Fernco type coupling shall be used to join the lateral to the service stub in. A minimum 4" diameter cleanout is required on wastewater service lines within ten feet of the building. A backflow preventer is required when the building finished floor elevation is equal to or lower than the the top of the nearest downstream manhole. Service laterals shall have #12 tracer wire taped to the pipe at 4' intervals and shall have marking tape installed 12 to 18 inches above the pipe as per Article 2.3.12.

3.5 WASTEWATER LIFT STATIONS

3.5.1 GENERAL. In those locations where a development area cannot be served by gravity into the existing Authority system, the Authority may approve the construction of a wastewater lift station. The developer must demonstrate the necessity of installing a lift station/forcemain system in lieu of a gravity sewer. The developer shall provide the Authority with a set of design calculations and drawings for review and acceptance by the Authority. The wastewater lift station shall satisfy all of the requirements of the Georgia EPD and of these Standard Specifications.

The Authority shall require that the developer's engineer prepare a set of "as built" drawings of the wastewater lift station. In cases where the lift station will require GA EPD review, the developer's engineer shall prepare all necessary reports, drawings, and submittals. Upon completion of the lift station, the contractor shall also provide the Authority with two (2) copies of an Operation and Maintenance Manual for the lift station.

3.5.2 DESIGN APPROACH. The developer shall furnish, install and dedicate to the Authority the entire lift station/forcemain system. The system will be designed by the developer's

engineer (Professional Engineer registered in the State of Georgia). The design must be reviewed and approved by the Authority's Engineer.

The designer shall locate the lift station to drain the largest possible sub-basin. The Authority Manager will investigate the service impact associated with future Jackson County needs within the sub-basin, and the potential installation of additional mains required to serve the sub-basin that will drain to the lift station. If, in his opinion, an additional or larger forcemain(s) is to be installed concurrently with the developer's project, the designer will design and the Authority's Engineer will approve the design of said additional mains. Where practical, all of the forcemains will be installed in parallel and in the same ditch. In such cases, the extra costs for the additional or larger mains will be determined and allocated by prior agreement between the developer and the Authority.

3.5.3 LIFT STATION SUBMITTAL CHECKLISTS. Prior to submittal of Lift Station Design Packages, the Developer's Engineer shall verify that the design satisfies the checklist items listed on the following sheets:

- A. *Pump Station and Forcemain Common Problems List*, dated 5/31/06 from the GA EPD.
- B. *System Application Checklist for Wastewater Lift Stations* in Appendix B.

3.5.4 LIFT STATION TYPE AND DESIGN CAPACITY.

- A. Pump Stations with design capacity less than 700 gpm shall be submersible type, utilizing one of the following pump manufacturers:
 - 1. ITT Flygt
 - 2. Yeomans
 - 3. ABS
 - 4. Other Approved Equal
- B. Pump Stations with design capacity greater than 700 gpm shall be approved on a case by case basis and also require approval by GA EPD. Pump Stations with design capacity greater than 700 gpm require a magnetic flowmeter with bypass or prefabricated spool or dismantling joint to permit meter removal.

3.5.5 LIFT STATION DESIGN CRITERIA

- A. A buffer shall be placed around each lift station site. The buffer will extend 25 feet outside the 40'x40' fenced in area of the station to make a 90'x90' area. The Authority, at its discretion, may require a larger buffer dependent on the proximity of structures, type of development, size of pump station, or other factors which may indicate a need for additional buffer. This buffer is required in residential subdivisions, and shall be indicated on the final plat. In addition, a permanent easement, dedicated to the Authority, shall be provided to include the required fenced in area, which an additional 6-inches extending beyond the fence on all sides.

- A permanent 20 ft access easement, dedicated to the authority, shall be provided as well.
- B. Fill slopes around the pump station shall be stabilized per the GA ES&PC Manual. All fill slopes shall be compacted to not less than 95% of maximum density. A Soils Compaction Report shall be provided to the Authority inspector prior to final inspection as described in Article 4.1.2 of these Standard Specifications.
- C. Driveway
1. All pump station sites shall be provided with a 12' wide paved access road in a 20' wide permanent easement dedicated to the Authority. Concrete or asphalt paving is required for the access roadway.
 2. If the access road is over 50' in length, a turnaround will be required. For access roads less than 50', the requirement for a turnaround will be determined on a case-by-case basis. The turnaround shall be 20' off the fence 16' deep with a 15' radius to the driveway.
 3. Asphalt paved driveways that show permanent deflection, fatigue cracking, thermal cracking or stripping at the end of one year must be repaired before the lift station will be accepted by the Authority
- D. Site plans must show finished grade contour lines (2' intervals) in and around the lift station and access road. Spot elevations shall be provided as needed to show proper drainage.
- E. Site plans must show all existing and proposed utilities. All utility meters must be properly mounted outside of the fenced station. If gas service is required, gas piping must be buried underground.
- F. A 1" copper potable water service with an acceptable reduced pressure principle backflow preventer installed in an above grade, heated enclosure (Hot Box or equal) is required for all lift stations. A 1" frost-proof yard hydrant with 50' of 1" reinforced rubber hose with brass nozzle is also required. The water meter shall be installed at the right of way.
- G. Provide site lighting.
- H. Fenced areas for all stations are to be a minimum of 40' x 40'. Fences are to be installed using 8-foot high #4 chain link wire with top rails and bottom tension wires; 3 strands of barbed wire at the top on angled extension arms; posts in 3' of concrete spaced 10' apart. A 2' chain that can be locked with a #2 Masterlock must be provided. Provide a 14' wide gate on 4" diameter posts.
- I. The entire area within the pump station fence, shall be covered with a minimum 12 inch depth of CL 57 crushed stone paving. Crushed stone paving shall be graded to drain away from the pump station at a minimum of 2% in all directions.
- J. Spare parts (to be provided at the time of final acceptance by the Authority).
1. Provide a spare air and vacuum relief valve for forcemain (if applicable).

2. Provide two extra sets of seals per model of pump, two sets of wear rings, five float switches, and one motor starter.
3. Provide one spare fuse of each type used.
4. Provide any other spare parts or special tools recommended by the manufacturers of the lift station component equipment.

K. Wetwell/Check Valve Vault.

1. The wetwell usable volume shall be sized to prevent excessive cycling of the pumps. Starts shall be limited to one start per fifteen minutes unless otherwise recommended by the pump manufacturer. The wetwell dimensions and pump spacing shall be as recommended by the pump manufacturer except that the wetwell shall be a minimum of 6-foot in diameter.
2. Hatch doors shall be sized by the pump supplier to allow adequate clearance to easily remove the pumps. Hatches shall be aluminum with stainless steel hardware suitable for 150 lb. per sq. ft. loading. Provide cylinders to prevent hatch from slamming shut. Hatches shall be vented or a separate vent pipe shall be provided.
3. Check valve vaults for all stations shall be a minimum of 6' x 6' in plant, precast concrete with (1) 48" x 48" double leaf aluminum hatch for 4" and 6" piping. Vault size shall be a minimum of 8' x 8' for piping 8" and above.
5. Storage shall be provided above the high-level alarm equal to three (3) hour at design flow. Storage volume is calculated to be that volume between the high-level alarm and the lowest point of overflow (including basement elevations regardless of backflow valves in service lines). Said storage may consist of any combination of line capacity, manhole capacity, and wetwell volume.
6. Swing check valves suitable for sewage service shall be iron body with flanged ends, cushioned closure as manufactured by:
 - a. Val-Matic
 - b. GA Industries, Inc.
 - c. APCO
 - d. Other approved equal.
7. All pump stations shall have a plug valve and capped tee installed on the forcemain to allow for emergency connection by portable pumps. Plug valve shall be no less than 3' outside the pump station. A valve key shall be provided to the Authority.
8. All piping in the wetwell and check valve vault is to be flangexflange. No Uni-flange, Mega-flange, or other "Collar" type flange adapters will be allowed. A restrained, solid sleeve type flexible joint shall be installed between the wetwell and valve vault.

9. Wetwell level sensing for pump sequencing is to be accomplished by floats or level sensing probes with critical backup floats. No bubbler systems will be permitted.
10. Manhole steps, if present, are to be removed from the wetwell and check valve vault before station is accepted by the Authority. The walls of wetwells and check valve vaults are to be grouted where steps have been removed.
11. Wetwell and forcemain discharge manholes are to be coated with a high solids epoxy for corrosion resistance. Coatings shall be Thoroc Sewerguard® HBS100 or equal.
12. All pump stations shall comply with NFPA 820

L. Lift Station Electrical

1. Three-phase power shall be provided for all pumps. No phase converters or single-phase power is allowed.
2. All conduit shall be galvanized rigid conduit threaded couplings. No threadless couplings shall be allowed.
3. No conduit runs or junction boxes are to be installed inside or on top of wetwell. Splicing of cables inside the wetwell will not be permitted.
4. When main fused disconnect switch or main circuit breaker is used, it shall meet the following requirements.
 - a. Be of a type that can be locked in the on or off position.
 - b. The switch shall be U.L. listed for service entrance.
 - c. The enclosure shall be stainless steel.
 - d. The switch must be mounted inside the fenced area of the station.
5. Pump stations shall have factory installed six digit non-resettable elapsed time meters to show individual pump running time to the 1/10th of an hour. A similar elapsed time meter shall be included to indicate simultaneous operation of pumps to the 1/10th of an hour.
6. All control wiring shall be stranded. No solid wire shall be allowed.
7. Pump control panel enclosure shall be NEMA-4X stainless steel.
8. Provide one RJ-11 telephone jack in the control panel.
9. A surge suppressor shall be provided at the power service entrance. The surge suppressor shall have voltage characteristics to match the power service.
 - a. The surge suppressor shall be in NEMA-4X stainless steel enclosure and shall provide line to line, line to neutral, line to ground and neutral to ground protection modes as applicable for the power service.

- b. The surge suppressor shall be provided with a disconnect. Minimum surge current rating shall be 100KA per phase per NEMA LS-1. The surge suppression system shall be duty cycle tested to survive 20KV, 10KA, IEEE C62.41 category surge current with less than 5% degradation of clamping voltage. The surge suppressor shall have minimum repetitive surge capacity of 2500 impulses per mode and 5000 impulses per phase. Status indicating lights and form 'C' dry alarm contacts shall be provided.
 - c. The surge suppressor shall be U.L. listed and labeled under UL1449 and UL1283. Acceptable manufacturers are:
 - Liebert
 - Current Technologies
 - United Power
- M. All pump stations must be provided with back-up power. This back-up power can be provided by independent dual utility power feeds or diesel generators.
- N. Generator Specifications.
- 1. The standby generator shall be rated for continuous standby duty for the stations full load demand. The generator shall be sized to run all pumps simultaneously with staggered startups or as indicated in the drawings. The engine-generator set shall be rated for continuous standby duty operating in an ambient temperature of 40 deg. C shall have a standby power capacity sufficient to operate all pumps simultaneously with staggered startups and pump station auxiliary loads at 0.80 power factor, and shall operate at a speed not to exceed 1,800 rpm. It shall be rated 480/277 volt, as indicated, 3-phase, 4-wire, 60 Hertz.
 - 2. Voltage regulation from no load to rated load shall be within plus or minus 4 percent of rated voltage for units up to and including 25 kw and within plus or minus 3 percent of rated voltage for units rated 30 kw or higher.
 - 3. Frequency regulation shall not exceed 3 Hertz from no load to rated load. Frequency variation shall not exceed plus or minus 0.3 Hertz for constant loads from no load to rated load.
 - 4. Instantaneous voltage dip for all possible sequences of load application and motor starting for loads described in conditions of service shall not exceed 20 percent of nominal voltage.
 - 5. The generator and associated appurtenances shall be housed in a weatherproof sound attenuated enclosure. Quiet site soundproofing shall be provided to reduce noise to 73 db at a distance of 23 feet (7 meters) for diesel powered generators.
 - 6. Generator insulation shall be Class B or F. Temperature rise shall be in accordance with NEMA Standard MG1 for continuous duty at all output ratings.
 - 7. Voltage regulator shall be an automatic, temperature compensated, solid-state type with a manual adjustment range of plus or minus 5 percent of rated voltage. Exciter shall be a solid-state, static type or brushless rotating type utilizing

rotating diode rectifiers. Minimum rating of exciter shall be according to NEMA Std. MG-1.

8. Generator lead terminal box shall be of ample size to accept and terminate connecting cables as indicated on the drawings. Generator leads shall be furnished with terminal connectors suitable for the customers connecting cables.
9. The engine shall be heavy-duty compression-ignition, cold-starting diesel type arranged for direct connection to an alternating current generator. It shall be a current model of a type in a regular production by a manufacturer regularly engaged in building this type of diesel engine. Engine shall have at least a published intermittent brake horsepower rating at specified generator speed required by generator at rated full load output and shall operate without undue heating, vibration, or wear. Engine shall operate satisfactorily on No. 2 diesel fuel.
10. Battery charger shall be automatic, two rate type providing for equalizing charge and continuous taper charging. Output characteristics shall match requirements of battery furnished. Provide charger suitable for operation on 120 volt, single-phase, 60-Hertz current to be rated not less than 6-amp direct current. Furnish battery charger with following features:
 - Direct current voltage regulation: plus or minus 2 percent for variations in line voltage of plus or minus 10 percent.
 - Direct current voltmeter and direct current ammeter, each with suitable scales.
 - Automatic current limiting to prevent overloading due to engine cranking, shorted output or reversed battery connections.
 - Equalize charge rate with manually set timer.
 - Integral protection to prevent battery discharge through charger on loss of alternating current line voltage.
 - Terminal block with terminals for all external connections.
11. The entire standby generator set shall be warranted for a period of five years from the date of commissioning.
12. Outdoor weather-protective housing with critical grade exhaust muffler shall be installed. The housing shall have hinged side access doors and a rear control door. All doors shall be lockable. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color. Vibration isolators as recommended by the generator set manufacturer shall be provided. The generator must be mounted far enough away from obstructions to allow all doors to be opened 90°. All conduits shall be installed underground.
13. Generator shall be supplied with all auxiliary systems necessary for operation (i.e. batteries, battery charger, block heater, convenience receptacle, enclosure light, motorized dampers etc.). The auxiliary systems shall be powered from load center with adequately sized 480 / 208 / 120 V transformer, installed in the enclosure.

14. Generator control panel shall be mounted with vibration isolators on the unit. Instruments shall be of direct-reading type, factory mounted and factory connected. Instruments shall be accurate within 3 percent. Provide panel with the following instruments gauges, features and alarms:
 - a. Three position MANUAL-OFF-AUTO switch.
 - b. Manual starting switch.
 - c. Emergency shutdown switch.
 - d. Full automatic starting from pilot device initiating start when normal power fails. Automatic cranking shall be interrupted cycle type not affected by ambient temperature with overall time limit. A total of five cranking cycles shall automatically shut down engine after a time delay.
 - e. Automatic shutdown devices with manual reset and individual indicating lights for: low oil pressure, high coolant temperature , engine overspeed, failure of engine to start. Auxiliary contacts on all aforementioned shutdown devices to operate a remote generator failure alarm.
 - f. Gauges and instruments shall include: Fuel gauge, Running time meter, Lubricating oil gauge, Coolant temperature gauge, Voltmeter, and Ampermeter.
15. The standby power system shall include an automatic transfer switch according to UL 1008. Transfer switch shall be rated for 100% of full load and shall have short circuit current rating as indicated. Switch shall be provided with indicators for all phases of operation and be equipped with a fully programmable timer for exercising the equipment. Provide silver plated load contacts with arcing tips and arc extinguishing devices. Provide the transfer switch with an internal manual operator, with the same transfer speed as the electrical operator.
16. Provide the automatic transfer switch with the following features:
 - a. Full phase relay protection with three voltage sensing relays.
 - b. Starting and load transfer to alternate source on a drop to 80 percent on any phase of normal voltage or 1 Hz frequency drop. Retransfer of load to normal source when voltage of all phases is restored to 90-95 percent.
 - c. Transfer to standby generator when generator voltage and frequency are 90 percent of rated values
 - d. Adjustable time delay, 0 to 2 minutes, on transfer from alternate to normal.
 - e. After transfer to the normal source, engine generator to run for adjustable time period to 0 to 5 minutes before shutdown.
17. Generator shall be load tested at 100% full load on site for a period of four hours using resistive load banks. Notify the Authority inspector prior to test, and provide certification letter from the manufacturer. Perform functional transfer tests simulating loss and return of utility power.

18. Three complete sets of O&M manuals and keys shall be provided for generator and automatic transfer switch.
 19. Generator control system must include a programmable control device (exerciser) to allow automatic start-up and test functions. Test functions can be programmed for daily, weekly or monthly testing. Connections for remote monitoring of function and failure must be provided.
 20. Generators shall be natural gas when adequate supply is available. Otherwise, generators shall be provided with 100 gallons minimum fuel storage capacity or 24-hour operating time, whichever is greater. Fuel storage shall be accomplished by the use of corrosion-resistant double wall sub-base fuel tank only; no underground storage will be allowed. A leak detection device shall be provided in the interstitial space for sensing fuel leakage. The device contact shall be connected to the generator control panel terminals for telemetry.
 21. Acceptable generator manufacturers are:
 - a Caterpillar
 - b Cummins-Onan
 - c Kohler
 - d Other Approved Equal
 22. Generator manufacturer will provide a 60-month comprehensive warranty to include parts and labor.
 23. Provide the manufacturer recommended set of spare parts for the generator and the automatic transfer switch. These shall include but shall not be limited to: one filter for each system, two spare injectors, fuel injection pump, one fuse of each rating, and two indicating lights of each type. Pack spare parts in suitable boxes, bearing label of the content and the equipment for which it is intended.
 24. Transfer switches shall be in NEMA-4 X enclosure and shall be supplied by the generator manufacturer. Acceptable manufacturers are:
 - a. Cummins-Onan
 - b. Kohler
 25. A generator ground grid must be provided and connected to the pump station grounding system.
- O. Monitoring system.
1. Provide pump station with Strison Lift Station Monitoring System, Cell Alert model CA-2000, complete with wireless transceiver, relay interface, antenna, and mounting hardware. Coordinate equipment and installation with the JCWSA Systems Integrator, Turbitrol Company, 706-654-3094.

3.6 FORCEMAINS

- A. Forcemains **will not** be approved to flow downhill into the receiving manhole. After the proposed forcemain passes over the last high point along its route a new gravity sewer line must be installed to convey the flow downhill to the existing sewer system.
- B. Provide spare air and vacuum relief valve for forcemain at the time of installation.
- C. Within the proposed development, the forcemain shall be located in a 10' utility easement immediately outside the proposed right-of-way.
- D. Requirements:
 - 1. Size: Minimum size for forcemains shall be 4-inch diameter.
 - 2. Forcemain shall have 4 feet of cover unless authorized by the inspector, based on field conditions.
 - 3. D.I.P. (Ductile Iron Pipe) shall be utilized on all forcemains. Pipe class shall be such that the "manufacturers allowable working pressure" is either a minimum of twice the design working pressure, or one and one half time the design surge pressure, whichever is the greater.
 - 4. Air Release Valves: Forcemains shall have an air release valve at each high point. Air release valves shall be stainless steel and suitable for sewage service, as manufactured by Vent-O-Mat.
 - 5. On forcemains exceeding 2500 feet, plug valves may be required to facilitate future repairs.
 - 6. All valves shall be full port eccentric plug valves as manufactured by DeZurik, or approved equal.

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