SECTION 300 - DESIGN CRITERIA

301. GENERAL

The criteria listed herein is not intended to cover all aspects of design, but rather to mention the basic guidelines and those particulars that are required by the Cherokee County Water and Sewerage Authority.

302. TYPES OF SEWERS AND LINE EXTENSION REQUIREMENTS

Sewers shall be designed as separate sanitary sewers only in which rainwater from roofs, streets, and other areas and groundwater from foundation drains are excluded. Overflows from sewers shall not be permitted.

A.) All specifications required by the Authority and by the Georgia Department of Natural Resources must be met by the Developer.

B.) If an existing sanitary sewer main must be extended to serve a particular development, the Developer will be required to pay all of the initial costs, including but not limited to construction costs, testing fees, engineering fees, etc.

C.) In certain circumstances, the Authority may require a larger pipe size to be installed than is required by these standards, and the cost of this oversizing may be funded by the Authority. The Developer may be required to pay all of the initial costs. If the purpose of the oversizing is due to the Authority's master plan for sewage collection within the County, the Authority may enter into negotiations with the Developer to provide funding for the betterment.

303. DESIGN PERIOD

Sewer systems should be designed for the estimated ultimate tributary population. Tributary population is considered to be all areas upstream of the discharge point of the system being designed. Consideration should be given to the maximum anticipated capacity of institutions, industrial parks, etc.

304. DESIGN FACTORS

Sewers will be designed and installed from the existing Authority sewer system to the uppermost property line of the development being served. In determining the required capacities of sanitary sewers, the following factors should be considered:

A.) Maximum hourly sewage flow.

B.) Additional maximum sewage or waste flow from industrial plants.

C.) Ground water infiltration.

D.) Topography of the area.

E.) Depth of excavation.

New sewer systems shall be designed on the basis of an average daily flow of sewage of not less than 400 gallons per household per day. Sewers should be designed to carry the per capita flow when flowing one-half full. Normally, all sewers shall be designed with a peaking factor of not less than 3.6 and this may be increased upon the direction of the reviewing engineer. When deviation from the foregoing per capita rates is demonstrated, a description of the procedure used for design shall be included.

The Authority has the option of granting a variance from the requirement for the Developer to install sanitary sewers within the development to the uppermost property line of the development if this creates an undue hardship on the Developer. If this variance is granted, the Developer will be required to grant and record a 60 foot wide construction easement and a 20 foot wide permanent easement dedicated to the Cherokee County Water & Sewerage Authority for future use. The sanitary sewer line must be designed to the uppermost property line of the development so that the easements will be set in the proper location to build the sewer line. The construction easements will remain in effect until such time as the sanitary sewer lines are constructed and accepted by the Authority. The Cherokee County Water & Sewerage Authority may at its option require additional easements.

Minimum easement widths to be dedicated are 20 feet for permanent easements and 60 feet for construction easements, with both the permanent and the construction easements typically centered on the sewer main. The easements may need to be offset if paralleling a vegetative buffer adjacent to a creek. Also, in the event that a trunk or interceptor sewer line greater than 15 inches or of great depth is expected to pass through the development, the construction

easement width shall be increased to the amount required for construction of the expected sewer. All easements are to be checked in the field and must be adequate for the purpose for which they are dedicated. Also, consideration must be given for expected building locations and the easement shall be located for the least possibility of conflict before the sewer may be constructed.

No structures shall be built on dedicated easements and the Authority will not be responsible for the removal of fences that are placed on dedicated easements in the event the sewer is constructed. Septic tanks in these types of developments shall be placed in a location to facilitate the connection of the sewer service to the sewer main. See Section 207 for further information regarding easements.

305. DETAILS OF DESIGN AND CONSTRUCTION

A.) Size

No sanitary sewer main shall be less than 8" after leaving the uppermost property line to be served. Trunk mains shall be a minimum of 10" in diameter.

Where the need for sizes of pipe differ between manholes (such as 15" PVC and 16" D.I.P.), the Developer shall install the one size of D.I.P. for the entire section of line between the manholes. Transition sleeves are not allowed.

B.) Depth

Any sewers installed in the street shall be sufficiently deep to provide 5 feet of cover at the inlet end of all service laterals at the street right-of-way, and over any part of the main or service within the street right-of-way.

Any sewers on off-street easements shall have a minimum of four feet of cover unless ductile iron pipe is used. Filling over the pipe to obtain minimum cover is not allowed if the fill will impede the natural flow of surface water or will cause an erosion problem.

Sanitary sewers paralleling creeks or ditches shall be designed to make the top of the sewer line at least two feet below the bottom of the creek or ditch adjacent to the sewer throughout the site to be developed.

C.) Ditch and Creek Crossings

Aerial sewers are not allowed. The required method of crossing a river, stream, creek, impoundments, or wet weather ditch is with a bore under the creek or river with a minimum of two feet (2') of cover between the lowest

point in the stream and the top of outside diameter of the casing. See Section 512 for detailed requirements regarding crossing streams.

D.) Polyethylene Encasement

Ductile iron pipe shall be provided with polyethylene encasement whenever the sewer main either crosses or is in close proximity to a steel gas main. Ductile iron pipe installed in low-lying damp areas and in areas where anode beds are known to exist shall also be provided with polyethylene encasement. The length of the encasement of D.I.P. gravity sewers shall be in accordance with DIPRA recommendations. The reviewing engineer and the Authority shall have final authority over the required length of the encasement during the plan review process. The entire length of D.I.P. force mains shall be encased in green polyethelene tubing.

E.) Dams

Gravity sewer lines may be placed at the toe of the slope of the dam, but not in the slope. Pressurized force mains and water mains shall not be closer than 20 feet to the toe of a dam.

306. GRAVITY SEWER PIPE

All gravity sanitary sewer pipe up through 24-inch diameter must be Polyvinyl Chloride (PVC), Vitrified Clay Pipe (VCP), Ductile Iron Pipe (D.I.P.), or Steel Pipe, except where D.I.P. or Steel Pipe is required. For pipe larger than 24-inches in diameter, the Contractor may have the option of using either Polyvinyl Chloride (P.V.C.), Reinforced Concrete Pipe (R.C.P.), Ductile Iron Pipe or Steel Pipe, except where Ductile Iron Pipe (D.I.P.) or Steel Pipe is specifically shown on the plans. High Density Polyethylene (HDPE) pipe is allowable for gravity installations only in trenchless technology applications. All pipe shall be installed with a minimum of Class "C" bedding.

307. SLOPE

All sewers shall be so designed and constructed to give mean velocities, when flowing one-half full, of more than 2.0 feet per second based on Kutter's formula using an "N" value of 0.013. The following are the minimum slopes which shall be provided; However, slopes greater than these are desirable:

Minimum Slope in Feet

Sewer Size	Per 100 Feet
8"	0.50
10"	0.40
12"	0.30
15"	0.20
16"	0.20
18"	0.18
21"	0.14
24"	0.10
27"	0.10
30"	0.10
36"	0.10

These minimum slopes shall be used only when sufficient flows are expected to maintain a velocity of more than 2.0 feet per second and maintain a cleansing action in the line. Sewers shall be laid with uniform slope between manholes. Sewers on 20 percent slope or greater shall be ductile iron pipe and shall be anchored securely with concrete anchors (See Standard Details) to prevent displacement by erosion or shock. Maximum slope of sewers shall be 30 percent and sewers shall be designed at less than 20 percent whenever possible.

308. INCREASING SIZE

When a certain size sewer is connected to a larger one at a manhole, the connection shall not be lower than matching the 0.8 depth point of both sewers to the same elevation. For example, when connecting an 8 inch pipe to a 60 inch pipe, a point 6.4 inches above the invert of the 8 inch pipe shall not be lower than a point 48 inches above the invert of the 60 inch pipe. Match crowns of the two pipes whenever possible.

309. SEWER LINES THROUGH GOLF COURSES

Where sewer lines are installed through existing or proposed golf courses, the pipe size shall be oversized as determined by the Authority. The Developer may be required to install parallel sewer lines if growth patterns indicate an increase in sewage generation upstream of the golf course. This applies to gravity mains and force mains and is subject to the discretion of the Authority.

310. SANITARY SEWER FORCE MAINS

A.) Force mains 4 inches in diameter or larger shall be ductile iron pipe and shall conform to section 402.A of these Standards. Ductile iron force mains shall be encased in green polyethylene tubing.

B.) Force mains smaller than 4 inches in diameter shall be CertainTeed, Eslon, Dyka, Vulcan, or alternate acceptable to the Authority, Class 200 SDR 21 integral bell PVC pressure pipe. HDPE pipe is also allowable for these smaller force mains.

C.) See Standard Details for the minimum concrete blocking requirements. Design engineer shall be responsible for design of blocking where more than the minimum is required. For internal pressures in excess of 100 PSI, blocking calculations MUST be submitted to the Cherokee County Water & Sewerage Authority for review.

D.) The location of force mains inside subdivisions shall be 11' behind the back of the curb. The location of force mains outside of subdivisions shall be as allowed by Cherokee County and approved by the Authority The preferred location of the force main is the side opposite the water main.

E.) Force mains shall be installed so that the top of the pipe is a minimum of four feet below final grade, four feet below the edge of the pavement, or four feet below the ditch paralleling the road, whichever is deepest. Permission must be granted by the Authority to vary from this requirement.

F.) All force mains shall enter the receiving manhole with 6" or larger diameter pipe. At a point 10 feet away from the manhole, the force main may reduce down to its normal pumping diameter.

G.) Force mains shall not be closer than 20 feet to the toe of a dam.

311. MANHOLES

Manholes shall be installed at the end of each line; all changes in grade, size, or alignment; at all intersections; and at distances normally not greater than 350 feet. Spacing for 8 inch sewers can be more than 350 feet but not more than 400 feet and will be allowed only in isolated cases when, in the opinion of the reviewing engineer, it is impractical to install an additional manhole and when the extra distance will not impede maintenance of the line. Manhole spacing in sewers 10" and larger will conform to Ten State Standards. In no circumstance will a spacing of greater than 300 feet be allowed when the slope exceeds 10 percent. Cleanouts may be used only for special conditions and shall not be substituted for manholes nor installed at the ends of laterals greater than 150 feet in length. Manholes in cross-country areas shall be elevated so that the top is 18

inches above ground. Manholes installed in future streets for the next unit shall be elevated so that the top of the manhole is 48" above ground.

A maximum of four holes shall be cored into the base of a manhole for pipes. More holes may be cut into the manhole if the holes are staggered in elevation by 2 feet and are used for laterals going with the flow.

312. DROP MANHOLES

A drop pipe shall be provided for a sewer entering a manhole at an elevation of more than 2.0 feet above the manhole invert. The drop pipe shall be of ductile iron materials. All outside 90^{o} elbows shall have thrust block poured below the elbow. Drop Manhole will be noted on the construction plans at any time the drop exceeds 2.0 feet. Where the difference in elevation between the incoming sewer and the manhole invert is less than 2.0 feet, the invert shall be sloped to prevent solids deposition. **Inside drop manholes are required where the drop in elevation is 10 feet or more**. Inside drop manholes shall be a minimum of five feet in diameter for pipe less than 15" in diameter and six feet in diameter for pipe greater than or equal to 15" in diameter, and shall be constructed in accordance with the details in Section 700. The structure of the drop inside the manhole shall be located opposite of the manhole steps. Inside drop manholes are not allowed in manholes with safety platforms.

313. CONNECTIONS TO THE AUTHORITY'S SEWER SYSTEM

At the point of connection to the Authority's existing sanitary sewer system, the new sanitary sewer line shall remain plugged or otherwise disconnected from the system until the new sanitary sewer lines are inspected, tested and determined to be acceptable to the Authority's Chief Inspector. The Developer will be fined for any storm water flows, mud or other construction debris that enters the Authority's system due to non-compliance with this requirement.

314. CONNECTIONS TO EXISTING MANHOLES

Connections to existing manholes shall be made by coring the existing manhole with a coring machine. "Knocking out" holes for connections shall not be allowed. The cores shall be made at an elevation of 2' or less above the invert of the manhole.

All force mains shall enter the receiving manhole with 6" or larger diameter pipe. At a point 10 feet away from the manhole, the force main may reduce down to its normal pumping diameter.

315. STEEL CASINGS

Steel casing pipe shall be used for all cased piping where the carrier pipe is eight inches (8") or greater in size.

316. PROTECTION OF WATER SUPPLY AND OTHER UTILITIES

A.) The Cherokee County Water and Sewerage Authority has an established Cross-Connection Program (See Appendix To Water Standards) to prevent the entry of contaminants or pollutants into any area of the potable water supply through the control of cross connections. It is illegal to introduce any substance into or to have any cross connections with the potable water supply. There shall be no physical connection between a public or private potable water supply system and a sanitary sewer which would permit the passage of any sewage or polluted water into the potable water supply.

B.) Relation to Water Mains

A horizontal separation of at least 10 feet is required between water mains and existing or proposed sanitary sewer mains (measured edge to edge). Should conditions prevent a separation of 10 feet, the lines shall be laid in separate trenches.

When sewers cross under water mains, the sewer shall be laid so that the crown of the sewer shall be at least 18 inches below the invert of the water main. The two pipes shall be installed such that a full length of pipe will be centered over the crossing so that all joints will be separated as much as possible. Ductile iron pipe shall be installed for both mains when clearance is less than two feet.

In the rare circumstance when the 18 inches clearance between the water and sewer mains cannot be maintained, the D.I.P. mains shall be installed as described in the paragraph above with the joints as far apart as possible, plus both mains shall be wrapped in polyethylene tubing and then encased in concrete for a distance of 10 feet on both sides of the crossing.

When sewers are laid within public streets, the manholes and sewer lines shall normally be laid along the centerline of the street at a depth of not less than 6 feet from the pavement surface to the top of the pipe. In curves and other areas where this is not possible, the lines and manholes are to be installed within the confines of the curb to avoid conflict with the curb and other utilities. Ductile iron pipe shall be used for sewer lines crossing storm sewers with less than a two foot clearance and at other times when directed

by the Authority.

317. SEWER SERVICES

All connections to existing sewer lines shall only be made at manholes.

A sewer service shall be provided for every existing or proposed lot or building All services shall be shown on the construction and as-built drawings. A common service shall not be allowed for two or more buildings. The service shall extend to the property line of the lot being served and shall normally be within 10 feet of the lower corner of the lot. Each service shall terminate with a 6" PVC clean-out stubbed out of the ground and sealed with a temporary PVC cap as shown in standard detail S712.

The Developer shall be responsible for serving all lots developed. On any lot where the service cannot be found, the Developer shall be responsible for payment of the cost of installation of the service. Also, unless noted on the final plat, the service shall be low enough to serve the first floor elevation at building line. The Builder shall be responsible for the location of the service prior to the pouring of the foundation, driveway or other appurtenance. The Authority will not be responsible for any house built too low to be served nor for any service covered by construction.

No plumber or contractor will be allowed to connect to the sewerage system except to the end of the service provided for his connection. Also, any service provided will be utilized without the installation of additional services. The Builder will be responsible for replacing the temporary P.V.C. cap with a traffic rated brass cap flush with grade as shown in standard detail S713.

318. GREASE TRAPS AND SAND/OIL TRAPS

The Cherokee County Water and Sewerage Authority has developed and implemented a sewage pretreatment program to limit the amount of grease, sand and oil entering the sewer system from restaurants, service stations, feed mills, car wash operations and any other establishment where such devices are necessary for the proper handling of liquid wastes containing sand, grease, oil, flammable wastes or other harmful ingredients. The Developer is hereby required to meet with the Authority's Pretreatment Coordinator to determine the need for such a device. the Authority requires all such establishments to include a grease trap and/or a combination sand/oil trap as part of their sewage collection system, located between the business and the tap into the Authority's sewer line. The Standard Details include a typical design for these structures, but the size and dimensions of the trap and piping are dependent on the quantity of flow from the business. **The design engineer will be responsible for sizing the structure and the piping and submitting design calculations with the plans. (Minimum Size = 1500 gallons) the Authority will review the design**

and calculations for minimum requirements prior to approving the construction plans. the Authority will require that the traps be maintained and cleaned out on a regular basis at intervals determined by the Authority's policy. Sanitary sewage from the facility's toilets shall not route through the grease trap.

319. INDUSTRIAL SEWAGE PRETREATMENT

Wastewater connections from industrial processes shall not be made until the Authority's Pretreatment Coordinator has approved the deposit of the sewage into the system. Industrial wastewater may need to be pretreated on site before the Authority will accept the wastewater from certain processes. This need for pretreatment will be reviewed in the first stages of the preliminary plan review process. Sanitary sewage from the facility's toilets shall not route through the pretreatment process.

the Authority has developed a set of "Sewer Use and Industrial Wastewater Control Regulations." Developers are required to meet with the Authority's Pretreatment Coordinator to determine if the project will be required to meet the additional requirements specified in this document. If the Authority determines that the sewage does need to be pretreated, the designer will be responsible for the design of the pretreatment process and related calculations. **The design engineer will be responsible for designing the process and the piping and submitting the design and calculations with the plans. the Authority will review the design and calculations prior to approving the construction plans.**

320. DUMPSTER PAD REQUIREMENTS

A.) Dumpster pads shall be minimum of 5" thick reinforced concrete slabs on grade. The concrete for the pads shall be 4000 psi concrete reinforced with 6" x 6" welded wire fabric. The dumpster pad shall be placed on a sub-base of 12" of graded aggregate base. The pad shall be sloped to drain to the back of the pad at a rate of ¼" per foot. Stop posts are to be placed in front of the pad drain so the dumpster or other objects will not block access to the drain. Dumpster pads shall have 6" concrete retaining curbs on three sides. Where required or desired, a concrete block concealment wall may substitute for the retaining wall.

B.) Drain: Dumpster pad drains for single or multiple dumpster installations shall be ZURN Model ZN 415 8" grate with solid hinged lid or alternate acceptable to the Authority All drains shall have either a separate or a built in trap to prevent the escape of sewer gas.

C.) Piping: All drain piping shall have a minimum diameter of 4". Piping of 4"

and greater under the slab or other paved areas shall be ductile iron pipe. Piping that is not under the slab or other paving and not greater than 36" in depth may be PVC. Clean-outs shall be installed at all changes in piping direction. Piping shall be sloped to drain by gravity. Minimum slope of 4" pipe is 2.5%.

D.) Connection to Sanitary Sewer: Dumpster pad drains shall be connected to and routed through the grease trap. Authority approval will be required for any connection varying from this requirement.

321. WASTEWATER LIFT STATION DESIGN SPECIFICATIONS

The following minimum requirements apply to wastewater lift stations:

General:
The Cherokee County Water and Sewerage Authority reserves the right to make any changes in these requirements as may be deemed necessary. The design of the lift station shall be based on the future build out of the drainage basin upstream of the station.

1.) Submittals to the Authority for lift stations shall include:

A.) TDH calculations.
B.) Pump curves from pump manufacturer.
C.) System curves.
D.) Cycle time calculations.
E.) Buoyancy calculations.
F.) Profile and aerial views of force main and pump station.
G.) Surge relief calculations showing whether surge control valves are necessary.
H.) The NRCS report of technical review for erosion and sediment control.
I.) Submittals shall be stamped by a professional engineer licensed to do work in the State of Georgia.

2.) Pumps that are acceptable are Flygt, Myers, EBARA, or alternate acceptable to the Authority, except that others for specific applications may be accepted on special approval by the the Authority

3.) Pump operation shall be by pressure transducer and programmable controller with a 4-20MA output for SCADA. A spare pressure transducer and controller or a redundant level control system shall be supplied at the Authority's request.

A pump operation and elevation schedule shall be provided on the design

drawings. This schedule shall call for pump operation elevations, ground water elevations and minimum liquid level in the wet well. The pump horsepower, pump model and impeller size shall be clearly shown in bold print on the plans next to the drawing of the pumps and wet well. There shall be a minimum of five levels of control as follows:

a.) Low Level Alarm
b.) Pumps Off
c.) Lead Pump On
d.) Lag Pump On
e.) Lag-Lag Pump On (Triplex and Quadplex Only)
f.) Lag-Lag-Lag Pump On (Quadplex Only)
g.) High Level Alarm

4.) Lift stations with pumps up to 25 HP shall be supplied with a complete spare pump at the request of the Authority. A spare total rebuild kit and spare impeller shall be required with all pump stations.

5.) Phase converters will not be used on lift station electrical power supply. Lift station power shall be 240 VAC / 3 phase or 480 VAC / 3 phase and control circuits shall be 120 VAC / 1 phase.

6.) Lift station check valves, isolation valves, and surge control valves (if required) shall be housed in a concrete valve pit adjacent to the lift station. Check valves provided shall be slow-closing check valves. Floor drain (3" diameter minimum) for the valve pit shall be provided and connected to the wet well. A P-trap shall be installed in the floor drain to block sewer gases from the wet well. Valve pits must be large enough for easy maintenance operations, with 2' to 3' clearance on all sides and with bottom of piping 2'-0" to 2'-6" off of the concrete floor. Valve pits shall be no deeper than 8' deep. Valve pits must have easy access. A hatch opening must be placed directly over the steps so that the steps are not recessed back away from the hatch opening. See Detail S731.

Acceptable maufacturers are as follows:

Check Valves: Golden-Anderson, Crispin or alternate acceptable to the Authority
Isolation Valves: Dezurik, Val-Matic, M&H or alternate acceptable to the Authority
Surge Relief Valves: Golden-Anderson or alternate acceptable to the Authority
Air Release Valves (where necessary): Crispin, Vent-O-Mat or alternate acceptable to the Authority

7.) For lift stations less than 100 HP, controls and electrical components shall be

housed in completely weather proof stainless steel metal cabinets (NEMA 4X stainless steel). The cabinets shall be provided with condensate heaters, spare fuses and spare bulbs of each type that is used in the electrical/control system. Soft start starters shall be acceptable in NEMA 3R ventilated or air-cooled panels.

For lift stations that are 100 HP or larger, an electrical building shall be provided to house the electrical distribution equipment. NEMA 1A enclosures shall be used in buildings. The buildings must be provided with a heat pump for climate control within the buildings.

8.) The Developer shall furnish a pump controller with all necessary controls including, but not limited to, the following:

- **a.)** Provide starters for each pump. (See description under Part 10 of this section.)
- **b.)** HOA Switches
- **c.)** Pilot Lights
- **d.)** Power Indicator Lights
- **e.)** Other Lights as Required
- **f.)** Alarm Silence Push Button
- **g.)** Alarm Reset Button
- **h.)** Elapsed Time Indicators
- **i.)** Control Transformers – 480V to 120V Step Downs shall not be mounted inside the control panel for heat control purposes.
- **j.)** Strip Heater and Thermostat
- **k.)** Alarm Horn and Wiring – 120 Volt
- **l.)** NEMA 4X Red Alarm Light and Wiring – 120 Volt
- **m.)** Phase Under Voltage Monitor With Time Delay
- **n.)** Moisture Sensing Seal Failure Relays With Indicator
- **o.)** Provide Alarm Outputs For High Water Alarms and Pump Trouble For Each Pump. Coordinate With SCADA Unit Manufacturer For Types of Outputs Required. Note: The Pump Trouble Outputs Are To Have No Time Delay Added.
- **p.)** Provide Relays for Phase Failure and Phase Unbalance Protection.
- **q.)** Provide Lag Pump On Delay Timer Relay, 0-60 Seconds For Each Pump, Such That The Pumps Cannot Start At The Same Time.
- **r.)** Provide Pump Failure Alarm Output For Each Motor To Include Motor Overload, Motor Thermal Cutout and Leak Seal Failure (FLS) Conditions.
- **s.)** Only the high level and low level alarms are to be wired to the alarm horn and red light. No pump failures shall be wired to the horn and light circuit.
- **t.)** Breakers for security lighting, generator block heater, and battery charger. Add two spare 120V breakers.

u.) Provide Terminal Blocks For All Connections Into and Out Of the Panel.

Note:
Pump Station Control Shall Be By Pump Manufacturer.

9.) The pump motor starters shall be provided by the pump manufacturer. Starters for motors less than 50 horsepower shall be full voltage, non-reversing, NEMA rated. Starters for 50 horsepower and larger motors shall be Square D Altistart, Allen Bradley, Solid State Reduced Voltage or alternate acceptable to the Authority

10.) All 480V circuit breakers in the pump control panel shall be rated a minimum of 14 KAIC and all 240V and 120V circuit breakers shall be rated a minimum of 10 KAIC.

11.) All wiring shall be done in rigid galvanized steel conduit. Conduit installed below grade shall be painted with two coats of asphaltum paint. Schedule 40 PVC conduit may be used for conduit runs underground. All PVC conduit shall be installed in concrete duct banks per NEC. Concrete ducts shall be poured monolithically with steel reinforcement as necessary.

12.) The control panel manufacturer shall coordinate with the pump manufacturer and the generator manufacturer, such that the SCADA system can be installed into the control panel. The control panel shall be sized such that there is adequate space for this equipment. The control panel manufacturer shall coordinate the receipt and installation of the SCADA equipment in the control panel. Make all connections between the SCADA equipment and the pump controls as required by the SCADA manufacturer.

13.) Each lift station shall be provided with a Remote Terminal Unit (RTU) to communicate with the Authority's SCADA System provided by Dexter Fortson Associates, Inc. or alternate acceptable to the Authority to include any and all radio repeater site/station required to communicate with the SCADA system. Each RTU at a minimum will provide the following monitoring/control points:

a.) Each Phase Voltage, Current, And Power Factor For Each Pump In The Station.
b.) Station Voltage Phase To Phase And Phase To Neutral And Current In Each Phase At The Line Side Of The Main Disconnect Switch And At The Emergency Power Input To The ATS.
c.) Manual On/Off Control For Each Pump From A Remote Signal

To The RTU.

d.) Status Of Each Pump – On/Off.

e.) Pump Trouble Alarm For Each Pump With 20 Second Time Delay.

f.) Station Operation – Simplex, Duplex, Triplex Or Quadplex.

g.) Station On Normal Power.

h.) Station On Emergency Power.

i.) Generator Running.

j.) Generator Alarm.

k.) Maintenance Shutdown.

l.) Man Down

m.) SCADA Control Off

n.) Low Wet Well Alarm

o.) High Wet Well Alarm

p.) Alarm Acknowledge / Silence

q.) Manual Off / On

r.) Generator Fuel Tank Leak Alarm

s.) Generator Start/Stop From A Remote Signal To The RTU.

t.) Provide Alternator For The Operation Of Pumps (Triplex And Quadplex Only).

u.) ATS Open (Normal Power) and Closed (Emergency Power) Indication.

v.) Control Voltage Alarm.

w.) Status of Control Voltage To The RTU.

14.) Line power shall be provided with a quick disconnect and a transient voltage surge suppressor at the main service entrance. Disconnects shall utilize a solid state circuit breaker.

15.) Upon installation, all pumps shall be checked by a manufacturer's representative for proper rotation, pumping capacity, amperage draw, lack of vibration, and other checks as may be deemed necessary to assure proper operation. All submersible pumps shall be pulled out of and reinstalled in the wet well in the presence of a representative of the Authority to assure proper clearances for easy removal of the pumps for maintenance. (Min. 2 day start-up time for all lift stations.)

16.) All submersible pumps shall be provided with stainless steel chains connected to each pump to facilitate the removal of the pump from the wet well for maintenance.

17.) All miscellaneous metals inside the wet well shall be stainless steel. Typical wet well pipe supports shall be constructed of stainless steel with stainless steel mounting hardware. Bracket shall be a minimum of 3” x 3” x 5/16”. Pipe strap shall be minimum 3” x 5/16” with minimum ½” stainless steel

bolts. Base of support shall be constructed of 5/16" stainless steel plate mounted with ¾" stainless steel bolts.

18.) All wastewater lift stations shall be designed so that the base elbow to the submersible pumps be mounted on a grout shelf approximately one foot above the base slab or to the pump manufacturer's recommendations. The base elbow shall be anchored to the base slab with four ¾" stainless steel bolts – 5000 pound pull-out each. Bolts shall be threaded into concrete a minimum of 8". Anchor inserts shall be cast into the invert. Carbon steel bolts shall not be accepted.

19.) For wet wells larger in area than a ten (10) foot diameter well, squirrel cage type ventilator fans shall be supplied and shall have enough capacity to provide a minimum of six air changes per hour. The fan shall include mounting curb, bird screen and explosion-proof motor. Acceptable manufacturers are Penn, Acme and Twin City Blowers or alternate acceptable to the Authority

20.) A vent for the wet well shall be supplied constructed of ductile iron pipe. The vent shall be a minimum of 4" diameter floor pipe, FL. x P.E., shall be cast in place and shall extend 4" up from the top of the wet well. A 1'-0" long D.I.P. FL. x FL. spool shall be connected to the floor pipe and two 4" diameter 90 degree bends shall be mounted to the spool to complete the vent pipe. A stainless steel bird screen shall be attached to the open end of the bend.

21.) The discharge pipe shall be tapped for a discharge pressure gauge. The gauge shall be Ashcroft Type 1009 or alternate acceptable to the Authority, Liquid-filled, 3 ½" dial, 0-200 PSI Range with a diaphragm seal suitable for wastewater service. An isolation valve shall be supplied between the pipe and the gauge.

22.) All pipes in the valve vault shall be supported by either flanged pipe supports or concrete pier pipe supports. All piping in the valve vault shall be restrained using stainless steel threaded rod.

23.) A lift station wet well access ladder shall be provided. The ladder is to be constructed of materials not likely to be affected by the corrosive atmosphere of the wet well. The ladder is to be permanently mounted in the wet well to provide access for maintenance. Cast-in concrete steps will not be acceptable as an access ladder. The ladder steps shall be roughened to deter foot slippage. Minimum ladder width shall be 18 inches. Ladder shall be equipped with "Safety-Climb" and must be easily accessible.

24.) A freeze proof yard hydrant of not less than 3/4 inch size shall be provided

at each lift station for washdown purposes. The potable water line shall be equipped with a reduced pressure zone backflow preventer in an above-ground housing. Backflow preventers must have a 120 VAC receptacle in the housing with electrical heat tape installed. The backflow assembly must be raised at least 12" above the concrete floor. (See the details in the Authority's Cross-Connection Control Program in the Appendix to the Water Standards.)

25.) Access roads to any lift station shall be paved. Roads shall have a minimum of 8" of graded aggregate base topped with a minimum of 2" of asphalt Type "B" or 6" of reinforced concrete with control joints every 10 feet. Roads shall be a minimum of 12 feet wide. A paved area inside the fencing shall be provided to facilitate service vehicle access to the pumping station wet well and other facilities. A paved turn around area shall be provided at each pumping station. All paved areas shall be contiguous with the paved access driveway.

26.) Lift station sites shall be fenced with a minimum of 6 foot high chain link fencing topped with 3 strands of barbed wire. The fenced area must be 50 feet by 50 feet minimum with a 14 foot wide chain link gate. (See Detail S729). A 14 foot wide cantilever gate shall be installed on the driveway entrance at the public right-of-way or a location determined by the Authority.

27.) All lift stations shall be provided with security lighting. Security light must be mounted on a hinged pole with winch. Standard pole shall be a galvanized steel hinged square pole, General Electric No. ASHS-(XX)-2T-4.011 GV, 16 to 20 feet in height, with a General Electric No. M180 Winch/Chain and a No. RBSU2H6 GV Bracket. The security light attached to the top of the pole shall be a General Electric No. M2RR-07-S-1-H-2-LN-PEC1TL (Typ. for 2 lights) or alternate acceptable to the Authority

28.) Unpaved areas inside the fenced lift station area shall be covered with a minimum of 6" inches of No. 57 stone.

29.) The sewage lift station access road and area within the fence shall be above the 100 year floodplain. The construction plans shall show the floodplain limits.

30.) Wet wells shall be a minimum of eight feet (8') in diameter. Rectangular wet wells shall be allowed upon approval of the Authority. Sizing of wet wells shall be as follows:

For lift station pumping, $V_{min} = T_{min} \times Q/4$, where:

V_{min} = The minimum effective wet well volume in gallons. This effective

volume is the volume between the “Pumps On” and the “Pumps Off” elevations. The “Pumps On” elevation shall be a minimum of 2’-0” below the invert of the inflow pipe.

T_{min} = The minimum cycle time in minutes. All lift stations shall be sized based on six starts per hour or T_{min} = 10 minutes. Although most pumps are rated at much higher starts per hour, the size is set at six starts per hour due to the limited number of starts per hour allowed by the electrical hardware. Ideal cycle time is achieved when the pump capacity (Q) is two times the inflow.

Q = Pump capacity in GPM.

31.) The wet well influent line(s) shall be provided with a channel grinder by Franklin Miller, JWC or alternate acceptable to the Authority. Stations equipped with grinder pumps are exempt but may still be required by the Authority to have removable aluminum trash basket(s). The basket(s) shall be 8” x 20” x 28” as detailed by Halliday Products Series B1A. The basket shall have 2” diameter holes at 3” on center each way. Both systems, grinder and or basket, shall have a guide rail system for easy removal from the wet well or channel.

32.) Where lift stations are built by a Developer, the Developer shall give the Cherokee County Water and Sewerage Authority a one year warranty on each lift station. The lift station property shall be deeded to the Authority in fee simple.

33.) <u>The minimum requirement for the provision of emergency power for lift stations shall be that each station shall be provided with an emergency generator capable of starting and running the appropriate number of pumps necessary to meet and/or exceed the maximum daily demand of the pump station and other ancillary devices.</u> The generator shall be diesel powered with an automatic transfer switch and provisions for an automatic exercise cycle. The Contractor shall set the ATS transfer delay from utility to generator at a 30 second delay.

The generator and control panel shall be field located by the CCWSA authorized personnel. The generator pad shall be installed such that the bottom of the pad is six inches below grade and the top of the pad is six inches above grade.

The person responsible for sizing the standby generator (it’s KW rating) must supply a letter to the Developer, Contractor and Cherokee County Water and Sewerage Authority, stating that they guarantee the unit will operate the lift station pumps and other electrical demands with no greater

than a 20% voltage dip. This letter must be signed and delivered before the day of scheduled start up.

35.) Odor control equipment is required on all new sewer lift stations. Proposed odor control equipment is subject to review and approval by C.C.W.S.A. on a case by case basis.

A.) GENERAL PROVISIONS AND REQUIREMENTS

i.) General Description. This specification defines the requirements for an emergency or standby Electric Generator Set. The generator set shall consist of an engine directly coupled to an electric generator, together with the necessary controls and accessories to provide electric power for the duration of any failure of the normal power supply. The generator set shall have the following characteristics:

Voltage	480 VAC or 230 VAC
Phase	3
Connection	Y
Wire	4
Hertz	60
Power Factor	0.8

The generator set shall be capable of starting and running the necessary loads without exceeding the maximum voltage and frequency variations specified herein, or the maximum temperature limitations of the engine and generator

ii.) Quality and Experience. All materials and parts of the generator set shall be new and unused. Each component shall be of current manufacture from a firm regularly engaged in the production of such equipment. Units and components offered under these specifications shall be covered by the manufacturer's standard warranty on new machines, a copy of which shall be included in the submittal.

iii.) Warranty. The warranty specified in paragraph ii above shall be 2 years from date of acceptance.

iv.) Parts and Service. The Authority shall accept only engine driven generator sets that can be properly maintained and serviced without causing the Authority to either carry expensive parts stock or be subjected to the inconvenience of long periods of interrupted service because of lack of available parts. The Developer shall specify the nearest location of permanent parts outlets from which parts may be obtained.

v.) **Operation and Maintenance Information**. The system supplier shall furnish 3 sets of operating, maintenance and parts manuals covering all components for the generator set. The supplier shall also instruct the Authority in operation and maintenance of the unit.

vi.) **Vibrations.** The system shall be free of injurious torsional and bending vibrations within a speed range from 10% below to 10% above synchronous speed.

vii.) **Guards.** The system shall be adequately guarded both physically and electrically for protection of operating personnel.

C.) **ENGINE**

i.) **General Description.** The engine shall be of the internal combustion type equipped to operate on No. 2 diesel fuel.

ii.) **Engine Power Rating.** The rated net horsepower of the engine at the generator synchronous speed, with all accessories, shall not be less than that required to produce the KW required by Section 320.34.a.i. The horsepower rating shall take into account the generator efficiency and all parasitic losses such as fan, battery charger, etc. The generator set shall be capable of producing the required KW (without overload) for the duration of the power outage (standby rating), under the following ambient conditions:

Altitude, feet	1000
Ambient temperature range, ^{o}F	0-100
Humidity at max. ambient temp. %	80

iii.) **Fuel and Oil Consumption.** Accompanying the design submittals, the Developer shall supply fuel and oil consumption estimates based on engine manufacturer's data, a copy of which shall be included in the plan submittal.

iv.) **Governor (Engine Speed Control).** The engine shall be equipped with a suitable governor to maintain frequency within limits, as specified below, by controlling engine and generator speed.

Type: isochronous

Stability: 1/4% maximum steady state frequency variation at any constant load from no load to full load.

Regulation: 1/4% maximum frequency deviation between no-load steady state and full-load steady state.

Transient: 5% maximum frequency dip on most severe motor starting condition.

Transient: 2 seconds maximum recovery time for maximum motor start.

The manual speed adjusting control shall be mechanical or electrical if located on the generator set or electrical if located in a remote control panel.

v.) **Engine Crank-Start System.** The engine shall be electric start, provided with a solenoid energized motor, with either positive engagement or clutch drive to the engine.

Lead-calcium batteries shall be furnished to provide power to the engine cranking motor. The batteries shall be designed for operation at a minimum ambient temperature of 0^{o}F.

The voltage shall be as required by the engine manufacturer.

The batteries shall be capable of a minimum of four crank cycles (rolling) of the specified prime mover and have sufficient current available for "break-away" currents for the particular engine used at the specified worse case temperature.

A float type battery charger, compatible with the batteries selected, shall be furnished which shall maintain the starting batteries at full charge. Battery chargers for 25 kW – 200 kW shall be a 5 amp charger, 10 amp chargers for 230 kW - 800 kW, and 20 amp chargers for 900 kW - 2250 kW generators. The charging system shall permit charging from either the normal or the emergency power source. It shall have a high rate and low rate charging system. A voltmeter shall indicate the charge rate and the circuit will be protected by either fuses or circuit breakers. The charger or charging circuit shall be so designed that it will not be damaged during the engine cranking, achieved, for example, by a current limiting charger or a crank disconnect relay. It shall also be capable of recharging a discharged battery in 12 hours while carrying normal loads.

vi.) **Engine Cooling System.** The engine shall be liquid cooled. The type of liquid cooling system shall be a unit mounted radiator. The radiator capacity shall be suitable for operation in the ambient temperature

specified in Section 320.34.b.ii, plus the air temperature rise across the engine.

vii.) Air Supply/Exhaust System.

Cleaner: An air cleaner and silencer shall be furnished as recommended by the engine manufacturer and shall be located and mounted as recommended by the engine manufacturer.

Exhaust: An exhaust system of suitable size, configuration and material in accordance with engine manufacturers recommendations shall connect the exhaust outlet of the engine to the silencer. The type of silencer shall meet the requirements of engine manufacturers and shall be critical silencing type.

The exhaust system and silencer shall have the configuration shown on the plans submitted, and shall be of such size that back pressure on the system will not exceed the back pressure permitted by the manufacturer's recommendation. A flexible connection shall be mounted at the engine exhaust outlet and the discharge end of the exhaust line shall be protected against entry of precipitation. Screening or suitable lagging shall protect piping within reach of personnel. All exhaust piping shall be gas tight.

viii.) Engine Protective Devices. The following engine protective devices shall be provided, and an indicating light shall be supplied for use with each device specified:

Alarm system for high water temperature.

Alarm system for low oil pressure.

Automatic engine shutdown for high water temperature.

Automatic engine shutdown for low oil pressure.

Alarm and shutdown system for high water temperature.

Alarm and shutdown system for low oil pressure.

Engine over-speed automatic shutdown device.

Engine failed to start indicator light (over-crank).

Alarm for low coolant level.

A shunt trip and under-voltage trip shall be incorporated to cause the circuit breaker to open simultaneously with any automatic shutdown of the engine.

ix.) Fuel Supply for Engine.

A dual wall sub-base fuel tank shall be supplied with the generator set, which will allow the generator to operate continuously at full load for 60 hours, but shall not exceed 1,000 U.S. gallons. The tank shall be constructed of aluminized steel with all access ports and vents located on the top horizontal surface. The tank shall be pressure and load tested according to U.L. 142 and shall be U.L. listed. The tank shall be capable of supporting the weight of the generator, isolator, and enclosure, and shall have four lifting eyes capable of lifting the entire generator set package. Low level and leak detector float switches shall be provided, both wired to control panel alarm lights, and a tank mounted fuel gauge.

The generator fuel storage tank shall be completely filled with fuel by the Developer before start-up of the lift station.

C.) GENERATOR

i.) Description. The generator shall meet all requirements of NEMA MG-1, Part 22, in design, performance and factory test procedures. The regulator shall be factory wired and tested with the generator. The generator shall have the characteristics and ratings required by paragraph 22.10.

ii.) Excitation System. The generator shall be equipped with a permanent magnet generator (PMG) excitation system. Both the PMG and the rotating brushless exciter shall be mounted outboard of the bearing. The system shall supply a minimum short circuit support current of 300% of the standby rating for 10 seconds. The rotating exciter shall use a three-phase full wave rectifier assembly with hermetically sealed silicon diodes protected against abnormal transient conditions by a multiplate selenium surge protector.

iii.) Construction. The insulation system of both the rotor and stator shall be of NEMA Class H materials and shall be synthetic and non-hygroscopic. Field windings shall be on the rotor, and the rotor core shall be shrunk-fit and keyed to the shaft. The stator winding shall use an optimum pitch design to eliminate harmonics. Units rated above 1500 kW or 601 volts or higher shall be form wound.

The temperature rise of both the rotor and the stator shall be in accordance with the applicable sections of NEMA MG-1-22, BS-5000 part 99, or CSA C22.2, for the type of service intended. The generator shall be self-ventilated.

iv.) **Conduit Box.** Load connections shall be made in the front-end mounted junction box. The generator construction will allow connection to the load through the top, bottom or either side of the junction box.

The conduit box shall contain two compartments: one to house the rotating rectifier and PMG, and the other to house the connection area and regulator. This is to separate the rotating elements from the load connection and voltage regulator adjustments.

v.) **Verification of Performance.** All performance and temperature rise data submitted by the Developer shall be the result of the actual test of the same or duplicate generators. Temperature rise data shall be the result of full load, 0.8 power factor heat runs at the rated voltage and hertz. All performance testing shall be done in accordance with MIL-STD-705 and/or IEEE Standard-115.

vi.) **Efficiency.** The generator efficiency shall be determined in accordance with NEMA MG-1, paragraph 22.44. All test results shall be submitted to the Authority for approval.

D.) VOLTAGE REGULATION

i.) The generator shall be equipped with a voltage regulator to maintain voltage within limits as specified below:

ii.) Stability: 1/2% maximum voltage variation at any constant load from no load to full load.

iii.) Regulation: 1% maximum voltage between no load steady state and full load steady state.

iv.) Transient: 20% maximum voltage dip in most severe motor starting condition.

v.) Transient: 2 seconds maximum voltage recovery time with application or removal of 0.8 P.F. full load.

vi.) The regulator shall be a solid-state type using transistors or SCR's. The unit shall include volts/hertz underspeed protection, 3 phase RMS sensing, and overexcitation protection. The regulator shall also provide loss of sensing protection, regulator current limit, temperature protection and an engine unloading circuit. EMI suppression shall be provided meeting MIL-STD-461B, part 9 standards.

E.) GENERATOR FULL MAIN LINE CIRCUIT BREAKER

i.) A generator main circuit breaker shall be provided. The interrupting capability shall be greater than the generator short circuit capability, but not less than 30,000 symmetrical amperes at 480 volts. The breaker continuous current trip rating shall be selected to provide overload protection for the generator. Main circuit breaker shall have GFCI protection per NEC.

ii.) The breaker shall be provided with a shunt trip device. The generator starting circuit battery system will be used as the power source for the shunt trip circuit. The shunt trip coil voltage shall be suitable for use on the starting circuit.

iii.) The breaker shall include 3 normally open and 3 normally closed auxiliary contacts.

iv.) The breaker shall be a Square D Type MA, or alternate as manufactured by General Electric, Merlin Gerin, Eaton/Cutler-Hammer or alternate acceptable to the Authority

F.) AUTOMATIC START AND STOP CONTROLS

i.) **General Description.** Automatic starting and stopping controls shall be furnished to start the engine automatically when the normal electric power fails or falls below specific limits and to stop the engine automatically after the normal power supply resumes. The signal for starting or stopping the engine shall be from an external auxiliary contact. The controls shall be capable of operating at 50% of normal DC system supplied voltage.

ii.) **Engine Cranking Control.** Crank control and time delay relays shall provide at least four cranking periods. Each cranking period shall be for at least 7 seconds, and the cranking attempts shall be separated by appropriate rest periods. A sensing device shall automatically disconnect the starting circuit when the engine has started. If the

engine has not started at completion of the starting program, the over-cranking signal shall so indicate. The engine starting controls shall be locked out and no further starting attempts shall take place until the over-cranking device has been manually reset.

iii.) **Selector Switch.** A selector switch shall be incorporated in the automatic engine start and stop controls. It shall include an "off" position that prevents manual or automatic starting of the engine, a "manual" or "handcrank" position that permits the engine to be started manually by the pushbutton on the control cabinet and run unloaded; an "automatic" position which readies the system for automatic start or stop on demand of the automatic load transfer switch or a programmed exerciser.

iv.) **Manual Test Operation.** It shall be possible to start the engine manually and run it unloaded by a manual pushbutton on the control cabinet that causes the engine to start, run and stop through the automatic start and stop controls.

G.) INSTRUMENTATION

i.) **Instruments and Controls.** The following engine and generator instruments and controls shall be furnished and installed:

A.C. ammeter
A.C. voltmeter
Voltage adjusting rheostat
Battery Voltage Meter
Governor speed adjusting control
Water temperature gauge
Oil Pressure gauge
Manual start/stop control
Manual-Off-Auto mode switch
Voltmeter/ammeter phase selector switch
Generator "Run" Status Dry Contacts
Common Alarm Dry Contacts
Elapsed time meter
Panel lights
Indicator lights for engine alarm

All wiring and interconnections shall be in accordance with commercial electrical standards.

ii.) **Location.** All of the foregoing instruments, lights and controls shall be mounted in a control panel on the generator set. All instrumentation must be isolated from engine generator set vibration.

iii.) **Panel Design.** All instruments, controls and indicating lights shall be properly identified. All wires shall be individually identified and must agree with wiring diagrams provided.

Terminals on all terminal blocks shall be individually identified.

H.) ACCESSORIES

i.) **Enclosure.** Weatherproof, sound attenuating, outdoor enclosure. 14 gauge steel construction. Includes two (2) single access doors per side. Painted standard alkyd enamel finish. The Authority shall make the determination if the enclosure shall be sound attenuated for a commercial installation or residential installation. The Authority shall also make the determination as to the dBA level of attenuation that shall be required, at each unique site, on a case by case basis. A bench mark of 65 dBA @ 7 meters will be used as a guide. Exhaust roof dress cap, silencer mounting brackets, exhaust system assembly including the above mentioned silencer designed to go inside the enclosure with flex, elbow and rain cap. Painted standard alkyd enamel finish. Oil and water drains are extended to the exterior of the enclosure, each with identifying nameplate.

The enclosure shall be provided with the following electrical accessories:

- Junction boxes for battery charger and jacket water heater connection.
- Connection for low alarm, high alarm, leak alarm, and fuel fill pump switch.

ii.) **Block Heater.** An engine block heater shall be provided to keep the engine coolant at a temperature of 85 degree F with the ambient temperature at the minimum specified in Section 320.34.b.ii. The heater shall be suitable for operation at 120 volts ac, single phase. External only; No internal elements shall be inside the engine.

iii.) **Control Panel Heater.** If needed, a heater shall be provided in the control panel to keep the interior of the panel above 40 degrees F when at the minimum ambient temperature specified in Section 320.34.b.ii. The heater shall be operated by a thermostat, and shall be

suitable for operation at 120 volts ac, single phase. Manufacturers using control panels with modules that are environmentally sealed and that are not subject to moisture and can operate accurately in temperatures of –40 F to 158 F are not required to use control panel heaters.

iv.) Catwalk. All generators sitting on fuel tanks higher than 30 inches above ground must have painted steel or an aluminum "Catwalk" installed all the way around the unit for maintenance purposes.

l.) AUTOMATIC TRANSFER SWITCH

i.) General. The transfer switch shall be rated for total normal and emergency system transfer for use on a 480 or 230 VAC, 3 phase, 4 wire system.

Each automatic transfer switch shall consist of a power transfer module and a control module, interconnected to provide complete automatic operation. The automatic transfer switch shall be mechanically held and electrically operated by a single-solenoid mechanism energized from the source to which the load is to be transferred. The switch shall be rated for continuous duty and be inherently double throw. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal and emergency.

All main contacts shall be of silver composition. The operating transfer time in either direction shall not exceed one-sixth (1/6) of a second.

All contacts, coils, springs and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.

Automatic transfer switches utilizing components of molded-case circuit breakers, contactors, or parts thereof which have not been intended for continuous duty or repetitive load transfer switching are not acceptable.

ii.) Standards. The automatic transfer switch shall conform to the requirements of NEMA Standard ICS-2-447 and Underwriters' Laboratories UL-1008 and shall be UL listed as follows:

- For use in emergency systems in accordance with Articles 700, 701, and 702 of the National Electrical Code.

- Rated in amperes for total system transfer including control of motors, electric discharge lamps, electric heating and tungsten filament lamp loads as referred to in Paragraph 30.9 of UL-1008.

iii.) **Control.** Sensing and control logic shall be solid-state. Interfacing relays shall be industrial control grade plug-in type with dust covers.

All phases of the normal shall be monitored line-to-line. Close differential voltage sensing shall be provided. The pickup voltage shall be field adjustable from 85% to 100% of nominal and the dropout voltage shall be adjustable from 75% to 95% of the pickup value. The transfer to emergency will be initiated upon reduction of normal source to 85% of nominal voltage and retransfer to normal shall occur when normal source restores to 95% of nominal.

The following time delays shall be provided:

- A time delay to override momentary normal source outages. The time delay shall be field adjustable from 0.5 to 6 seconds and factory set at 1 second.

- A time delay on retransfer to normal source. The time delay shall be automatically bypassed if the emergency source fails and normal source is available. The time delay shall be field adjustable from 0 to 30 minutes and factory set at 5 minutes.

- An unloaded running time delay for emergency generator cool down. The time delay shall be field adjustable from 0 to 5 minutes and factory set at 5 minutes.

- A time delay on transfer to emergency. The time delay shall be field adjustable from 0 to 5 minutes for controlled timing of load transfer to emergency, and factory set at zero.

The following features and accessories shall be provided:

- Independent single phase voltage and frequency sensing of emergency source. The pickup voltage shall be adjustable from 85% to 100% of nominal. Pickup frequency shall be adjustable from 90% to 100% of nominal. Transfer to emergency upon normal source failure when emergency source voltage is 90% or more of nominal and frequency is 95% or more of nominal.

- A contact that closes when normal source fails and one that opens when normal source fails, rated 10 Amps, 120V ac.

- A white signal light to indicate when the automatic transfer switch is connected to the normal source. A yellow signal light to indicate when the automatic transfer switch is connected to the emergency source.

- Two auxiliary contacts that are closed when the automatic transfer switch is connected to normal and two auxiliary contacts that are closed when the automatic transfer switch is connected to emergency. Rated 10 Amps, 120 volts, 60 Hz. AC.

- A test switch to momentarily simulate normal source failure.

- Reset switch to manually bypass time delay on retransfer to normal.

- A permissive start/stop feature to provide for start/stop of the generator from a remote site regardless of the presence of normal utility power.

iv.) **Enclosure.** The automatic transfer switch shall be mounted in a NEMA 4X for outdoor installations or a NEMA 1A for indoor non-ventilated installations.

v.) **Tests.** Certified laboratory test data on a switch of the same design and rating shall be provided by the automatic switch manufacturer to confirm the following switching abilities:

a.) Overload and endurance at 480 VAC or 230 VAC per Tables 21.2, 23.1 and 23.2 of UL-1008.

b.) Temperature rise tests after the overload and endurance tests to confirm the ability of the transfer switches to carry their rated current within the allowable temperature limits of the insulation in contact with current-carrying parts.

c.) Withstand current tests per Paragraph 25 of UL-1008 for 100,000 amperes rms symmetrical, at rated voltage and an X/R ratio of 6.6, when used with current limiting fuses.

d.) No welding of contacts. Transfer switch must be

operable by the normal means after the withstand current tests.

e.) Dielectric tests at 1960 volts, rms, minimum after the withstand current test.

f.) The complete automatic transfer switch shall be tested as to ensure proper operation of the individual components and correct overall sequence operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

g.) The complete automatic transfer switch shall be subjected to a dielectric strength test per NEMA standard ICS 1-109.21, after the withstand current test.

h.) The control panel shall meet or exceed the voltage surge withstand capability in accordance with ANSI/IEEE Standard C37.90a, latest edition, and the impulse withstand voltage test in accordance with the proposed NEMA Standard ICS 1-109.

vi.) **Operator's Manual**. Each automatic transfer switch shall be furnished with 3 sets of the operator's manual providing installation and operating instructions.

vii.) **Manufacturer** The automatic transfer switch shall be manufactured by ASCO, Zenith or alternate acceptable to the Authority

J.) INSTALLATION, ASSEMBLY AND TESTING

i.) **Assembly Drawings and Wiring Diagrams.** Copies of installation drawings and complete wiring diagrams and interconnections shall be furnished to the Authority

ii.) **Mounting.** The mounting of the generator set shall be sufficiently rigid to maintain alignment and to minimize the engine and generator stresses. The floor loading shall not exceed 5000 lbs. per sq. ft. A suitable number of spring type, vibration, rubber type, and fiberglass isolators shall be inserted between the engine generator set and the floor.

iii.) **Ventilation Requirements.** The Developer shall submit with his plans an estimate of airflow requirements for cooling

and combustion, plus an estimate of heat rejection of the engine and generator when operating at 100% load. These estimates shall be based on manufacturers data.

iv.) **Acceptance Test.** The extent of testing shall be at the discretion of the Authority. The completed generator set shall be tested at 1.0 P.F. for a period of one hour at full load prior to shipment to the job site. In addition, the generator set supplier shall include in his plan submittal the cost of an on site, full load test (using portable resistive type load banks or building load or combination thereof) for a minimum of four hours in the presence of a representative of the Authority before final acceptance.

K.) MANUFACTURER

The generator set shall be manufactured by 1st Generac, Onan, Katolight, Caterpillar or alternate acceptable to the Authority

322. WASTEWATER TREATMENT PLANTS (PUBLIC AND PRIVATE)

All sanitary sewer treatment facilities that are constructed within the boundaries of Cherokee County, and are located outside of municipalities which have the ability to treat sewage (such as Canton and Woodstock), shall be designed and constructed in accordance with the specifications of the EPD, the Ten States Standards and the Authority. Where requirements conflict, the more restrictive of the requirements shall govern. the Authority shall have the final review authority over the design of the treatment facility. Any revisions to the design made during construction must be approved by the Authority