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SECTION 0 – DEFINITIONS, ACRONYMS, AND FORMAT

This section of the *OJRSA Development Policy* contains definitions, acronyms, abbreviations, and formatting that are specific to this document.

0.1 DEFINITIONS

#67 Stone shall mean crushed stone that is three-fourths of an inch (0.75 in.) or smaller in size.

ARCH D shall mean architectural drawing sizes equaling twenty-four inches by thirty-six inches (24 in. x 36 in.).

Automatic FOG Trap shall mean a FOG Control Device that uses mechanical or electrical means to skim FOG from wastewater.

B10 Life shall mean the time at which ten percent (10%) of units in a population will fail. Alternatively, this is a reliability rating of ninety percent (90%).

Board shall mean the OJRSA Board of Commissioners.

C Factor. See definition for Hazen-Williams Roughness Coefficient.

Capacity, Management, Operations, and Maintenance (CMOM) shall mean a flexible, dynamic plan for utilities to identify and incorporate widely-accepted wastewater industry practices to:

- A. Better manage, operate, and maintain collection systems;
- B. Investigate capacity constrained areas of the collection system; and
- C. Respond to sanitary sewer overflow events.

Commercial Pretreatment Users shall mean customers which are either directly or indirectly connected to the OJRSA that are subject to the requirements to install Special Devices as defined herein.

Contractor shall mean a person or company that undertakes a contract to provide materials or labor to perform a service or do a job on behalf of the OJRSA, including projects that will be owned, operated, and maintained in the future by the OJRSA. *This includes subcontractors of the person or company under contract with the OJRSA.*

Coordinate (or Coordinates) shall mean the following:

- A. When referencing surveying, coordinates are the northing and easting values.
- B. When referencing GPS or GIS, coordinates are the latitude and longitude referencing the geographic coordinate system.

Dental Amalgam Separator shall mean a device designed to capture amalgam particles, such as mercury and other metals, from dental office wastewater through sedimentation, filtration, centrifugation, or a combination of these mechanisms.

Developer shall mean the project owner, including their staff and other designee(s), of a project that is responsible for the purchase, building, management, and/or leasing of a project that affects the OJRSA wastewater conveyance and/or treatment facilities.

Enforcement Mandate shall mean any form of enforceable directive issued against the OJRSA by the State of South Carolina or the United States due to a violation of a law or regulation. These requirements are typically in the form of a Consent Order, Consent Decree, or Administrative Order; however, these may also require that other documents and policies be developed by the OJRSA as part of the Enforcement Action, such as a Work Plan, Capacity Management Operation and Maintenance (CMOM) Plan, etc.

Engineer of Record shall mean a Registered Professional Engineer who seals drawings, reports, and/or documents for a project. The seal shall acknowledge that the EOR prepared, coordinated, or had subordinates prepare under the direct supervision of the EOR, drawings, reports, or documents for a project.

FOG Control Devices shall mean FOG Interceptors, FOG Traps, or other OJRSA approved means of eliminating fats, oils, and grease from the wastewater conveyance system and treatment works.

FOG Generator shall mean any User (as defined in the *OJRSA Sewer Use Regulation*), including Food Service Establishments (FSE), which produces fats, oils, and grease waste. Single-Family Residential locations and Multi-Family Developments with four (4) or less separated living units as stated in SECTION 9 of the *OJRSA Sewer Use Regulation* are not considered a FSE or FOG Generator and will not be subject to the OJRSA FOG Program unless they are preparing food for commercial purposes (catering and other such operations are considered a commercial purpose subject to FSE regulations).

FOG Interceptor shall mean a tank or device so constructed, typically in the ground, as to separate and hold fats, oils, and grease (FOG) from the wastewater in order to reduce the FOG entering the sanitary sewer. FOG Interceptors are commonly referred to as “grease interceptors” or “grease traps”; however, the OJRSA does not consider these to be the same as under-the-sink FOG Traps and shall not be construed as meeting this definition. FOG Interceptors are a minimum of one thousand gallons (1,000 gal) in capacity.

FOG Tee (Influent and Effluent) shall mean a T-shaped pipe fitting extending from the ground surface below grade into the FOG interceptor to a depth allowing recovery (discharge) of the water layer located under the layer of FOG.

FOG Trap shall mean a device placed inside a Food Service Establishment for removal of FOG from the waste stream. These are identified as an “under the sink” reservoir or a “floor trap” which is a small container or tank with baffles designed for inside installation at kitchen fixtures and appliances. These devices shall be connected to a drain immediately following a sink or wash basin. A FOG Trap is often referred to as a “grease interceptor” but should not be confused with a FOG Interceptor as defined by the OJRSA.

Food Service Establishment shall mean any establishment, business, or facility engaged in preparing, serving, or making food available for consumption. Single-Family Residential locations and Multi-Family Developments with four (4) or less separated living units as stated in SECTION 9 of the *OJRSA Sewer Use Regulation* are not considered a FSE or FOG Generator and will not be subject to the FOG requirements unless they are preparing food for commercial purposes (catering operations is considered a commercial purpose subject to FSE regulations) or for other reasons that are defined in regulation or policy. FSEs will include but are not limited to: restaurants, cafeterias, delis, grocery stores, hospitals, hotels, motels, religious organization locations, school kitchens, assisted living facilities, ice cream shops, coffee shops, food courts, butcher shop operations, catering facilities, and Mobile Food Units involved in the preparation of food for nonresidential purposes. A Food Service Establishment can include any facility which cuts, prepares, cooks, fries, bakes, or serves food or which disposes of food-related wastes. Also see definition of FOG Generator.

Full Service Commercial Kitchen shall mean the type of Food Service Establishment that mechanically or hand washes cookware and apparatuses associated with food and drink preparation as well as utensils, cups, plates, etc. used by customers.

Grandfathered shall mean an exemption from the requirements of a section of Policy affecting their previous rights, privileges, uses, or practices.

Hair Trap/Interceptor shall mean a device used to remove hair before it enters the sewer system. Facilities that may be required to install a Hair Trap/Interceptor include, but not limited to, beauty salons, barber shops, animal grooming facilities, and animal hospitals. These devices may be installed on individual sinks or on a common effluent line shared by a number of wash stations.

Hazen-Williams Roughness Coefficient shall mean a factor or value used to indicate the smoothness of the interior of a pipe, which is often stated as a “C Factor.” The higher the C Factor, the smoother the pipe, the greater the carrying capacity, and the smaller the friction or energy losses from water flowing in the pipe. To calculate the C Factor, measure the flow, pipe diameter, distance between two pressure gauges, and the friction or energy loss of the water between the gauges. The formula for C Factor is:

$$C \text{ Factor} = \frac{\text{Flow}}{(193.75 \times \text{Pipe Diameter}^{2.63}) \times \text{Slope}^{0.54}}$$

Where: Flow = gallons per minute (gpm) and Pipe Diameter = feet (ft)

High Voltage shall mean a voltage greater than or equal to four hundred eighty volts (480 V). Below this is considered low voltage.

Intrinsically Safe shall mean electronics that allow for safe operation in hazardous areas by limiting the electrical or thermal energy available for ignition.

Lateral (or Service Lateral). See definition for Sewer Service.

Licensed Architect shall mean a person who is licensed as an architect in the State of South Carolina by the appropriate South Carolina Labor, Licensing, and Regulation board.

Lint Interceptor shall mean a device used to remove lint and other debris from wastewater prior to its discharge to the sewer system. Facilities that may be required to install a Lint Interceptor include, but not limited to, laundromats, hotels/motels, dormitories, and apartment complexes with common laundry facilities shared by users.

Low Voltage shall mean a voltage less than four hundred eighty volts (480 V). At or above this is considered high voltage.

Manifolding of Force Mains shall mean two (2) or force mains from pump stations sharing any portion of a force main.

May is permissive. Shall is mandatory and requires compliance.

Mil (or mils) shall mean a unit of length equal to one one-thousandth of an inch (0.001 in.) and is typically used in measuring thickness.

Mobile Food Unit shall mean a self-propelled or vehicle- or trailer-mounted unit intended to be used as a Food Service Establishment. Mobile Food Units must have an approved location to discharge used fats, oils, and grease waste.

Multi-Family Development shall mean a structure or complex of buildings intended for multiple families to reside in for extended periods of time. Examples include, but are not limited to, apartments, townhomes, condominiums, duplexes/multiplexes, etc. A structure or complex of buildings is also considered to be a Multi-Family Development if it has shared sewer plumbing serving two (2) or more individual living units (e.g., apartments, townhomes, etc.) that is combined prior to connection to the public sewer system. Multi-Family Developments with five (5) or more separate living units shall have FOG Control Devices as stated in the *OJRSA Sewer Use Regulation*.

Oil/Water Interceptor shall mean a tank typically used in low flow drain lines where small quantities of oils, sediment and other liquid contaminants can be removed from wastewater prior to being discharged to the conveyance system or treatment facility. These drain lines may come from a variety of facilities including, but not limited to, covered car washes, parking garages, machine shops, service stations, and manufacturing facilities. These devices may also be referred to as an "oil/water separator" or other such name.

Owner shall mean an individual or entity in possession of title for land, building, or another item. The Owner can be a claimer, controller, holder, homeowner, householder, landowner, landlord, lessor, occupier, person holding ownership on record, possessor, property owner, proprietor, record-holder retainer, or title holder.

Permittee shall mean the name as listed on a permit as issued by OJRSA.

Plaster Interceptor shall mean a device used to remove plaster from wastewater prior to discharge into the sewer system. Facilities that may be required to install a Plaster Interceptor include, but not limited to, dental offices or locations where arts and crafts are performed (e.g., a school art room). These devices may be installed on individual sinks or on a common effluent line shared by a number of sinks.

Policy shall mean the *OJRSA Development Policy* unless explicitly stated otherwise.

Private Residential Kitchen shall mean a Single-Family Residential home or dwelling in which food is prepared or served for individual and family consumption only. Catering and Mobile Food Unit vendors are considered Single Service Commercial Kitchens.

Private Sewer shall mean a sewer which is not owned by a public body. These privately-owned sewers also include sewer services (“laterals” or “service laterals”). It is not a public sewer.

Project Owner. See definition for Developer.

Public Main shall mean a new collection system of sewer lines, manholes, and associated facilities typically serving new areas that are either currently being developed or are for future development.

Public Sewer shall mean a trunk or transportation sewer line or sewer facilities which is owned and controlled by the OJRSA, or a collection of lateral lines or adjunct facilities owned and controlled by Satellite Sewer Systems that are connected to the OJRSA in any way, including by passing through another Satellite Sewer System.

Publicly Owned Treatment Works shall mean treatment facilities as defined by Section 212 of the Federal Water Pollution Control Act (also known as the Clean Water Act) and amendments. (33 USC §1251 et seq.). This definition includes any devices or systems used in the collection, storage, treatment, recycling, and reclamation of sewage or industrial wastes of a liquid nature, and any conveyance systems that transport wastewater to a treatment plant. This definition does not include pipes, storm sewers, or other conveyances not connected to a facility providing transportation and/or treatment for wastewater.

Record Drawing shall mean the final plan set signed and sealed by the Registered Professional Engineer of Record. These are sometimes referred to as “as-built” drawings or plans.

Registered Professional Engineer shall mean a person who is registered as a professional engineer in the State of South Carolina by the appropriate South Carolina Labor, Licensing, and Regulation board. However, a professional engineer, registered in any state is deemed to be a “Registered Professional Engineer” within the meaning of this standard when approving designs of equipment or materials to be used in interstate commerce.

Sand/Oil Interceptor shall mean an appropriately sized in-ground tank designed to capture dirt, sand, sweepings, minor petroleum spills, etc. from car washes, vehicle maintenance facilities, and other service and maintenance facilities to prevent these pollutants from entering the wastewater conveyance system and treatment facilities. These devices may also be referred to as a “grit interceptor,” “sand trap,” or other such name.

Sanitary Wastewater (or Sanitary Sewer or Sanitary Waste). See definition for Wastewater.

Satellite Sewer System, which may also be referred to as a Subdistrict, shall mean a sewer system that is owned or operated by one (1) person, political subdivision, company, or other such party (all collectively referred to as “party” in this definition) that discharges to a system that is owned or operated by a different party, the operation and maintenance of which are covered in SC R61-9.610. These systems may be publicly or privately owned. Satellite Sewer Systems depend on a separate party for final wastewater treatment and discharge and include systems approved under SC R61-9.505.8. It does not mean a system that is monitored by supervisory control and data acquisition (SCADA) systems.

Basically, every wastewater system that is not covered by either a NPDES Permit or a State Land Application Permit is a Satellite Sewer System. The group of systems that are covered by this Regulation and the Satellite Sewer System General Permit as issued by SCDES (or other such permit issued by SCDES and/or EPA) are those that would require a construction permit under SC R61-67 if built today. There are two (2) basic situations that would normally apply:

- A. Sewers serving more than one building (apartments, subdivisions, industrial complex, etc.)
- B. Pretreatment systems at industries

There are some exemptions for a construction permit if the system is defined as a service connection in SC R61-67; however, the OJRSA may, at its discretion, issue an operating or other such permit to such facilities.

SC811 shall mean the Palmetto Utility Protection Service (doing business as South Carolina 811 or “PUPS”) operates under the Underground Facility Damage Prevention Act of South Carolina to protect buried facilities and keep excavators and the general public safe.

Service Area shall mean all areas served or capable to be served by the OJRSA as recognized by the appropriate governing body(ies).

Sewer Master Plan shall mean a document adopted by the Board that has been developed for the OJRSA and is used by agency staff, Board members, Satellite Sewer Systems, government agencies, and developers for one (1) or more of the following purposes:

- A. To understand and address deficiencies in the Sewer System;
- B. Repair aged sewer infrastructure;
- C. Expand the system;
- D. Address growth-related pressures on the system; and/or
- E. Plan for the future.

Sewer Master Plans may include the entire OJRSA Service Area or smaller portions within (e.g., Central Oconee County, I-85 corridor, specific topographical or pump station basin, etc.) and usually assess periods ranging from five (5) to twenty (20) years, although these can vary. Sewer Master Plans may also be referred to as a “sewer basin plan” or other such name that may be commonly used throughout the wastewater utility sector.

Sewer Service (aka “Lateral” or “Service Lateral”) shall mean piping or plumbing that serves individual properties and connect a privately-owned sewer system and plumbing (the portion located on private property) to the public sewer line.

Sewer System shall mean a Satellite Sewer System, Public Sewer, Private Utility, and/or Private Sewer.

Shall is mandatory and requires compliance. May is permissive.

Single-Family Residential shall mean an independent residential structure that sits on its own land and is intended to be used as a single unit with unshared utilities. Includes traditional detached homes, mobile homes, Multi-Family Developments (if units have individual sewer plumbing that is not combined prior to connection to the public sewer system), and recreational vehicle (“RV”)/camper site with an individual Water Meter and sewer connection.

Single Service Commercial Kitchen shall mean the type of Food Service Establishment that mechanically or hand washes cookware and apparatuses associated with food and drink preparation *but does not wash the utensils, cups, plates, etc. used by customers as all these items are disposable or are for food consumption offsite.*

Short-Term Wastewater Generator shall mean developments where wastewater flow is concentrated during only a fraction of a twenty-four (24) hour period, such as at a school or church. This flow would typically take place in a single daily period of six (6) hours or less per twenty-four (24) hours.

SJOW Cable shall mean junior severe service cable with voltage rating of three hundred volts (300 V), oil-resistant outer jacket, and weather and water resistant (for indoor and outdoor use).

South Carolina Department of Environmental Services (SCDES) shall mean the government agency, or its successor agency, responsible for protecting the State of South Carolina’s air, land, and water resources as authorized under multiple state and federal laws. Prior to July 1, 2024, the agency responsible for these functions was the South Carolina Department of Health and Environmental Control. (SCDES is to supersede SCDHEC on July 1, 2024.)

South Carolina Department of Health and Environmental Control (SCDHEC) see definition for South Carolina Department of Environmental Services.

Special Devices shall mean, at a minimum, FOG Control Devices, Dental Amalgam Separators, Hair Trap/Interceptor, Lint Interceptor, Plaster Interceptor, Oil/Water Interceptors, and Sand/Oil Interceptors.

Springline shall mean the horizontal line at the midpoint of the vertical axis of the pipe.

Surety Bond shall mean a guarantee by a surety company to pay the OJRSA if the second party (typically the contractor) fails to meet its obligations. These bonds involve three (3) parties:

- Principal – Company/person who must make good on an obligation
- Obligee – Company/person who needs a guarantee that principal will perform
- Surety – Issuer of surety bond guaranteeing that the principal will meet their obligation

Ten States Standards shall mean *Recommended Standards for Wastewater Facilities*, latest edition as published by the Wastewater Committee of the Great Lakes - Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers.

Thermoplastic shall mean any plastic polymer material that becomes pliable, moldable, or fusible when heated and solidifies upon cooling.

Unit Contributory Loadings shall mean such loadings on the system as shall from time to time be calculated and published by SCDHEC/SCDES as *Unit Contributory Loadings to All Domestic Wastewater Treatment Facilities* (SC Regulation 61-67 Appendix A).

Ura Foam Polyurethane shall mean a common foam insulation injected into walls.

User shall mean any person or entity (Residential, Nonresidential, Commercial, Industrial, Institutional, Nonsignificant Industrial, and/or other) who directly or indirectly discharges, causes, or permits the discharge of wastewater to the POTW. See OJRSA Sewer Use Regulation for further information and definitions of these User types.

Wastewater shall mean the combination of the liquid and water-carried wastes from residences, commercial buildings, industrial plants, institutions, and other locations, including cooling water, holding tank waste, and infiltration and inflow.

- A. Sanitary wastewater shall mean the combination of liquid and water carried wastes discharged from toilet and other sanitary plumbing facilities.
- B. Industrial wastewater shall mean a combination of liquid and water carried wastes discharged from any industrial establishment and resulting from any trade or process carried on in that establishment and shall include the wastes from pretreatment facilities and cooling water.

Waterstop shall mean a material embedded in the concrete, with the singular purpose to obstruct the passage of water through the joint.

0.2 SYMBOLS, ACRONYMS, AND ABBREVIATIONS

°: Degrees (can indicate a unit of temperature or measure of angle)

°C: Degrees Celsius (unit of temperature)

°F: Degrees Fahrenheit (unit of temperature)

>: Greater Than

≥: Greater Than or Equal To

<: Less Than

≤: Less Than or Equal To

μm: Micrometer (unit of length)

μΩ: Microohm (unit of resistance)

-x: Negative (where "x" is a number)

%: Percent

±: Plus or Minus

+x: Positive (where "x" is a number)

§: Section

A: Ampere (unit of electric current)

AASHTO: American Association of State Highway and Transportation Officials

AC: Alternating Current

ACI: American Concrete Institute

Ahr: Ampere Hours (unit of electric charge)

AISI: American Iron and Steel Institute

aka: Also Known As

ANSI: American National Standards Institute

APWA: American Public Works Association

AREA: American Railway Engineering Association

ARV: Air Release Valve

ASTM: American Society for Testing and Materials
(aka ASTM International)

AWG: American Wire Gauge

AWS: American Welding Society

AWWA: American Water Works Association

C Factor: Hazen-Williams Roughness Coefficient

CCTV: Closed-Circuit Television

CFM: Cubic Feet per Minute (unit of flow)

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CMOM: Capacity, Management, Operations, and Maintenance	inHg: Inches of Mercury (unit of pressure)
CPVC: Chlorinated Polyvinyl Chloride	in.: Inch (unit of length)
CSA: Canadian Standards Association	Inc.: Incorporated
d/D: Depth of Flow Relative to Diameter of Pipe	IP: Internet Protocol
dB: Decibels (unit of sound level)	IPS: Iron Pipe Size
dBA: A-weighted Decibels (unit of sound level)	IR: Infrared
DC: Direct Current	ISO: International Organization for Standardization
DI: Ductile Iron	kA: Kiloampere (unit of electric current)
DIP: Ductile Iron Pipe	lb/yd ³ : Pounds per Cubic Yard (unit of mass)
DR: Dimension Ratio	lb: Pound or Pounds, as appropriate (unit of mass)
DWV: Drain, Waste, and Vent	LCD: Liquid Crystal Display
e.g.: Exempli Gratia, Latin for "for example"	LED: Light Emitting Diode
EOR: Engineer of Record	LF: Linear Feet
EPA: United States Environmental Protection Agency or any successor agency	m: Meter (unit of length)
EPDM: Ethylene Propylene Diene Monomer	mA: Milliampere (unit of electric current)
ETL: Electrical Testing Laboratories	MOV: Metal Oxide Varistor
FCC: Federal Communications Commission	mph: Miles per Hour (unit of speed)
FCD: FOG Control Device	ms: Milliseconds (unit of time)
FM: Factory Mutual	MSL: Mean Sea Level
FOG: Fats, Oils, and Grease	MSS: Manufacturers Standardization Society
fpm: Feet per Minute (unit of flow)	MTBF: Mean Time Between Failure
fps: Feet per Second (unit of flow)	MΩ: Megaohm (unit of resistance)
FPVC: Fusible Polyvinyl Chloride	NACE: National Association of Corrosion Engineers
FS: Federal Standard	NEC: National Electric Code
FSE: Food Service Establishment	NECA: National Electrical Contractors Association
ft: Foot or Feet, as appropriate (unit of length)	NEMA: National Electrical Manufacturers Association
ft ² : Square Foot or Square Feet, as appropriate (unit of area)	NESC: National Electric Safety Code
ft-lb: Foot-pounds (unit of torque)	NETA: National Electrical Testing Association
gal: Gallon (unit of volume)	NFPA: National Fire Protection Association
GFI: Ground Fault Interrupters	NIST: National Institute of Standards and Technology
GFPE: Ground Fault Protection Equipment	NOAA: National Oceanic and Atmospheric Administration or any successor agency
GIS: Geographic Information System	NPCA: National Precast Concrete Association
gpd: Gallons per Day (unit of flow)	NPT: National Pipe Threads
gpm: Gallons per Minute (unit of flow)	NSF: National Science Foundation
GPS: Global Positioning System	O&P: Operations & Planning
HART: Highway Addressable Remote Transducer Protocol	OCPD: Overcurrent Protection Device
HDD: Horizontal Directional Drill	OD: Outside Diameter
HDPE: High Density Polyethylene	OJRSA: Oconee Joint Regional Sewer Authority
HMI: Human-Machine Interface	OPC: Object Linking and Embedding for Process Control
hp: Horsepower (unit of power)	OSB: Oriented Strand Board
Hz: Hertz (unit of frequency)	OSHA: Occupational Health and Safety Administration or any successor agency
IAPMO: International Association of Plumbing and Mechanical Officials	oz: Ounce (unit of mass or volume, as appropriate)
IBC: International Building Code	PDF: Portable Document Format
ICRI: International Concrete Repair Institute	PDI: Plumbing and Drainage Institute
IEEE: Institute of Electrical and Electronics Engineers	PE: Polyethylene
in./ft: Inches per Foot (unit of distance)	PFA: Perfluoroalkoxy
	PLC: Programmable Logic Controller
	POTW: Publicly Owned Treatment Works

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psf: Pounds per Square Foot (unit of pressure)
psi: Pounds per Square Inch (unit of pressure)
psig: Pounds-per-Square-in-Gauge (unit of pressure)
PTFE: Polytetrafluoroethylene
PVC: Polyvinyl chloride
PVCO: Molecularly Oriented Polyvinyl Chloride
rpm: Revolutions per Minute (unit of speed)
RTU: Remote Terminal Unit
SC: South Carolina
SCADA: Supervisory Control and Data Acquisition
SCCR: Short Circuit Current Rating
SCDES: South Carolina Department of Environmental Services or any successor agency
SCDHEC: South Carolina Department of Health and Environmental Control, which is to be succeeded by SCDES on July 1, 2024
SCDHEC/SCDES: South Carolina Department of Health and Environmental Control or South Carolina Department of Environmental Services (as appropriate)
SCDOT: South Carolina Department of Transportation or any successor agency
SDR: Standard Dimension Ratio
SDS: Safety Data Sheet
sec.: Second (unit of time)
SMS: Short Message Service
SF: Service Factor
SJOW: S-Service Cord, J-Junior Service Cord, O-Oil Resistant Outside Jacket, and W-Weather/Water Resistance
SPD: Surge Protection Device
SSPC: Society for Protective Coatings
SST: Stainless Steel Type
STWG: Short-Term Wastewater Generation
SUR: *OJRSA Sewer Use Regulation*
TBD-CBCB: To Be Determined on Case-by-Case Basis
TCP: Transmission Control Protocol
TDH: Total Dynamic Head (unit of pressure)
TIF: Telephone Influence Factor
TLS: Transport Layer Security
TW: Thermoplastic Water-Resistant
UDP: User Datagram Protocol
UF: Underground Feeder Cable
UI: User Interface
UL: Underwriters Laboratories
USC: United States Code
USE: Underground Service Entrance Cable
VAC: Volts Alternating Current (unit of current pressure)
VDC: Volts of Direct Current (unit of current pressure)

VFD: Variable Frequency Drive
VOC: Volatile Organic Compound
W: Watts (unit of power)
WG: Water Gauge
WPCF: Water Pollution Control Federation

0.3 DOCUMENT FORMAT

This manual contains fonts and styles that mean certain things, including points of emphasis or reference other sections or materials. Below is a list of the types used within this manual and what it represents when encountered in the *OJRSA Development Policy*.

BOLD RED CAPITAL LETTERS	Important point of emphasis
<i>Italic 'Cambria Math' Font</i>	Mathematic or chemistry formula
<u>Dashed Underline</u>	Name of a form to use for documenting a task referenced in the document
<i>Italics</i>	Title of books, manuals, and other documents
MIX-SIZED CAPITAL LETTERS	Name of sections or appendices in a book, manual, or other document
<u>Underlined Blue Font</u>	Hyperlink to section within the document or website
<u>Underlined Italics</u>	A note of caution or warning

0.4 REVISION HISTORY

AS THIS DOCUMENT IS AN EXTENSION OF THE OJRSA SEWER USE REGULATION AND OTHER OJRSA POLICIES AS APPROVED BY THE BOARD OF COMMISSIONERS. CURRENT AND ALL PREVIOUS EDITIONS MUST BE MAINTAINED IN ACCORDANCE WITH THE SEWER USE REGULATION DOCUMENT AS STATED IN THE OJRSA RECORDS RETENTION POLICY.

Revision Number	Date	Description of Changes
0000	09/2005	Initial issue of document
0001	05/06/2024	Comprehensive policy update adopted by <i>OJRSA Resolution 2024-09</i>

SECTION 1 – POLICY AS REGULATION AND ADMINISTRATIVE ITEMS

1.1 AUTHORITY AND ADOPTION

1.1.1 Adoption

The *OJRSA Development Policy* (Policy) shall become effective immediately upon adoption in accordance with OJRSA Resolution 2024-09.

1.1.2 Non-substantive Changes to Policy

Certain portions of this Policy, such as additions and/or corrections to internet addresses and links, illustrations, referenced forms, referenced standards (SECTION 7), creation or modification of forms (SECTION 8), standard details (SECTION 9), changes to APPENDIX A and APPENDIX B, and as noted elsewhere within may be updated as necessary by the OJRSA Executive Director without being considered a substantive change to this Policy. Non-substantive changes shall not be documented in the Revision History table (SECTION 0.4).

1.2 APPLICABILITY

The *OJRSA Development Policy* applies to all projects on the OJRSA system as follows:

- A. If a public main is to be owned by OJRSA, all sections shall apply.
- B. If a public main extension is to serve a Satellite Sewer System and will connect directly to OJRSA infrastructure, applicable sections associated with the direct connections shall apply.
- C. If OJRSA agrees to perform contract operations and maintenance (O&M) service for an Owner of a Satellite Sewer System, then all sections must apply from the date of the executed contract.
- D. All Commercial Pretreatment Users shall comply with SECTION 6 and other sections of this policy, as appropriate.
- E. If a connection shall only serve one (1) property and it is not a Satellite Sewer System, then it is considered a service lateral extension. Applicable sections governing service laterals shall apply if:
 1. It connects directly to OJRSA, or
 2. It is in a system that will be operated and maintained by contract as stated in paragraph C of this Section.

1.3 SUBSTITUTIONS

The OJRSA Executive Director, or his/her designee, at his/her sole discretion shall have the right to:

- A. Substitute equipment and materials that are stated in Preferred Manufacturers as listed throughout this Policy for all equipment and materials when it is deemed to be in the best interest of the OJRSA (such as when a make/model is no longer produced, supply chain issues causing extreme delays, performance issues, etc.).
- B. Allow for alternate calculating methods determining appropriate sizes for tanks, vessels, Special Devices, etc. when this Policy, the OJRSA Sewer Use Regulation, and/or other OJRSA-approved policies and procedures require devices that could be detrimental to the operation of a facility's private sewer system or that of the OJRSA or Satellite Sewer System. A Registered Professional Engineer serving as a consultant of the OJRSA or the Executive Director shall approve all alternate calculations.
- C. All substitutions described in this section and elsewhere in this Policy must be authorized in writing by the OJRSA. Decisions shall be based on what is in the best interest of the OJRSA.
- D. **THE AUTHORIZATION TO ALLOW FOR SUBSTITUTIONS SHALL BELONG SOLELY TO THE OJRSA AND ARE NOT TO BE INFLUENCED BY THE DEVELOPER OR THEIR REPRESENTATIVES.**

1.4 ITEMS NOT ADDRESSED WITHIN THIS POLICY

The OJRSA Executive Director, or his/her designee, shall have the discretion to decide upon equipment, construction and/or design methods, and other items not addressed within this Policy. The OJRSA may make these decisions with or without consulting the agency's engineer of choice or other sources of counsel as appropriate. Decisions shall be based on what is in the best interest of the OJRSA. **THIS DECISION SHALL BELONG SOLELY TO THE OJRSA AND IS NOT TO BE INFLUENCED BY THE DEVELOPER OR THOSE REPRESENTING THEM.**

1.5 APPEALS

- A. Items as stated within this Policy can be appealed to the OJRSA Board of Commissioners via the agency's standing Operations & Planning (O&P) Committee by requesting that OJRSA Administration add the matter to an O&P Committee meeting agenda. Dates of the meetings can be found on the OJRSA website (www.ojrsa.org) but it is recommended that the developer filing for appeal contact the OJRSA office by phone at 864-972-3900 to confirm meeting dates and times. *Developers requesting a variance shall attend all meetings to present their case for appeal and address questions and concerns from Commissioners and OJRSA staff; however, attending the meetings is not a substitute to submitting a written appeal as stated above.*
- B. Requests for appeals must be received no less than five (5) business days prior to the upcoming meeting and must be in writing to:
- Oconee Joint Regional Sewer Authority
ATTN: Engineering
623 Return Church Road
Seneca, South Carolina 29678
info@ojrsa.org
- C. If the developer's request is approved by the O&P Committee, then it will proceed to the OJRSA Board of Commissioners at the next scheduled meeting for consideration. The decision made by the Board of Commissioners shall be final.

END OF SECTION 1

SECTION 2 – GENERAL REQUIREMENTS

2.1 GENERAL

- A. This submittal and approval process is applicable to all developments requiring service from OJRSA and are based on local, state, and federal environmental and health requirements as well as the requirements of OJRSA.
- B. No deviation from these standards will be accepted without prior written consent from the OJRSA.
- C. Design and construction of all wastewater systems shall be in accordance with OJRSA standards.
- D. No wastewater system located outside the boundaries of the OJRSA Service Area will be considered for operation and maintenance by OJRSA without the approval of the OJRSA Board. There may also be other state and local laws and/or agreements that exist that shall require compliance prior to the OJRSA agreeing to own, operate, and/or maintain a system outside of its Service Area.
- E. No application will be accepted and no wastewater system shall be put into service prior to the receipt of all applicable fees, approved project closeout documents, and a South Carolina Department of Health and Environmental Control or South Carolina Department of Environmental Services (SCDHEC/SCDES) final Permit to Operate.
- F. Wastewater systems to be operated and maintained by OJRSA must be constructed by an OJRSA-approved contractor.
- G. All connections to existing wastewater systems owned and operated by OJRSA must be inspected and approved by OJRSA. Any repairs required to conform with OJRSA requirements must be performed at the developer or User's expense prior to sewer service commencing.
- H. Engineers, developers, and others involved with new projects are advised to schedule an appointment and meet with OJRSA to review plans and coordinate projects with OJRSA's long-term master plans. Contact the OJRSA at 864-972-3900 to schedule an appointment.
- I. As part of the project review process, OJRSA will review plans for compliance with the Commercial Pretreatment Users section of this Policy. Facilities that utilize Special Devices to remove prohibited items from the sewer prior to connection with a POTW shall comply with all requirements of the *OJRSA Sewer Use Regulation* and SECTION 6 of this Policy.
- J. The OJRSA requires plans and project proposals to be submitted in electronic format. Project submittals for review can be sent to OJRSA at engineering@ojrsa.org. If a developer does not have the ability to submit plans electronically, call the Engineering Department at 864-972-3900 for instructions on how to provide the necessary information.
- K. Refer to the *OJRSA Sewer Use Regulation (SUR)* for additional information. The SUR can be found on the OJRSA Resources web page at www.ojrsa.org/resources.
- L. All master plans, construction documents, and record drawings shall be created with a goal of seamless integration into the GIS system at the completion of the project as documented in SECTION 2.10 of this manual.

2.2 COMPLIANCE WITH SEWER MASTER PLANS AND REGULATORY REQUIREMENTS

As part of the project review process, OJRSA will review plans for consistency with any OJRSA Board approved Sewer Master Plan(s) (see APPENDIX A) and/or regulatory requirements imposed by SCDHEC/SCDES and EPA (e.g., changes in regulations; Enforcement Mandates; Capacity, Management, Operations, and Maintenance (CMOM) Plan; etc.) (see APPENDIX B). All private and public¹ development that requires extensions and/or improvements to the existing wastewater conveyance system that serves the OJRSA and its Satellite Sewer Systems shall make all reasonable attempts to address the consistency of their project with all applicable Sewer Master Plan(s) as part of the submittal to OJRSA.

2.3 FEES

- A. The fee(s) due are based on the date of when the project is approved as stated in SECTION 2.7 and shall use the fees in place as of that date.

¹ To include Satellite Sewer Systems served by OJRSA.

- B. The current *OJRSA Schedule of Fees* can be found on the OJRSA Resources web page at www.ojrsa.org/resources.
- C. OJRSA fees are subject to change over time as approved by the OJRSA Board of Commissioners.

2.4 SEWER AVAILABILITY, CAPACITY APPROVAL, AND REQUEST FOR SERVICE

- A. Hydraulic modeling analysis (aka “downstream impact assessment”) is required for potential projects that meet certain conditions to determine the impact a project will have on the existing wastewater conveyance system. The OJRSA’s acceptable level of service for its hydraulic model is for it to indicate that no surcharging occurs any closer than one foot (1 ft) below the rim elevation level of any manhole downstream of the connection point with its system. The hydraulic model will use a two (2) year storm event as identified by the current NOAA Precipitation Series for the nearest location to where the project shall be constructed.
 - 1. Projects requiring downstream impact modeling are all those for new, upsized, or changes in developments that:
 - (a) Will increase flow by at least ten thousand gallons (10,000 gal) per day, *or*
 - (b) Are in areas of concern within the sewer system as identified in the current version of the OJRSA hydraulic model or known areas of concerns based on field observations and staff knowledge of the system, regardless of the proposed or potential wastewater volume associated with the potential.
 - 2. When a project meets either of the criteria stated above, then it is necessary for the developer to complete and submit the Downstream Wastewater Modeling Analysis Request form to OJRSA to initiate the request. The form is available at www.ojrsa.org/resources or in SECTION 8 of this Policy. The owner of the parcel where the development is to take place is responsible for paying for the downstream impact assessment fees prior to the information being provided to the owner or developer. The payment of fees is required whether it is determined there is capacity in the OJRSA conveyance system or not.
 - 3. The determination as to whether the OJRSA has capacity within its system is made by the OJRSA’s hydraulic modeling consultant. **THE DECISION ABOUT WHETHER TO ALLOW A PROJECT TO BE CONSTRUCTED IS BASED ON THE OJRSA CONSULTANT’S RECOMMENDATION AND OJRSA STAFF, BOTH OF WHICH TAKE INTO ACCOUNT REGULATORY REQUIREMENTS, BEST ENGINEERING AND OPERATING PRACTICES, AND KNOWN CONDITIONS AND ISSUES WITHIN THE OJRSA WASTEWATER CONVEYANCE SYSTEM. THIS CAN BE APPEALED TO THE OJRSA BOARD OF COMMISSIONERS AS STATED IN SECTION 1.5.**
 - 4. Expiration of Downstream Assessment Results
 - (a) The results of the analysis are valid for one hundred eighty (180) calendar days from the day of receipt from the OJRSA’s engineer unless a separate developer interested in building within the same sewer basin submitted their request for the downstream assessment after the initial project submitted but received their SCDHEC/SCDES Permit to Construct their wastewater system prior to initial project developer. If this is the case, the first developer will need to have the downstream assessment performed again at their expense.
 - (b) If the project fails to receive their SCDHEC/SCDES Permit to Construct at the end of the one hundred eighty (180) calendar day period, then an additional assessment will be necessary as hydraulic conditions in the system may have changed. This assessment must be performed at the developer’s expense. The OJRSA Executive Director or his/her designee may waive this requirement under certain circumstances.
- B. OJRSA will review applications for proposed developments and issue a Conditional Acceptance for Treatment and/or Conveyance letter once the design of applicable features that may impact the POTW is found to be in compliance with the SUR and all permits and payment of fees have been completed. This letter will remain valid for a maximum of one hundred eighty (180) calendar days from the date that it was issued.
- C. Any significant modifications to the proposed development after a Conditional Acceptance for Treatment and/or Conveyance letter is issued by the OJRSA will require submission of a new application. Besides additional plan reviews being necessary, an additional hydraulic modeling assessment may be required if there is

potential the development will discharge more flow than was originally reviewed.

2.5 OWNERSHIP

2.5.1 Easements

- A. Applicable Details and Documents
 - 1. Details
 - (a) D001 EASEMENT GRADING
 - (b) D034 STEEL DOUBLE GATE FOR EASEMENTS
 - 2. Documents – Standard Easement Agreement (see SECTION 8)
- B. Permanent sewer easements shall be established for all gravity sewer and force mains not installed in a dedicated road right-of-way from which an encroachment permit cannot be obtained from the owner of the road. Sewer infrastructure installed in a road right-of-way must be approved by South Carolina Department of Transportation (SCDOT), and/or the appropriate City/County as applicable, in addition to OJRSA.
- C. A permanent sewer easement conforming to these requirements shall be established for the sewer main even when it is overlaid on an existing easement for another utility.
- D. Where vehicular access to perform maintenance or respond to emergencies is not possible (either due to obstructions, waterways, grade, etc.), a separate permanent access easement shall be provided. This easement shall be of an adequate width in order for the OJRSA and its contractors to safely access the site with heavy equipment and other equipment necessary to perform maintenance and repairs.
- E. All permanent sewer and access easements shall be recorded with the county Register of Deeds.
- F. Grades across permanent and access easements shall be as added as appropriate to Detail D001.
- G. Easements shall be grassed and clear of trees and debris.
- H. Obstructions and Objects Within an Easement
 - 1. Asphalt paths, concrete sidewalks, roads, parking lots, grass, shrubs, crops, and other types of plants whose natural height does not exceed three feet (3 ft) are permitted within the easement limits. Maintenance for these items is the responsibility of the property owner or homeowner's association as applicable. If a row crop is to be planted that will exceed three (3) feet, such as corn, then the property owner will need to obtain written authorization from the OJRSA prior to planting.
 - 2. Obstructions within, below, or above any easement (e.g., trees, buildings, fences, building overhangs, building footers, lighting, power lines, signage, etc.) which may limit access to or use of the entire easement are not permitted within the easement limits. If installed improperly, such obstructions (including, but not limited to, those described above) are at risk of damage and subject to removal as required to perform maintenance or gain access to a site.
 - 3. If trees are planted in close proximity to the sewer easement, OJRSA will require root barrier protection to be installed. **TREES CANNOT BE PLANTED WITHIN THE EASEMENT, EVEN WITH A ROOT BARRIER.**
 - 4. Fences
 - (a) Fences are not permitted to be parallel to the sanitary sewer line within the sanitary sewer easement.
 - (b) Fences are not permitted to cross the sanitary sewer line without written consent from OJRSA. If OJRSA allows fencing to be placed within the sanitary sewer easement, two (2) six foot (6 ft) wide gates are required (or one (1) twelve foot (12 ft) wide gate) and the OJRSA shall provide a lock for their use. The property owner may also install a lock; however, the installation of their lock cannot be done in such a way as to prevent OJRSA from opening its lock and accessing the site.
 - (c) The center of the gates shall match the center of the sanitary sewer easement. Refer to Detail D034.
- I. OJRSA will not assume any responsibility for damage to utilities or other items placed within the easement. Once the easement is turned over to OJRSA, OJRSA has the legal authority to have any obstruction removed

without advanced notice to the property owner. All costs incurred to remove the obstruction may be transferred to the property owner.

- J. Any existing easements shall be shown on the plans or exhibits prepared by the applicant's engineer for the Project Closeout Checklist submittal package (SECTION 8). The easement shall include the Deed Book and page number of the recorded instrument. Any restrictive clauses as to the use of the easement shall be noted on the plan adjacent to the specific easement. Examples of restrictive clauses may include but are not limited to:
 - 1. Utility purposes (e.g., gas, electric, telephone, water) only;
 - 2. Drainage purposes only;
 - 3. Sanitary sewer purposes only;
 - 4. Access purposes for property owner only.
- K. Easement Width
 - 1. Refer to Detail D001 for general easement or right-of-way dimensions.
 - 2. Exhibits and record drawings prepared for the Project Closeout submittal package must show permanent easements, including those for ingress/egress, along the sanitary sewer line as constructed. This includes easements that extend outside of a road right-of-way.
 - 3. Width of temporary construction easements (taking into account the width of the permanent easement) shall not be less than fifty feet (50 ft) without written OJRSA approval.
 - 4. Edge of easement should not be less than ten feet (10 ft) from any building, building footer, permanent structure, or stormwater impoundments.
 - 5. Wastewater gravity lines and force mains may be placed in the same easement. Each respective line must be laid with a minimum of ten feet (10 ft) of horizontal separation between the inside edge of the pipes. The width of the easement shall be increased such that there is no less than ten feet (10 ft) of separation between the centerline of the pipe and the edge of the easement.
 - 6. OJRSA reserves the right to increase the width of any easement during the dedication process if conditions requiring such changes arise.
- L. Easement Agreement: The Applicant's Engineer shall be responsible for completing the Standard Easement Agreement, which will serve as a transfer of the easement from the developer to OJRSA. The developer shall fill out the agreement using the OJRSA Standard Easement Agreement document (refer to SECTION 8).

2.5.2 Public Sewers and Pump Stations

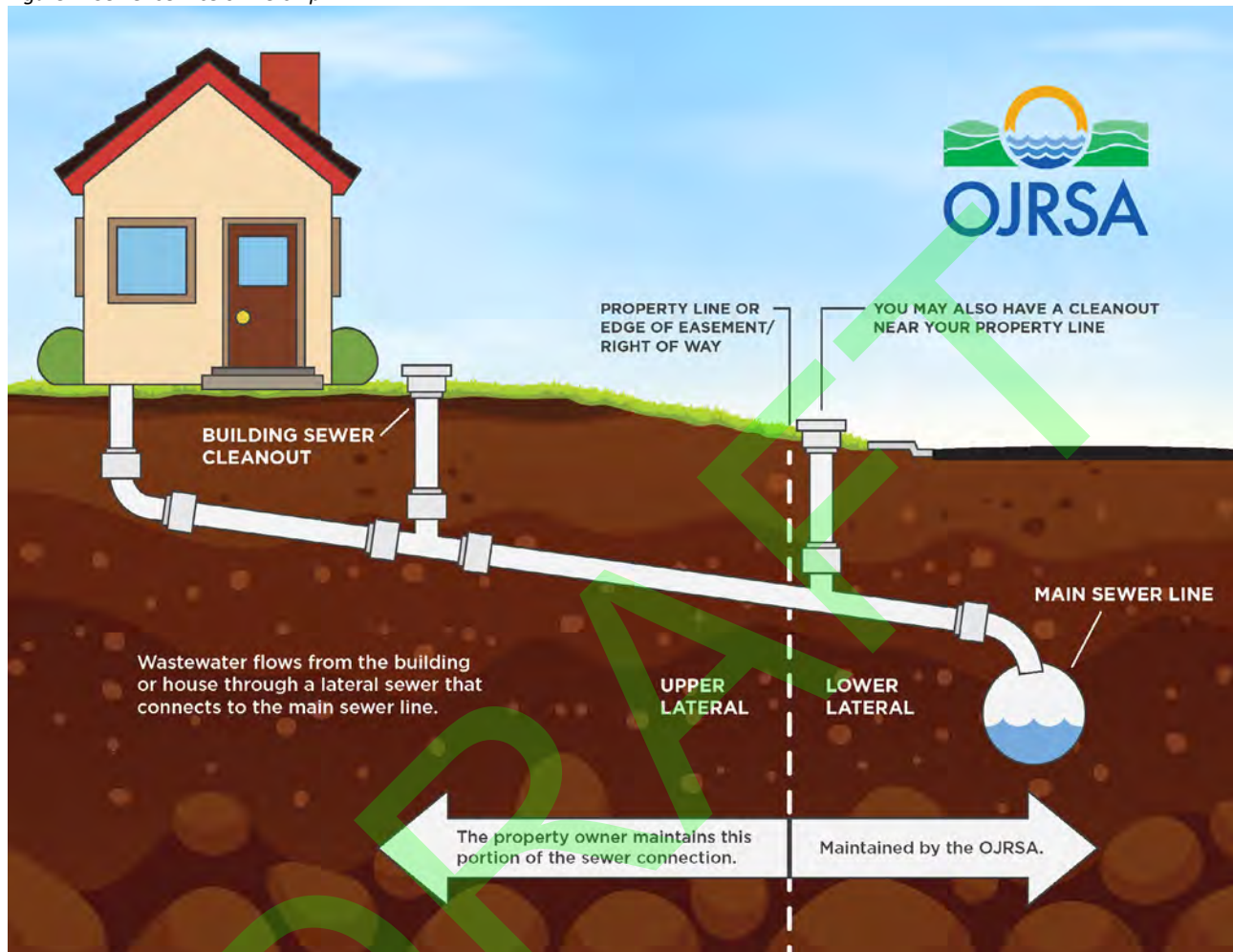
- A. **SEWER SERVICES EIGHT INCHES (8 IN.) AND LARGER WILL REQUIRE APPROVAL FROM OJRSA AND WILL BE CONSIDERED AN EXTENSION OF A PUBLIC MAIN, WHICH MUST BE OWNED, OPERATED, AND MAINTAINED BY THE OJRSA OR A SCDHEC/SCDES PERMITTED SATELLITE SEWER SYSTEM.** This type of service will require a manhole connection at the property line.
- B. For systems to be owned by OJRSA: OJRSA will take over ownership and operation of the system only after the completion of the Project Closeout Checklist (see SECTION 8) and issuance of an issuance of an Ownership Acceptance Letter by OJRSA.
- C. Ownership and maintenance of the pipe connecting to the OJRSA is the responsibility of the Satellite Sewer System or system owner. The OJRSA shall own and maintain the manhole.

2.5.3 Sewer Services (Laterals)

- A. For service connections eight inches (8 in.) and larger, see SECTION 2.5.2.
- B. Sewer services (also known as "laterals") serve individual properties by gravity and connect the privately-owned sewer system and plumbing (the portion located on private property) to the public sewer line. For services that require to be pumped, see SECTION 2.5.4.
- C. A cleanout shall be installed on the lateral at the edge of the right of way to provide access to inspect and clean the sewer lateral.
- D. Ownership and Maintenance: In cases where OJRSA owns the public sewer main that the lateral is connecting to, OJRSA will own and maintain the section of the lateral between the public sewer and the cleanout as stated in Paragraph C above only after the issuance of an Ownership Acceptance Letter by OJRSA. In the case where a cleanout does not exist, the OJRSA shall own and maintain the portion of the lateral within the OJRSA

easement or publicly owned right-of-way/easement. The property owner shall own and be responsible for the lateral beyond the cleanout to the facility it is serving. The OJRSA shall not be responsible for any sewer services on publicly or privately owned Satellite Sewer Systems. See Figure 1 for an illustration.

Figure 1: Sewer service ownership



2.5.4 Grinder Pumps (Individual) and Affiliated Force Mains

- A. Where individual gravity sewer service connections to the public sewer (laterals) are not feasible, OJRSA may choose to serve a property or properties with individual grinder pump stations, which consist of a small pumping system that will convey flow through a force main to the nearest gravity sewer. OJRSA will be responsible for installation, operation, and maintenance of the grinder pumps station, force main, and appurtenances. In these situations, the property owner shall grant an easement consisting of the following minimum dimensions:
1. Eight feet by eight feet (8 ft x 8 ft) around the pump station (centered on the pump station).
 2. Eight feet (8 ft) wide along the force main (centered along the pipeline).
 3. **LARGER EASEMENT DIMENSIONS MAY BE REQUIRED IN ISOLATED CASES DEPENDING ON THE LAYOUT, TOPOGRAPHY, ETC.**
- B. **ALL EASEMENTS MUST BE RECORDED WITH THE COUNTY REGISTER OF DEEDS.**
- C. The OJRSA shall not own, operate, nor maintain grinder pumps or other such equipment within a private structure, such as a building. If it is necessary to pump from a building to an individual grinder pump that serves the structure, then the property owner shall be responsible for owning, operating, and maintaining all equipment and piping upstream of the OJRSA individual grinder pump.
- D. See PS-3 GRINDER PUMP STATION SITE PLAN.

2.6 REVIEW OF PLANS

- A. The developer or engineer shall submit a plan review package to OJRSA to include the following:
 1. One (1) ARCH D size electronic PDF set of wastewater system plans signed and sealed by a South Carolina Registered Professional Engineer. If requested, the developer or engineer must provide one (1) paper copy for review. Plans shall be drawn to a horizontal scale of at least one inch (1 in.) equals fifty feet (50 ft) and a vertical scale of at least one inch (1 in.) equals five feet (5 ft). Plans shall include the following, at a minimum:
 - (a) Complete system design to include cover sheet, general development plans, layout plans, storm water drainage plans, landscaping plans, and demolition plans.
 - (b) Gravity sewer main profiles.
 - (c) Profiles for sewer mains installed by jack and bore or horizontal directional drilling where steel casings are used.
 - (d) Locations and sizes of wastewater services.
 - (e) County Tax Map reference numbers of development property and surrounding properties.
 - (f) Public and private rights-of-way, indicating ownership of existing roads (e.g., city, county, state) and operating and maintaining agency of roads.
 - (g) Existing and proposed easements including ownership and other pertinent information.
 - (h) Locations and sizes of all water meters serving the property.
 2. One (1) electronic PDF and one (1) paper copy set of wastewater calculations signed and by a Registered Professional Engineer. Calculations shall comply with all requirements of OJRSA Standards as stated in this Policy.
- B. All electronic submittals must be received in PDF form via email to engineering@ojrsa.org. For large files, these should be provided using a fileshare site.
- C. Upon completion of the project submittal review, OJRSA will issue the following to the developer or engineer:
 1. Required design revisions and review comments.
 2. Request for any additional information required.

2.7 APPROVAL OF PLANS AND SUBMITTALS

- A. If design revisions are required during plan review, the Engineer of Record (EOR) shall submit one (1) electronic PDF set of the wastewater system. If requested, the developer or engineer must provide one (1) paper copy for review. These revised plans are to be based on OJRSA's review comments from the initial plan review. **REVISIONS MUST CLEARLY CALL OUT OR IDENTIFY MODIFICATIONS TO THE PLANS BASED ON OJRSA COMMENTS.** OJRSA will notify the developer or engineer in writing once the plans have been approved.
- B. Upon approval of the project plans and payment of fees (SECTION 2.2), OJRSA will issue a Conditional Acceptance for Treatment and/or Conveyance letter and/or a Capacity Permit (as defined in the *OJRSA Sewer Use Regulation*).
- C. Upon approval of the project plans, the EOR shall submit to OJRSA the following:
 1. One (1) complete ARCH D sized set of approved plans.
 2. One (1) complete ARCH D electronic PDF set of approved plans.
 3. Completed Permit for OJRSA Wastewater System Capacity form.
 4. Impact Fees due.
 5. Copy of SCDHEC/SCDES Construction Permit Application.
 6. All required information for obtaining necessary encroachment permits.
- D. Upon receiving a Conditional Acceptance for Treatment and/or Conveyance letter from OJRSA, the EOR shall submit a complete SCDHEC/SCDES Construction Permit Application package to SCDHEC/SCDES for approval.

2.8 PROJECT CONSTRUCTION

- A. Prior to the beginning of construction, the Engineer of Record (EOR) shall submit a copy of the SCDHEC/SCDES Permit to Construct to OJRSA.
- B. Prior to the beginning of construction, the engineer shall coordinate a Pre-Construction Meeting to be attended by the developer, the engineer, the contractor, and an OJRSA representative at a minimum.

- C. Engineer shall make all submittals available in order to provide sufficient review time for the OJRSA as required in SECTION 4.
- D. The EOR shall monitor construction of the project as required to ensure that all design requirements and OJRSA standards are met.
- E. All required encroachment permits shall be provided to OJRSA prior to the commencement of any construction activities in any public rights-of-way or easements.
- F. The OJRSA reserves the right to inspect any or all installation, materials used, etc. during construction.
- G. **OJRSA RESERVES THE RIGHT TO STOP THE WORK AT ANY TIME UPON BECOMING AWARE THAT ALL PROJECT CONSTRUCTION REQUIREMENTS ARE NOT MET. THE OJRSA SHALL NOT BE RESPONSIBLE FOR ANY FEES ASSOCIATED WITH THE DELAY OF A PROJECT DUE TO FAULTS BY THE CONTRACTOR OR DEVELOPER.**
- H. Following the installation, the project site shall be returned to a condition equal to or better than the pre-construction condition of the site.
- I. Contractor and their personnel shall be familiar with and abide by the applicable provisions of the OSHA regulations at all times during construction. The contractor shall provide their safety policy to OJRSA prior to any construction.
- J. Substitutions
 - 1. In the event the contractor obtains written OJRSA approval for equipment substitution, the contractor shall, at their own expense, make all resulting changes to the enclosures, buildings, piping, or electrical systems as required to accommodate the proposed equipment. Revised detail drawings illustrating the substituted equipment shall be submitted to the OJRSA prior to acceptance.
 - 2. Should the contractor choose to substitute an "equal" or "approved equal" product, then the contractor shall ensure that the product so substituted is compatible in all electrical, mechanical, structural, and environmental aspects and that dimensionally it will fit within the space allowed. The contractor shall make all necessary adjustments to ensure a complete, functional, and neat installation in keeping with the intent of these specifications.
 - (a) The request should include sufficient detail to indicate that quality and style are equal to the specified item.
 - (b) A written approval from a Registered Professional Engineer must be issued before the proposed substitution can be considered for possible use.
 - (c) Verbal approvals are unacceptable. The burden shall be on the contractor to have the written approvals before proceeding.

2.9 FINAL INSPECTION

- A. Upon completion of construction, all aspects of the fully constructed wastewater system must be inspected by an OJRSA-approved contractor familiar with performing sanitary sewer evaluation surveys (SSES) to ensure conformance with the approved plans and all OJRSA standards. The developer shall be responsible for paying for this inspection.
- B. Prior to scheduling the final inspection, the Engineer of Record shall submit a final inspection package including the following:
 - 1. Record Drawings
 - (a) One (1) complete ARCH D sized paper set of approved plans.
 - (b) One (1) complete ARCH D electronic PDF set of approved plans.
 - (c) Record drawing plans shall be signed and sealed by a South Carolina Registered Professional Engineer and shall be drawn to a horizontal scale of at least one inch equals fifty feet (1 in. = 50 ft) and a vertical scale of at least one inch equals five feet (1 in. = 5 ft). Record drawing plans shall include the following:
 - (i) Complete system design to include cover sheet, general development plans, layout plans, storm water drainage plans, landscaping plans, and demolition plans. Record drawing plans must be clear, accurate, and of good quality.
 - (ii) Gravity sewer main profiles.
 - (iii) Profiles for sewer mains installed by jack and bore or horizontal directional drilling

where steel casings are used.

- (iv) Plan and elevation views for wastewater pump stations.
 - (v) Station numbers at all manholes, valves, services, air release valves, and all fittings.
 - (vi) Line lengths and termination points.
2. Inside diameter, rim elevation, and invert elevation(s) of manholes. Invert elevations shall be provided for all manhole connections.
 3. Street names and addresses, tax map numbers, unit numbers, lot numbers, and block designations for all parcels shown on drawings.
 4. All recorded easement information.
 5. Surveyed gravity line elevations and wastewater facility locations, signed and sealed by a professional land surveyor registered in the State of South Carolina.
 6. Certified pressure test results for force mains (see forms in SECTION 8).
 7. Certified low-pressure test results for gravity sewer lines (see forms in SECTION 8).
 8. Certified vacuum test results for manholes as requested by OJRSA (see forms in SECTION 8).
 9. Certified pipe deflection test results for gravity sewer lines as requested by OJRSA.
 10. Two (2) copies of CCTV inspection footage using a common video format (e.g., .mp4, .mov, etc.) for gravity sewer lines. **100% OF THE GRAVITY SEWER LINES MUST BE INSPECTED PRIOR TO TRANSFER ACCEPTANCE BY OJRSA.**
 11. Complete list of spare parts supplied to OJRSA.
- C. OJRSA will notify the engineer upon approval of the final inspection package at which time the engineer may contact OJRSA to schedule the final inspection.
 - D. Attendance for the final inspection shall include at a minimum the Engineer of Record, the contractor, and an OJRSA representative.
 - E. If necessary, the OJRSA will issue a punch list to the engineer upon completion of the final inspection. The punch list will include items to be corrected by the contractor prior to final project approval.

2.10 PROJECT CLOSEOUT

2.10.1 General

- A. Prior to acceptance of the utility by the OJRSA, the developer/project owner shall submit a project closeout package to OJRSA upon completion of the final inspection and final approval of the record drawings by the Engineer of Record. The project closeout package shall include all necessary items as stated within this Section.
- B. Secure file sharing site, flash drive, or other acceptable methods for transferring electronic files shall be used.
- C. The following general items shall be delivered to the OJRSA:
 1. All necessary spare parts.
 2. One (1) hard copy and one (1) electronic PDF copy of each operation and maintenance manual.
 3. One (1) year Surety Bond (maintenance warranty) form covering all items built or altered which are to become OJRSA property. See SECTION 8 of this Policy for the Surety Bond Form.

2.10.2 Certifications and Records

- A. The following certifications and records must be submitted:
 1. Engineer's Certification Letter stating that the project has been completed in accordance with the approved plans and all OJRSA standards.
 2. One (1) hard copy and one (1) electronic PDF copy of recorded easements, including plats and surveys, with signature and seal.
 3. Certified pressure test results for force mains.
 4. Certified low-pressure test results for gravity sewer lines.
 5. Certified vacuum test results for manholes as requested by OJRSA.
 6. Certified pipe deflection test results for gravity sewer lines as requested by OJRSA.
 7. Certified pump station drawdown test results.
- B. Record Drawings

1. The Engineer of Record (EOR) will prepare, or have prepared, record drawings based on as-built information provided by a Professional Surveyor registered in South Carolina and from information provided by the EOR's staff. The EOR shall retain the signed and sealed "as-built" drawings with other project records for possible review by the OJRSA upon request.
2. Each sheet of the record drawings must be signed and sealed by the EOR. The cover sheet is to be signed and sealed by the EOR and shall include the following statement: "I certify that these record drawings have been reviewed by me, or by individual(s) under my direction, and that these drawings incorporate the information contained in the certified as-built drawings. To the best of my knowledge and belief, these record drawings reflect the wastewater facilities as constructed. The accuracy of these record drawings is reliant on the accuracy applied by the survey of that prepared the certified as-builts, which was [include the Professional Surveyor's name, business name, surveyor's South Carolina registration number, address, and phone number]. The surveyor has certified to me that the as-built location information of the wastewater facilities conforms to the minimum technical standards for land surveying in the State of South Carolina."
3. Drawings are to contain the information in the design and as-built drawings, including: cover sheet, overall layout, blowups, details, standard details, legends, etc.
4. Digital photographs of any unusual situations should be included to memorialize any major field adjustments.
5. Drawings are to show information as the project was constructed, not document changes between the design and construction drawings. Any OJRSA facilities constructed in the horizontal location more than one foot (1 ft) or vertical location greater than one-tenth of a foot (0.1 ft) than the design location will have their design location erased and redrafted at the constructed location. Incorrect information shall not be struck through; it will be erased and replaced with the corrected information. Any information that is no longer relevant due to changes during construction will be deleted. Design drawing dimensioning to utilities will be corrected as necessary.
6. Minimum Record Drawing Content
 - (a) Show the entire sewer system, including gravity sewer, manholes, force mains, pump stations, valves, and fittings.
 - (b) All dimensioning is to be in English (Imperial) units using decimals and not fractions.
 - (c) Information must be clear and understandable to the OJRSA.
 - (d) Show all abandoned-in-place facilities, including the extent and method of abandonment.
 - (e) Show elevations to the nearest one-tenth of a foot (0.1 ft) for:
 - (i) Top of pipe for force mains and water lines at vertical deflection points and every two hundred feet (200 ft) along straight runs.
 - (ii) Top of sewer facilities where they cross all other facilities (e.g., water lines, storm sewer, power, gas lines, telephone/communication, etc.)
 - (f) Show elevations to the nearest one-one hundredth of a foot (0.01 ft) for:
 - (i) Invert elevations within manholes
 - (ii) Invert elevations of wet wells
7. Must be submitted in both AutoCAD (.dwg) and PDF format.
8. One ARCH D size paper copy shall be provided.
9. Should include identification and descriptions of unexpected variations to subsoil conditions or discovery of uncharted utilities.
10. Additional Information Required
 - (a) General Project Information
 - (i) Project name
 - (ii) Project date
 - (iii) Contractor name and address
 - (iv) Subdivision name if constructed as part of a subdivision
 - (v) Developer name and address
 - (vi) Tax Map parcel number (and lot and unit numbers, as appropriate)

- (vii) Elevation datum
- (viii) Survey benchmark data
- (ix) Street names
- (x) Site map
- (b) Gravity Sewers
 - (i) Length
 - (ii) Pipe size
 - (iii) Pipe material and manufacturer
 - (iv) Slope
 - (v) Service lateral location (designated by station number)
 - (vi) Existing and finished grade
 - (vii) Manhole diameter, material, invert elevations, rim elevations, lining material, and coordinates
- (c) Force Mains
 - (i) Length
 - (ii) Pipe size
 - (iii) Pipe material, pressure class, and manufacturer
 - (iv) Air release valve location, depth (shown on profile), and manufacturer
 - (v) Isolation valve location, depth, valve open direction, number of turns, and manufacturer
 - (vi) Existing and finished grade
 - (vii) Fitting location, size, and type
 - (viii) Thrust block location and size
 - (ix) Location and length of restrained joint pipe
- (d) Pump stations: For all pump stations, civil, structural, electrical, and mechanical drawings showing the following information shall be provided:
 - (i) Number of pumps
 - (ii) Pump duty point, curve, manufacturer, and pump model number
 - (iii) Generator size and manufacturer
 - (iv) Valve type, size, and manufacturer
 - (v) Wet well top slab, influent invert, bottom, pump on/off elevations, and alarm elevations
 - (vi) Wet well dimensions
 - (vii) Control panel
 - (viii) Electrical one-line diagram
 - (ix) All conduit and pipeline size and materials onsite

2.10.3 GIS Submittals

- A. Engineers shall obtain the current geodatabase scheme from Oconee County and OJRSA prior to starting design and shall incorporate the properties of all feature classes applicable.
- B. Format
 - 1. Preferred: ArcGIS Pro Layer Packages (.lpx)
 - 2. If shop does not have ArcGIS seat or capabilities: AutoCAD (.dwg/.dxf) or MicroStation (.dgn)
- C. Coordinate System: GIS submittals must be based on South Carolina State Plane Coordinate System NAD83 Datum and units of International Feet and tied to the correct realization of the South Carolina Geodetic Survey Virtual Reference Station (VRS) network and elevations related to National Geodetic Vertical Datum of 1929 (NGVD 29).
- D. Accuracy
 - 1. Coordinates shall be accurate to the nearest one-tenth of a foot (0.1 ft) and shown to a precision of the nearest one-tenth of a foot (0.1 ft).
 - 2. Manholes must have elevations for the pipe inverts in, invert out, grade at manhole, and rim/cover to

the nearest one-tenth of a foot (0.1 ft).

3. To support checking of the coordinates, the OJRSA may request the submittal of a metadata report that addresses the following:
 - (a) Identify the coordinate datum and projection.
 - (b) Identify control points used to establish the project coordinates. Provide full backup information regarding the source of the control point coordinate data and their coordinates. If the source control point coordinate datum/projection differs from the project coordinate datum/projection, then provide coordinates for the control points in both the source datum/projection and in the project datum/projection. Indicate the method and/or software utilized to make the conversion.
 - (c) Describe the method used to establish the project coordinates.
 - (d) Indicate the estimated accuracy of the project coordinates.

E. Information Required:

1. For easements
 - (a) Boundaries of permanent and access easement. Offsets from center of pipe or as appropriate. **IF ATYPICAL EASEMENT WIDTH DUE TO UNUSUAL CONDITION (e.g., CREEK OR STREAM, PUBLIC ROADWAY, ETC.), ONLY INCLUDE EASEMENT THAT BELONGS TO OJRSA AND DO NOT HAVE IT TRAVERSE ONTO PROPERTY(IES) NOT ASSOCIATED WITH OJRSA EASEMENT.**
 - (b) Classification as either permanent or access easement
 - (c) Date of execution of easement agreement
 - (d) Total area of easement (in square feet)
2. For gravity sewer lines
 - (a) Pipe diameter
 - (b) Pipe material
 - (c) Length
 - (d) Slope
 - (e) Downstream invert
 - (f) Upstream invert
 - (g) Downstream manhole number
 - (h) Upstream manhole number
3. For manholes
 - (a) Manhole number
 - (b) Station number
 - (c) Manhole height inside
 - (d) Manhole height outside
 - (e) Invert in elevation
 - (f) Invert out elevation
 - (g) Manhole rim elevation
 - (h) Manhole diameter
 - (i) Coordinates
4. For force mains
 - (a) Pipe diameter
 - (b) Pipe material
 - (c) Length of pipe (to be separated by ARVs and/or isolation valves)
 - (d) Lining type
5. For force main air release valves
 - (a) Valve size
 - (b) Coordinates
6. For force main isolation valves
 - (a) Valve size
 - (b) Valve type

- (c) Number of turns
- (d) Coordinates
- 7. For pump stations
 - (a) Pump station name
 - (b) Wet well size or diameter
 - (c) Invert in elevation
 - (d) Wet well bottom elevation
 - (e) Wet well top elevation
 - (f) Coordinates
 - (g) Number of pumps
 - (h) Pump type
 - (i) Force main diameter
- 8. For sewer services (“laterals” or “service connections”)
 - (a) For locations served by gravity sewer service
 - (i) Connection location to gravity sewer or manhole
 - (ii) Service pipe diameter
 - (iii) Service pipe material
 - (iv) Length of pipe
 - (v) Sewer cleanout location
 - (b) For locations served by individual grinder pump station
 - (i) Grinder pump location
 - (ii) Force main diameter
 - (iii) Force main pipe material
 - (iv) Length of pipe
 - (v) Connection location to public sewer system
 - (vi) Valves and appurtenances
 - (vii) Easements for grinder pump station and associated private force main
 - (viii) Pump manufacturer and model

END OF SECTION 2

SECTION 3 – DESIGN CRITERIA

3.1 MINIMUM DESIGN STANDARDS

Unless specifically addressed within this Policy, all designs must comply with SCDHEC/SCDES regulations at a minimum.

3.2 SEWER SYSTEM INFRASTRUCTURE SIZING

- A. Sewer system components shall be sized according to peak hourly flow requirements, calculated in accordance with [Recommended Standards for Wastewater Facilities, latest edition \(aka “Ten States Standards”\)](#) as published by the Wastewater Committee of the Great Lakes - Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers. In no circumstance should a peaking factor less than two and a half times (2.5x) the average daily flow be used. Peaking factors shall be calculated as follows:

$$\text{Peaking Factor} = \frac{18 + \sqrt{P/1,000}}{4 + \sqrt{P/1,000}}$$

Where P is Average Daily Flow (ADF) in gallons per day (gpd) ÷ 100

- B. The [South Carolina Department of Health and Environmental Control \(SCDHEC\) Standards for Wastewater Facility Construction, Appendix A](#) (R.61-67, Appendix A) provides unit contributory loadings based on the type of facility requiring wastewater service. These unit contributory loadings should be used to estimate average daily flow. **THE OJRSA BOARD OF COMMISSIONERS HAS ADOPTED REVISIONS TO PORTIONS OF THIS, WHICH CAN BE SEEN IN SECTION 7.1 OF THIS POLICY. WHEN APPLICABLE, THE OJRSA-APPROVED UNIT CONTRIBUTORY LOADINGS SHALL BE USED FOR CALCULATIONS.**
- C. The peak hourly flow for areas with a Short-Term Wastewater Generator (as defined in SECTION 0.1) shall be calculated by applying the peaking factor to the average daily flow divided by the number of hours that wastewater is generated. This formula uses hydraulic loading gallons per day usage estimates as stated in Table 24, which can be seen in SECTION 7.

$$\text{STWG (gallons per minute, gpm)} = \frac{2.5 \times ((X_1 \times H_1) + (X_2 \times H_2) + (X_3 \times H_3) + \dots)}{n \times 60 \text{ minutes/hour}}$$

Where 2.5 is the Peaking Factor constant to be used; X is the Number of Units; H is Hydraulic Loading per Unit; ... is for Additional Units as Necessary; and n is Number of Hours per Day of Wastewater Generation

For example, a school that has one hundred (100) students and staff would have an average daily flow of eight hundred gallons per day (800 gpd) (based on eight gallons per day (8 gpd) per person according to Table 24. Assuming that the school is open eight (8) hours per day and using a peaking factor of two and a half times (2.5), the peak hourly flow would be calculated as follows:

$$\text{Example} = \frac{2.5 \times 800 \text{ gpd}}{8 \text{ hours/day} \times 60 \text{ minutes/hour}} = 4.2 \text{ gallons per minute (gpm)}$$

- D. Pump Station Sizing: **WHILE INCORPORATING ANTICIPATED SEWER BASIN/UPSTREAM PROJECT BUILDOUT, PUMP STATIONS SHALL BE SIZED TO RUN NO MORE THAN THE HOURS SPECIFIED BELOW WHILE RESERVING ONE (1) PUMP TO SERVE IN STANDBY:**
- 1. NO MORE THAN TEN (10) HOURS PER DAY UNDER NORMAL OPERATING CONDITIONS, AND**
 - 2. NOT TO EXCEED FOURTEEN (14) HOURS OF OPERATION DURING A TWO (2) YEAR STORM EVENT.**

3.3 GRAVITY SEWER DESIGN CRITERIA

3.3.1 General

- A. Applicable Details

1. D001 EASEMENT GRADING
 2. D002 GRAVITY SEWER TRENCH & BEDDING
 3. D003 GRAVITY SEWER TRENCH & BEDDING – WET LOCATIONS
 4. D004 ASPHALT PAVEMENT REPLACEMENT AT PIPE TRENCH
 5. D005 STREAM CROSSING
 6. D006 LONG SPAN STREAM CROSSING
 7. D007 STREAM BANK PROTECTION
 8. D022 PIPE CASTING UNDER PAVED AREAS
 9. D023 SEWER LINE CROSSING WATER LINE
 10. D024 SEWER LINE CROSSING STORM DRAINAGE
 11. D025 CONCRETE ENCASEMENT
- B. Gravity sewer mains shall be designed according to the requirements of these standards and the requirements of the current version of SCDHEC/SCDES *Standards for Wastewater Facility Construction* (R.61-67).
- C. Designs shall comply with SECTION 2 of this Policy.
- D. The minimum diameter for gravity sewer mains shall be eight inches (8 in.).
- E. The minimum depth of cover for gravity sewer mains below finished grade shall be three feet (3 ft).
- F. Unless stated otherwise, gravity sewer mains shall be polyvinyl chloride (PVC). If the depth of cover exceeds fifteen feet (15 ft), then ductile iron pipe (DIP) shall be used.
- G. Gravity sewer mains shall have sufficient depth to receive sewer flow from the lowest service.
- H. Gravity sewer mains shall have straight alignment with uniform slope between manholes.
- I. The minimum downstream angle for gravity sewer mains intersecting at a manhole is ninety degrees (90°).
- J. When possible, gravity sewer mains and manholes shall be located outside of paved roadways.

3.3.2 Minimum Pipe Slope

The minimum pipe slope requirement is to prevent solids accumulation in the line. Under no scenario shall the slope of a gravity sewer main values fall below the minimum values listed in Table 1.

Table 1: Minimum pipe slope for gravity sewer based on nominal pipe diameter

Nominal Sewer Diameter (inches)	Minimum Slope (feet per 100 feet of pipe)	Nominal Sewer Diameter (inches)	Minimum Slope (feet per 100 feet of pipe)
8	0.40	21	0.10
10	0.28	24	0.08
12	0.22	27	0.06
15	0.15	30	0.06
16	0.14	36	0.05
18	0.12	Others	As approved by OJRSA
20	0.11		

3.3.3 Maximum Pipe Slope

The maximum pipe slope would be to ensure there's not a scouring/erosion issue, but also to ensure there's not a vulnerability to the sewer line shifting.

- A. Where velocities are expected to exceed ten feet per second (10 fps), provisions should be made to prevent impact from scouring or erosion.
- B. All effort shall be made to limit slopes on gravity sewers to ten percent (10%) or less.
- C. Sewers with slopes greater than ten percent (10%) shall be evaluated on a case-by-case basis.
- D. Slopes greater than twenty percent (20%) shall require concrete anchors designed by a structural engineer licensed in the State of South Carolina.

3.3.4 Minimum Flow Depths

All gravity sewer mains shall be sized such that peak hourly flow does not exceed the maximum percent full at peak flow values (e.g., depth of flow relative to the diameter of the pipe (d/D)) as shown in Table 2.

Table 2: Maximum allowable fullness of pipe (percentage) based on nominal pipe diameter

Nominal Sewer Diameter (inches)	Maximum % Full at Peak Flow (d/D)	Nominal Sewer Diameter (inches)	Maximum % Full at Peak Flow (d/D)
8	0.50	15	0.65
10	0.60	16	0.65
12	0.60	18 and Larger	0.70

3.3.5 Gravity Sewer Main Sizing

- A. Gravity sewer mains shall be sized in accordance with the requirements of SECTION 3.2.
- B. Gravity sewer mains shall be designed to provide a minimum flow velocity of two feet per second (2 fps) when flowing full.
- C. Pipe for gravity sewer shall be sized based on material type as stated in Table 3.

Table 3: Gravity sewer pipe diameters and types allowed

Size (inches)	Material	Size (inches)	Material
8	PVC & DIP	21	PVC
10	PVC & DIP	24	PVC & DIP
12	PVC & DIP	27	PVC & DIP
15	PVC	30	PVC & DIP
16	DIP	36	PVC & DIP
18	PVC & DIP	Others	Case-by-case
20	DIP		

3.3.6 Manholes

- A. Applicable Details
 1. D008 STANDARD MANHOLE
 2. D009 DOGHOUSE MANHOLE
 3. D010 INSIDE DROP MANHOLE
 4. D011 OUTSIDE DROP MANHOLE
 5. D012 PRECAST MANHOLE FOR AERIAL GRAVITY SEWER
 6. D013 SHALLOW PRECAST MANHOLE
 7. D014 PIPE CONNECTION AT MANHOLE
 8. D015 STANDARD MANHOLE FRAME & COVER
 9. D016 HEAVY DUTY MANHOLE COVER
 10. D017 HEAVY DUTY MANHOLE COVER WITH CAM LOCK
 11. D018 HEAVY DUTY MANHOLE FRAME
 12. D029 FORCE MAIN CONNECTION AT MANHOLE
- B. Manholes shall be installed at all gravity sewer main intersections, at the end of each gravity sewer line, and at all changes in alignment, size, or grade.
- C. Maximum Spacing Between Manholes: The maximum spacing for sewer manholes is set forth below of shall be based on the SCDHEC/SCDES regulatory standards at the time of design approval, whichever spacing is shorter:
 1. Pipe diameters less than or equal to fifteen inches (≤ 15 in.): Four hundred feet (400 ft).
 2. Pipe diameters greater than fifteen inches (> 15 in.) but less than or equal to thirty inches (≤ 30 in.): Five hundred feet (500 ft).
 3. Pipe diameters greater than thirty inches (> 30 in.): Evaluated by OJRSA on a case-by-case basis.
- D. When possible, manholes along roadways shall be located outside of paved travel lanes. Manholes which must be located within paved roadways or sidewalks shall be entirely within paved roadway or sidewalk.
- E. Under no circumstances should manholes be located within or near parking spaces or in other areas which may inhibit access to manholes.
- F. Minimum manhole diameters are based on conditions, which are listed in Table 4. *The minimum diameter*

shall be based on the largest gravity pipe within the manhole.

Table 4: Minimum manhole diameters based on certain gravity sewer parameters

Condition	Minimum Manhole Diameter (feet)
All pipe sizes with a depth of 8 ft or more from rim	5
All drop-type manholes	5
Gravity sewer main size of 8 in. to 12 in.	4
Gravity sewer main size of 15 in. to 18 in.	5
Gravity sewer main size of 21 in. to 30 in.	6
Gravity sewer main size greater than 30 in.	As approved by OJRSA

- G. Gravity sewer main connections to manholes with an invert elevation of at least twenty-four inches (24 in.) above the manhole invert elevation will require an inside drop pipe. A maximum of two (2) six inch (6 in.) drops or one (1) eight inch (8 in.) drop is allowed in a single manhole.
- H. Manhole invert channels shall be smooth, semicircular, and conforming to the shape, slope, and crown height of the connecting gravity sewer mains.
- I. Manhole benches shall be provided on each side of manhole channel(s) and shall have a slope of at least one-half inch per foot (0.5 in./ft). No sewer discharge will be allowed onto the bench surface.
- J. Access shall be provided to all manholes and shall allow adequate access for cleaning.
- K. Manholes that contain a drop of five feet (5 ft) or more shall be constructed of polymer concrete.
- L. Manholes shall have minimum one-tenth of a foot (0.1 ft) drop between invert in and invert out.
- M. Force Main Connections to Manholes
 - 1. As applicable for new installations: At a minimum, all manholes within the first one thousand feet (1,000 ft) after a force main discharge shall be constructed of polymer concrete. Additional polymer manholes may be required downstream where high levels of hydrogen sulfide are possible.
 - 2. For existing applications: See 4.17.4.
- N. Refer to Detail D010 and D011 for manhole core sizes for connections.

3.3.7 Gravity Sewer in Proximity to Water Mains & Storm Drainage Structures

- A. Applicable Details
 - 1. D023 SEWER LINE CROSSING WATER LINE
 - 2. D024 SEWER LINE CROSSING STORM DRAINAGE
- B. Drinking Water Main Proximity: Must comply with current versions of SCDHEC/SCDES *State Primary Drinking Water Regulations* 61-58.4(D)(12) and SCDHEC/SCDES *Standards for Wastewater Facility Construction Regulation* 61-67.300.A(14).
- C. Storm Sewer Proximity
 - 1. Gravity sewer mains shall not come into contact with or pass through a storm drainage pipe or structure.
 - 2. A minimum horizontal separation of five feet (5 ft) shall be maintained between gravity sewer mains and existing or proposed storm drainage pipes or structures as measured from edge to edge.
 - 3. Where a gravity sewer main crosses above a storm drainage pipe or structure, a minimum vertical separation of twelve inches (12 in.) shall be maintained between the outside edges of the gravity sewer main and the storm drain.
 - 4. Where a gravity sewer main crosses below a storm drainage pipe or structure, the following conditions shall be maintained:
 - (a) Single Storm Drainpipe, twenty-four inch and smaller diameter (24 in.): A minimum vertical separation of eighteen inches (18 in.) shall be maintained between the outside edges of the gravity sewer main and the storm drain. Joints in the gravity sewer shall be located as far as possible from the storm drain crossing.
 - (b) Single Storm Drainpipe, greater than twenty-four inch (24 in.) diameter: A minimum vertical separation of eighteen inches (18 in.) shall be maintained between the outside edges of the

gravity sewer main and the storm drain. The gravity sewer main shall be installed in a steel casing that extends five feet (5 ft) beyond both sides of the crossing. Joints in the gravity sewer shall be located as far as possible from the storm drain crossing.

- (c) Multiple Adjacent Storm Drainpipes: A minimum vertical separation of eighteen inches (18 in.) shall be maintained between the outside edges of the gravity sewer main and the storm drain. The gravity sewer main shall be installed in a steel casing that extends five feet (5 ft) beyond both sides of the crossing. Joints in the gravity sewer shall be located as far as possible from the storm drain crossing.
- (d) Box Culverts: A minimum vertical separation of eighteen (18 in.) shall be maintained between the outside edges of the gravity sewer main and the box culvert. The gravity sewer main shall be installed in a steel casing that extends five (5 ft) beyond both sides of the box culvert. Joints in the gravity sewer shall be located as far as possible from the box culvert.

3.3.8 Gravity Sewer in Proximity to Sources of Energy or Corrosive Soils

Where ductile iron pipe gravity sewers may be installed in areas where the pipe may be vulnerable to corrosion, such as corrosive soils, the pipeline crossing or coming into close proximity (within twenty-five feet (25 ft) horizontally) of an overhead or buried power line or metal gas main), corrosion control shall be considered. Should corrosion be determined to be a valid concern, examples of acceptable mitigation measures are as follows:

- A. Material change to PVC if all other criteria for using PVC are met
- B. Polyethylene wrap
- C. Zinc-coated pipe
- D. Cathodic protection system

3.3.9 Sewer Services (Laterals)

- A. Applicable Details
 - 1. D010 INSIDE DROP MANHOLE
 - 2. D011 OUTSIDE DROP MANHOLE
 - 3. D030 SEWER LATERAL AND CLEANOUT
 - 4. D031 SEWER LATERAL ON EXISTING GRAVITY SEWER
 - 5. D032 SADDLE CONNECTION FOR LIVE STREAM WASTEWATER MAINS
 - 6. D033 DEEP SEWER LATERAL
- B. In plan view, service laterals shall be installed perpendicular to the gravity sewer and connected to a manhole (preferred) or connected using a wye fitting to the pipe.
- C. **SERVICE LINES LARGER THAN FOUR INCHES (4 IN.) SHALL BE CONNECTED TO MANHOLES FOR ALL CONNECTIONS ON AN EIGHT INCH (8 IN.) GRAVITY PIPE. OTHER SERVICE LINES SHALL BE CONSIDERED ON A CASE-BY-CASE BASIS BASED ON MAIN LINE DIAMETER AND OTHER CONDITIONS.**
- D. Sewer services shall be located at property corners and shall maintain a straight alignment from the main connection to the cleanout measured perpendicular to the centerline of the road.
- E. Cleanouts shall be provided for all services and shall be located at property lines or easement edges to allow access to cleanouts.
- F. Service connections shall be made with compatible, corrosion-proof materials, shall be watertight, and shall not protrude into the gravity sewer main.
- G. Service connections to gravity sewer mains shall utilize wye branches installed at a horizontal angle of at least thirty degrees (30°).
- H. Service connections to manholes shall protrude approximately one inch (1 in.) into the inside of the manhole and shall be installed so that the service and the gravity sewer main have matching crown elevations. Service connections shall be properly grouted to provide a watertight connection to manholes.
- I. The minimum sewer service size shall be six inches (6 in.) for the following applications:
 - 1. Up to two (2) individual residential units connected via double wye. **NO MORE THAN TWO RESIDENTIAL CONNECTIONS ARE PERMITTED TO MANIFOLD INTO A SINGLE SERVICE.**
 - 2. A single commercial building with a single occupant.

- J. The minimum sewer service size for Multi-Family Development building of more than four (4) units shall be eight inches (8 in.).
- K. Sewer service slopes shall comply with Table 5.

Table 5: Sewer service (lateral) pipe minimum slope

Nominal Sewer Diameter (inches)	Minimum Slope (feet per 100 feet of pipe)
4	1.00
6	1.00
Others	As these are not considered to be sewer services and are instead considered as sewer main extensions, Table 1 and applicable sections of this Policy shall apply

- L. Spacing between service lateral connections shall be at least ten feet (10 ft).
- M. Service laterals shall be generally located ten feet (10 ft) from any property lines.
- N. In plan view, service laterals shall be installed perpendicular to the gravity sewer and connected to a manhole (preferred) or connected using a wye fitting to the pipe.

3.4 SEWER FORCE MAIN DESIGN CRITERIA

3.4.1 General

- A. Applicable Details
 - 1. D001 EASEMENT GRADING
 - 2. D004 ASPHALT PAVEMENT REPLACEMENT AT PIPE TRENCH
 - 3. D005 STREAM CROSSING
 - 4. D006 LONG SPAN STREAM CROSSING
 - 5. D007 STREAM BANK PROTECTION
 - 6. D019 FORCE MAIN TRENCH & BEDDING
 - 7. D020 HORIZONTAL JOINT RESTRAINT
 - 8. D021 VERTICAL JOINT RESTRAINT
 - 9. D022 PIPE CASTING UNDER PAVED AREAS
 - 10. D023 SEWER LINE CROSSING WATER LINE
 - 11. D024 SEWER LINE CROSSING STORM DRAINAGE
 - 12. D025 CONCRETE ENCASEMENT
 - 13. D026 VALVE BOX
 - 14. D028 PIPELINE & VALVE MARKER
 - 15. D029 FORCE MAIN CONNECTION AT MANHOLE
 - 16. PS-3 GRINDER PUMP STATION SITE PLAN
- B. Sewer force mains shall be dedicated to a single pump station and must discharge within a manhole or wet well. **MANIFOLDING OF FORCE MAINS IS STRICTLY PROHIBITED.**
- C. The minimum cover depth for sewer force mains is listed in Table 6.

Table 6: Minimum force main cover (burial) depth

Force Main Diameter (inches)	Minimum Cover (Burial) Depth (Feet)
Less than 12 in.	≥ 3 ft
Greater than 15 in.	≥ 5 ft

- D. Force Main Materials
 - 1. Unless stated otherwise in this section, sewer force mains shall be C900 or C905 PVC.
 - 2. For sections of the force main where the operating pressure exceeds seventy-five pounds per square

- inch (75 psi), the force main shall be ductile iron pipe (DIP).
3. For sections of force main that may be exposed to air or are three feet (3 ft) or less vertically of an intermediate high point that would be exposed to air, the force main shall be either polyvinyl chloride (PVC) or DIP with a protective lining as specified in SECTION 4.2.

3.4.2 Sewer Force Main Sizing

- A. Sewer force mains shall be sized in accordance with the requirements of SECTION 3.2.
- B. The minimum diameter for sewer force mains is four inches (4 in). When approved for use, small grinder pump stations are permitted to utilize a two inch (2 in.) force main.
- C. Sewer force mains shall be designed to provide a minimum flow velocity of two feet per second (2 fps) at the design flow.
- D. Force mains shall be designed to operate efficiently at a variety of conditions that will be encountered over the life of the pipeline. Hazen-Williams roughness coefficients (“C Factor”) for the force main design shall be selected to reflect this philosophy.
- E. Pipe for force mains shall be sized based on material type as stated in Table 7.

Table 7: Force main pipe diameters and types allowed

Size (inches)	Material ¹	Size (inches)	Material
2 ²	PVC	12	PVC & DIP
4	PVC & DIP	15	PVC
6	PVC & DIP	16	DIP
8	PVC & DIP	18	PVC & DIP
10	PVC & DIP	Others	Case-by-Case

3.4.3 Force Main in Proximity to Water Mains & Storm Drainage Structures

- A. Applicable Details
 1. D023 SEWER LINE CROSSING WATER LINE
 2. D024 SEWER LINE CROSSING STORM DRAINAGE
- B. Drinking Water Main Proximity: Must comply with current versions of SCDHEC/SCDES *State Primary Drinking Water Regulations* 61-58.4(D)(12) and SCDHEC/SCDES *Standards for Wastewater Facility Construction Regulation* 61-67.300.A(14).
- C. Storm Sewer Proximity
 1. Force mains shall not come into contact with or pass through a storm drainage pipe or structure.
 2. A minimum horizontal separation of five feet (5 ft) shall be maintained between force mains and existing or proposed storm drainage pipes or structures as measured from edge to edge.
 3. Where a force main crosses above a storm drainage pipe or structure, a minimum vertical separation of twelve inches (12 in.) shall be maintained between the outside edges of the force main and the storm drain.
 4. Where a force main crosses below a storm drainage pipe or structure, the following conditions shall be maintained:
 - (a) Single Storm Drainpipe, twenty-four inch (24 in.) and smaller diameter: A minimum vertical separation of eighteen inches (≥ 18 in.) shall be maintained between the outside edges of the force main and the storm drain. Joints in the force main shall be located as far as possible from the storm drain crossing.
 - (b) Single Storm Drainpipe, greater than twenty-four inch (> 24 in.) diameter: A minimum vertical separation of eighteen inches (≥ 18 in.) shall be maintained between the outside edges of the force main and the storm drain. The force main shall be installed in a steel casing that extends five feet (5 ft) beyond both sides of the crossing. Joints in the force main shall be located as far as possible from the storm drain crossing.

¹ For allowed PVC & DIP force main materials, see SECTION 3.4.1(D).

² Only allowed for individual grinder pumps as permitted by OJRSA.

- (c) Multiple Adjacent Storm Drainpipes: A minimum vertical separation of eighteen inches (≥ 18 in.) shall be maintained between the outside edges of the force main and the storm drain. The force main shall be installed in a steel casing that extends five feet (5 ft) beyond both sides of the crossing. Joints in the force main shall be located as far as possible from the storm drain crossing.
- (d) Box Culverts: A minimum vertical separation of eighteen inches (≥ 18 in.) shall be maintained between the outside edges of the force main and the box culvert. The force main shall be installed in a steel casing that extends five feet (5 ft) beyond both sides of the box culvert. Joints in the force main shall be located as far as possible from the box culvert.

3.4.4 Force Main in Proximity to Sources of Energy or Corrosive Soils

Where ductile iron pipe (DIP) force main may be installed in areas where the pipe may be vulnerable to corrosion, such as corrosive soils, the pipeline crossing or coming into close proximity (within twenty-five feet (25 ft) horizontally) of an overhead or buried power line or metal gas main), corrosion control shall be considered. Should corrosion be determined to be a valid concern, examples of acceptable mitigation measures are as follows:

- A. Material change to PVC if all other criteria for using PVC are met
- B. Polyethylene wrap
- C. Zinc-coated pipe
- D. Cathodic protection system

3.4.5 Force Main Valves

- A. Applicable Details
 - 1. D026 VALVE BOX
 - 2. D027 AIR RELEASE VALVE
 - 3. D028 PIPELINE & VALVE MARKER
- B. Air release valves shall be installed at high points along sewer force mains and at a maximum interval of three thousand feet (3,000 ft). Sewer force mains shall be designed to minimize the number of air release valves (ARV) required.
- C. A plug valve shall be installed at the midpoint of sewer force mains of lengths greater than five thousand feet (5,000 ft) and within two hundred fifty feet (250 ft) of an air release valve where no additional isolation valve exists.
- D. If required by OJRSA, all valve markers shall be concrete.

3.4.6 Connections to Existing Systems

- A. Applicable Detail: D029 FORCE MAIN CONNECTION AT MANHOLE
- B. **MANIFOLDING OF FORCE MAINS IS STRICTLY PROHIBITED.**
- C. Force main connections to existing gravity sewer mains shall be made at existing or proposed transition manholes. These must meet requirements as specified in SECTION 3.3.6(M).

3.5 SEWER PUMP STATION DESIGN CRITERIA

Pump stations shall be sized in accordance with the requirements of SECTION 3.2.

3.5.1 Pump Station Site

- A. Applicable Details
 - 1. PS-1 TYPICAL SUBMERSIBLE PUMP STATION SITE PLAN
 - 2. PS-2 TYPICAL SUCTION LIFT PUMP STATION SITE PLAN
 - 3. PS-9 TYPICAL BYPASS
 - 4. PS-10 TYPICAL YARD HYDRANT
 - 5. PS-11 STANDARD CHAIN LINK FENCING
 - 6. E-2 YARD LIGHT
 - 7. E-3 PUMP STATION ONE-LINE DIAGRAM
- B. Pump station sites shall have a minimum property size of fifty feet by fifty feet (50 ft x 50 ft).

- C. A six inch (6 in.) layer of #67 stone with weed barrier shall be installed throughout the entire area of the pump station site. **IF A DEVELOPER PREFERS AN ASPHALT PAVING WITHIN THE FENCED AREA, THE OJRSA WILL CONSIDER IT ON A CASE-BY-CASE BASIS.**
- D. A four inch (4 in.) bypass connection shall be provided within the pump station fence.
- E. A yard light shall be provided and maintained by the electrical utility provider unless otherwise approved by OJRSA.
- F. A receiving manhole accepting flow from all incoming gravity sewers shall be provided on the pump station influent line within the pump station fence. See SECTION 3.3.6.
- G. Unless otherwise approved by OJRSA, the electric meter shall be located outside of the perimeter fence of the pump station site.
- H. In areas where potable water is readily available, a water service line with a backflow preventer (type as required by the water provider) and water meter shall provide water service to the site. Unless otherwise approved by OJRSA, the water meter shall be located outside of the secured area of the pump station. A minimum of one (1) yard hydrant shall be located within the pump station fence.
- I. A manual transfer switch shall be provided within the pump station fence to allow for use of a portable generator (as shown in DETAIL E-3 PUMP STATION ONE-LINE DIAGRAM).
- J. A six foot (6 ft) chain link fence with barbed wire shall be provided to secure the pump station site. The fence shall include an eighteen foot (18 ft) double swing gate for vehicle access and a separate three foot (3 ft) wide man gate if required by OJRSA) for personnel access.
- K. An all-weather access drive shall be provided for each pump station site plan.

3.5.2 Pump Station Type and Pumps

- A. Applicable Details
 - 1. PS-4 SUBMERSIBLE PUMP STATION TOP PLAN & PIPING PLAN
 - 2. PS-5 SUBMERSIBLE PUMP STATION ELEVATION
 - 3. PS-6 SUCTION LIFT PUMP STATION PLAN
 - 4. PS-7 SUCTION LIFT PUMP STATION ELEVATION
 - 5. PS-9 TYPICAL BYPASS
- B. **PUMPS SHALL BE CENTRIFUGAL SUCTION LIFT TYPE (see SECTION 4.8.1) FOR ALL WET WELLS WITH A DEPTH LESS THAN OR EQUAL TO EIGHTEEN FEET (18 FT). FOR WET WELL DEPTHS GREATER THAN EIGHTEEN FEET (18 FT), COORDINATE WITH OJRSA TO DETERMINE IF PUMPS SHALL BE CENTRIFUGAL SUCTION LIFT OR SUBMERSIBLE (SECTION 4.8.2). THE OJRSA DOES NOT PERMIT THE CONSTRUCTION OF WET PIT/DRY PIT TYPE STATIONS DUE TO INGRESS/EGRESS SAFETY ISSUES AND TO ELIMINATE THE POTENTIAL OF FLOODING OF EQUIPMENT IN THE DRY WELL.**
- C. Suction lift station enclosure types are to be based on the pump station size (Small, Medium, Large, or Other) as stated in Table 8. Contact OJRSA prior to design to confirm preferences.

Table 8: Pump station sizing and required enclosure sizes

Pump Station Size Designation	Discharge Piping Size (inches)	Minimum Required Size of Pump Station
Small	3 or 4	6 ft by 6 ft
Medium	6	8 ft by 12 ft
Large	8	Modular (appropriate custom size)
Other	Other	As required by OJRSA on individual basis

- D. A minimum of two (2) pumps shall be provided at each sewer pump station. The pumps shall have the same capacity and shall each have adequate individual capacity to handle the peak design flow. The design shall never include using multiple pumps operating simultaneously to achieve peak design flow.
- E. Pumps shall be non-overloading for all duty points.
- F. Pumps shall be selected such that the operating point is at (or as close as possible to) the best efficiency point.
- G. Pumps shall operate on an alternating cycle in a typical lead-lag sequence.
- H. The minimum diameter for suction and discharge piping is four inches (4 in). Individual grinder pump stations

(SECTION 4.8.3) are permitted to utilize two inches (2 in.) discharge piping when approved by OJRSA.

- I. The discharge piping for each pump shall be installed with a cushioned swing check valve, plug valve, flow meter (magmeter), and pressure gauge located outside of the pump station wet well in a separate pre-cast concrete vault.
- J. A surge relief valve shall be provided where necessary to prevent buildup of excessive surge pressures.

3.5.3 Wet Wells

A. Applicable Details

1. PS-5 SUBMERSIBLE PUMP STATION ELEVATION
2. PS-6 SUCTION LIFT PUMP STATION ELEVATION

B. The wet well diameter shall be at least six feet (6 ft). **THE OJRSA MAY REQUIRE A RECTANGULAR WET WELL BASED ON ITS ENGINEER'S RECOMMENDATION.**

C. The top of the wet well slab shall be sloped to facilitate drainage away from the pump station.

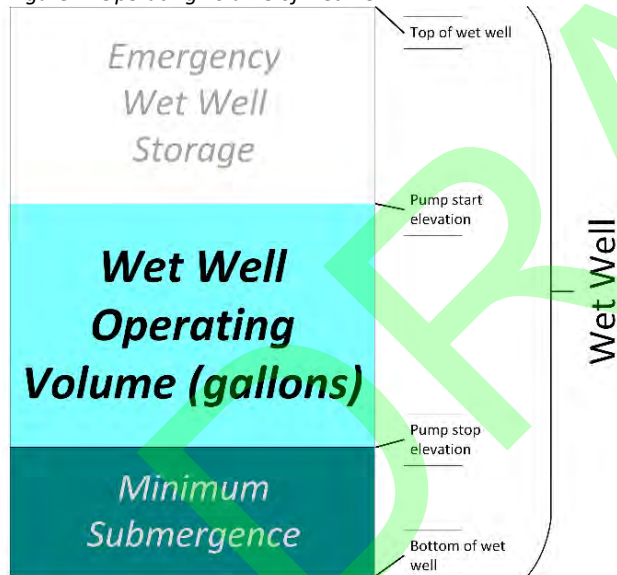
D. The wet well size shall be determined according to the following formula:

$$V = \frac{tq}{4}$$

Where V is the Operating Volume (in gallons); t is the Minimum Pump Cycle Run; Time (in minutes); and q is the Pump Discharge Rate (in gallons per minute, gpm)

See Figure 2 for an illustration of the operating volume range of a wet well.

Figure 2: Operating volume of wet well



- E. The wet well shall be designed so that no pump starts more than the pump manufacturer's recommended maximum number of starts per hour but shall never exceed ten (10) starts per hour.
- F. Lead-Lag Pump Operations
 1. The minimum difference between the lead pump on and lag pump on elevations shall be six inches (6 in.).
 2. The minimum difference between the lag pump on and the high-water alarm elevations shall be six inches (6 in.).
 3. The minimum difference between the high-water alarm elevation and the invert elevation of the wet well influent pipe shall be twelve inches (12 in.).

3.5.4 Electrical

A. Applicable Details

1. PS-8 MAGMETER VAULT

2. S-1 CANOPY AND ELECTRICAL PAD PLAN & ELEVATIONS
 3. E-1 DUPLEX PUMP STATION ELECTRICAL STANDARDS
 4. E-2 YARD LIGHT
 5. E-3 PUMP STATION ONE-LINE DIAGRAM
- B. Pump station electrical services and controls shall be coordinated with electrical utilities and designed to handle the ultimate electrical capacity of the pump station.
 - C. Pump station electrical design shall be in accordance with the latest edition of NFPA 70 and the latest edition of NFPA 820.
 - D. Single phase power is allowed on motors of less than or equal to five horsepower (5 hp). Three-phase power is required on all motors of greater than five horsepower (5 hp). No phase converters shall be used.
 - E. Electrical equipment racks shall be of aluminum or Type 316 stainless steel construction with adequate grounding and shall be of sufficient size for mounting of all electrical control and SCADA equipment.
 - F. Electrical components shall be placed in a north-facing orientation to prevent the sun from deteriorating plastics and/or making components difficult for operators to read due to glare or fading. If this is not possible, designer is to coordinate with OJRSA personnel on acceptable alternative.
 - G. All electrical equipment racks shall be provided with a concrete pad.
 - H. LED lights shall be provided for electrical rack canopy.
 - I. If possible, the electric meter should be mounted to the electrical equipment rack outside of the pump station fence in order for the electric utility to have unimpeded access to the meter. If it is mounted inside the fence, it shall be mounted so that it can be read easily from outside of the fenced area.
 - J. Power and control wiring shall be run in underground conduits between equipment and electrical equipment rack.
 - K. The pump station control panel shall be located a sufficient distance from the pump station wet well hatch opening to satisfy the requirements of NFPA 70 and NFPA 820. Conduits feeding the control panel shall be protected with conduit seals.
 - L. A weather-tight wireway shall be installed beneath the control panel, and all wiring from the pump station wet well shall be terminated in the wireway.
 - M. All power, control, and alarm circuits shall have the capability to be disconnected from outside the pump station wet well and shall be provided with strain relief.
 - N. All terminals and connectors shall be weatherproof and located outside of the pump station wet well or shall be protected using watertight seals.
 - O. A transient voltage surge suppressor shall be mounted to the electrical equipment rack and shall be provided on the load side of the transfer switch.
 - P. Motors greater than or equal to twenty horsepower (≥ 20 hp) shall be provided with soft starters or variable frequency drives (VFDs). The use of VFDs must be approved by OJRSA.
 - Q. A portable generator plug shall be provided at each pump station.
 - R. Weatherproof, duplex GFI receptacles shall be provided at each pump station.

3.5.5 Supervisory Control and Data Acquisition (SCADA)

Unit shall meet current OJRSA standards, which the design engineer should request prior to station design. Installation should be conducted by qualified personnel.

END OF SECTION 3

SECTION 4 – MATERIALS OF CONSTRUCTION

THE OJRSA EXECUTIVE DIRECTOR, OR HIS/HER DESIGNEE, SHALL HAVE THE DISCRETION TO DECIDE UPON EQUIPMENT, CONSTRUCTION AND/OR DESIGN METHODS, AND OTHER ITEMS NOT ADDRESSED WITHIN THIS POLICY. THE OJRSA MAY MAKE THESE DECISIONS WITH OR WITHOUT CONSULTING THE AGENCY'S ENGINEER OF CHOICE OR OTHER SOURCES OF COUNSEL AS APPROPRIATE. DECISIONS SHALL BE MADE FOR WHAT IS IN THE BEST INTEREST OF THE OJRSA. THIS DECISION SHALL BELONG SOLELY TO THE OJRSA AND IS NOT TO BE INFLUENCED BY THE DEVELOPER OR THOSE REPRESENTING THEM. (SECTION 1.4)

4.1 GRAVITY SEWER PIPE

4.1.1 Referenced Standards

Unless otherwise indicated, all referenced standards shall be the latest edition available at the time of bidding. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.1.2 Submittals

- A. Product Data: Submit manufacturer's information indicating proposed materials, accessories, details, and construction information.
- B. Permits: Submit four (4) copies of applicable permits, such as *Wastewater Construction Permit* as issued by SCDHEC/SCDES, roadway open cut permit, and land disturbance permit.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Tests and Evaluation Reports: Submit reports indicating field tests made and results obtained.
- E. Manufacturer Instructions
 1. Indicate special procedures required to install specified products.
 2. Submit detailed description of procedures for connecting new sewer to existing sewer line.
- F. Closeout Submittals
 1. Project Record Documents: Record invert elevations and actual locations of pipe runs, connections, manholes, and service lateral locations.
 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

4.1.3 Preferred Manufacturers

- A. PVC Pipe: OJRSA does not have a preferred pipe manufacturer.
- B. Ductile Iron Pipe and Fittings: The OJRSA does not have a preferred manufacturer; however, all DIP and fittings shall be lined with a nominal dry film thickness of forty (40) mils with the following:
 1. Protecto 401,
 2. Permax-CTF, or
 3. Tnemec 431.

4.1.4 Materials of Construction

- A. PVC Pipe
 1. Material: Polyvinyl chloride (PVC) made from PVC compounds as defined and described in ASTM D1784 with a cell classification of 12454-B.
 2. End Connections: Bell and spigot style, with rubber-ring-gasket sealed gasket joint.
 3. Length: Pipe shall be furnished and installed in fourteen feet (14 ft) or twenty feet (20 ft) nominal laying lengths.
 4. Joints: Elastomeric gaskets that comply with ASTM F477.
- B. Ductile Iron Pipe
 1. Manufacture of Pipe
 - (a) General: Centrifugally cast ductile iron pipe in sand lined or metal molds in accordance with ANSI A21.51/AWWA C151 and ASTM A746. Use only new pipe, Pressure Class 150, or greater as per burial depth, with push on or mechanical joints.

- (b) Coating: Except where the pipe is to be field painted, coat the exterior of the pipe with a bituminous coating of either coal tar or asphalt base in accordance with ANSI A21.51/AWWA C151.
- (c) Pipe Lengths: Furnish pipe in nominal eighteen feet (18 ft) or twenty feet (20 ft) lengths unless a longer length is required by OJRSA to span creeks, ditches, washes, or other such areas. Shorter lengths may be used where required by construction details.
- (d) Marking: Cast or stamp the weight, Class or nominal thickness, casting period, and the letters "DI" or "Ductile" on the pipe; no pipe will be accepted unless these markings appear on all ductile iron pipe.

2. Jointing

- (a) Push-On Joint Pipe and Fittings: Conform to ANSI A21.51/AWWA C151 for centrifugally cast pipe and to ANSI A21.10/AWWA C110 for rubber-gasket joints. Factory-machine the plain end of the pipe to a true circle and chamfer to facilitate fitting the gasket.
- (b) Gaskets: Elastomeric gaskets conforming with ASTM F477.

C. Pipe Bedding

- 1. Use crushed stone or crushed gravel meeting the requirements of ASTM C33, Gradation 57.
 - 2. Soil backfill from above pipe to finish grade: subsoil with no rocks over two inches (2 in.) in diameter, frozen earth, or foreign matter.
 - 3. When concrete cradles are required, use four thousand pounds per square inch (4,000 psi) concrete, air entrained, with rough troweled finish.
- D. Magnetic Tape: All open trench installed pipe shall include installation of electronically or magnetically detectable tape buried twelve inches (12 in.) deep over the pipe. Tape shall be at least two inches (2 in.) wide and boldly labeled every eighteen inches (18 in.) to thirty-two inches (32 in.) with "CAUTION SEWER LINE BURIED BELOW". Tape shall have a tensile strength of not less than four thousand pounds per square inch (4,000 psi), and a minimum thickness of five and one-half (5.5) mils and include sufficient metal to allow easy detection.

END OF SECTION 4.1

4.2 FORCE MAIN SEWER PIPE

4.2.1 Polyvinyl Chloride (PVC) Pipe Force Mains

4.2.1.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.2.1.2 Submittals

- A. Product Data: Submit manufacturer's information indicating proposed materials, accessories, details, and construction information.
- B. Shop Drawings: Indicate restrained joint locations.
- C. Permits: Submit four (4) copies of applicable permits, such as *Wastewater Construction Permit* as issued by SCDHEC/SCDES, roadway open cut permit, and land disturbance permit.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Tests and Evaluation Reports: Submit reports indicating field tests made and results obtained.
- F. Manufacturer Instructions
 - 1. Indicate special procedures required to install specified products.
 - 2. Submit detailed description of procedures for connecting new sewer to existing sewer line.

4.2.1.3 Preferred Manufacturers

- A. PVC Pipe: OJRSA does not have a preferred manufacturer for PVC pipe.
- B. Ductile Iron Fittings: The OJRSA does not have a preferred manufacturer; however, all DIP fittings shall be lined with a nominal dry film thickness of forty (40) mils with the following:
 - 1. Protecto 401,

2. Permax-CTF, or
 3. Tnemec 431.
- C. Mechanical Seal Thrust Restraint
1. EBAA Iron, Inc. Series 2000PV, or
 2. OJRSA-approved equal.
- D. Mechanical Split Bell Joint Restraint
1. EBAA Iron, Inc., or
 2. OJRSA-approved equal.

4.2.1.4 Materials of Construction

- A. Diameter Less than or Equal to Three Inches (≤ 3 in.) (*Used with Grinder Pumps Only*)
1. PVC Pipe: Schedule 80 PVC pipe with elastomeric gaskets conforming with ASTM F477.
 2. Pipe Lengths: Provide pipe in nominal twenty foot (20 ft) lengths. Shorter lengths may be used where required by construction details.
 3. Fittings: Schedule 80 PVC fittings with elastomeric gaskets conforming with ASTM F477.
- B. Diameter Greater Than or Equal to Four Inches (≥ 4 in.)
1. Pipe: Comply with the requirements of AWWA C900/AWWA C905 conforming with the outside diameter dimensions of cast iron pipe, with a dimension ratio of DR-18. Mark pipe in compliance with the requirements of AWWA C900/AWWA C905.
 2. Pipe Lengths: Provide pipe in nominal twenty foot (20 ft) lengths. Shorter lengths may be used where required by construction details.
 3. Pipe Joints: Bell and spigot style, with rubber-ring-gasket sealed gasket joint. Gaskets shall be elastomeric gaskets conforming with ASTM F477.
 4. Fittings
 - (a) Use Pressure Rated Class 250 fittings, either ductile iron or gray cast iron, conforming to applicable sections of ANSI A21.10/AWWA C110 or ANSI A21.53/AWWA C153 and ANSI A21.11/AWWA C111. Use push on or mechanical joint fittings corresponding to the jointing of the pipe being used.
 - (b) Except where fittings are to be field painted, coat the exterior of all fittings with a bituminous coating of either coal tar or asphalt base in accordance with ANSI A21.10/AWWA C110 or ANSI A21.53/AWWA C153.
 - (c) Mark fittings in accordance with ANSI A21.10/AWWA C110 or ANSI A21.53/AWWA C153; fit-tings without these markings will not be accepted.
5. Thrust Restraint
- (a) Provide mechanical joint thrust restraint for all new tees, bends, and plugs on pipe four inches (4 in.) and larger in diameter.
 - (b) Provide mechanical split bell joint thrust restraint for all bells requiring restraint on pipe four inches (4 in.) and larger in diameter.
- C. Magnetic Tape: All open trench installed pipe shall include installation of electronically or magnetically detectable tape buried twelve inches (12 in.) deep over the pipe. Tape shall be at least two inches (2 in.) wide and boldly labeled every eighteen inches (18 in.) to thirty-two inches (32 in.) with "CAUTION SEWER LINE BURIED BELOW". Tape shall have a tensile strength of not less than four thousand pounds per square inch (4,000 psi), and a minimum thickness of five and one-half (5.5) mils, and include sufficient metal to allow easy detection.
- D. Tracer Wire: Wire shall be stranded twelve (12) gauge copper with green insulation rated UF or USE by Underwriters Laboratories. Wire shall be looped into ground level cast-iron valve boxes (w/ caps labeled "SEWER"). Tracer wire access intervals shall not be greater than one thousand feet (1,000 ft), and "dummy" boxes shall be installed when distance between valves exceeds one thousand feet (1,000 ft).

4.2.2 Ductile Iron Pipe (DIP) Force Mains

4.2.2.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.2.2.2 Submittals

- A. Product Data: Submit manufacturer's information indicating proposed materials, accessories, details, and construction information.
- B. Shop Drawings: Indicate restrained joint locations.
- C. Permits: Submit four (4) copies of applicable permits, such as *Wastewater Construction Permit* as issued by SCDHEC/SCDES, roadway open cut permit, and land disturbance permit.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Tests and Evaluation Reports: Submit reports indicating field tests made and results obtained.
- F. Manufacturer Instructions
 1. Indicate special procedures required to install specified products.
 2. Submit detailed description of procedures for connecting new sewer to existing sewer line.

4.2.2.3 Preferred Manufacturers

- A. DIP Pipe: OJRSA does not have a preferred manufacturer for DIP. All DIP shall be lined with a nominal dry film thickness of forty (40) mils with the following:
 1. Protecto 401,
 2. Permox-CTF, or
 3. Tnemec 431.
- B. Ductile Iron Fittings: OJRSA does not have a preferred manufacturer for DIP; however, all DIP fittings shall be lined with a nominal dry film thickness of forty (40) mils with the following:
 1. Protecto 401,
 2. Permox-CTF, or
 3. Tnemec 431.
- C. Restrained Joints:
 1. American Pipe Fast-Grip, Flex-Ring, Field Flex-Ring, or Lok-Ring;
 2. US Pipe TR Flex or Field Lok;
 3. Griffin Pipe Snap-Lok;
 4. EBAA Iron, Inc.;
 5. Megalug; or
 6. OJRSA-approved equal.

4.2.2.4 Materials of Construction

- A. Manufacture of Pipe
 1. General: Centrifugally cast ductile iron pipe in sand lined or metal molds in accordance with ANSI A21.51/AWWA C151. Use only new pipe, Pressure Class 150, or greater as per burial depth, with push on or mechanical joints.
 2. Lining: To be required where DIP is allowed as stated in SECTION 3.4.
 3. Coating: Except where the pipe is to be field painted, coat the exterior of the pipe with a bituminous coating of either coal tar or asphalt base in accordance with ANSI A21.51/AWWA C151.
 4. Pipe Lengths: Furnish pipe in nominal eighteen foot (18 ft) or twenty foot (20 ft) lengths unless a longer length is required by OJRSA to span creeks, ditches, washes, or other such areas. Shorter lengths may be used where required by construction details.
 5. Marking: Cast or stamp the weight, class or nominal thickness, casting period, and the letters "DI" or "Ductile" on the pipe; no pipe will be accepted unless these markings appear on all ductile iron pipe.
 6. Fittings
 - (a) Use Pressure Rated Class 250 fittings, either ductile iron or gray cast iron, conforming to applicable sections of ANSI A21.10/AWWA C110 or ANSI A21.53/AWWA C153 and A21.11/AWWA

C111. Use push on or mechanical joint fittings corresponding to the jointing of the pipe being used.

- (b) Except where fittings are to be field painted, coat the exterior of all fittings with a bituminous coating of either coal tar or asphalt base in accordance with ANSI A21.10/AWWA C110 or ANSI A21.53/AWWA C153.
- (c) Mark fittings in accordance with ANSI A21.10/AWWA C110 or ANSI A21.53/AWWA C153; *fittings without these markings will not be accepted.*

B. Jointing

1. Push on Joint Pipe and Fittings: Conform to ANSI A21.51/AWWA C151 for centrifugally cast pipe and to ANSI A21.11/AWWA C111 for Rubber Gasket Joints. Factory machine the plane end of the pipe to a true circle and chamfer to facilitate fitting the gasket.
2. Mechanical Joint Pipe and Fittings: Conform to ANSI A21.51/AWWA C151 for centrifugally cast pipe and to ANSI A21.11/AWWA C111 for Mechanical Joints. Use gaskets, bolts and nuts for mechanical joints which are furnished by the pipe manufacturer.
3. Flanged Pipe and Fittings: Conform to the requirements of ANSI A21.51/AWWA C151 for centrifugally cast pipe. Flanged pipe shall be a minimum of Class 53. Furnish long hub flanges which are screwed on tight at the foundry by machine before they are faced and drilled.
 - (a) Cast ductile iron flanged fittings in conformance with ANSI A21.10/AWWA C110 or ANSI A21.53/AWWA C153, and use special drilling or tapping, as necessary, to insure correct alignment and bolting. Integrally cast flanges for flanged fittings and specials which are at right angles to the axis, accurately faced, and machined smooth and true. Use flanges which are of a pressure classification adequate for pressure of two hundred fifty pounds per square inch (250 psi).
 - (b) Make flanged joints with bolts, bolt studs with a nut on each end or studs with nuts where the flange is tapped. Use Grade B bolts conforming to ASTM A307.
 - (c) Use ring gaskets of rubber with cloth insertion. Gasket thickness:
 - (i) For diameters twelve inches (12 in.) and smaller, use gaskets that are one sixteenths of an inch (1/16 in.).
 - (ii) For diameters larger than twelve inches (12 in.), use gaskets that are three thirty-seconds of an inch (3/32 in.).
 - (d) Provide flange fillers where layout of flange piping necessitates their use.
4. Restrained Pipe and Fittings: Restrained joint pipe and fittings shall conform to ANSI A21.51/AWWA C151 for centrifugally cast-iron pipe and to ANSI A21.11/AWWA C111 for rubber gasket joints. Both pipe and fittings have a minimum working pressure of one hundred fifty pounds per square inch (150 psi).
5. Gaskets: Elastomeric gaskets conforming with ASTM F477.

C. Pipe Bedding

1. Use crushed stone or crushed gravel meeting the requirements of ASTM C33, Gradation 57 when in-situ soil is unsuitable for bedding material.
2. When concrete cradles are required, use four thousand pounds per square inch (4,000 psi) concrete.

D. Magnetic Tape: All open trench installed pipe shall include installation of electronically or magnetically detectable tape buried twelve inches (12 in.) deep over the pipe. Tape shall be at least two inches (2 in.) wide and boldly labeled every eighteen inches (18 in.) to thirty-two inches (32 in.) with "CAUTION SEWER LINE BURIED BELOW". Tape shall have a tensile strength of not less than four thousand pounds per square inch (4,000 psi), and a minimum thickness of five and one-half (5.5) mils and include sufficient metal to allow easy detection.

E. Tracer Wire: Wire shall be stranded twelve (12) gauge copper with green insulation rated UF or USE by Underwriters Laboratories. Wire shall be looped into ground level cast-iron valve boxes (w/ caps labeled "SEWER"). Tracer wire access intervals shall not be greater than one thousand feet (1,000 ft), and "dummy" boxes shall be installed when distance between valves exceeds one thousand feet (1,000 ft).

END OF SECTION 4.2

4.3 HORIZONTAL DIRECTIONAL DRILLING

4.3.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.3.2 Submittals

Within thirty (30) calendar days after the contractor has received the OJRSA's Notice to Proceed, submit the following product data:

- A. Drilling Operations Plan, addressing procedures for pilot hole drilling and reaming, and procedures for tracking and controlling the drilling head location.
- B. Drilling fluid management plan.
- C. Spoils handling and disposal plan.
- D. Pipe storage and handling plan that addresses the means and methods for protecting pipe and ensuring temperature control in accordance with the contractor's installation calculations.
- E. Pipeline assembly and installation plan, addressing procedures for pipe joining, pipeline pullback, and pullback monitoring.
- F. Plan for prevention of inadvertent fluid losses and spills; contingencies or rapid containment and cleanup; measures to mitigate risk of inadvertent fluid returns to surface; procedures for monitoring and controlling drilling fluid flows and pressures; equipment, resources, and procedures for identifying, containing, and cleaning up fluid losses and spills.
- G. Quality control and testing procedures.

4.3.3 Preferred Manufacturers

- A. HDD Materials: OJRSA does not have a preferred manufacturer for horizontal directional drill (HDD) materials.
- B. Fittings and Other Materials: For all other materials addressed within *OJRSA Development Policy* to be used in conjunction with HDD, use only materials listed within Policy. For all others, OJRSA does not have a preferred manufacturer.

4.3.4 Materials of Construction

- A. General. The directional drilling equipment shall consist of the following:
 1. A directional drilling rig of sufficient capacity to perform the bore and pullback the pipe.
 2. A drilling fluid mixing, delivery, and recovery system of sufficient capacity to complete the crossing.
 3. A drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be reused.
 4. A magnetic guidance system to accurately guide boring operations.
 5. A vacuum truck of sufficient capacity to handle the drilling fluid volume.
 6. Trained and competent personnel to operate the system.
- B. Drilling System
 1. General: The directional drilling equipment, as a minimum, shall consist of a directional drilling rig of sufficient capacity to perform the bore(s) and pullback of the pipe(s), a drilling fluid mixing & delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations, and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials, and spare parts on hand to maintain the system in good working order for the duration of this project. All required equipment shall be included in the emergency and contingency plan as submitted per these specifications.
 2. Drilling Rig: The directional drilling machine shall consist of a hydraulically powered system to rotate, push, and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing, and rotating pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pullback pressure during pullback operations. The rig shall be grounded during drilling and pullback operations.

There shall be a system to detect electrical current from the drilling string and an audible alarm that automatically sounds when an electrical current is detected.

3. Drill Head

- (a) The horizontal directional drilling equipment shall produce a stable fluid lined tunnel with the use of a steerable drill head and any subsequent pre-reaming heads.
- (b) The system must be able to control the depth and direction of the drilling operation.
- (c) Drill head shall contain all necessary cutters and fluid jets for the operation and shall be of the appropriate design for the ground medium being drilled.

4. Drilling Fluid System

(a) Drilling Fluid

- (i) Drilling fluid shall be a mixture of water and bentonite clay. The fluid shall be inert. The fluid should remain in the tunnel to ensure the stability of the tunnel, reduce drag on the pulled pipe, and provide backfill within the annulus of the pipe and tunnel.
- (ii) Disposal of excess drilling fluid and spoils shall be the responsibility of the contractor who must comply with all relevant regulations, right-of-way, workspace, and permit agreements. Excess drilling fluid and spoils shall be disposed at an approved location. The contractor is responsible for transporting all excess drilling fluid and spoils to the disposal site and paying any disposal costs. Excess drilling fluid and spoils shall be transported in a manner that prevents accidental spillage onto roadways. Excess drilling fluid and spoils will not be discharged into sanitary sewers, storm drain systems, or waterways.
- (iii) Drilling fluid returns (caused by fracturing or formations) at locations other than the entry and exit points shall be minimized. The contractor shall immediately clean up any drilling fluid that surfaces through fracturing.
- (iv) Mobile spoils removal equipment capable of quickly removing spoils from entry or exit pits and areas with returns caused by fracturing shall be present during guided boring operations.
- (v) The contractor shall be responsible for making provisions for a clean water supply for the mixing of drilling fluid.

(b) Mixing System

- (i) A drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid for the project.
- (ii) The mixing system shall be able to ensure thorough mixing of the drilling fluid. The drilling fluid reservoir tank shall be sized for adequate storage of the fluid.
- (iii) The mixing system shall continually agitate the drilling fluid during drilling operations.

(c) Drilling Fluid Delivery and Recovery System

- (i) The drilling fluid pumping system shall have a minimum capacity to supply drilling fluid in accordance with the drilling equipment pullback rating at a constant required pressure.
- (ii) The delivery system shall have filters or other appropriate inline equipment to prevent solids from being pumped into the drill pipe.
- (iii) Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. The use of spill containment measures shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits, and drilling fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps, vacuum truck(s), and/or storage of sufficient size shall be in place to contain excess drilling fluid.
- (iv) A closed-loop drilling fluid system and a drilling fluid cleaning system should be used to whatever extent practical, depending upon project size and conditions. Under no circumstances shall drilling fluid that has escaped containment be reused in the drilling system.

- (d) Drilling Control System
 - (i) Calibration of the electronic detection and control system shall be verified prior to the start of the bore.
 - (ii) The drilling head shall be remotely steerable by means of an electronic or magnetic detection system. The drilling head location shall be monitored in three (3) dimensions:
 - (A) Offset from the baseline,
 - (B) Distance along the baseline, and
 - (C) Depth of cover.
 - (iii) Point of rotation of the head shall also be monitored.
 - (iv) For gravity application and on-grade drilling, sonde/beacon or approved equipment applicable for grade increments of one tenth of one percent (0.1%) shall be used.
- (e) Pipe Pull Head
 - (i) Pipe pull heads shall be utilized that employ a positive through-bolt design assuring a smooth wall against the pipe cross-section at all times.
 - (ii) Pipe pull heads shall be specifically designed for use with fusible polyvinylchloride (FPVC) pipe and shall be as recommended by the pipe supplier.
- (f) Pipe Rollers
 - (i) Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe during handling and pullback operations.
 - (ii) A sufficient quantity of rollers and spacing per the pipe supplier's guidelines shall be used to ensure adequate support and excessive sagging of the product pipe.

C. Materials: Pipes and Fittings

- 1. High Density Polyethylene Pipe (HDPE)
 - (a) HDPE and fittings shall be used in accordance with the materials specifications. All additional appurtenances shall meet the materials specifications. All pipe installed by guided boring shall be joined by an approved butt fusion or electro-fusion technique according to the manufacturer's specifications.
 - (b) HDPE pipe shall be produced from resins meeting the requirements of ASTM D1248 designation PE3408, ASTM D3350 cell classification PE34543C, and shall meet the requirements of AWWA C901 and C906. Pipes shall be legibly marked at intervals of no more than five feet (5 ft) with the manufacturer's name, trademark, pipe size, HDPE cell classification, appropriate legend such as SDR 11 OR ASTM D3035, and dates of manufacture, and point of origin. The pipe shall be ductile iron pipe size.
- 2. Fusible Polyvinyl Chloride (FPVC)
 - (a) FPVC pipe shall conform to AWWA C900 or AWWA C905, and/or ASTM D2241 or ASTM D1785 for iron pipe size (IPS) standard dimensionality, if applicable.
 - (b) The pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind.
 - (c) The pipe shall be manufactured in standard twenty foot (20 ft), thirty foot (30 ft), or forty foot (40 ft) nominal lengths.
 - (d) The pipe shall be green in color to comply with APWA Uniform Color Code for wastewater.
 - (e) The pipe shall be marked in accordance with the requirements of AWWA C900/AWWA C905 including nominal pipe size, PVC material, dimension ratio (DR), pressure class, extrusion production record code, trademark name, and cell classification 12454.
 - (f) Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible defects.
 - (g) Unless otherwise specified, FPVC pipe lengths shall be assembled in the field with butt-fused joints. The contractor shall follow the pipe supplier's written guidelines for this procedure. All fusion joints shall be completed as described in this specification.
 - (h) Use ductile iron fittings at transitions from HDD meeting with pressure rating of one hundred

fifty pounds per square inch (150 psi): ANSI/AWWA C110/A21.10, lined with Protecto 401, forty (40) mils nominal thickness.

END OF SECTION 4.3

4.4 BORING ENCASEMENT

4.4.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.4.2 Submittals

Product data: Within thirty (30) calendar days after the contractor has received the OJRSA's Notice to Proceed, submit the manufacturer's specifications and other data needed to provide compliance with the specified requirements.

4.4.3 Preferred Manufacturers

OJRSA does not have a preferred manufacturer.

4.4.4 Materials of Construction

A. Carrier Pipe: Carrier pipe shall be as specified in other sections.

B. Encasement Pipe

1. Encasement pipe installed by boring and jacking shall be welded steel pipe conforming to ASTM A139 and shall match the specified size. Pipe shall be bituminous coated on the outside. Minimum wall thickness shall be as listed in Table 9.

Table 9: Minimum wall thickness for encasement pipe

Diameter (inches)	Thickness (inches)	Diameter (inches)	Thickness (inches)
Less than 8	0.188	26	0.406
8	0.188	28	0.438
10	0.188	30	0.469
12	0.250	32	0.500
14	0.250	34	0.532
16	0.281	36	0.532
18	0.312	42	0.625
20	0.344	48	0.688
22	0.344	Other	Per design engineer ¹
24	0.375		

2. **WHEN ENCASEMENT PIPE IS INSTALLED WITHOUT A PROTECTIVE COATING OR CATHODIC PROTECTION, THE WALL THICKNESS SHALL BE INCREASED A MINIMUM OF SIXTY-THREE THOUSANDTHS OF AN INCH (0.063 IN.) GREATER THAN THE MINIMUM THICKNESS SHOWN ABOVE.**

C. As applicable, materials shall comply with references stated within this Section.

END OF SECTION 4.4

¹ And with OJRSA engineer's approval.

4.5 MANHOLES

4.5.1 Precast Concrete Manholes

4.5.1.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.5.1.2 Submittals

- A. Product Data: Submit manufacturer information for manhole covers, component construction, features, configuration, and dimensions.
- B. Shop Drawings: Indicate structure locations and elevations; and sizes and elevations of penetrations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- E. Source Quality-Control Submittals: Indicate results of factory tests and inspections.
- F. Qualifications Statement: Submit qualifications for manufacturer.

4.5.1.3 Approved Manufacturers

- A. Precast manholes shall be a standard unit as manufactured by:
 - 1. MST Concrete Products, Inc.,
 - 2. Tindall Concrete Products, Inc., or
 - 3. OJRSA-approved equal.
- B. Manhole Frame and Cover: Manhole Frame and Cover: Shall be EJ (formerly known as East Jordan Iron Works, Inc.) frame and covers or OJRSA-approved equal. If alternate proposed, it must be made of steel produced in the United States.

4.5.1.4 Materials of Construction

- A. General: Conform to details indicated.
- B. Materials
 - 1. Concrete used in manhole structures shall conform to ASTM C478 and the following:
 - (a) Compressive Strength: Minimum five thousand pounds per square inch (5,000 psi) at twenty-eight (28) calendar days.
 - (b) Air Content: Minimum four percent (4%).
 - (c) Cementitious Materials: Minimum of five hundred sixty-four pounds per cubic yard (564 lb/yd³).
 - (d) Coarse Aggregates: ASTM C33. Sound, crushed, angular granitic stone only. Smooth or rounded stone shall not be used.
 - (e) Fine Aggregates: ASTM C33. Free from organic impurities.
 - (f) Chemical Admixtures: ASTM C494. Calcium chloride or admixtures containing calcium chloride shall not be used.
 - (g) Air Entraining Admixtures: ASTM C260.
 - (h) Reinforcing steel shall be ASTM A615 Grade 60 deformed bar, ASTM A82 wire, or ASTM A185 welded wire fabric.
 - (i) Butyl rubber sealant shall conform to Federal Standards SS-S-210A, AASHTO M198, Type B - Butyl Rubber and as follows: Maximum of one percent (1%) volatile matter and suitable for application temperatures between ten degrees Fahrenheit (10°F) and one hundred degrees Fahrenheit (100°F).
 - (j) Bentonite Impregnated Butyl Rubber Sealant shall contain ninety-nine percent (99%) solids with a maximum of one percent (1%) volatile matter and suitable for application temperatures between five degrees Fahrenheit (5°F) and one hundred twenty-five degrees Fahrenheit (125°F).
 - 2. Provide precast base sections that extend above pipe top and form portion of barrel.

3. When base sections do not form portion of barrel, waterstop shall be installed between base section and barrel section.
4. Barrel sections constructed of manhole risers topped with tapered sections or flat tops as indicated.
5. Conform manhole sections to ASTM C478; resilient connectors to ASTM C923 secured with stainless steel clamps. Modifications to existing manholes which require the addition of a supplemental connection shall incorporate the use of an elastomeric manhole adapter specifically designed for this application.
6. Manhole steps must comply with the following requirements of:
 - (a) OSHA Standard 1910.24
 - (b) Manhole steps shall be made of composite plastic steel construction. Minimum design live load of steps shall be a single concentrated load of three hundred pounds (300 lb). Steps shall have nonskid top surfaces and shall be designed so that the foot cannot slip off the end.
 - (c) Steps shall have a minimum cross-sectional dimension of one inch (1 in.), and a minimum width of ten inches (10 in). Steps shall be evenly spaced on sixteen inch (16 in.) centers with each step embedded in the wall a minimum of three inches (3 in.). Each step shall project a minimum of four inches (4 in.) from the wall as measured from the point of embedment. Composite steel straps shall consist of a one-half inch (0.5 in.) deformed steel reinforcing rod encapsulated in copolymer plastic. Reinforcing rods shall conform to ASTM A615.
7. Where force mains are discharged to manholes, such manhole interior shall be adequately protected with an approved coating to prevent hydrogen sulfide damage as stated in SECTION 3.3.6(M).

C. Frame and Covers

1. Provide cast iron frames and covers as indicated and as required by the structure and ASTM A48, Class 35B, or ductile iron conforming to ASTM A536, Grade 60-40-18.
2. Provide frames and covers meeting AASHTO M306 HS-20 load rating in traffic areas (minimum sixteen thousand pounds (16,000 lb) dynamic wheel load).
3. Provide removable covers to seat in frames without rocking.
4. Provide lockable, bolt-down covers where required by OJRSA.
5. Identify covers with cast markings "OJRSA SEWER" and "CONFINED SPACE PERMIT REQUIRED" as shown on Standard Manhole Frame and Cover detail and include the name and location of manufacturer on frame and cover castings.
6. Provide castings free of blowholes, splits, cracks, blisters, mold-pull, and other imperfections affecting strength or serviceability.
7. Provide watertight manhole frames and covers where required by OJRSA.

D. Joints

1. Provide Butyl Rubber Sealant conforming to ASTM C990 or O-Ring rubber-gasket joints conforming to ASTM C443 at the precast joints.
2. Provide an external wrap of butyl rubber sealant at least one sixteenth inch (1/16 in.) thick and six inches (6 in.) wide at the external precast joints.

E. Pipe Connections: Conform to ASTM C923.

F. Precast Inverts: Conform to ASTM C913.

G. Mortar and Grout

1. Materials
 - (a) Portland Cement: ASTM C150, Type I, gray.
 - (b) Mortar Aggregate: ASTM C144, standard masonry type.
 - (c) Water: Clean and potable.
2. Mortar and Mixing
 - (a) Thoroughly mix ingredients in accordance with ASTM C270 in quantities needed for immediate use.
 - (b) Maintain sand uniformly damp immediately before the mixing process.
 - (c) Do not use anti-freeze compounds to lower the freezing point of mortar.
 - (d) If water is lost by evaporation, re-temper only within two (2) hours of mixing.

- (e) Use mortar within two (2) hours after mixing at temperatures of ninety degrees Fahrenheit (90°F), or two and one-half (2.5) hours at temperatures less than fifty degrees Fahrenheit (50°F).

4.5.2 Polymer Concrete Manholes

4.5.2.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.5.2.2 Submittals

Submit manufacturer's data and details of following items for approval:

- A. Shop drawings of manhole sections, base units, and construction details, jointing methods, materials, reinforcement details, rim and invert elevations, and dimensions.
- B. Summary of criteria used in structure design including, as minimum, material properties, loading criteria, and dimensions assumed. Include certification from manufacturer that polymer concrete manhole design meets or exceeds the load and strength requirements of ASTM C478 and ASTM C857, reinforce in accordance with ACI 440.1R-15.
- C. Frames, grates, rings, and covers.
- D. Materials to be used in fabricating pipe drop connections.
- E. Materials to be used for pipe connections.
- F. Materials to be used for stubs and stub plugs, if required.
- G. References of ten (10) previous polymer concrete projects including scope in the last five (5) years performed, with reference information for both owner and contractor for each project.

4.5.2.3 Approved Manufacturers

- A. Polymer Concrete Manholes: Manufacturer of manholes shall employ manufacturing methods and material formulation in use for a minimum of five (5) years. Manufacturer shall have been actively producing manholes under current name for a minimum of seven (7) years with no more than one (1) year between manhole projects. References demonstrating this requirement shall be submitted for review. Polymer concrete manholes shall be manufactured in accordance with ASTM C478.
 - 1. U.S. Composite Pipe, Inc. (a division of Thompson Pipe Group);
 - 2. Armorock, LLC; or
 - 3. OJRSA-approved equal.
- B. Manhole Frame and Cover: Shall be EJ (formerly known as East Jordan Iron Works, Inc.) frame and covers or OJRSA-approved equal. If alternate proposed, it must be made of steel produced in the United States.

4.5.2.4 Materials of Construction

- A. General: Conform to details indicated.
- B. All manhole components shall be rated for AASHTO M306 HS-20 loadings.
- C. Materials
 - 1. Resin: The manufacturer shall use only polyester or vinyl ester resin systems designed for use with this particular application. Resin content shall be a minimum of seven percent (7%) by weight.
 - 2. Filler: All aggregate, sand, and quartz powder shall meet the requirements of ASTM C33, where applicable.
 - 3. Additives: Resin additives, such as curing agents, pigments, dyes, fillers and thixotropic agents, when used, shall not be detrimental to the manhole.
 - 4. Elastomeric Gaskets: Gaskets shall be suitable for the service intended. All gaskets shall meet the requirement of ASTM C443.
- D. Manufacturing and Product Construction
 - 1. Manholes: Manhole components shall be manufactured by the vibratory vertical casting process resulting in a dense, non-porous, corrosion-resistant, homogeneous, composite structure. Manholes shall be steel reinforced per ASTM C478. Hoop reinforcement shall use acid resistant reinforcement (FRP Bar) in accordance with ACI 440.1R-06 as applicable for polymer concrete design. Manholes shall

have a monolithic base slab unless otherwise approved. Manholes shall have engineered and rated lifting devices that shall not penetrate through the wall.

2. Section Joints: Round manhole components shall be connected with an elastomeric sealing gasket as the sole means to maintain joint watertightness and both the gasket material and the manhole joint shall meet the requirements of ASTM C443. Round manholes shall utilize spigot and bell type joints incorporating either a confined O-ring or single step profile joint. Square and rectangular structures shall utilize a ship-lap joint and be sealed with a butyl rope sealant per ASTM C990 as recommended by the structure manufacturer.
3. Pipe to Manhole Connections: Pipes shall be directly connected to all structures using resilient flexible pipe to manhole connector per ASTM C923. Cold joint pipe stub grouting shall not be allowed unless shown on plans as such. In cases where cold joint pipe stubs are shown, they shall be grouted using a corrosion resistant grout and rubber waterstop grout ring.
4. Fittings: Cones, reducer slabs, base slabs, and adjusting rings shall be of the same material as adjoining riser sections.
5. Invert Channels: Invert channels shall be factory built with polymer concrete. Portland cement concrete shall not be allowed for channel construction.

E. Design

1. Manholes shall be designed to withstand all live loads and dead loads as described in project plans and specifications. Dead loads shall include overburden load, soil side pressure, and hydrostatic loading conditions. Manhole shop drawings shall be sealed by a Registered Professional Engineer.
2. Manholes wall thickness shall be designed to resist hydrostatic pressures with a minimum safety factor of two (2.0) for full depth conditions from grade to invert. Design wall sections for depth and loading conditions with wall thickness as designed by polymer concrete manufacturer.
3. Manholes shall be designed with sufficient bottom anchorage and side friction to resist buoyancy. Field cast floatation collars are acceptable.
4. The manhole shall be manufactured in one (1) class of load rating. This class shall be AASHTO M306 HS-20 wheel load (minimum sixteen thousand pounds (16,000 lb) dynamic wheel load).

F. Testing

1. Manholes: Manholes shall be manufactured in accordance with ASTM C478.
2. Joints: Joints shall meet the requirements of ASTM C443.
3. Compressive strength: Polymer concrete shall have a minimum unconfined compressive strength of nine thousand pounds per square inch (9,000 psi) when measured in accordance with ASTM C497.
4. Manhole Leakage: Manhole shall be tested in accordance with ASTM C1244.

G. Inspection: The OJRSA or other designated representative shall be entitled to inspect manholes and witness the manufacturing process.

H. Handling and Shipping: Handling and shipping shall be performed in accordance with the Manufacturer's instructions.

I. Frame and Cover

1. Provide cast iron frames and covers as indicated and as required by the structure and ASTM A48, Class 35B, or ductile iron conforming to ASTM A536, Grade 60-40-18.
2. Provide frames and covers meeting AASHTO M306 HS-20 load rating in traffic areas.
3. Provide removable covers to seat in frames without rocking.
4. Provide lockable, bolt-down covers where required by OJRSA.
5. Identify covers with cast markings "OJRSA SEWER" and "CONFINED SPACE PERMIT REQUIRED" as shown on Standard Manhole Frame and Cover detail and include the name and location of manufacturer on frame and cover castings.
6. Provide castings free of blowholes, splits, cracks, blisters, mold-pull, and other imperfections affecting strength or serviceability.
7. Provide watertight manhole frames and covers where required by OJRSA.

END OF SECTION 4.5

4.6 SEWER SERVICE (LATERAL) PIPE AND CONNECTIONS

4.6.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.6.2 Submittals

- A. Product Data: Submit manufacturer's information indicating proposed materials, accessories, details, and construction information.
- B. Permits: Submit four (4) copies of applicable permits, such as *Wastewater Construction Permit* as issued by SCDHEC/SCDES, roadway open cut permit, and land disturbance permit.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Tests and Evaluation Reports: Submit reports indicating field tests made and results obtained.
- E. Manufacturer Instructions:
 1. Indicate special procedures required to install specified products.
 2. Submit detailed description of procedures for connecting new sewer to existing sewer line.

4.6.3 Approved Manufacturers

- A. Pipe: OJRSA does not have a preferred manufacturer.
- B. Service Connection Fittings: OJRSA does not have a preferred manufacturer.
- C. Main Line Tapping Saddles:
 1. Predco Fastfit with Stabilizing Bands,
 2. Romac CB Sewer Saddle, or
 3. OJRSA-approved equal.
- D. Tracer Wire: OJRSA does not have a preferred manufacturer.

4.6.4 Materials of Construction

- A. **SERVICE LINES GREATER THAN FOUR INCHES (> 4 IN.) SHALL BE CONNECTED TO MANHOLES FOR ALL CONNECTIONS ON AN EIGHT INCH (8 INCH) GRAVITY PIPE. OTHER SERVICE LINES SHALL BE CONSIDERED ON A CASE-BY-CASE BASIS BASED ON MAIN LINE DIAMETER AND OTHER CONDITIONS.**
- B. Wyes shall be the same diameter as the sewer main (eight inch (8 in.), ten inch (10 in.), twelve inch (12 in.), etc.), by four inch (4 in.) or six inch (6 in.) of the same material as the main line pipe and shall have the same type of gasket connections. *Tees are unacceptable.*
- C. Service pipe shall be standard four inch (4 in) or six inch (6 in.) diameter service pipe. PVC service pipe shall be SDR-35 pipe conforming to ASTM D3034 with gasketed joints and all required markings.
- D. Saddles shall be mounted on pipe according to the manufacturer's recommendations.
- E. With exception of grinder pump station force mains, the minimum pipe size connection to either existing sewer main lines or manholes is four inches (4 in.). Grinder pump station force main connections shall be evaluated on a case-by-case basis.
- F. Tracer wire shall be stranded 12-gauge copper with green insulation rated UF or USE by Underwriters Laboratories. Wire shall be looped into ground level cast-iron valve boxes (w/ caps labeled "SEWER").

END OF SECTION 4.6

4.7 WET WELLS AND VAULTS

4.7.1 Precast Concrete Wet Wells and Vaults

4.7.1.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.7.1.2 Submittals

- A. Product Data: Submit manufacturer information for manhole covers, component construction, features, configuration, and dimensions.
- B. Shop Drawings: Indicate structure locations and elevations; and sizes and elevations of penetrations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- E. Source Quality-Control Submittals: Indicate results of factory tests and inspections.
- F. Qualifications Statement: Submit qualifications for manufacturer.

4.7.1.3 Approved Manufacturers

- A. Precast concrete wet wells and vaults shall be a standard unit as manufactured by:
 1. MST Concrete Products, Inc.,
 2. Tindall Concrete Products, Inc., or
 3. OJRSA-approved equal.
- B. Aluminum hatches shall be a standard unit as manufactured by:
 1. Bilco,
 2. Halliday, or
 3. OJRSA-approved equal.

4.7.1.4 Materials of Construction

- A. Materials
 1. Concrete used in wet well and valve pit structures shall conform to ASTM C478 and the following:
 2. Compressive Strength: Minimum five thousand pounds per square inch (5,000 psi) at twenty-eight (28) days.
 3. Air Content: Minimum four percent (4%).
 4. Cementitious Materials: Minimum of five hundred sixty-four pounds per cubic yard (564 lb/yd³).
 5. Coarse Aggregates: ASTM C33. Sound, crushed, angular granitic stone only. Smooth or rounded stone shall not be used.
 6. Fine Aggregates: ASTM C33. Free from organic impurities.
 7. Chemical Admixtures: ASTM C494. Calcium chloride or admixtures containing calcium chloride shall not be used.
 8. Air Entraining Admixtures: ASTM C260.
 9. Reinforcing steel shall be ASTM A615 Grade 60 deformed bar, ASTM A82 wire, or ASTM A185 welded wire fabric.
 10. Butyl Rubber Sealant shall conform to Federal Standards SS-S-210A, AASHTO M198, Type B - Butyl Rubber and as follows: maximum of one percent (1%) volatile matter and suitable for application temperatures between ten degrees Fahrenheit (10°F) and one hundred degrees Fahrenheit (100°F).
 11. Bentonite Impregnated Butyl Rubber Sealant shall contain ninety-nine percent (99%) solids with a maximum of one percent (1%) volatile matter and suitable for application temperatures between five degrees Fahrenheit (5°F) and one hundred twenty-five degrees Fahrenheit (125°F).
- B. Components of Precast Unit Structures
 1. Precast manufacturing shall be in conformance with ASTM C913. Wall and inside slab finishes resulting from casting against forms standard for the industry shall be acceptable, except form ties through the wall of the structure are not allowed. Exterior slab surfaces shall have a float finish. Small surface holes, normal color variations, normal joint form marks, and minor depressions, chips, and spalls will be tolerated. Dimensional tolerances shall be those set forth in the appropriate referenced standard specifications and as specified below.
 2. Joint surfaces on joints between precast structure components shall be keyways or tongue and grooves manufactured to the joint surface design and tolerance requirements of ASTM C913.
 3. Lifting inserts and holes shall be sized for a precision fit with the lifting device, shall conform to OSHA standard 1926.704, and shall not penetrate through the precast structure wall.

4. Precast base sections shall be cast monolithically without construction joints or with an approved galvanized or PVC waterstop in the cold joint between the base slab and the walls. Base section slab extensions shall be provided for counter floatation. The width of the extensions shall be the slab thickness as a minimum.
5. The minimum lay length of rectangular and elliptical precast riser sections shall be thirty-six inches (36 in.). For round riser sections, the minimum lay length shall be sixteen inches (16 in.).
6. Pipe to precast wall connectors shall conform to ASTM C923. The location of all pipe penetrations shall vary from the location shown on the plans by no more than one-half inch (0.5 in.) vertically and five degrees (5°) horizontally for round sections, and no more than one half inch (0.5 in.) vertically and horizontally for elliptical and rectangular sections.
7. Joints between precast components shall be sealed internally between the tongue and groove and additionally around the external perimeter as follows:
 8. Internal seals shall consist of a butyl rubber rope at least fourteen feet (14 ft) long and having a cross sectional area no less than the annular space times the height of the joint. A bentonite impregnated butyl rubber sealant shall be used for joints when the perimeter is greater than eighteen feet (18 ft).
 9. External seals shall consist of a polyethylene backed flat butyl rubber sheet at least one-sixteenth of an inch (1/16 in.) thick and six inches (6 in.) wide applied to the outside perimeter of the joint.
 10. The floor shall be cast with a slope of at least one hundred twenty-five thousandths of an inch per foot (0.125 in./ft) to the drain line.

C. Hatches

1. All openings for hatches shall be located to ensure alignment with pipe openings and equipment lift-out locations. Hatch locations shall vary by no more than one-half inch (0.5 in.) in any direction from the locations indicated on the project plans.
2. Aluminum hatches as specified shall be provided for access to the wet well or valve pit, as noted on the drawings. Hatch size and location shall be coordinated with pump manufacturer and precast manufacturer.

D. As applicable, materials shall comply with references stated within this Section.

4.7.2 Polymer Concrete Wet Wells and Vaults

4.7.2.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.7.2.2 Submittals

Submit manufacturer's data and details of following items for approval:

- A. Shop drawings of manhole sections, base units, and construction details, jointing methods, materials, reinforcement details, rim and invert elevations, and dimensions.
- B. Summary of criteria used in structure design including, as minimum, material properties, loading criteria, and dimensions assumed. Include certification from manufacturer that polymer concrete manhole design meets or exceeds the load and strength requirements of ASTM C478 and ASTM C857, reinforce in accordance with ACI 440.1R-15.
- C. Frames, grates, rings, and covers.
- D. Materials to be used in fabricating pipe drop connections.
- E. Materials to be used for pipe connections.
- F. Materials to be used for stubs and stub plugs, if required.
- G. References of ten (10) previous polymer concrete projects including scope in the last five (5) years performed, with reference information for both owner and contractor for each project.

4.7.2.3 Approved Manufacturers

- A. Polymer concrete wet wells shall be manufactured by U.S. Composite Pipe, Inc. (a division of Thompson Pipe Group) or OJRSA-approved equal.

- B. Manufacturer of wet wells shall employ manufacturing methods and material formulation in use for a minimum of five (5) years. Manufacturer shall have been actively producing wet wells under current name for a minimum of seven (7) years with no more than one (1) year between manhole projects. References demonstrating this requirement shall be submitted for review. Polymer concrete wet wells shall be manufactured in accordance with ASTM C478.

4.7.2.4 Materials of Construction

- A. General: Conform to details indicated.
- B. All manhole components shall be rated for AASHTO M306 H-20 loadings.
- C. Wet Wells
1. Resin: The manufacturer shall use only polyester or vinyl ester resin systems designed for use with this particular application. Resin content shall be a minimum of seven percent (7%) by weight.
 2. Filler: All aggregate, sand and quartz powder shall meet the requirements of ASTM C33, where applicable.
 3. Additives: Resin additives, such as curing agents, pigments, dyes, fillers, and thixotropic agents, when used, shall not be detrimental to the manhole.
 4. Elastomeric Gaskets: Gaskets shall be suitable for the service intended. All gaskets shall meet the requirement of ASTM C443.
- D. Manufacturing and Product Construction
1. Wet wells: Wet well components shall be manufactured by the vibratory vertical casting process resulting in a dense, non-porous, corrosion-resistant, homogeneous, composite structure. Wet wells shall be steel reinforced per ASTM C478. Per ASTM C478, hoop reinforcement shall only be allowed in forty-eight inch (48 in.) diameter manhole risers with no openings. Larger diameter wet wells shall not use hoop reinforcement. Wet wells shall have a monolithic base slab unless otherwise approved. Wet wells shall have engineered and rated lifting devices that shall not penetrate through the wall.
 2. Section Joints: Round wet well components shall be connected with an elastomeric sealing gasket as the sole means to maintain joint watertightness and both the gasket material and the wet well joint shall meet the requirements of ASTM C443. Round wet wells shall utilize spigot and bell type joints incorporating either a confined O-ring or single step profile joint. Square and rectangular structures shall utilize a ship-lap joint and be sealed with a butyl rope sealant per ASTM C990 as recommended by the structure manufacturer.
 3. Pipe to Wet Well Connections: Pipes shall be directly connected to all structures using resilient flexible pipe to manhole connector per ASTM C923. Cold joint pipe stub grouting shall not be allowed unless shown on plans as such. In cases where cold joint pipe stubs are shown, they shall be grouted using a corrosion resistant grout and rubber water stop grout ring.
 4. Fittings: Cones, reducer slabs, base slabs and adjusting rings shall be of the same material as adjoining riser sections.
 5. Invert Channels: Invert channels shall be factory built with polymer concrete. Portland cement concrete shall not be allowed for channel construction.
 6. The floor shall be cast with a slope of at least one hundred twenty-five thousandths of an inch per foot (0.125 in./ft) to the drain line.
- E. Manufacturer of wet wells shall employ manufacturing methods and material formulation in use for a minimum of five (5) years. Manufacturer shall have been actively producing wet wells under current name for a minimum of seven (7) years with no more than one (1) year between manhole projects. References demonstrating this requirement shall be submitted for review. Polymer concrete wet wells shall be manufactured in accordance with ASTM C478.
- F. Design
1. Wet wells shall be designed to withstand all live loads and dead loads as described in project plans and specifications. Dead loads shall include overburden load, soil side pressure and hydrostatic loading conditions. Wet well shop drawings shall be sealed by a Registered Professional Engineer.
 2. Wet well wall thickness shall be designed to resist hydrostatic pressures with a minimum safety factor of two (2.0) for full depth conditions from grade to invert. In no cases shall the wall thickness be less

than four inches (< 4 in.) for seventy-two inch (72 in.) diameter and larger and three inch (3 in.) for forty-eight inch (48 in.) and sixty-inch (60 in.) diameter vaults.

3. Wet wells shall be designed with sufficient bottom anchorage and side friction to resist buoyancy. Field cast floatation collars are acceptable.
4. The wet well shall be manufactured in one (1) class of load rating. This class shall be AASHTO M306 H-20 wheel load (minimum 16,000 pounds dynamic wheel load).

G. Testing

1. Wet wells shall be manufactured in accordance with ASTM C478.
2. Joints: Joints shall meet the requirements of ASTM C443.
3. Compressive strength: Polymer concrete shall have a minimum unconfined compressive strength of nine thousand pounds per square inch (9,000 psi) when measured in accordance with ASTM C497.
4. Wet Well Leakage: Wet wells shall be tested in accordance with ASTM C1244.
5. Inspection: The OJRSA or other designated representative shall be entitled to inspect wet wells and witness the manufacturing process.
6. Handling and Shipping: Handling and shipping shall be performed in accordance with the manufacturer's instructions.

H. Hatches

1. All openings for hatches shall be located to ensure alignment with pipe openings and equipment lift-out locations. Hatch locations shall vary by no more than one-half inch (0.5 in.) in any direction from the locations indicated on the project plans.
2. Aluminum hatches as specified shall be provided for access to the wet well or valve pit, as noted on the design drawings. Hatch size and location shall be coordinated with pump manufacturer and pre-cast manufacturer.

END OF SECTION 4.7

4.8 PUMP STATIONS

4.8.1 Centrifugal Suction Lift Pump Stations

4.8.1.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.8.1.2 Submittals

- A. Shop drawings shall provide layout of mechanical equipment and anchor bolt locations for equipment baseplate. The electrical ladder logic drawings shall illustrate motor branch and liquid level control circuits to extent necessary to validate function and integration of circuits to form a complete working system.
- B. Operations Maintenance Manuals
 1. Installation shall be in accordance with written instructions provided by the pump station manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping, and valves, but lack experience with the exact equipment supplied.
 2. Documentation shall be specific to the pump station supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station manufacturer. Support data for any equipment supplied by others, even if mounted or included in the overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:
 - (a) Functional description of each major component, complete with operating instructions.
 - (b) Instructions for operating pumps, pump controls in all modes of operation.
 - (c) Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.

- (d) Support data for commercially available components not produced by the station manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.
 - (e) Electrical schematic diagram of the pump station circuits shall be in accordance with NFPA 70. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.
 - (f) Mechanical layout drawing of the pump station and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves, and piping.
3. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications. Operations Maintenance Manuals which rely on vendor cut-sheets and literature which include general configurations, or require operating personnel to selectively read portions of the manual shall not be acceptable.

4.8.1.3 Approved Manufacturer

- A. Centrifugal suction lift pumps and prefabricated facilities shall be Gorman-Rupp. The OJRSA has standardized on this manufacturer in order to improve operation and maintenance effectiveness by optimizing service responsiveness, simplifying maintenance complexity and training of staff, and to ensure availability and interchangeability of many of the spare parts.
- B. Submersible pressure transducers shall be manufactured by Rosemount, KPSI, or OJRSA-approved equal.

4.8.1.4 Materials of Construction

A. Pump Construction

- 1. Pump shall be horizontal, self-priming centrifugal type, designed specifically for handling raw un-screened domestic sanitary sewage or industrial waste.
- 2. Pump casing shall be cast iron Class 30 with integral volute scroll. Casing shall incorporate following features:
 - (a) Fill port cover plate, three and a half inch diameter (3.5 in.) diameter, shall be opened after loosening a positive lock clamp bar assembly. In consideration for safety, cap screw threads must provide slow release of pressure, and the clamp bar shall be retained by detente lugs. A non-metallic gasket shall prevent adhesion of the fill port cover to the casing while assuring a reliable seal.
 - (b) Casing drain plug shall be at least one and a half inches (1.5 in.) NPT to ensure complete and rapid draining.
- 3. Cover plate shall be cast iron Class 30. Design must incorporate the following maintenance features:
 - (a) Retained by acorn nuts for complete access to pump interior. Cover plate removal must provide ample clearance for removal of stoppages, and allow service to the impeller, seal, wear plate or check valve without removing suction or discharge piping.
 - (b) A replaceable wear plate secured to the cover plate by weld studs and nuts shall be AISI 1015 HRS. Wear plate shall be self-cleaning design ensuring that debris is cleared away and does not collect on the impeller vanes.
 - (c) In consideration for safety, a pressure relief valve shall be supplied in the cover plate. Relief valve shall open at seventy-five pounds per square inch (75 psi) to two hundred pounds per square inch (200 psi).
 - (d) Two (2) O-rings of Buna-N material shall seal cover plate to pump casing.
 - (e) Pusher bolt capability to assist in removal of cover plate. Pusher bolt threaded holes shall be sized to accept same retaining caps crews as used in rotating assembly.
 - (f) Easy-grip handle shall be mounted to face of cover plate.

4. Rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, seal plate, and bearing housing, must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate the following features:
 - (a) Seal plate and bearing housing shall be cast iron Class 30. Anti-rotation ribs shall be cast into the seal plate to reduce internal wear and maximize component life. Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Cavities must be cooled by the liquid pumped. Three (3) lip seals will prevent leakage of oil.
 - (i) The bearing cavity shall have an oil level sight gauge and fill plug check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.
 - (ii) The seal cavity shall have an oil level sight gauge and fill/vent plug. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.
 - (iii) Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.
 - (b) Impeller shall be ductile iron, two (2) vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall be statically or dynamically balanced. Impeller shall thread onto the pump shaft and be secured with a lock screw and conical washer.
 - (c) Shaft shall be AISI 4140 alloy steel unless otherwise specified by the design engineer, in which case AISI 17-4 pH stainless steel shall be supplied.
 - (d) Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil lubricated from a dedicated reservoir. Pump designs which use the same oil to lubricate the bearings and shaft seal shall not be acceptable.
 - (e) Shaft seal shall be oil lubricated mechanical type. The stationary and rotating seal faces shall be silicon carbide alloy. Each mating surface shall be lapped to within three (3) light bands flatness (equal to thirty-five millionths of an inch (0.000035 in.)), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating by virtue of a dual O-ring design. An external O-ring secures the stationary seat to the seal plate, and an internal O-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads which cause shaft deflection, vibration, and axial/radial movement). Elastomers shall be Viton; cage and spring to be stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings.
 - (f) Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same cap screws as used for retaining rotating assembly.
5. Adjustment of the impeller face clearance (distance between impeller and wear plate) shall be accomplished by external means.
 - (a) Clearances shall be maintained by a four (4) point external shimless cover plate adjustment system, utilizing a four (4) collar and four (4) adjusting screw design allowing for incremental adjustment of clearances by hand as required. Each of the four (4) points shall be lockable to prevent inadvertent clearance increases or decreases due to equipment vibration or accidental operator contact. The four (4) point system also allows for equal clearance gaps at all points between the impeller and wear plate. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Cover plate shall be capable of being removed without disturbing clearance settings. Clearance adjustment systems that utilize less than four (4) points will not be considered.
 - (b) There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the cover plate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above.

(c) Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

6. An externally removable suction check valve shall be molded Neoprene with integral steel and nylon reinforcement. A blow-out center shall protect pump casing from hydraulic shock or excessive pressure. Removal or installation of the check valve must be accomplished from the top of pump without disturbing the suction piping or completely draining the casing. The sole function of check valve shall be to save energy by eliminating need to reprime after each pumping cycle. Pumps requiring a suction check valve to assist reprime will not be acceptable.
7. Pump shall include flange kit consisting of two (2) female one hundred twenty-five pounds per square inch (125 psi) NPT cast iron Class 30 flanges suitable for attachment to suction and discharge ports.
8. Pump Drain Kit (when required by OJRSA): The pump drain kit shall consist of a ten foot (10 ft) length of plastic hose with a quick connect female camlock fitting on one (1) end of hose and two (2) sets of fittings for pump drains. Each set of fittings for pump drain includes a stainless steel pipe nipple, stainless steel bushing, stainless steel ball valve, and an aluminum quick connect male camlock fitting. The pump drain shall connect to the wet well.
9. There shall be furnished with the pump station the following minimum spare parts (when required by OJRSA):
 - (a) One (1) spare pump mechanical seal (complete), and with it all gaskets, seals, sleeves, O rings, and packing required to be replaced during replacement of the seal.
 - (b) One (1) set of impeller clearance adjustment shims.
 - (c) One (1) set cover plate O ring.
 - (d) One (1) rotating assembly O ring.

B. Valves and Piping

1. Check Valve (four inch (4 in.) and six inch (6 in.) Swing Check Valves Only): Each pump shall be equipped with a full flow type check valve capable of passing a three inch (3 in.) spherical solid. Valve shall be constructed with flanged ends and fitted with an external lever and torsional spring. Valve seat shall be constructed of stainless steel, secured to the body to ensure concentricity, sealed by an O-ring, and shall be replaceable. The valve body shall be cast iron incorporating a clean out port large enough to allow removal and/or replacement of the valve clapper without removing valve or piping from the line. Valve clapper shall have a molded neoprene seating surface incorporating low pressure sealing rings. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings. Shaft nut shall have double O-rings which shall be easily replaceable without requiring access to interior of valve body. All internal hardware shall be stainless steel. Valve shall be rated at one hundred seventy-five pounds per square inch (175 psi) water working pressure and three hundred fifty pounds per square inch (350 psi) hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a three inch (3 in.) spherical solid shall not be acceptable.
2. Plug Valve: The discharge header shall include individual two (2) way plug valves to permit either or both pumps to be isolated from the common discharge header. Valves shall have ports designed to pass spherical solids equal to the pump's capability. The plug valve shall be non-lubricated, tapered type. Valve body shall be semi steel with flanged end connections drilled to one hundred twenty-five pound (125 lb) standard. Valve shall be furnished with a drip tight shutoff plug mounted in stainless steel bearings and shall have a resilient facing bonded to the sealing surface. Valve shall be operated with a single lever actuator manual hand wheel, or a manual chain fall as required by OJRSA.
3. Automatic Air Release Valves
 - (a) An automatic air release valve shall be furnished for each pump designed to permit the escape of air to the atmosphere during initial priming or unattended repriming cycles. Upon completion of the priming cycle or repriming cycle, the valve shall close to prevent recirculation. Valves shall provide visual indication of valve closure and shall operate solely on discharge pressure. Valves which require connection to the suction line shall not be acceptable.
 - (b) All valve parts exposed to sewage shall be constructed of cast iron, stainless steel, or similar

corrosion resistant materials. Diaphragms, if used, shall be of fabric reinforced neoprene or similar inert material.

- (c) A cleanout port, three inches (3 in.) in diameter, shall be provided for ease of inspection, cleanout, and service.
- (d) Valves shall be field adjustable for varying discharge heads.
- (e) Connection of the air release valves to the station piping shall include stainless steel fittings.

4. Gauge Kit (when required by OJRSA)

- (a) Each pump shall be equipped with a glycerin-filled compound gauge to monitor suction pressures, and a glycerin-filled pressure gauge to monitor discharge pressures. Gauges shall be a minimum of four inches (4 in.) in diameter and shall be graduated in feet of water column. Rated accuracy shall be one percent (1%) of full-scale reading. Compound gauges shall be graduated negative thirty-four (-34) to positive thirty-four (+34) feet of water column (minimum).
- (b) Gauges shall be mounted on a resilient panel and frame assembly which shall be firmly secured to pumps or piping. Gauge installations shall be complete with all hoses and stainless steel fittings and shall include a shutoff valve installed in each gauge inlet at the point of connection to suction and discharge pipes.

5. Station Low Enclosure Temperature Alarm (when required by OJRSA): Pump station shall be supplied with a thermostat which shall monitor interior station temperature. The control shall incorporate an unpowered dry contact wired to terminal blocks for field connection to a remote alarm device. The contact will close in the event that the temperature within the enclosure falls below approximately thirty-five degrees Fahrenheit (35°F).

6. Piping

- (a) Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI C115/AWWA A21.51 and Class 53 thickness.
- (b) Flanges shall be cast iron Class 125 and comply with ASME/ANSI B16.1.
- (c) Pipe and flanges shall be threaded, and suitable thread sealant applied before assembling flange to pipe.
- (d) Bolt holes shall be in angular alignment within one-half degree (0.5°) between flanges. Flanges shall be faced with a gasket finish.

7. Contractor must ensure all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps or station piping. Pump station discharge force main piping shall be anchored with thrust blocks where shown on the contract drawings.

C. Drive Unit

1. Motors

- (a) Pump motors shall be in compliance NEMA MG 1 Design B with cast iron frame with copper windings, induction type, with Class F insulation and one and fifteen hundredths safety factor (1.15 SF) for normal starting torque and low starting current characteristics, suitable for continuous service. The motors shall not overload at the design condition or at any head in the operating range as specified.
- (b) Motors shall be tested in accordance with provisions of ANSI/IEEE Std 112.

D. Finish: Pumps, piping, and exposed steel framework shall be cleaned prior to coating using an approved solvent wipe or phosphatizing cleaner. The part must thoroughly dry before paint application. Open joints shall be caulked with an approved polyurethane sealant. Exposed surfaces shall be applied with one (1) coat of Tnemec Series 69 Polyamide Epoxy Primer and one (1) finish coat of Series 73 Aliphatic Acrylic Polyurethane for a total dry film thickness of four (4) mils to six (6) mils. Finish coat shall be semi-gloss white for optimum illumination and enhancement. The coating shall be corrosion, moisture, oil, and solvent resistant when completely dry. The factory finish shall allow for over-coating and touch-up for six (6) months after coating. Thereafter, it will generally require sanding to accept a topcoat or touch-up coating.

E. Liquid Level Control System

1. Sequence of Operation with Utility Power

- (a) The level control system shall start and stop the pump motors in response to changes in wet well level, as set forth herein. The level control system shall utilize the PLC sequencer to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle or if one pump runs as the lead pump for an excessive time.
 - (b) Upon operator selection of automatic operation, the PLC shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "lead pump stop level", the PLC shall stop this pump. These actions shall constitute one (1) pumping cycle. Should the wet well level continue to rise, the PLC shall start the second pump when the liquid reaches the "lag pump start level" so that both pumps are operating.
 2. Alarms and shutdown routines shall operate as follows:
 - (a) Condition Abnormal: The general alarm pilot light will quick flash until acknowledged, then slow flash until reset, then glow steady until condition returns to normal, then off. The operator interface will display the alarm when acknowledged. The external alarms will be active until silenced, and then off.
 - (b) Condition Abnormal then Returns to Normal: The general alarm pilot light will quick flash until silenced, then slow flash until reset, then off. The operator interface will display the alarm when acknowledged. The external alarms will be active until silenced, and then off.
 - (c) Subsequent alarms will re-alarm when silenced or reset.
 3. Submersible Level Transducer Level Sensor (when required by OJRSA)
 - (a) The level control system shall utilize a submersible transducer. It shall be a strain gauge transducer with a pressure sensor housed in an SST 316 or Titanium case designed to extend into the wet well. The pressure transducer shall provide a proportional signal for distribution to the display and electronic comparators of the electronic pressure switch, and remainder of the level control system. Sensor range shall be zero feet (0 ft) to twelve feet (12 ft) of water column minimum with an over-pressure rating three (3) times full scale. The transducer shall have output capability of zero-to five volts of direct current (0-to-5 VDC) or four-to-twenty milliamperes (4-to-20 mA). The transducer's polyurethane jacketed shielded cable shall be of suitable length for proper installation into the wet well without splicing.
 - (b) An intrinsically safe repeater shall be supplied in the control enclosure. Repeater must be recognized and listed as intrinsically safe by a nationally recognized testing laboratory. Station manufacturer shall make all connections from repeater to feeder lines and motor controls. Installing contractor shall make connections from repeater to transducer.
 - (c) Submersible transducer will be furnished with transient voltage surge suppression to protect related equipment from an induced voltage spike from lightning.
- F. Station Fiberglass Enclosure and Base
 1. Small Pump Station (as defined in Table 8 on page 32)
 - (a) The station enclosure shall contain and protect all pumps, interior piping, valves, and associated controls. Enclosure shall incorporate the following design and service features:
 - (i) Access panels must be supplied on all sides. Location and size shall permit access for routine maintenance functions such as pump and motor inspection, drive belt adjustment, and pump clean out. Non-hinged panels shall be secured with stainless steel tamper-proof hardware.
 - (ii) A continuous hinge and latch shall be installed on at least two (2) access panels. The hinged panels shall allow easy access to the electrical controls for frequent adjustments and inspections. A two (2) point mechanical latch assembly shall secure the panel at top and bottom. Latch handle locks shall be match keyed, requiring only one (1) key to open all access panels.
 - (iii) A vent in one (1) access panel shall allow free air flow for enclosure ventilation.

- (iv) The complete station enclosure, less base, must be completely removable after disengaging reusable hardware. After disassembly, no portion of the enclosure (except electrical service entrance) shall project above the base surface to interfere with maintenance or endanger personnel.
 - (v) Disassembly and removal of the enclosure shall require no more than two (2) people working without assistance of lifting equipment.
 - (b) Station enclosure shall be manufactured of molded reinforced orthophthalic polyester resins with a minimum of thirty percent (30%) fiberglass and a maximum of seventy percent (70%) resin. Resin fillers or extenders shall not be used.
 - (i) Chopped glass fibers of one and a quarter inch (1.25 in.) average length shall be sprayed and rolled. Major design consideration shall be given to structural stability, corrosion resistance, and watertight integrity. The polyester laminates shall provide a balance of mechanical, chemical, and electrical properties to insure long life. They must be impervious to microorganisms, mildew, mold, fungus, corrosive liquids, and gases which are expected to be present in the environment surrounding the wet well.
 - (ii) All interior surfaces of the housing shall be coated with a polyester resin rich finish providing maintenance free service, abrasion resistance, and protection from sewage, greases, oils, gasoline, and other common chemicals.
 - (iii) Outside surfaces of the enclosure shall be coated with gel-coat pigmented resin to insure long maintenance free life and UV protection. Color used shall deemphasize the presence of dirt, grease, etc.
 - (c) Station base shall be constructed of precast, reinforced concrete encapsulated in a fiberglass mold. The design shall resist deformation of the structure during shipping, lifting, or handling. Base shall incorporate drainage provisions, and an opening sized to permit installation of piping and service connections to the wet well. After installation, the opening shall serve as a grout dam to be utilized by the contractor. The base shall incorporate anchor bolt recesses for securing the complete station to a concrete pad (supplied by the contractor) in accordance with the project plans.
 - (d) A blower mounted in the station roof shall be sized to exchange station air volume at least once every two (2) minutes. Blower motor shall energize automatically at approximately seventy degrees Fahrenheit (70°F) and turn off at fifty five degrees Fahrenheit (55°F). The blower motor control circuit shall incorporate a thermal magnetic circuit breaker providing overcurrent and overload protection. Exhaust and inlet locations shall prevent the entrance of rain, snow, or debris.
 - (e) Tall Enclosure with Split Doors: The station shall be equipped with a ninety-one inch (91 in.) tall fiberglass enclosure at a minimum. The control panel side and suction side of the fiberglass enclosure shall have split doors with the upper section of the doors raised vertically and the lower section of the doors opening horizontally outward. The upward portion of the split doors shall have additional equipment installed to prevent premature closing of the door. The pump station shall be furnished with one inch (1 in.) thick spray foam insulation, which shall be applied to the roof, doors, and corner panels.
- 2. Medium Pump Station (as defined in Table 8 on page 32)
 - (a) The station enclosure shall provide sufficient inside area for maintenance personnel to perform normal operation and maintenance inside, sheltered, and free from foul weather.
 - (b) The enclosure shall consist of a base to support the pumps and a cover. Minimum dimensions of the enclosure shall be eight feet by twelve feet (8 ft x 12 ft) and nine feet (9 ft) in height.
 - (c) The station enclosure shall be manufactured of molded fiberglass reinforced orthophthalic polyester resins with a minimum of thirty percent (30%) fiberglass and a maximum of seventy percent (70%) resin. Glass fibers shall have a minimum average length of one and a quarter inch (1.25 in.). Resin fillers or extenders shall not be used. Major design considerations shall be given to structural stability, corrosion resistance, and watertight properties. The polyester

laminates shall provide a balance of mechanical, chemical, and electrical properties to insure long maintenance free life. They must be impervious to microorganisms, mildew, mold, fungus, corrosive liquids, and gases which can reasonably be expected to be present in the environment surrounding the wet well. Wood core type enclosures are not acceptable and shall be basis for equipment rejection. See manufacturer's requirements for enclosure warranty in these specifications.

- (d) All interior surfaces of the housing shall be gel coated with a polyester resin. It shall be of suitable thickness and formulated to provide:
 - (i) Maintenance free service
 - (ii) Abrasion resistance
 - (iii) Protection from sewage, greases, oils, gasoline, and other common chemicals.
 - (iv) Color fastness
 - (v) Gloss retention
- (e) Interior surfaces of the enclosure cover shall be white for maximum light reflectivity. The base shall be of a darker color to deemphasize the presence of dirt, grease, etc. Colors used for both portions shall result in a pleasing looking structure.
- (f) The pump station shall be furnished with one inch (1 in.) thick foam insulation which shall be applied to the walls, door, and roof to achieve an R-6 insulation factor. A gasketed seal around the door shall also be included.
- (g) The outside of the enclosure shall be coated with a suitable pigmented resin compound to ensure long, maintenance free life. The fiberglass enclosure shall be a regular product of the pump station manufacturer.
- (h) Station base shall be constructed of precast, reinforced concrete encapsulated in a fiberglass mold. The design shall resist deformation of the structure during shipping, lifting, or handling. Base shall incorporate drainage provisions, and an opening sized to permit installation of piping and service connections to the wet well. After installation, the opening shall serve as a grout dam to be utilized by the contractor. The base shall incorporate anchor bolt recesses for securing the complete station to a concrete pad (supplied by the contractor) in accordance with the project plans.
- (i) Holes through the base shall be provided for suction and discharge lines, air release lines, and level control line. Holes for the suction and discharge lines shall be provided with a grout dam incorporated in a grout retention cavity which the contractor shall fill at installation with suitable grout to seal each pipe to base joint against the entrance of hazardous gases from the wet well.
- (j) Station base shall incorporate a suitable flange designed for securing the pump station to the concrete pad in accordance with the station plans.
- (k) The enclosure cover shall be provided with a hinged fiberglass reinforced access door. Minimum dimensions of the door shall be thirty-six inches wide by seventy-eight inches high (36 in. wide x 78 in. high) for access by maintenance personnel to station interior. Door shall be a minimum one and seven-eighths (1.875 in.) thick and shall be hinged with a minimum of two (2) heavy-duty stainless steel hinges to the enclosure cover. Door shall be furnished with a padlockable handle connected to a latching mechanism. Latch shall engage door casing or maximum security against vandalism. All mounting hardware for door casing and door must be concealed or of such type as to prevent vandalism with ordinary tools.
- (l) Removable panels shall be supplied on two (2) sides of the enclosure for additional access to equipment. Location and size shall permit access for routine maintenance functions such as pump and motor inspection, drive belt adjustment, and pump clean out. Non-hinged panels shall be secured with stainless steel tamper-proof hardware
- (m) A duplex ground fault indicating utility receptacle providing one hundred fifteen volts (115 V), single-phase, sixty hertz (60 Hz) shall be mounted inside the pump station. Receptacle shall be NEMA 5-15R configuration, heavy duty, specification grade, and fitted with a weatherproof

cover. The receptacle shall be protected by normal duty circuit breaker.

- (n) A shuttered exhaust fan with a minimum capacity of five hundred cubic feet per minute (500 CFM) to change the air in the enclosure once every minute, shall be mounted in the end wall approximately opposite the hinged door opening. An air intake vent shall be mounted in the hinged door assembly. Both intake and exhaust opening shall be equipped with a screen and cowl suitably designed to prevent the entrance of rain, snow, rocks, and other foreign material. The thermostatically controlled exhaust fan shall energize automatically at approximately seventy degrees Fahrenheit (70°F) and turned off at fifty-five degrees Fahrenheit (55°F). Fan circuit shall be protected by a normal duty circuit breaker.
 - (o) Two (2) enclosed and gasketed eighty Watt (80 W) fluorescent light (or equivalent LED light) fixtures shall be provided. The fixtures shall be NEMA 250 Standard 4, suitable for wet location. The fixtures shall be located to provide adequate light to all parts of the station and shall not constitute a physical hazard to inspection or service personnel. Light circuit shall be protected by a normal duty circuit breaker and shall be provided with a disconnect switch.
3. Large Pump Station (as defined in Table 8 on page 32)
- (a) The station shall incorporate a fiberglass enclosure and steel base. The station shall be supplied as a complete, weathertight unit with all pump, piping, and controls installed and wired by the pump manufacturer.
 - (b) The enclosure and base are to be rectangular. The internal height of the enclosure shall be eight and one half feet (8.5 ft).
 - (c) A minimum of four (4) lifting eyes provided on the station base shall be provided to ease handling and installation onto a concrete pad furnished by the contractor.
 - (d) Enclosure walls and roof shall be seamless, one (1) piece sprayed fiberglass panels laminated to form a structural composite as follows: one and one-eighth inch (0.125 in.) thick fiberglass outside surface, minimum two inch (2 in.) thick Ura Foam Polyurethane core, seven sixteenths inch (7/16 in.) oriented strand board (OSB), and three thirty-seconds (3/32 in.) thick fiberglass inside surface. OSB shall replace foam at all cut-out openings and penetration points.
 - (e) Each wall panel shall overlap at the corner and form an internal connection joint using stainless steel hardware. All panel joints shall be thoroughly sealed with silicone caulk. The enclosure shall have a minimum R-10 insulation factor and shall be capable of withstanding one hundred fifty mile per hour (150 mph) wind loads.
 - (f) The pump station enclosure shall incorporate an optional insulation package which increases the standard R-10 insulation rating to R-20 by doubling the thickness of the Ura Foam Polyurethane core in the wall and roof panels. (When required by OJRSA)
 - (g) The exterior of the enclosure shall be covered with an aesthetically pleasing simulated brick façade, consisting of polyurethane panels affixed to the exterior fiberglass enclosure with industrial grade urethane adhesive and mechanical fasteners. The polyurethane panels shall be manufactured from highly durable weatherproof material with near zero (0) UV degradation. The insulation factor (R-value) of the polyurethane panels shall achieve a minimum of an R-2 factor. The polyurethane material used in the manufacturing of the panels shall be tested in accordance with ASTM test methods. (When required by OJRSA)
 - (h) All interior surfaces shall be sprayed white isophthalic gel coat finish offering the same characteristics as the exterior surfaces.
 - (i) The roof panel shall be an arched, one (1) piece design incorporating the same materials of construction as the side walls. The roof shall be removable as a unit, allowing for complete access to the pumping equipment with a crane. The pitch of the roof shall be sufficient for good moisture drainage and withstand a minimum snow load of forty pounds per square foot (40 psf).
 - (j) The station shall be furnished with one (1) thirty-six inch wide by 80 inch high (36 in. wide x 80 in. high) entrance door(s) that shall be constructed of the same laminated fiberglass and foam core materials as the remainder of the station. OSB will replace the insulation in areas where

auxiliary equipment will be mounted. Each door shall be hung with three (3) stainless steel ball bearing type hinges incorporating a three (3) point closure system with a lockable door handle. An adjustable door positioner and holder shall be mounted at the top of the door. A gasket consisting of solid rubber and sponge shall seal the door while closed. The door and all hardware shall be mounted to withstand one hundred fifty mile per hour (150 mph) winds. A wall mounted drip molding will be installed above each door.

- (k) The station enclosure shall be furnished with one (1) extra wide door. A double hung door design with three (3) point locking hardware, door closer, and hinges on each section shall allow complete access to the sixty inches wide by eighty inches high (60 in. wide x 80 in. high) full door opening without the need for a center sill.
 - (l) The station enclosure shall be furnished with an overhead rolling hurricane style service door measuring seven feet wide by eight feet high (7 ft wide x 8 ft high) or seven feet wide by ten feet high (7 ft wide x 10 ft high). The door shall be sealed and gasketed for weather protection and shall be capable of being internally padlocked. Door shall include overhead receiver and track hardware installed and shall be constructed with locking provisions. Door shall be capable of being electrically operated by one (1) or more optional devices including a push-button and/or keypad. It will also include manual override in the event of a power outage. (When required by OJRSA)
 - (m) The pump base shall comprise a base plate, perimeter flange, and reinforcements. Base plate shall be fabricated of steel and must be at least one quarter inch (0.25 in.) thick. Perimeter flange and reinforcements shall be designed to prevent flexing or warping under operating conditions.
 - (n) The design shall resist deformation of the structure during shipping, lifting, or handling. Base shall incorporate drainage provisions, and an opening sized to permit installation of piping and service connections to the wet well. After installation, the opening shall serve as a grout dam to be utilized by the contractor. The base shall incorporate anchor points for securing the complete station to a concrete pad (supplied by the contractor) in accordance with the project plans.
 - (o) Pumps and motor stands shall bolt directly to the station base eliminating the need for a pump skid.
 - (p) Holes through the base shall be provided for suction and discharge lines, air release lines, and level control cabling or air lines. Holes for the suction and discharge lines shall be provided with a grout dam incorporated in a grout retention cavity which the contractor shall fill at installation with suitable grout to seal each pipe to base joint against the entrance of hazardous gases from the wet well.
 - (q) The station base shall be coated with a non-slip surface.
 - (r) The walls of the fiberglass enclosure shall be mounted to the steel base with mechanical fasteners in two foot (2 ft) intervals. The connection between the enclosure walls and the steel base shall be sealed with a neoprene gasket.
 - (s) The station shall be positioned on the concrete mounting pad.
4. Enclosure Functional Equipment:
- (a) The interior of the station shall be illuminated by factory installed one hundred twenty volt (120 V) LED or equivalent florescent light fixtures. All lights will be prewired and run to a load center through PVC conduit and a weatherproof switch shall be installed adjacent to each station entrance. The lighting circuit shall be protected by a thermal-magnetic circuit breaker.
 - (b) A thermostatically controlled one hundred twenty volts alternating current (120 VAC) exhaust fan with screen and weatherproof shutters shall be installed in the wall approximately opposite the fresh air intake vent. The fan shall have a minimum capacity of one thousand six hundred cubic feet per minute (1,600 CFM) at free air and be capable of changing the air in the enclosure a minimum of six (6) times per hour. The exhaust fan shall be protected by a thermal-magnetic circuit breaker.

- (c) The enclosure will be complete with one (1) set of exhaust louvers. The exhaust louvers will be completely self-contained and shall not require the use of motors, solenoids, or other electrically operated devices. Exhaust louver will consist of four (4) fifteen inch wide and eighteen and seven-eighths inch high (15 in. wide x 18.875 in.) shutters that open automatically at seventy-five degrees Fahrenheit (75°F) and close at sixty degrees Fahrenheit (60°F). Shutter operation will be the result of the expansion and contraction of wax in an enclosed plunger which shall drive the louver vanes through a mechanical linkage. The exhaust shutter will have the actuator mounted in the flow of the exhaust air and shall maintain the shutter vanes in the open position. Exhaust shutter frame will be constructed of anodized aluminum with zinc plated steel actuator mounting and linkage. The shutter vanes will pivot on plastic bearings. The four (4) intake shutters will be mounted in two (2) aluminum fixed vane louver assemblies to prevent the entrance of rain or snow.
 - (d) A twelve volts of direct current (12 VDC) with battery backup emergency lighting system shall provide fifty Watts (50 W) of illumination for one and a half (1.5) hours in the event of power outage. The system shall be fully self-contained for automatic operation of two (2) sealed beam lamps powered by a maintenance free pure-lead twelve volt (12 V) battery. An automatic solid state battery charger with integral transfer circuit shall maintain the battery in a constant state of readiness. A charge rate pilot light and test switch shall be provided. The charging circuit shall be protected by a thermal-magnetic circuit breaker. (When required by OJRSA)
 - (e) A high-capacity electric blower type station heater shall be provided for the protection of the pumping equipment. The heater shall maintain an inside/outside differential temperature of sixty degrees Fahrenheit (60°F) while operating on the primary voltage supplied to the station. The heater shall be provided with an adjustable thermostat, circuit breaker, and contactor. (When required by OJRSA)
 - (f) One (1) wall mounted duplex GFI utility receptacle providing one hundred twenty volts alternating current (120 VAC) power shall be installed and prewired through PVC conduit with the station lighting. The receptacle shall be protected by thermal magnetic circuit breaker.
 - (g) Consists of a three (3) piece assembly including duck bill check valve, SST strainer top, and PVC spacer to provide a gas and watertight drain receptacle for use in concrete pad within Modular Enclosure. (Note: A four inch (4 in.) PVC drainpipe and PVC coupling shall be required to be provided and installed by others.) (When required by OJRSA)
 - (h) The station enclosure shall include limit switches with defeater switch alarm circuit and time delay, mounted, and wired in the station enclosure to indicate that there has been a door left open or unauthorized entry to the station. There shall be an adjustable period for the operator to disable alarm with an unmarked pushbutton located inside the station. The notification shall be activated when a station door is opened. Includes dry contacts pre-wired to a terminal strip for remote monitoring. (When required by OJRSA)
5. Pump Control Panel
- (a) Enclosure: NEMA 250 Type 4X with 316 stainless steel, either freestanding or stainless steel floor stand kit with eighteen inch (18 in.) legs, drip shield, door stop, hinged exterior door, easy open latches (no tools required), and padlocking provisions. Panel shall be provided with a hinged interior panel. All breakers, lights, pushbuttons, switches, and accessories shall be visible and operable without opening the hinged interior panel.
 - (b) Panel door shall include Panduit Verisafe voltage tester or approved equal.
 - (c) Panel shall be evaluated for arc flash potential and necessary labels installed.
 - (d) Functional Requirements: The control panel shall be an automatic pump control center suitable for four hundred eighty volts (480 V), sixty hertz (60 Hz), three-phase power. The panel shall provide the following features:
 - (i) Main power circuit breaker/disconnect switch.
 - (ii) Transient surge suppressor with indication lights and integral disconnect switch with

one hundred sixty kiloampere (160 kA) rating in a NEMA 250 Type 4X enclosure remotely mounted.

- (iii) Phase monitor and lightning arrestor.
- (iv) Control power breaker.
- (v) Separate breaker for each pump starter.
- (vi) Variable speed drives (VFDs) with emergency bypass or soft starters. Verify starter type with OJRSA and its engineer. Provide switches to control normal and bypass operation of each VFD.
- (vii) "Hand-Off-Auto" switches for each pump.
- (viii) Run indication lights for each pump.
- (ix) Manual-Automatic speed selection switch for each pump (If VFDs are used).
- (x) Manual and Auto speed indication lights for each pump (If VFDs are used).
- (xi) Manual speed potentiometer for each pump (If VFDs are used).
- (xii) Indication lights and reset buttons for motor failure of each pump on over temperature and VFD fail (If VFDs are used). Failure lights shall be latching until the reset button is pressed.
- (xiii) Flashing alarm light, horn, and auxiliary contacts with test button, horn silence button, and reset button.
- (xiv) Remote Terminal Unit (RTU) manufactured by approved SCADA manufacturer (see SECTION 4.12). RTU model shall be selected based on the required inputs and outputs.
- (xv) Auxiliary dry contacts shall be provided on all alarm indications to SCADA RTU for external use including, but not limited to pump run, pump fault alarm, high level alarm, power failure alarm, generator run alarm, generator fault alarm, generator low fuel alarm, phase monitor alarm, and automatic transfer switch emergency position alarm. Contacts shall be provided with both normally open and normally closed logic.
- (xvi) Terminal for over-temperature thermal switches of each phase of the motor windings, upper bearings, and lower bearings for each pump.
- (xvii) Hour meters documenting run times for each pump.
- (xviii) Ammeter for each pump.
- (xix) Lead pump selection switch.
- (xx) Oversized control power transformer large enough to serve the breakers in the panel.
- (xxi) Control power-indicating light.
- (xxii) Programmable logic controller with HMI display panel, uninterruptible power supply, and sufficient number of discrete inputs, analog inputs, discrete outputs, and analog output modules, and relays, timers, switches, and other equipment as necessary to operate the pumps and other instrumentation according to the control scheme and monitor all functions associated with the operation of the facility as described herein and as shown on the drawings. The duplex pump station operating sequence shall be as follows:
 - (A) Normal operation will allow the pumps to alternate between the lead and lag pump position upon each successive wet well cycle. The lead pump shall be started upon reaching a predetermined lead pump on level. The lag pump shall be started if the wet well level continues to rise to a predetermined lag pump on level. All pumps will stop when the wet well reaches a predetermined pump off elevation. A selector switch shall be provided to select the lead pump and determine whether they will alternate.
 - (B) Under normal operation, both the lead and lag pumps will vary their speed according to the level in the wet well with adjustable tuning parameters.
 - (C) When the wet well is below a predetermined level, there shall be an alarm indicating low water level and all pumps shall be locked out from operation in

- either the hand or automatic position until the wet well level reaches at least the lead pump on level which shall unlock the pumps to operate. The low-level alarm, however, will not reset until the reset button is pressed.
- (D) An alarm condition will occur on a high level in the wet well at a predetermined elevation.
 - (E) The alarm will be provided with a panel mounted flashing light, panel mounted alarm horn, auxiliary contacts, a horn silence button, and an alarm reset button.
 - (F) In the "Hand" operating position, the selected pump shall operate independently from the alternation sequence but will not run if the wet well is below the low-level alarm elevation.
 - (G) Upon resuming power after a power failure, the pumps will be provided with an automatic staggered restart of the equipment with a field adjustable time from one (1) second to ninety-nine (99) seconds.
 - (H) The level transducer shall provide level control under normal conditions and floats shall be used for backup operation in case of failure of level transducer.
 - (I) In the event the level controller fails to operate, one hundred twenty volts (120 V) controls shall be in place to provide basic functionality to control the on and off operation of the pumps based on the float control logic.
- (xxiii) GFI convenience outlet.
 - (xxiv) Interior panel LED light with switch.
 - (xxv) Submersible Pressure Transducer
 - (A) Four-to-twenty milliamperes (4-to-20 mA) output with Type 316 stainless steel construction with aneroid bellows.
 - (B) Unit shall be a maintenance free closed system to be used for primary level control.
 - (xxvi) Mercury switch type wet well floats with cable long enough without splicing. Floats will serve as backup level control to submersible pressure transducer.
 - (xxvii) Remote-mounted flow meter to be installed in concrete vault on discharge force main.
 - (xxviii) Internally mounted space heater with thermostat.
 - (xxix) Side mounted air conditioning unit (as needed).
 - (xxx) In addition to the breakers provided due to the above requirements, the panel shall be equipped with circuit breakers as listed below:
 - (A) One (1) each:
 - (1) Twenty ampere (20 A) breaker for interior panel light
 - (2) Twenty ampere (20 A) breaker for panel mounted GFI receptacle
 - (3) Twenty ampere (20 A) breaker (GFPE rated) for heat tracing of exposed piping
 - (B) Two (2) each: Twenty ampere (20 A) breaker breakers (spare)

4.8.2 Submersible Pump Stations

4.8.2.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.8.2.2 Submittals

- A. Shop drawings shall provide layout of mechanical equipment and anchor bolt locations for equipment baseplate. The electrical ladder logic drawings shall illustrate motor branch and liquid level control circuits to extent necessary to validate function and integration of circuits to form a complete working system.
- B. Operations Maintenance Manuals

1. Installation shall be in accordance with written instructions provided by the pump station manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping, and valves, but lack experience with the exact equipment supplied.
2. Documentation shall be specific to the pump station supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station manufacturer. Support data for any equipment supplied by others, even if mounted or included in the overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:
 - (a) Functional description of each major component, complete with operating instructions.
 - (b) Instructions for operating pumps, pump controls in all modes of operation.
 - (c) Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.
 - (d) Support data for commercially available components not produced by the station manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.
 - (e) Electrical schematic diagram of the pump station circuits shall be in accordance with NFPA 70. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control, and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.
 - (f) Mechanical layout drawing of the pump station and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves, and piping.
3. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications. Operations Maintenance Manuals which rely on vendor cut sheets and literature which include general configurations or require operating personnel to selectively read portions of the manual shall not be acceptable.

4.8.2.3 Approved Manufacturer

- A. Submersible pumps shall be manufactured by KSB, Inc. The OJRSA has standardized on this manufacturer in order to improve operation and maintenance effectiveness by optimizing service responsiveness, simplifying maintenance complexity and training of staff, and to ensure availability of spare parts.
- B. Submersible pressure transducers shall be manufactured by Rosemount, KPSI, or OJRSA-approved equal.
- C. Above ground valve package shall be manufactured in compliance with SECTION 4.8.2.4(M) by Gorman-Rupp or an OJRSA-approved equal.

4.8.2.4 Materials of Construction

A. General

1. Each pump shall be equipped with a submersible electric motor of the size and type described herein and shall be suitable for use with variable frequency drives when indicated.
2. Provide pumps capable of handling raw unscreened wastewater. Design pumps to allow for removal and reinstallation without the need to enter the wet well and without removal of bolts, nuts, or other fasteners.
3. Provide a pump which connects to a permanently mounted discharge connection by simple downward motion, without rotation, guided by at least two (2) non-load bearing guides.
4. All system components for guide cable systems, including cable, shall be supplied and warranted by the pump manufacturer. For guide pipe systems, the pipe shall be supplied and warranted by the installing contractor. Guide cable systems shall be suitable for proper operation when installed at up to

five degrees (5°) misalignment from vertical and pipe guides must be installed perfectly plumb and vertical. Intermediate guide supports (between upper bracket and discharge elbow connections) shall not be required for cable systems but must be supplied where needed to maintain perfect alignment for pipe guides.

5. Final connection shall insure zero (0) leakage between pump and discharge connection flange. Provide a discharge connection/ guide system so that no part of the pump bears directly on the floor of the wet well.
6. Provide Type 316 stainless steel chain of sufficient length to lift pumps properly and safely from the wet well.
7. All exposed cast iron and ferrous surfaces shall be cleaned of dirt and grease, sandblasted to near white finish, and coated with an anti-corrosion reaction primer. The pump shall then be coated with two-component thick coat paint, with an epoxy resin base, having at minimum eighty-three percent (83%) solids by volume. This coating shall be non-toxic and approved for both wastewater and water applications.

B. Pump Construction

1. Pump Case: Cast Iron, ASTM A48, Class 35B
 2. Motor Housing: Cast Iron, ASTM A48, Class 35B
 3. Impeller: Cast Iron, ASTM A48, Class 35B
 4. Intermediate Housing (Backplate): Cast Iron, ASTM A48, Class 35B
 5. Discharge Base Elbow: Cast Iron, ASTM A48, Class 35B
 6. Pump/Motor Shaft: Carbon Steel, ASTM A576, Grade 1045 with replaceable ASTM A276 Type 420 shaft protection sleeve. (*NOTE: If sleeve is not supplied, entire shaft is to be ASTM A276 Type 420 stainless steel*)
 7. Shaft Sleeve (if used): Stainless steel, ASTM A276 Type 420
 8. Wear Ring, case: Cast Iron, ASTM A48, minimum 200 Brinell
 9. Wear Ring, impeller (enclosed impellers only): Stainless steel, AISI 329, 350 Brinell
 10. O-Rings: Nitrile Rubber (NBR)
 11. Fasteners (including impeller fastener): Stainless steel, ASTM A276 Type 316Ti.
 12. Lower Seal Faces: Silicon Carbide/Silicon Carbide
 13. Upper Seal Faces: Silicon Carbide stationary/Carbon rotating
 14. Guide Rails/Cables and Mounting Brackets: Stainless steel, ASTM A276 Type 316 (cables shall be nylon coated)
 15. Lifting Chain or cable: Stainless steel, ASTM A276 Type 316
 16. Oil-All Uses (seal lubrication, etc.): Ecologically safe, paraffin or mineral base
 17. Power/Control Cable Jacket: Chloroprene with non-wicking fillers
- C. Power Cable: Provide sufficient length of power/control cable with each pump, suitable for submersible wastewater application, sized in accordance with NEC requirements. Provide cable terminal box on side of motor housing, with cable entry sealed to ensure that no entry of moisture is possible into the high-voltage motor/terminal area even if the cable is damaged or severed below water level. Cable seal shall include a compressed rubber grommet to seal the cable exterior and epoxy fill to seal the interior passages. A strain relief device, in direct contact with both the cable and the cast iron entry housing, shall be provided. The cable entry shall be rated by FM or UL for submerged operating depths up to eighty-five feet (85 ft).
- D. Temperature Protection: Furnish temperature monitoring devices in motor windings for use in conjunction with and supplemental to external motor overload protection. Arrange controls to shut down pump should any of the monitors detect high temperature and automatically reset once motor temperature returns to normal. Set temperature monitors at levels recommended by pump manufacturer.
- E. Seal Leak Detection: Provide a detector in the motor's stator cavity which allows a control panel mounted relay to indicate leakage into the motor. In addition, on motors eighty horsepower (80 hp) and larger provide a stainless steel float switch in a separate leakage collection chamber to indicate leakage past the inner mechanical seal prior to its entrance into either the motor stator cavity or the lower bearing. Electronic probes which depend on sensing resistance value changes in seal oil will not be acceptable as seal leak indicators.

F. Motor Sensor Monitoring Relay

1. The pump supplier shall furnish all relays required for monitoring all motor sensors. The relays shall be installed by others in the motor control panel and properly wired in accordance with pump manufacturer's instructions. Relays shall mount in standard twelve (12) pin socket bases (provided) and shall operate on available control voltage of twenty-four to two hundred forty volts alternating current (24-to-240 VAC). If relays require an input voltage that is not available in the motor control panel an adequate transformer (with fused input) shall be provided by the pump supplier. Relays shall have a power consumption of no more than two and eight-tenths watts (2.8 W) and shall be UL approved. Relays shall be modular in design, with each relay monitoring no more than two (2) motor sensor functions.
2. Each relay module shall include a dual color (red/green) LED to indicate the status of each monitored sensor. Green will indicate "Status OK"; red will indicate a failure or alarm condition. A self-corrected fault will allow the relay output contacts to reset and cause the LED to change from a steady alarm indication to a flashing signal. The LED shall continue to flash until locally cleared, providing the operator an indication of a potential intermittent fault. Each relay shall also include a power-on LED and both "test" and "reset" pushbuttons.
3. An independent fail-safe (switch on power loss) form-C output contact shall be included for each monitored sensor to provide a normally-open/normally-closed dry contact to initiate a remote alarm device or shut down the motor. Contacts shall be rated for five amperes (5 A) at one hundred twenty volts (120 V).

G. Impeller and Wear Rings: Provide non-clog type impeller, capable of passing any solids that may enter the impeller. Statically and dynamically balance the impeller. On enclosed impeller designs, provide hard metal wear rings of material and Brinell hardness specified, to ensure maximum pump/impeller life and continuing high efficiencies. Impellers must incorporate back vanes which reduce axial loads and propel solids away from the seal area. Do not use soft metals (e.g., bronze, Type 304 or Type 316 stainless steel) or elastomers as wear ring material as these are incompatible with the grit contaminate expected in the pumpage.

H. Shaft: Provide common pump/motor shaft of sufficient size to transmit full driver output with a maximum deflection of two one thousandths of an inch (0.002 in.) measured at the lower mechanical seal. Machine the shaft of carbon steel (for maximum strength and motor efficiency) and isolate the shaft from the pumped media with a replaceable Type 420 stainless steel shaft sleeve under the lower mechanical seal. Do not use carbon steel as shaft material without a stainless steel sleeve. If a sleeve is not used, machine the entire pump/motor shaft of ASTM A276 Type 420 stainless steel.

I. Shaft Seal: Provide two (2) totally independent mechanical shaft seals, installed in tandem, each with its own independent single spring system acting in a common direction. Install the upper seal in an oil-filled chamber with drain and inspection plug (with positive anti-leak seal) for easy access from external to the pump. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced. Provide seals which are non-proprietary in design, with replacements available from a source other than the pump manufacturer or its distributors. Do not provide seals with the following characteristics: conventional double mechanical seals with single or multiple springs acting in opposed direction; cartridge-type mechanical seals; seals incorporating coolant circulating impellers, seals with face materials other than those specified.

J. Bearings: Furnish upper and lower bearings, single row (preferred) or double row as needed to provide a B10 life of, at minimum, one hundred thousand (100,000) hours at all anticipated axial and radial loadings. Provide sealed/shielded (permanently lubricated) bearings. If open-type (non-shielded) bearings are used, provide re-lubrication ports with positive anti-leak plugs for periodic addition of lubrication from external to the pump.

K. Motor

1. Provide a motor which is squirrel cage, induction in design, housed in a completely watertight and air-filled chamber, with a minimum one and fifteen hundredths safety factor (1.15 SF). The motor shall be adequately sized and rated for continuous operation at a maximum fluid temperature of one hundred four degrees Fahrenheit (104°F) [optional: one hundred forty degrees Fahrenheit (140°F)]. Allowable maximum submergence shall not be less than one hundred feet (100 ft). The motor stator shall be

wound using Class H monomer-free polyester resin insulation resulting in an overall motor rating of three hundred eleven degrees Fahrenheit (311°F), Class F insulation. The stator windings shall be trickle impregnated resulting in a winding fill factor of at least ninety-five percent (95%). The use of a multiple step "dip and bake" type stator insulation method shall not be acceptable. The rotor bars and short circuit rings shall be made of aluminum. The motor and pump set complete shall be designed and manufactured by the same company. Provide temperature protection and seal leak detection as described in section above. Provide adequately rated motor with sufficient surface area for ambient only cooling suited for the intermittent mode of operation in wet well wastewater applications, submerged or partially submerged, without damage. Motors containing di-electric oils used for motor cooling and/or bearing lubrication or motors where the pumped media or externally provided fresh water is directed through the motor shell for cooling are not acceptable.

2. Provide motors which are FM listed for use in Class I Division 1 Groups C&D hazardous locations as defined by the National Electric Code.

L. Pump Control Panel

1. Enclosure: NEMA 250 Type 4X with type 316 stainless steel, either freestanding or stainless steel floor stand kit with eighteen inch (18 in.) legs, drip shield, door stop, hinged exterior door, easy open latches (no tools required), and padlocking provisions. Panel shall be provided with a hinged interior panel. All breakers, lights, pushbuttons, switches, and accessories shall be visible and operable without opening the hinged interior panel.
2. Panel shall be evaluated for arc flash potential and necessary labels installed
3. Functional Requirements: The control panel shall be an automatic pump control center suitable for four hundred eighty volts (480 V), sixty hertz (60 Hz), three-phase power. The panel shall provide the following features:
 - (a) Main power circuit breaker/disconnect switch.
 - (b) Transient surge suppressor with indication lights and integral disconnect switch with one hundred sixty kiloampere (160 kA) rating in a NEMA 250 Type 4X enclosure remotely mounted.
 - (c) Phase monitor and lightning arrestor.
 - (d) Control power breaker.
 - (e) Separate breaker for each pump starter.
 - (f) Variable speed drives (VFD) with emergency bypass or soft starters. Verify starter type with OJRSA and its engineer. Provide switches to control normal and bypass operation of each VFD.
 - (g) "Hand-Off-Auto" switches for each pump.
 - (h) Run indication lights for each pump.
 - (i) Manual-Automatic speed selection switch for each pump (If VFDs are used).
 - (j) Manual and Auto speed indication lights for each pump (If VFDs are used).
 - (k) Manual speed potentiometer for each pump (If VFDs are used).
 - (l) Indication lights and reset buttons for motor failure of each pump on over temperature, seal failure, and VFD fail (If VFDs are used). Failure lights shall be latching until the reset button is pressed.
 - (m) Flashing alarm light, horn, and auxiliary contacts with test button, horn silence button, and reset button.
 - (n) Remote Terminal Unit (RTU) manufactured by approved SCADA manufacturer as stated in SECTION 4.12. RTU model shall be selected based on the required inputs and outputs.
 - (o) Auxiliary dry contacts shall be provided on all alarm indications to SCADA for external use including, but not limited to pump run, pump fault alarm, high level alarm, power failure alarm, generator run alarm, generator fault alarm, generator low fuel alarm, phase monitor alarm, and automatic transfer switch emergency position alarm. Contacts shall be provided with both normally open and normally closed logic.
 - (p) Solid-state control relays for moisture sensors in each pump.
 - (q) Terminal for over-temperature thermal switches of each phase of the motor windings, upper bearings, and lower bearings for each pump.

- (r) Hour meters documenting run times for each pump.
 - (s) Ammeter for each pump.
 - (t) Lead pump selection switch.
 - (u) Oversized control power transformer large enough to serve the breakers in the panel.
 - (v) Control power-indicating light.
 - (w) Programmable logic controller with HMI display panel, uninterruptible power supply, and sufficient number of discrete inputs, analog inputs, discrete outputs, and analog output modules, and relays, timers, switches, and other equipment as necessary to operate the pumps and other instrumentation according to the control scheme and monitor all functions associated with the operation of the facility as described herein and as shown on the drawings. The duplex pump station operating sequence shall be as follows:
 - (i) Normal operation will allow the pumps to alternate between the lead and lag pump position upon each successive wet well cycle. The lead pump shall be started upon reaching a predetermined lead pump on level. The lag pump shall be started if the wet well level continues to rise to a predetermined lag pump on level. All pumps will stop when the wet well reaches a predetermined pump off elevation. A selector switch shall be provided to select the lead pump and determine whether they will alternate.
 - (ii) Under normal operation, both the lead and lag pumps will vary their speed according to the level in the wet well with adjustable tuning parameters.
 - (iii) When the wet well is below a predetermined level, there shall be an alarm indicating low water level and all pumps shall be locked out from operation in either the hand or automatic position until the wet well level reaches at least the lead pump on level which shall unlock the pumps to operate. The low-level alarm, however, will not reset until the reset button is pressed.
 - (iv) An alarm condition will occur on a high level in the wet well at a predetermined elevation.
 - (v) The alarm will be provided with a panel mounted flashing light, panel mounted alarm horn, auxiliary contacts, a horn silence button, and an alarm reset button.
 - (vi) In the "Hand" operating position, the selected pump shall operate independently from the alternation sequence but will not run if the wet well is below the low-level alarm elevation.
 - (vii) Upon resuming power after a power failure, the pumps will be provided with an automatic staggered restart of the equipment with a field adjustable time from one (1) second to ninety-nine (99) seconds.
 - (viii) The level transducer shall provide level control under normal conditions and floats shall be used for backup operation in case of failure of level transducer.
 - (ix) In the event the level controller fails to operate, one hundred twenty volts (120 V) controls shall be in place to provide basic functionality to control the on and off operation of the pumps based on the float control logic.
4. GFI convenience outlet.
 5. Interior panel LED light with switch.
 6. Submersible Pressure Transducer
 - (a) Four-to-twenty milliamperes (4-to-20 mA) output with Type 316 stainless steel construction with aneroid bellows.
 - (b) Unit shall be a maintenance free closed system to be used for primary level control.
 7. Mercury switch type wet well floats with cable long enough without splicing. Floats will serve as backup level control to submersible pressure transducer.
 8. Remote-mounted flow meter to be installed in concrete vault on discharge force main.
 9. Internally mounted space heater with thermostat.
 10. Side mounted air conditioning unit (as needed).

11. In addition to the breakers provided due to the above requirements, the panel shall be equipped with circuit breakers as listed below:

- (a) One (1) each
 - (i) Twenty ampere (20 A) breaker for interior panel light
 - (ii) Twenty ampere (20 A) breaker for panel mounted GFI receptacle
 - (iii) Twenty ampere (20 A) breaker (GFPE rated) for heat tracing of exposed piping
- (b) Two (2) each: Twenty ampere (20 A) breakers (spare)

M. Above Ground Valve Package

1. System Description: The contractor shall furnish and install one (1) factory built automatically controlled above ground submersible pump valve package capable of handling raw unscreened sewage or similar liquids
2. Manufacturer
 - (a) The pump station system integrator must be ISO 9001, latest applicable revision certified, with scope of registration including design control and service after sales activities complete sets of Type 316 stainless steel wear rings for volute and impeller.
 - (b) The specifications and project drawings depict equipment and materials manufactured by Gorman-Rupp Company, which are deemed most suitable for the service anticipated. It is not intended, however, to eliminate other products of equal quality and performance; however, this shall be determined by OJRSA in consultation with its engineer of choice. The contractor shall prepare their bid based on the specified equipment for purposes of determining low bid. Award of a contract shall constitute an obligation to furnish the specified equipment and materials.
 - (c) After execution of the contract, the contractor may offer substitutions to the specified equipment for consideration. The equipment proposed for substitution must be superior in construction and performance to that specified in the contract, and the higher quality must be demonstrated by a list of current users of the proposed equipment in similar installations.
3. Station Enclosure
 - (a) The station enclosure shall contain and enclose all valves, and associated controls and shall be constructed to enhance serviceability by incorporating the following design characteristics:
 - (i) Two (2) access panels per side of station shall be provided. Panels shall be sized and placed to permit routine maintenance operations through the panel openings of the enclosure. For these purposes, routine maintenance shall include frequently performed adjustments and inspections of the electrical components, controls, and valves.
 - (ii) The access panels shall be provided with a hinge and latch. Hinge shall be the continuous type. Latch shall engage the enclosure at not less than three (3) places and shall be protected by a keyed lock.
 - (iii) One enclosure side shall contain a screened vent to maximize air flow for enclosure ventilation
 - (iv) Station enclosure, less base, must be removable or able to be disassembled following the removal of reusable hardware.
 - (v) Removal or disassembly of the enclosure shall be accomplished by not more than two (2) maintenance personnel without the use of lifting equipment.
 - (b) The station enclosure shall be manufactured of molded reinforced orthophthalic polyester resins with a minimum of thirty percent (30%) fiberglass and a maximum of seventy percent (70%) resin. Resin fillers or extenders shall not be used.
 - (c) Glass fibers shall have a minimum average length of one and one quarter inch (1.25 in.). Major design considerations shall be given to structural stability, corrosion resistance, and water-tight properties. The polyester laminates shall provide a balance of mechanical, chemical, and electrical properties to insure long life. They must be impervious to micro-organisms, mildew, mold, fungus, corrosive liquids, and gases which can reasonably be expected to be present in

the environment surrounding the wet well.

- (d) All interior surfaces of the housing shall be coated with a polyester resin-rich finish. It shall provide:
 - (i) Maintenance-free service
 - (ii) Abrasion resistance
 - (iii) Protection from sewage, greases, oils, gasoline, and other common chemicals
 - (iv) The outside of the enclosure shall be coated with a suitable pigmented resin, compounded to insure long maintenance-free life
 - (e) An exhaust blower shall be mounted on the side of the enclosure. Blower capacity shall be sufficient to change station air a minimum of once every two (2) minutes. Blower motor shall be operated automatically and shall be turned on at approximately seventy degrees Fahrenheit (70°F) and shall be turned off at fifty-five degrees Fahrenheit (55°F). Blower motor and control circuit shall be protected by a thermal-magnetic air circuit breaker to provide overcurrent and overload protection. Blower exhaust outlet shall be designed to prevent the entrance of rain, snow, rocks, and foreign material.
4. Station Base
- (a) Station base shall be constructed of pre-cast, reinforced concrete bonded inside a fiberglass form covering top and sides and shall be designed to ensure adequate strength to resist deformation of the structure during shipping, lifting, or handling. The enclosure base shall function at the wet well top and incorporate a duplex access lid, sized for the installation and removal of the specified pumps, and shall be of sufficient size to permit access to the wet well. Color used shall de-emphasize the presence of dirt, grease, etc., and shall be provided with a non-skid surface.
 - (b) A static wet well vent shall be mounted in the station base and be housed in the station enclosure. The station enclosure shall provide a transition area between the wet well and the vent outlet. The vent shall terminate through the station wall with a screened opening which shall be designed to prevent the entrance of rain, snow, rocks, and foreign material.
 - (c) The station base shall incorporate a cable transition adapter for the pump cables, level controls, and associated wiring. The adapter shall provide for a vapor tight transition between the wet well and the lift station enclosure. The adapter shall incorporate cable grips for each cable and be provided with a gasket between the adapter and the station for a positive seal. Junction boxes shall not be considered for cable transition.
 - (d) The station base shall be furnished with elastomeric compression sealing devices for all piping penetrations to provide for a vapor tight transition between the wet well and lift station enclosure.
5. Station Heater: Pump station shall be provided with a one thousand three hundred / one thousand five hundred watt (1,300/1,500 W), one hundred fifteen volt (115 V) electric heater with cord, thermostat, and grounding plug. Ungrounded heaters shall not be acceptable.
6. Discharge Gauge Kit: The pump station shall be equipped with a glycerin-filled pressure gauge to monitor discharge pressures. Gauge shall be a minimum of four inch (4 in.) in diameter and shall be graduated in feet of water column. Rated accuracy shall be one percent (1%) of full-scale reading. Pressure gauge shall be graduated zero (0) to one hundred forty (140) feet of water column at a minimum. Gauge kit shall be mounted and complete with all hoses and stainless steel fittings and shall include a shutoff valve installed in each connection to discharge piping and a three-way valve to monitor either pump.
7. Compression Couplings shall be provided for each suction and discharge connection to join plain end ductile iron pipe to wet well piping
8. Valves and Piping
- (a) Check Valve: Each pump shall be equipped with a full flow type check valve capable of passing a three inch (3 in.) spherical solid. Valve shall be constructed with flanged ends and fitted with

an external lever and torsional spring. Valve seat shall be constructed of stainless steel, secured to the body to ensure concentricity, sealed by an O-ring, and shall be replaceable. The valve body shall be cast iron incorporating a clean-out port large enough to allow removal and/or replacement of the valve clapper without removing valve or piping from the line. Valve clapper shall have a molded neoprene seating surface incorporating low pressure sealing rings. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings. Shaft nut shall have double O-rings which shall be easily replaceable without requiring access to interior of valve body. All internal hardware shall be stainless steel. Valve shall be rated at one hundred seventy-five pounds per square inch (175 psi) water working pressure and three hundred fifty pounds per square inch (350 psi) hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a three inch (3 in.) spherical solid shall not be acceptable.

- (b) Each discharge line shall be equipped with a two-way plug valve to permit isolation of the pumps from the common discharge header. The plug valve shall be non-lubricated type. Valve body shall be cast iron with flanged end connections drilled to one hundred twenty-five pound (125 lb) standard. Valve shall be furnished with a drip-tight shutoff plug mounted in stainless steel, Teflon, or phenolic bearings and shall have a resilient facing bonded to the sealing surface. Valves shall have ports designed to pass three inch (3 in.) spherical solids.

9. Piping

- (a) Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI C115/AWWA A21.51 and Class 53 thickness.
- (b) Flanges shall be cast iron Class 125 and comply with ASME/ANSI B16.1.
- (c) Pipe and flanges shall be threaded, and suitable thread sealant applied before assembling flange to pipe.
- (d) Bolt holes shall be in angular alignment within one half of one degree (0.5°) between flanges. Flanges shall be faced and a gasket finish applied.
- (e) All pipes connected to the pump station shall be supported according to good commercial practice.

N. Accessories and Spare Parts: The following list of spare parts shall be supplied to OJRSA. All spare parts shall be clearly labeled, properly protected, and delivered in a sturdy wooden box(es) for long term storage.

- 1. One (1) spare complete pump assembly
- 2. One (1) set of any specialty tools necessary for repair or maintenance of the pumping equipment.
- 3. Two (2) complete sets of:
 - (a) Type 316 stainless steel wear rings for volute and impeller.
 - (b) Upper and lower bearings.
 - (c) Upper and lower shaft seals.
 - (d) All Nitrile O-rings and elastomer cable grommets required for one (1) pump.
- 4. One (1) impeller with Type 316 stainless steel wear ring.

4.8.3 Grinder Pumps for Individual Users

4.8.3.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.8.3.2 Submittals

- A. Shop drawings shall provide the layout of the grinder pump station.
- B. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications. Operations Maintenance Manuals which rely on vendor cut sheets and literature which include general configurations or require operating personnel to selectively read portions of the manual shall not be acceptable.

4.8.3.3 Approved Manufacturers

Grinder pump units shall be manufactured by E/One (Environment One Corporation). The OJRSA has standardized on this manufacturer in order to improve operation and maintenance effectiveness by optimizing service responsiveness, simplifying maintenance complexity and training of staff, and to ensure availability of spare parts.

4.8.3.4 Materials of Construction

A. General

1. All grinder pump station components shall be made of corrosion-resistant materials wherever practical.
2. Manufacturer shall have extensive experience and service history consisting of, at minimum, at least ten (10) years of experience in the design and manufacturing of units and five hundred (500) successful installations of low-pressure sewer systems utilizing grinder pumps where an installation would consist of at least twenty-five (25) units.
3. Pumps shall be manufactured domestically.
4. Pumps shall be capable of delivering the following flows at the corresponding rated total dynamic head as shown below. The pump should also be capable of operating at a negative total dynamic head (TDH) without overloading the motor. Under no conditions should modifications to piping or valving be allowed to create a false apparent head.
 - (a) Fifteen gallons per minute (15 gpm) at zero feet total dynamic head (0 ft TDH)
 - (b) Eleven gallons per minute (11 gpm) at ninety-two feet total dynamic head (92 ft TDH)
 - (c) Seven and eight-tenths gallons per minute (7.8 gpm) at one hundred eighty-five feet total dynamic head (185 ft TDH)
5. All maintenance tasks for the pump station must be possible without entry into the grinder pump station basin.
6. Packaged units shall be fully factory assembled integral units and factory tested for each unit shipped. Field assembly of the pump and controls into the basin is not acceptable.
7. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from noise, odor, or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform as specified. The grinder pump shall bear the seal of NSF International. Third-party testing to NSF standard shall not be accepted.
8. Completely assembled and wired grinder pump stations shall be listed by UL to be safe and appropriate for intended use. UL listing of components of the station, or third-party testing to UL standards are not acceptable.
9. Pump station shall be installed so that ground slopes away from the pump station.

B. Pump Construction

1. Pumps should be custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with a single mechanical seal. Double radial O-ring seals are required at all casting joints to minimize corrosion and create a protective barrier. All pump castings shall be cast iron, fully epoxy coated to eight (8) to ten (10) mil nominal dry thickness, wet applied. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. This material shall be suitable for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.
2. Cutter wheels should be exceptionally durable and intended for harsh conditions. Pumps shall utilize a one-piece cutter wheel to perform in the intended environment and for their wear and corrosive resistant properties.
3. Pump cutting mechanisms must not exceed four feet per second (4 fps) velocity as higher velocities may cause blinding by leaving solids clogged in the pump opening. Inlet shrouds should have a diameter of at least five inches (5 in.) which assist in minimizing the inlet velocity.

- C. Power Cable shall be six (6) conductor, 14-gauge type SJOW cable, pre-wired and watertight to meet UL requirements with a factory installed NEMA 6P EQD half attached to it.
- D. The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.
- E. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. The grinder impeller (cutter wheel) assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable. The grinder impeller shall be a one-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth. The cutter teeth shall be inductively hardened to Rockwell 50–60c for abrasion resistance. The shredder ring shall be of the stationary type and the material shall be white cast iron. The teeth shall be ground into the material to achieve effective grinding. The shredder ring shall have a staggered tooth pattern with only one (1) edge engaged at a time, maximizing the cutting torque. These materials have been chosen for their capacity to perform in the intended environment as they are materials with wear and corrosive resistant properties.
- F. Pump motors should be a capacitor start, ball bearing, air-cooled induction type motor. Oil-filled motors are not acceptable.
- G. Pump Control Panel
1. Each pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall or pole mounting.
 2. Enclosure shall be manufactured of thermoplastic polyester. Enclosure shall include a hinged, lockable cover with padlock.
 3. Panel shall be evaluated for arc flash potential and necessary labels installed.
 4. Electrical quick disconnects shall be provided between the pump and control panel.
 5. The panel shall contain one (1) fifteen ampere (15 A), double-pole circuit breaker for the pump core's circuit and one (1) fifteen ampere (15 A), single-pole circuit breaker for the alarm circuit. All circuit boards in the alarm panel shall be protected with a conformal coating on both sides and the AC power circuit including an auto resetting fuse.
 6. Alarm panel shall include the following features:
 - (a) External audible and visual alarm
 - (b) Push-to-run switch
 - (c) Push-to-silence switch
 - (d) Redundant pump start
 - (e) High-level alarm capability
 - (f) Alarm sequence consisting of the following:
 - (i) When liquid level in the wet well basin rises above the alarm level, the contacts on the alarm pressure switch activate, audible and visual alarms are activated, and the redundant pump starting system is energized.
 - (ii) The audible alarm may be silenced by means of the externally mounted, push-to-silence button.
 - (iii) Visual alarm remains illuminated until the liquid level in the wet well drops below the "off" setting of the alarm pressure switch.
 - (g) Alarm lamp shall be inside a red, oblong lens mounted to the top of the enclosure in such a manner as to maintain a NEMA 4X rating.
 - (h) Audible alarm shall be externally mounted on the bottom of the enclosure, capable of ninety-three decibels (93 dB) at two feet (2 ft). Alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure.
 7. The control panel shall include a twenty ampere (20 A), two hundred fifty volts alternating current (250 VAC) generator receptacle with a spring-loaded, gasketed cover suitably mounted to provide access for connection of an external generator while maintaining a NEMA 4X rating. An automatic transfer switch shall be provided that automatically switches from AC power to generator power.

H. Wet Well (or Basin)

1. The tank shall be a wet well design consisting of a single wall, laminated fiberglass construction. The resin used shall be of a commercial grade suitable for the environment. The reinforcing material shall be a commercial grade of glass fiber capable of bonding with the selected resin. The inner surface shall have a smooth finish and be free of cracks and crazing. The exterior tank surface shall be relatively smooth with no exposed fiber or sharp projections present.
2. The tank wall and bottom shall be of sufficient thickness and construction to withstand the imposed loading due to saturated soil at the specified burial depth for each available tank height. All station components must function normally when exposed to the external soil and hydrostatic pressures developed at the specified burial depth. The tank bottom shall be reinforced with a fiberglass plate extending beyond the tank walls to support concrete anchoring, as required, to prevent flotation
3. The fiberglass tank shall have a stainless steel discharge bulkhead which terminates outside the tank wall with a one and one quarter inch (1.25 in.) female pipe thread. The discharge bulkhead shall be factory installed and warranted by the manufacturer to be watertight. The tank shall be furnished with a field installed EPDM grommet to accept a four and a half inch (4.50 in.) OD (four inch (4 in.) DWV or PVC Schedule 40) inlet pipe.
4. The basin vent shall not protrude above the ground surface but shall be constructed into the basin where the lid of the basin contains the vent without penetration above the surface.
5. Basin penetrations for inlet and outlet pipes shall be molded in and factory sealed in order to ensure a leak-free installation.

I. Valves and Piping

1. Anti-siphon check valves shall be built into the discharge pipe.
2. Discharge piping shall be stainless steel.
3. Inlet connection shall be PVC.

J. Accessories and Spare Parts: The following list of spare parts shall be supplied to OJRSA. All spare parts shall be clearly labeled, properly protected, and delivered in a sturdy wooden box(es) for long term storage.

1. One (1) spare complete pump package for every ten (10) pumps to be supplied or installed by the developer/owner. If less than ten (10) are supplied or installed, then there shall be one (1) provided unless OJRSA determines that has enough units in inventory.
2. One (1) set of any specialty tools necessary for repair or maintenance of the pumping equipment.

END OF SECTION 4.8

4.9 STANDBY GENERATORS

4.9.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.9.2 Submittals

Shop Drawings shall be submitted for review and shall include the following:

- A. Materials list of items proposed to be provided under this Section.
- B. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
- C. Shop Drawings in sufficient detail to show fabrication, anchorage, and interface of the work of this Section with the work of adjacent trades.
- D. Manufacturer's recommended installation procedures which, when approved by the OJRSA and/or its representative, will become the basis for accepting or rejecting actual installation procedures used on the project.
- E. Load Calculations: Generator shall be sized for all pumps running fully loaded (step started). Base computations on reduced-voltage starters with three hundred fifty percent (350%) current limit setting and variable frequency drives (VFDs) with six (6) pulse rectifiers. The maximum voltage drop shall be twenty percent (20%).

4.9.3 Approved Manufacturer

Standby generators shall be Caterpillar, Inc.; Engine Division. The OJRSA has standardized this manufacturer in order to improve operation and maintenance effectiveness by optimizing service responsiveness, simplifying maintenance complexity and training of staff, and to ensure availability of spare parts.

4.9.4 Materials of Construction

A. Engine Generator Set

1. Furnish a coordinated assembly of compatible components.
2. Output Connections: Three-phase, four (4) wire.
3. Safety Standard: Comply with ASME B15.1.
4. Nameplates: Each major system component is equipped with a conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, model, and serial number of items.
5. Resistance to Seismic Forces: Supports for internal and external components, and fastenings for batteries, wiring, and piping are designed and constructed to withstand static or anticipated seismic forces, or both, in any direction. For each item, use a minimum force value equal to weight of item.
6. Limiting dimensions indicated for system components are not exceeded.
7. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
8. Skid: Adequate strength and rigidity to maintain alignment of mounted components without depending on a concrete foundation. Skid is free from sharp edges and corners. Lifting attachments are arranged to facilitate lifting with slings without damaging any components.
9. Rigging Diagram: Inscribed on a metal plate permanently attached to skid. Diagram indicates location and lifting capacity of each lifting attachment and location of center of gravity.

B. Generator-Set Performance

1. Steady-State Voltage Operational Bandwidth: Four percent (4%) of rated output voltage from no load to full load.
2. Steady-State Voltage Modulation Frequency: Less than one hertz (1 Hz).
3. Transient Voltage Performance: Not more than twenty percent (20%) variation for fifty percent (50%) step-load increase or decrease. Voltage recovers to remain within the steady-state operating band within three (3) seconds.
4. Steady-State Frequency Operational Bandwidth: Half of one percent (0.5%) of rated frequency from no load to full load.
5. Steady-State Frequency Stability: When system is operating at any constant load within rated load, there are no random speed variations outside the steady-state operational band and no hunting or surging of speed.
6. Transient Frequency Performance: Less than five percent (5%) variation for a fifty percent (50%) step-load increase or decrease. Frequency recovers to remain within the steady-state operating band within five (5) seconds.
7. Output Waveform: At no load, harmonic content measured line to line or line to neutral does not exceed five percent (5%) total and three percent (3%) for single harmonics. The telephone influence factor (TIF), determined according to ANSI/NEMA MG 1, shall not exceed fifty telephone influence factor (50 TIF).
8. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, the system will supply greater than or equal to two hundred fifty percent (250%) of rated full-load current for not less than ten (10) seconds and then clear the fault automatically, without damage to any generator system component.
9. Start Time: Comply with NFPA 110, Type 10, system requirements.

C. Service Conditions: Environmental Conditions: Engine generator system withstands the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Between five degrees Celsius (5°C) to forty degrees Celsius (40°C).

2. Relative Humidity: Zero percent (0%) to ninety-five percent (95%).
3. Altitude: Zero feet mean sea level (0 ft MSL) to one thousand five hundred feet mean sea level (1,500 ft MSL).

D. Engine

1. Comply with NFPA 37.
2. Fuel: Fuel oil, Grade DF-2.
3. Rated Engine Speed: One thousand eight hundred revolutions per minute (1,800 rpm).
4. Maximum Piston Speed for Four-Cycle Engines: Two thousand two hundred fifty feet per minute (2,250 fpm).
5. Lubrication System: Pressurized by a positive-displacement pump driven from engine crankshaft. The following items are mounted on engine or skid:
 - (a) Filter and Strainer: Rated to remove ninety percent (90%) of particles five micrometers (5 μ m) and smaller while passing full flow.
 - (b) Thermostatic Control Valve: Controls flow in system to maintain optimum oil temperature. Unit is capable of full flow and is designed to be fail-safe.
 - (c) Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps or siphons or special tools or appliances.
6. Engine Fuel System: Comply with NFPA 37. System includes the following:
 - (a) Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
 - (b) Relief/Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
 - (c) Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment.

E. Governor Type: Electronic

F. Engine Cooling System

1. Description: Closed loop, liquid cooled, with radiator factory mounted on engine generator-set skid and integral engine-driven coolant pump.
2. Radiator: Rated for specified coolant.
3. Coolant: Solution of fifty percent (50%) ethylene-glycol-based antifreeze and fifty percent (50%) water, with anticorrosion additives as recommended by engine manufacturer.
4. Expansion Tank: Constructed of welded steel plate and equipped with gauge glass and petcock.
5. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
6. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
7. Rating: Maximum of fifty pounds per square inch gauge (50 psig) working pressure with one hundred eighty degrees Fahrenheit (180°F) coolant, and non-collapsible under vacuum.
8. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

G. Fuel Supply System

1. Comply with NFPA 30 and NFPA 37.
2. Base-Mounted Fuel Oil Tank: Factory-installed and -piped, listed and labeled fuel oil tank. Features include the following:
 - (a) Tank level indicator.
 - (b) Capacity: Fuel for forty-eight (48) hours of continuous operation at one hundred percent (100%) rated power output.
 - (c) Vandal-resistant fill cap.
 - (d) Dual wall with leak detection alarm.

H. Engine Exhaust System

1. Muffler: Critical type, sized as recommended by engine manufacturer. Measured sound level at a distance of ten feet (10 ft) from exhaust discharge, is no more than seventy-five A-weighted decibels (75

dB(A).

2. Condensate Drain for Muffler: Schedule 40, black steel pipe connected to muffler drain outlet through a petcock.
 3. Connections from Engine to Exhaust System: Flexible section of corrugated stainless steel pipe.
 4. Connection from Exhaust Pipe to Muffler: Stainless steel expansion joint with liners.
 5. Combustion-Air-Intake: Description: Heavy-duty engine-mounted air cleaner with replaceable dry filter element and "blocked filter" indicator.
- I. Starting System: Description: Twenty-four volt (24 V) electric, with negative ground and including the following items:
1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in this Section.
 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 3. Cranking Cycle: As required by NFPA 110 for system level specified.
 4. Battery: Adequate capacity within ambient temperature range specified in this Section to provide specified cranking cycle at least three (3) times without recharging.
 5. Battery Cable: Size as recommended by generator set manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
 6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater is arranged to maintain battery above ten degrees Celsius (10°C) regardless of external ambient temperature within range specified in this Section. Include accessories required to support and fasten batteries in place.
 7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and minimum thirty-five ampere (35 A) continuous rating.
 8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit complies with UL 1236 and includes the following features:
 - (a) Operation: Equalizing-charging rate of ten ampere (10 A) is initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit then automatically switches to a lower float-charging mode and continues operating in that mode until battery is discharged again.
 - (b) Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from negative forty degrees Celsius (-40°C) to positive sixty degrees Celsius (+60°C) to prevent overcharging at high temperatures and undercharging at low temperatures.
 - (c) Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to plus/minus ten percent ($\pm 10\%$).
 - (d) Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates.
 - (e) Safety Functions: Include sensing of abnormally low battery voltage arranged to close contacts providing low battery voltage indication on control and monitoring panel. Also include sensing of high battery voltage and loss of AC input or DC output of battery charger. Either condition closes contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
 - (f) Enclosure and Mounting: NEMA 250 Type 1 wall-mounted cabinet.
- J. Control And Monitoring
1. Functional Description: When the mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in automatic-transfer switch initiate starting and stopping of the generator set. When the mode-selector switch is switched to the on position, the generator set manually starts. The off position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms.
 2. Configuration: Operating and safety indications, protective devices, basic system controls, and engine

gauges are grouped on a common control and monitoring panel mounted on the generator set. Mounting method isolates the control panel from generator-set vibration.

3. Indicating and Protective Devices and Controls: Include those required by NFPA 110 for a Level 1 system and the following:
 - (a) AC voltmeter.
 - (b) AC ammeter.
 - (c) AC frequency meter.
 - (d) DC voltmeter (alternator battery charging).
 - (e) Engine-coolant temperature gauge.
 - (f) Engine lubricating-oil pressure gauge.
 - (g) Running-time meter.
 - (h) Ammeter-voltmeter, phase-selector switch(es).
 - (i) Generator-voltage adjusting rheostat.
 - (j) Start-stop switch.
 - (k) Overspeed shutdown device.
 - (l) Coolant high-temperature shutdown device.
 - (m) Coolant low-level shutdown device.
 - (n) Oil low-pressure shutdown device.
 - (o) Fuel tank derangement alarm.
 - (p) Fuel tank high-level shutdown of fuel supply alarm.
 - (q) Generator overload.
 - (r) Fuel tank leak detection alarm.
 4. Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support specified items. Locate sensors and other supporting items on engine, generator, or elsewhere as indicated. Where not indicated, locate to suit manufacturer's standard.
- K. Generator Overcurrent and Fault Protection:
1. Generator Circuit Breaker: Molded-case, thermal-magnetic type; eighty percent (80%) rated; complying with UL 489 and other standards as appropriate.
 2. Tripping Characteristic: Designed specifically for generator protection.
 3. Trip Rating: Matched to generator rating.
 4. Mounting: Adjacent to or integrated with control and monitoring panel.
- L. Generator, Exciter, And Voltage Regulator
1. Comply with NEMA MG 1 and specified performance requirements.
 2. Drive: Generator shaft is directly connected to engine shaft. Exciter is rotated integrally with generator rotor.
 3. Electrical Insulation: Class H or Class F.
 4. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
 5. Construction prevents mechanical, electrical, and thermal damage due to vibration, overspeed up to one hundred twenty-five percent (125%) of rating, and heat during operation at one hundred ten percent (110%) of rated capacity.
 6. Excitation uses no slip or collector rings, or brushes, and is arranged to sustain generator output under short-circuit conditions as specified.
 7. Enclosure: Drip proof.
 8. Instrument Transformers: Mounted within generator enclosure.
 9. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
 10. Adjusting rheostat on control and monitoring panel provides plus/minus five percent ($\pm 5\%$) adjustment of output-voltage operating band.
 11. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
 12. Windings: Two-thirds (2/3) pitch stator winding and fully linked amortisseur winding.
 13. Subtransient Reactance: Maximum twelve percent (12%).

M. Outdoor Generator-Set Enclosure

1. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to one hundred miles per hour (100 mph). Multiple panels are lockable and provide adequate access to components requiring maintenance. Panels are removable by one (1) person without tools. Instruments and control are mounted within enclosure.
2. Muffler Location: Internal to enclosure.
3. Engine Cooling Airflow through Enclosure: Adequate to maintain temperature rise of system components within required limits when unit operates at one hundred ten percent (110%) of rated load for two (2) hours with ambient temperature at top of range specified in system service conditions.
4. Louvers: Fixed-engine cooling air inlet and discharge. Louvers prevent entry of rain and snow.
5. Automatic Dampers: At engine cooling air inlet and discharge. Dampers are closed to reduce enclosure heat loss in cold weather when unit is not operating.
6. Interior Lights: With switch. Factory-wired, vaporproof-type fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external circuit supply.
7. Convenience Outlets: Factory wired. Arrange for external circuit supply.
8. Finishes for Outdoor Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and compatible standard primer.

N. Source Quality Control

1. Factory Tests: Include prototype testing and project-specific equipment testing (testing of equipment manufactured specifically for the project it is to be used for).
2. Prototype Testing: Performed on a separate engine generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
3. Tests: Comply with those required for Level 1 energy converters in Paragraphs 3.2.1, 3.2.1.1, and 3.2.1.2 of NFPA 110.
4. Generator Tests: Comply with IEEE 115.
5. Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype have been tested to demonstrate compatibility and reliability.
6. Project-Specific Equipment Tests: Factory test engine generator set and other system components and accessories before shipment. Perform tests at rated load and power factor. Include the following tests.
 - (a) Full load run.
 - (b) Maximum power.
 - (c) Voltage regulation.
 - (d) Transient and steady-state governing.
 - (e) Single-step load pickup.
 - (f) Safety shutdown.
7. Observation of Factory Tests: Provide fourteen (14) calendar day advance notice of tests and opportunity for observation of test by OJRSA and/or its representatives.
8. Report factory test results within ten (10) business days of completion of test.

END OF SECTION 4.9

4.10 TRANSFER SWITCHES

4.10.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.10.2 Submittals

Shop Drawings shall be submitted for review and shall include the following:

- A. Materials list of items proposed to be provided under this Section.
- B. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

- C. Shop Drawings in sufficient detail to show fabrication, anchorage, and interface of the work of this Section with the work of adjacent trades.
- D. Manufacturer's recommended installation procedures which, when approved by the OJRSA and/or its representative, will become the basis for accepting or rejecting actual installation procedures used on the Work.

4.10.3 Approved Manufacturers

Transfer switches shall be Caterpillar, Inc.; Engine Division. The OJRSA has standardized on this manufacturer in order to improve operation and maintenance effectiveness by optimizing service responsiveness, simplifying maintenance complexity and training of staff, and to ensure availability of spare parts.

4.10.4 Materials of Construction

A. General Transfer-Switch Product Requirements

1. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding thirty percent (30%) of switch ampere rating, unless otherwise indicated.
2. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008. Where transfer switch includes internal fault-current protection, a rating of switch and trip unit combination exceeds indicated fault-current value at installation location.
3. Solid-State Controls: Repetitive accuracy of all settings is plus/minus two percent ($\pm 2\%$) or better over an operating temperature range of negative twenty degrees Celsius (-20°C) to positive seventy degrees Celsius ($+70^{\circ}\text{C}$).
4. Resistance to Damage by Voltage Transients: Components meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components meet or exceed voltage-impulse withstand test of NEMA ICS 1.
5. Enclosures: NEMA 250 Type 4X stainless steel.
6. Heater: Equip switches exposed to outdoor temperature and humidity conditions, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
7. Factory Wiring: Train and bundle factory wiring and label consistent with Shop Drawings, either by color code or by numbered or lettered wire and cable tape markers at terminations.
8. Designated Terminals: Pressure type suitable for types and sizes of field wiring indicated.
9. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
10. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
11. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
12. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - (a) Switch Action: Double throw; mechanically held in both directions.
 - (b) Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units rated at least two hundred twenty-five amperes (225 A) have separate arcing contacts.
13. Manual transfer switches shall be provided with an integrated three-position rotary transfer switch and generator docking station.
14. Plug connection shall be color-coded Type 16 Cam-lock connectors.

B. Automatic Transfer Switches

1. Comply with Level 1 equipment according to NFPA 110.
2. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
3. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is the same as for electrical operation. Control circuit automatically disconnects from

electrical operator during manual operation.

4. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
5. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from one (1) second to thirty (30) seconds.
6. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics:
 - (a) Fully automatic make-before-break operation.
 - (b) Load transfer without interruption, through momentary interconnection of both power sources not exceeding one hundred milliseconds (100 ms).
 - (c) Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
 - (i) Initiation occurs without active control of generator set.
 - (ii) Controls ensure closed-transition load transfer closure occurs only when the two (2) sources are within plus/minus five (± 5) electrical degrees, maximum and plus/minus five percent ($\pm 5\%$) maximum voltage difference.
7. Failure of the power source serving the load initiates automatic break-before-make transfer.
8. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two (2) sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within fifteen (15) electrical degrees, and only if transfer can be completed within sixty (60) electrical degrees. Transfer is initiated only if both sources are within two hertz (2 Hz) of nominal frequency and seventy percent (70%) or more of nominal voltage.

C. Automatic Transfer-Switch Features

1. Undervoltage Sensing for Each Phase of Normal Source: Senses low phase-to-ground voltage on each phase. Pickup voltage is adjustable from eighty-five percent (85%) to one hundred percent (100%) of nominal, and dropout voltage is adjustable from seventy-five percent (75%) to ninety-eight percent (98%) of pickup value. Factory set for pickup at ninety percent (90%) and dropout at eighty-five percent (85%).
 2. Time delay for override of normal-source voltage sensing delays transfer and engine start signals. Adjustable from zero (0) to six (6) seconds and factory set for one (1) second.
 3. Voltage/Frequency Lockout Relay: Prevents premature transfer to generator set. Pickup voltage is adjustable from eighty-five percent (85%) to one hundred percent (100%) of nominal. Factory set for pickup at ninety percent (90%). Pickup frequency is adjustable from ninety percent (90%) to one hundred percent (100%) of nominal. Factory set for pickup at ninety-five percent 95%.
 4. Time Delay for Retransfer to Normal Source: Adjustable from zero (0) to thirty (30) minutes; factory set for ten (10) minutes. Provides automatic defeat of delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 5. Test Switch: Simulates normal-source failure.
- D. Switch-Position Pilot Lights: Indicate source to which load is connected.
- E. Source-Available Indicating Lights: Supervise sources via transfer-switch, normal- and emergency-source sensing circuits.
1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 2. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
- F. Unassigned Auxiliary Contacts: Two normally open single-pole, double-throw contacts for each switch position, rated ten amperes (10 A) at two hundred forty volts alternating current (240 VAC).
- G. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
- H. Engine Starting Contacts: One isolated, normally closed and one isolated, normally open, rated ten amperes (10 A) at thirty-two volts alternating current (32 VAC), minimum.
- I. Engine Shutdown Contacts: Time delay adjustable from zero (0) to five (5) minutes; factory set for five (5)

minutes. Initiates shutdown at remote engine-generator controls after retransfer of load to normal source.

- J. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine-generator set and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from seven (7) days to thirty (30) days. Running periods are adjustable from ten (10) to thirty (30) minutes. Factory settings are for seven (7) day exercise cycle, twenty (20) minute running period, and five (5) minute cool-down period. Exerciser features include the following:
 - 1. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - 2. Push-button programming control with digital display of settings.
 - 3. Integral battery operation of time switch when normal control power is not available.
- K. Source Quality Control: Factory Test Components, Assembled Switches, and Associated Equipment: Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

END OF SECTION 4.10

4.11 SURGE PROTECTION FOR LOW-VOLTAGE (LESS THAN 480 V) ELECTRICAL POWER CIRCUITS

4.11.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.11.2 Submittals

Shop Drawings shall be submitted for review and shall include the following:

- A. Materials list of items proposed to be provided under this Section.
- B. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
- C. Shop Drawings in sufficient detail to show fabrication, anchorage, and interface of the work of this Section with the work of adjacent trades.
- D. Manufacturer's recommended installation procedures which, when approved by the OJRSA or its representative, will become the basis for accepting or rejecting actual installation procedures used on the Work.

4.11.3 Approved Manufacturers

- A. Service Entrance and Transfer Switch Suppressor Manufacturers
 - 1. Advanced Protection Technologies, Inc. (APT)
 - 2. Current Technology, Inc.
 - 3. Eaton
 - 4. General Electric Company
 - 5. LEA International
 - 6. SIEMENS Industry, Inc.; Energy Management Division
 - 7. Square D or ASCO by Schneider Electric
- B. Panel Suppressor Manufacturers
 - 1. Advanced Protection Technologies, Inc. (APT)
 - 2. Current Technology, Inc.
 - 3. Eaton
 - 4. General Electric Company
 - 5. LEA International
- C. OJRSA-approved equal for all of the above.

4.11.4 Materials of Construction

- A. Service Entrance and Transfer Switch Suppressor
 - 1. Surge Protection Devices (SPD): Listed and labeled as complying with UL 1449, Type 2. SPDs with the following features and accessories:

- (a) Integral disconnect switch.
 - (b) Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 - (c) Indicator light display for protection status.
 - (d) Form-C contacts rated at two amperes (2 A) and twenty-four volts alternating current (24 VAC), one normally open and one normally closed, for remote monitoring of protection status.
 - (e) Surge counter.
2. Comply with UL 1283.
 3. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than two hundred kiloamperes (200 kA). The peak surge current rating shall be the arithmetic sum of the ratings of the individual metal oxide varistor (MOV)s in a given mode.
 4. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four (4) wire circuits shall not exceed the following:
 - (a) Line to Neutral: One thousand two hundred volts (1,200 V) for four hundred eighty wye/two hundred seventy-seven volts (480Y/277 V)
 - (b) Line to Ground: One thousand two hundred volts (1,200 V) for four hundred eighty wye/two hundred seventy-seven volts (480Y/277 V)
 - (c) Line to Line: Two thousand volts (2,000 V) for four hundred eighty wye/two hundred seventy-seven volts (480Y/277 V)
 5. Short Circuit Current Rating (SCCR): Equal or exceed one hundred kiloamperes (100 kA).
 6. Nominal Rating: Twenty kiloamperes (20 kA).
- B. Panel Suppressors
1. SPDs: Comply with UL 1449, Type 2.
 - (a) Include LED indicator lights for power and protection status.
 - (b) Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 2. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall at least one hundred kiloamperes (100 kA). The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
 3. Comply with UL 1283.
 4. Protection modes and UL 1449 VPR for grounded wye circuits with four hundred eighty wye/two hundred seventy-seven volts (480Y/277 V); two hundred eight wye/one hundred twenty volts (208Y/120 V); three-phase, four (4) wire circuits shall not exceed the following:
 - (a) Line to Neutral: One thousand two hundred volts (1,200 V) for four hundred eighty wye/two hundred seventy-seven volts (480Y/277 V); seven hundred volts (700 V) for two hundred eight wye/one hundred twenty volts (208Y/120 V).
 - (b) Line to Ground: One thousand two hundred volts (1,200 V) for four hundred eighty wye/two hundred seventy-seven volts (480Y/277 V); seven hundred volts (700 V) for two hundred eight wye/one hundred twenty volts (208Y/120 V).
 - (c) Neutral to Ground: One thousand two hundred volts (1,200 V) for four hundred eighty wye/two hundred seventy-seven volts (480Y/277 V); seven hundred volts (700 V) for two hundred eight wye/one hundred twenty volts (208Y/120 V).
 - (d) Line to Line: Two thousand volts (2,000 V) for four hundred eighty wye/two hundred seventy-seven volts (480Y/277 V); one thousand two hundred volts (1,200 V) for two hundred eight wye/one hundred twenty volts (208Y/120 V).
 5. Protection modes and UL 1449 VPR for two hundred forty/one hundred twenty volts (240/120 V), single-phase, three (3) wire circuits shall not exceed the following:
 - (a) Line to Neutral: seven hundred volts (700 V)
 - (b) Line to Ground: seven hundred volts (700 V)
 - (c) Neutral to Ground: seven hundred volts (700 V)

- (d) Line to Line: One thousand two hundred volts (1,200 V)
 - 6. SCCR: Equal or exceed one hundred kiloamperes (100 kA).
 - 7. Nominal Rating: Twenty kiloamperes (20 kA).
- C. Enclosures
- 1. Indoor Enclosures: NEMA 250 Type 1.
 - 2. Outdoor Enclosures: NEMA 250 Type 4X stainless Steel.

END OF SECTION 4.11

4.12 SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

- A. Developer/project owner to provide SCADA unit and its installation to OJRSA at the developer's expense.
- B. Coordinate with OJRSA for current SCADA requirements.

END OF SECTION 4.12

4.13 GENERAL ELECTRICAL PROVISIONS

4.13.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.13.2 Submittals

Shop Drawings shall be submitted for review for the appropriate electrical equipment per the requirements of the appropriate sections.

4.13.3 Approved Manufacturers

OJRSA does not have a preferred manufacturer.

4.13.4 Materials of Construction

- A. Material Standards
 - 1. ANSI, SCDHEC/SCDES, International Building Code, NEC, OSHA, UL, and other standards shall apply as appropriate.
 - 2. All electrical materials and equipment installed on this project shall be new and manufactured within one (1) year of bid date.
 - 3. All electrical materials and equipment shall be UL listed. *Exception: Registered Professional Engineer provides written authorization for use of materials and equipment listed by an alternate testing laboratory or certifying agency, such as Electrical Testing Laboratories (ETL) or Canadian Standards Association (CSA).*
 - 4. The intent of these specifications is to establish the quality and style of products to be furnished. Products are specified in these specifications by reference to manufacturer, vendor, trade name, product line, and/or catalog number.
- B. Material Substitutions
 - 1. *No substitutions of specified material will be permitted after award of the contract.*
 - 2. Where the term "or equal" is used, then the contractor may substitute products considered to be "trade equal" to those specified.

END OF SECTION 4.13

4.14 FLOW METERS

4.14.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.14.2 Submittals

Shop Drawings shall be submitted for review and shall include manufacturer's scale drawings, or catalog cuts, including descriptive literature with complete characteristics and specifications, and code requirements.

4.14.3 Approved Manufacturers

Flow meters shall be:

- A. Toshiba High Performance LF654 Series Flanged Type Electromagnetic Flowmeter
- B. Rosemount (coordinate model with OJRSA staff)

4.14.4 Materials of Construction

A. The flow meter shall meet the following criteria:

1. Flowtube Sensor: Flanged Flowtube shall be fully flanged with ASME B16.5 and ANSI Class 150 flanges meeting the requirements herein.
2. Overall System Performance: Complete Magmeter System shall have a system accuracy of plus/minus one half of one percent ($\pm 0.5\%$) of flow rate when mounted as close as one (1) pipe diameter from the flange of the magmeter when located next to elbows in line sizes up to eight inches (8 in.). It will also have no downstream piping requirements for maintaining its published accuracy specification.
3. Manufacturer shall provide a written guarantee on upstream (based on one pipe diameter clearance) and downstream (based on zero (0) clearance) installation accuracy performance.
4. The meter shall have a standard certified flow accuracy of two-tenths of one percent (0.2%) of rate or better. There may be some slight deviation with no more than an additional plus/minus one half of one percent ($\pm 0.5\%$) of reading permitted.
5. Each flowmeter will be flow lab calibrated in the manufacturer's flow lab. The manufacturer will flow lab calibrate all meters twice (2x) at zero percent (0%), fifty percent (50%), and one hundred percent (100%) of flow for a total of six (6) flow point calibrations. The dual flow calibration technique will confirm the results of the first flow test and ensure that the meter will exhibit a typical installed accuracy of plus/minus two-tenths of one percent ($\pm 0.2\%$) better of actual flowrate.
6. The meter shall be supplied with PFA liner that is mechanically retained for three inch (3 in.) meter size or over, polyurethane rubber or hard rubber liner to allow full vacuum service (negative fifteen pounds per square inch gauge (-15 psig)).
7. The electrodes shall be Type 316L stainless steel or Hastelloy C, electrolytic polished with non-stick self-cleaning finish.
8. Flanges will be carbon steel as standard up to and including eighteen inches (18 in.).
9. The meter shall be capable of bi-directional flow without requiring any re-zeroing.
10. The detectors neck (connection between coils and wiring plate) shall be epoxy sealed to prevent moisture or water from entering the body of the detector.
11. All sensing tubes (regardless of size) must be stamped with the original flow lab calibration factor to allow "dry calibration" and interchangeability between all flow converters and sensing tubes to original accuracy.
12. All meters must have forty (40) years or higher MTBF-rated detector as printed in the manufacturer's specifications.
13. All meters must be IP67 and NEMA 250 Type 4X watertight as standard or optionally, IP68 and NEMA 6P and submersible to fifteen meters (15 m) in water.

B. Converter

1. The meter shall have its own "built-in" field re-verification tool, which can re-verify and recalibrate the converter to the original flow lab calibration without the need of other devices.

2. The converter shall have noninvasive three (3) button infrared display that configures using a self-prompting menu without exposing the converter internals to the surrounding atmosphere.
 3. The magnetic flowmeter converter shall be microprocessor based, have “built in” diagnostics, and retain program configuration in memory for at least ten (10) years.
 4. The meter shall work on any conductive fluid without re-calibration for different fluid types.
 5. The meter shall be capable of switching between four (4) different ranges and forward/reverse two-range switching.
 6. The meter shall have a full function dot-matrix one hundred twenty eight by one hundred twenty eight (128 x 128) analog/digital LCD display backlit for night viewing that is electrically three hundred sixty degrees (360°) rotatable in ninety degree (90°) increments using the meter’s software.
 7. The electronic circuit boards will be conformal coated for protection from moisture.
 8. All electronic circuit boards will use Surface Mount Technology to provide resistance to vibration.
 9. The meter shall incorporate high input impedance circuitry and have an input impedance of at least fifty megaohm (50 MΩ), thus negating the need for external electrode cleaning devices and to eliminate errors caused by changing process conductivity.
 10. The meter must be capable of normal operation during abnormal voltage conditions from a minimum of eighty volts (80 V) during low voltage conditions or a maximum of two hundred sixty four volts (264 V) during over voltage conditions.
 11. The converter housing must be NEMA 250 Type 4X fireproof and made of corrosion resistance anodized aluminum with acrylic resin coating.
 12. The converter will be supplied with surge protection in the power supply and the signal output circuit.
- C. Alarm. The meter shall have the following alarms as standard:
1. High
 2. Low
 3. Empty pipe
 4. Rate-of-change
 5. Limit alarms
 6. Control limit time
 7. Self-diagnostics and data checking
 8. Over-range flow
 9. Under-range flow
 10. Over totalize
 11. Under totalize
 12. Range change
 13. Preset output
 14. Adjustable low flow cutoff
 15. Totalizer preset value reached
 16. Reverse flow
 17. Converter failure
- D. Outputs
1. One (1) four-to-twenty milliamperes (4-to-20 mA) analog with Highway Addressable Remote Transducer Protocol (HART)
 2. HART (standard) or Modbus RTU four-to-twenty milliamperes (4-to-20 mA) or PROFIBUS-PA (optional – selected one)
 3. Capable of two (2) outputs (for alarms, batching, and pulse applications)
- E. Inputs: One digital twenty volts of direct current to thirty volts of direct current (20-to-30 VDC) input for range switching, totalizer control, fixed value outputs, zero (0) adjustment.
- F. Advanced Noise Suppression
1. The meter shall incorporate separate advanced noise suppression and filtering circuit specially designed for slurry applications. Auto zeroing, averaging, or dampening type algorithms in lieu of noise filtering circuitry are not acceptable.

2. A built-in rate limit function shall be available to further eliminate extraneous output dynamics.
 3. The meter shall have user selectable excitation frequencies of six hertz (6 Hz), twelve hertz (12 Hz), or twenty-four hertz (24 Hz) to further reduce noise.
- G. Approvals and Certifications
1. The meter shall be approved for cFMus Class 1, Div II, Groups B, C, and D.
 2. Meters with polyurethane rubber liner shall be certified by NSF on NSF/ANSI Standard 6.
- H. Environmental Specifications
1. The unit shall have an ambient temperature rating of at least negative forty degrees Celsius (-40°C) to positive sixty degrees Celsius (+60°C) for remote flow tube with PFA liner, and - negative forty degrees Celsius (-40°C) to positive sixty degrees Celsius (+60°C) for remote flow tube with polyurethane rubber or hard rubber liner and remote/combined converter.
 2. Both the sensing tube and the converter shall be IP67 rated (watertight).
- I. Warranty: Manufacturer shall provide a written warranty from defects in materials or workmanship for a period of at least ten (10) years.

END OF SECTION 4.14

4.15 VALVES, PRESSURE GAUGES, AND ASSOCIATED APPURTENANCES

4.15.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.15.2 Submittals

- A. Product Data: Submit manufacturer catalog information.
- B. Shop Drawings: Indicate materials, dimensions, weights, and end connections on assembly drawings.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Tests and Evaluation Reports: Submit reports indicating field tests made and results obtained.
- E. Manufacturer Instructions: Certify that equipment has been installed according to manufacturer instructions.
- F. Qualifications Statement: Submit qualifications for manufacturer.

4.15.3 Approved Manufacturers

- A. Plug valves shall be:
 1. DeZurik
 2. Kennedy
 3. M&H
- B. Ball valves shall be:
 1. Val-Matic
 2. DeZurik
- C. Combination sewage air valve (commonly referred to as "air release valve") shall be:
 1. ARI D-020 or D-025L
 2. Val-matic 802A
- D. Surge valves shall be:
 1. Standard Application:
 - (a) DeZurik APCO
 - (b) GA Industries Figure 624-DS
 2. Long Radius Elbow Body: GA Industries Figure 625-DS
 3. Wye Body: GA Industries Figure 626-DS
- E. Cushioned swing check valves shall be:
 1. DeZurik APCO
 2. GA Industries Figure 250-D
- F. Pressure gauges shall be manufactured by:

1. U.S. Gauge
2. Ashcroft "Duragauge"
- G. Tapping valves shall be: American four inches (4 in.) to forty-eight inches (48 in.). Series 2500 ductile iron two hundred fifty pounds per square inch gauge (250 psig) rating (accepts full-size shell cutter)
- H. Tapping sleeves shall be:
 1. Mueller H-615
 2. Mueller T-9 or OJRSA-approved equal shall be provided.
- I. OJRSA-approved equal for all of the above.

4.15.4 Materials of Construction

A. Plug Valves

1. Valves shall be of the non-lubricated eccentric type with an elastomer covering all seating surfaces. The elastomer shall be suitable for the service intended. Flanged valves shall be manufactured in accordance with ASME/ANSI B16.1 Class 125 / 150 including facing, drilling and flange thickness. Mechanical joint ends shall comply ANSI A21.11/AWWA C111. Grooved ends shall be manufactured to the dimensions of AWWA C606 for ductile or steel pipe as required. Ports shall be round on sizes two and a half inches (2.5 in.) to twelve inches (12 in.) and rectangular port design on valves fourteen inches (14 in.) and larger. All valves shall be capable of being "pigged" with a soft pig when required. Valve bodies shall be of ASTM A126 Class B cast iron and thickness in accordance with AWWA C517 Section 4.4.1.4. Valves three inches (3 in.) and larger shall be furnished with a welded-in overlay seat of one-twelfth of an inch (0.125 in.) thick of not less than ninety-nine (99%) nickel in accordance with AWWA C517, Section 4.3.3.4. *Sprayed, plated or screwed-in seats are not acceptable.*
2. Plugs shall be of ASTM A536 Grade 65-45-12 for all sizes in compliance with AWWA C517 Section 4.3.3.2. The plugs shall be of one-piece solid construction with polytetrafluoroethylene (PTFE) thrust bearings on the upper and lower bearing journals to reduce torque and prevent dirt and grit from entering the bearing and seal area.
3. Valves shall be furnished with replaceable sleeve type bearings conforming to AWWA C517, Section 4.3.3.6. Bearings shall be of sintered, oil impregnated type stainless steel. Valve shaft seals shall be of the "U" cup type in accordance with AWWA C517 Section 4.4.7. Seals shall be self-adjusting and re-packable without removing the bonnet from the valve.
4. Wrench operated valves two and a half inches (2.5 in.) to eight inches (8 in.) shall be capable of being converted to worm gear or automated operation without removing the bonnet or plug from the valve. All wrench operated valves shall be equipped with a two inches (2 in.) square nut for use with removable levers or extended "T" handles.
5. Worm gear operators, where required, shall be of heavy-duty construction with the ductile iron quadrant supported on the top and bottom by oil impregnated bronze bearings. The worm gear and shaft shall be manufactured of hardened steel and operate on high efficiency roller bearings.
6. Valves shall be designed and manufactured to shut off bubble-tight at one hundred seventy-five pounds per square inch (175 psi) for valves two and a half inches (2.5 in.) to twelve inches (12 in.) and one hundred fifty pounds per square inch (150 psi) for valves fourteen inches (14 in.) and larger. Each valve shall be given a hydrostatic and seat test with the test results being certified when required by OJRSA. Certified copies of Proof-of-Design test reports shall be furnished as outlined in AWWA C517 Section 5.2.2 when requested.

B. Ball Valves

1. Valves shall be designed, manufactured, and tested in accordance with AWWA C507. The valves shall be certified to be Lead-Free in accordance with NSF/ANSI 372.
2. Body: The valve shall be constructed with a two (2) piece body rated for one hundred fifty pounds per square inch (150 psi) or three hundred pounds per square inch (300 psi) and with end flanges in full conformance with ASME/ANSI B16.1 Class 125 or Class 250. The main body section and end piece shall contain integrally cast support feet and lifting lugs.
3. Port & Ball: The valve port shall be a one hundred percent (100%) clear bore equal to the nominal

valve size with no seat hardware in the flow stream when fully open. The ball shall be self-flushing when in intermediate positions for wastewater service.

4. Body Seat: Double (or single) resilient seats shall provide drop-tight service and shall be located on the ball and mechanically retained with a stainless steel retaining ring and stainless steel Nylok cap screws, which shall pass through both the resilient seat and the retaining ring. The retaining ring shall be continuous or investment cast with overlapping sections, serrated grooves, and shoulders. The resilient seat shall be field adjustable and replaceable without removing the valve from the pipeline and mate to a continuous Type 316 stainless steel body seat ring.
 5. Shafts: Shall be inserted into blind hubs in the ball and locked to the ball with taper pins retained with stainless steel jam bolts. The shaft shall be sealed with resilient grit seals in the body bores.
 6. Bearings: Teflon-lined, fiberglass-backed sleeve bearings shall be located in the body hubs. An adjustable thrust bearing shall be provided to center the ball in the body.
 7. Shaft Seals: Shall be of the V-type and shall be replaceable without removal of the valve from the line or the shaft from the valve.
 8. Actuators
 - (a) Manual Actuators: Shall be of the traveling nut design with characterized closure per AWWA C507 and equipped with externally adjustable closed position stops capable of withstanding four hundred fifty foot-pounds (450 ft-lb) of torque. Actuators shall be lubricated with EP-2 grease and fully enclosed in an iron housing sealed against the entry of water.
 - (b) Cylinder Actuators: Shall be traveling nut design with characterized closure sized to position the valve with an air, water, or oil supply pressure of eighty pounds per square inch (80 psi) to one hundred fifty pounds per square inch (150 psi) and built-in accordance with AWWA C541. The rotating mechanism will consist of a lever and traveling nut directly connected to the cylinder rod. The cylinder rod, heads and barrel shall be constructed of stainless steel or non-metallic material for water service. Rod and piston seals shall be of the self-adjustable, wear-compensating type. The piston shall be one (1) piece with a wear strip.
 - (c) Motor Actuators: Shall be furnished in accordance with AWWA C542 for Power Actuators and factory tested on the production ball valve. The motor unit shall be mounted to a self-locking traveling nut actuator with characterized closure and externally adjustable closed stop. The motor actuator assembly shall be designed for open/close service with a minimum operating time of sixty (60) seconds. The motor unit shall be furnished with a position indicator, independently adjustable, fifteen ampere (15 A) limit switches, and adjustable torque sensors to protect the valve indicator. A handwheel with a declutch lever shall be provided so that the handwheel does not rotate during electrical operation. Motors shall be sized with a one and a half safety factor (1.5 SF) and a power supply of two hundred thirty-four hundred sixty volts (230/460 V), three-phase, sixty hertz (60 Hz) alternating current (AC). Electrical operation shall include Local-Off-Remote selector switch, Local Open/Close push buttons, and position indication lamps.
 9. Coatings: Valve interiors and exteriors shall be coated with an NSF/ANSI 61 certified fusion bonded epoxy in accordance with AWWA C550.
- C. Valve Boxes: Cast Iron Valve Boxes: Boxes shall be three (3) piece type with fully adjustable top for all valves installed underground. The boxes shall be in the range of twenty-four inches (24 in.) to thirty-six inches (36 in.) long in order to adjust to fit the depth of earth cover over the valve when final grade is established and when pavement resurfacing occurs. Box shall have a minimum of three-sixteenths of an inch (3/16 in.) thickness of metal.
- D. Combination Sewage Air Valve (commonly referred to as "air release valve")
1. The combination sewage air valve shall be designed to exhaust large amounts of air during filling, to release small amounts of accumulated air during operation, and to admit large amounts of air upon impending vacuum during draining.
 2. The valve shall be float operated and both the air and vacuum and air release functions shall be housed in a single body. Body and cover shall be Type 316 stainless steel. All leverage mechanism

parts and the spherical float shall be Type 316 stainless steel. The large and small orifices seats shall be Buna-N and shall be renewable. All wetted parts shall be Type 316 stainless steel.

3. The combination sewage air valve shall be supplied with "Flushing Attachments" to allow periodic flushing of sediment, grease, and solids. Attachments consist of a two inch (2 in.) stainless steel inlet isolating valve, one inch (1 in.) stainless steel blow-off, and one half inch (0.5 in.) stainless steel flushing valves, and a minimum of five feet (5 ft) of rubber hose with quick disconnects to allow connection to a clean water source.

E. Surge Valve

1. Function: The surge relief valve shall quickly open when the system pressure exceeds its setting, remain open whenever the pressure exceeds this setting, and slowly close drop tight when the pressure subsides below the spring setting.
2. Body: Main valve body shall be long radius elbow or wye pattern of cast iron conforming to ASTM A126 Class B, with integral flanges, faced and drilled per ASME/ANSI B16.1 Class 125. The valve body shall be inherently self-cleaning and have a net flow area through the valve no less than the area of its nominal pipe size. The body shall have a removable Type 316 stainless steel seat.
3. Disc: The valve disc shall be ductile iron with a renewable, resilient seat ring of rubber or other suitable material and be retained by a Type 316 stainless steel follower ring and stainless steel screws. The valve stem shall be stainless steel and be guided by a bronze bushing retained in the valve cover. Dual seals shall seal the valve stem where it passes through the body, separated by a lantern ring with external leak detection port.
4. Springs & Adjustability: Sizes through eight inches (8 in.) shall have dual compression springs; valves larger than eight inches (8 in.) shall have a single compression spring. Springs shall be encased in steel cylinders; *exposed springs or tension springs are not acceptable*. An integral hydraulic system shall permit quick opening and adjustable, slow closing without the need of pre-charged cylinders. The valve shall be fully capable of operating in any position. The valve shall be factory tested and set to open at a pre-determined pressure. Springs shall permit field adjustment from near zero percent (0%) to ten percent (10%) above factory setting.

F. Cushioned Swing Check Valves

1. The swing check valve shall conform to the design, materials of construction and testing required by AWWA C508 plus be supplied with an outside lever, adjustable counterweight, and adjustable air-cushion chamber to minimize slam and hammer caused by rapid flow reversal.
2. The valve flow area anyplace through the valve shall be no less than the area of the nominal inlet pipe size when the disc has swung no more than twenty-five degrees (25°) away from the seat.
3. The swing check valve shall be NSF/ANSI 61 certified for contact with drinking water and NSF/ANSI 372 certified lead free.
4. The standard valve shall have the same size flanged inlet and outlet connections faced, drilled and of the thickness required by ASME/ANSI B16.1 Class 250, as shown on plans or in the valve schedule.
5. Body: The valve body shall be made from cast iron conforming to ASTM A126 Class B with a bolted cover through which all internal parts can be removed for service. The body shall have a mechanically retained and replaceable Type 316 stainless steel seat ring.
6. Shaft: The hinge shaft shall be made from Type 316 stainless steel and be supported at both ends by non-corrosive, lead free bushings. The shaft shall be sealed where it passes through the body by compression packing retained by a packing gland, gland studs and nuts. *Non-adjustable or O-ring shaft packing is not acceptable*.
7. Disc: A ductile iron disc arm shall be keyed to and suspended from the hinge shaft. A non-rotational, cast-iron disc with replaceable Buna-N rubber disc seat ring shall be attached to the disc arm by means of a center pin and nut providing three hundred sixty degree (360°) oscillation. The disc seat ring shall be retained by a Type 316 stainless steel follower ring and stainless steel screws.
8. Cushion Chamber: Valve closure shall be cushioned by the action of a bronze piston in a bronze cushion cylinder. The cushion chamber assembly shall be non-pivoting and be mounted to the side of the

valve body on machined pads without the need for brackets. The amount of cushioning shall be adjustable. Pivoting and/or commercial pneumatic cylinders are not acceptable.

9. Cover bolts, nuts and studs shall be zinc plated carbon steel.
10. Shaft sizes are determined by the size of the valve as stated in Table 10.

Table 10: Cushioned swing check valve shaft diameters

Valve Size (inches)	Shaft Diameter (inches)	Valve Size (inches)	Shaft Diameter (inches)
2	0.75	16	2
3	0.75	18	2
4	0.875	20	2
6	1	24	2.75
8	1.25	30	4
10	1.25	36	5
12	1.5		

11. Supply as needed: The valve shall be equipped with a double pole, double throw NEMA 250 Standards 1, 4, and 13 limit switch to indicate valve closed position.
12. The valve shall be supplied with Type 316 stainless steel cover fasteners and with external and exposed internal ferrous surfaces coated with minimum six (6) mil NSF 61 certified two-part epoxy.
13. Valve shall be completely serviceable in the line and all internal parts shall be removable through the top cover.

G. Tapping Valves

1. Tapping valves shall be resilient seat type with bodies and bonnets made of ductile iron for two hundred fifty pounds per square inch gauge (250 psig) working pressure. The valve shall also be UL Listed and FM Approved in applicable configurations at two hundred fifty pounds per square inch gauge (250 psig) and shall be Certified to NSF/ANSI 61-G and NSF/ANSI 372.
2. The valve shall be furnished with a flange-end connection on one end and a mechanical joint end on the opposite end. The flange shall be furnished with an alignment ring conforming to MSS SP-60 to help ensure true alignment of the valve and tapping sleeve. The mechanical joint end shall be furnished in accordance with ANSI A21.53/AWWA C153 and MSS SP 113.
3. All tapping valves shall include a minimum three-eighths of an inch (0.375 in.) NPT pipe plug on the bonnet of the valve body to aid in the field testing of the valve.
4. All wedges shall be fully encapsulated with EPDM rubber and shall be provided with guide covers.
5. All interior and exterior ferrous surfaces shall be protected against corrosion by fusion-bonded epoxy coating. Coating shall be applied prior to assembly to assure coverage of all exposed areas, including bolt holes. All valves greater than or equal to thirty inches (≥ 30 in.) shall be supplied with the appropriate gear configuration.

H. Tapping Sleeves

1. Tapping sleeves shall be constructed of heavy gray cast iron, ductile cast iron, or high-strength steel and in two (2) halves for reduced size taps. Full body ductile iron mechanical joint tapping sleeves.
2. Joints
 - (a) Tapping sleeves shall seal to the pipe by use of a confined “O” ring gasket and able to withstand a pressure test of one hundred fifty pounds per square inch (150 psi) with no leakage in accordance with ANSI A21.10/AWWA C110. A three-quarter inch (0.75 in.) NPT test plug shall be provided for pressure testing. All bolts joining the two (2) halves shall be high-strength, low alloy Type 304 stainless steel in accordance with Section 11-6.5 of ANSI A21.11/AWWA C111 and shall be included with the sleeve.
 - (b) The outlet branch flange shall be a one hundred twenty-five pound (125 lb.) flange joint suitable for attachment by all other makes of tapping valves meeting AWWA Standards.
3. Coatings: All ductile cast iron sleeves shall have an outside bituminous coating in accordance with ANSI A21.10/AWWA C110 and inside lining of forty (40) mil nominal of Protecto 401, PermoX-CTF, or

Tnemec 431 ceramic epoxy.

- I. Valve Boxes: Cast Iron Valve Boxes: Boxes shall be three (3) piece type with fully adjustable top for all valves installed underground. The boxes shall be in the range of twenty-four inches (24 in.) to thirty-six inches (36 in.) long in order to adjust to fit the depth of earth cover over the valve when final grade is established and when pavement resurfacing occurs. Box shall have a minimum of three-sixteenths of an inch (3/16 in.) thickness of metal.
- J. Pressure Gauges: Pressure gauges shall be suitable for wastewater application. They shall be round black case, four and a half inch (4.5 in.) nominal diameter with phosphor bronze Bourdon tubes, bottom connected with one half inch (0.5 in.) male threads, stainless steel rack and pinion movement, black micro-adjusted pointers and black figures with white plastic dials, and a threaded ring. The gauges shall be furnished factory-mounted with a complete protective diaphragm attachment which shall be demountable without breaking the seal. The space above diaphragm filled with glycerin fluid, the lower portion (wastewater side) provided with a bleed screw. Gauges shall be installed with short nipple and a Type 316 stainless steel shut off ball valve.

END OF SECTION 4.15

4.16 PAINTING

4.16.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.16.2 Submittals

- A. Submit manufacturer's printed literature and other data as required to certify compliance with requirements and systems specified herein.
- B. Colors to be selected by the OJRSA and indicated on schedule.
- C. Volatile Organic Compound (VOC) requirements: Submit manufacturer's certification that paints and coatings comply with Federal, State, and Local, requirements for VOCs.

4.16.3 Approved Manufacturers

See within SECTION 4.16.4 for approved suppliers based on application.

4.16.4 Materials of Construction

A. Materials

1. Colors and Finishes: Paint colors shall be coordinated with OJRSA. Paint colors, surface treatment, and finishes are indicated in the Schedules of the Contract Documents. If color or finish is not designated, OJRSA will select these from standard colors available for the materials systems specified. Use representative colors when preparing samples for review. Final acceptance of colors will be from samples applied on the job.
2. Paint: Provide paint which is well ground, will not cake or thicken in the container, is readily broken with a paddle to a smooth consistency, and has easy brushing properties.
3. Lead Content: **DO NOT USE COATINGS HAVING A LEAD CONTENT GREATER THAN SIX HUNDREDTHS OF A PERCENT (> 0.06%) BY WEIGHT OF NONVOLATILE CONTENT.**
4. Color Pigments: Use pure, non-fading, applicable types to suit the substrates and service indicated.
5. Paint Thinner: As recommended by paint manufacturer. Use only within recommended limits.
6. Tinting: As recommended by paint manufacturer for the particular material tinted. Use only within the recommended limits.
7. Quality
 - (a) Manufacturer
 - (i) A NACE-certified technical representative from the paint manufacturer shall visit the job site to review the progress and to support the contractor's personnel or the engi-

neer as needed and/or requested. Visits shall be made on a weekly basis as a minimum or as needed to help review hold points for the engineer. Additional visit shall be made as needed and/or requested by the OJRSA or contractor. Forty-eight (48) hours' notice is required by the contractor for each hold point observations.

- (ii) Pre-Job/Start Up Meeting: All parties, to include the OJRSA and/or its representative, engineer, architect, contractor, installer, inspector(s) and the product manufacture, shall meet prior to any work is started to review the spec and discuss job specific expectations, needs and requirements.

(iii) Coating Systems

(A) Ferrous Metal Submerged in Wastewater and Non-Potable Water

- (1) Surface Preparation: SSPC-SP10/NACE 2 Near-White Blast Cleaning
- (2) Finish Type: Semi-gloss
- (3) System: Tnemec
 - (a) Shop Coat: 1 Omnithane Primer, two and a half (2.5) to three and a half (3.5) dry mils
 - (b) 2nd Coat: 66 Hi-Build Epoxoline, four (4.0) to six (6.0) dry mils
 - (c) Stripe Coat: 66 Hi-Build Epoxoline, four (4.0) to six (6.0) dry mils
 - (d) 3rd Coat: 141 Epoxoline, eight (8.0) to fourteen (14) dry mils
- (4) System: Sherwin-Williams
 - (a) Shop Coat: Corothane 1 Galvpak Primer, two and a half (2.5) to three and a half (3.5) dry mils
 - (b) 2nd Coat: Tank Clad HS, five (5.0) to eight (8.0) dry mils
 - (c) Stripe Coat: Tank Clad HS, five (5.0) to eight (8.0) dry mils
 - (d) 3rd Coat: Tank Clad HS, five (5.0) to eight (8.0) dry mils

(B) Ferrous Metal Submerged in Potable Water

- (1) Surface Preparation: SSPC-SP10/NACE 2 Near White Blast Cleaning
- (2) Type Finish: Not applicable
- (3) System: Tnemec
 - (a) Shop Coat: 94H20 Hydro-Zinc Primer, two and a half (2.5) to three and a half (3.5) dry mils
 - (b) 2nd Coat: 20-1255 Pota-Pox, four (4.0) to six (6.0) dry mils
 - (c) Stripe Coat: 20-15BL Pota-Pox, four (4.0) to six (6.0) dry mils
 - (d) 3rd Coat: 20-15BL Pota-Pox, four (4.0) to six (6.0) dry mils
- (4) System: System: Sherwin-Williams
 - (a) Shop Coat: Corothane 1 Galvpak Primer, two and a half (2.5) to three and a half (3.5) dry mils
 - (b) 2nd Coat: Sherplate 600, four (4.0) to six (6.0) dry mils
 - (c) Stripe Coat: Sherplate 600, four (4.0) to six (6.0) dry mils
 - (d) 3rd Coat: Sherplate 600, four (4.0) to six (6.0) dry mils

(C) Ferrous Metal, Including Cast Iron or DIP, Non-Immersion

- (1) Surface Preparation: SSPC-SP6/NACE 3 Commercial Blast Cleaning (fabrications) or SSPC-SP3 Power Tool Cleaning.
- (2) Type Finish: See within system listed within this section below.
- (3) System: Tnemec
 - (a) Type Finish: Semi-gloss
 - (b) Shop Coat: Manufacturer Standard Compatible Solvent Based Primer, four (4.0) to six (6.0) dry mils
 - (c) 2nd Coat: 135 Chembuild, four (4.0) to six (6.0) dry mils
 - (d) 3rd Coat: 740-Color UVX, three (3.0) to five (5.0) dry mils
- (4) System: Sherwin-Williams

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- (a) Type Finish: Gloss
 - (b) Shop Coat: Manufacturer Standard Compatible Solvent Based Primer, four (4.0) to six (6.0) dry mils
 - (c) 2nd coat: Macropoxy 646 FC, five (5.0) to eight (8.0) dry mils
 - (d) 3rd Coat: Sherloxane 800, four (4.0) to six (6.0) dry mils
- (D) Overhead Metal Decking and Joists
- (1) Surface Preparation: SSPC-SP13/NACE 6 for concrete. Surface must be clean and dry. Allow concrete to cure twenty-eight (28) days. SSPC-SP 6/NACE 3 Commercial Blast Cleaning for Steel or SSPC-SP3 Power Tool Cleaning
 - (2) Type Finish: Semi-gloss
 - (3) System: Tnemec
 - (a) Shop Coat: Manufacturer Standard Compatible Solvent Based Primer
 - (b) 1st Coat: 115 Ini-Bond DF, three (3.0) to four (4.0) dry mils
 - (c) 2nd Coat: 115 Ini-Bond DF, three (3.0) to four (4.0) dry mils
 - (4) System: Sherwin-Williams
 - (a) Shop Coat: Manufacturer Standard Compatible Solvent Based Primer
 - (b) 1st Coat: Pro Industrial Multi Surface Acrylic Semi Gloss, three (3.0) to four (4.0) dry mils
 - (c) 2nd Coat: Pro Industrial Multi Surface Acrylic Semi Gloss, three (3.0) to four (4.0) dry mils
- (E) High Heat Coating: Use on items of equipment, piping, etc. subject to high temperatures such as blowers, blower piping, hydraulic power units, and hydraulic piping, etc. where indicated.
- (1) Surface Preparation: SSPC-SP10/NACE 2 Near-White Blast Cleaning.
 - (2) Type Finish: Not applicable
 - (3) System: Tnemec
 - (a) 1st Coat: 1528 Endura-Heat, four (4.0) to eight (8.0) dry mils
 - (b) 2nd Coat: 1558 Endura-Heat, two (2.0) to three (3.0) dry mils
 - (4) System: Sherwin-Williams
 - (a) 1st Coat: Heat Flex 1200 Plus, five (5.0) to six (6.0) dry mils
 - (b) 2nd Coat: Heat Flex 1200 Plus, five (5.0) to six (6.0) dry mils
- (F) Concrete Block, Interior
- (1) Surface Preparation: SSPC-SP13/NACE 6, Surface must be clean and dry.
 - (2) Type Finish: See within system listed within this section below.
 - (3) System: Tnemec
 - (a) Type Finish: Semi-gloss
 - (b) 1st Coat: 1254 EpoxoBlock WB eighty square feet per gallon (80 ft²/gal) (fill all voids)
 - (c) 2nd Coat: 27WB Typoxy, six (6.0) to eight (8.0) dry mils
 - (d) 3rd Coat: 27WB Typoxy, six (6.0) to eight (8.0) dry mils
 - (4) System: Sherwin-Williams
 - (a) Type finish: Gloss
 - (b) 1st Coat: Kem Cati-Coat Epoxy Block Filler ten (10.0) to twenty (20.0) dry mils
 - (c) 2nd Coat: Sherloxane 800, four (4.0) to six (6.0) dry mils
 - (d) 3rd Coat: Sherloxane 800, four (4.0) to six (6.0) dry mils
- (G) Concrete Block, Exterior

- (1) Surface Preparation: SSPC-SP13/NACE 6, Surface must be clean and dry.
 - (2) Type Finish: Flat, sand
 - (3) System: Tnemec
 - (a) 1st Coat: 151 Enviro-Grip, seven-tenths (0.7) to one and a half (1.5) dry mils
 - (b) 2nd Coat: 157 Enviro-Crete, six (6.0) to eight (8.0) dry mils
 - (c) 3rd Coat: 157 Enviro-Crete, six (6.0) to eight (8.0) dry mils
 - (4) System: Sherwin-Williams
 - (a) 1st coat: Loxon Conditioner Clear, two hundred square feet per gallon (200 ft²/gal) to three hundred square feet per gallon (300 ft²/gal) per gallon
 - (b) 2nd coat: Conflex Textured High Build Acrylic, six (6.0) to eight (8.0) dry mils
 - (c) 3rd coat: Conflex Textured High Build Acrylic, six (6.0) to eight (8.0) dry mils
- (H) Brick Masonry
- (1) Surface Preparation: SSPC-SP13/NACE 6, Surface must be dry, clean, and free of loose mortar.
 - (2) Type Finish: Not applicable
 - (3) System: Tnemec
 - (a) 1st Coat: Prime A Pell 200
 - (b) 2nd Coat: Prime A Pell 200
 - (4) System: Sherwin-Williams
 - (a) 1st Coat: Conflex 7% Siloxane Water Repellent
 - (b) 2nd Coat: Conflex 7% Siloxane Water Repellent (If second coat is needed, must be applied wet on wet.)
- (I) Concrete Walls and Ceilings, Interior
- (1) Surface Preparation: SSPC-SP13/NACE 6, Surface to be clean and dry.
 - (2) Type Finish: See within system listed within this section below.
 - (3) System: Tnemec
 - (a) 1st Coat: 1254 EpoxoBlock WB eighty square feet per gallon (80 ft²/gal) (fill all voids)
 - (b) 2nd Coat: 27WB Typoxy, six (6.0) to eight (8.0) dry mils
 - (c) 3rd Coat: 27WB Typoxy, six (6.0) to eight (8.0) dry mils
 - (d) Type Finish: Semi-gloss
 - (4) System: Sherwin-Williams
 - (a) 1st Coat: Kem Cati-Coat Epoxy Block Filler ten (10.) to twenty (20.0) dry mils
 - (b) 2nd Coat: Sherloxane 800, four (4.0) to six (6.0) dry mils
 - (c) 3rd Coat: Sherloxane 800, four (4.0) to six (6.0) dry mils
 - (d) Type finish: Gloss
- (J) Concrete Walls, Exterior
- (1) Surface Preparation: SSPC-SP13/NACE 6, Surface shall be clean and dry.
 - (2) Type Finish: Flat, sand
 - (3) System: Tnemec
 - (a) 1st Coat: 151 Enviro-Grip, seven-tenths (0.7) to one and a half (1.5) dry mils
 - (b) 2nd Coat: 157 Enviro-Crete, six (6.0) to eight (8.0) dry mils
 - (c) 3rd Coat: 157 Enviro-Crete, six (6.0) to eight (8.0) dry mils

- (4) System: Sherwin-Williams
 - (5) 1st Coat: Loxon Conditioner Clear, 200 to 300 Square Feet per gallon
 - (6) 2nd Coat: Conflex Textured High Build Acrylic, six (6.0) to eight (8.0) dry mils
 - (7) 3rd Coat: Conflex Textured High Build Acrylic, six (6.0) to eight (8.0) dry mils
- (K) Concrete, Exterior, Below Grade
- (1) Surface Preparation: SSPC-SP13/NACE 6, Surface must be clean and dry.
 - (2) Type Finish: Not applicable
 - (3) System Type: Tnemec
 - (a) 1st Coat: 46-465 H.B. Tnemecol, ninety-four square feet per gallon (94 ft²/gal)
 - (b) 2nd Coat: 46-465 H.B. Tnemecol, ninety-four square feet per gallon (94 ft²/gal)
 - (4) System: Sherwin-Williams
 - (a) 1st Coat: Targuard Coal Tar Epoxy, ten (10.0) to sixteen (16.0) dry mils
 - (b) 2nd Coat: Targuard Coal Tar Epoxy, ten (10.0) to sixteen (16.0) dry mils
- (L) Cast Iron or DIP, Bituminous Coated
- (1) Surface Preparation: SSPC-SP16 Brush-Off Blast Cleaning of Coated Uncoated Galvanized, Stainless and Non-Ferrous Metals. Surface shall be clean and dry.
 - (2) Type Finish: Not applicable
 - (3) System: Tnemec Series 1 Omnithane Primer, two and a half (2.5) to three and a half (3.5) dry mils
 - (4) System: Sherwin-Williams Corothane 1 Galvpak Zinc, two and a half (2.5) to three and a half (3.5) dry mils
- (M) Non-Ferrous Metals
- (1) Surface Preparation: SSPC-SP16 Brush-Off Blast Cleaning of Coated Uncoated Galvanized, Stainless and Non-Ferrous Metals. Surface shall be clean and dry.
 - (2) Type Finish: Not applicable
 - (3) Provide finish coats as specified above.
- (N) Wood Surfaces, Interior and Exterior
- (1) Surface Preparation: Surface shall be clean and dry.
 - (2) Type Finish: Semi-Gloss
 - (3) System: Tnemec
 - (a) 1st Coat: 10-99W Tnemec Primer, two and a half (2.5) to three (3.0) dry mils
 - (b) 2nd Coat: 1029 Enduratone, two and a half (2.5) to three (3.0) dry mils
 - (c) 3rd Coat: 1029 Enduratone, two and a half (2.5) to three (3.0) dry mils
 - (4) System: Sherwin-Williams
 - (a) 1st Coat: Exterior Alkyd Wood Primer- One (1) coat per data page two and a half (2.5) to three (3.0) dry mils
 - (b) 2nd Coat: Pro Industrial Pre Catalyzed Waterbased Urethane, two and a half (2.5) to four and a half (4.5) dry mils
 - (c) 3rd Coat: Pro Industrial Pre Catalyzed Waterbased Urethane,

two and a half (2.5) to four and a half (4.5) dry mils

(O) Insulated Pipe

- (1) Surface Preparation: Surface shall be clean and dry.
- (2) Type Finish: See within system listed within this section below.
- (3) System: Tnemec
 - (a) Type Finish: Semi-gloss
 - (b) Insulation coat: 971 (or 945 tape) Aerolon eighty (80) to one hundred (100) dry mils
 - (c) 1st Coat: 1029T Enduratone, two and a half (2.5) to three (3.0) dry mils
- (4) System: Sherwin-Williams
 - (a) Type Finish: Gloss
 - (b) 1st Coat: Macropoxy 646 FC three (3.0) to four (4.0) dry mils
 - (c) 2nd Coat: Heatflex 7000 one hundred (100.00) to one hundred & fifty (150) dry mils
 - (d) 3rd Coat (Topcoat): Shercryl HPA two (2.0) to three and a half (3.5) dry mils
 - (e) Going over insulation:
 - (i) 1st Coat: Shercryl HPA two (2.0) to three and a half (3.5) dry mils
 - (ii) 2nd Coat: Shercryl HPA two (2.0) to three and a half (3.5) dry mils Type Finish: Gloss

(P) Galvanized Surfaces

- (1) Surface Preparation: SSPC-SP16 Brush-Off Blast Cleaning of Coated Uncoated Galvanized, Stainless and Non-Ferrous Metals. Surface shall be clean and dry.
- (2) Type Finish: Not applicable
- (3) System: Tnemec
 - (a) One Coat: 20 Pota-Pox, four (4.0) to six (6.0) dry mils
 - (b) Finish with final coat as specified for ferrous metal submerged in wastewater or potable water.
- (4) System: Sherwin-Williams, One Coat: Macropoxy 646 FC, four (4.0) to six (6.0) dry mils

(Q) Concrete Floors, Light Traffic

- (1) Surface Preparation: SSPC-SP13/NACE 6, ICRI Technical Guideline No. 310-2 CSP3.
- (2) Type Finish: Not applicable
- (3) System: Tnemec
 - (a) 1st Coat: 280 Tneme-Glaze, eight (8.0) to twelve (12.0) dry mils
 - (b) 2nd Coat: 280 Tneme-Glaze, eight (8.0) to twelve (12.0) dry mils
 - (c) 3rd Coat: 248-Color Everthane, two and a half (2.5) to three (3.0) dry mils
- (4) System: Sherwin-Williams
 - (a) 1st Coat: Resuflor 3579, eight (8.0) to twelve (12.0) dry mils
 - (b) 2nd Coat: Resuflor 3746, ten (10.0) to twenty (20.0) dry mils
 - (c) 3rd Coat: Resutile 4638, two (2.0) to three and a half (3.5) dry mils

(R) Concrete Floors, Anti-Skid, Heavy Traffic

- (1) Surface Preparation: SSPC-SP13/NACE 6, ICRI Technical Guideline No.

- 310-2 CSP4.
- (2) Type Finish: Not applicable
 - (3) System: Tnemec
 - (a) 1st Coat: 222 Deco-Tread, one-twelfth of an inch (0.125 in.) double broadcast
 - (b) 2nd Coat: 284 Deco-Clear, eight (8.0) to ten (10) dry mils
 - (c) 3rd Coat: 248 EverThane, two (2.0) to three (3.0) dry mils
 - (4) Sherwin-Williams
 - (a) 1st Coat: Resuprime 3579 applied at two hundred fifty square feet per gallon (250 ft²/gal)
 - (b) 2nd Coat: Slurry Resuflor 3561 with 5350 and 5310 applied at published system guide coverage rates to achieve the required thickness. To yield one-eighth inch (0.125 in.) textured finish, broadcast to rejection of 5310-8 into wet slurry.
 - (c) 3rd Coat: Grout Coat, for the one-eighth inch (0.125 in.) textured version, Resuflor 3746 one hundred square feet per gallon (100 ft²/gal) to one hundred fifty square feet per gallon (150 ft²/gal)
 - (d) 4th Coat: Topcoat Resuflor 4638 applied at one hundred square feet per gallon (100 ft²/gal) to one hundred fifty square feet per gallon (150 ft²/gal)
 - (S) Concrete Flumes, Launderers, Channels, etc. Immersion or Intermediate Contact with Water
 - (1) Surface Preparation: SSPC-SP13/NACE 6, ICRI Technical Guideline No. 310-2 CSP5
 - (2) Type Finish: Not applicable
 - (3) System: Tnemec
 - (a) 1st Coat: 218 MortarClad applied to fill all holes, voids, and surface irregularities and to provide a smooth and even finish. This coating shall also skim the entire surface of the concrete.
 - (b) 2nd Coat: 22 Epoxoline-1218 Light Blue, twenty (20.0) to thirty (30.0) dry mils
 - (4) System: Sherwin-Williams
 - (a) 1st Coat: AW Cook MSM applied to fill in all holes, voids, and surface irregularities to and to provide a smooth and even finish. This Coating can also be used to fill in the entire surface being coated.
 - (b) 2nd Coat: Macropoxy 5000, one (1.0) to two (2.0) dry mils to prevent outgassing
 - (c) 3rd Coat: Duraplate 6000, twenty (20.0) to one hundred twenty five (125.0) dry mils depending on profile of concrete and severity of exposure.
 - (T) Gypsum Wallboard
 - (1) Surface Preparation: Surface must be dry, clean, and free of contaminants.
 - (2) Type Finish: See within system listed within this section below.
 - (3) System: Tnemec
 - (a) Type Finish: Semi-gloss
 - (b) 1st Coat: 151 Elasto-Grip, seven-tenths (0.7) to one and a half (1.5) dry mils

- (c) 2nd Coat: 113 Tufcoat, four (4.0) to six (6.0) dry mils
- (d) 3rd Coat: 113 Tufcoat, four (4.0) to six (6.0) dry mils
- (4) System: Sherwin-Williams
 - (a) Type finish: Eggshell
 - (b) 1st Coat: Pro Block Interior Latex primer one (1) coat
 - (c) 2nd Coat: Pro Industrial Waterborne Catalyzed Epoxy Eggshell three (3.0) to five (5.0) dry mils
 - (d) 3rd Coat: Pro Industrial Waterborne Catalyzed Epoxy Eggshell three (3.0) to five (5.0) dry mils

END OF SECTION 4.16

4.17 PROTECTIVE COATINGS FOR CONCRETE WET WELLS, VAULTS, AND MANHOLES

4.17.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.17.2 Submittals

A. Product Data

1. Technical data sheet for each repair and coating product to be used, including application, cure time, surface preparation procedures, and certification from coating project manufacturer as to the compatibility of the repair material(s) and coating system.
2. Safety Data Sheet(s) (SDS) for each product to be used.
3. Copies of independent testing performed on the coating product indicating the product meets the requirements as specified herein. Coating product physical properties shall be substantiated through submittal of testing results as documented by an accredited third-party laboratory and shall be representative of the actual field applied product including cure mechanism(s) as to be employed in the field.
4. Five (5) references of manufacturer indicating successful coating system performance greater than five (5) years in age of the submitted coating product(s) within the municipal wastewater environment.

B. Contractor Data

1. Current documentation from repair and coating product manufacturer(s) certifying contractor's training and equipment complies with the Quality Assurance requirements specified herein.
2. Five (5) references of contractor indicating successful coating system installation performance greater than five (5) years in age of coating product of the same material type as specified herein, applied by spray application within the municipal wastewater environment.
3. Documentation of the requirements in this section.

4.17.3 Approved Manufacturers

See within SECTION 4.17.4 for approved suppliers based on application.

4.17.4 Materials of Construction

A. Structure

1. Standard Portland cement or new concrete (*not quick setting, high strength cement*) must be well cured for minimum of twenty-eight (28) days prior to application of the protective coating.
2. Cementitious patching and repair materials should not be used unless their manufacturer provides information as to its suitability and procedures for top coating with an epoxy coating. Project specific submittals should be provided including application, cure time, and surface preparation procedures which permit optimum bond strength with the epoxy coating.
3. Remove existing coatings prior to application of the new protective coating. Applicator is to maintain

strict adherence to applicable SSPC/NACE recommendations regarding proper surface preparation and compatibility with existing coatings.

B. Approved Repair Materials

1. Repair materials shall be used to fill voids, structurally reinforce and/or rebuild substrate surfaces, etc. as determined necessary by the protective coating applicator. Materials shall be applied in accordance with the manufacturer's recommendations.
2. The following products are accepted and approved as repair materials for rehabilitation of existing manholes:
 - (a) Cementitious Coating (Build Back) Materials for Manhole Walls and Benches - All cementitious coating (build back) materials shall be specifically designed for the rehabilitation of manholes and other related wastewater structures. Liner materials shall be manufactured from a blend of one hundred percent (100%) pure calcium aluminate cement and enhanced with high density chemically stable aggregates. Materials shall contain poly fiber reinforcement and chemical admixtures. Liner materials shall be mixed with water per manufacturer's written specifications and applied using equipment specifically designed for low pressure spray application of cement mortars. The cement liner material must be at a minimum thickness of one half inch (0.5 in.) monolithic application.
 - (b) Approved material shall be:
 - (i) Mainstay Composite Liner consisting of Mainstay ML-72 Microsilica Restoration Mortar and Mainstay DS-5 Epoxy Coating as manufactured by Madewell Products. The epoxy must be moisture tolerant for damp applications and capable of curing in the presence of water. The protective coating system shall be able to be applied to damp concrete surfaces.
 - (ii) Raven 405 – One hundred percent (100%) solids, solvent-free ultra-high-build epoxy system as manufactured by Raven Lining Systems.
 - (iii) SewperCoat 2000 HS as manufactured by Imerys
 - (iv) Sherwin-Williams Dura-Plate 6000 or 6100 one hundred percent (100%) solids, solvent free ultra-high-build epoxy system. OJRSA and/or consultants working on behalf of the OJRSA shall determine appropriate product and method based specific product conditions.

C. Force Main Tie-In to Existing Manhole

1. Protective coatings standard for manholes with a new force main shall be applicable to all manholes as stated in SECTION 3.3.6(M).
2. The following products are accepted and approved and shall be used as composite lining materials for use when tying a force main to an existing unlined precast concrete manhole:
 - (a) Mainstay Composite Liner consisting of Mainstay ML-72 Microsilica Restoration Mortar and Mainstay DS-5 Epoxy Coating. The epoxy must be moisture tolerant for damp applications and capable of curing in the presence of water. The protective coating system shall be able to be applied to damp concrete surfaces.
 - (b) Mainstay DS-5 Epoxy Coating
 - (c) Raven 405 – One hundred percent (100%) solids, solvent-free ultra-high-build epoxy system as manufactured by Raven Lining Systems.

END OF SECTION 4.17

4.18 CHAIN LINK FENCES AND GATES

4.18.1 Referenced Standards

See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

4.18.2 Submittals

- A. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.
- B. Product Data: Submit data on fabric, posts, accessories, fittings, and hardware.
- C. Manufacturer's Installation Instructions: Submit installation requirements including post foundation anchor bolt templates if required.

4.18.3 Approved Manufacturers

OJRSA does not have a preferred manufacturer.

4.18.4 Materials of Construction

- A. General: Provide fencing that is six feet (6 ft) in height and is standard product of manufacturer of chain-link fencing, including accessories, necessary for complete installation.
- B. Posts, Rails, and Braces
 - 1. Forms: Round, formed "C" section, or square.
 - 2. Galvanized: In accordance with ASTM A123 or ASTM A153.
 - 3. Steel: ASTM A789/A789M-20 for light industrial fence.
 - 4. End or corner posts shall be round two and seven-eighths inches (2.875 in.) outside diameter or two and a half inches (2.5 in.) square.
 - 5. Braces and Rails: One and two-thirds inches (1.67 in.) outside diameter.
 - 6. Line Posts shall be round two and three-eighths inches (2.375 in.) outside diameter or "C" section two and a quarter inches by one and seven-tenths inches (2.25 in. x 1.70 in.)
 - 7. Tension Bars: Not less than three-eighths inches by thirty-four inches (0.375 in. by 34 in.) and not less than two inches (2 in.) shorter than fabric height.
 - 8. Truss Rods: Three-eighths inches (0.375 in.) diameter.
- C. Fabric: Galvanized Steel Wire Fabric: ASTM A392 for 9-gauge wire with two inch (2 in.) mesh; minimum weight of zinc coating, one and eight-tenths ounces per square foot (1.8 oz/ft²) determined in accordance with ASTM A90.
- D. Accessories
 - 1. Reinforcing Wire: Not lighter than 7-gauge woven through fence fabric. Provide aluminum clips for attaching wire to fabric at intervals not exceeding twenty-four inches (24 in.).
 - 2. Galvanized-Steel Extension Arms: For supporting three (3) strands of barbed wire above the top horizontal rail of fence. Extension arms A-type.
 - 3. Barbed Wire: ASTM A121, chain-link-fence grade, and double strands of 12.5-gauge with four (4) barbs of 14-gauge spaced at a distance of three inches (3 in.).
 - 4. Fence Fittings: ASTM F626
 - 5. Ground Rods: Three-quarters inches by ten feet (0.75 in. x 10 ft) copper-clad steel conforming to UL 467.
- E. Gates
 - 1. General: Provide galvanized-steel frames and accessories in conformance with fence materials unless otherwise required. Construct frame of square or round members and as indicated.
 - 2. Swing Gates: Provide as required complete with latches, stops, drop rods, keepers, and hinges in conformance with ASTM F900.
 - 3. Frames: Round one and nine-tenths inches (1.90 in.) outside diameter or two inches (2 in.) square.
 - 4. Fabric and Accessories: Same as fence material.
 - 5. Truss Rods: Minimum of five-sixteenths inches (5/16 in.) minimum diameter. Equip gates ten feet (10 ft) and over in width with horizontal brace and one (1) diagonal truss rod.
 - 6. Vertical Intermediate Bracing: Provide so that no members are more than eight feet (8 ft) apart.
 - 7. End Members of Gate Frame: Extend twelve inches (12 in.) above the top horizontal member to accommodate three (3) strands of barbed wire, uniformly spaced.
 - 8. Gateposts: Single or one (1) leaf of double gate, round four inches (4 in.) outside diameter. Provide

post of sufficient length to allow for depth of three feet (3 ft) below ground level.

END OF SECTION 4.18

END OF SECTION 4

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SECTION 5 – INSTALLATION

5.1 GRAVITY SEWER PIPE

5.1.1 General

- A. Examine the areas and conditions under which the pipe is to be installed for conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.1.2 Pipe Handling

- A. General: Transport pipe to the job site and handle in such a manner as not to damage the pipe or pipe coating.
- B. Stockpiling: Stockpile pipe within the rights-of-way so that no dangerous conditions will exist to life or property. Store pipe so that damage to surfaces and/or structures will be prevented. Provide suitable devices to support pipe when it is lifted.

5.1.3 Pipe Installation

- A. General
 - 1. Install ductile iron pipe in accordance with ANSI 21.50/AWWA C150.
 - 2. Install PVC pipe, fittings, and accessories in accordance with ASTM D2321, and seal joints watertight.
 - 3. Adhere to the rules, regulations, and requirements of OSHA.
- B. Precautions: Lay pipe in dry trenches only. Keep all trenches completely free of water during bedding, laying, and jointing of pipe. De-water and use sheeting where required by field conditions. Pump or drain all water away from the work and dispose of in a suitable manner so that no damage occurs outside the construction easement. Do not permit water to rise in an unbackfilled trench after pipe has been placed. Promptly repair any damage within the construction easement.
- C. Tolerances: Lay all pipe straight between changes in alignment and at uniform grade between change in grade. When jointed in the trench, the pipe shall form a true and smooth line.
- D. Pipe Lengths: Lay pipe in nominal fourteen foot (14 ft), eighteen foot (18 ft), or twenty foot (20 ft) lengths; except the joints adjacent to any manhole shall have a minimum length of two feet (2 ft) measured from the outside face of the manhole.
- E. Placing Pipe in Trench
 - 1. After delivery alongside the trench, visibly inspect each length of pipe for marking, damaged surfaces, breakage, and conformance to specifications.
 - 2. Acceptable pipe may be marked with paint or other permanent marking material so that the marks are plainly visible after installation in the trench and before the pipe is covered. Reject, stockpile, and remove from the site all pipe not conforming to standards or requirements.
 - 3. Before pipe is placed on the bedding material, excavate suitable bell holes so that after placement of the pipe, only the barrel receives bearing pressure from the supporting material. Support the entire length of the unit.
 - 4. Furnish approved devices to support all parts of the pipe unit when it is lifted. Protect pipe during handling against impact shocks and free falls. Do not permit hooks to come in contact with pre-molded joint surfaces. Lower pipe into position in the trench and joint without disturbing the bedding or adjoining section of pipe.
 - 5. Handle pipe having pre-molded joint rings or attached couplings so that no weight, including the weight of the pipe itself, will bear on or be supported by the jointing material. Take care to avoid dragging the spigot ring on the ground or allowing it to be damaged by contact with gravel, crushed stone, or other hard objects. Do not subject the bell and spigot sections to direct stress of any kind except that required to affect the jointing.

F. Pipe Laying

1. Start laying pipe at the lowest point and install the pipe so that the spigot end points in the direction of flow. Lay pipe to conform to specified lines and grades.
2. Clean all joint surfaces after the pipe units are aligned in the trench and are ready to be joined. Immediately before jointing the pipe, lubricate the bell or groove in accordance with the manufacturer's recommendations. Then carefully push pipe unit into place without damage to the pipe or gasket. Use suitable devices to force the pipe together so that they will fit with a minimum open recess inside or outside and so that they will have tightly sealed joints. Lay each pipe unit to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.
3. Immediately after the pipe units are put together, inspect the position of the gasket in the joint using an approved feeler gauge to make sure it is properly positioned. Pull apart and remake all joints, using new gaskets, if the gasket has become damaged or improperly positioned.
4. Make all joints in accordance with manufacturer's recommendations. Prior to backfill, fill bell holes with bedding material and compact so that the spigot will not move in the bell of the adjoining pipe under backfill load. Do not permanently support pipe on saddles, blocking, or boulders/rocks.

G. Mechanical Jointing: Wash sockets and spigots with soapy water before slipping gland and gasket over spigot. Insert the spigot in the socket full depth. Insert the gasket in the socket full depth. Brush the gasket with soapy water and push into position, making sure the gasket is evenly seated in the socket. Slide the gland into position for compression gasket. Tighten all bolts and nuts "finger tight", after which tighten the bolts to a uniform permanent tightness using a torque wrench for tightening. Tighten bolts alternately one hundred eighty degrees (180°) apart. Keep sockets, spigots, glands, and bolts clean and wet with soapy water until each joint is completed. Remake any joints which leak.

H. Push-On Type Jointing: Perform the jointing of push-on type pipe in accordance with manufacturer's recommendations.

I. Temporary Plugs: At all times when pipe laying is not actually in progress, close the open end of pipe by temporary watertight plugs or by other approved means. If water is in the trench when work is resumed, do not remove the plug until all danger of earth or other material entering the pipe has passed.

J. Backfill: Pipe shall be bedded using select material from excavated in-situ soil free of large stones, hard lumps, frozen matter, organic matter, debris, and other objectionable material. If in-situ soil is not acceptable, then the contractor shall provide suitable material for bedding and backfill from offsite sources. When pipe has been properly bedded and jointed, backfill trenches.

5.1.4 Testing

A. Low-Pressure Air Test

1. Perform test in accordance with applicable portions of ASTM F1417.
2. Test each section of gravity sewer piping between manholes.
3. Introduce air pressure slowly to approximately four pounds per square inch gauge (4 psig).
4. Determine groundwater elevation above spring line pipe. For every twelve inches (12 in.) of groundwater above spring line of pipe, increase starting air test pressure by forty-three-hundredths pounds per square inch gauge (0.43 psig); do not increase pressure above ten pounds per square inch gauge (10 psig).
5. Allow pressure to stabilize for at least five (5) minutes. Adjust pressure to three and a half pounds per square inch gauge (3.5 psig) or increased test pressure as determine above when groundwater is present for at least two (2) minutes. Start test.
6. Determine test duration for sewer section with single pipe size from Table 11. Do not make allowance for service connections (laterals).

Table 11: Test duration based on pipe diameter and length

Nominal Pipe Size (inches)	Length for Minimum Time (feet)	Minimum Test Time ¹ (minutes/100 feet of pipe)
4	597	1:53
6	398	2:50
8	298	3:47
10	239	4:43
12	199	5:40
15	159	7:05
16	Design engineer's recommendation	
18	133	8:30
20	Design engineer's recommendation	
21	114	9:55
24	99	11:20
27	88	12:45
30	80	14:10
36	66	17:00
Other	Design engineer's recommendation as appropriate	

7. Record drop in pressure during test period. When air pressure has dropped more than one half pounds per square inch gauge (0.5 psig) during test period, piping has failed. When one half pounds per square inch gauge (0.5 psig) air pressure drop has not occurred during test period, discontinue test and piping is accepted.
 8. When piping fails, determine source of air leakage, make corrections and retest; test section in incremental stages until leaks are isolated; after leaks are repaired, retest entire section between man-holes.
- B. Exfiltration Test: Test pipe larger than thirty-six inches (36 in.) diameter with exfiltration test not exceeding one hundred gallons (100 gal) for each one inch (1 in.) of pipe diameter for each mile per day for each section under test. Perform test with minimum positive head of two feet (2 ft). Pipes thirty-six inches (36 in.) and smaller shall only be tested by Low-Pressure Air Test (5.1.4(A)) or Infiltration Test (5.1.4(C)).
- C. Infiltration Test
1. Use only when gravity piping is submerged in groundwater minimum of four feet (4 ft) above crown of pipe for entire length being tested.
 2. Maximum Allowable Infiltration: One hundred gallons (100 gal) per one inch (1 in.) of pipe diameter for each mile per day for section under test; include allowances for leakage from manholes. Perform test with minimum positive head of two feet (2 ft).
- D. Deflection Testing of Plastic Piping
1. Perform vertical ring deflection testing on PVC sewer piping after backfilling has been in place for at least thirty (30) days, but no longer than twelve (12) months.
 2. Allowable maximum deflection for installed plastic sewer pipe is limited to five percent (5%) of original vertical internal diameter.
 3. Furnish rigid ball or mandrel with diameter greater than or equal to ninety-five (≥ 95%) of base or average inside diameter of pipe as determined by ASTM standard to which pipe is manufactured. Measure pipe in compliance with ASTM D2122.
 4. Perform deflection testing using properly sized rigid ball or "Go, No-Go" mandrel.
 5. Perform test without mechanical pulling devices.
 6. Locate, excavate, replace, and retest pipe exceeding allowable deflection.
- E. Repairs: Repair and retest, at contractor's expense, any section of pipe failing to meet the leakage test. Per-

¹ See Table 2 of ASTM F1417 for additional times by pipe length.

form repairs with capable personnel and with sound materials equal to those materials used in the manufacture of the pipe.

END OF SECTION 5.1

5.2 FORCE MAIN SEWER PIPE

5.2.1 Polyvinyl Chloride (PVC) Pipe Force Mains

5.2.1.1 General

- A. Examine the areas and conditions under which the pipe is to be installed for conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.2.1.2 Excavation

Except where specifically shown or indicated otherwise, lay all pipe with an earth cover of at least three feet (3 ft).

5.2.1.3 Pipe Handling

- A. General: Transport pipe to the job site and handle in such a manner as not to damage the pipe or pipe coating.
- B. Stockpiling
 1. Contractor shall be responsible for arranging for appropriate stockpile locations. Store pipe so that damage to surfaces and/or structures will be prevented. Provide suitable devices to support pipe when it is lifted.
 2. Cover pipe which is stored outside and exposed to prolonged periods of sunlight (more than one (1) month) with an opaque material. Clear plastic will not be acceptable as a cover. Provide air circulation under covering. Provide supports under pipe which are spaced to prevent the pipe from bending during storage.

5.2.1.4 Pipe Installation

- A. Precautions: Lay pipe in dry trenches only. Keep all trenches completely free of water during bedding, laying, and jointing of pipe. De-water and use sheeting where required by field conditions. Pump or drain all water away from the work and dispose of in a suitable manner so that no damage occurs outside the construction easement. Do not permit water to rise in an unbackfilled trench after pipe has been placed. Promptly repair any damage within the construction easement.
- B. Pipe Lengths: Lay pipe in nominal twenty foot (20 ft) lengths.
- C. Placing Pipe in Trench
 1. After delivery alongside the trench, visibly inspect each length of pipe for marking, damaged surfaces, breakage, and conformance to these specifications. Acceptable pipe may be marked with paint or other permanent marking material so that the marks are plainly visible after installation in the trench and before pipe is covered. Reject, stockpile, and remove from the site all pipe not conforming to specifications.
 2. Before pipe is placed on the bedding material, excavate suitable bell holes so that after placement of the pipe, only the barrel receives bearing pressure from the supporting material. Support the entire length of the unit. Protect pipe during handling against impact shocks and free falls. Do not permit hooks to come in contact with pre-molded joint surfaces.
 3. Handle pipe having pre-molded joint rings or attached couplings so that no weight, including the weight of the pipe itself, will bear on or be supported by the jointing material. Take care to avoid dragging the spigot ring on the ground or allowing it to be damaged by contact with gravel, crushed stone, or other hard objects. Do not subject the bell and spigot sections to direct stress of any kind except that required to affect the jointing.
- D. Pipe Laying

1. Lay pipe to conform to specified lines and grades.
 2. Immediately after the pipe units are put together, inspect the position of the gasket in the joint to make sure it is properly positioned. Pull apart and remake all joints, using new gaskets, if the gasket has become damaged or improperly positioned. Make all joints in accordance with manufacturer's recommendations which are subject to approval by the engineer. Prior to backfill, fill bell holes with bedding material and compact so that the spigot will not move the bell of the adjoining pipe under backfill load. Do not permanently support pipe on saddles, blocking, or boulders.
- E. Mechanical Jointing: Wash sockets and spigots with soapy water before slipping gland and gasket over spigot. Insert the spigot in the socket full depth. Insert the gasket in the socket full depth. Brush the gasket with soapy water and push into position, making sure the gasket is evenly seated in the socket. Slide the gland into position for compression gasket. Tighten all bolts and nuts "finger tight", after which tighten the bolts to a uniform permanent tightness using a torque wrench for tightening. Tighten bolts alternately one hundred eighty degrees (180°) apart. Keep sockets, spigots, glands, and bolts clean and wet with soapy water until each joint is completed. Remake any joints which leak.
- F. Push-On Type Jointing: Perform the jointing of push-on type pipe in accordance with manufacturer's recommendations.
- G. Longitudinal Bending: Make longitudinal bending through joint deflection only; axial flexure of the pipe will not be permitted. Do not exceed the pipe manufacturer's allowable joint deflection limits. Where changes in direction exceed the allowable deflection limits, make the change in direction with standard fittings.
- H. Temporary Plugs: At all times when pipe laying is not actually in progress, close the open end of pipe by temporary watertight plugs or by other approved means. If water is in the trench when work is resumed, do not remove the plug until all danger of earth or other material entering the pipe has passed.
- I. Thrust Blocking: Thrust blocks shall not be used unless previously approved. Contractor shall use restrained joint pipe and fittings for thrust protection.
- J. Backfill: Pipe shall be bedded using select material from excavated in-situ soil free of large stones, hard lumps, frozen matter, organic matter, debris, and other objectionable material. If in-situ soil is not acceptable, then the contractor shall provide suitable material for bedding and backfill from offsite sources. When pipe has been properly bedded and jointed, backfill trenches.

5.2.1.5 Testing

- A. Test system according to AWWA C600 or AWWA C605 and following:
1. Pipe trench shall be backfilled prior to testing.
 2. Hydrostatically test each portion of pressure piping, including valved section, at one and a half times (1.5x) working pressure of piping, based on elevation of lowest point in piping corrected to elevation of test gage.
 3. Conduct hydrostatic testing for at least two (2) hours.
 4. Slowly fill with water portion of piping to be tested, expelling air from piping at high points.
 5. Install corporation cocks at high points.
 6. Close air vents and corporation cocks after air is expelled.
 7. Raise pressure to specified test pressure.
 8. Maintain pressure within plus/minus five pounds per square inch (± 5.0 psi) of test pressure.
 9. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of testing.
 10. Compute maximum allowable leakage using following formula:

$$L = \frac{SD\sqrt{P}}{148,000}$$

Where L is the Testing Allowance (makeup water, GPH); S is the Length of Pipe Tested (ft); D is the Nominal Diameter of the Pipe (in.); and P is the Average Test Pressure During Hydrostatic Testing (psig)

If pipe undergoing testing contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each pipe size.

- B. If testing of piping indicates leakage greater than that allowed, locate source of leakage, make corrections,

and retest until leakage is within acceptable limits.

- C. Correct visible leaks regardless of quantity of leakage.
- D. Repairs: Repair and retest, at contractor's expense, any section of pipe failing to meet the leakage test. Perform repairs with capable personnel and with sound materials equal to those materials used in the manufacture of the pipe.

5.2.2 Ductile Iron Pipe (DIP) Force Mains

5.2.2.1 General

- A. Examine the areas and conditions under which the pipe is to be installed for conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.2.2.2 Excavation

Except where specifically shown or indicated otherwise, lay all pipe with an earth cover of at least three feet (3 ft).

5.2.2.3 Pipe Handling

- A. General: Transport pipe to the job site and handle in such a manner as not to damage the pipe or pipe coating.
- B. Stockpiling: Stockpile pipe within the rights of way so that no dangerous conditions will exist to life or property. Store pipe so that damage to surfaces and/or structures will be prevented. Provide suitable devices to support pipe when it is lifted.

5.2.2.4 Pipe Installation

- A. Precautions: Lay pipe in dry trenches only. Keep all trenches completely free of water during bedding, laying, and jointing of pipe. De-water and use sheeting where required by field conditions. Pump or drain all water away from the work and dispose of in a suitable manner so that no damage occurs outside the construction easement. Do not permit water to rise in an unbackfilled trench after pipe has been placed. Promptly repair any damage within the construction easement.
- B. Pipe Lengths: Lay pipe in nominal eighteen foot (18 ft) or twenty foot (20 ft) foot lengths.
- C. Placing Pipe in Trench
 1. After delivery alongside the trench, visibly inspect each length of pipe for marking, damaged surfaces, breakage, and conformance to specifications.
 2. Acceptable pipe may be marked with paint or other permanent marking material so that the marks are plainly visible after installation in the trench and before the pipe is covered. Reject, stockpile, and remove from the site all pipe not conforming to specifications.
 3. Before pipe is placed on the bedding material, excavate suitable bell holes so that after placement of the pipe only the barrel receives bearing pressure from the supporting material. Support the entire length of the unit.
 4. Furnish approved devices to support all parts of the pipe unit when it is lifted. Protect pipe during handling against impact shocks and free falls. Do not permit hooks to come in contact with pre-molded joint surfaces. Lower pipe into position in the trench and joint without disturbing the bedding or adjoining section of pipe.
 5. Handle pipe having pre-molded joint rings or attached couplings so that no weight, including the weight of the pipe itself, will bear on or be supported by the jointing material. Take care to avoid dragging the spigot ring on the ground or allowing it to be damaged by contact with gravel, crushed stone, or other hard objects. Do not subject the bell and spigot sections to direct stress of any kind except that required to affect the jointing.
- D. Pipe Laying
 1. Lay pipe to conform to specified lines and grades.
 2. Clean all joint surfaces after the pipe units are aligned in the trench and are ready to be joined. Immediately before jointing the pipe, lubricate the bell or groove in accordance with the manufacturer's

recommendations. Then, carefully push pipe unit into place without damage to the pipe or gasket. Use suitable devices to force the pipe together so that they will fit with a minimum open recess inside or outside and so that they will have tightly sealed joints. Lay each pipe unit to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.

3. Immediately after the pipe units are put together, inspect the position of the gasket in the joint using an approved feeler gauge to make sure it is properly positioned. Pull apart and remake all joints, using new gaskets, if the gasket has become damaged or improperly positioned.
 4. Make all joints in accordance with manufacturer's recommendations. Prior to backfill, fill bell holes with bedding material and compact so that the spigot will not move in the bell of the adjoining pipe under backfill load. Do not permanently support pipe on saddles, blocking, or boulders.
- E. Pipeline Deflection: The maximum allowable deflection in either the vertical or horizontal plain for pipe with nominal lengths of eighteen foot (18 ft) or twenty foot (20 ft) shall be in accordance with the pipe manufacturer's requirements.
 - F. Make any change in direction exceeding the maximum deflections noted above with standard fittings; ninety degrees (90°), forty-five (45°), twenty-two and a half degrees (22.5°), and eleven and a quarter degree (11.25°) bends.
 - G. Mechanical Jointing: Wash sockets and spigots with soapy water before slipping gland and gasket over spigot. Insert the spigot in the socket full depth. Insert the gasket in the socket full depth. Brush the gasket with soapy water and push into position making sure the gasket is evenly seated in the socket. Slide the gland into position for compression gasket. Tighten all bolts and nuts "finger tight" after which tighten the bolts to a uniform permanent tightness using a torque wrench for tightening. Tighten bolts alternately one hundred eighty degrees (180°) apart. Keep sockets, spigots, glands, and bolts clean and wet, with soapy water until each joint is completed. Remake any joints which leak.
 - H. Push On Type Jointing: Perform the jointing of push on type pipe in accordance with manufacturer's recommendations.
 - I. Temporary Plugs: At all times when pipe laying is not actually in progress, close the open end of pipe by temporary watertight plugs or by other approved means. If water is in the trench when work is resumed, do not remove the plug until all danger of earth or other material entering the pipe has passed.
 - J. Thrust Blocking: Thrust blocks shall not be used unless previously approved. Contractor shall use restrained joint pipe and fittings for thrust protection.
 - K. Backfill: Pipe shall be bedded using select material from excavated in-situ soil free of large stones, hard lumps, frozen matter, organic matter, debris, and other objectionable material. If in-situ soil is not acceptable, then the contractor shall provide suitable material for bedding and backfill from offsite sources. When pipe has been properly bedded and jointed, backfill trenches.

5.2.2.5 Testing

- A. Test system according to AWWA C600 or AWWA C605 and following:
 1. Pipe trench shall be backfilled prior to testing.
 2. Hydrostatically test each portion of pressure piping, including valved section, at one and a half times (1.5x) working pressure of piping, based on elevation of lowest point in piping corrected to elevation of test gage.
 3. Conduct hydrostatic testing for at least two (2) hours.
 4. Slowly fill with water portion of piping to be tested, expelling air from piping at high points.
 5. Install corporation cocks at high points.
 6. Close air vents and corporation cocks after air is expelled.
 7. Raise pressure to specified test pressure.
 8. Maintain pressure within plus/minus five pounds per square inch (± 5.0 psi) of test pressure.
 9. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of testing.
 10. Compute maximum allowable leakage using following formula:

$$L = \frac{SD\sqrt{P}}{148,000}$$

Where L is the Testing Allowance (makeup water, GPH); S is the Length of Pipe Tested (ft); D is the Nominal Diameter of the Pipe (in.); and P is the Average Test Pressure During Hydrostatic Testing (psig)

If pipe undergoing testing contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each pipe size.

- B. If testing of piping indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within acceptable limits.
- C. Correct visible leaks regardless of quantity of leakage.
- D. Repairs: Repair and retest, at the contractor's expense, any section of pipe failing to meet the leakage test. Perform repairs with capable personnel and with sound materials equal to those materials used in the manufacture of the pipe.

END OF SECTION 5.2

5.3 HORIZONTAL DIRECTIONAL DRILLING

5.3.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.3.2 Delivery and Off-Loading

- A. All pipe shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the OJRSA.
- B. Each pipe shipment should be inspected prior to unloading to see if the load has shifted or otherwise been damaged. Notify OJRSA immediately if more than immaterial damage is found. Each pipe shipment should be checked for quantity and proper pipe size, color, and type.
- C. Pipe should be loaded, off-loaded, and otherwise handled in accordance with AWWA M23, and all the pipe supplier's guidelines shall be followed.
- D. *Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.*
- E. During removal and handling, be sure that the pipe does not strike anything. Significant impact could cause damage, particularly during cold weather.
- F. If appropriate unloading equipment is not available, pipe may be unloaded by removing individual pieces. Care should be taken to ensure that pipe is not dropped or damaged. Pipe should be carefully lowered, not dropped, from trucks.

5.3.3 Handling and Storage

- A. Any length of pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
- B. Any scratch or gouge greater than ten percent (10%) of the wall thickness will be considered significant and can be rejected unless determined acceptable by OJRSA.
- C. Pipe lengths should be stored and placed on level ground. Pipe should be stored at the job site in the unit packaging provided by the manufacturer. Caution should be exercised to avoid compression, damage, or deformation to the ends of the pipe. The interior of the pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.
- D. Pipe shall be handled and supported with the use of woven fiber pipe slings or approved equal. Care shall be exercised when handling the pipe to not cut, gouge, scratch, or otherwise abrade the piping in any way.
- E. If pipe is to be stored for periods of one (1) year or longer, the pipe should be shaded or otherwise shielded from direct sunlight. Covering of the pipe which allows for temperature build-up is strictly prohibited. Pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.
- F. Pipe shall be stored and stacked per the pipe supplier's guidelines.

5.3.4 Fusion Process

A. General

1. Pipe shall be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this Specification and pipe supplier's guidelines.
 2. Pipe shall be fused by qualified fusion technicians as documented by the pipe supplier.
 3. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine.
 4. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following elements:
 - (a) Heat Plate: Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused per the pipe supplier's guidelines.
 - (b) Carriage: Carriage shall travel smoothly with no binding at less than fifty pounds per square inch (< 50 psi). Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.
 - (c) General Machine: Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.
 - (d) Data Logging Device: An approved data logging device with the current version of the pipe supplier's recommended and compatible software shall be used. Data logging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent one hundred ten volts (110 V) power source shall be available to extend battery life.
 5. Other equipment specifically required for the fusion process shall include the following:
 - (a) Pipe rollers shall be used for support of pipe to either side of the machine.
 - (b) A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement weather, extreme temperatures, and /or windy weather per the pipe supplier's recommendations.
 - (c) An infrared (IR) pyrometer for checking pipe and heat plate temperatures.
 - (d) Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.
 - (e) Facing blades specifically designed for cutting fusible pipe shall be used.
- B. Joint Recording: Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of fusible polyvinyl chloride (FPVC) or high-density polyethylene pipe (HDPE). The software shall register and/or record the parameters required by the pipe supplier and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

5.3.5 Drilling Operations

A. General

1. Bore path and alignment are as indicated in the contract documents. The path of the bore may be modified based on field and equipment conditions. Entry and exit locations and control-point elevations shall be maintained as indicated in the contract documents.
2. The engineer must be notified immediately if any obstruction is encountered that stops forward progress of drilling operations. The contractor and engineer must review the situation and jointly determine the feasibility of continuing guided boring operations or switching to an alternative construction method. The type of dewatering method will be at the option of the contractor. When water is encountered, the contractor must provide a dewatering system of sufficient capacity to remove water, keeping any excavations free of water until the backfill operation is in progress. Dewatering shall be

performed in a manner so that removal of soil particles is held to a minimum.

3. Bend radii shown in the contract documents are minimum allowable radii and shall not be reduced.

B. Location and Protection of Underground Utilities

1. Correct location of all underground utilities that may impact the horizontal directional drilling (HDD) installation is the responsibility of the contractor.
2. Utility location and notification services shall be contacted by the contractor prior to the start of construction.
3. All existing lines and underground utilities shall be positively identified, including exposing those facilities that are located within an envelope of possible impact of HDD installation as determined for the project specific site conditions. It is the contractor and HDD system operator's responsibility to determine this envelope of safe offset from existing utilities. This will include, but is not limited to, soil conditions and layering, utility proximity and material, HDD system and equipment, and foreign subsurface material.

C. Site Location Preparation

1. Work site shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made.
2. Contractor shall confine all activities to designated work areas.

D. Drilling Layout and Tolerances

1. The drilling equipment must be capable of placing the pipe within the planned line and grade.
2. The guidance system must have the capability of measuring inclination, roll, and azimuth. The guidance system must have an independent means to ensure the accuracy of the installation. The contractor shall demonstrate a viable method to eliminate accumulated error due to the inclinometer (pitch accelerometer).
3. The guidance system shall be capable of generating a plot of the borehole survey for the purpose of an as-built drawing.
4. The contractor shall supply a data log at the fusions indicating the successful fusion of all joints. The contractor shall supply a log of the depth every twenty-five feet (25 ft) along the length of the pipe.
5. The drill path shall be accurately surveyed with entry and exit areas placed in the appropriate locations within the areas indicated on drawings. If using a magnetic guidance system, drill path will be surveyed for any surface geomagnetic variations or anomalies.
6. Instrumentation shall be provided and maintained at all times that accurately locates the pilot hole, measures drill-string axial and torsional loads, and measures drilling fluid discharge rate and pressure.
7. Entry and exit areas shall be drilled so as not to exceed the bending limitations of the pipe as recommended by the pipe supplier.

E. Pilot Hole Boring

1. Pilot hole shall be drilled along bore path. In the event that the pilot bore does deviate from the bore path, it may require contractor to pull-back and re-drill from the location along bore path before the deviation.
2. The contractor shall limit curvature in any direction to reduce force on the pipe during pullback. The minimum radius of curvature shall be no less than that specified by the pipe supplier.
3. Alignment Adjustments and Restarts: In the event of difficulties at any time during boring operations, requiring the complete withdrawal from the tunnel, the contractor will be allowed to withdraw and abandon the tunnel completely filling the void and begin a second attempt at an approved location.

F. Reaming

1. After successfully completing the pilot hole, the bore hole shall be reamed to a diameter which meets the requirements of the pipe being installed. See Table 12 for an estimated guide.

Table 12: Bore hole diameters based on pipe diameters

Nominal Pipe Diameter (inches)	Bore Hole Diameter
Less than 8	<i>Pipe Diameter + 4 in.</i>
8-to-24	<i>Pipe Diameter × 1.5</i>

Greater than 24	<i>Pipe Diameter + 12 in.</i>
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2. Multiple reaming passes shall be used at the discretion of the contractor.
3. In the event of a drilling fluid fracture, returns loss, or other loss of drilling fluid, the contractor shall be responsible for restoring any damaged property to original condition and cleaning up the area in the vicinity of the damage or loss.

5.3.6 Pipe Pullback and Insertion

- A. Pipe shall be fused prior to insertion into one (1) continuous length if the site and conditions allow.
- B. Contractor shall handle the pipe in a manner that will not over-stress the pipe prior to insertion. Vertical and horizontal curves shall be limited so that the pipe does not bend past the pipe supplier's minimum allowable bend radius, buckle, or otherwise become damaged. Damaged portions of the pipe shall be removed and replaced.
- C. The pipe entry area shall be graded as needed to provide support for the pipe and to allow free movement into the bore hole.
 1. The pipe shall be guided into the bore hole to avoid deformation of or damage to the pipe.
 2. The pipe may be continuously or partially supported on rollers or other approved friction decreasing equipment during joining and insertion as long as the pipe is not over-stressed or critically abraded prior to or during installation.
 3. A swivel shall be used between the reaming head and the pipe to minimize torsion stress on the pipe assembly.
- D. Buoyancy modification shall be at the sole discretion of the contractor and shall not exceed the pipe supplier's guidelines in regards to maximum pull force or minimum bend radius of the pipe. Damage caused by buoyancy modifications shall be the responsibility of the contractor.
- E. Once pullback operations have commenced, the operation shall continue without interruption until the pipe is completely pulled through the bore hole.
- F. The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, or movement and distortion of surface features. Any damages caused by the contractor's operations shall be corrected by the contractor at no additional cost to OJRSA.
- G. Tracer Wire
 1. All lines installed by HDD shall be provided with a minimum of two (2) continuous type TW insulated #8 solid copper tracer wires. The wire shall be installed along the pipe, fastened securely to the pipe at five foot (5 ft) intervals, and terminated above ground with the lead taped around each structure.
 2. The tracer wire shall be capable of, and demonstrated to have, continuous transmission of tracing signal along the full length of the installed pipe.

5.3.7 Installation Cleanup

- A. All excavations will be backfilled and compacted per jurisdictional standards. All pavement and hardscape shall be repaired per applicable jurisdictional standards, excess materials shall be removed from the site, and disturbed areas shall be re-landscaped. All drilling fluid shall be properly disposed of per all applicable jurisdictional laws.
- B. Contractor shall verify that all utilities, structures, and surface features in the project area are sound.

5.3.8 Testing

- A. Testing shall comply with all applicable jurisdictional building codes, statutes, standards, regulations, and laws.
- B. Test system according to ASTM F2164 and the following:
 1. All fusible or butt welds shall be tested, including mechanical joint adapter fittings.
 2. The pressure testing of an HDPE line section shall be tested separately from any PVC or DIP line sections. Where that is impractical, the HDPE test section shall include only a minimum amount of PVC and DIP within the test section. If possible, the PVC and DIP test sections shall be left exposed during the pressure test for visual leakage observations.

3. All valved sections shall be hydrostatic tested to ensure sealing of all line valves.
4. All HDD greater than one hundred linear feet (> 100 LF) in length shall be air pressure tested (above ground) at five pounds per square inch (5 psi) for a period of fifteen (15) minutes, prior to insertion, with no pressure loss allowed.
5. Hydrostatically test each portion of pressure piping, including valved section, at one and a half times (1.5x) working pressure of piping, based on elevation of lowest point in piping corrected to elevation of test gage, or one hundred fifty pounds per square inch (150 psi), whichever is greater. Should the one and a half times (1.5x) the working pressure be greater than one hundred fifty pounds per square inch (150 psi), then test pressures as described below shall be adjusted accordingly.
6. Slowly fill with water portion of piping to be tested, expelling air from piping at high points.
7. Install corporation cocks at high points.
8. Close air vents and corporation cocks after air is expelled.
9. Total duration for the Initial and final testing phases described below shall not exceed eight (8) hours. If a test is not completed for any reason within eight (8) hours, then the test section shall be depressurized and allowed to “relax” for at least eight (8) hours before bringing the test section to test pressure again.
10. Initial Testing Phase
 - (a) Raise pressure within the pipeline to approximately one hundred sixty pounds per square inch (160 psi) and then allow the pipeline to be idle (no additional makeup water to be added) for 3 hours.
 - (b) During the three (3) hours, the test section shall be allowed to stabilize and come to an equilibrium stage. No additional makeup water shall be added unless the line pressure drops below one hundred forty pounds per square inch (140 psi), in which case only the amount of makeup water shall be added to maintain one hundred forty pounds per square inch (140 psi) pressure in the test section.
11. Final Testing Phase
 - (a) Apply makeup water to achieve an initial test pressure between one hundred fifty pounds per square inch (150 psi) and one hundred fifty-five pounds per square inch (155 psi).
 - (b) Allow test section to be idle (no additional makeup water added) for two (2) hours.
 - (c) After two (2) hours, add makeup water to re-establish the initial test pressure.
 - (d) Measure the quantity of makeup water added and compare to the allowable quantities as determined by Table 13 below.

Table 13: Allowable Leakage for HDPE Hydrostatic Test

Nominal Pipe Diameter (inches)	Allowable Makeup Water Per 100 feet of HDPE Pipe (gallons)
4	0.13
6	0.30
8	0.50
10	0.65
12	1.15

- C. If testing of piping indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within acceptable limits.
- D. Correct visible leaks regardless of quantity of leakage.
- E. Repairs: Repair and retest, at contractor’s expense, any section of pipe failing to meet the leakage test. Perform repairs with capable personnel and with sound materials equal to those materials used in the manufacture of the pipe

END OF SECTION 5.3

5.4 BORING AND TUNNELING

5.4.1 General Requirements

- A. Unless otherwise specified or directed, encasement up through forty-eight inches (48 in.) diameter shall be welded steel pipe installed by boring and jacking, and encasement larger than forty-eight inches (48 in.) diameter shall be steel liner plate installed by tunneling. No open excavation will be allowed within the limits of the encasement without approval.
- B. All sheeting, shoring, and bracing shall be provided as necessary for the satisfactory and safe performance of the work.
- C. If associated within a road, railroad, or other transportation right-of-way, all requirements will be subject to approval of the right-of-way or property owner.
- D. All work areas shall be maintained in a suitable dry condition at all times, with methods of dewatering, draining, pumping, and disposal of water subject to approval by other governing parties and property owners.

5.4.2 Boring

- A. Encasement pipe shall be installed by boring and jacking with welded joints to the required lines and grades. The contractor shall bear the cost of any corrective action required to meet the line and grade requirements specified. Welding shall conform to the requirements of the American Welding Society (AWS), the American Railway Engineering Association (AREA), and other recognized professional organizations for this type of work. The distance to which boring is carried ahead of the pipe shall be not more than is absolutely necessary for installation purposes and will be subject to approval. The work shall be performed so that no voids occur in the earth surrounding the pipe and so that ground settlement adjacent to and within the limits of the pipeline crossing is eliminated. If voids occur or are encountered outside the pipe, grout holes shall be drilled at ten foot (10 ft) centers in the top of the encasement pipe and the voids filled with one-to-three (1:3) Portland cement grout applied at sufficient pressure to fill the voids and prevent embankment settlement.
- B. If it becomes necessary to abandon an incomplete or unacceptable bore, the abandoned encasement shall be capped and filled completely with one-to-three (1:3) Portland cement grout. Abandonment procedures shall be completed prior to moving to another boring location. All costs in connection with an abandoned bore, including the construction cost and capping and filling costs, shall be the contractor's expense.

END OF SECTION 5.4

5.5 MANHOLES

5.5.1 Precast Concrete Manholes

5.5.1.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.5.1.2 Inspection

Verify excavation for manholes to proper depth and proper placement of bedding material in accordance with specifications.

5.5.1.3 Placing Manhole Sections

- A. Place precast manhole sections plumb and level and adjust to correct elevation. Provide bedding material in accordance with specifications.
- B. Form and construct cast-in-place manhole plumb and level, to correct dimensions and elevations.
- C. After manhole assembly, plug lift holes with non-shrink grout.
- D. Cut and fit for pipe connections.
- E. Invert Channels
 1. Built up with concrete, grout, or brick and mortar covered by at least two inches (2 in.) of mortar.
 2. Smooth and semicircular, conforming to inside of adjacent sewer section.

3. Changes in direction of flow made with a smooth curve radius as large as manhole size will permit.
4. Slope floor of manhole outside channels, smooth, and not less than one inch per foot (1 in./ft) nor more than two inches per foot (2 in./ft).

F. Drop Pipe

1. A drop pipe shall be provided for a sewer entering a manhole at an elevation of twenty-four inches (24 in.) or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than twenty-four inches (24 in.), the invert shall be filleted to prevent solids deposition.
2. Drop manholes shall be constructed with an outside drop connection. The entire drop pipe shall be encased in concrete per SECTION 3.3.6(A).

G. Set manhole frames and covers level to correct elevations.

5.5.1.4 Pipe Connections to Existing Manholes

Pipe connections to existing manholes shall be made in such a manner that the finished work will conform as nearly as practical to the essential requirements specified for new manholes, including all necessary concrete work, cutting, and shaping.

5.5.1.5 Testing

A. Perform an allowable leakage (exfiltration) test prior to backfilling around manholes deeper than twenty-four feet (24 ft) deep.

1. Plug pipes in manhole; remove water in manhole; observe plugs over period of not less than two (2) hours to ensure there is no leakage into manhole.
2. Determine groundwater level outside manhole.
3. Fill manhole with water to within four inches (4 in.) of top of cover frame. Prior to test, allow manhole to soak from minimum of four (4) hours to maximum of seventy-two (72) hours; after soak period, adjust water level inside manhole to within four inches (4 in.) of top of cover frame.
4. Measure water level from top of manhole frame; at end of four (4) hour test period, again measure water level from top of manhole frame; compute drop in water level during test period.
5. Manhole exfiltration test is considered satisfactory when drop in water level is less than values listed in Table 14.
6. When unsatisfactory test results are achieved, repair manhole and retest until result meets criteria; repair visible leaks regardless of quantity of leakage.

Table 14: Allowable leakage (exfiltration) for precast concrete manholes

Manhole Depth (feet)	Allowable Leakage (in inches based on manhole diameter)		
	4 Foot Diameter Manhole	5 Foot Diameter Manhole	6 Foot Diameter Manhole
Less than 24	See appropriate section for vacuum test		
26	0.74	0.93	1.11
28	0.79	0.99	1.19
30	0.85	1.06	1.28

B. Perform a vacuum test for manholes less than or equal to twenty-four feet (24 ft) deep.

1. Test shall include the joint between manhole and frame. Plug and brace pipe openings.
2. All manholes shall be tested via vacuum testing per ASTM C1244 except that the minimum test times shall be defined in Table 15 (test times modified from those in ASTM C1244). The vacuum test unit shall be placed at the top of the manhole structure to include the frame/cone interface/seal in the test. A plate test unit will likely be required to perform the test. Bladder units can be used as long as the bladder does not cover the interface of the frame and the cone section.
3. Vacuum tests shall be performed by placing the testing unit at the top of the manhole in accordance with the manufacturer's recommendations. A vacuum of ten inches of mercury (10 inHg) shall be drawn on the manhole, the valve on the vacuum line of the test unit closed, and the vacuum pump

shut off. The time shall be measured for the vacuum reading to drop from ten inches of mercury (10 inHg) to nine inches of mercury (9 inHg) meets or exceeds the test times indicated in Table 15. The test times are modified from those in ASTM C1244. If the actual manhole diameter falls between those listed in the table below, use the test times for the next larger diameter. This table shall be included in the contractor’s test reports. Refer to ASTM C1244 for further requirements.

4. If manhole fails the test, make necessary repairs, and repeat the vacuum test and repairs until manhole passes test.

Table 15: Minimum allowable vacuum test times for precast concrete manholes

Manhole Depth (feet)	4 Foot Diameter Manhole Test Time (seconds)	5 Foot Diameter Manhole Test Time (seconds)	6 Foot Diameter Manhole Test Time (seconds)
4	60	60	60
6	60	60	60
8	60	60	60
10	60	66	82
12	60	78	98
14	70	92	114
16	80	104	132
18	90	118	148
20	100	130	162
22	110	144	178
24	118	156	194
Greater than 24	See appropriate section for allowable leakage (exfiltration) test		

5.5.2 Polymer Concrete Manholes

5.5.2.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.5.2.2 Inspection

Verify excavation for manholes to proper depth and proper placement of bedding material in accordance with specifications.

5.5.2.3 Placing Manhole Sections

- A. Place polymer manhole sections plumb and level and adjust to correct elevation. Provide bedding material in accordance with specifications.
- B. After manhole assembly, plug lift holes with non-shrink grout.
- C. Cut and fit for pipe connections.
- D. Jointing
 1. Sealing surfaces and joint compounds shall be inspected for damage and cleaned of all debris.
 2. Apply joint lubricant to elastomeric seals. Use only lubricants approved by the manufacturer.
 3. Use suitable equipment and set manholes.
 4. Placement and compaction of surrounding backfill material shall be applied so as to provide sufficient and equal side pressure on the manhole.
- E. Invert Channels
 1. Built up with concrete, grout, or brick and mortar covered by at least two inches (2 in.) of mortar.
 2. Smooth and semicircular, conforming to inside of adjacent sewer section.
 3. Changes in direction of flow made with a smooth curve radius as large as manhole size will permit.
 4. Slope floor of manhole outside channels, smooth, and not less than one inch per foot (1 in./ft) nor more than two inches per foot (2 in./ft).
- F. Drop Pipe
 1. A drop pipe shall be provided for a sewer entering a manhole at an elevation of twenty-four inches

(24 in.) or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than twenty-four inches (24 in.), the invert shall be filleted to prevent solids deposition.

2. Drop manholes shall be constructed with an outside drop connection. The entire drop pipe shall be encased in concrete per SECTION 3.3.6(A).

G. Set manhole frames and covers level to correct elevations.

5.5.2.4 Pipe Connections to Existing Manholes

Pipe connections to existing manholes shall be made in such a manner that the finished work will conform as nearly as practical to the essential requirements specified for new manholes, including all necessary concrete work, cutting, and shaping.

5.5.2.5 Testing

A. Perform an allowable leakage (exfiltration) test prior to backfilling around manholes deeper than twenty-four feet (24 ft) deep.

1. Plug pipes in manhole; remove water in manhole; observe plugs over period of not less than two (2) hours to ensure there is no leakage into manhole.
2. Determine groundwater level outside manhole.
3. Fill manhole with water to within four inches (4 in.) of top of cover frame. Prior to test, allow manhole to soak from minimum of four (4) hours to maximum of seventy-two (72) hours; after soak period, adjust water level inside manhole to within four inches (4 in.) of top of cover frame.
4. Measure water level from top of manhole frame; at end of four (4) hour test period, again measure water level from top of manhole frame; compute drop in water level during test period.
5. Manhole exfiltration test is considered satisfactory when drop in water level is less than values listed in Table 16.
6. When unsatisfactory test results are achieved, repair manhole and retest until result meets criteria; repair visible leaks regardless of quantity of leakage.

Table 16: Allowable leakage (exfiltration) for polymer concrete manholes

Manhole Depth (feet)	Allowable Leakage (in inches based on manhole diameter)		
	4 Foot Diameter Manhole	5 Foot Diameter Manhole	6 Foot Diameter Manhole
Less than 24	See appropriate section for vacuum test		
26	0.74	0.93	1.11
28	0.79	0.99	1.19
30	0.85	1.06	1.28

B. Perform a vacuum test for manholes less than or equal to twenty-four feet (24 ft) deep.

1. Test shall include the joint between manhole and frame. Plug and brace pipe openings.
2. All manholes shall be tested via vacuum testing per ASTM C1244 except that the minimum test times shall be defined in Table 17 (test times modified from those in ASTM C1244). The vacuum test unit shall be placed at the top of the manhole structure to include the frame/cone interface/seal in the test. A plate test unit will likely be required to perform the test. Bladder units can be used as long as the bladder does not cover the interface of the frame and the cone section.
3. Vacuum tests shall be performed by placing the testing unit at the top of the manhole in accordance with the manufacturer’s recommendations. A vacuum of ten inches of mercury (10 inHg) shall be drawn on the manhole, the valve on the vacuum line of the test unit closed, and the vacuum pump shut off. The time shall be measured for the vacuum reading to drop from ten inches of mercury (10 inHg) to nine inches of mercury (9 inHg) meets or exceeds the test times indicated in Table 17. The test times are modified from those in ASTM C1244. If the actual manhole diameter falls between those listed in the table below, use the test times for the next larger diameter. This table shall be included in the contractor’s test reports. Refer to ASTM C1244 for further requirements.

4. If manhole fails the test, make necessary repairs, and repeat the vacuum test and repairs until manhole passes test.

Table 17: Minimum allowable vacuum test times for polymer concrete manholes

Manhole Depth (feet)	4 Foot Diameter Manhole Test Time (seconds)	5 Foot Diameter Manhole Test Time (seconds)	6 Foot Diameter Manhole Test Time (seconds)
4	60	60	60
6	60	60	60
8	60	60	60
10	60	66	82
12	60	78	98
14	70	92	114
16	80	104	132
18	90	118	148
20	100	130	162
22	110	144	178
24	118	156	194
Greater than 24	See appropriate section for allowable leakage (exfiltration) test		

END OF SECTION 5.5

5.6 SERVICE PIPE AND CONNECTIONS

5.6.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.6.2 Approved Manufacturers

See materials stated within SECTION 5.6.4, which vary based on application.

5.6.3 Installation for New Sewer Mains

- A. Service lines shall be properly installed at the required locations. All wyes, bends, service pipe, and other appurtenances shall be provided as required for each connection. All joints shall be installed so as to provide watertight connections.
- B. Wye joints shall be installed as directed with the branch turned to the proper direction, or as specified. Wyes shall be firmly supported by methods and materials used for bedding of main line pipe. Branch of wyes shall be installed at an angle of forty-five (45°) to the pipe springline as long as grade requirement allows.
- C. Bends for service lines shall be placed in the wyes where necessary for proper alignment.
- D. When installed during sewer line construction, service pipe shall be installed to the proper line and grade from the sewer line to the property line at a grade of at least one quarter of an inch per foot (0.25 in./ft). Backfilling and bedding procedures shall be as for sewer mains. Watertight plugs shall be installed in the end of service line stubs. Plugs shall be as recommended by the pipe manufacturer and shall be installed in accordance with the manufacturer's recommendations. Suitable markers shall be installed at the ends of service line stubs for above ground location. A suitable marker shall include a section of pipe of the same material as the service line extended two feet above the ground surface.

5.6.4 Service Line Installation for Existing Sewer Mains

- A. Minimum pipe size connection to existing sewer lines or manholes shall be four inches (4 in.) unless associated with a grinder pump for individual user (see SECTION 2.5.4)
- B. Taps into existing sewer mains shall use a gasketed fitting in conjunction with the approved Main Line Tapping Saddles. Saddles shall be mounted on pipe in accordance with manufacturer's recommendations.
- C. Taps into manholes shall be made by coring the manhole wall and installing a manhole boot of the proper size

as stated in Table 18.

Table 18: Manhole bore hole diameters based on pipe diameters

Nominal Pipe Size (inches)	Bore Hole Diameter NOT TO EXCEED (inches)	Nominal Pipe Size (inches)	Bore Hole Diameter NOT TO EXCEED (inches)
2.0-3.9	7.0	12.0	24.0
4.0	8.0	15.0	27.0
6.0	12.0	18.0	30.0
8.0	16.0	Other	As required by OJRSA
10.0	20.0		

- D. Sewer mains shall only be tapped when no service line stub is available or when service line stub cannot be located. Service lines shall be installed at an angle of forty-five (45°) to the springline as long as grade requirements allow.
- E. Ties to Existing Service Line Stubs (see Detail D030 SEWER LATERAL AND CLEANOUT)
1. The connection shall be made with the proper watertight connector suitable for the particular application.
 2. The connection shall remain visible until it has been inspected by OJRSA.
 3. Backfill shall be carefully placed and tamped around the connection in order to prevent settlement or movement.
- F. Taps to Sewer Mains (see Details D031 SEWER LATERAL ON EXISTING GRAVITY SEWER, D032 SADDLE CONNECTION FOR LIVE STREAM WASTEWATER MAINS, and D033 DEEP SEWER LATERAL)
1. Tapping saddles shall be installed in accordance with manufacturer's recommendations.
 2. Holes for tapping saddles shall be made by mechanical hole cutters or by keyhole saw or saber saw only. Holes shall be laid out with a template at an angle of forty-five degrees (45°) to the vertical (unless prohibited by grade requirements) and shall be deburred and carefully beveled to provide a smooth hole shaped to conform to the fitting. Care shall be taken to prevent any foreign material from entering the cut-in pipe opening. Any material or debris that enters the line shall be removed.
 3. The service line shall be connected to the tapping saddle by means of a fixture specified by the tapping saddle manufacturer.
 4. If the integrity of the sewer main is breached during installation of the tap:
 - (a) Where installation of the tap causes visible cracks or splits in clay sewer lines, the sewer main shall be encased in concrete for the full length of the cracked pipe.
 - (b) Where installation of the tap causes visible cracks or splits in PVC sewer lines, the cracked sewer line shall be cut out and replaced with a section of the appropriate size SDR 35 PVC using gasketed, PVC, bell x bell or bell x spigot couplings. OJRSA shall determine the length of damaged sewer main to be replaced to remove all damaged material. **"FERNCO" OR SIMILAR RUBBER STRAPPED COUPLINGS REQUIRE APPROVAL BEFORE USE IN MAKING SEWER MAIN CONNECTIONS.**
 - (c) Any sewer lines damaged during installation of a tap shall be repaired by the contractor at no cost to OJRSA. Repairs shall meet OJRSA standards.
 5. The contractor shall pump the trench as dry as necessary to make the complete connection visible at the time of inspection.
 6. Backfill shall be carefully placed and tamped around the connection in order to prevent settlement or movement. Where a cracked pipe is encased in concrete, backfilling shall not commence until the encasement has hardened.
- G. Taps to Manholes (see Details D010 INSIDE DROP MANHOLE and D011 OUTSIDE DROP MANHOLE)
1. Service line shall enter manhole at an angle at least ninety degrees (90°) relative to the direction of flow.
 2. For Manholes Less Than or Equal to Twelve Feet (12 ft) Deep

- (a) Contractor shall core drill the manhole wall directly above manhole bench to a diameter specified by the manhole boot manufacturer. If the slope of the bench is less than two and a half inches per foot (< 2.5 in/ft), the invert of the service line shall enter the manhole six inches (6 in.) above the bench, and a suitable service invert formed on the bench.
 - (b) Pipe connections shall be made by a flexible synthetic rubber boot mechanically clamped to the manhole and to the pipe in order to provide a watertight seal and designed to accommodate pipe movement up to two inches (2 in.) radically or twenty-two degrees (22°) angularly in any direction. The synthetic rubber boot shall have a minimum wall thickness of three-eighths inches (0.375 in.). The synthetic rubber boot material shall conform to ASTM C923. Bands, clamps, and other metal accessories shall be of Type 304 stainless steel.
 - (c) Approved Manufacturers: Manhole boots shall be:
 - (i) Kor-N-Seal,
 - (ii) PSX Direct Drive, or
 - (iii) OJRSA-approved equal.
 - (d) The void area inside the manhole boot shall be filled with non-shrink grout and walls shall be troweled smooth with such as Preco Plug or OJRSA-approved equal.
 - (e) A curved trough shall be formed in the manhole bench to direct flow into the main invert. If the service enters below the bench, the bench must be removed, and a new trough must be formed.
 - (f) Inspection shall occur before backfilling begins. Work must be entirely visible during inspection.
 - (g) Backfill shall be carefully placed and tamped around the connection to prevent settlement or movement and shall begin only after non-shrink grout has sufficiently hardened.
3. For manholes more than twelve feet (12 ft) deep, an inside drop may be installed. Inside drops on existing four foot (4 ft) inside diameter manholes are allowed for six inch (6 in.) services; however, it is critical that the drop be constructed in order to minimize the intrusion into the manhole. (see Detail DO10 INSIDE DROP MANHOLE)
- (a) Contractor shall core drill the manhole wall a minimum of four feet (4 ft) below the ground surface.
 - (b) Pipe connections shall be made by a flexible synthetic rubber boot mechanically clamped to the manhole and to the pipe in order to provide a watertight seal and designed to accommodate pipe movement up to two inches (2 in.) radically or twenty-two (22°) angularly in any direction. The synthetic rubber boot shall have a minimum wall thickness of three-eighths inches (0.375 in.). The synthetic rubber boot material shall conform to ASTM C923. Bands, clamps, and other metal accessories shall be of Type 304 stainless steel.
 - (c) Approved Manufacturers: Manhole boots shall be:
 - (i) Kor-N-Seal,
 - (ii) PSX Direct Drive, or
 - (iii) OJRSA-approved equal.
 - (d) Service pipe shall be inserted through the manhole wall.
 - (e) A tee shall be placed on the pipe with run horizontal for clean out, and a PVC plug, with a section removed, shall be inserted in the run of the tee. The plug shall prevent high flows from overrunning the drop but permit the use of rodding tools for cleaning.
 - (f) The drop pipe shall extend to the manhole bench and a forty-five degree (45°) bend shall be installed on the end. The forty-five degree (45°) bend shall be rotated toward the direction of water flow in the invert.
 - (g) Inside piping shall be secured to the manhole wall by means of a stainless-steel strap spaced every four feet (4 ft) vertically and securely anchored to the manhole wall. The space between the entering pipe and the manhole opening shall be sealed with a non-shrink grout.
 - (h) A curved trough shall be formed in the manhole bench to direct flow into the main invert. The trough shall extend beyond the opening of the forty-five degree (45°) bend to its curvature or

- change in direction.
- (i) The void area inside the manhole boot shall be filled with non-shrink grout and walls shall be troweled smooth with such as Preco Plug or OJRSA-approved equal.
 - (j) Inspection shall occur before backfilling begins. Work must be entirely visible during inspection.
 - (k) Backfill shall be carefully placed and tamped around the connection to prevent settlement or movement and shall begin only after non-shrink grout has sufficiently hardened.
 - (l) OJRSA can reject the installation of an inside drop for any reason. If an inside drop is planned, the contractor shall seek approval prior to continuing work.
4. If a tap fails inspection, the connection shall be corrected at no additional cost to OJRSA.

END OF SECTION 5.6

5.7 WET WELLS AND VAULTS

5.7.1 Precast Concrete Wet Wells and Vaults

5.7.1.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.7.1.2 Inspection

- A. Verify excavation for vaults to proper depth and proper placement of bedding material in accordance with specifications.
- B. The contractor shall inspect all components prior to unloading them from the truck.

5.7.1.3 Preparation

- A. The contractor shall prepare the excavation for the installation of the units by placing #57 stone to the depth required. The stone bed should be leveled prior to setting the base section.
- B. The contractor shall coordinate delivery with manufacturer, handle, and store the components in accordance with ASTM C891 and the manufacturer's recommendations using methods that will prevent damage to the components.
- C. The contractor shall determine the proper orientation of the units on the site prior to setting the base section. Take care to ensure that the openings for the influent lines and the pipe stubbed out for connections align properly with their tie-ins.
- D. Clean and dry all precast joint surfaces prior to setting of concrete sections.

5.7.1.4 Installation

- A. Set the base section level and plumb on the crushed stone base.
- B. Apply the butyl rubber joint sealant to the base section groove. Be sure the joint surfaces are clean and dry before applying.
- C. Set risers and top section using the manufacturer's alignment marks.
- D. Fill the voids between joints with a sand/cement grout.
- E. Plug the lift holes in the structure sections if there is less than two inches (< 2 in.) of wall thickness existing. Use a sand/cement mortar to fill the holes.

5.7.1.5 Testing

- A. Perform an allowable leakage (exfiltration) test prior to backfilling around precast concrete structures deeper than twenty-four feet (24 ft) deep.
 - 1. Plug pipes in structure; remove water in structure; observe plugs over period of not less than two (2) hours to ensure there is no leakage into structure.
 - 2. Determine groundwater level outside structure.
 - 3. Fill manhole with water to within four inches (4 in.) of top of cover frame. Prior to test, allow struc-

- ture to soak from minimum of four (4) hours to maximum of seventy-two (72) hours; after soak period, adjust water level inside manhole to within four inches (4 in.) of top of cover frame.
4. Measure water level from top of structure frame; at end of four (4) hour test period, again measure water level from top of structure frame; compute drop in water level during test period.
 5. Structure exfiltration test is considered satisfactory when drop in water level is less than values listed in Table 19.
 6. When unsatisfactory test results are achieved, repair structure and retest until result meets criteria; repair visible leaks regardless of quantity of leakage.
 7. **FOR STRUCTURES WITH DIFFERENT DIAMETERS OR RECTANGULAR STRUCTURES, LEAKAGE SHALL NOT EXCEED ONE GALLON PER FIFTY SQUARE FEET (1 gal/50 ft²) OF STRUCTURE WALL PER FOUR (4) HOUR PERIOD.**

Table 19: Allowable leakage (exfiltration) for precast concrete wet wells and vaults

Manhole Depth (feet)	Allowable Leakage (in inches based on manhole diameter)		
	4 Foot Diameter Manhole	5 Foot Diameter Manhole	6 Foot Diameter Manhole
Less than 24	See appropriate section for vacuum test		
26	0.74	0.93	1.11
28	0.79	0.99	1.19
30	0.85	1.06	1.28

- B. Perform a vacuum test for precast concrete structures less than or equal to twenty-four feet (24 ft) deep.
1. Test shall include the joint between structure and frame. Plug and brace pipe openings.
 2. All structures shall be tested via vacuum testing per ASTM C1244 except that the minimum test times shall be defined in Table 20 (test times modified from those in ASTM C1244). The vacuum test unit shall be placed at the top of the structure to include the frame/cone interface/seal in the test. A plate test unit will likely be required to perform the test. Bladder units can be used as long as the bladder does not cover the interface of the frame and the cone section.
 3. Vacuum tests shall be performed by placing the testing unit at the top of the structure in accordance with the manufacturer's recommendations. A vacuum of ten inches of mercury (10 inHg) shall be drawn on the structure, the valve on the vacuum line of the test unit closed, and the vacuum pump shut off. The time shall be measured for the vacuum reading to drop from ten inches of mercury (10 inHg) to nine inches of mercury (9 inHg) meets or exceeds the test times indicated in Table 20. The test times are modified from those in ASTM C1244. If the actual structure diameter falls between those listed in the table below, use the test times for the next larger diameter. This table shall be included in the contractor's test reports. Refer to ASTM C1244 for further requirements.
 4. If structure fails the test, make necessary repairs, and repeat the vacuum test and repairs until structure passes test.
 5. **FOR RECTANGULAR OR OTHER STRUCTURES NOT COVERED HEREIN, THE ENGINEER SHALL PROVIDE CALCULATIONS TO DETERMINE MINIMAL TEST TIMES FOR THE PARTICULAR STRUCTURE.**

Table 20: Minimum allowable vacuum test times for precast concrete wet wells and vaults

Structure Depth (feet)	Manhole or Wet Well Diameter (inches)								
	36	42	48	54	60	66	72	84	96
	Test Time (seconds)								
4	60	60	60	60	60	60	60	60	60
6	60	60	60	60	60	60	60	60	60
8	60	60	60	60	60	60	60	60	60
10	60	60	60	60	66	72	82	98	114
12	60	60	60	70	78	86	98	118	138
14	60	60	70	82	92	102	114	136	158

Structure Depth (feet)	Manhole or Wet Well Diameter (inches)								
	36	42	48	54	60	66	72	84	96
	Test Time (seconds)								
16	60	68	80	92	104	116	132	160	188
18	64	76	90	104	118	130	148	178	208
20	70	84	100	116	130	144	162	194	226
22	78	92	110	128	144	158	178	212	246
24	84	102	118	140	156	174	194	232	270
Greater than 24	See appropriate section for allowable leakage (exfiltration) test								

5.7.2 Polymer Concrete Wet Wells and Vaults

5.7.2.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.7.2.2 Inspection

- A. Verify excavation for wet well to proper depth and proper placement of bedding material in accordance with specifications.
- B. The contractor shall inspect all components prior to unloading them from the truck.

5.7.2.3 Preparation

- A. The contractor shall prepare the excavation for the installation of the units by placing crushed stone to the depth required. The stone bed should be leveled prior to setting the base section.
- B. The contractor shall coordinate delivery with manufacturer, handle, and store the components in accordance with ASTM C891 and the manufacturer’s recommendations using methods that will prevent damage to the components.
- C. The contractor shall determine the proper orientation of the units on the site prior to setting the base section. Take care to ensure that the openings for the influent lines and the pipe stubbed out for connections align properly with their tie-ins.
- D. Clean and dry all precast joint surfaces prior to setting of concrete sections.

5.7.2.4 Placing Wet Well Sections

- A. Place polymer wet well sections plumb and level and adjust to correct elevation. Provide bedding material in accordance with specifications.
- B. After wet well assembly, plug lift holes with non-shrink grout.
- C. Jointing
 - 1. Sealing surfaces and joint compounds shall be inspected for damage and cleaned of all debris.
 - 2. Apply joint lubricant to elastomeric seals. Use only lubricants approved by the manufacturer.
 - 3. Use suitable equipment and set wet wells.
 - 4. Placement and compaction of surrounding backfill material shall be applied so as to provide sufficient and equal side pressure on the wet well.

5.7.2.5 Installation

- A. Set the base section level and plumb on the crushed stone base.
- B. Apply the butyl rubber joint sealant to the base section groove. Be sure the joint surfaces are clean and dry before applying.
- C. Set risers and top section using the manufacturer’s alignment marks.
- D. Fill the voids between joints with a sand/cement grout.
- E. Plug the lift holes in the structure sections if there is less than two inches (2 in.) of wall thickness existing. Use a sand/cement mortar to fill the holes.

5.7.2.6 Testing

- A. Perform an allowable leakage (exfiltration) test prior to backfilling around polymer concrete structures deeper

than twenty-four feet (24 ft) deep.

1. Plug pipes in structure; remove water in structure; observe plugs over period of not less than two (2) hours to ensure there is no leakage into structure.
2. Determine groundwater level outside structure.
3. Fill manhole with water to within four inches (4 in.) of top of cover frame. Prior to test, allow structure to soak from minimum of four (4) hours to maximum of seventy-two (72) hours; after soak period, adjust water level inside manhole to within four inches (4 in.) of top of cover frame.
4. Measure water level from top of structure frame; at end of four (4) hour test period, again measure water level from top of structure frame; compute drop in water level during test period.
5. Structure exfiltration test is considered satisfactory when drop in water level is less than values listed in Table 21.
6. When unsatisfactory test results are achieved, repair structure and retest until result meets criteria; repair visible leaks regardless of quantity of leakage.
7. **FOR STRUCTURES WITH DIFFERENT DIAMETERS OR RECTANGULAR STRUCTURES, LEAKAGE SHALL NOT EXCEED ONE GALLON PER FIFTY SQUARE FEET (1 gal/50 ft²) OF STRUCTURE WALL PER FOUR (4) HOUR PERIOD.**

Table 21: Allowable leakage (exfiltration) for polymer concrete wet wells and vaults

Manhole Depth (feet)	Allowable Leakage (in inches based on manhole diameter)		
	4 Foot Diameter Manhole	5 Foot Diameter Manhole	6 Foot Diameter Manhole
Less than 24	See appropriate section for vacuum test		
26	0.74	0.93	1.11
28	0.79	0.99	1.19
30	0.85	1.06	1.28

B. Perform a vacuum test for polymer concrete structures less than or equal to twenty-four feet (24 ft) deep.

1. Test shall include the joint between structure and frame. Plug and brace pipe openings.
2. All structures shall be tested via vacuum testing per ASTM C1244 except that the minimum test times shall be defined in Table 22 (test times modified from those in ASTM C1244). The vacuum test unit shall be placed at the top of the structure to include the frame/cone interface/seal in the test. A plate test unit will likely be required to perform the test. Bladder units can be used as long as the bladder does not cover the interface of the frame and the cone section.
3. Vacuum tests shall be performed by placing the testing unit at the top of the structure in accordance with the manufacturer's recommendations. A vacuum of ten inches of mercury (10 inHg) shall be drawn on the structure, the valve on the vacuum line of the test unit closed, and the vacuum pump shut off. The time shall be measured for the vacuum reading to drop from ten inches of mercury (10 inHg) to nine inches of mercury (9 inHg) meets or exceeds the test times indicated in Table 22. The test times are modified from those in ASTM C1244. If the actual structure diameter falls between those listed in the table below, use the test times for the next larger diameter. This table shall be included in the contractor's test reports. Refer to ASTM C1244 for further requirements.
4. If structure fails the test, make necessary repairs, and repeat the vacuum test and repairs until structure passes test.
5. **FOR RECTANGULAR OR OTHER STRUCTURES NOT COVERED HEREIN, THE ENGINEER SHALL PROVIDE CALCULATIONS TO DETERMINE MINIMAL TEST TIMES FOR THE PARTICULAR STRUCTURE.**

Table 22: Minimum allowable vacuum test times for polymer concrete wet wells and vaults

Structure Depth (feet)	Manhole or Wet Well Diameter (inches)								
	36	42	48	54	60	66	72	84	96
	Test Time (seconds)								
4	60	60	60	60	60	60	60	60	60
6	60	60	60	60	60	60	60	60	60

Structure Depth (feet)	Manhole or Wet Well Diameter (inches)								
	36	42	48	54	60	66	72	84	96
	Test Time (seconds)								
8	60	60	60	60	60	60	60	60	60
10	60	60	60	60	66	72	82	98	114
12	60	60	60	70	78	86	98	118	138
14	60	60	70	82	92	102	114	136	158
16	60	68	80	92	104	116	132	160	188
18	64	76	90	104	118	130	148	178	208
20	70	84	100	116	130	144	162	194	226
22	78	92	110	128	144	158	178	212	246
24	84	102	118	140	156	174	194	232	270
Greater than 24	See appropriate section for allowable leakage (exfiltration) test								

END OF SECTION 5.7

5.8 PUMP STATIONS

5.8.1 Centrifugal Suction Lift Pumps

5.8.1.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.8.1.2 Inspection

Examine the areas and conditions under which the pumps are to be installed for conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

5.8.1.3 Preparation

Protect structures near the wet well site from damage.

5.8.1.4 Installation

- A. The pumping station shall be constructed so as to conform to all other applicable portions of other sections of these specifications.
- B. The contractor shall install the pumps and other equipment in strict accordance with the manufacturer's instructions. After installation, pump alignments shall be checked and corrected if necessary. Excessive vibration or noise are not acceptable.
- C. The completed installation shall be properly lubricated, checked, and the operating characteristics determined by the manufacturer's representative. Additionally, the amperage draw shall be checked at the design conditions for each pump unit.
- D. Upon inspection by the manufacturer's representative, a letter of certification shall be provided stating that the equipment has been installed in accordance with the manufacturer's recommendations and contains the certified results from all manufacturer's field testing.
- E. A manufacturer's representative shall make one (1) trip consisting of two (2) eight (8) hour days for installation inspection, start-up, and training services.
- F. Electrical wiring, motors, and controls shall be installed and electrically connected in accordance with the Shop Drawings and the manufacturer's recommendations for the equipment supplied and as specified. All electrical work shall be subject to the provisions of the NEC and shall be installed by licensed personnel.

5.8.1.5 Tolerances

Pumps shall be installed plumb and true to the lines and grades as specified.

5.8.1.6 Performance Testing

- A. Notify OJRSA a minimum of forty-eight (48) hours (two (2) business days) prior to flow rate testing.
- B. Each pump shall be tested separately to verify that it delivers the required flow under actual field conditions. The pumps shall also be tested simultaneously to record the pumping capacity of all pumps operating in parallel. A copy of the test results shall be certified by the manufacturer's representative and provided to OJRSA along with the manufacturer's verification of installation.

5.8.1.7 Warranty

The pump manufacturer shall guarantee the complete pumping assemblies one hundred percent (100%) for a period of eighteen (18) months after final acceptance. The pump manufacturer shall provide a sixty (60) month prorated warranty for the remaining duration following final acceptance. The warranty as specified here shall cover all defective parts, material, and workmanship. The responsible manufacturer shall replace all items deemed to be defective without cost to OJRSA.

5.8.2 Submersible Pumps

5.8.2.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.8.2.2 Inspection

Examine the areas and conditions under which the pumps are to be installed for conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

5.8.2.3 Preparation

- A. Protect structures near the wet well site from damage.
- B. Contractor and his personnel shall be familiar with and abide by the applicable provisions of the OSHA regulations at all times during construction.

5.8.2.4 Installation

- A. The pumping station shall be constructed so as to conform to all other applicable portions of other sections of these specifications.
- B. The contractor shall install the pumps and other equipment in strict accordance with the manufacturer's instructions. After installation, pump alignments shall be checked and corrected if necessary. Excessive vibration or noise are not acceptable.
- C. The completed installation shall be properly lubricated, checked, and the operating characteristics determined by the manufacturer's representative. Additionally, the amperage draw shall be checked at the design conditions for each pump unit.
- D. Upon inspection by the manufacturer's representative, a letter of certification shall be provided stating that the equipment has been installed in accordance with the manufacturer's recommendations and contains the certified results from all manufacturer's field testing.
- E. A manufacturer's representative shall make one (1) trip consisting of two (2) eight (8) hour days for installation inspection, start-up, and training services.
- F. Electrical wiring, motors, and controls shall be installed and electrically connected in accordance with the Shop Drawings and the manufacturer's recommendations for the equipment supplied and as specified. All electrical work shall be subject to the provisions of the NEC and shall be installed by licensed personnel.

5.8.2.5 Tolerances

Pumps shall be installed plumb and true to the lines and grades as specified.

5.8.2.6 Performance Testing

- A. Notify OJRSA a minimum of seven (7) business days prior to flow rate testing.
- B. Each pump shall be tested separately to verify that it delivers the required flow under actual field conditions.

The pumps shall also be tested simultaneously to record the pumping capacity of all pumps operating in parallel. A copy of the test results shall be certified by the manufacturer's representative and provided to OJRSA along with the manufacturer's verification of installation.

5.8.2.7 Warranty

The pump manufacturer shall warrant the pump, motor, and guide system to the OJRSA against defects in workmanship and materials for a period of five (5) years under normal use and service. If a guide cable system is used the pump manufacturer shall warrant the guide cable system (including guide cables and brackets) to the OJRSA against defects in workmanship and materials for a period of ten (10) years under normal use and service. Both pump manufacturer warranties shall be in published form and shall apply to all similar units. A copy of each warranty shall be provided to the OJRSA at startup.

5.8.3 Grinder Pumps for Individual Users

5.8.3.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.8.3.2 Inspection

Examine the areas and conditions under which the pumps are to be installed for conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

5.8.3.3 Preparation

Protect structures near the wet well site from damage.

5.8.3.4 Installation

- A. The pumping station shall be constructed so as to conform to all other applicable portions of other sections of these specifications.
- B. The contractor shall install the pumps and other equipment in strict accordance with the manufacturer's instructions. After installation, pump alignments shall be checked and corrected if necessary. Excessive vibration or noise are not acceptable.
- C. The completed installation shall be properly lubricated, checked, and the operating characteristics determined by the manufacturer's representative. Additionally, the amperage draw shall be checked at the design conditions for each pump unit.
- D. Upon inspection by the manufacturer's representative, a letter of certification shall be provided stating that the equipment has been installed in accordance with the manufacturer's recommendations and contains the certified results from all manufacturer's field testing.
- E. Electrical wiring, motors, and controls shall be installed and electrically connected in accordance with the Shop Drawings and the manufacturer's recommendations for the equipment supplied and as specified. All electrical work shall be subject to the provisions of the NEC and shall be installed by licensed personnel.

5.8.3.5 Tolerances

Pumps shall be installed plumb and true to the lines and grades as specified.

5.8.3.6 Performance Testing

- A. Notify OJRSA a minimum of seven (7) business days prior to flow rate testing.
- B. Each pump shall be tested separately to verify that it delivers the required flow under actual field conditions. The pumps shall also be tested simultaneously to record the pumping capacity of all pumps operating in parallel. A copy of the test results shall be certified by the manufacturer's representative and provided to OJRSA along with the manufacturer's verification of installation.

5.8.3.7 Warranty

The pump manufacturer shall warrant the pump, motor, and guide system to the OJRSA against defects in workmanship and materials for a period of five (5) years under normal use and service.

END OF SECTION 5.8

5.9 STANDBY GENERATORS

5.9.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.9.2 Inspection

- A. Examine areas, equipment foundations, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Examine roughing-in of electrical connections. Verify actual locations of connections before packaged engine generator installation.

5.9.3 Installation

- A. Concrete Bases: Install concrete bases of dimensions indicated for packaged engine generators as required by manufacturer.
- B. Comply with packaged engine generator manufacturers' written installation and alignment instructions and comply with NFPA 110.
- C. Set packaged engine generator set on concrete bases.
 - 1. Support generator-set mounting base on rectangular metal blocks and shims or on metal wedges having small taper, at points near foundation bolts to provide three-quarters of an inch (0.75 in.) to one and a half inch (1.5 in.) gap between generator base and foundation for grouting.
 - 2. Adjust metal supports or wedges until generator is level.
- D. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- E. Install condensate drain piping for diesel-engine exhaust system. Extend drain piping from low points of exhaust system and from muffler to condensate traps and to point of disposition.
- F. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted. Verify that electrical wiring is installed according to manufacturers' submittal and NEC. Proceed with equipment startup only after wiring installation is satisfactory.

5.9.4 Connections

Ground Equipment: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

5.9.5 Identification

Identify system components with panel labels and wire tags.

5.9.6 Field Quality Control

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to assist in testing. Report results in writing.
- B. Testing: Perform field quality-control testing under the supervision of the manufacturer's factory-authorized service representative.
- C. Include the following tests:
 - 1. Those recommended by manufacturer.
 - 2. International Electrical Testing Association Tests: Perform each visual and mechanical inspection and electrical and mechanical test stated in NETA ATS for emergency engine generator sets, except omit vibration baseline test. Certify compliance with test parameters for tests performed.
 - 3. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified

here including, but not limited to, the single-step full-load pickup test.

4. Battery Tests: Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery. Verify acceptance of charge for each element of battery after discharge. Verify measurements are within manufacturer's specifications.
 5. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 6. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 7. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding forty inches water gauge (40 in. WG). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
 8. Exhaust Emissions Test: Comply with applicable government test criteria.
 9. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for fifty percent (50%) and one hundred percent (100%) step-load increases and decreases and verify that performance is as specified.
 10. Harmonic-Content Tests: Measure harmonic content of output voltage under twenty-five percent (25%) and at one hundred percent (100%) of rated linear load. Verify that harmonic content is within specified limits.
 11. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, and compare measured levels with required values.
- D. Coordinate tests with tests for transfer switches and run them concurrently.
- E. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- F. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- G. Test instruments shall have been calibrated within the last twelve (12) months, traceable to standards of the NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

5.9.7 Battery Equalization

Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

5.9.8 Cleaning

On completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

5.9.9 Demonstration

Engage a factory-authorized service representative to train OJRSA maintenance personnel to adjust, operate, and maintain packaged engine generators as follows:

- A. Train OJRSA's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
- B. Review data in maintenance manuals.
- C. Schedule training with OJRSA with at least ten (10) days' advance notice.

END OF SECTION 5.9

5.10 TRANSFER SWITCHES

5.10.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.10.2 Wiring to Remote Components

Match type and number of cables and conductors to control and communications requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost if necessary to accommodate required wiring.

5.10.3 Connections

Ground equipment as indicated and as required by NFPA 70.

5.10.4 Field Quality Control

- A. Test transfer-switch products by operating them in all modes. Perform tests recommended by manufacturer under the supervision of manufacturer's factory-authorized service representative. Correct deficiencies and report results in writing. Record adjustable relay settings.
- B. Perform the following field quality-control testing under the supervision of the manufacturer's factory-authorized service representative in addition to tests recommended by the manufacturer:
 1. Before energizing equipment, after transfer-switch products have been installed:
 - (a) Measure insulation resistance phase-to-phase and phase-to-ground with insulation resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Meet manufacturer's specified minimum resistance.
 - (b) Check for electrical continuity of circuits and for short circuits.
 - (c) Inspect for physical damage; proper installation and connection; and integrity of barriers, covers, and safety features.
 - (d) Verify that manual transfer warnings are properly placed.
 - (e) Perform manual transfer operation.
 2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three (3) times.
 - (a) Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - (b) Simulate loss of phase-to-ground voltage for each phase of normal source.
 - (c) Verify time-delay settings.
 - (d) Verify pickup and dropout voltages by data readout or inspection of control settings.
 - (e) Perform contact-resistance test across main contacts and correct values exceeding five hundred microhms (500 $\mu\Omega$) and values for one (1) pole deviating by more than fifty percent (50%) from other poles.
 - (f) Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown sequence.
- C. Coordinate tests with tests of generator plant and run them concurrently.
- D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

5.10.5 Cleaning

- A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean equipment internally on completion of installation according to manufacturer's written instructions.

5.10.6 Demonstration

Engage a factory-authorized service representative to train OJRSA personnel to adjust, operate, and maintain transfer switches and related equipment as specified below:

- A. Coordinate this training with that for generator equipment.
- B. Train OJRSA maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
- C. Review data in maintenance manuals.
- D. Schedule training with OJRSA with at least seven (7) days' advance notice.

END OF SECTION 5.10

5.11 SURGE PROTECTION

5.11.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.11.2 Installation

- A. Comply with NECA 1.
- B. Install overcurrent protection device (OCPD) or disconnect as required to comply with UL listing of the Surge Protection Device (SPD).
- C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible and adjust circuit-breaker positions to achieve **shortest and straightest leads**. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
- D. Use crimped connectors and splices **only**. Wire nuts are not acceptable.

5.11.3 Field Quality Control

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
 - 1. Confirm equipment nameplate data compliance with specifications.
 - 2. Inspect anchorage, alignment, grounding, and clearances.
 - 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. An SPD will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

5.11.4 Startup Service

- A. Complete startup checks according to manufacturer's written instructions.
- B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests and reconnect them immediately after the testing is over.
- C. Energize SPDs after power system has been energized, stabilized, and tested.

5.11.5 Demonstration

Engage a factory-authorized service representative to train OJRSA maintenance personnel to operate and maintain SPDs.

END OF SECTION 5.11

5.12 SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

5.12.1 Surface Conditions

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

5.12.2 Installation

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
- B. Install the work of this Section in strict accordance with the original design and the manufacturer's recommended installation procedures. Install remote terminal units in accordance with manufacturer and supplier's recommendations.
 - 1. Delineate timing of RTU installation and commissioning.
 - 2. Conform to NEC and local codes.
 - 3. Label inputs as to their purpose on enclosure lid schematic.
 - 4. Terminations Inside RTU Enclosure: Low voltage.
 - 5. Provide manufacturer's representative inspection of sites prior to completion.
 - 6. Test inputs for successful transmission prior to OJRSA acceptance.
 - 7. Adjust antenna placement or elevation to obtain consistent, stable system operation.
- C. Perform All Wiring
 - 1. A licensed electrical contractor shall make final connections and/or terminations for all power wiring that is at least one hundred twenty volts (120 V).
 - 2. Final connections and/or terminations for all signal, data, and low voltage control wiring (shielded cable, fiber optic cable, and #14 AWG wiring) shall be made by the appropriate system or equipment vendor or integrator.

5.12.3 Applications Software Development

Provide user interface website to include graphics displays for each remote site. Reports, graphics displays, real-time trends, historical trends, security, and alarming shall be developed or modified by the Instrumentation and Control System Integrator. The Instrumentation and Control System Integrator shall design graphics displays for each new or improved remote site.

5.12.4 Training

- A. System supplier to provide operation and maintenance training for OJRSA's personnel to ensure their adequate knowledge of use of the system.
- B. Training to be conducted on-site by instructors thoroughly familiar with operation of the system, with training divided into three (3) general areas as follows:
 - 1. Analog and Digital Hardware Maintenance Training
 - (a) Instruct OJRSA's maintenance personnel in the proper preventative maintenance and repair tasks associated with system maintenance.
 - (b) For analog instrumentation include detailed calibration and checking instruction along with familiarization training for basic repair and maintenance tasks expected to be encountered.
 - (c) For computer hardware maintenance, include general familiarization with computer hardware and peripheral devices with instruction in preventative maintenance tasks associated primarily with peripheral devices. It is not intended that this course will produce trained computer maintenance technicians.
 - (d) Include detailed instruction in maintenance and repair work associated with the computer process I/O sub-system.
 - 2. Operator Familiarization Training
 - (a) Instruct OJRSA's operating personnel in the proper use of the analog and digital process control system.

- (b) Include instruction in the system control steps and basic interface with the computer system.
 - (c) Provide sufficient training to OJRSA's operating personnel so they can respond to the normal tasks required for operation of the plant.
3. Supervisor and Application Software Training
- (a) Provide supervisory personnel with a working knowledge of all application software supplied.
 - (b) Include basic digital and computer concepts, process control concepts, database configuration, report configuration, graphic display configuration, and control strategy development.

5.12.5 Start-Up Services

- A. System supplier to be responsible for placing of SCADA equipment and systems in operation.
- B. System supplier is to provide qualified personnel on the job site until successful operation of system is attained.

END OF SECTION 5.12

5.13 GENERAL ELECTRICAL PROVISIONS

5.13.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.13.2 Work Included

- A. The contractor shall provide all labor, materials, and equipment indicated or reasonably implied to carry out the intent of the work complete.
- B. The contractor shall be responsible for the mounting of and the final electrical connections to all electrical equipment and devices.
- C. Final termination of all power feeders and branch circuits to all motors and other power consuming equipment.

5.13.3 Supervision and Scheduling

- A. Work shall be properly supervised at all times by a field supervisor or competent foreman employed by and representing the contractor.
- B. The contractor shall acquaint themselves with the plans for shop drawings as necessary to properly install equipment, conduits, etc. at proper stage of construction and shall work in advance of the others as required to eliminate all cutting and patching possible.
- C. In the event the project requirements necessitate disconnecting or temporary shutting down of any existing electrical services or systems, it shall be the contractor's responsibility to coordinate such down time(s) with OJRSA.

5.13.4 Additions, Renovations, and Demolitions

- A. No requests for additional compensation will be considered for work which a thorough examination of existing conditions would have shown was reasonably required in order to properly complete the work.
- B. Disconnect, relocate, and reconnect any existing electrical equipment shown or required to be removed or relocated. Contractor shall safeguard all existing equipment from damage during construction.
- C. Disconnect, disassemble, and remove all existing electrical materials and equipment shown for demolition or removal or required to be removed to complete the work. Deliver and turn over to OJRSA all materials specified as remaining the property of OJRSA. Remove from the site and dispose of all other materials.
- D. All work in existing areas shall be done in such a manner as to minimize any disturbance to existing operations. Any power outages shall be as short as possible and shall be coordinated with OJRSA. Schedule power outages for weekends or nights if required by OJRSA. Inform OJRSA and local fire department and/or security alarm provider of any alterations or shutdowns which will disrupt any of the life safety systems.

5.13.5 Cutting, Drilling, and Patching

- A. To avoid unnecessary cutting of the structures, all inserts and conduit or cable sleeves required in the general construction for completion of the work specified herein shall be furnished and installed by the contractor in time to avoid delay in the general construction.
- B. Should any cutting of the structures be required to provide sleeves and other openings the contractor shall perform all the necessary cutting and patching. Do not cut, drill, or core any structural members except with approval.
- C. Seal with suitable materials all openings in masonry or concrete, roofs, sidewalls, etc. All openings in floors under consoles, switchgear, etc. open to atmosphere are to include as a firestop a closed-cell structure foaming agent that meets or exceeds Factory Mutual Class I Specification for Combustion. The agent used shall be listed to maintain the fire/smoke rating of the structure penetrated.

5.13.6 Touch-Up Painting

The contractor shall be responsible for restoring all electrical equipment to its original condition, which includes touch-up painting as required.

Clean-Up

- A. Clean interior of all panel cabinets, pull boxes, and other equipment enclosures.
- B. Wash and wipe clean all lighting fixtures, lamps, and other electrical equipment which may have become soiled during the installation.

5.13.7 Demonstration of Completed Electrical Systems

- A. The contractor shall demonstrate proper operation of all electrical systems and equipment in the presence of the appropriate building code authority.
- B. Make such changes as directed to make installation comply with the plans and specifications.
- C. Repair or replace all faulty work and/or equipment.
- D. The contractor shall furnish for transmittal to OJRSA one (1) hard copy and one (1) electronic copy of instruction books and manufacturer's installation/operation/maintenance data for all electrical equipment purchased by the contractor. Instruction books and other data shall include a list of spare parts for this equipment.

5.13.8 Warranty

The contractor shall warrant the completed electrical system to be free from mechanical and electrical defects for a period of one (1) year from the date of Substantial Completion.

END OF SECTION 5.13

5.14 FLOW METERS

5.14.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.14.2 Inspection

Examine the areas and conditions under which the pumps are to be installed for conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

5.14.3 Installation

Install in accordance with ANSI C2, NFPA 70, and the requirements specified herein.

5.14.4 Inspection and Testing

If, during the guarantee period, it appears that flow metering and recording equipment is not performing adequately, the system shall be tested by the equipment manufacturer in conjunction with the engineer, OJRSA, and independent testing laboratory as specified by the engineer. If tests show equipment is not performing satisfactorily, the manufacturer shall immediately replace the equipment with new equipment which shall be subject to the provisions specified herein. Removal and replacement costs shall be paid by the equipment manufacturer as specified by the guarantee.

5.14.5 Service

The equipment manufacturer shall provide the service of an engineer who is specifically trained on the type of equipment specified herein. The engineer's assistance shall be provided for a period of no less than one (1) eight (8) hour day during construction to assist the contractor in the methods of installation of conduit, cable, equipment, and protection of equipment, calibration, start-up, and instruction prior to placing into service. During the first year of operation, there may be a maximum of four (4) one (1) one day service calls for calibration and repair of the equipment, as necessary, to ensure the proper operation of the system. Cost of such service calls shall be included in the bid. The minimum days specified above do not relieve the manufacturer of the responsibility to provide the necessary service for satisfactory operation of the system. A complete written report shall be submitted to the OJRSA and design engineer after each service visit detailing the reason for the service call and recommendations to prevent reoccurrence.

5.14.6 Operator Training

Manufacturer shall conduct a training course for operators during regularly scheduled hours. This time shall be included in the service time specified above. Expenses of travel by the manufacturer's representative shall be included in the contract price for the equipment. Training shall include operation and maintenance procedures and common problems and solutions.

5.14.7 Equipment Protection

Lightening and surge suppression devices shall be provided with all instrumentation equipment.

5.14.8 Warranty

Equipment warranty will begin on the date the equipment is placed in service and the OJRSA receives beneficial use thereof. The guarantee shall extend for twelve (12) months after this date. In the event of failure of any system due to mechanical defects or faulty installation during the guarantee period, the contractor shall remove and replace the defective or faulty equipment, including, but not limited to, removal, freight, installation, and any other costs incidental thereto. In the event of failure of any system due to faulty equipment during the guarantee period, the manufacturer shall remove and replace the faulty equipment, including, but not limited to, removal, freight, installation, and any other costs incidental thereto. A copy of the warranty shall be provided to the OJRSA at startup.

END OF SECTION 5.14

5.15 VALVES

5.15.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.15.2 Inspection

Examine the areas and conditions under which valves are to be installed for conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

5.15.3 Installation

- A. Install valves to the same specification which covers the piping to which these items are connected.
- B. Installation of Taps by Contractor
 - 1. General: All material supplied and drilling and tapping equipment used to make taps shall be serialized in accordance with AWWA Standards.
 - 2. After the tapping sleeve and valve have been installed and before the tap is made, the sleeve shall be tested to ensure a watertight joint. A test plug will be provided in the sleeve and, after the sleeve has been installed, it will be filled with water and the pressure increased to one hundred fifty pounds per square inch (150 psi). All leaking joints will be repaired at the contractor's expense.

END OF SECTION 5.15

5.16 PAINTING

5.16.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.16.2 Installation Conditions

- A. Do not apply paint in snow, rain, fog, or mist. Do not apply paint when the relative humidity exceeds eighty-five (85%) or to damp or wet surfaces unless otherwise permitted by the paint manufacturer's printed instructions.
- B. Apply interior coatings when the surfaces to be painted are dry and the temperature can be kept above forty-five degrees Fahrenheit (45°F) and below ninety-five degrees Fahrenheit (95°F) during the application of ordinary paints and between sixty-five degrees Fahrenheit (65°F) and ninety-five degrees Fahrenheit (95°F) during the application of enamels or varnishes.
- C. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the manufacturer during application and drying periods.

5.16.3 Inspection

- A. Examine the area and conditions under which painting work is to be applied and provide written notification of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Starting of painting work will be construed as acceptance of the surfaces and conditions within any particular area. Do not paint over dirt, rust scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

5.16.4 Preparation of Surfaces

- A. General
 - 1. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
 - 2. Remove or mask all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove if necessary for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.
- B. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program the cleaning and painting so that contaminants from the cleaning process will not fall onto wet, newly-painted surfaces. Treat and remove all contaminants. Correct all defects. Cleaning must be in accordance with the manufacturer documented recommendations.
- C. Cementitious Materials

1. Prepare cementitious surfaces of concrete block to be painted in accordance with SSPC-SP-13/NACE 6 and ensure removing all efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
 2. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint. Do not paint over surfaces where the moisture content exceeds that permitted in the manufacturer's printed directions.
- D. Ferrous Metals: In accordance with appropriate SSPC-SP/NACE standard, remove dirt and grease with mineral spirits and wipe dry with clean cloths. Remove rust, mill scale, and defective paint down to sound surface using scraper, sandpaper, or wire brush as necessary. Grind if necessary to remove shoulders at edge of sound paint to prevent flaws from photographing through finish coats. Touch-up bare metal and damaged shop coats with specified rust-inhibitive primer. Necessary touching up of shop primer shall be done on ferrous metal surfaces of items installed adjacent to masonry prior to any openings between metal surfaces and adjacent surfaces being filled in or caulked.
- E. Galvanized Surfaces: Comply with SSPC-SP 16.

5.16.5 Materials Preparation

- A. Colors and Scheduling: Secure approval of color samples before applying any paint or finish. Priming coats and undercoats shall be tinted to approximate shade of final coat. Furnish schedule showing when respective coats of paint for the various areas and surfaces are to be applied. Keep schedule current as job progress dictates.
- B. Labor, Tools and Materials: Employ only skilled mechanics. Application may be by brush, roller, or spray in accordance with manufacturer's published recommendation, except for specific cases specified otherwise. Keep equipment clean and in condition to provide quality job specified. Do not use same brush for application of paint on smooth surfaces which have been used to paint concrete. Materials shall be mixed, thinned, modified, and applied only as specified by manufacturer's directions on container. Successive coats of material applied to a surface shall be of compatible chemical composition.
- C. Mixing
1. Mix and prepare painting materials in accordance with manufacturer's directions.
 2. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.
 3. Stir materials before application to produce a mixture of uniform density and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film and if necessary, strain the material before using.

5.16.6 Application

- A. General
1. Before painting is started in any area, broom-clean it and remove excessive dust from all areas to be painted. Broom cleaning after painting operations begin in a given area will not be allowed; cleaning shall then be done with only commercial vacuum cleaning equipment. Provide adequate illumination in all areas where painting operations are in progress.
 2. Surfaces shall be clean, dry, and protected from dampness. Moisture content shall be less than or equal to twenty percent (20%) as tested with a moisture testing meter.
 3. Test areas frequently enough to assure that no finish is applied to surface with moisture in excess of above limitation. Surfaces shall be smooth, even, and true to plane. Surfaces shall be free of any foreign material which will adversely affect adhesion or appearance of applied coating.
 4. Apply paint in accordance with the manufacturer's direction. Use applicators and techniques best suited for the substrate and type of material being applied.
 5. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint until the paint film is of uniform finish, color and appearance. Give special attention to ensure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film

thickness equivalent to that of flat surfaces.

6. Sand lightly between each succeeding enamel or varnish coat.
7. Omit the first coat (primer) on metal surfaces which have been shop primed with compatible and approved primer and/or touch-up paint, unless otherwise indicated.

B. Scheduling Painting

1. Apply the first coat material to surfaces that have been cleaned, pre-treated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent deterioration.
2. Allow sufficient time between successive coatings to permit proper drying. Do not re-coat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and the applications lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness

1. Apply each material at not less than the manufacturer's recommended spreading rate to establish a total dry film thickness as indicated or as recommended by coating manufacturer.
2. If paints are thinned for spraying, the film thickness after application shall be the same as though the unthinned paint were applied by brush. That is, the addition of a thinner shall not be used as a means of extending the coverage of the paint, but the area covered shall be no greater than the area which would have been covered with the same quantity of unthinned paint.

D. Steel Work and Iron Work

1. Before being erected or set, those parts of ironwork and steelwork which are to be embedded in concrete or masonry shall be given one field coat of the same type of paint as the shop coat. This provision does not apply to concrete reinforcement, steel conduits, and accessories.
2. Steel work and light iron work, neither exposed to view nor embedded in masonry, and for which no other painting is specified, shall be given two field coats of the same type of paint as the shop coat.
3. The touch-up coat and first coat of paint shall be applied to all steel work and light ironwork immediately upon arrival at the site.

E. Drying Time: The minimum time to be in accordance with manufacturer's requirements.

F. Prime Coats

1. Apply a prime coat to material which is required to be painted or finished, and which has not been prime coated by others.
2. Re-coat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat to assure a finish coat with no burn through or other defects due to insufficient sealing.

G. Mechanical and Electrical Work

1. Painting of mechanical and electrical work is limited to those items exposed in mechanical equipment rooms and in occupied spaces.
2. Mechanical items to be painted include, but are not limited to, piping, pipe hangers, and supports.
3. Electrical items to be painted include, but are not limited to, conduit and fittings.

H. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. *Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.*

I. Field Adjustment of Final Coat: Minor tinting to adjust finish coat to either lighter or darker shade shall be done in field as directed.

J. Pipe Identification and Color Coding: In addition to any other specified painting for exposed interior piping, stencil a legend showing the name of the contents and an arrow showing the direction of flow on each pipe. The color of piping shall be selected in accordance with [Ten State Standards](#). The size and location of the legend shall be in accordance with ASME A13.1.

5.16.7 Clean-Up and Protection

A. Clean-Up

1. During the progress of the work, remove from the site all discarded paint materials, rubbish, cans, and rags the end of each workday.
2. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove

spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Protection

1. Whether to be painted or not, protect against damage by painting and finishing work. Correct any damage by cleaning, repairing, or replacing and repainting as acceptable to OJRSA.
2. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings.
3. Protect work of other trades provided by others for protection of their work after completion of painting operations.
4. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

END OF SECTION 5.16

5.17 PROTECTIVE COATINGS FOR CONCRETE WET WELLS, VAULTS, AND MANHOLES

5.17.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.17.2 Acceptable Applicators

- A. Repair mortar must be applied by manufacturer trained and approved applicators. The cementitious mortar shall be applied according to manufacturer's recommendations.
- B. Protective coating must be applied by a Certified Applicator of the protective coating manufacturer and according to manufacturer specifications.

5.17.3 Examination

- A. Appropriate actions shall be taken to comply with local, state, and federal regulatory and other applicable agencies with regard to environment, health, and safety.
- B. Any active flows shall be dammed, plugged, or diverted as required to ensure that the liquid flow is maintained below the surfaces to be coated.
- C. Installation of the protective coating shall not commence until the concrete substrate has properly cured in accordance with these specifications.
- D. Temperature of the surface to be coated should be maintained between forty degrees Fahrenheit (40°F) and one hundred twenty degrees Fahrenheit (120°F) during application. Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the structure being coated. Where varying surface temperatures do exist, care should be taken to apply the coating when the temperature is falling versus rising.

5.17.4 Surface Preparation

- A. Applicator shall inspect all surfaces specified to receive a protective coating prior to surface preparation.
- B. All contaminants including oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed.
- C. All concrete or mortar that is not sound or has been damaged by chemical exposure shall be removed to a sound concrete surface or replaced.
- D. Surface preparation method(s) should be based upon the conditions of the substrate, service environment, and the requirements of the epoxy protective coating to be applied.
- E. Surfaces to receive protective coating shall be cleaned and abraded to produce a sound surface with adequate profile and porosity to provide a strong bond between the protective coating and the substrate. At a minimum, this will be achieved with a high-pressure water cleaning equipment using a zero degree (0°) rotating nozzle at five thousand pounds per square inch (5,000 psi) and four gallons per minute (4 gpm). Other meth-

ods such as high-pressure water jetting (refer to SSPC-SP 12/NACE 5), abrasive blasting, shot blasting, grinding, scarifying, and/or acid etching may also be used. In addition, detergent water cleaning and hot water blasting may be necessary to remove oils, grease, or other hydrocarbon residues from the concrete. The method(s) used shall be performed in a manner that provides a uniform, sound, clean, neutralized surface that is not excessively damaged.

- F. Infiltration shall be stopped by using a material which is compatible with the specified repair mortar and is suitable for top coating with the specified epoxy protective coating.
- G. Test prepared surfaces after cleaning but prior to application of the epoxy coating to determine if pH or moisture content of the concrete meets the manufacturer's recommendations.

5.17.5 Application of Repair Materials

- A. Areas where structural steel has been exposed or removed shall be repaired in accordance with the manufacturer's recommendations.
- B. Repair materials shall meet the specifications herein. The materials shall be trowel or spray applied utilizing proper equipment to specified surfaces. The material thickness shall be according to OJRSA requirements and to the manufacturer's recommendations.
- C. If using approved cementitious repair materials, such shall be troweled to provide a smooth surface with an average profile equivalent to coarse sandpaper to optimally receive the protective coating. No bug holes or honeycomb surfaces should remain after the final trowel procedure of the repair mortar.
- D. The repair materials shall be permitted to cure according to the manufacturer's recommendations. Curing compounds should not be used unless approved for compatibility with the specified protective coating.
- E. Application of the repair materials, if not performed by the coating Certified Applicator, should be inspected by the protective coating Certified Applicator to ensure proper finishing for suitability to receive the specified coating.
- F. After abrasive blast and leak repair is performed, all surfaces shall be inspected for remaining laitance prior to protective coating application. Any evidence of remaining contamination or laitance shall be removed by additional abrasive blast, shot blast, or other approved method. Areas to be coated must also be prepared in accordance with these specifications after receiving a cementitious repair mortar and prior to application of the epoxy coating.

5.17.6 Application of Protective Coating

- A. Application procedures shall conform to the recommendations of the protective coating manufacturer, including material handling, mixing, environmental controls during application, safety, and spray equipment.
- B. The spray equipment shall be specifically designed to accurately ratio and apply the specified protective coating materials and shall be regularly maintained and in proper working order.
- C. The protective coating material must be spray applied by a Certified Applicator of the protective coating manufacturer.
- D. Specified surfaces shall be coated by spray application of a moisture tolerant, solvent-free, one hundred percent (100%) solids, epoxy protective coating as further described herein. Spray application shall be to an average dry film thickness of one hundred twenty-five (125) mils on new structures and one hundred (100) mils on build back applications. Pre-primed ductile iron pipes inside the structures shall be top-coated with an average dry film thickness of fifty (50) mils.
- E. Airless spray application equipment approved by the coating manufacturer shall be used to apply each coat of the protective coating.
- F. If necessary, subsequent top coating or additional coats of the protective coating should occur as soon as the basecoat becomes tack free, ideally within twelve (12) hours but no later than the recoat window for the specified products. Additional surface preparation procedures will be required if this recoat window is exceeded.

5.17.7 Testing and Inspection

- A. During application, a wet film thickness gauge, meeting ASTM D4414, shall be used to ensure a monolithic coating and uniform thickness during application.

- B. After the protective coating has set hard to the touch, it shall be inspected with high-voltage holiday detection equipment. The spark tester shall be initially set at one hundred volts (100 V) per one (1) mil of film thickness applied. All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional protective coating material can be hand applied to the repair area. All touch-up/repair procedures shall follow the protective coating manufacturer's recommendations.
- C. A final visual inspection shall be made by the NACE Level III Certified Coating Inspector and manufacturer's representative. Any deficiencies in the finished coating shall be marked and repaired according to the procedures set forth herein by the Applicator. The inspector shall submit a final report documenting field observations and testing results.

5.17.8 Clean-Up

- A. Upon completion, coating applicator shall clean-up and remove from site all surplus materials, tools, appliances, empty containers, and residues following proper procedures in accordance with the manufacturer's recommendations.
- B. All work areas shall be properly and completely cleaned, leaving the site in a neat, orderly condition.

END OF SECTION 5.17

5.18 CHAIN LINK FENCES AND GATES

5.18.1 General

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

5.18.2 Installation

- A. Install framework, fabric accessories, and gates in accordance with ASTM F567 manufacturer's instructions.
- B. Set end, corner, line, and gateposts plumb in concrete footing with top of footing six inches (6 in.) below finish grade. Slope top of concrete for water runoff. Provide concrete with three thousand pounds per square inch (3,000 psi) strength.
- C. An acceptable alternative to concrete footings is Anchor Fence, Drive Anchor Footings, when used with an Anchor Fencing System and installed in accordance with manufacturer's instructions.
- D. Make line post footing depth below finish grade in accordance with ASTM F567.
- E. Make corner-, gate-, and terminal-post footing depth below finish grade in accordance with ASTM F567.
- F. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one (1) bay from end and gate posts.
- G. Provide top rail through line-post tops and splice with six inch (6 in.) long rail sleeves.
- H. Install center and bottom brace rail on corner gate leaves.
- I. Stretch fabric between terminal posts or at intervals of one hundred feet (100 ft) maximum, whichever is less.
- J. Position bottom of fabric two inches (2 in.) above finish grade.
- K. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum fifteen inches (15 in.) on centers.
- L. Attach fabric to end, corner, and gateposts with tension bars and tension bar clips.
- M. Install bottom tension wire strap stretched taut between terminal posts.
- N. Install extension arms sloped outward and attach barbed wire, then tension and secure.
- O. Install gate with fabric and barbed wire. Install three hinges per leaf, latch, catches, drop bolt, foot bolts and sockets, torsion spring retainer, retainer, and locking clamp.
- P. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.
- Q. Install fabric on posts facing away from enclosed area.
- R. Remove from site surplus excavated material and debris resulting from erection of fence.

5.18.3 Erection Tolerances

- A. Maximum Variation from Plumb: One quarter inch (0.25 in.)
- B. Maximum Offset from True Position: One inch (1 in.)
- C. **DO NOT ALLOW FENCE COMPONENTS TO INFRINGE UPON ADJACENT PROPERTIES.**

END OF SECTION 5.18

END OF SECTION 5

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SECTION 6 – COMMERCIAL PRETREATMENT USERS

6.1 GENERAL

- A. This Section applies to all Users as stated in 1.2(D).
- B. Installation, inspection, ownership, operation, and maintenance of all Special Devices are subject to the *OJRSA Sewer Use Regulation* and this Policy.
- C. It is the intent of this Policy to provide for specific standards for device location, design, installation, construction, operation, and maintenance of new and existing units to as to comply with applicable regulatory discharge standards.
- D. If a Special Device is required, it shall be the responsibility of the Owner, as defined in SECTION 0.1, to install and maintain the device in accordance with applicable OJRSA regulations.
- E. Sizing and selection of Special Devices shall be subject to the approval of the OJRSA.
- F. All devices shall be of a type and capacity approved by the OJRSA and shall be located so as to be readily and easily accessible for maintenance, cleaning, and inspection as stated within this Policy.
- G. Before a Special Device is installed, the Owner or User shall submit all plans to OJRSA for review and approval. The Owner or User will require written authorization by OJRSA approving the design and allowing discharge of wastewater from the properly installed unit. When submitting plans for review, they must include the following:
 - 1. Name, address, and TMS number of the facility, and the phone number and mailing address of the person legally responsible for operation and maintenance of the Special Device.
 - 2. Plans of the Special Device with capabilities and dimensions.
 - 3. Site map detailing all drains and trap/interceptor location.
 - 4. Location of the water sources discharging to the device, including floor drains and similar fixtures.
- H. Facilities are responsible for payment of all fees as stated in SECTION 2.2.

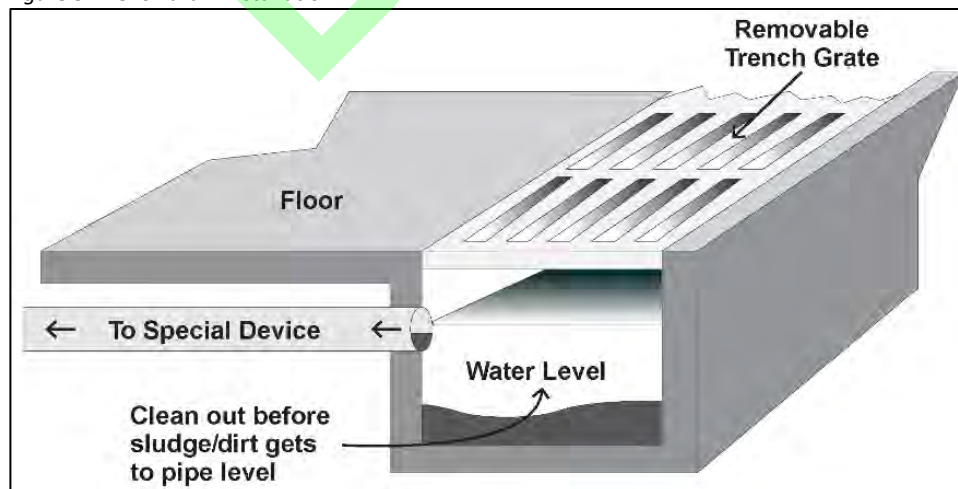
6.2 REFERENCES

Referenced Standards: See SECTION 7. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

6.3 INSTALLATION, OWNERSHIP, OPERATION, AND MAINTENANCE OF SPECIAL DEVICES

- A. All Special Devices are to be installed and owned by the Owner as stated by the county's Register of Deeds at their expense.
- B. **Floor Drains and Trench Drains:** Where drains are located in areas where a pollutant referenced in this Section may be present, then it should be piped to a proper Special Device as described herein. If a trench drain is to be used, then it shall be installed in accordance with Figure 3.

Figure 3: Trench drain installation



- C. Users must submit a Best Management Plan (BMP) to the OJRSA for approval prior to utilizing a Special Device. The BMP outlines the practices, procedures, operation, and maintenance necessary for the proper maintenance of the Special Device and the management of the pollutants and floor/trench drains in order to protect the public sewer system.
- D. Operating and maintaining the Special Devices shall be the responsibility of the User. If the User fails to maintain the Special Device as required by this Policy and *OJRSA Sewer Use Regulation*, the OJRSA shall hold the Owner responsible.
- E. The Owner is responsible for maintenance and/or repairs to the device and/or OJRSA infrastructure due to an improperly functioning unit, inadequately sized device, and/or missing Special Device in accordance with the *OJRSA Sewer Use Regulation*. Failure to comply with this Policy shall be considered a violation of applicable sections of the *OJRSA Sewer Use Regulation* and the Owner and/or Permittee shall be subject to applicable penalties, cost recovery, and/or denial or discontinuance of sewer service.
- F. Users shall maintain detailed, written records of maintenance and waste disposal as required by OJRSA and have it available for inspection.
 - 1. FOG Generators: Records shall be maintained onsite by the User in accordance with *OJRSA Sewer Use Regulation* SECTION 9.4.
 - 2. Non-FOG Generators (Users of Other Special Devices): Records shall be maintained onsite by the User for a minimum of three (3) years.

6.4 APPROVALS FOR INSTALLATION AND OPERATION

- A. All Special Devices shall be installed in accordance with applicable plumbing codes and OJRSA specifications contained within this Policy. Deviations from standards must be approved by OJRSA in writing.
- B. Approvals: The following written approvals shall be issued by OJRSA, either by email or letter, prior to the following:
 - 1. Installation of a Special Device, and
 - 2. Placing a device into operation. **THE COMPLETED INSTALLATION MUST BE INSPECTED AND APPROVED BY OJRSA BEFORE THE DEVICE MAY BE USED.**
- C. All devices must be inspected prior to use. If the inspection confirms satisfactory installation, OJRSA will issue a release to the building permitting authority (e.g., Oconee County, etc.), which is contingent upon satisfactory completion of all other requirements for the project as required by OJRSA. The building permitting authority may withhold issue of a Certificate of Occupancy pending receipt of this release by OJRSA.

6.5 VARIANCES AND DEVIATIONS

Variances and deviations from this Policy must be approved by OJRSA in writing.

6.6 FATS, OILS, AND GREASE (FOG) CONTROL DEVICES

This section establishes the standards for general and technical design of FOG Control Devices (FCD).

6.6.1 Applicability

- A. FOG Control Devices shall be provided to prevent the discharge of fats, oils, and grease (FOG) to the public sewer.¹
- B. These standards apply to all of the following:
 - 1. Full Service Commercial Kitchens,
 - 2. Single Service Commercial Kitchens (*Catering and Mobile Food Unit vendors are considered Single Service Commercial Kitchens*),
 - 3. Multi-Family Developments², and
 - 4. FOG Generators as defined in SECTION 9 of the *OJRSA Sewer Use Regulation*.

¹ 2018 IPC Chapter 10 Section 1003.1

² The requirement for a two thousand gallon (2,000 gal) interceptor as stated in the *OJRSA Sewer Use Regulation* may be reduced to a smaller size upon justification via calculations and certified by a Registered Professional Engineer or Licensed Architect, however, it shall never be smaller than one thousand gallons (1,000 gal).

- C. Facilities that provide dining space and vending machines with no food preparation other than microwave ovens and the like will be evaluated on a case-by-case basis.
- D. Exemptions: The following exclusions shall apply:
 - 1. Single Family Residential structures with a Private Residential Kitchen shall be exempt from SECTION 6.6 of this Policy.
 - 2. Multi-Family Developments with four (4) or less separated living units as stated in *OJRSA Sewer Use Regulation* SECTION 9 are not considered a FSE or FOG Generator unless they are preparing food for commercial purposes (catering and other such operations are considered a commercial purpose subject to FSE regulations), at which point they shall be considered a FOG Generator.

6.6.2 Applicable Details

- A. FOG-1 TYPICAL GREASE TRAP PLUMBING PLAN
- B. FOG-2 FATS, OILS, AND GREASE INTERCEPTOR

6.6.3 Requirements

- A. Prior to the approval of plans for a FOG Control Device, the User shall submit a Food Service Establishment (FSE) Questionnaire to the OJRSA for review in order to determine what type of device(s) will be necessary.
- B. FOG Control Devices include FOG Traps and FOG interceptors and shall comply with the applicable standards and details as stated within this Section. Deviations from this standard must be approved by OJRSA in writing.
- C. The size, type, and location of FOG Control Device shall be designed and installed in accordance with the manufacturer's instructions, applicable detail(s), and the requirements of this Section based on the anticipated conditions of use.¹
- D. FOG Control Devices may be installed on individual fixtures (FOG Traps) or collectively on more than one (1) fixture, if properly sized for the fixtures.
- E. Wastes that do not require treatment or separation shall not be discharged into any FCD.²
- F. Rate of Flow Controls: FCDs shall be equipped with devices to limit the rate of water flow so that it does not exceed the rated flow. The flow control device shall be vented and terminate not less than six inches (< 6 in.) above the flood rim level or be installed in accordance with the manufacturer's instructions.³
- G. The discharge piping from a FCD shall be directly connected to the sanitary drainage system.⁴

6.6.4 Required Connections

- A. Mop sinks, kitchen floor drains/sinks, three (3) compartment and other dishwashing sinks, dishwashers without prerinse sinks, and the pre-rinse sink for the dishwasher shall be connected to a FOG Control Device. *If a mop basin is located outside of the facility, then its dump station must be covered with a canopy or roof to prevent storm water from entering the sewer. The mop basin if located outside the building must also have a berm to prevent storm water drainage entering the sewer.*
- B. FCD(s) required are based on SECTION 9 of the *OJRSA Sewer Use Regulation*.

6.6.5 Prohibitions

- A. Automatic FOG Control Devices, Traps, or Interceptors (as defined in SECTION 0.1): **OJRSA DOES NOT ALLOW AUTOMATIC GREASE TRAPS TO BE INSTALLED AFTER MARCH 1, 2019. EXISTING AUTOMATIC FOG TRAPS WILL BE GRANDFATHERED UNDER THIS REGULATION UNLESS THE UNIT NEEDS TO BE REPLACED OR THE FACILITY CLOSSES AND A NEW OWNER ACQUIRES THE FACILITY, AT WHICH TIME IT MUST BE REPLACED WITH EITHER A FOG TRAP OR FOG INTERCEPTOR AS STATED WITHIN THIS SECTION.**
- B. FOG Control Devices shall receive waste only from fixtures and equipment that allow fats, oils, or grease to be discharged.⁵
- C. Discharge or addition of the following materials to a FOG Control Device is strictly prohibited:

¹ 2018 IPC Chapter 10 1003.2

² 2018 IPC Chapter 10 1003.2

³ 2018 IPC Chapter 10 1003.3.5.2

⁴ 2018 IPC Chapter 10 1003.8

⁵ 2018 IPC 1003.3.1

1. Water from refrigerator drain lines, beverage dispenser drain lines, ice machines, or handwashing sinks;
 2. Water from showers, toilets, bathroom sinks, washing machines, and baths/showers; and
 3. Wastewater discharged from a Garbage Grinder.¹
- D. Additives to FOG Control Devices: Dispensing systems that introduce additives to FOG Control Devices shall not be installed.

6.6.6 FOG Traps

A. Sizing

1. FOG Traps shall be sized in accordance with fixture flows per the 2018 IPC.
2. The required hydraulic capacity of FOG Traps shall be determined by the OJRSA FOG Trap Sizing Worksheet – Class 1 Facilities as contained in the *FOG Trap and Interceptor Sizing Calculations* spreadsheet. The spreadsheet can be accessed at www.ojrsa.org/resources or can be provided by request from the OJRSA Regulatory Services Coordinator.
3. FOG Traps shall have the grease retention in Table 23 for the flowthrough rates indicated. The minimum size is twenty gallons per minute (20 gpm) and forty pounds (40 lbs) grease holding capacity. For flow-through rates that exceed one hundred gallons per minute (100 gpm), double the flow-through rating to determine the grease retention capacity in pounds (lb).²

Table 23: Capacity of FOG Traps

Total flow through rating (GPM)	Grease Retention Capacity (lbs)
20	40
25	50
35	70
50	100
75	150
100	200

B. Materials of Construction

1. All FOG Traps shall be constructed entirely of non-metallic, non-corrosive materials.
2. The device chosen and the vendor supplying the device must adhere to all the design requirements set forth in this Policy. FOG Traps must have the Plumbing and Drainage Institute (PDI) Certification Seal and be installed as per manufacturer's specifications, *OJRSA Sewer Use Regulation*, and this Policy.

C. Location and Installation

1. FOG Traps shall be required to receive the drainage from fixtures and equipment with grease laden waste.
2. Where lack of space or other constraints prevent the installation or replacement of a FOG Trap, one (1) or more FOG Traps shall be permitted to be installed on or above the floor and upstream of an existing FOG Trap.³
3. FOG Traps shall be in a place that allows access for maintenance and inspection.
4. All FOG Traps shall be installed entirely above the grade of floor.

D. Leak Testing: FOG Traps shall be leak tested prior to placing into operation.

E. FOG Traps shall comply with the applicable detail as stated within this Section. Deviations from this standard must be approved by OJRSA in writing; however, any unit must contain all baffles, sample locations, and general design and construction methods as shown in the OJRSA's detail.

¹ 2018 IPC Chapter 10 1003.3.2

² 2018 IPC Chapter 10 1003.3.5.1

³ 2018 IPC 1003.3.1

6.6.7 FOG Interceptors

A. Sizing

1. FOG Interceptor sizing shall be based on SECTION 9 in the *OJRSA Sewer Use Regulation*.
2. Design shall be based on a minimum of one (1) hour retention time, not including FOG and solids storage in the unit.
3. Minimum FOG Interceptor size requirement is one thousand gallons (1,000 gal).
4. Maximum single FOG Interceptor size is two thousand five hundred gallons (2,500 gal). If sizing requires more than two thousand five hundred gallons (2,500 gal), two (2) or more tanks shall be installed in series unless a variance is granted by OJRSA Regulatory Services Coordinator or Executive Director. Gravity FOG Interceptors that are installed in series shall be installed in such a manner to ensure positive flow between the tanks at all times.
5. Capacity of FOG Interceptors
 - (a) The required hydraulic capacity of FOG Interceptors shall be determined by the OJRSA FOG Interceptor Sizing Worksheet – For Class 2, 3, 4, and 5 Food Service Establishments or OJRSA FOG Interceptor Sizing Worksheet – Drainage Fixture Unit Method for Class 2, 3, 4, and 5 Facilities, as appropriate, as contained in the *FOG Trap and Interceptor Sizing Calculations* spreadsheet. The spreadsheet can be accessed at www.ojrsa.org/resources or can be provided by request from the OJRSA Regulatory Services Coordinator.
 - (b) Size grease capacity for FOG Interceptors by doubling the flow-through rating (in gpm) to determine the grease retention capacity in pounds (lbs).¹
6. Multi-Family Developments: When approved by OJRSA, up to two (2) buildings within the development may utilize a single properly-sized FOG Interceptor.

B. Design and Testing: FOG Interceptors shall be designed and tested in accordance with IAPMO/ANSI Z1001 and *OJRSA Sewer Use Regulation*.

C. Materials of Construction

1. Tank

- (a) Thermoplastic: **PREFERRED BY OJRSA.** FOG Interceptors manufactured from thermoplastic material are acceptable if the construction of the unit complies with all other standards contained herein.
 - (b) Precast Concrete: Precast concrete with minimum twenty-eight (28) day compressive strength of four thousand five hundred pounds per square inch (4,500 psi). Preformed bars for steel reinforcement shall be in accordance with ASTM A615 Grade 60. Welded-wire fabric reinforcement shall be in accordance with ASTM A185, Grade 65. Precast concrete tanks shall have a minimum wall and baffle thickness of four inches (4 in.). Baffles shall be secured in place by slotted vault walls or with stainless steel angles.
2. Piping: FOG Interceptors shall have internal piping made of PVC or stainless steel of appropriate grade sized to match the influent and effluent pipe diameter. External piping may be PVC, cast iron, ductile iron or other materials as allowed by 2018 IPC Sections 702.1 through 702.3. Manhole Rings and Covers
 - (a) Cast iron with twenty-four inch (24 in.) diameter with bolt-locking cover. Polymer will be considered by OJRSA upon request so long as it meets all other necessary requirements.
 - (b) Covers must have the word "GREASE" cast into all covers associated with the FOG Interceptor.
 - (c) Covers shall not allow passage of air or gasses.

D. Location and Installation

1. FOG interceptors shall be installed in accordance with manufacturer's instructions. Where manufacturer's instructions are not provided, FOG interceptors shall be installed compliance with ASME A112.14.6 and IAPMO/ANSI Z001.

¹ 2018 IPC Chapter 10 1003.3.5.1

2. FOG Interceptors shall be in non-traffic areas unless a written waiver is granted by OJRSA due to site conditions that make it prohibitive to do so. If approved by OJRSA to be installed in areas where vehicular traffic is present, then traffic rated tops and/or tanks must be used (AASHTO M306 H-20), which must be approved by the Owner's representative and presented to OJRSA.
3. FOG Interceptors shall be installed outdoors and within twenty feet (20 ft) of a paved or improved path for access by appropriate maintenance vehicles.
4. The device should be installed in a location such that surface water drains away from the interceptor in all directions. If this is not possible, berms or other such devices must be installed to deflect water away from all manholes and ports.
5. Access manholes shall extend at least to finished grade and be designed and maintained to prevent inflow and infiltration. Manhole covers shall be readily removable to facilitate inspection, FOG removal, and wastewater sampling activities and shall be kept clear of obstructions such as trees, shrubs, flowers, mulch, etc.
6. FOG Interceptor access manholes shall be installed in such a way that the ninety-degree (90°) "FOG Tee" is visible from all manholes.
7. The FOG Tee shall extend from the ground surface below grade into the FOG Interceptor to a depth allowing recovery (discharge) of the water layer located under the layer of FOG as illustrated in DETAIL FOG-2.
8. Vent lines from FOG Interceptors shall be vented according to local plumbing codes.
9. A potable water supply (e.g., hose bibb, yard hydrant, etc.) shall be located no more than forty feet (40 ft) from all FOG Interceptors for maintenance and cleaning.
10. Excavation for precast FOG Interceptors shall be sufficient to provide a minimum of twelve inches (12 in.) between the vault and the side of the excavation.
11. Manhole frames and covers shall be adjusted to the elevation required by the engineer prior to acceptance of the work. Adjusting rings shall be manufactured from precast reinforced concrete. The total height of rings shall be from eight inches (8 in.) minimum to twenty inches (20 in.) maximum.
12. The FOG Interceptor shall be placed on firm soil. If the foundation material is inadequate, the contractor shall use foundation gravel or bedding concrete under the normal base to support the unit.
13. The vault shall be placed and set plumb so as to provide vertical sides. The completed interceptor shall be rigid and watertight.
14. The inside and outside of manhole adjusting rings, joints of precast concrete sections, and the perimeter of precast baffles shall be thoroughly wetted and completely filled with mortar, plastered, and troweled smooth with three-quarters inch (3/4 in.) of mortar in order to attain a watertight surface.
15. All lift holes, if any, on precast items shall be completely filled in with expanding mortar, smoothed both inside and out, to ensure water tightness. All steel loops, if any, on precast section must be removed flush with the vault wall.
16. The stubs shall be covered with mortar and smoothed. Rough, uneven surfaces will not be permitted.
17. Precast vault and baffle shall be provided with eight inch (8 in.) knockouts at all pipe openings or have openings core-drilled prior to installation.
18. All rigid pipe entering or leaving the structure shall be provided with flexible joints within twelve inches (12 in.) of the manhole structure and shall be placed on firmly compacted bedding. Special care shall be taken to see that the openings through which pipes enter the structure are completely and firmly filled with mortar from the outside to ensure water tightness. All PVC pipe connections to vault and baffle shall be made with gasketed coupling as approved by OJRSA.

6.7 OTHER SPECIAL DEVICES

This Section establishes the standards for general and technical design of Special Devices as defined in SECTION 0.1 of this Policy. Such Special Devices include, but are not limited to, Dental Amalgam Separator, Hair Trap/Interceptors, Lint Interceptors, Oil/Water Interceptors, Plaster Interceptors, and Sand/Oil Interceptors.

6.7.1 Applicability

- A. This Section applies to Users that discharge or have the potential to discharge the following to the POTW, which shall include Satellite Sewer Systems served by OJRSA facilities:
 - 1. Sand, plaster, and other solids that may settle and/or accumulate;
 - 2. Hair, lint, feathers, or other solid materials that may collect in, adhere to, and/or accumulate; and/or
 - 3. Petroleum oils or liquid products (other than FOG materials addressed in SECTION 6.6) that may separate, float, and/or accumulate.
- B. Special Devices shall be provided to prevent the discharge of solids or liquids in excess of concentrations allowed by *OJRSA Sewer Use Regulation*. If it is determined that a facility discharges to or has the potential to discharge to the POTW, then a pretreatment device shall be used to remove the solids or liquids to attain compliance with OJRSA requirements.
- C. These standards apply to, but are not limited to, commercial beauty shops, laundromats, hotels, slaughterhouses, garages, car washes, medical/dental facilities, schools, and oil change businesses.

6.7.2 Applicable Details

- A. Oil/Water Interceptors shall comply with FOG-3 OIL/WATER SEPARATOR.
- B. Other Special Devices should include a detail with submittal of plans. The OJRSA will review and approve these on a case-by-case basis.

6.7.3 Requirements

- A. Special Devices must meet the requirements of 2018 IPC.
- B. Special Devices must perform to achieve compliance with the *OJRSA Sewer Use Regulations*.
- C. Sizing: Special Devices must be sized for the maximum flows reasonably expected by the User and have ample retention for the separated solids or liquids.
- D. Materials: Special Devices must be constructed of materials that are non-corrosive and suitable for the location and application. *The OJRSA reserves the right to request that particular materials not be used to ensure the unit remains serviceable and functional based on its location and application.*
- E. Installation
 - 1. The installation of the Special Device must comply with the manufacturer's requirements and also provide ample access for maintenance, service, cleaning, and pump-out.
 - 2. Special Devices located below ground outdoors shall be rated for AASHTO M306 H-20 loadings.
 - 3. Ports for pumping must be accessible at ground level.
 - 4. Two-way cleanouts with concrete donut rings must be provided for inlet and exit piping.
- F. Testing: The unit shall be leak tested in accordance with the leak testing of the plumbing system. Documentation of the test shall be provided to OJRSA upon request.
- G. A potable water supply (e.g., hose bibb, yard hydrant, etc.) shall be located no more than forty feet (40 ft) from all Special Devices for maintenance and cleaning.

6.7.4 Submittals

- A. All applicants requesting permission to install Special Devices must submit to OJRSA:
 - 1. Applicable details for the proposed device with specifications and product drawings, along with the building plumbing drawings.
 - 2. Sizing calculations or manufacturer's schedule for sizing the Special Device.
 - 3. Materials of construction, sizes, thicknesses, etc.
 - 4. Installation information related to sizes of connections, access, locations, and positioning the Special Device.
 - 5. Maintenance information related to cleaning, operating, and maintaining the equipment.
- B. The submittals related to the selection of sizing, equipment, and the plumbing design must be stamped by a Registered Professional Engineer or architect licensed to practice in State of South Carolina.

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SECTION 7 – REFERENCED STANDARDS

Unless otherwise indicated, all referenced standards shall be the latest edition available¹ at the time of final design approval by OJRSA and are subject to change. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards.

NOTE: SECTION 7 is subject to change based on SCDHEC/SCDES regulatory changes and/or changes to Non-SCDHEC/SCDES standards and may be updated as necessary by Executive Level staff (as defined in OJRSA Procurement and Property Disposal Policy APPENDIX A) without begin considered as a substantive change to this Policy.

7.1 SCDHEC/SCDES REGULATION 61-67, APPENDIX A [JUNE 26, 2015 VERSION], WITH EXCEPTIONS NOTED

Table 24: SC R61-67 Appendix A with OJRSA modifications as approved by OJRSA Board

Type of Establishment Per SCDHEC/SCDES Regulation 61-67 Appendix A		Hydraulic Loading (gpd)
A	Airport:	
	Per Employee	8
	Per Passenger	4
B	Apartments, Condominiums, Patio Homes:	
	Four-to-Six (4-to-6) Bedroom (Per Unit) ²	300
	Three (3) Bedrooms (Per Unit)	300
	Two (2) Bedrooms (Per Unit)	225
	One (1) Bedroom (Per Unit)	150
C	Assembly Halls: (Per Seat)	4
D	Barber Shop:	
	Per Employee	8
	Per Chair	75
E	Bars, Taverns:	
	Per Employee	8
	Per Seat, Excluding Restaurant	30
F	Beauty Shop/Pet Grooming Shop:³	
	Per Employee	8
	Per Chair	94
G	Boarding House, Dormitory: (per resident)	38
H	Bowling Alley:	
	Per Employee	8
	Per Lane, No Restaurant, Bar, or Lounge	94
I	Camps:	
	Resort, Luxury (Per Person)	75
	Summer (Per Person)	38
	Day, with Central Bathhouse (Per Person)	26
	Travel Trailer (Per Site)	131
J	Car Wash: (Per Car Washed)	56
K	Churches:	
	Per Seat	2
	Fellowship Hall with Commercial Kitchen ⁴	5

¹ Or superseded edition, if applicable.

² Email received from Gina Abbott with SCDHEC on December 19, 2019 stated: "R. 61-67 does not specify a loading for a 4 or 5 bedroom apartment unit. The loading for a residential lot is 300 gpd. It would be acceptable to use 300 gpd for a 4 or 5 bedroom apartment unit."

³ To be included as it is not addressed elsewhere in this document.

⁴ Per Seat, per OJRSA Policy established August 21, 2000.

OJRSA Development Policy
May 6, 2024

Type of Establishment Per SCDHEC/SCDES Regulation 61-67 Appendix A	Hydraulic Loading (gpd)
L Clinics, Doctor's Office:	
Per Employee	11
Per Patient	4
M Country Club, Fitness Center, Spa: (Per Member)	38
N Dentist Office:	
Per Employee	11
Per Chair	6
Per Suction Unit; Standard Unit	278
Per Suction Unit; Recycling Unit	71
Per Suction Unit; Air Generated Unit	0
O Factories, Industries:	
Per Employee	19
Per Employee, with Showers	26
Per Employee, with Kitchen	30
Per Employee, with Showers and Kitchen	34
P Fairgrounds: (Average Attendance, Per Person)	4
Q Grocery Stores: (Per square foot of floor space, unknown occupant)¹	0.20
R Hospitals:	
Per Resident Staff	75
Per Bed	150
S Hotels: (Per Bedroom, No Restaurant)	75
T Institutions: (Per Resident)	75
U Laundries: (Self Service, Per Machine)	300
V Marinas: (Per Slip)	23
W Mobile Homes: (Per Unit)	225
X Motels: (Per Unit, No Restaurant)	75
Y Nursing Homes:	
Per Bed	75
Per Bed, with Laundry	113
Z Offices, Small Stores, Administration Buildings, General: (Per square foot of floor space, unknown occupant)²	0.20
AA Picnic Parks: (Average Attendance, Per Person)	8
BB Prison/Jail:	
Per Employee	11
Per Inmate	94
CC Residences: (Per House, Unit)	300
DD Rest Areas, Welcome Centers:	
Per Person	4
Per Person, with Showers	8
EE Rest Homes/Retirement Homes/Assisted Living Facilities:	
Per Bed	75
Per Bed, with Laundry	113
FF Restaurants/Coffee Shops/Cafes/Bakeries/Event Venues (and other locations with food service):	
Not Twenty-Four (24) Hours (Per Seat)	30

¹ OJRSA Board adopted using the former SCDHEC standard of 200 GPD per 1,000 sqft of floor space on October 5, 2015.

² OJRSA Board adopted using the former SCDHEC standard of 200 GPD per 1,000 sqft of floor space on October 5, 2015.

Type of Establishment Per SCDHEC/SCDES Regulation 61-67 Appendix A		Hydraulic Loading (gpd)
	Twenty-Four (24) Hour Restaurant (Per Seat)	53
	Drive-In (Per Car Served)	30
	Vending Machine, Walk-up Deli (Per Person)	30
GG	Schools, Day Care:	
	Per Person	9
	Per Person, with Cafeteria	11
	Per Person, with Cafeteria, Gym, and Showers	15
HH	Service Stations/Gasoline or Fueling Stations	
	Per Employee	8
	Per Car Served	8
	Car Wash (Per Car Washed)	56
II	Shopping Centers, Large Department Stores, Malls: (Per square foot of floor space, unknown occupant)¹	0.20
JJ	Stadiums, Coliseums: (Per Seat, No Restaurant)	4
KK	Swimming Pools: (Per Person, with Sewer Facilities and Showers)	8
LL	Theaters:	
	Indoor (Per Seat)	4
	Drive-In (Per Stall)	4
N/A	Industrial Process Wastewater:	TBD-CBCB
N/A	Special Requested Discharge:	TBD-CBCB

7.2 REFERENCED STANDARDS – NON-SCDHEC/SCDES

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M198: Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

AASHTO M306: Standard Specification for Drainage, Sewer, Utility, and Related Castings

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 440.1R-06: Guide for the Design and Construction of Structural Concrete Reinforced with FRP Bars

ACI 440.1R-15: Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer (FRP) Bars

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI 1015 Carbon Steel

AISI 17-4 Stainless Steel

AISI 329 Stainless Steel

AISI 4140 Low Alloy Steel

ANSI: AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI C2: National Electrical Safety Code

ANSI Class 150 Measures for Pipe Sizes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)/AMERICAN WATER WORKS ASSOCIATION (AWWA)

ANSI A21.10/AWWA C110: Gray-Iron and Ductile Iron Fittings, 2-Inch Through 48-Inch, for Water and Other Liquids

ANSI A21.11/AWWA C111: Rubber-Gasket Joints for Cast-Iron and Ductile Iron Pressure Pipe and Fittings

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

ANSI A21.51/AWWA C151: Ductile Iron Pipe, Centrifugally Cast, In Metal Molds or Sand Lined Molds for Water or Other Liquids

ANSI A21.53/AWWA C153: Ductile-Iron Compact Fittings, 3-in through 24-in and 54-in through 64-in for Water Service

¹ OJRSA Board adopted using the former SCDHEC standard of 200 GPD per 1,000 sqft of floor space on October 5, 2015.

ANSI C115/AWWA A21.51: Cast / Ductile Iron Pipe with Threaded Flanges

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)/INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
ANSI/IEEE Std 112: Test Procedure for Polyphase Induction Motors

AMERICAN PUBLIC WORKS ASSOCIATION (APWA)
APWA Uniform Color Code

AMERICAN RAILWAY ENGINEERING ASSOCIATION (AREA)
AREA standards as appropriate

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
ASME A13.1: Scheme for the Identification of Piping Systems
ASME A112.14.6 FOG (Fats, Oils, and Greases) Disposal Systems
ASME B15.1: Safety Standard for Mechanical Power Transmission Apparatus
ASME B16.5: Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24, Metric/Inch Standard

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)/AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
ASME/ANSI B16.1: Cast Iron Pipe Flanges and Flanged Fittings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)/NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
ANSI/NEMA MG 1: Motors and Generators

ASTM (formerly known as American Society for Testing and Materials)
ASTM A48: Standard Specification for Gray Iron Castings
ASTM A53: Specifications for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A82: Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A90: Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
ASTM A121: Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
ASTM A123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A126: Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A139: Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe
ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A185: Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A276: Standard Specification for Stainless Steel Bars and Shapes
ASTM A307: Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners
ASTM A392: Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A536: Standard for Ductile Iron Castings
ASTM A576: Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality
ASTM A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A746: Standard Specification for Ductile Iron Gravity Sewer Pipe
ASTM A789: Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service
ASTM C33: Standard Specification for Concrete Aggregates
ASTM C144: Standard Specification for Aggregate for Masonry Mortar
ASTM C150: Standard Specification for Portland Cement
ASTM C260: Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C270: Standard Specification for Mortar for Unit Masonry
ASTM C348: Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
ASTM C443: Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C478: Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
ASTM C494: Standard Specification for Chemical Admixtures for Concrete
ASTM C497: Standard Test Methods for Concrete Pipe, Concrete Box Sections, Manhole Sections, or Tile
ASTM C857: Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM C891: Standard Practice for Installation of Underground Precast Concrete Utility Structures
ASTM C913: Standard Specification for Precast Concrete Water and Wastewater Structures

ASTM C923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals

ASTM C990: Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

ASTM C1244: Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Back-fill

ASTM D1248: Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable

ASTM D1784: Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D1785: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

ASTM D2122: Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

ASTM D2241: Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

ASTM D2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

ASTM D2464: Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D2467: Socket-Type Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D2564: Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings

ASTM D3034: Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

ASTM D3035: Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter

ASTM D3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

ASTM D4414: Standard Practice for Measurement of Wet Film Thickness by Notch Gages

ASTM E18: Standard Test Methods for Rockwell Hardness of Metallic Materials

ASTM F477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

ASTM F567: Standard Practice for Installation of Chain-Link Fence

ASTM F626: Standard Specification for Fence Fittings

ASTM F900: Standard Specification for Industrial and Commercial Steel Swing Gates

ASTM F1417: Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air

ASTM F2164: Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure

ASTM: Other standards as appropriate

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C507: Ball Valves, 6 Inches Through 60 Inches

AWWA C508: Swing-Check Valves for Waterworks Service, 2-In. Through 24-In

AWWA C517: Resilient-Seated Cast-Iron Eccentric Plug Valves

AWWA C541: Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates

AWWA C542: Electric Motor Actuators for Valves and Slide Gates

AWWA C550: Protective Interior Coatings for Valves and Hydrants

AWWA C600: Installation of Ductile-Iron Mains and Their Appurtenances

AWWA C605: Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings

AWWA C606: Grooved and Shouldered Joints

AWWA C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), For Water Transmission and Distribution

AWWA C901: Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. (13 mm) - 3 in. (76 mm), for Water Service

AWWA C905: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution

AWWA C906: Polyethylene (PE) Pressure Pipe and Fittings, 4 in. (100 mm) - 63 in. (1,575 mm), for Water Distribution and Transmission

AWWA M23: PVC Pipe - Design and Installation

AWWA: Other standards as appropriate

AMERICAN WELDING SOCIETY (AWS)

AWS standards as appropriate

CANADIAN STANDARDS ASSOCIATION (CSA)

CSA standards as appropriate

ELECTRICAL TESTING LABORATORIES (ETL)

ETL standards as appropriate

FACTORY MUTUAL (FM)

FM standards as appropriate

FEDERAL STANDARDS

SS-S-210A: Federal Specification: Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 115: Guide for Test Procedures for Synchronous Machines Including Acceptance and Performance Testing and Parameter Determination for Dynamic Analysis

IEEE C62.41: Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)/AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

IAPMO/ANSI Z1001 Prefabricated Gravity Grease Interceptors

INTERNATIONAL CODE COUNCIL (ICC)

ICC: International Building Code (IBC)

INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)

ICRI Technical Guideline Number 310-2

INTERNATIONAL PLUMBING CODE

2018 IPC Chapter 10 Traps, Interceptors and Separators

2018 IPC: Other standards as appropriate

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 9001 International Organization for Standardization

MANUFACTURERS STANDARDIZATION SOCIETY (MSS)

MSS SP 60: Connecting Flange Joints Between Tapping Sleeves and Tapping Valves

MSS SP 113: Connecting Joints Between Tapping Machines and Tapping Valves

NATIONAL ELECTRIC CODE (NEC)

NEC: National Electric Code (see NFPA 70)

NECA: NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

NECA 1: Standard for Good Workmanship in Electrical Construction

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 5-15: Receptacle Descriptions

NEMA 6P: Submersible Enclosures

NEMA 110: Connectors

NEMA 250: Enclosures for Outdoor Use

NEMA ICS 1: Industrial Control and Systems: General Requirements

NEMA MG 1: Motors and Generators

NATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS: Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30: Flammable and Combustible Liquids Code

NFPA 37: Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 70: National Electrical Code
NFPA 110: Standard for Emergency and Standby Power Systems
NFPA 820: Standard for Fire Protection in Wastewater Treatment and Collection Facilities

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST standards as appropriate

NATIONAL SCIENCE FOUNDATION (NSF) /AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

NSF/ANSI 6: Food Equipment Standards
NSF/ANSI 61: Drinking Water System Components – Health Effects
NSF/ANSI 372: Drinking Water System Components – Lead Content

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

OSHA Standard 1910.24: Step Bolts and Manhole Steps
OSHA Standard 1926.704: Requirements for Precast Concrete

SOCIETY FOR PROTECTIVE COATINGS (SSPC) (formerly Steel Structures Painting Council)

SSPC-SP 3: Power Tool Cleaning
SSPC-SP 16: Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

SOCIETY FOR PROTECTIVE COATINGS (SSPC) (formerly known as Steel Structures Painting Council)/NACE (formerly known as National Association of Corrosion Engineers)

SSPC-SP 6/NACE 3: Commercial Blast Cleaning
SSPC-SP 10/NACE 2: Near-White Blast Cleaning
SSPC-SP 12/NACE 5: Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultra High-Pressure Water Jetting Prior to Recoating
SSPC-SP 13/NACE 6: Surface Preparation of Concrete

UNDERWRITERS LABORATORIES (UL)

UL 467: Grounding and Bonding Equipment
UL 486A: Standard for Safety Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 489: Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 1008: Transfer Switches
UL 1236: Battery Chargers for Charging Engine-Starter Batteries
UL 1283: Electromagnetic Interference Filters
UL 1449: Surge Protective Devices
UL: Other standards as appropriate

WASTEWATER COMMITTEE OF THE GREAT LAKES - UPPER MISSISSIPPI RIVER BOARD OF STATE AND PROVINCIAL PUBLIC HEALTH AND ENVIRONMENTAL MANAGERS

Recommended Standards for Wastewater Facilities, latest edition (a.k.a. "Ten State Standards")

END OF SECTION 7

SECTION 8 – FORMS

NOTE: SECTION 8 is subject to change and may be updated as necessary by Executive Level staff (as defined in OJRSA Procurement and Property Disposal Policy APPENDIX A) without being considered as a substantive change to this Policy.

The OJRSA can provide electronic versions of the forms contained within this Policy, including:

- A. Sewer Service Availability Request
- B. Surety Bond Form
- C. Standard Easement Agreement
- D. Project Closeout Checklist
- E. CCTV Inspection Report
- F. Gravity Sewer Low-Pressure Air Test
- G. Force Main Hydrostatic Pressure Test
- H. Manhole Vacuum Test
- I. Pump Station Drawdown Test (Circular Wet Well)
- J. Pump Station Drawdown Test (Rectangular Wet Well)
- K. Fats, Oils, & Grease (FOG) Interceptor Installation Checklist
- L. Fats, Oils, and Grease (FOG) Interceptor Inspection & Waste Disposal Form
- M. Fats, Oils, & Grease (FOG) Control Device Inspection Form

DRAFT

8.1 DOWNSTREAM WASTEWATER MODELING ANALYSIS REQUEST

Reset Form



Downstream Wastewater Modeling Analysis Request

Project Name: _____ Date: _____

Company/Person Requesting Evaluation: _____ Contact: _____

Oconee Tax Map Number(s): _____

Use Type (check all that apply): Subdivision Multi-Family (apartments, condos, duplexes, etc.) Commercial/Retail
 Industrial Institutional (school, campground, prison, etc.) Other: _____

ATTACH FLOW CALCULATIONS JUSTIFYING THE FOLLOWING. Estimated Sewer Flow: _____ gallons per day (gpd)
Use SCDHEC Unit Contributory Loadings in SC R.61-67 Appendix A.

To provide responses to the next item, you will need to contact the nearest city to where your project is located to determine if wastewater service near the site. **SEE MAP ON THE NEXT PAGE TO IDENTIFY THE LIKELY RETAIL SEWER PROVIDER.** The contact phone number for the utility is listed below or on the map. Identify who will be the provider below:

- Seneca Light & Water 864-885-2723
- Walhalla Utilities Department 864-638-4343
- Westminster Utilities Department 864-647-3200
- West Union Public Works Department 864-638-9978
- Oconee Joint Regional Sewer Authority 864-972-3900

Current amount based on OJRSA Schedule of Fees as posted at www.ojrsa.org

It will be necessary for you to commit to paying for the fee prior to this service being performed. The current cost for each basic hydraulic modeling assessment is [REDACTED]. By my signature below, I commit to paying the fees associated with this request. I understand that the results will not be provided until full payment has been received by OJRSA. The report will be provided in PDF format to the email address provided below.

I also understand that this request does not constitute a permit to connect to OJRSA or any satellite sewer system (sanitary sewer agency), nor is it to be used to obtain building or construction permits from any regulatory agency. In cases where capacity appears available to serve a project, such capacity can neither be guaranteed nor reserved by the findings as stated in the assessment. Capacity is allocated on a first come, first serve basis during the subsequent OJRSA Capacity Approval Process. Preliminary approval for this project shall not exceed six (6) months from the date signed by the engineer or other timeframes stated in the OJRSA Development Policy Section regarding SEWER AVAILABILITY, CAPACITY APPROVAL, AND REQUEST FOR SERVICE, whichever is less. All other OJRSA regulations and policies shall apply.

I commit to paying for the assessment: Yes No (If "No" is selected, assessment will not be performed until payment is received)

Company/Person to Submit Invoice to: _____ Phone: _____

Name to Submit Invoice to: _____ Preferred Invoice Method: Email US Mail

Email: _____ Mailing Address: _____

Signature: _____

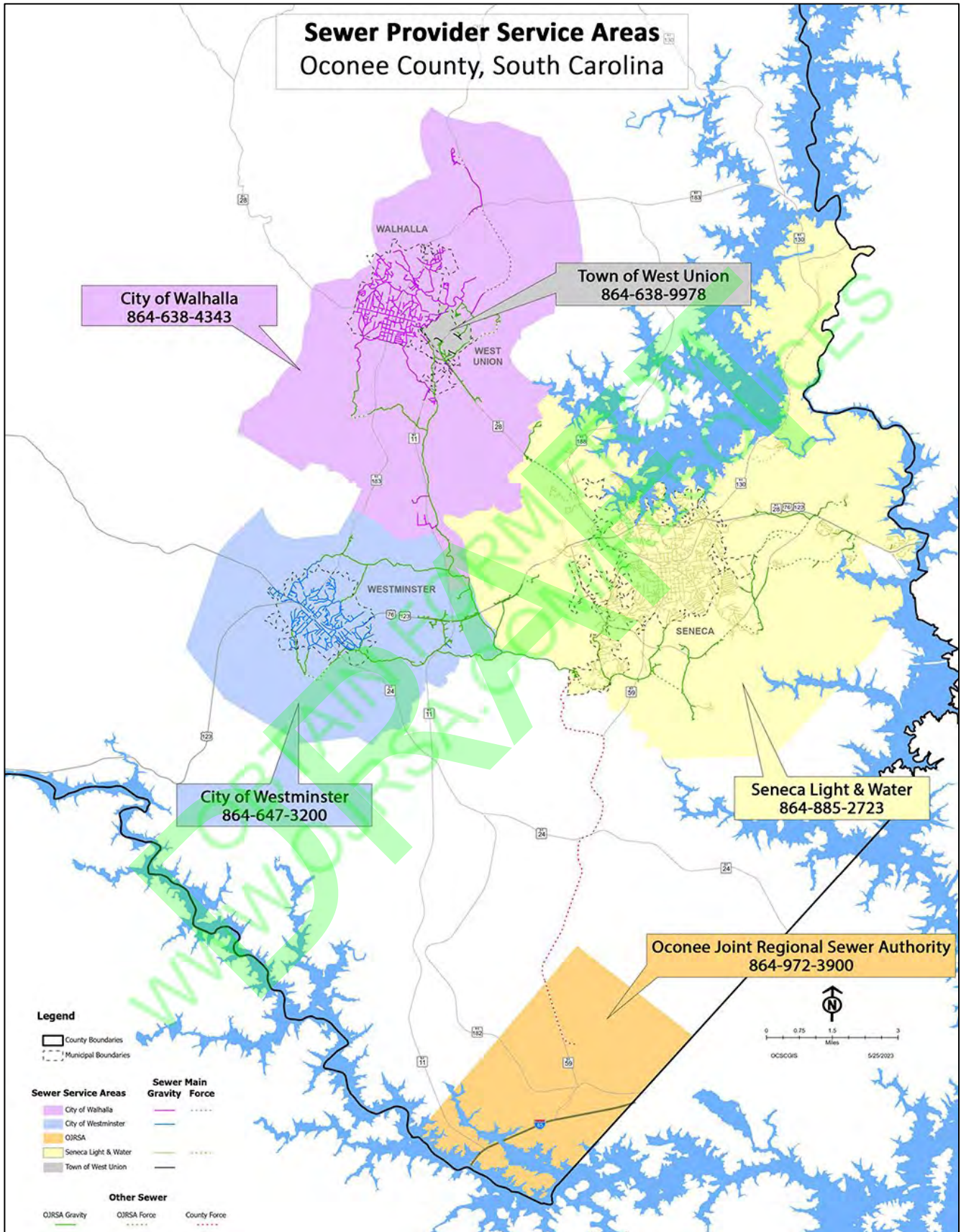
Once form is completed, submit by email to info@ojrsa.org.

TO BE COMPLETED BY OJRSA

Connection Type to Existing Sewer: Gravity Force Main Connection Point Owner: City/Town OJRSA

Project Will Connect to Sewer (nearest street address, GPS coordinates, etc.): _____

Comments



8.2 SURETY BOND FORM

To be provided by OJRSA on as needed basis.

8.3 STANDARD EASEMENT AGREEMENT

To be provided by OJRSA on as needed basis.

DRAFT

8.4 PROJECT CLOSEOUT CHECKLIST



Oconee Joint Regional Sewer Authority
 Engineering Department

Project Closeout Checklist

SC DHEC Project Name: _____

Date: _____ SC DHEC Permit Number: _____

Contractor: _____

Engineering Firm: _____

All boxes should be marked by the Engineering Firm as either "Complete" or "Not Applicable"

General Project Items

General (OJRSA Development Policy sections 2.9.1 & 2.9.2)	Not	Engineer	OJRSA	
	Applicable	Complete	Complete	Incomplete
Engineer's Letter of Certification				
Spare parts provided to OJRSA				
One (1) hard copy and one (1) PDF copy of each O&M Manual				
One (1) hard copy and one (1) PDF copy of each recorded easement, including plats, with signature and seal				
Surety Bond (maintenance warranty) form covering all items built or altered which are to become OJRSA property. MUST BE FOR AT LEAST ONE (1) YEAR.				
Wastewater Infrastructure Deed				
Title to Real Estate for pump stations				
Approved easement plat				
Easement agreements recorded with county				
Pump station electric bill for account owner transfer				
Pump station water/other bill for account owner transfer				
Certified test results for:				
Pressure testing for force mains				
Low-pressure testing for gravity sewer				
Manhole vacuum testing for gravity sewer				
Pipe deflection testing for gravity sewer (if requested by OJRSA)				
Pump station drawdown testing				

See following pages for Record Drawing information

For Record Drawings

General Items	Not Applicable	Engineer Complete	OJRSA	
			Complete	Incomplete
Each sheet of record drawings signed and sealed by Engineer of Record				
Cover sheet include the statement required as stated in <i>OJRSA Development Policy</i> SECTION 2.9.2(B)(2)				
One (1) electronic copy and one (1) hard copy of certified record drawings				
DHEC Permit Number on all sheets				
Lot, unit, and Tax Map Numbers				
Street names				
Site map				
Text height = 0.08 inch or larger				
New mains must be shown as a dark, thick line and labeled with length, diameter, and material (i.e., 150 LF, 8" PVC)				
Graphic and relative scales – Maximum 1" = 40'				
North arrow				
Legend				
Utility contractor's name, address, phone number, and email address				
Engineering firm name, address, and phone number				
Construction completion date (month, year) and horizontal and vertical datum				
Professional Land Surveyor (PLS) signature and stamp				
Registered Professional Engineer (PE) signature and stamp				
Sewer easements				

Gravity Mains	Not Applicable	Engineer Complete	OJRSA	
			Complete	Incomplete
Indicate how the new gravity main ties into the existing main				
Manhole invert and rim (top) elevations –on both Plan and Profile sheets				
Manhole station numbers				
Manholes numbered				
Gravity sewer mains (show on both Plan and Profile):				
Length (manhole to manhole), diameter, and material				
Percent of grade (slope) – manhole to manhole				

Force Mains	Not Applicable	Engineer Complete	OJRSA	
			Complete	Incomplete
Indicate how the new force main ties into the existing force main or manhole				
Sewer force mains (show on both Plan and Profile):				

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Project Closeout Checklist for SCDHEC Project Name: _____

Length (pump station to discharge point), diameter, and material				
Valves				
Air release valve (ARV) station numbers				
Force main valves				

Pump Stations	Not Applicable	Engineer Complete	OJRSA	
			Complete	Incomplete
Address and TMS# of pump station property				
Pump station plan and details				
Pump station electrical schematics				
Site map				
Address and TMS# of pump station property				

Electronic Records	Not Applicable	Engineer Complete	OJRSA	
			Complete	Incomplete
One (1) hard copy and one (1) PDF copy of each O&M Manual				
One (1) hard copy and one (1) PDF copy of each recorded easement, including plats, with signature and seal				
Digital photographs of any unusual situations				
AutoCAD (.dwg) files of the Record Drawings				
GIS Submittals (as stated in Section 2.9.3 of the Policy):				
Required coordinate system used				
Required minimum accuracy used				
Easement requirements met				
Gravity sewer lines and all required information				
Manholes and all required information				
Force mains and all required information				
Force main air release valves and all required information				
Force main isolation valves and all required information				
Pump stations and all required information				
Gravity sewer services ("laterals") and all required information				
Grinder pumps/force mains and all required information				

Signatures

Engineer: _____ Date: _____

OJRSA: _____ Date: _____

8.5 CCTV INSPECTION REPORT



Oconee Joint Regional Sewer Authority
Engineering Department

CCTV Inspection Report

SC DHEC Project Name: _____

Date: _____ SC DHEC Permit Number: _____

Contractor: _____

Engineering Firm: _____

The Oconee Joint Regional Sewer Authority (OJRSA) has completed a CCTV inspection for this project to verify that the installed sanitary sewer system has been constructed to meet OJRSA regulatory specifications and standards. The results of the CCTV inspection are:

- Deficiencies were not identified or observed during the inspection.
- Deficiencies have been identified and shall be repaired prior to OJRSA's acceptance of the sewer system.
 - Copies of the CCTV video and deficiencies are available to the engineer and may be picked up at OJRSA.
 - Copies of the deficiencies are included with this Report.

The Applicant's Engineer shall notify the Applicant of these deficiencies and verify that repairs have been made. Any sewer lines that are repaired shall be re-tested in accordance with *OJRSA Standard Specifications and Details*. The Applicant's Engineer shall confirm that all repairs and testing are complete by filling out the information below, signing, and returning this document to OJRSA.

Issued by OJRSA Representative: _____ Date: _____

I, _____ (Applicant's Engineer), certify to the best of my knowledge and belief, that all repairs required to correct the deficiencies identified by the CCTV inspection have been completed and that the project is ready for a follow-up inspection (attach completed testing forms).

Applicant's Engineer's Signature: _____ Date: _____

- A follow-up CCTV inspection indicates that deficiencies remain, and additional work is required. The Applicant's Deficiencies were not identified or observed during the inspection.

Follow-up #1 OJRSA Representative: _____ Date: _____

Follow-up #2 OJRSA Representative: _____ Date: _____

Follow-up #3 OJRSA Representative: _____ Date: _____

I, _____ (Applicant's Engineer), certify to the best of my knowledge and belief, that all repairs required to correct the deficiencies identified by the follow-up CCTV inspection have been completed and that the project is ready for a follow-up inspection (attach completed testing forms).

Follow-up #1 Applicant's Engineer Signature: _____ Date: _____

Follow-up #2 Applicant's Engineer Signature: _____ Date: _____

Follow-up #3 Applicant's Engineer Signature: _____ Date: _____

- The sanitary sewer system meets all OJRSA requirements and specifications. OJRSA's ownership acceptance letter will be mailed to the Applicant's Engineer's office and transmitted via email within several working days.

Issued by OJRSA Representative: _____ Date: _____

8.6 GRAVITY SEWER LOW-PRESSURE AIR TEST



Oconee Joint Regional Sewer Authority
Engineering Department

Gravity Sewer Low-Pressure Air Test

SC DHEC Project Name: _____

Date: _____ SC DHEC Permit Number: _____

Contractor: _____

Engineering Firm: _____

Upstream MH	Downstream MH	Diameter (in.)	Length (ft.)	Test Time (min:sec)	Groundwater Adjustment (psig)	Start Test Pressure (psig)	Pressure Drop (psig)	Pass/Fail

Contractor Representative: _____ Date: _____

Engineer Representative: _____ Date: _____

OJRSA Representative: _____ Date: _____

8.7 FORCE MAIN HYDROSTATIC PRESSURE TEST



Oconee Joint Regional Sewer Authority
Engineering Department

Force Main Hydrostatic Pressure Test

SC DHEC Project Name: _____

Date: _____ SC DHEC Permit Number: _____

Contractor: _____

Engineering Firm: _____

Start Station	End Station	Length (ft.)	Diameter (in.)	Start Time	End Time	Test Pressure (psig)	Allowable Leakage (psig)	Actual Leakage (psig)	Pass/Fail

Allowable Leakage

$$L = \frac{SD\sqrt{P}}{148,000}$$

L = Allowable Leakage (gph)

S = Length of Pipe Tested (ft)

D = Nominal Pipe Diameter (in)

P = Test Pressure (psig)

Contractor Representative: _____

Date: _____

Engineer Representative: _____

Date: _____

OJRSA Representative: _____

Date: _____

8.8 MANHOLE VACUUM TEST



Oconee Joint Regional Sewer Authority
 Engineering Department

Manhole Vacuum Test

SC DHEC Project Name: _____

Date: _____ SC DHEC Permit Number: _____

Contractor: _____

Engineering Firm: _____

Note: Test Time shall be per ASTM C1244 for the vacuum pressure to drop from 10 inHg to 9 inHg. Test passes if Pressure Drop is less than 1 inHg for Test Time.

Manhole Number	Diameter (ft.)	Rim Elevation (MSL)	Invert Out Elevation (MSL)	Depth (ft.)	Test time (sec.)	Start Test Pressure (inHg)	Pressure Drop (inHg)	Pass/Fail

Contractor Representative: _____ Date: _____

Engineer Representative: _____ Date: _____

OJRSA Representative: _____ Date: _____

8.9 PUMP STATION DRAWDOWN TEST (CIRCULAR WET WELL)



Oconee Joint Regional Sewer Authority
 Engineering Department

**Pump Station Drawdown Test
 Circular Wet Well**

Pump Station Name: _____

SC DHEC Project Name: _____

Date: _____ SC DHEC Permit Number: _____

Contractor: _____

Engineering Firm: _____

Pump Number	Start Depth (in.)	Stop Depth (in.)	Volume (gallons)	Test Time (min.)	Pumping Rate (gpm)	Gauge Pressure (psig)	Gauge Elevation (MSL)	Wet Well Water Surface (MSL)	Total Dynamic Head (ft.)

<p>Wet Well Volume Pumped</p> $V = 7.48 \frac{\text{gal}}{\text{ft}^3} \times 0.785D^2 \times (E_1 - E_2)$ <p>V = Volumes pumped (gal) D = Wet well diameter (ft) E_1 = Pump start elevation (ft) E_2 = Pump stop elevation (ft)</p>	<p>Pumping Rate</p> $Q = \frac{V}{T}$ <p>Q = Pumping rate (gpm) V = Volume pumped (gal) T = Test rate (min)</p>	<p>Total Dynamic Head (TDH)</p> $TDH = (Z_G - Z_W) + P \frac{144 \frac{\text{in}^2}{\text{ft}^2}}{62.4 \frac{\text{lb}}{\text{cf}}}$ <p>TDH = Total pumping head (ft) Z_G = Gauge elevation (MSL) Z_W = Wet well water elevation (MSL) P = Gauge pressure (psig)</p>
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Contractor Representative: _____ Date: _____

Engineer Representative: _____ Date: _____

OJRSA Representative: _____ Date: _____

8.10 PUMP STATION DRAWDOWN TEST (RECTANGULAR WET WELL)



Oconee Joint Regional Sewer Authority
 Engineering Department

**Pump Station Drawdown Test
 Rectangular Wet Well**

Pump Station Name: _____

SC DHEC Project Name: _____

Date: _____ SC DHEC Permit Number: _____

Contractor: _____

Engineering Firm: _____

Pump Number	Start Depth (in.)	Stop Depth (in.)	Volume (gallons)	Test Time (min.)	Pumping Rate (gpm)	Gauge Pressure (psig)	Gauge Elevation (MSL)	Wet Well Water Surface (MSL)	Total Dynamic Head (ft.)

<p>Wet Well Volume Pumped</p> $V = 7.48 \frac{\text{gal}}{\text{ft}^3} \times L \times W \times (E_1 - E_2)$ <p>V = Volumes pumped (gal) L = Wet well length (ft) W = Wet well width (ft) E_1 = Pump start elevation (ft) E_2 = Pump stop elevation (ft)</p>	<p>Pumping Rate</p> $Q = \frac{V}{T}$ <p>Q = Pumping rate (gpm) V = Volume pumped (gal) T = Test rate (min)</p>	<p>Total Dynamic Head (TDH)</p> $TDH = (Z_G - Z_W) + P \frac{144 \frac{\text{in}^2}{\text{ft}^2}}{62.4 \frac{\text{lb}}{\text{cf}}}$ <p>TDH = Total pumping head (ft) Z_G = Gauge elevation (MSL) Z_W = Wet well water elevation (MSL) P = Gauge pressure (psig)</p>
--	---	--

Contractor Representative: _____ Date: _____

Engineer Representative: _____ Date: _____

OJRSA Representative: _____ Date: _____

8.11 FATS, OILS, & GREASE (FOG) INTERCEPTOR INSTALLATION CHECKLIST



Oconee Joint Regional Sewer Authority
Pretreatment Department
623 Return Church Road
Seneca, South Carolina 29678
Phone (864) 972-3900 | www.ojrsa.org

Fats, Oils, and Grease (FOG) Interceptor Installation Checklist

Date of Inspection: _____ Time of Inspection: _____
FOG Generator Business Name: _____ Contact Name: _____
Generator Address: _____ Phone: _____
Generator Email: _____
Installer Business Name: _____ Email: _____
Installer Address: _____ Phone: _____
Installer Contact Name: _____

Is the interceptor installed the location that was approved on the plans? YES NO N/A (replacement of existing)
Comments: _____

Is inlet "T" installed offset of the manhole lid with approximately 6 inch gap from the bottom of the concrete lid?
 YES NO
Comments: _____

Is piping from the inlet "T" approximately 24 inches from the water level? YES NO
Comments: _____

Is the baffle wall securely in place? YES NO
Comments: _____

Does baffle wall standpipe have 6 inch gap from the bottom of the concrete lid? YES NO
Comments: _____

Does baffle wall piping have approximately 18-20 inch gap from the inside bottom of interceptor? YES NO
Comments: _____

Is center of the baffle wall crossover at the water line level? YES NO
Comments: _____

Is effluent "T" installed offset of the manhole lid with approximately 6 inch gap from the bottom of the concrete lid?
 YES NO
Comments: _____

Is piping from the effluent "T" approximately 18-24 inches from the inside bottom of the interceptor? YES NO
Comments: _____

Is there a 2-way sweep cleanout on the effluent side of the interceptor? YES NO
Comments: _____

Additional Comments

Installation approved or rejected: APPROVED REJECTED

Inspector: _____
Print Name Signature

8.12 FATS, OILS, AND GREASE (FOG) INTERCEPTOR INSPECTION & WASTE DISPOSAL FORM



Oconee Joint Regional Sewer Authority
Pretreatment Department
623 Return Church Road
Seneca, South Carolina 29678
Phone (864) 972-3900 | www.ojrsa.org

Fats, Oils, and Grease (FOG) Interceptor Inspection & Waste Disposal Form

All FOG Waste Disposal Forms are to be submitted to the OJRSA monthly and a copy given to the FOG Generator by the Waste Hauler

Date of Inspection: _____ Time of Inspection: _____

FOG Generator Business Name: _____ Contact Name: _____

Generator Address: _____ Phone: _____

Generator Email: _____

Property Owner Name: _____ Phone: _____

Property Owner Address: _____

Hauler Company Name: _____ Email: _____

Hauler Address: _____ Phone: _____

Waste Disposal Site: _____ Phone: _____

Disposal Site Address: _____

Volume of Waste Removed (in gallons): _____ gallons

The following FOG interceptor maintenance activities must be performed:

- A) Complete removal of all contents of the FOG interceptor rather than skimming the top grease layer. **Top skimming, decanting, or backflushing of the device, its contents, septage waste, solids, water, or other materials back into the FOG interceptor for the purpose of reducing the volume of waste to be hauled is prohibited by regulation.** Vehicles capable of separating water from FOG shall not discharge separated water into the interceptor or wastewater conveyance system.
- B) Provide a thorough cleaning of the FOG interceptor to remove FOG buildup from inner walls and baffles.

Is the inlet and outlet flow visible? YES NO

Comments: _____

Is FOG being discharged to the sewer through the effluent? YES NO

Comments: _____

Walls and baffle wall washed down? YES NO

Comments: _____

Is the aggregate showing in any part of the tank? YES NO

Comments: _____

Was the tank completely pumped out? YES NO

Comments: _____

Continued on next page

Is there an inlet "T" installed offset of the manhole lid? YES NO

Comments:

Is the piping from the inlet "T" approximately 24 inches from the water level? YES NO

Comments:

Is the baffle wall secure and in place? YES NO

Comments:

Does the baffle wall piping have approximately 18-20 inch gap from inside bottom of interceptor? YES NO

Comments:

Is the center of baffle wall crossover at the water line level? YES NO

Comments:

Is there an effluent "T" installed offset of the manhole lid? YES NO

Comments:

Is the piping from the effluent "T" approximately 18-24 inches from the inside bottom of interceptor? YES NO

Comments:

Is there a water source (e.g., yard hydrant, spigot) within 50 feet of the interceptor for washdown? YES NO

Comments:

Actions Required

Additional Comments

Generator: _____
Print Name

Signature

Waste Hauler: _____
Signature

8.14 FATS, OILS, & GREASE (FOG) CONTROL DEVICE INSPECTION FORM



OCCONEE JOINT REGIONAL SEWER AUTHORITY
Pretreatment Department
623 Return Church Road
Seneca, South Carolina 29678
Phone (864) 972-3900 | www.ojrsa.org

Fats, Oils, & Grease (FOG) Control Device Inspection Form

Establishment Name: _____

Date: _____ Time: _____ Contact Name: _____

Type of Business: _____ Owner Name: _____

Fiscal Address: _____ Phone: _____

Mailing Address: _____ Number of Seats: _____

1. Type of FOG control device ("device") at the establishment:
 Trap Interceptor Oil/Water Separator None Other (describe in Comments section)
2. Is the device covered under a variance? No Yes Date variance given: _____
3. Has the device been approved by the OJRSA for installation? Yes NO (MAJOR)
4. Is the device cleaned and maintained regularly? Yes NO (MAJOR) N/A (Initial inspection)
5. Frequency of maintenance: _____ N/A (Initial inspection)
6. Are maintenance/cleaning records kept on-site? Yes NO (MAJOR) N/A (Initial inspection)
7. Does facility have Best Management Practices (BMPs) that have been approved by the OJRSA?
 Yes No (minor)
8. Does it appear that BMPs are being followed? Yes No (minor) N/A (Initial inspection)
9. Are fats, oils, and/or grease (FOG) visible around the yellow grease recycle bin?
 Yes (minor) No N/A
10. Is FOG present in downstream manhole? Yes No (may require additional investigation) Not Checked
11. Were downstream sewer lines inspected? Yes No
12. Was a sample taken? Yes No If "Yes," from where? _____

FOG Trap/Interceptor Information:

Size: _____ Make/Model: _____

Location: _____

Fixtures Served: _____

FOG Traps:

1. Is this FOG trap constructed of non-metallic, non-corrosive materials? Yes NO (MAJOR)
2. Is this FOG trap located above grade of floor? Yes NO (MAJOR)
3. Does this device meet the regulated minimum requirement of 20 pounds and 10 gallons per minute?
 Yes NO (MAJOR)
4. Is the flow control device installed and visible for future inspections and servicing?
 Yes No (minor)

- 5. Is the FOG trap installed properly? Yes NO (MAJOR)
- 6. Is this trap accessible for servicing and cleaning? Yes NO (MAJOR)
- 7. Is the trap maintained according to OJRSA Regulations? Yes NO (MAJOR) N/A (Initial inspection)

FOG Interceptors:

- 1. Does this FOG interceptor meet the regulated minimum requirement of 20 gallons per seat?
 Yes NO (MAJOR)
- 2. Is this interceptor accessible for servicing and cleaning? Yes NO (MAJOR)
- 3. Is the device maintained according to OJRSA Regulations? Yes NO (MAJOR) N/A (Initial inspection)

Actions Required/Comments:

Compliance Result:

- SATISFACTORY** – No further action required beyond actions currently taken
- NEEDS IMPROVEMENT** – Minor deficiencies noted and action(s) necessary by facility (select one):
 - Follow-up Necessary – To be conducted on or around _____
 - No follow-up necessary but items will need to be adequately addressed prior to next inspection or an Unsatisfactory rating could be issued
- UNSATISFACTORY** – Repeat or serious violations constituting of one “major” or three or more “minor” deficiencies. Unsatisfactory rating could lead to enforcement actions as defined in the *OJRSA Sewer Use Regulation* and/or request by the OJRSA to have water service disconnected. Follow-up required and will be conducted on or around _____.

OJRSA Representative: _____

SECTION 9 – STANDARD DETAILS

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-	Cover
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D001	Easement Grading
D002	Gravity Sewer Trench & Bedding
D003	Gravity Sewer Trench & Bedding – Wet Locations
D004	Asphalt Pavement Replacement at Pipe Trench
D005	Stream Crossing
D006	Long Span Stream Crossing
D007	Stream Bank Protection
D008	Standard Manhole
D009	Doghouse Manhole
D010	Inside Drop Manhole
D011	Outside Drop Manhole
D012	Precast Manhole for Aerial Gravity Sewer
D013	Shallow Precast Manhole
D014	Pipe Connection at Manhole
D015	Standard Manhole Frame & Cover
D016	Heavy Duty Manhole Cover
D017	Heavy Duty Manhole Cover with Cam Lock
D018	Heavy Duty Manhole Frame
D019	Force Main Trench & Bedding
D020	Horizontal Joint Restraint
D021	Vertical Joint Restraint
D022	Pipe Casting Under Paved Areas
D023	Sewer Line Crossing Water Line
D024	Sewer Line Crossing Storm Drainage
D025	Concrete Encasement
D026	Valve Box
D027	Air Release Valve
D028	Pipeline & Valve Marker
D029	Force Main Connection at Manhole
D030	Sewer Lateral and Cleanout
D031	Sewer Lateral on Existing Gravity Sewer
D032	Saddle Connection for Live Stream Wastewater Mains
D033	Deep Sewer Lateral
D034	Steel Double Gate for Easements
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FOG-2	Fats, Oils, and Grease Interceptor
FOG-3	Oil/Water Separator
PS-1	Typical Submersible Pump Station Site Plan
PS-2	Typical Suction Lift Pump Station Site Plan
PS-3	Grinder Pump Station Site Plan
PS-4	Submersible Pump Station Top Plan & Piping Plan
PS-5	Submersible Pump Station Elevation
PS-6	Suction Lift Pump Station Plan
PS-7	Suction Lift Pump Station Elevation

Sheet Number	Sheet Title
PS-8	Magmeter Vault
PS-9	Typical Bypass
PS-10	Typical Yard Hydrant
PS-11	Standard Chain Link Fencing
S-1	Canopy and Electrical Pad Plan & Elevations
E-1	Duplex Pump Station Electrical Standards
E-2	Yard Light
E-3	Pump Station One-Line Diagram

END OF SECTION 9

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APPENDIX A – SEWER MASTER PLANS

See the following Sewer Master Plans as approved by OJRSA Board:

- *Fair Play and Townville Area Sewer Basin Plan (2023)*

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APPENDIX B – REGULATORY REQUIREMENTS SPECIFIC TO OJRSA

See the following document(s) regarding regulatory mandates, such as enforcement actions imposed against the OJRSA, that may apply to the *OJRSA Development Policy*:

- *SCDHEC Consent Order 21-025-W* executed May 14, 2021
- *Report of Findings – Summary of Deficiencies and Work Plan* (August 24, 2022) as submitted to SCDHEC per Consent Order. Contact OJRSA to inquire about which of these project(s) may have been completed.
- *Capacity, Management, Operation, and Maintenance (CMOM) Plan* (September 2023) as submitted to SCDHEC per Consent Order. Appendices of this plan have been removed as they have been updated or are not relevant to the *OJRSA Development Policy*. Contact OJRSA with any questions regarding the CMOM.

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WESTON & SAMPSON ENGINEERS, INC.
3543 Pelham Rd, Suite 204
Greenville, SC 29615
tel: 864.686.5774

Fair Play and Townville Area Sewer Basin Plan

May 2023

Oconee Joint Regional Sewer
Authority
SOUTH CAROLINA



Fair Play and Townville Area Sewer Basin Plan

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Fair Play and Townville Area Sewer Basin Plan

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Fair Play and Townville Area Sewer Basin Plan

1.0 SEWER MASTER PLANNING

1.1 Introduction

1.1.1 Background and Study Area

The purpose of this study is to explore the feasibility of sanitary sewer extension in and around Fair Play and Townville, SC. This study included both technical analysis and stakeholder engagement to explore the viability and public support for these infrastructure improvements.

At the onset of this project, the study area included only the southernmost portion of Oconee County. After the first stakeholder meeting, it was decided by Oconee County and Oconee Joint Regional Sewer Authority (OJRSA) that the study area should be expanded to include additional areas of interest. The resulting study area included the Village of Fair Play and the whole Fair Play zip code, Townville, Interstate 85 from the Georgia border to just past Exit 11, a buffer around Highway 24, and West Oak High School near the intersection of Highway 11 and Highway 24 (see Appendix A, Figure 1. Report Study Area). This area encompasses the southernmost portion of Oconee County (Census Tracts 309.01, 309.03, 309.04) and northwest corner of Anderson County (Census Tract 109) in South Carolina. This area currently does not contain public sewer except for a pump station at the Golden Corner Commerce Park and two parallel force mains associated with the pump station that connect to the OJRSA Coneross Creek Water Reclamation Facility (WRF). A proposed sewer project, referred to as Sewer South Phase II, was considered during this study. Sewer South Phase II provides sewer service to the Exit 1 Welcome Center, Exit 2 area, and Village of Fair Play, and ties into the existing Golden Corner Commerce Park Pump Station. The contract for construction of Sewer South Phase II was awarded in March 2023, and the project is expected to be in service by mid-2024. Several of the studies proposed sanitary sewer projects planned for the initial 0-5 year timeframe assume this sewer infrastructure is in service by 2024.

The goal for this study is to complete a 20-year planning document (2022-2042) that projects anticipated growth within the study area and the potential extended sanitary sewer needs and costs associated with planned public and private improvements.

Currently, OJRSA is funded through fees paid by its three member cities (Seneca, Walhalla, and Westminster), who own and maintain their own collection systems that convey flow to OJRSA for transport to the Coneross Creek WRF for treatment. OJRSA does not receive any ad valorem tax money or other funding except for funding provided by Oconee County.¹ OJRSA currently has no retail customers, but will once the Sewer South Phase II Project goes online, as there is not another sewer provider in the area. Any future customers, retail or otherwise, in the Fair Play area will likewise be a direct customer of OJRSA.

The study area currently has limited sewer service, and what sewer infrastructure exists is owned by private providers, apart from the existing Exit 1 Welcome Center treatment system. The current sewer infrastructure is as follows:

¹ Of note, Oconee County has not provided any funding for OJRSA's existing sewer system in at least six years. The only funds provided by the county has been for funding this study, subsidizing the construction of a small retail sewer system at Interstate 85 ("Sewer South Phase II"), and to operate and maintain the Golden Corner Commerce Park Pump Station, which is owned by the county.

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- Foxwood Hills – serves the Foxwood Hills neighborhood. The treatment system design flow is 200,000 gallons per day (gpd).
- Chickasaw Point – serves the Chickasaw Point neighborhood. Wastewater collected and treated via a spray irrigation system on the golf course. Permitted for 150,000 gpd.
- Jacabb Utilities – a land application system serving Exit 4. Permitted for 15,000 gpd.
- West Oak High School (owned/operated by the School District of Oconee County) – serves the high school. The treatment system has a design flow of 32,000 gpd.
- Carolina Landing Campground - the treatment system has a design flow of 40,000 gpd.
- Welcome Center (owned/operated by SC Department of Parks, Recreation, and Tourism) – the treatment system has a design flow of 15,000 gpd.

In general, in the absence of sewer infrastructure, the existing developments have occurred along highways, which are generally located along ridgelines. This makes collecting sewer from existing residents and businesses difficult to do on a large scale.

Sewer investments in this area will likely stimulate additional development that may not have been possible without sewer access. This could benefit not only the study area but Oconee and Anderson Counties as well by increasing the tax base. Having a thoughtful conversation about future publicly provided sewer needs is an important aspect as a community considers plans for growth. Sewer infrastructure has both costs and benefits, and where to invest is the critical question. Based on available information, this study considered the following:

- Current infrastructure and needs
- Locations for future growth areas
- Economic development goals
- Population growth potential
- Commercial and industrial needs
- Feasibility of sewer by location
- Cost for installation and maintenance
- Environmental concerns/area constraints on growth
- Cost/benefit for both the sewer provider and customers

1.1.2 Policy Considerations – Oconee Joint Regional Sewer Authority and Oconee County

OJRSA Sewer Use Regulation Section 2.4 states:

“The Owner of all houses, buildings, or properties used for human occupancy, employment, recreation, or other purposes, abutting on any street, alley, or right-of-way in which there is a public sanitary sewer, is hereby required at the expense of the Owner to install suitable toilet facilities therein, and to connect such facilities directly with the public sewer in accordance with the provisions of these Regulations, within ninety (90) calendar days after date of official notice to do so, provided that said public sewer is within three hundred (300) feet of the property line. Under unusual or specific circumstances, the Director may waive this provision.”

This policy means that if public sewer is available within a reasonable distance (300 feet or less) to a home or business property line (not the structure itself), the owner of that home or business would be required to connect to the service, unless provided a waiver of exemption due to an extreme

Fair Play and Townville Area Sewer Basin Plan

circumstance. What is not clear within this regulation is what happens to existing septic users or what constitutes a specific circumstance that would allow a waiver. This concern was frequently vocalized at the June 28, 2022, public meeting and in the public survey results. Several residents who have new or working septic systems voiced concern about the requirement to tie into public sewer if it were made available within 300 feet of their property line. Additional information from the survey is included in Section 2.1.2 and in **Appendix B**.

1.1.3 Policy Consideration – Anderson County Use of Public Sewer

Anderson County has a policy regulating sewer discharge within the county's jurisdiction. Their approach is tiered pending the linear foot (LF) distance from the property to the sewer availability based on land use and size of the development. The following is the verbiage in the regulation of sewer discharge within Anderson County's jurisdiction Section 44-26:

"All sewage disposal within the jurisdiction of the county shall be regulated by the county, and disposal shall be by public sewers and sewerage system except where connection is impractical for technical reasons as follows:

- *Single Family Residence – 300 LF*
- *Duplex Apartment Complex (2-6 units) – 800 LF*
- *Up to 30 lot subdivision – 1500 LF*
- *30-60 lot subdivisions – 3000 LF*
- *60-90 lot subdivisions – 4500 LF*
- *Greater than 90 for subdivision – 1 mile"*

There are some exceptions to this rule including challenging topography, right-of-way considerations, and subdivisions with lot sizes that are four acres or more. Additionally, according to this rule, force main lines are not considered to be readily available to the public and thus only properties that are approved for force main access by county council or wastewater department will be permitted to connect to these lines.

1.1.4 Policy Considerations – South Carolina Department of Health and Environmental Control

South Carolina Department of Health and Environmental Control (SCDHEC) has regulation related to wastewater treatment facility accessibility, regulation R 61-56 Section 300, which reads as follows:

"300.1 Permits for new onsite wastewater systems shall not be issued where a wastewater treatment facility is accessible for connection.

300.2 Repairs to or replacement of failing onsite wastewater systems shall not be allowed where a wastewater treatment facility is accessible for connection." (SCDHEC 2022).

Although SCDHEC does not specify a distance to which this accessibility regulation kicks in, there is a South Carolina State statute that addresses the authority for determining the connection. SC Code, Sections 5-31-210, authorizes municipal governments to "adopt and enforce regulations requiring all properties to which sewer service is available to connect to the municipality's sewage collection

Fair Play and Townville Area Sewer Basin Plan

facilities” (Title 5 Municipal Corporations).² This puts the responsibility of determining accessibility in the provider’s jurisdiction, which provides context for the different approaches outlined in Section 1.1.2 and 1.1.3.

1.1.5 Policy Considerations – 303(d) South Carolina Department of Health and Environmental Control

Failing septic systems have been a concern within the study area. Coneross and Beaverdam Creeks underwent a successful Clean Water Act Section 319 Grant project. By 2005, 38 failing septic systems in the area were repaired or replaced. Both creeks were removed from the section 303(d) list of Impaired Waters in 2002, because of the development of a Total Maximum Daily Load for each site, and by 2005 water quality standards were met (EPA, 2007). Beaverdam Creek, which flows north-south, east of Highway 59 was listed again on the 303(d) list in 2018 for *E.coli* (SCDHEC, 2020). Snow Creek at the north edge of this study area, flowing west to east is also on the section 303(d) List for *E.coli* (SCDHEC, 2020). Both creeks drain to Lake Hartwell. At the time of this report, the 2018 list was the most current available and finalized version of the 303(d) list from the South Carolina Department of Health and Environmental Control (SCDHEC, 2020). During the period that this report was developed, the draft 2020 and 2022 lists were under review and not available.

Due to the lack of publicly available data for the age of septic systems in this area, an accurate depiction of failing units on water quality is unclear. Additionally, SCDHEC only requires a permit for new or total replacement of septic systems. Maintenance and repairs to individual dwelling or business septic systems are the responsibility of the owner and do not require a permit or notice from SCDHEC, which makes tracking this information difficult (SCDHEC, 2022).

1.1.6 Policy Considerations – Comprehensive Plans

Oconee County mentions sewer expansion several times in their comprehensive plan. Expanding sewer facilities for new residential use is a goal under many elements within the plan and the availability of public sewer (and water service) is noted as having the following benefits:

- “Reduce initial residential construction and development costs and enable smaller residential lot sizes in appropriate areas” making “residential development more attractive to prospective developers and less expensive for potential buyers”
- “The extension of public sewer service to currently unserved areas can lower residential development costs”
- “Increased availability of water and sewer service can also encourage the location of new industries and businesses that provide additional jobs and increased community investment” (Oconee, 2020)

Additionally, the Oconee comprehensive plan acknowledges that “although wells and septic tanks can be less expensive alternatives to publicly provided water and sewer service over time”, the need for larger lot sizes “can sometimes raise land prices higher than the smaller lots in more densely developer projects that have water and sewer service” and the initial development costs can be high for septic tank installation (Oconee, 2020). **Table 1** below summarize the goals, objectives, and

² A legal opinion should be obtained to determine if this also applies to the OJRSA as a Joint Authority Water and Sewer System under SC Code 6-25, counties (SC Code Title 4), and other governments.

Fair Play and Townville Area Sewer Basin Plan

strategies related to sewer within the Oconee Comprehensive Plan.

Table 1: Summary of Sewer Related Goals from Oconee County Comprehensive Plan

Goals/Objectives/Strategies	Accountable Agencies	Time Frame for Evaluation	Date Completed
Goal 3.2. Promote and enhance access to affordable, safe, and decent housing for all Oconee residents through public and private cooperation.			
Objective 3.2.2. Work with the State, municipalities, neighboring communities, and other public and private organizations to remove barriers to, and identify solutions for, the provision of affordable housing.			
Strategy 3.2.2.1. Encourage the expansion of water and sewer infrastructure and facilities to increase opportunities for new residential development and provide service for existing residential areas that are currently unserved.	<ul style="list-style-type: none"> Oconee County Municipalities Water and Sewer Providers S.C. Dept. of Commerce 	2023	
Goal 6.3. Preserve, protect, and enhance the quality and quantity of the water resources of Oconee County.			
Objective 6.3.1. Expand sewer service to additional areas as feasible.			
Strategy 6.3.1.1. Support wastewater treatment providers in the extension of sewer service to currently unserved or underserved areas to minimize the need for septic tanks where conditions are not suitable or water sources may be compromised.	<ul style="list-style-type: none"> Oconee County Oconee Joint Regional Sewer Authority (OJRSA) Municipal Providers Other Public and Private Providers 	2025	
Strategy 6.3.1.2. Support wastewater treatment providers in the upgrade and expansion of existing treatment facilities to accommodate the expansion of sewer service.	<ul style="list-style-type: none"> Oconee County OJRSA Municipal Providers Other Public and Private Providers 	2023	
Goal 7.1. Provide adequate, safe, and efficient infrastructure to support current and projected needs.			
Objective 7.1.2. Improve and expand wastewater treatment within Oconee County.			
Strategy 7.1.2.1. Expand sewer service throughout areas identified by the Land Use Element as potential areas of development, while implementing appropriate measures to avoid negative impacts on sensitive areas.	<ul style="list-style-type: none"> Oconee County OJRSA Other Sewer Providers 	2025	
Strategy 7.1.2.2. Work with neighboring jurisdictions when possible to establish regional efforts to expand sewer service into prime commercial and industrial locations	<ul style="list-style-type: none"> Oconee County Neighboring Jurisdictions 	Annually	
Strategy 7.1.2.3. Partner with municipalities and the Joint Regional Sewer Authority to coordinate efforts to provide sewer throughout high growth corridors.	<ul style="list-style-type: none"> Oconee County Municipalities OJRSA Other Sewer Providers 	Annually	
Strategy 7.1.2.4. Establish partnerships with regional, state, and federal agencies to seek and secure funding for wastewater treatment facility upgrade and expansion needs.	<ul style="list-style-type: none"> Oconee County OJRSA Other Sewer Providers Relevant Regional, State and Federal Agencies 	Annually	

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Goal 7.2. Manage community facilities, infrastructure, and public resources in a manner that ensures both current residents and businesses and future generations can enjoy the benefits and opportunities that make Oconee County an attractive and affordable place to live.			
Objective 7.2.5. Strengthen coordination among the County, municipalities, neighboring counties, regional and State agencies, and other public and private organizations.			
Strategy 7.2.5.2. Continue coordination of the provision of water, sewer, and electricity with municipalities and other public and private providers.	<ul style="list-style-type: none"> • Oconee County • Municipal Utility Providers • Public & Private Utilities 	Ongoing	

Note: Information directly sourced from Oconee, 2020

Anderson County does not specifically mention sewer expansion in their comprehensive plan. Anderson does acknowledge that cost is a factor for extending water and sewer to undeveloped land within the county, impacting the affordability of new residential development (Anderson, 2016). Anderson also notes that there are many individuals on-lot septic systems that exist in moderate density communities (Anderson, 2016).

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2.0 PLANNING AND ANALYSIS

2.1 Data Review & Engagement

Phase 1 of this project included reviewing previous studies performed in this area, researching, and analyzing additional data, as well as meeting with stakeholders, including the public, to better inform potential future sewer users within the study area (**Figure 1. Report Study Area**).

Throughout the beginning phases of this project, many previous studies, analyses, and data were considered as a part of this effort. Those items that were reviewed include, but are not limited to:

- Oconee County Comprehensive Plan (2020)
- Anderson County Comprehensive Plan (2016)
- Oconee County Zoning Enabling Ordinance (2009)
- Village of Fair Play Strategic Master Plan (2022) by Studio Main
- Wastewater Basin Study Interstate-85 Exit 4 (2021) by Thomas & Hutton
- I-85 Corridor Sewer Expansion Feasibility Study for Oconee Economic Alliance (2015) by Davis & Floyd
- Fair Play Sewer Extension Town Hall Notes from 2017 and 2018 provided by OJRSA
- Destination Oconee County Report (2015) provided by Oconee County
- Asbury Campground Market Analysis for Anderson County Economic Development (2020) provided by Anderson County Economic Development
- Census Data (2010, 2020)

When analyzing the data available to project future growth of an area, our team focused on reviewing past studies, analyzing available recent census data and projections, followed by comparing that information to institutional knowledge from stakeholders. We also considered the feasibility of growth in the area based on current land use and both opportunities and constraints to growth in this area.

2.2 Stakeholder & Public Engagement Planning Process

The following activities were completed to assist with sewer projections for the Fair Play Basin area:

- 1) Kickoff meeting with OJRSA and Oconee County
 - a. February 1, 2022
- 2) One-on-one stakeholder calls. A summary of knowledge gained through those conversations can be found in **Appendix C**.
- 3) Stakeholder Meetings
 - a. In-person March 17, 2022, at OJRSA
 - b. In-person June 20, 2022, at OJRSA
 - c. In-person November 2, 2022, at OJRSA
- 4) Public Meeting
 - a. In-person June 28, 2022, at Earle's Grove Baptist Church

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A kickoff meeting was held at OJRSA on February 1, 2022, to review project scope, goals, schedule, and process. Additionally, the Stakeholder Group was identified, with the following groups originally recommended to be present at the stakeholder meetings:

- OJRSA
- Oconee County
- Anderson County
- Oconee Economic Alliance
- Anderson County Economic Development
- Oconee County Parks & Recreation
- Appalachian Council of Governments
- Lake Hartwell Association
- Lake Hartwell Partners for Clean Water
- Pioneer Water
- Village of Fair Play Development Corporation

The Project Team then completed several weeks of due diligence research and preliminary GIS analysis ahead of the first stakeholder meeting, held on March 17, 2022. During this stakeholder meeting it was suggested that the original proposed study area from the Request for Qualifications be revised to include Foxwood Hills to the west, West-Oak High School to the north, a buffer around Highway 24 to include parcels on both sides of the corridor, Townville, and along I-85 through Exit 11 within Anderson County. Oconee County council voted unanimously to support this expansion during their April 19, 2022, council meeting. These additions are reflected in the study area map in the previous section (**Figure 1. Report Study Area**). As a result, Anderson County was added to the stakeholder group.

According to state statute, OJRSA is a Joint Water and Sewer System under SC Code 6-25 (Joint Authority Water and Sewer Systems Act). By this statute OJRSA is allowed as an entity to expand services into an adjacent county. Additionally, they are eligible for grants and can enter into contracts related to expanding services. Both Oconee and Anderson Counties would need to be in agreement for cross county line service to occur and the Appalachian Council of Governments (ACOG) would also need to be involved as the regional planning agency for this area. The ACOG planning authority is derived from Section 208 of the Clean Water Act.

A second stakeholder meeting was held on June 20, 2022, to review the changes in data analysis due to the study area expansion. Preparation for the public meeting was also completed and stakeholders were reminded to advertise for the public meeting. The public meeting was held on June 28, 2022, at Earle's Grove Baptist Church. Approximately 30 people were present for the public meeting. A handout and a survey (both paper and online formats) were provided to attendees (**Appendix B**). In addition to the survey, attendees were asked to place a green dot on a map where they would like to see sewer infrastructure and a red dot on a map where they would prefer no sewer to be installed. Each attendee had three of each color dots that they could choose to place, but they did not have to place all six of their dots. The results are shown in Appendix A (**Figure 2. Areas Public Meeting Attendees Supported Sewer Growth** and **Figure 3. Areas Public Meeting Attendees Opposed Sewer Growth**). The general trend is that most attendees would like to see sewer along major corridors and would prefer the areas in between to be on septic if they are developed. Similar trends were observed by the few addresses specified in the results from the online version of the survey.

A third stakeholder meeting was held on November 2, 2022, to review the engineering analysis and

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proposed phasing for sewer expansion. These observations are provided in Section 3.

2.3 Public Survey

A seven-question survey was developed and distributed to garner public opinion on sewer within the study area. The full results are included in **Appendix B**. The survey was available online under the Resource page on OJRSA's webpage from June 28 through July 24, 2022. Stakeholders and public participants who attended the in-person meeting were encouraged to promote others to take the survey. OJRSA also posted flyers with information on how to access the survey in key businesses within the study area. There were 141 survey takers who predominantly described themselves as full-time residents within the study area (109 people or 77.3 percent). A summary of the results is included below, with predominant responses noted in **bold text**.

1. How would you classify your relationship to the study area? (Check all that apply)
 - o **77.3% (109) full-time residents**
 - o 9.2% (13) business owner or employee
 - o 7.8% (11) concerned citizen residing outside the study area
 - o 6.4% (9) seasonal/weekend residents
 - o 6.4% (9) rental property / investment owner
 - o 6.4% (9) agricultural
 - o 6.4% (9) open space / vacant property owner

2. How do you feel about sanitary sewer expansion within the study area?
 - o **33.3% (47) strongly support**
 - o 4.3% (6) moderately support
 - o 6.4% (9) neither support nor oppose
 - o 4.3% (6) moderately oppose
 - o **43.3% (61) strongly oppose**
 - o 7.8 % (11) depends (please comment below) – results are summarized below in section 2.1.3.1

3. Where would you like to see sewer investment made (select all that apply)
 - o 27.7 % (39) residential (general)
 - o **39.7% (56) commercial/industrial (general)**
 - o **39.7 % (56) I-85 corridor**
 - o **35.5 % (50) along other main corridors (examples Hwy-24, Hwy-11, Hwy-59, Old Dobbins Bridge Road)**
 - o 22.7% (32) Village of Fair Play
 - o 12.1% (17) Townville
 - o 9.9% (14) western Anderson County
 - o 18.4% (26) along Lake Hartwell
 - o **39.7% (56) I would prefer no sanitary sewer in the area**

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4. What concerns do you have about sewer expansion in the area?
 - o Open ended – *results are summarized below in section 2.1.3.1*
5. What opportunities do you identify with sewer expansion in the area?
 - o Open ended – *results are summarized below in section 2.1.3.1*
6. Is there a specific address that you would like to comment on regarding sanitary sewer?
 - o Open ended – *results are summarized below in section 2.1.3.1*
7. Would you like to be contacted by the project team to share additional information?
 - o 31 people, providing 30 individual emails asked to be contacted. These individuals were emailed shortly after the survey closed at the end of July to inquire about additional input.

2.4 Open Ended Question Survey Summary

Question two allowed survey takers to elaborate on their responses. In general, most of the comments fell into the following categories:

- Support for sewer in certain places, which differed by responder
- Opposition for sewer due to concerns regarding growth/loss of rural appeal to the area
- Opposition for the current Sewer South project
- General questions about cost, having land taken, and being forced to connect to sewer if they are already on a viable septic system
- General concern about being retired and having a fixed income and concern about cost

Question four asked for responders to voice their concerns. In general, most of the comments fell into the following categories:

- Cost was the most frequently mentioned
 - o Cost to install
 - o Cost to connect
 - o Tax increase concerns
 - o Cost especially for seniors/retirees
- Expansion without proper planning and zoning
- Odor
- Being required to connect
- Uncontrolled growth
- Loss of agriculture
- Loss of quality of life, too crowded
- Maintenance for the new system, failure of lift stations, leaks
- Health of Lake Hartwell if sewer is installed due to concern about additional growth or failing sewer infrastructure.
- Opposition to the potential Sanctuary Pointe development
- Increased traffic and congestion
- Damage to roads
- Damage to real estate
- Unnecessary loss of trees and plants
- Higher water bills
- Increase in crime due to population increases
- The current makeup of OJRSA's board and only having city representatives
- Contamination of drinking water

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Additionally, there were some positive comments expressed under this question:

- Positive comments about replacing septic along Lake Hartwell for sewer as an environmental benefit
- Positive comment about sewer being critical to safe and desirable spaces to live

Question five asked for responders to voice what opportunities they identify with sewer. In general, most of the comments fell into the following categories:

- Economic development and business
- High incidence of septic tank failure, sewer to mitigate bacteria pollution, watershed protection/environmental benefits
- Industry
- Upgrade to visitor center
- Neighborhood development
- Growth in general
- Restaurants
- Managed growth, keeping rural environment intact
- Access to retail/grocery
- More efficient land use and less time and cost for permitting
- Hospital and nursing home facilities
- Sustainable development that maintains agricultural and recreational communities – residential and industrial development should be dense
- Jobs
- Better support for residents
- Increased tax base
- Expand sewer around the cities

Additionally, there were some critiques/suggestions expressed under this question:

- There was concern that this study isn't being performed for the Clemson/Seneca area, where development opportunities should be occurring
- One existing septic user requested that the hookup be offered at a discount
- Consideration to roads should take place before growth
- Golden Corner Commerce Park has not had development yet even with investment in infrastructure
- General concern about the disconnect between benefits to the tax base and the desire to keep the area rural
- Reiteration that residents do not want to be forced to tie into sewer

2.5 Census Data & 20-year Projections

Population growth forecasts were needed to assess potential future demand for sewer in the study area. First, the project team developed a baseline for the current population in the area and the extent of sewer within the study area. The Population Density and Proposed Sewer map illustrates where the population is primarily located and the proposed sewer lines to be installed from the Golden Corner Commerce Park pump station to Exit 1 on Interstate-85 (Sewer South Project) (Figure 4. Population Density and Proposed Sewer).

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The South Carolina Revenue and Fiscal Affairs Office provides population projections through 2035 for the state and each county based on Census data (Table 2). According to those projections, growth in Oconee and Anderson should continue through 2035 at a rate slightly lower than the total state growth. Both counties are projected to experience less growth over time through 2035.

Table 2. South Carolina Population Estimates and Projections

Table 2 South Carolina Population Estimates from 2010-2015 and Population Projections from 2020-2035							
Location	2010 Estimates	2015 Estimates	2020 Projections	2025 Projections	2030 Projections	2035 Projections	Growth 2010-2035
	Total	Total	Total	Total	Total	Total	Total
South Carolina	4,635,846	4,896,006	5,225,257	5,565,142	5,913,634	6,263,614	
Percent Change		6%	7%	7%	6%	6%	35%
Oconee County	74,349	75,908	80,243	84,121	87,557	90,506	
Percent Change		2%	6%	5%	4%	3%	22%
Anderson County	187,095	193,806	204,486	214,765	224,862	234,656	
Percent Change		4%	6%	5%	5%	4%	25%

Notes: Data from South Carolina Revenue and Fiscal Affairs Office; Population Projections 2010-2035 – Revised September 2021
<https://rfa.sc.gov/data-research/population-demographics/census-state-data-center/population-data/population-projections-2000-2035-rev2019>

Narrowing to the study area and considering growth between 2010 and 2020 within the pertinent census tracts, this area experienced a 9.2 percent increase in population (Table 3). The nature of this study lends itself to focusing on recent growth trends rather than considering past trends that may skew the data.

Table 3. Census Tract Population and Percent Change

Table 3 Census Tract Population for Study Area and Percent Change between 2010 and 2020							
County Census Tract	2010			2020			
	Oconee 309.01	Oconee 309.02	Anderson 109	Oconee 309.01	Oconee 309.03	Oconee 309.04	Anderson 109
Population	2,454	7,526	4,085	3,148	4,688	3,020	4,504
Percent Change by Tract Between 2010 and 2020				28.3%	2.4%		10.3%
Study Area Population Total 2010						14,065	
Study Area Population Total 2020						15,360	
Percent Change Total Between 2010 and 2020						9.2%	

Notes: Data from the U.S. Census Bureau; Decennial Census P1 2010 Race; Decennial Census P1 2020 Race;
<https://data.census.gov/cedsci/>; generated February 1, 2022.

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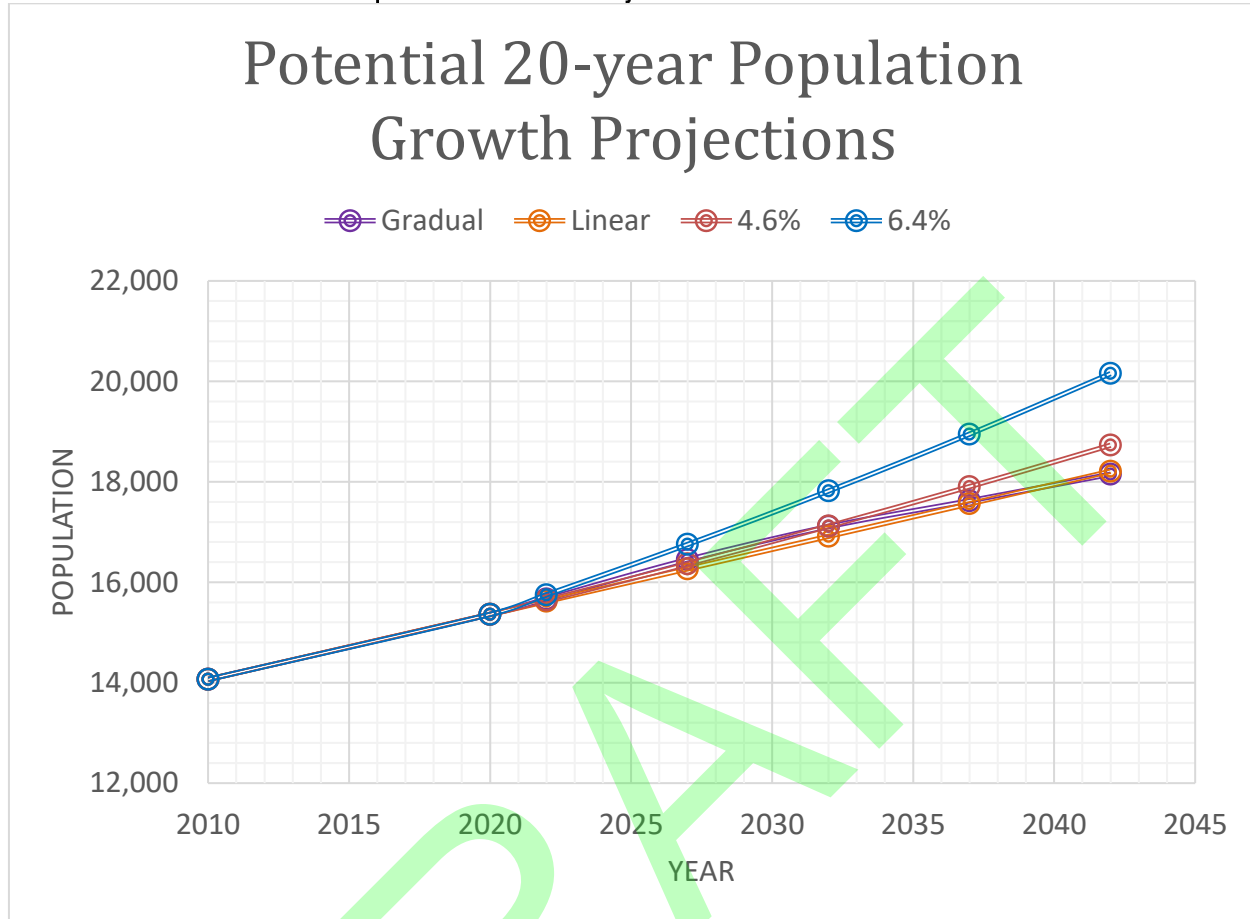
According to stakeholder information, the Upstate of South Carolina has been experiencing significant growth and it was articulated by many stakeholders that the lack of sewer in the study area could be hindering possible growth within that region, potentially losing out on its share of the growth. The most recent census tract data indicates that the growth happening in the study area is more concentrated within the census tract that is on the western edge of Oconee County along Lake Harwell (census tract 309.01). Census tract 309.02 in Oconee from 2010 became two census tracts in 2020 – 309.03 and 309.04.

This data was presented to the stakeholder group at the second meeting along with four growth scenarios (**Chart 1**). The four growth scenarios assume different levels of growth starting with the same known total populations for the study area for 2010 (14,065 persons) and 2020 (15,360 persons). Each growth scenario estimated the current population for 2022 and then extrapolated over the 20-year study period in five-year increments (2022-2027, 2027-2032, 2032-2037, 2037-2042). The scenarios are in order as follows:

1. Gradual Growth
 - a. Assumes similar growth to the Oconee County projections from the SC Revenue and Fiscal Affairs Office – 5% initially through 2027, 4% through 2032, and 3% through 2042
 - b. This is the growth projection should the rate continue with the trend estimated for Oconee County
 - c. Yields 15.9% total growth from 2022-2042 or 2,483 additional persons
2. Linear Growth
 - a. Assumes linear growth using the two known data points
 - b. This is very similar to the gradual growth scenario
 - c. Yields 16.6% total growth from 2022-2042 or 2,590 additional persons
3. 4.6% Growth
 - a. Assumes growth will continue at the same rate at each five-year increment that the study area experienced between 2010 and 2020
 - b. Assumes a consistent 4.6% growth every 5 years – 4.6% is half of the growth rate of 9.2% observed between 2010 and 2020 for the study area
 - c. This is a slightly more aggressive growth model
 - d. Yields 19.7% total growth from 2022-2042 or 3,086 additional persons
4. 6.4% Growth
 - a. Assumes a consistent 6.4% growth every 5 years – 6.4% is half of the growth rate of 12.7% observed between 2010 and 2020 for the state of South Carolina
 - b. Assumes growth in the study area will exceed the rate observed from 2010-2020
 - c. This growth model could occur if a catalyst project leads to a significant change in the growth pattern for this area
 - d. This is an ambitious growth model, implying the study area will surpass the anticipated growth rates
 - e. This model could also help correct for the unknown growth potential that may occur in this area should sewer become more readily available
 - f. Yields 28.0% total growth from 2022-2042 or 4,403 additional persons

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Chart 1: Potential 20-Year Population Growth Projections



Feedback was requested of the shareholder group after presenting the graphic pictured above. There was some disagreement about how quickly this area could grow. Some felt that if sewer was available, this area could grow rapidly, but others were skeptical about any drastic population changes to this rural area. There appeared to be consensus that the more ambitious 6.4% growth model would be inclusive of a catalyst project in this study area – for example, an industry moving into Golden Corner Commerce Park. The Oconee Economic Alliance informed the project team that they are targeting industry that will increase jobs in this area, but it is unclear how significant that job growth could be and what it could mean for residential growth specifically for this study area. According to the Oconee County Comprehensive Plan, between 2010 and 2019, economic development announcements brought 1,783 jobs into the County as a whole. This difference in opinion was considered during the following steps for sewer infrastructure need projections.

2.6 Land Use

In addition to considering census data and receiving feedback from stakeholders about growth within this region, the Project Team considered spatial data to project growth. The Current Zoning for the study

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area (**Figure 5. Current Zoning**) and the proposed Future Land Use for the study area (**Figure 6. Future Land Use**) from each county's comprehensive plans were studied. The current land use is predominately unzoned, and the future land use is predominately agricultural with some residential. Neither of these provide much assistance with projecting how the area could grow

A constraints analysis was prepared which considered the following items as areas that may not be capable of being developed for feasibility or policy reasons (**Figure 7. Constraints**):

- Wetlands
- 100-year floodplain
- Hydric soils
- Prime farmland (*see reasoning below*)
- Known conservation easements and protected lands
- Steep slopes greater than 33% over 10 feet

This analysis pointed out that there are some steep slopes near the lake, which would present challenge for sewer infrastructure. Additionally, many of the protected lands are clustered within the triangular area formed by Highways 24, 59, and 243. The study area also contains a significant amount of prime farmlands. Although prime farmland is not a direct constraint to redevelopment, it is important to note where this land is located within the study area since both agritourism, and agriculture are an important economic benefit to this area.

2.7 Potential Future Sewer

The Potential Sewer Map (**Figure 8. Sewer Potential**) shows the opportunity parcels for sewer based on existing constraints for development, current and future land use, stakeholder feedback, and adherence to smart growth principles, focusing on main corridors and nodes for development. Specific opportunities were noted throughout this process:

- Develop along the main corridors such as I-85, Hwy 11, Hwy 24, Hwy 243, and Hwy 59
- Develop industry at and adjacent to Golden Corner Commerce Park along Hwy 59.
- Capitalize on outdoor recreation as an opportunity for growth
- Align growth to complement the Village of Fair Play development goals

The following were not considered as part of the planning process and would be dependent upon the feasibility of sewer installation based on engineering requirements:

- Consideration to tourism, rentals, and second homes, particularly along Lake Hartwell, which are already significant within this study area.
- Sewer to aging package plants within specific communities, for example, Chickasaw Point and Foxwood Hills.

This analysis was the basis for sewer projections moving forward with this study.

2.8 Joint Treatment Plant Potential for Anderson and Oconee Counties

Prior to and during this study, both Anderson and Oconee Councils met separately in executive session³ to discuss the potential of a new, regional sewer plant that could result in a partnership between the two

³ Oconee County Council discussed this at their August 16, 2022 meeting, where they revealed the project was formally known under an economic development codename, Project Harmony, which was first acknowledged as

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counties. At the end of the project analysis, Weston & Sampson and Bolton & Menk were made aware of these conversations, and we were provided two draft engineering reports prepared by Goodwyn Mills Cawood (GMC) that reflected previous work on this topic. One report was prepared for Oconee Economic Alliance and the other was prepared for Oconee and Anderson Counties. The following are the planning implications for future sewer planning from these GMC reports:

- Both GMC reports and the efforts within this report consider a very similar study area.
- Future sewer infrastructure phasing in this report (OJRSA Fair Play and Townville Area Sewer Basin Plan) reflects a public engagement process, while the GMC reports were not informed by a public engagement process. As a result, the goals reflected in the GMC reports were different from those that were expressed by the stakeholder group and from the public survey that this project gathered.
- The GMC reports made future growth potential assumptions that were high level and did not take land use into consideration. As a result, the areas targeted for growth led to different phasing recommendations.
- Both GMC reports identify the potential impact and increased demand for sewer needs at Golden Corner Commerce Park should an economic development project arise in the area.

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an executive session item for consideration at the December 7, 2021 meeting. Anderson County Council's first publicly referenced a joint treatment plant with Oconee County at their October 5, 2021 meeting and continued considering it as late as their July 19, 2022 meeting.

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3.0 PLANNING RECOMMENDATIONS AND CONCLUSIONS

The following recommendations are based on research, stakeholder conversations, and public involvement with respect to the scope of work performed by Bolton & Menk.

- 1) Consider revisiting the current guidelines for the Oconee County overlay districts. There is a concern about targeting specific land uses and specific types of development to aid in the growth of the study area based on the public feedback.
- 2) Although not readily available, it would be beneficial to work with SCDHEC to further understand where failing septic systems within the study area may be located for a more proactive approach to sewer connections or septic repair/replacement.
- 3) Public opinion was predominately divided between strong opposition and strong support for sewer within this study area. In addition to the general confusion around the 300-foot rule based on current OJRSA Sewer Use Regulation, there was also a clear divide between responders' opinions about which wastewater solution, septic or public sewer, was better for the environment. We suggest a partnership with other public entities including the Army Corps of Engineers, SCDHEC, Clemson University Center for Watershed Excellence, Anderson County, Oconee County, and Lake Hartwell Partners for Clean Water for public outreach explaining the pros and cons to both, including publicly available supporting data. This could potentially be funded by a grant.
- 4) Perform an Oconee County-wide study to be inclusive of all potential growth areas for a more holistic view of sewer needs. We suggest including census tract 109 in Anderson County for a more comprehensive basin approach, should a potential cross county partnership remain viable. We also suggest combining this effort with a land use analysis that considers both sewer and water infrastructure. This would better align with the goals articulated in the Oconee County Comprehensive Plan.
 - a) Should additional public engagement/surveying occur, adding some demographic questions could assist with better understanding the financial hardship existing users may experience should they be required to connect newly available potential sewer. Additionally, we would recommend gathering better location information from survey takers to confirm inclusive participation.
 - b) Consider revisiting the current zoning and future land use in partnership with Oconee and Anderson Counties. There are inconsistencies between the current maps, public feedback, and the Comprehensive Plans, especially with respect to where growth and development should take place.
- 5) Clarify the OJRSA Sewer Use Regulation Section 2.4, 300-foot rule and provide communication to the public. According to the survey, existing septic users are very concerned about the cost to connect if they already have a viable septic system. Additionally, there was concern about the word "required" within the regulation and what exceptions would be allowed from OJRSA that are categorized as "unusual" or "specific". We recommend that the existing policy be reviewed and revised, and public outreach performed to lessen the current confusion and concern. A path forward should be determined for current septic users within the study area and the potential for incentives to connect to new public sewer lines. Articulating what will happen to existing septic users is important for public transparency. Septic tanks will continue to fail sporadically and having an incentive plan may help alleviate waiting until failure of existing septic systems occurs.
 - a) Consider updating Oconee County's municode website to clarify that the 300-foot rule language has been repealed and only OJRSA has such a regulatory requirement, if this is indeed the case.

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- b) Should OJRSA/Oconee and Anderson embark on a treatment plant together, it is recommended that the counties have consistent approaches for handling grandfathered uses within the sewer basin, as well as future connections. Revisions to the current language should take into consideration the financial burden implications to residents within this rule, which may require additional study and outreach.
 - c) Should Oconee and Anderson embark on a treatment plant together, it is recommended that both utilize and enforce a commonly agreed upon set of ordinances/regulations that are identical and enforceable across county lines for the system that will be served by this treatment facility.
 - d) Analysis should be performed to determine at each stage of sewer expansion if the wastewater system itself has the capacity to handle all the potential volume from property owners that would be required to or could potentially connect.
 - e) Should it be determined that the financial burden could be unattainable for some residents, Oconee and Anderson County could consider an annual stipend or grants that provide assistance for residents to apply as an offset to the costs to connect to sewer. This could be beneficial to Oconee County as they are required to subsidize the operation and maintenance of the retail sewer in the county if OJRSA is not able to receive enough revenue from the connected users to offset these expenses. If more customers are connected, especially in areas where gravity sewer is already available, then more revenue is likely achieved and costs for each user should be reduced.
- 6) Future assessments and considerations
- a) At a minimum, this plan - the Fair Play and Townville Area Sewer Basin Plan – should be revisited every 3 years or after a major change to the area such as a catalyst project or development.
 - b) We also recommend that the stakeholder group established by this planning process continue to meet twice a year for a facilitated conversation regarding sewer in order to maintain the positive momentum established during this project.
 - c) We suggest also adding an agricultural / farming interest person or persons to the stakeholder group.

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4.0 SEWER IMPLEMENTATION PLANNING

4.1 Assumptions

The planning portion of the project detailed in the Section 1.0 identified areas where there is interest in developing or would be well suited to developing. The planning also provided estimates for population growth over the 20-year study period. The third piece of this analysis involves looking at the area from a sewer infrastructure perspective based on the results of the initial planning assessment.

Certain areas that are near existing infrastructure or in low-lying areas easily served by gravity sewer can be served with sewer more economically than others. By considering all of these factors, a sewer master plan can be developed that provides a road map to serve the area that balances capital improvement costs, provides flexibility to expand the system beyond the planning period, and meets the needs of the community while providing growth opportunities where the community would like growth. The population projections for the study area can be allocated in large part to these areas served with sewer since sewer infrastructure will be a significant driver for where population growth will occur.

The analysis looks at what anticipated population growth means as far as wastewater flows for sizing the system and what the population growth means as far as adding customers to fund the improvements. Assuming higher customer growth would be conservative from an infrastructure sizing perspective but less conservative from a funding perspective. As a result, the analysis used separate assumptions for sizing the system and for projecting what the revenue might be as that infrastructure is installed.

Sewer system infrastructure is typically sized for a 20-year timeframe or longer, because the incremental cost of building infrastructure for a longer-term flow is cheaper and less impactful to the public than having to build upgrades over a 20-year period. Therefore, for the basins which were projected to be served with sewer within the 20-year timeframe, it was assumed that 50 percent of the present population would connect to the new sewer within the 20-year timeframe. This percentage is a conservative number since current residents would have existing septic tanks, and many would not have a need to tie on during a 20-year period. Also, it is common for a septic tank or associated facilities to require expensive repairs or replacement within the 20-year period and many of these customers will either elect to connect to sewer or be required to by state regulations. Furthermore, additional sewer lines would need to be extended into the basin over the 20-year period to fully serve the basin. The sizing calculations assumed that all new residents would be connected to sewer, since development in the area would tend to aggregate near areas served with sewer.

For the revenue projection assumptions, we assumed 100% of new residents adjacent to gravity sewer would connect to sewer as it's made available. If all new residents are assumed to be connected to the sewer, then it is reasonable to expect all new residents to be paying customers. For projecting revenue due to existing residents, two options were evaluated:

- Zero existing residents connecting to sewer
- 50% of the existing residents within a 300-foot distance of the proposed sewer infrastructure.

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In the end, the revenue resulting from new residents was significantly more than the revenue from either existing resident scenario, and as a result, did not affect the conclusions regarding projected revenue.

4.2 Methodology

Available GIS contour data was used to delineate the study area into 28 different sub-basins (Figure 9. Sub-basin Boundaries for Study Area).

The sub-basins were labeled and relationships between drainage areas defined (Figure 10. Sub-basin Boundaries for Study Area with Labels). For instance, N-1 was designated as a sub-basin draining directly into Lake Hartwell. Two sub-basins (N-2 and N-3) both drain to N-1. Further upstream, N-2A drains to N-2 and N-3A to N-3. These drainage relationships help define what flows will be conveyed to sub-basins further downstream in the analysis.

Where described below, residences within each subbasin were estimated from reviewing parcel maps and aerial photography, and are included in Table 4.

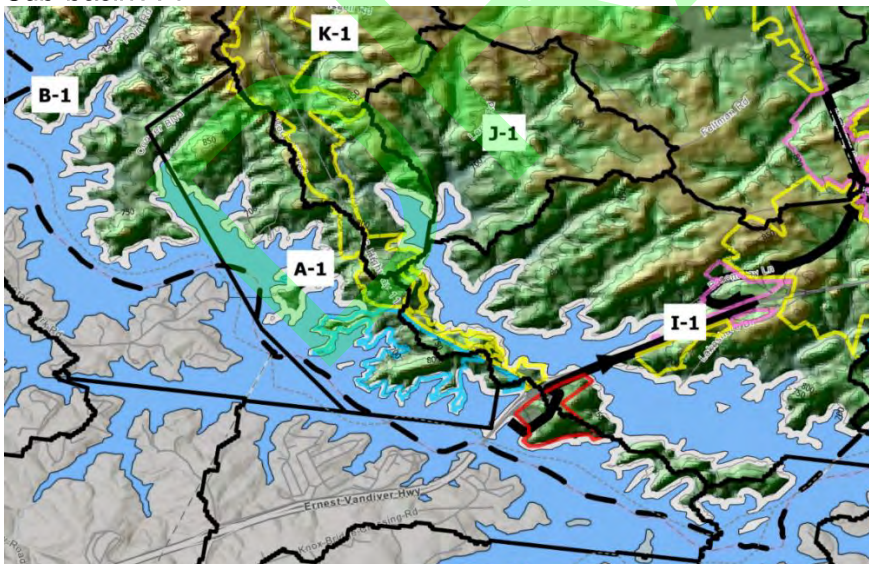
4.3 Sub-Basin Focus

Based on the criteria described above, the following subbasins were identified as good prospects for sewer infrastructure and additional development:

4.3.1 A-1

Subbasin A-1 includes the western side of Highway 11 at Exit 1. On the east side of Exit 1 is an existing restaurant, fireworks store, and office building, that is currently served by septic. Additional existing developments served by septic are Cherokee Bay, Heritage Shores, and Lake Hartwell State Park.

Sub-basin A-1

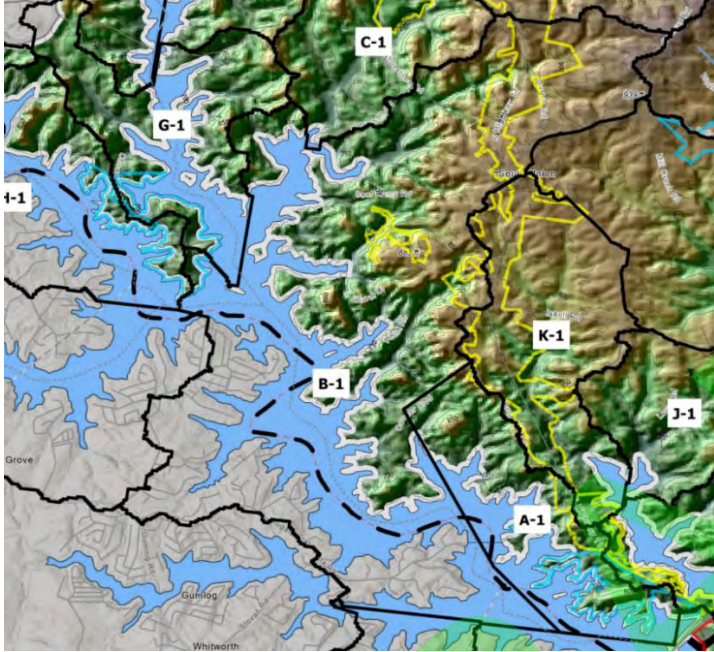


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4.3.2 B-1

Subbasin B-1 continues up the western side of Highway 11 along the Savannah River branch of Lake Hartwell. The Chickasaw Point subdivision is currently served by a private collection system and a wastewater treatment plant that provides partially treated water to the neighborhood golf course for irrigation.

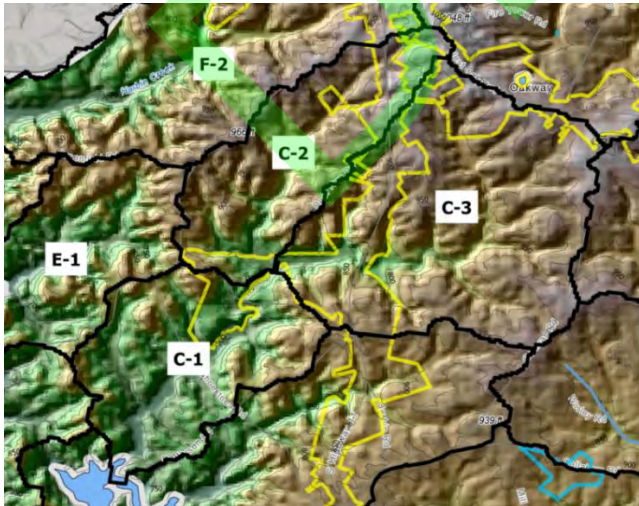
Sub-basin B-1



4.3.3 C-2

Subbasin C-2 is further inland from Lake Hartwell near the West Oak area, and currently has about 140 residences within the basin. Flow from the subbasin would flow by gravity to C-1 which is not suitable for future development due to steep topography around Lake Hartwell.

Sub-basins C-2 and C-3



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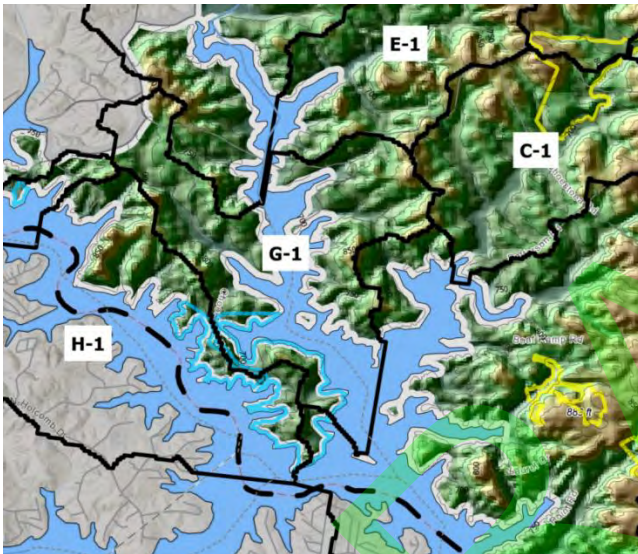
4.3.4 C-3

Subbasin C-3 is to the south of C-2 bisected by Highway 11, and currently has about 370 residences on septic systems within the basin. Flow from the subbasin would flow by gravity to C-1 which is not suitable for future development due to steep topography around Lake Hartwell.

4.3.5 G-1

Subbasin G-1 is in the far northwest portion of the study area. Foxwood Hills subdivision, currently sewered by a private collection system and treatment plant, is contained in this basin as well as others. All wastewater flow is assumed to be conveyed to the treatment plant in subbasin G-1. Thus, the flow for the entire subdivision is allocated to G-1. There are currently approximately 1,330 residences in the subbasin.

Sub-basin G-1

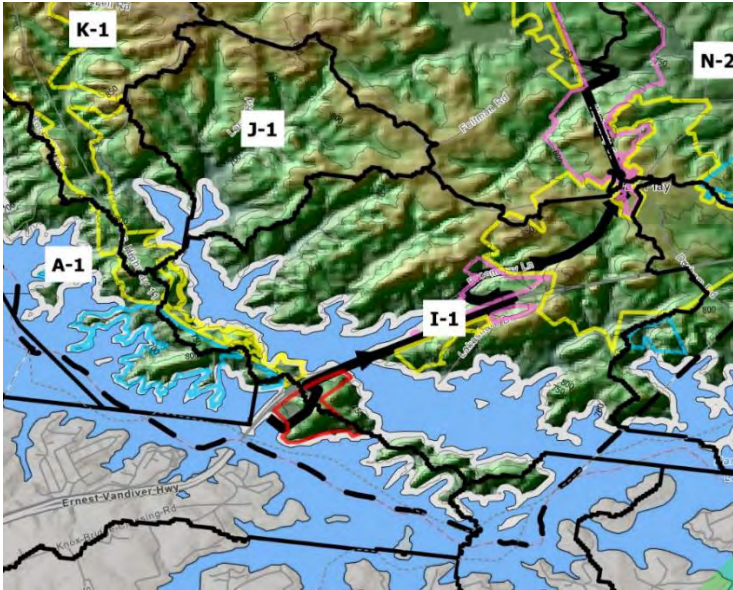


4.3.6 I-1

Subbasin I-1 includes the Exit 2 area the Welcome Center Pump Station at Exit 1, and Sanctuary Pointe, which will soon be served by the Sewer South project, slated to be constructed by mid-2024. The completion of the project will make this an advantageous and strategic subbasin to add sewer infrastructure. Additionally, the Welcome Center Pump Station at Exit 1 that will be constructed as part of the Sewer South Phase II project will convey flow to this subbasin, so wastewater from that area is allocated to I-1 as well. There are currently approximately 375 residences in the subbasin.

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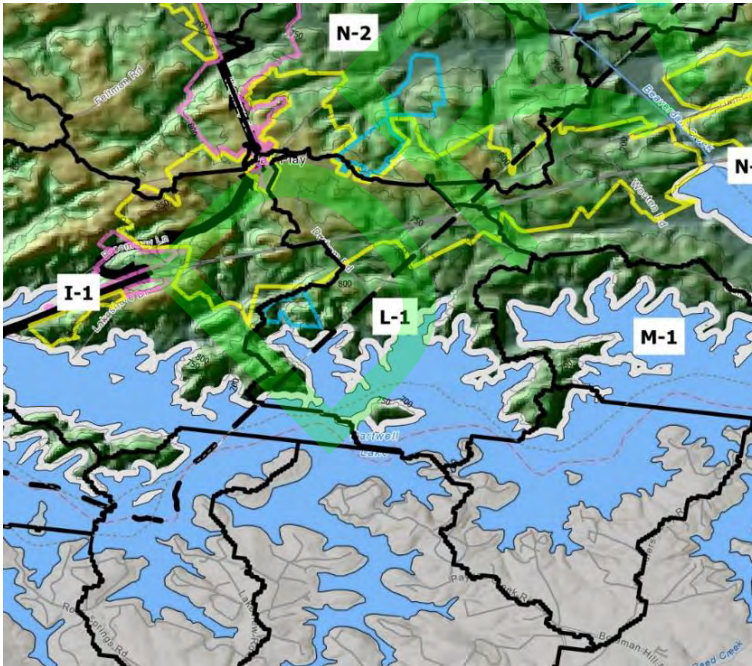
Sub-basin I-1



4.3.7 L-1

Subbasin L-1 includes the Exit 4 area that straddles the Oconee County / Anderson County line. There are currently approximately 315 residences in the subbasin, the Carolina Landing campground, plus a 15,000 gpd treatment package plant that serves the truck stops at Exit 4. L-1 has areas near the lake that have fairly steep topography that could inhibit significant sewer construction.

Sub-basin L-1

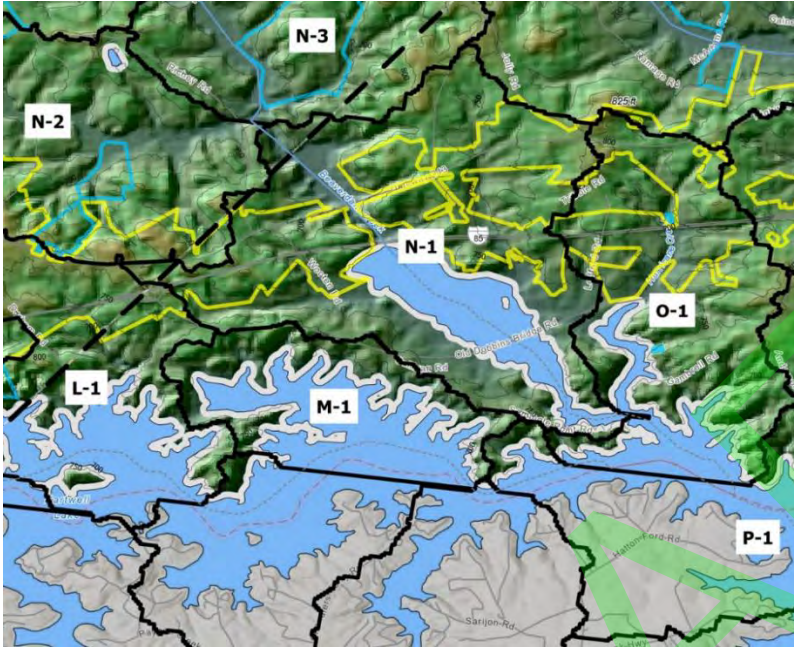


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4.3.8 M-1

Subbasin M-1 lies along Lake Hartwell in Anderson County west of L-1. There are currently approximately 330 residences on septic systems in the subbasin. M-1 has areas with fairly steep topography near the lake.

Sub-basin M-1



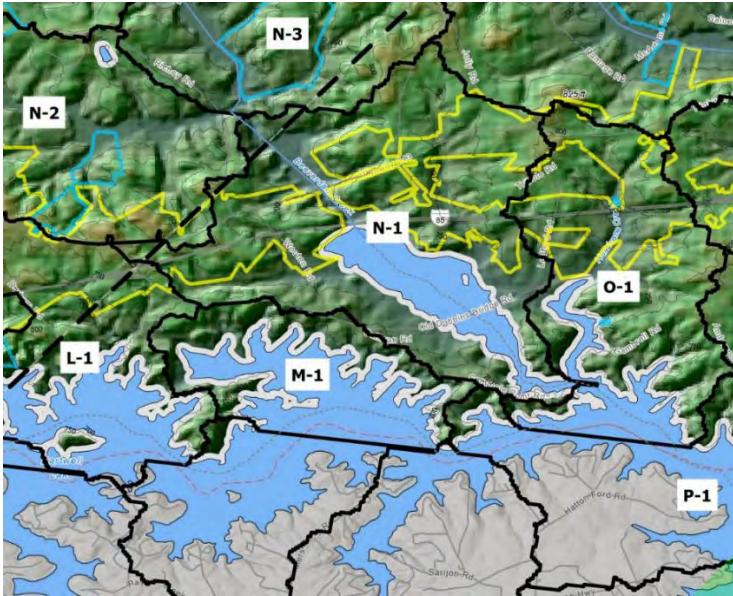
4.3.9 N-1

Subbasin N-1 lies along Lake Hartwell in Anderson County west of M-1. Beaverdam Creek flows through and discharges to Lake Hartwell within the subbasin. There are currently approximately 336 residences in the subbasin.

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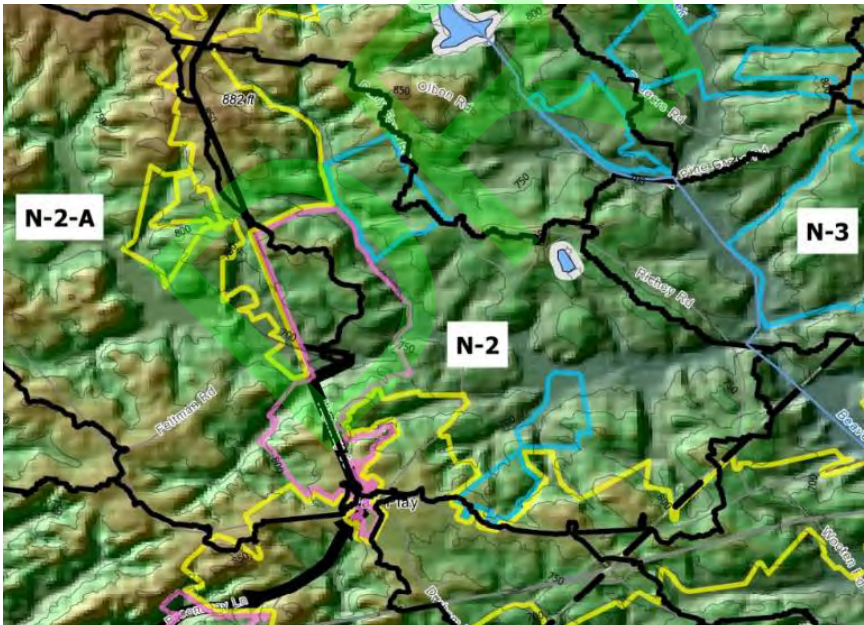
Sub-basin N-1



4.3.10 N-2

Subbasin N-2 lies along Beaverdam Creek upstream of N-1. The northeastern quadrant of the Town of Fair Play lies within the basin, and all flow east of Highway 59 and north of Highway 243 in Fair Play would flow into N-2. The Golden Corner Pump Station is at the upper end of the N-2 subbasin. There are currently approximately 235 residences in the subbasin.

Sub-basin N-2

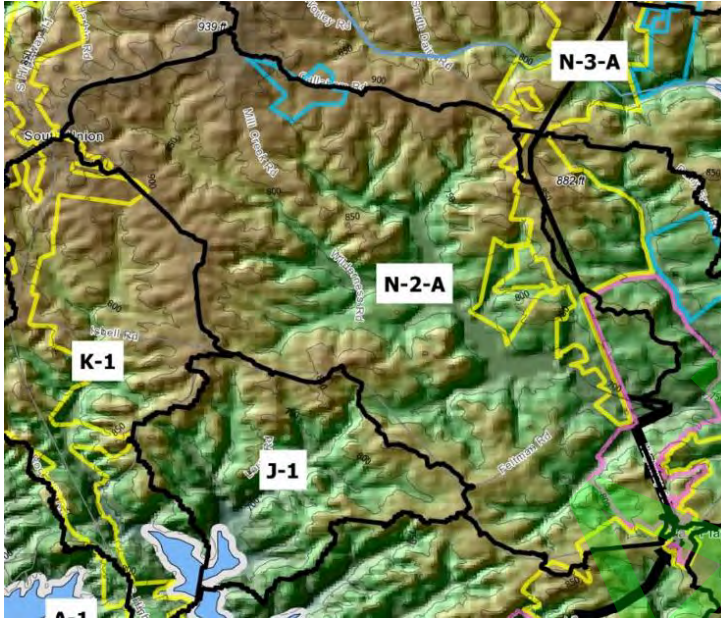


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4.3.11 N-2-A

Subbasin N-2-A lies along Beaverdam Creek upstream of N-2. The northwestern quadrant of the Town of Fair Play lies within the subbasin. The Golden Corner Pump Station lies at the bottom of the subbasin, and so all flow within N-2-A would flow by gravity there. There are currently approximately 370 residences in the subbasin.

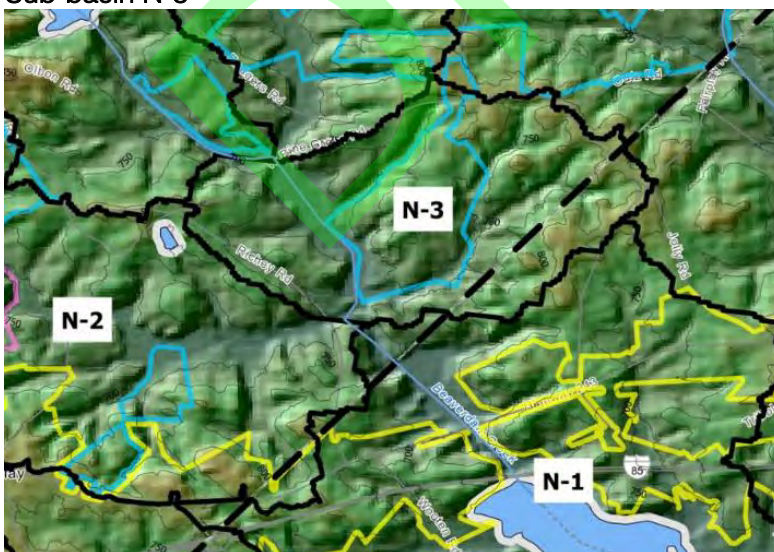
Sub-basin N-2-A



4.3.12 N-3

Subbasin N-3 is centered along the eastern tributary of Beaverdam Creek east of N-2, upstream of N-1. The lower 20% of the basin lies in Anderson County; the remainder is in Oconee County. There are currently approximately 72 residences in the subbasin.

Sub-basin N-3

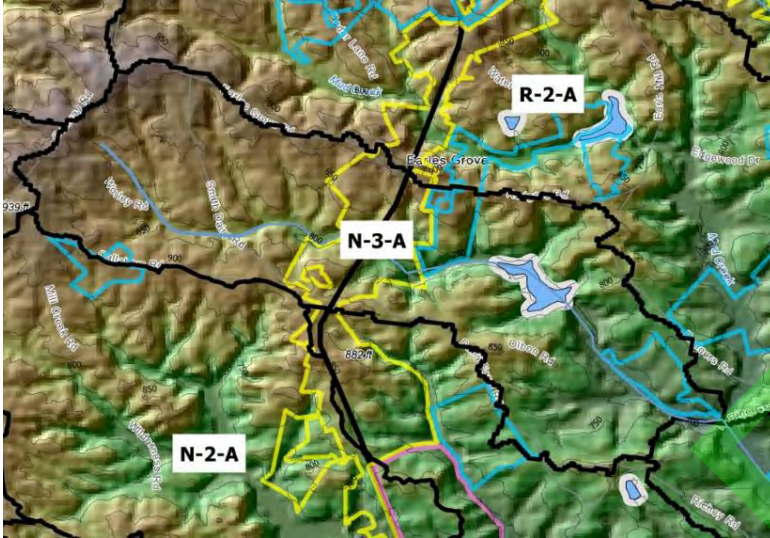


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4.3.13 N-3-A

Subbasin N-3-A lies along Beaverdam Creek upstream of N-1. There are currently approximately 150 residences in the subbasin.

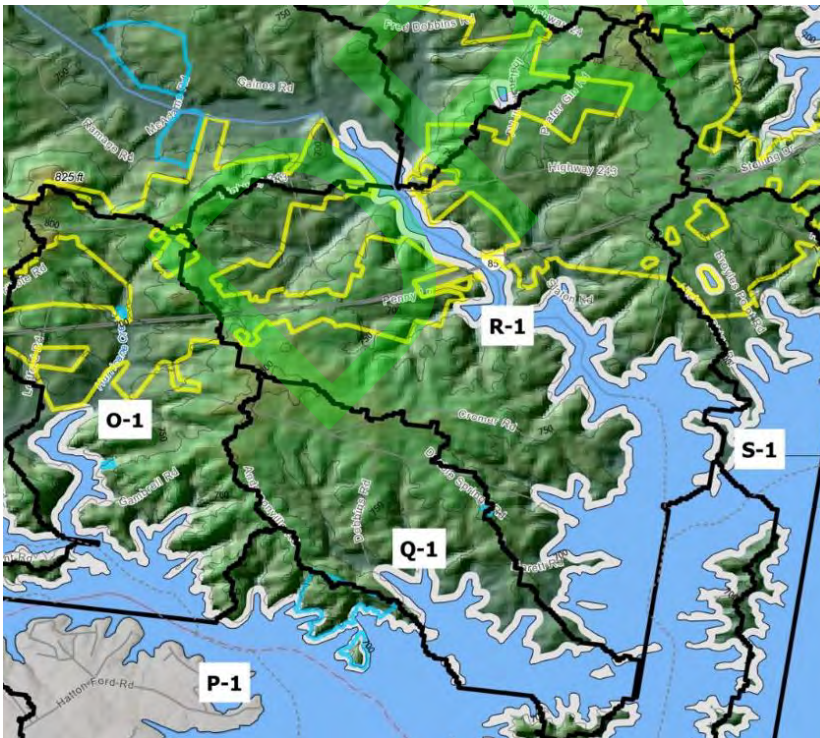
Sub-basin N-3-A



4.3.14 R-1

Subbasin R-1 lies along Lake Hartwell and includes the western half of the Exit 11 (Highway 24) area. In addition to a few convenience stores, there are currently approximately 407 residences in the subbasin.

Sub-basin R-1



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4.3.15 R-2

Subbasin R-2 lies further inland from R-1 extending to the southeastern corner of West Oak and drains into R-1. The subbasin is largely undeveloped, but the northeastern boundary of the subbasin is Highway 24, so any future development within the subbasin would likely occur there. There are currently approximately 383 residences in the subbasin.

Sub-basins R-2 and R-3



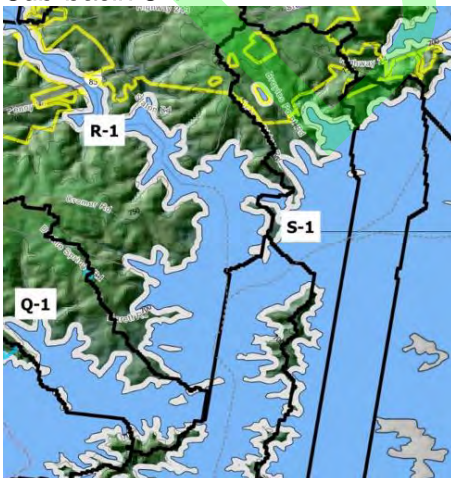
4.3.16 R-3

Subbasin R-3 lies further inland from R-1 along the southern side of Highway 24 near the Exit 11 intersection. There are currently approximately 150 residences in the subbasin.

4.3.17 S-1

Subbasin S-1 includes the southeastern quadrant of the Exit 11 intersection and drains to Lake Hartwell. There are currently approximately 175 residences in the subbasin.

Sub-basin S-1

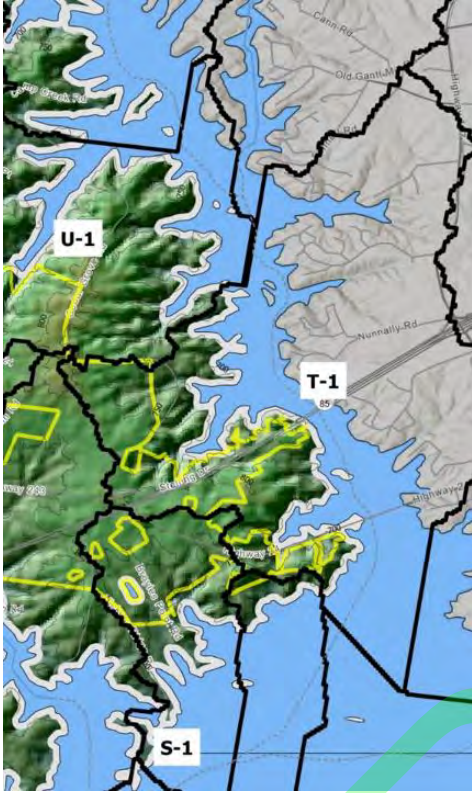


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4.3.18 T-1

Subbasin T-1 includes the northeastern quadrant of the Exit 11 intersection and drains to the Seneca River branch of Lake Hartwell. There are currently approximately 173 residences in the subbasin.

Sub-basin T-1



4.3.19 AA-1

Subbasin AA-1 lies in the very northern corner of the study area. It connects to a currently sewered area served by a 36-inch interceptor just upstream of Coneross Creek WRF. There are currently approximately 116 residences in the subbasin.

Sub-basin AA-1

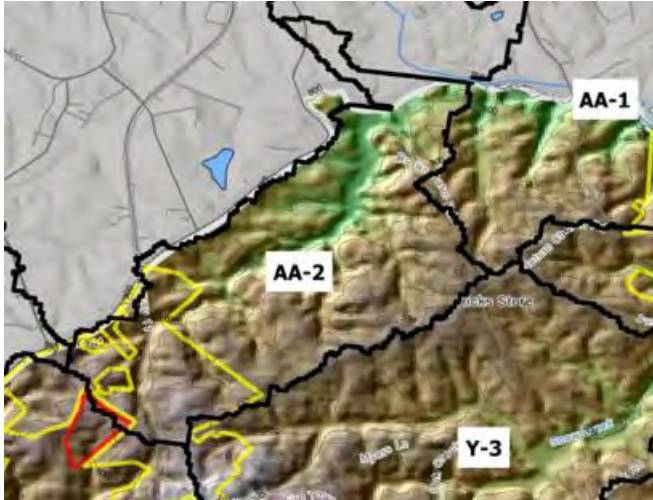


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4.3.20 AA-2

Subbasin AA-2 is upstream of AA-1. The Oakway community is in the subbasin, as well as West Oak High School, which is currently served by an existing dedicated wastewater treatment facility. There are currently approximately 265 residences in the subbasin.

Sub-basin AA-2



4.3.21 Future Flow Projections

As noted in Section 2.5, a variety of population growth projections were considered. The most aggressive projection, a net population growth of 4,403 people over the 20-year period (6.4% growth) was carried forward into the engineering projections. Stakeholders agreed that this aggressive projection would be inclusive of the growth that may occur, should a catalyst project such as an employee-heavy industry moving into Golden Corner, were to come to fruition. This projection was selected for the engineering analysis as it would provide for the most conservative sizing assumptions to ensure that the infrastructure that was planned would be sufficient to accommodate future growth over the planning period. This population was then allocated to each subbasin as shown in Figure 11. **Basin Population Growth Estimates.**

Once the focused subbasins were identified, population growth over the 20-year period was allocated to each subbasin. To do so, several factors were considered. Future known development projects were identified by stakeholders in the B-1 and G-1 subbasins along Lake Hartwell, and population growth was allocated there accordingly. Additional population growth was then focused on those subbasins that will have sewer infrastructure plus other advantageous characteristics including interstate access, topography, proximity to other developed areas, etc: I-1 (Exit 1 and 2), L-1 and M-1 (Exit 4), and R-1, S-1, and T-1 (Exit 11). Those subbasins were assumed to grow by 33% over the 20-year period. Subbasins N-2 (Town of Fair Play), and AA-1 and AA-2 (Oakway community) have a community footprint already but are not as close to the interstate and Lake Hartwell, and were allocated 6-7% as a result. The remainder of the basins were then allocated 0-2% growth depending on the favorability of the basin for development.

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In addition to the residential growth, some targeted commercial growth was also projected at the Exit 1, Exit 2, and Exit 11 subbasins. Sanctuary Pointe, at Exit 1, is an area of undeveloped land that has been considered for a potential development project for decades. While it is unknown whether any development will ultimately occur, it was considered in the future flow projections for this study. The 300,000 gpd flow estimate for that development was allocated to the I-1 (Exit 2) subbasin because it would be pumped to that basin through the new Welcome Center Pump Station as part of the Sewer South project.

Specific industrial flows are not projected, as the magnitude of them can vary widely. Industrial developments such as warehouses can require large amounts of land but have very low wastewater flows. Conversely, there could be industrial developments that have smaller footprints but that could be very water-intensive. New industrial developments that produce large volumes of wastewater typically contribute capital improvement funds for needed infrastructure upgrades as part of their developments.

Important notes:

- All costs stated within this section are in 2023 dollars and are not adjusted for inflation or other factors⁴ that are unknown at the time this report was completed.
- Project costs include construction, plus a 30% allowance for “soft costs”: design, stand, legal services, land purchase, etc. A 20% project contingency is included in the costs as well.
- Unless otherwise indicated, this study does not include the project cost for smaller collection lines that will need to be extended beyond the main trunk sewers described herein. The main trunk sewers are the larger lines that form the backbone of a sewer system; there will also be smaller collector lines that may be constructed within the neighborhoods or to serve smaller clusters of properties. These collector lines will typically be funded and constructed by developers as part of projects to provide sewer service to future developments.
- Some subbasins above (mainly along the lake) have been noted to have steep topography that could inhibit either denser development or sewer construction. Areas like this could be served by grinder pump systems (a small pump system individually owned and located at each house) or low pressure grinder sewer systems (owned and operated by OJRSA that would serve multiple houses in small developments). Both would pump to a public gravity sewer system, and could share force mains where appropriate.

A summary of the projected flow calculations are shown in Table 4:

⁴ Examples: Changes in regulations governing treatment technology requirements and wastewater-related construction materials, considerable levels of rock that cannot be accounted for in a basin study, supply and demand of materials, escalation of land and easement costs for purchase, infrastructure-related demands caused by government or other programs such as the American Rescue Plan Act of 2021, etc.

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Table 4. Projected Flow Calculations by Subbasin

Table 4: Projected Flow Calculations By Subbasin								
Subbasin	Area (acres)	Existing Septic Residences In Basin ¹	Total Existing Flow ² (gpd)	Projected New Residences ³	Projected New Residential Flow ⁴ (gpd)	Projected New Commercial Flow ⁵ (gpd)	Total Projected New Flow ⁶ (gpd)	Total Projected 20-Year Flow ⁷ (gpd)
A-1	1,008	40	5,988	-	-	20,000	20,000	25,988
B-1	5,210	680	88,400	346	103,844	-	103,844	192,244
C-2	1,140	140	18,200	3	989	-	989	19,189
C-3	2,283	370	48,100	8	2,472	-	2,472	50,572
G-1	1,237	1,331	173,030	659	197,799	-	197,799	370,829
I-1	2,648	375	48,750	124	37,087	325,000	362,087	410,837
L-1	1,322	315	80,950	104	31,153	25,000	56,153	137,103
M-1	693	330	42,900	109	32,637	-	32,637	75,537
N-1	2,963	336	43,680	8	2,275	-	2,275	45,955
N-2	2,726	235	30,550	15	4,549	-	4,549	35,099
N-2-A	4,189	370	48,100	9	2,571	-	2,571	50,671
N-3	1,557	72	9,360	2	494	-	494	9,854
N-3-A	3,292	150	19,500	3	989	-	989	20,489
R-1	3,728	407	52,910	134	40,252	20,000	60,252	113,162
R-2	6,990	383	49,790	8	2,472	-	2,472	52,262
R-3	1,873	150	19,500	-	-	-	-	19,500
S-1	778	175	22,750	58	17,307	10,000	27,307	50,057
T-1	1,168	173	22,490	57	17,110	10,000	27,110	49,600
AA-1	1,068	116	15,080	8	2,275	-	2,275	17,355
AA-2	1,842	265	34,450	18	8,100	-	5,341	39,791
TOTALS	47,714	6,413	933,268	1,693	501,168	410,000	911,618	1,801,096

¹ Calculated from review of parcels and aerial photography

² Assumes 50% of the septic residences tie on to the sewer within the 20-year period (for infrastructure sizing purposes)

³ Derived from allocating projected growth within the various subbasins based on concentrating future growth in areas with sewer availability and other favorable characteristics for development

⁴ 300 gallons per day per residence

⁵ Small commercial growth at interstate exits assumed

⁶ New residential flow plus new commercial flow

⁷ Total projected new flow plus total existing flow

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4.4 Scenarios Overview

The next step was to develop a master plan, which would include identifying infrastructure to serve the area. In many cases, infrastructure development is a step-by-step process. A package treatment plant, pump station or gravity sewer lower in the basin must be built before infrastructure is built further upstream. Emphasis was made to install the lower infrastructure to facilitate additional system expansion as the study period progresses. Additionally, emphasis was made to develop infrastructure in the areas identified as being best suited to spur development, such as around the interstate exits. Over the course of the study, it became apparent that it would be helpful to identify various levels of investment and note that there could be multiple ways to serve the area with sewer. Four options were evaluated:

Scenario 1 (Base)

- The base scenario, which includes serving Exit 1, 2, 4, and 11, Chickasaw, West Oak, and Beaverdam Creek. A WRF was included on Beaverdam Creek near the Oconee / Anderson County line.

Scenario 1B

- The base scenario plus constructing a pump station to take the existing treatment plant at Foxwood and pump it to the new system. During the course of the study, it was discovered that the Foxwood system was in the process of being purchased. It is unclear at this time if the new owners would be willing to transfer ownership and was not included as a potential expansion area at this time and should be reconsidered in the future.

Scenario 2

- The base scenario but replacing the WRF at Beaverdam Creek with a pump station and a force main that pumps to the existing Golden Corner force main. Since the Golden Corner PS is eliminated in this scenario, its force main is available to be utilized for repurposing as part of the Beaverdam Creek PS.

Scenario 3

- The base scenario except moving the Water Reclamation Facility (WRF) upstream to the Golden Corner site. This would eliminate development in the Beaverdam Creek basin downstream of Golden Corner. In discussing with OJRSA, the cost savings did not warrant the lack of developable basins, in conjunction with other challenges that made the Golden Corner location not as desirable, such as having a WRF in close proximity to the existing Pioneer Water District water treatment plant. As a result, this option was not further analyzed.

4.5 Scenario 1

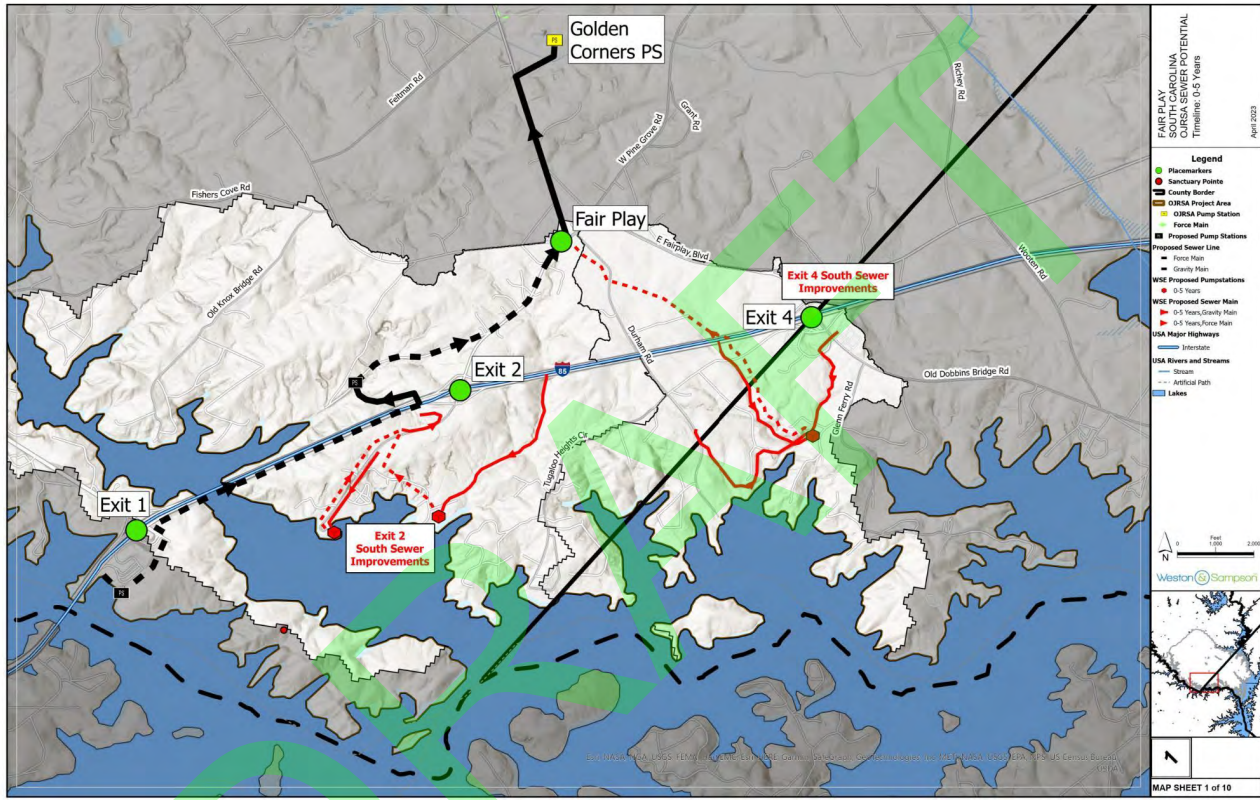
4.5.1 0-5 Year Plan

The Sewer South project, expected to be complete by mid-2024, will provide sewer service to both Exit 1 and 2 (shown in black in **Figure 12. Scenario 1: 0-5 Years**). The Welcome Center Pump Station at Exit

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1 and the Broomway Pump Station at Exit 2 will convey flow to the Golden Corner Pump Station. That project is already funded and not included in the CIP for the 0-5 year scenario. However, additional projects will utilize those improvements as a sewer backbone for the extension within the area.

The two projects slated for the 0-5 year plan are the Exit 2 Sewer Improvements that will provide the area between I-85 Exit 2 and Lake Hartwell with sewer service, and the Exit 4 Sewer Improvements, which will do the same for Exit 4. The Exit 4 project could additionally eliminate a small treatment system that serves the Loves Truck Stop at Exit 4.



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Table 5. Capital Improvement Plan, 0-5 Years

Table 5 Capital Improvement Plan, 0-5 Years			
Basin No.	Project Name	Description	Capital Costs
L-1	Exit 2 South Sewer Improvements	120-gpm pump station, 15,200 L.F. 8" gravity sewer, and 3,000 L.F. 4" force main collecting flow from south side of Exit 2 and discharging to Sewer South at Exit 2	\$ 5,300,000
L-1	Exit 4 South Sewer Improvements	120-gpm pump station, 12,900 L.F. 8" gravity sewer, and 5,300 L.F. 4" force main collecting flow from south side of Exit 4 and discharging to Sewer South at Fair Play	\$ 5,100,000
		TOTAL	\$ 10,400,000

4.5.2 5-10 Years

The second five-year timeframe, from 5-10 years, builds upon the infrastructure created at Exits 2 and 4, and adds infrastructure at the other two interstate exits within the study area, at Exit 1 and Exit 11 (see **Figure 14. Scenario 1: 5-10 Years**). The Exit 1 Improvements consist of a gravity sewer that collects flow from the northeast side of Exit 11, flowing to a pump station that then conveys it to the Welcome Center Pump Station on the southwest side of the exit. The Exit 11 Improvements will consist of gravity sewer to collect flow from the west side of Exit 11 that flows to a pump station which then conveys it either to a new treatment plant (discussed below) or the Golden Corner Pump Station.

Beaverdam Creek is a favorable geographic location for a wastewater treatment plant to serve the study area. OJRSA's only existing treatment plant, the Coneross Creek WRF, is approximately 14.5 miles away from Exit 11, and to convey flow from the various corners of the study area would entail a significant capital and ongoing maintenance expenses from numerous pump stations and force mains.⁵ Constructing a treatment plant on Beaverdam Creek would minimize additional costs, as well as allow future expansion and upgrades at the Coneross Creek to be delayed, thus postponing a necessary significant expense at that site for numerous years. Locating a plant on Beaverdam Creek would allow for eventually eliminating the Golden Corner Pump Station, which is located further upstream on Beaverdam Creek, as it can be served by a gravity sewer extension from the Beaverdam Creek WRF (see 10-15 year plan below). The optimal location for the treatment plant would be in the vicinity of the Oconee / Anderson County line just north of Highway 243.

It is recommended that the WRF be sized for a flow of 1.5 million gallons per day (mgd), but that OJRSA purchase enough land to eventually upgrade the plant to buildout flows of 3.0 mgd or greater. A

⁵ Besides the annual cost to operate and maintain pump stations and force mains, these typically have a design life of 20 years before extensive rehabilitation and/or replacement must take place. It should also be planned to replace pumps and other mechanical equipment every 10-12 years for each station. On the other hand, if sized appropriately and growth escalates as projected, then gravity sewers generally have a much longer useful life, typically exceeding 40 years before some rehabilitation may be necessary; replacement of a gravity sewer is extremely rare. The costs to operate and maintain gravity sewers over time versus pump stations and force mains is inversely proportional—gravity sewers are more expensive to install initially and cost less over the years whereas pump stations are relatively inexpensive (compared to gravity sewer) to install but may be more expensive in the long run.

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sufficient buffer area around the built-out plant should be considered when purchasing the land. For planning purposes, a buffer of 150-200 feet should be considered when purchasing land, but could be decreased depending on neighboring land use, proximity to houses, etc. An area of 8-16 acres would be needed for the original construction of a plant this size with a future parallel train. The need would vary based on shape of the property (the more square a property the less property needed), topography, unusable acreage within the property, treatment method selected, any auxiliary uses envisioned beyond the basic treatment processes, etc. It should be noted that the plant coming online is shown in the 5-10 year timeframe solely because the time to design, permit, and construct a new treatment plant is typically 4-6 years at a minimum after the decision to build one is made. As a result, should OJRSA wish to bring the plant online within the schedule shown, it should begin the preliminary engineering phase as soon as possible.

Table 6. Capital Improvement Plan, 5-10 Years

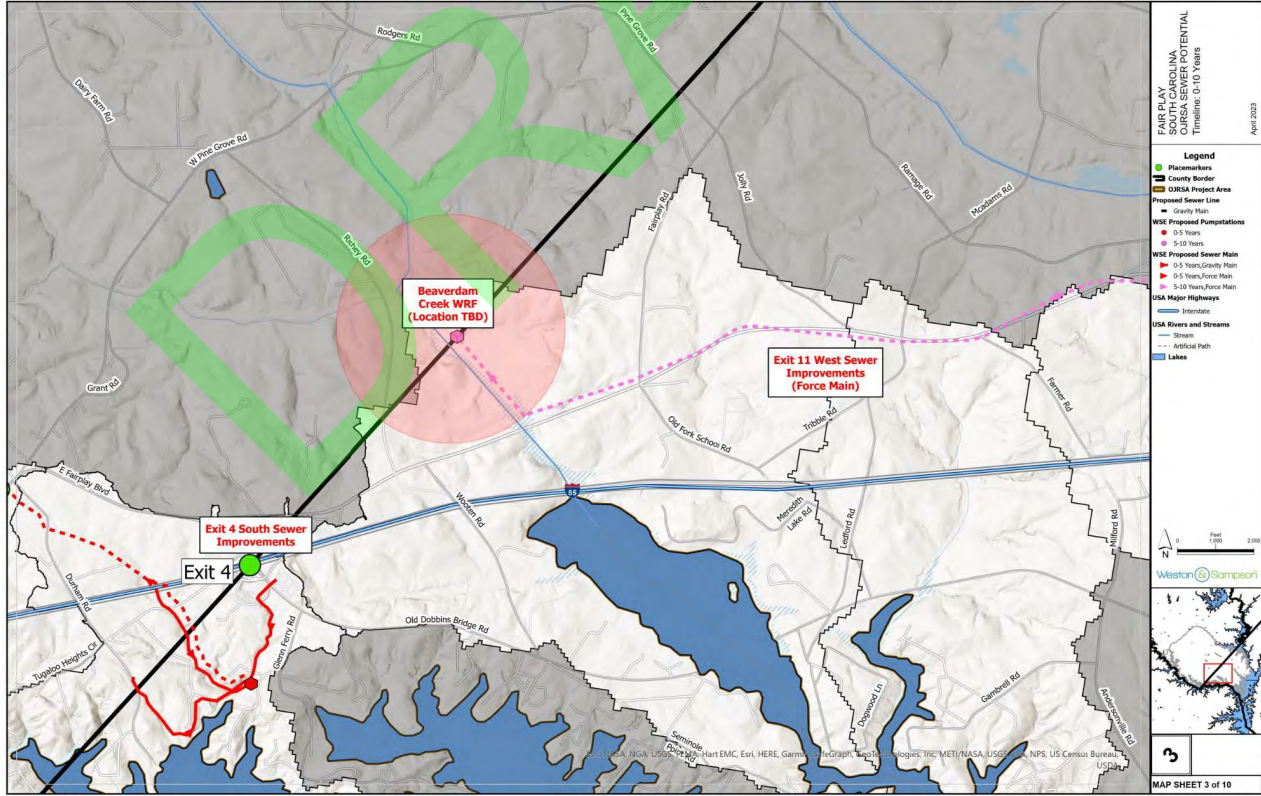
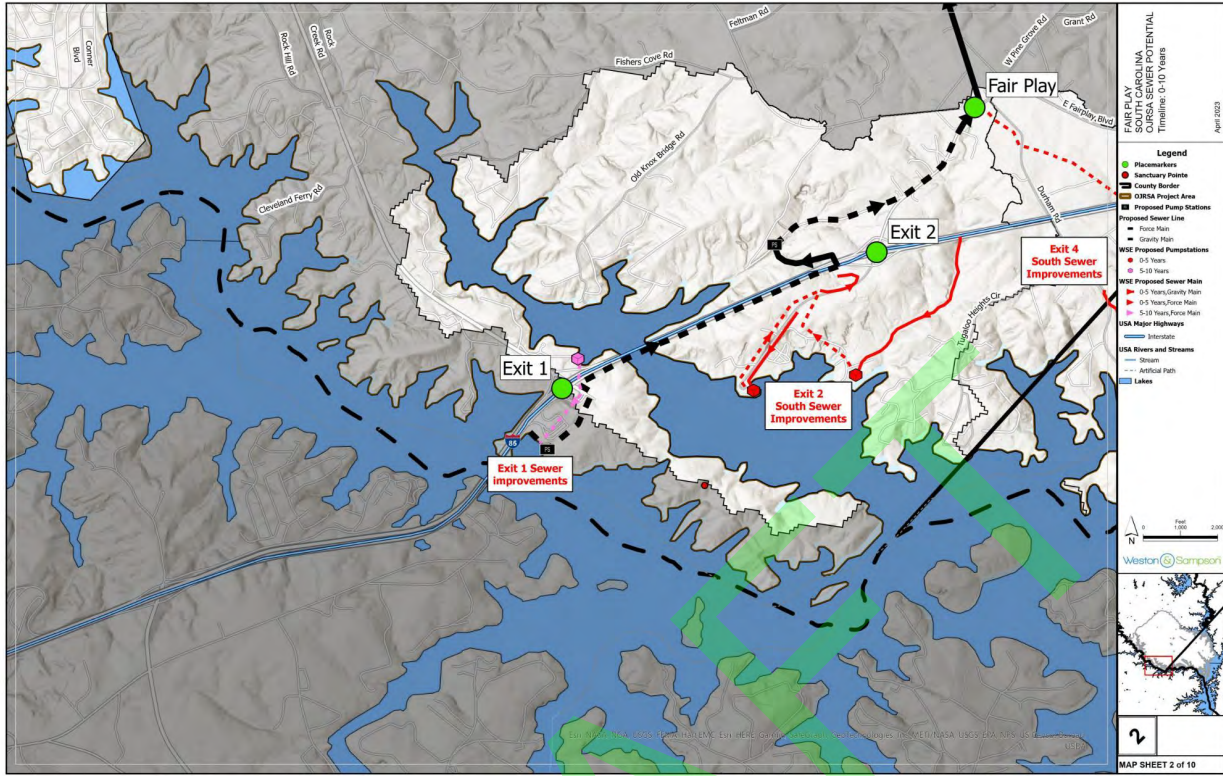
Table 6 Capital Improvement Plan, 5-10 Years			
Basin No.	Project Name	Description	Capital Costs
R-1	Exit 11 West Sewer Improvements	Pump station, gravity sewer, and force main collecting flow from west side of Exit 11 and discharging to Golden Corner PS or Beaverdam Creek WWTP	\$ 11,300,000
N-1	Beaverdam Creek WWTP	1.5 MGD WWTP, with land available to expand to 3.0 MGD	\$ 32,300,000
A-1	Exit 1 Sewer Improvements	Pump Station, gravity sewer, and force main collecting flow from north side of Exit 1 and pumping to Welcome Center PS	\$ 1,400,000
		TOTAL	\$ 45,000,000

4.5.3 10-15 Years

The next timeframe, from 10-15 years, will build upon the construction of the Beaverdam Creek WRF by extending gravity sewer up further up Beaverdam Creek, first to take the Golden Corner Pump Station offline (Lower Mill Creek Sewer Improvements) and then to provide sewer service to Highway 11 by continuing the sewer all the way to the top of the basin (Upper Mill Creek Sewer Improvements). Once sewer is extended to Highway 11, then the Chickasaw Point land application system could be taken offline and pumped to the Upper Mill Creek gravity sewer (see **Figure 18. Scenario 1: 10-15 Years**).⁶

⁶ Note: The condition of the Chickasaw Point and other privately owned wastewater collection systems is unknown and is beyond the scope of this study. Before taking ownership of any privately-owned sewer collection or treatment system, the OJRSA should perform a comprehensive assessment of the system to determine its condition and funding needs to rehabilitate it as necessary.

Fair Play and Townville Area Sewer Basin Plan



Fair Play and Townville Area Sewer Basin Plan

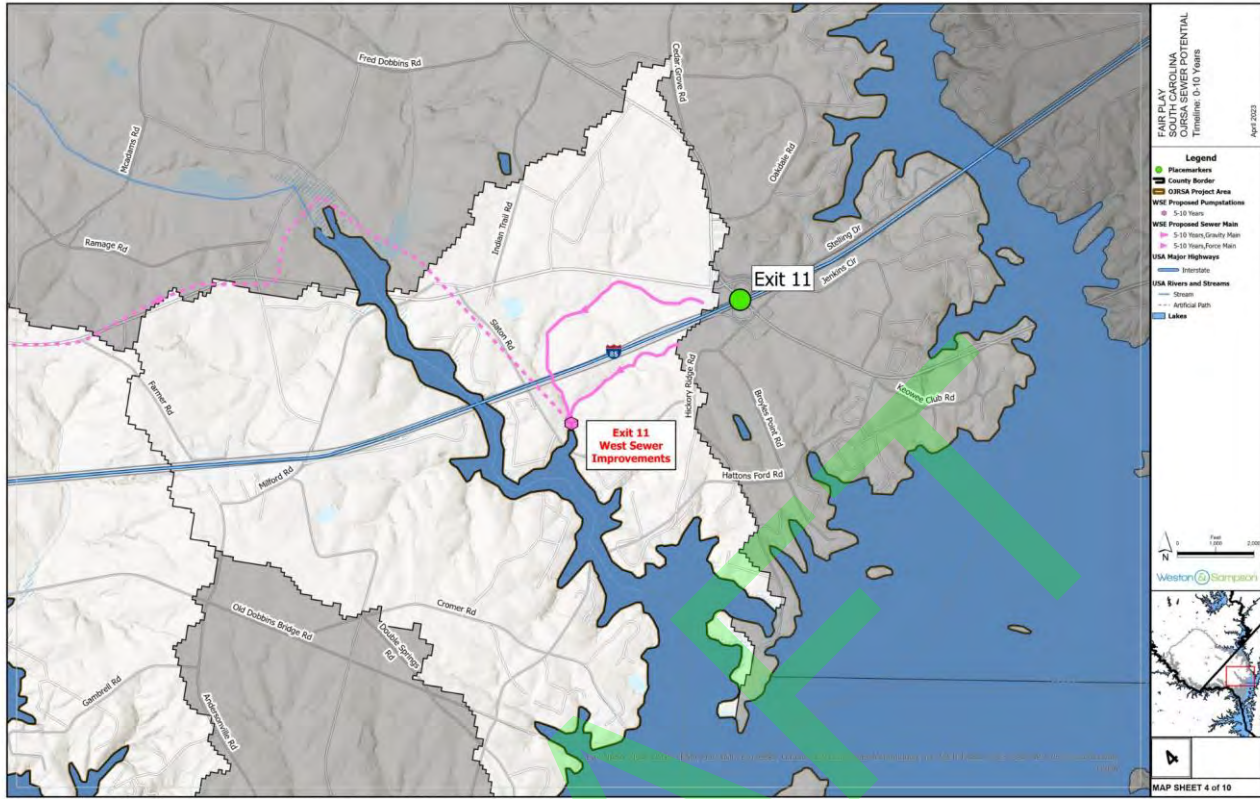


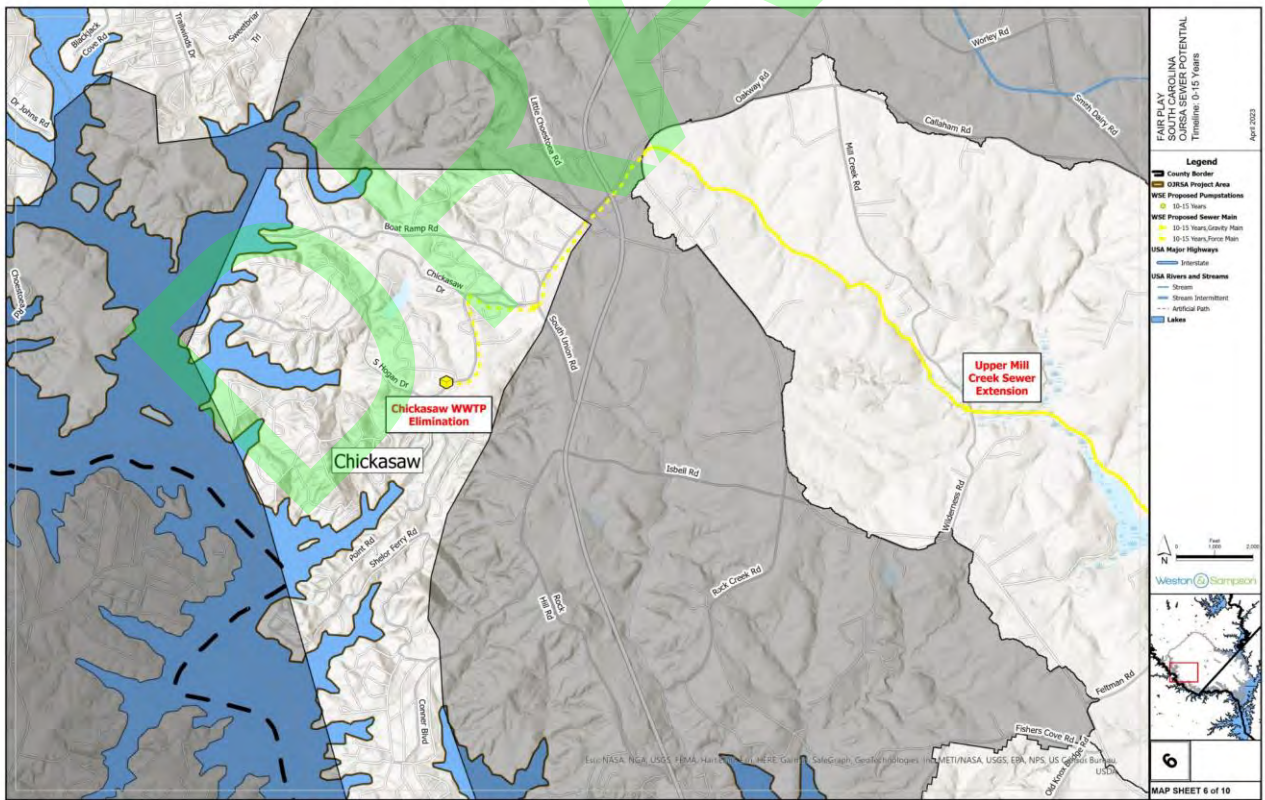
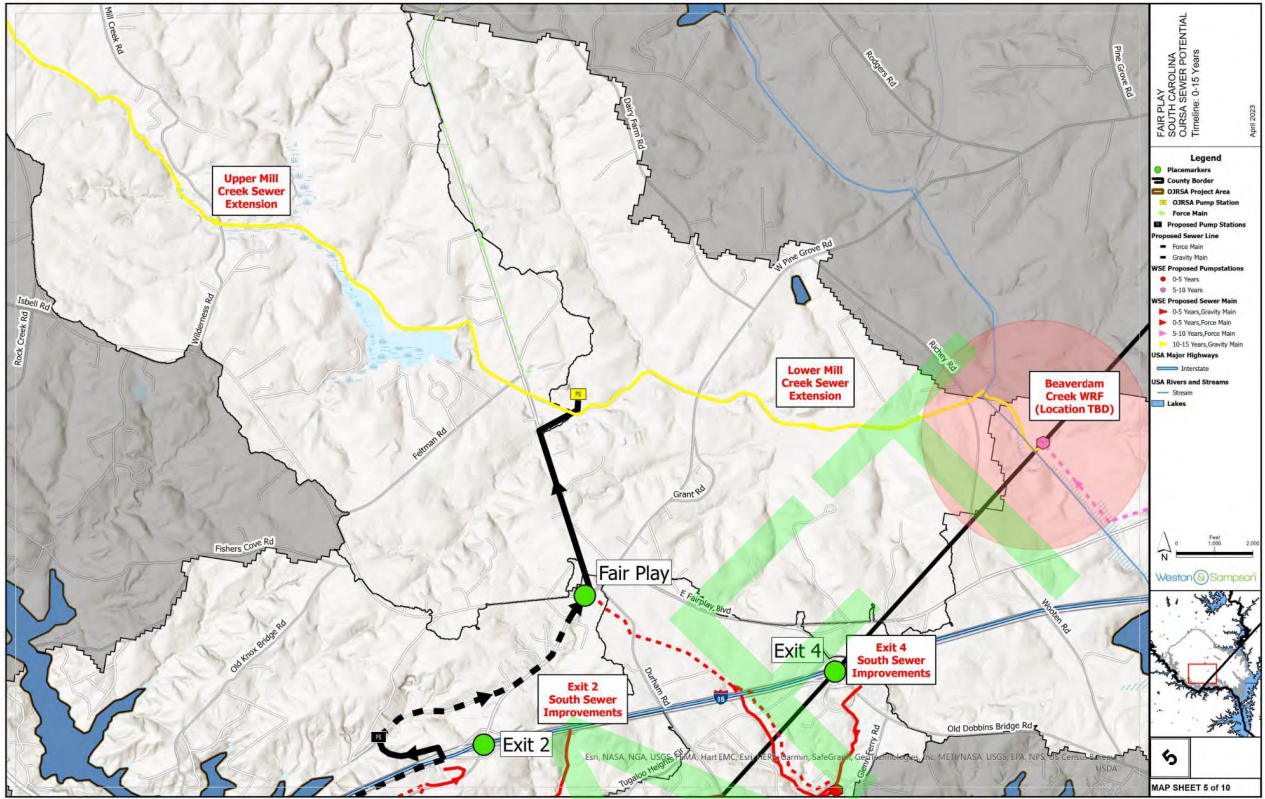
Table 7. Capital Improvement Plan, 10-15 Years

Table 7 Capital Improvement Plan, 10-15 Years			
Basin No.	Project Name	Description	Capital Costs
N-2	Lower Mill Creek Sewer Extension	Eliminate Golden Corner PS and convey flow to Beaverdam Creek WWTP	\$ 8,800,000
N-2A	Upper Mill Creek Sewer Extension	Extend gravity sewer from Golden Corner PS to Hwy 11	\$ 7,500,000
B-1	Chickasaw WWTP Elimination	Pump Station & Force Main to eliminate existing WWTP, to discharge to Mill Creek Sewer	\$ 4,900,000
		TOTAL	\$ 21,200,000

4.5.4 15-20 Years

The final time period, from 15-20 years, focuses on the northern corner of the study area (see **Figure 21. Scenario 1: 15-20 Years**). The West Oak Sewer Extension provides sewer service to the West Oak High School area, connecting to the existing interceptor upstream of the Coneross Creek WRF. The project would take an existing plant adjacent to the high school offline. Unlike the remainder of the recommended capital improvements projects, this project is not dependent on other projects being completed. As a result, it could be moved to an earlier timeframe should conditions or demand warrant it.

Fair Play and Townville Area Sewer Basin Plan



Fair Play and Townville Area Sewer Basin Plan

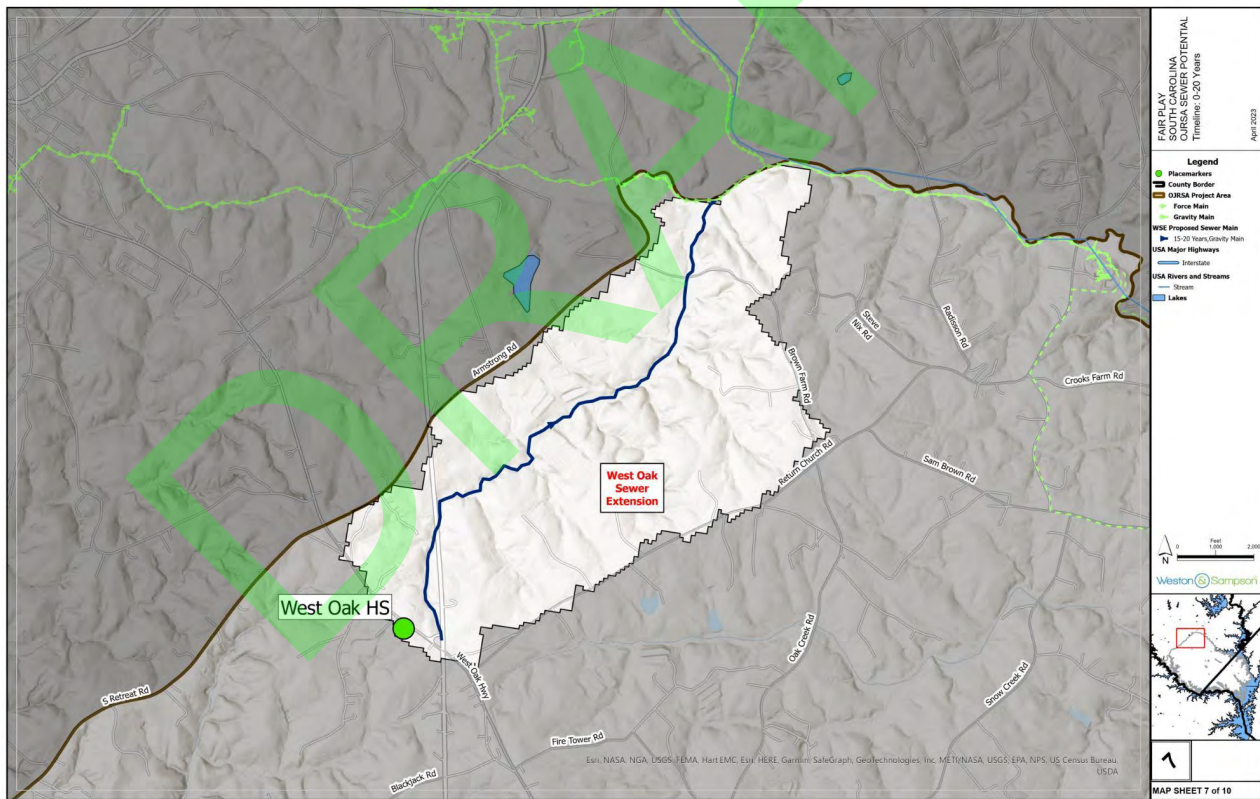
Table 8. Capital Improvement Plan, 15-20 Years

Table 8 Capital Improvement Plan, 15-20 Years			
Basin No.	Project Name	Description	Capital Costs
AA-1	West Oak Sewer Extension	Gravity Sewer to eliminate West Oak HS WWTP	\$ 4,400,000

4.6 Scenario 2

As discussed above, a separate scenario was considered where instead of constructing the Beaverdam Creek WRF, a pump station is constructed at the same location (see **Figure 23. Scenario 2**). Flow would then be pumped north to the Coneross Creek WRF which has a remaining capacity of approximately 3.1 mgd. The existing Golden Corner force main could be used for a portion of the route to minimize additional capital costs, since it would be eliminated under this scenario.

IMPORTANT NOTE: This will require expansion of the Coneross Creek WRF. The requirements and costs of such an expansion are beyond the scope of this project but could be further investigated if desired.

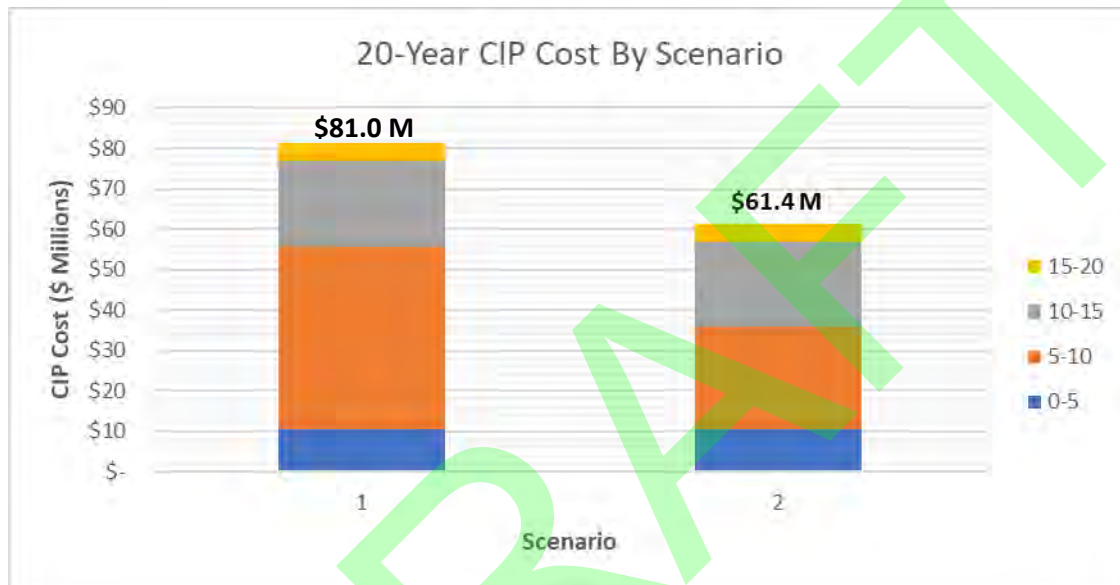


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4.7 Scenario Comparison

Of the two scenarios that were finalized, Scenario 1 had the highest capital costs due to the high cost of the treatment plant construction. However, because of the higher capacity of the plant versus the pump station, the capacity for future development within the study area will be higher with the treatment plant. Additionally, constructing the treatment plant could delay costly upgrades at the Coneross Creek WRF, which could save or postpone OJRSA significant costs.

Chart 2: Scenario Capital Cost Comparison (Scenario 2 does not include the CIP costs to expand Coneross Creek WRF)



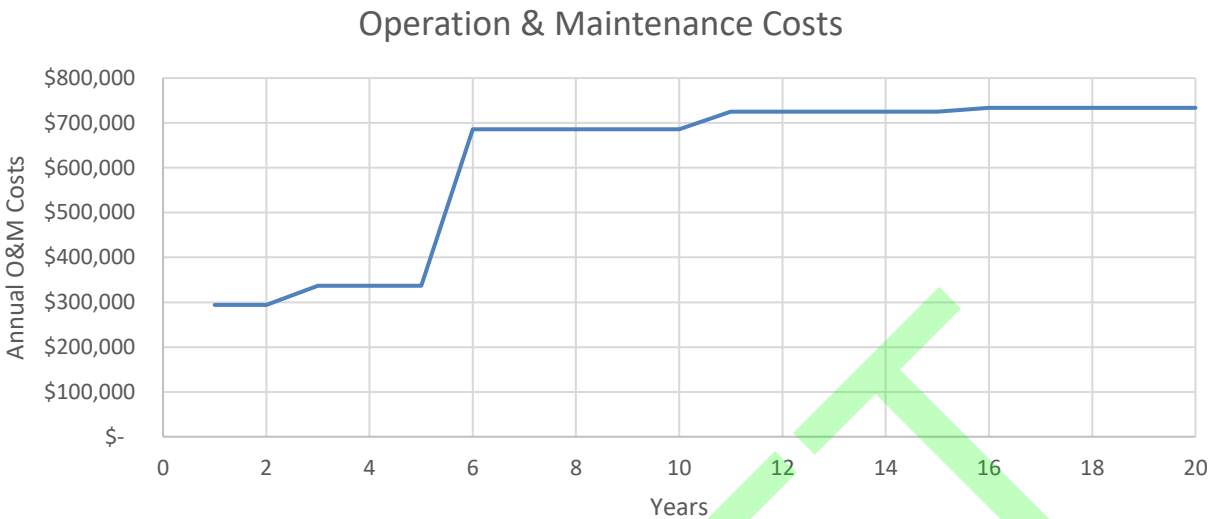
4.8 Operation and Maintenance Costs

Operation and maintenance (O&M) costs were estimated for Scenario 1. These annual O&M costs can be overshadowed by the capital costs in situations like this, but it is important to have a realistic expectation for budgeting purposes. Chart 3 shows how annual O&M costs will increase over time as infrastructure gets added. The large jump in Year 6 is when the Beaverdam Creek WRF comes online, and the increased costs associated with operating the plant become a factor. The O&M costs were estimated in conjunction with OJRSA input, the annual OJRSA operations budget, and general industry information.

- \$325,000/year for a 1.5 mgd WRF (including operator labor costs)
- \$18,000/year for each pump station in the system
- \$0.50/year for each linear foot of gravity sewer
- \$240,000/year for additional staffing, overhead (includes two staff plus vehicle and miscellaneous expense)

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Chart 3: Operation and Maintenance Costs



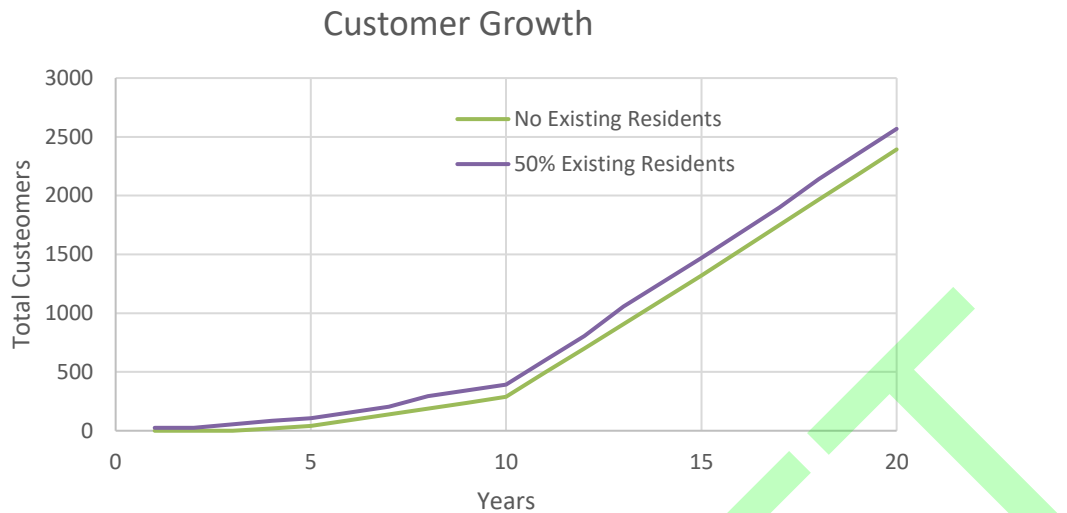
4.9 Customer Growth and Revenue

Customer growth, and by extension, revenue growth, will be slow in the initial stages of the study period. There are not many areas of significant concentrated development within the study area. The residences and commercial areas within the study area are relatively spread out. Furthermore, without sewer service in the area, development has historically occurred along the highways (generally on top of ridges), rather than along low-lying areas where gravity sewer would be placed. While gravity sewer will (and should) be routed to maximize the number of residents that can connect to the sewer, it will still be a relatively small number that will be able to connect to sewer.

The majority of the customer growth will be due to new and likely more dense developments being located near the sewer infrastructure. As a result, two scenarios were considered for customer growth: one where no existing residents connected within the 20-year period; and a second scenario where 50% of the existing residents within a 300-foot distance of the gravity sewer connected (see below, Chart 4).

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Chart 4: Customer Growth



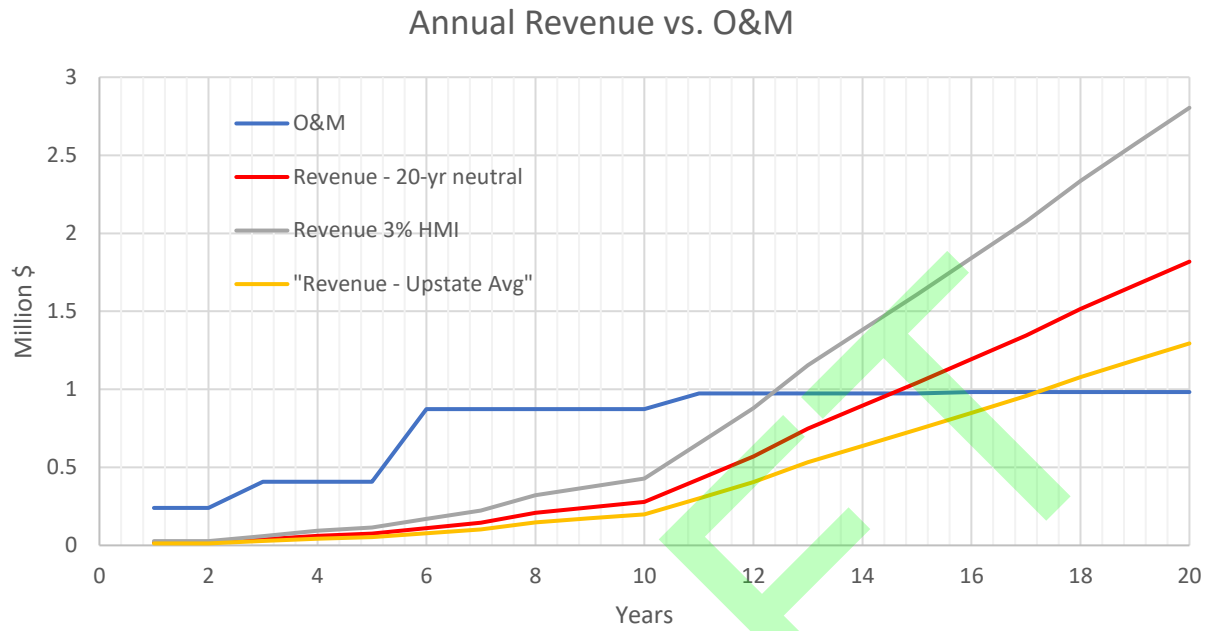
A full rate study should be performed to develop a rate structure that is equitable and optimizes revenue, but there are some high-level assumptions that can be made to estimate revenue. At more than \$60 million over 20 years, it is not feasible to cover capital costs over the 20-year period. Capital improvement costs will have to be funded by a combination of grants, low interest loans, and investment by the County and OJRSA. A few different approaches were considered as part of this study, but none of them resulted in revenue that exceeded O&M costs until Year 12 at the earliest.⁷ However, because of the fast increase in customer growth, revenue does increase well beyond O&M costs during the latter phases of the 20-year period (see below, Chart 5). The three revenue assumptions that were considered were:

- Sewer bill equal to the Upstate average sewer bill in the Upstate: \$42/month (*South Carolina Rural Infrastructure Authority Office of Local Government 2021 Municipal Water & Sewer Rate Survey*)
- Sewer bill that would result in revenue over the 20-year period equal to the total 20-year O&M costs (\$59/month)
- Sewer bill equal to 3% of the Household Monthly Income for the Fair Play area: \$91/month. (*U.S. Census Bureau (2021) American Community Survey 5-year estimates*). The 3% HMI is an industry standard for a maximum bill that meets affordability criteria.

⁷ However, a large wastewater generator, such as an industry, could drastically impact this timeline.

Fair Play and Townville Area Sewer Basin Plan

Chart 5: Annual Revenue vs. O&M Costs



Fair Play and Townville Area Sewer Basin Plan

5.0 ENGINEERING CONCLUSIONS AND RECOMMENDATIONS

The following recommendations are based on the engineering analysis performed as part of this study:

- 1) Perform a rate study to develop an optimal rate structure for the retail system in the Fair Play area.
- 2) Perform preliminary planning and engineering work to evaluate further feasibility of the Beaverdam Creek WRF, since the duration needed to permit, design, and construct a new treatment plant is typically at least 4-6 years.
- 3) As soon as the treatment plant concept is proven viable, pursue purchasing land for the WRF.
- 4) Refine conceptual plans for the capital improvements in the 0-5 year timeframe.
- 5) Identify and pursue funding opportunities for the 0-5 year timeframe capital improvement projects.
- 6) Where applicable, begin discussions with private systems to gauge their interest in allowing OJRSA to take over their systems as a possibility to quickly develop a customer base. If there is interest, OJRSA would want to perform an analysis of the private system to ensure that an acquisition would be beneficial.
- 7) Update the master plan every 3 years to adjust the plan to any changes in conditions.

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Fair Play and Townville Area Sewer Basin Plan

6.0 REFERENCES

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APPENDIX A
Report Figures

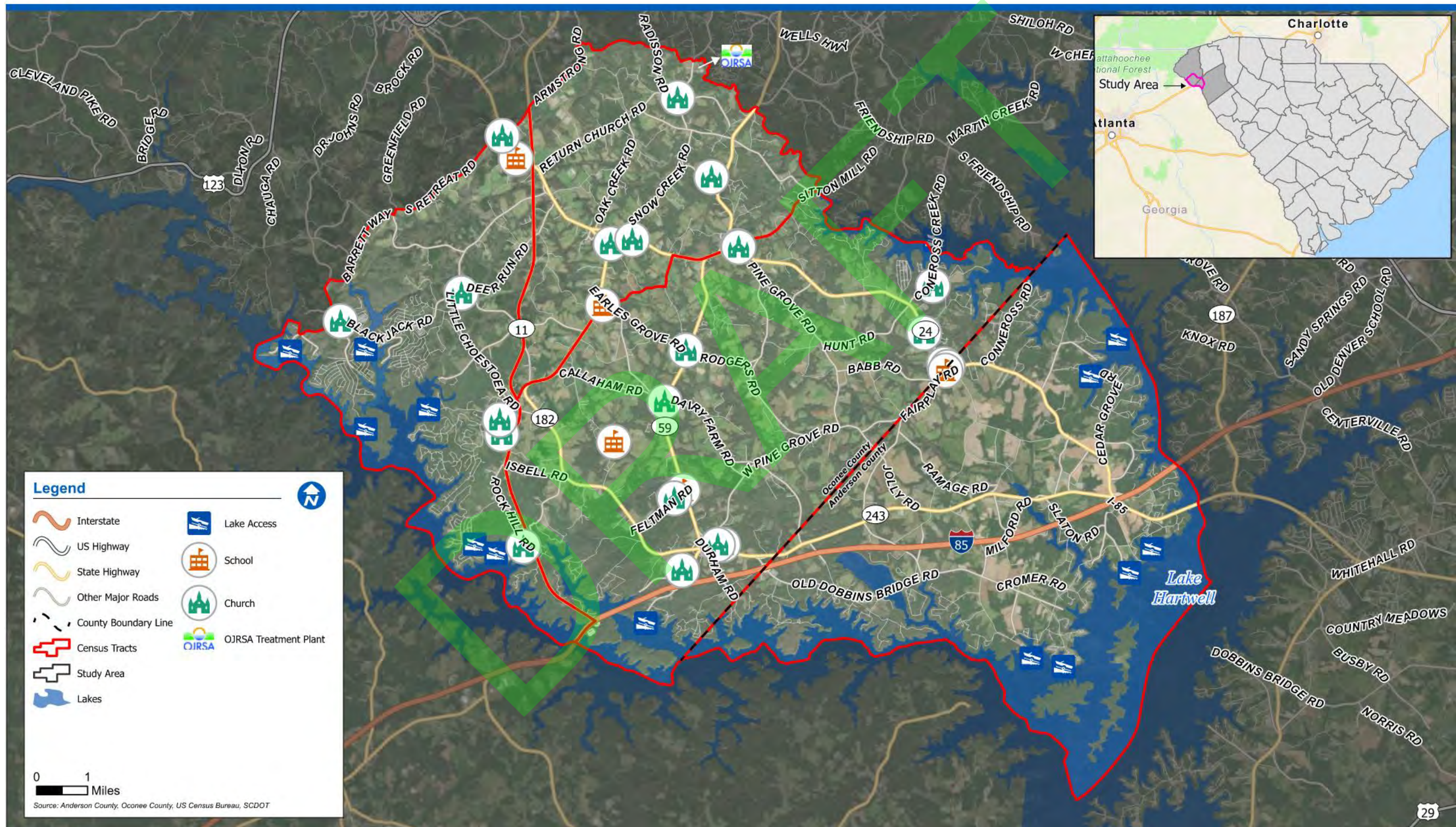


Figure 1. Report Study Area

Figure 2. Areas Public Meeting Attendees Supported Sewer Growth

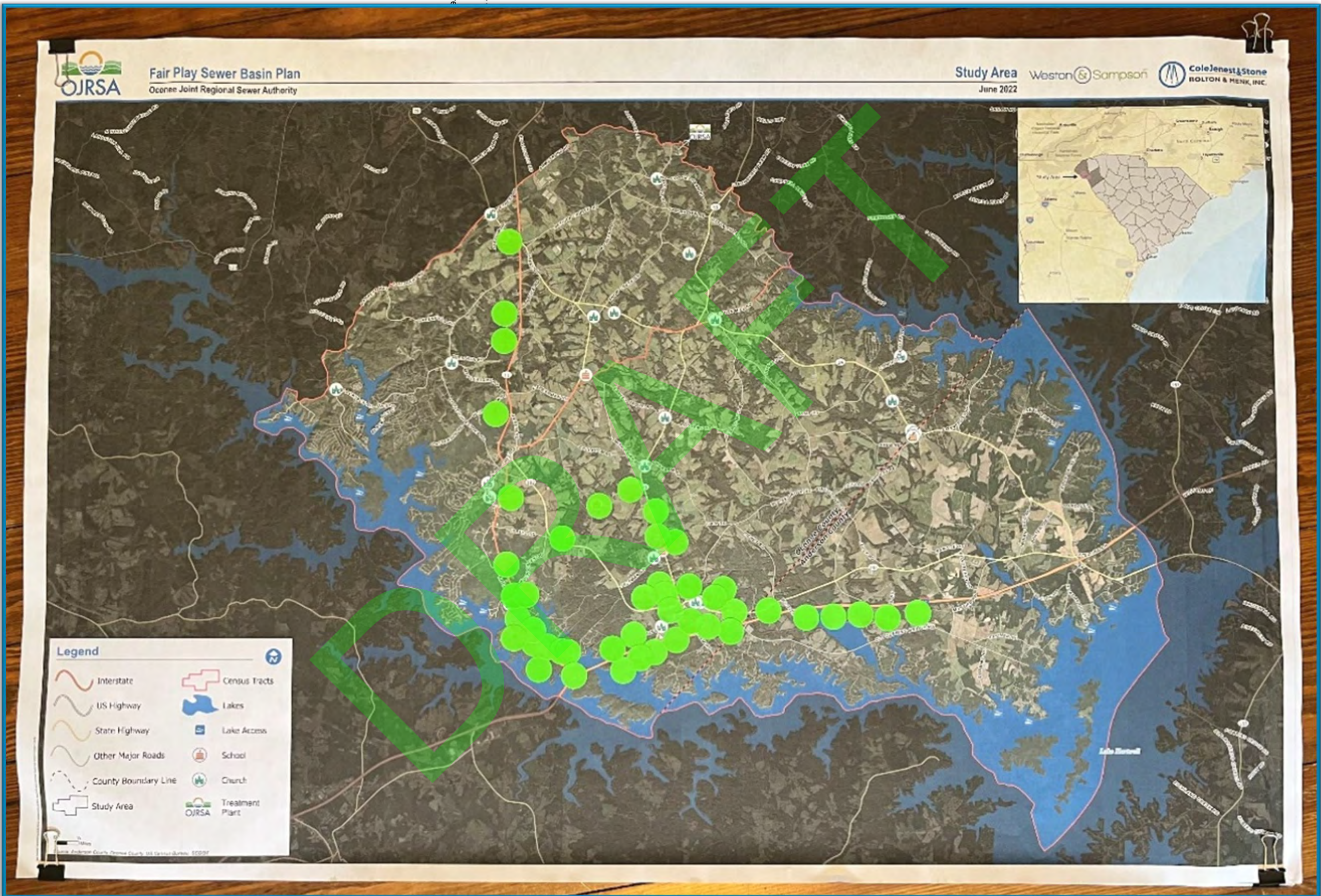
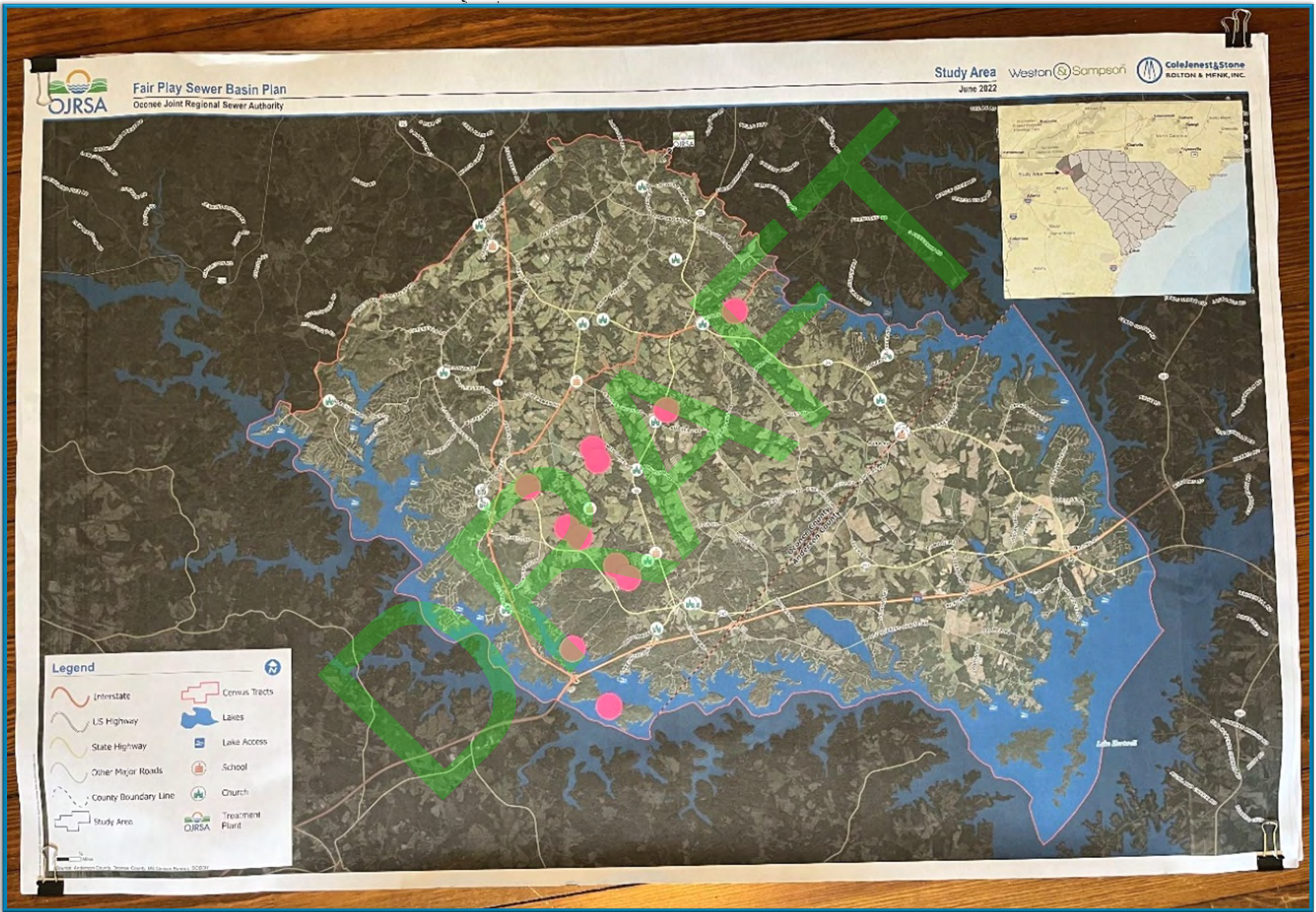


Figure 3. Areas Public Meeting Attendees Opposed Sewer Growth



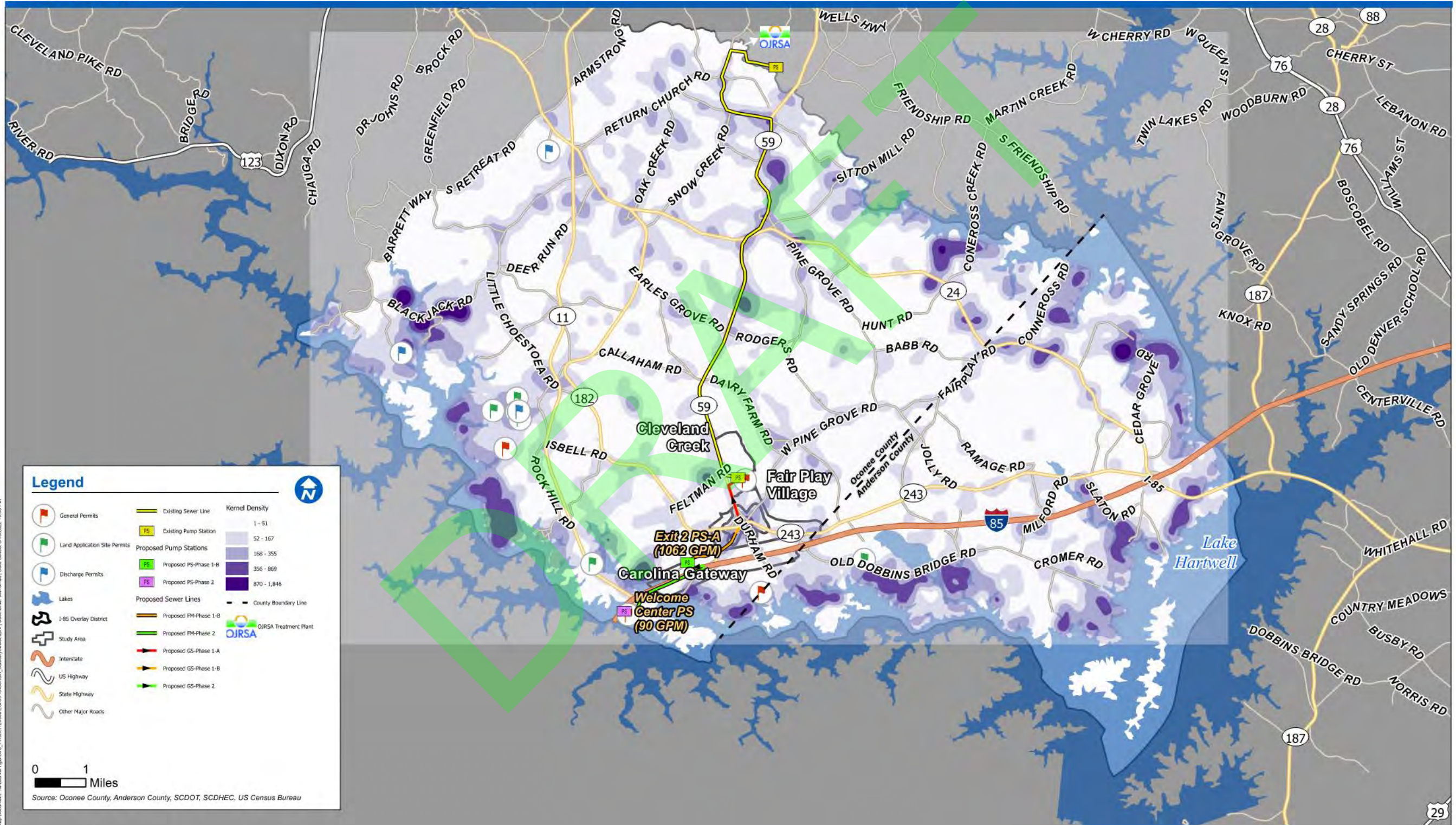


Figure 4. Population Density and Proposed Sewer

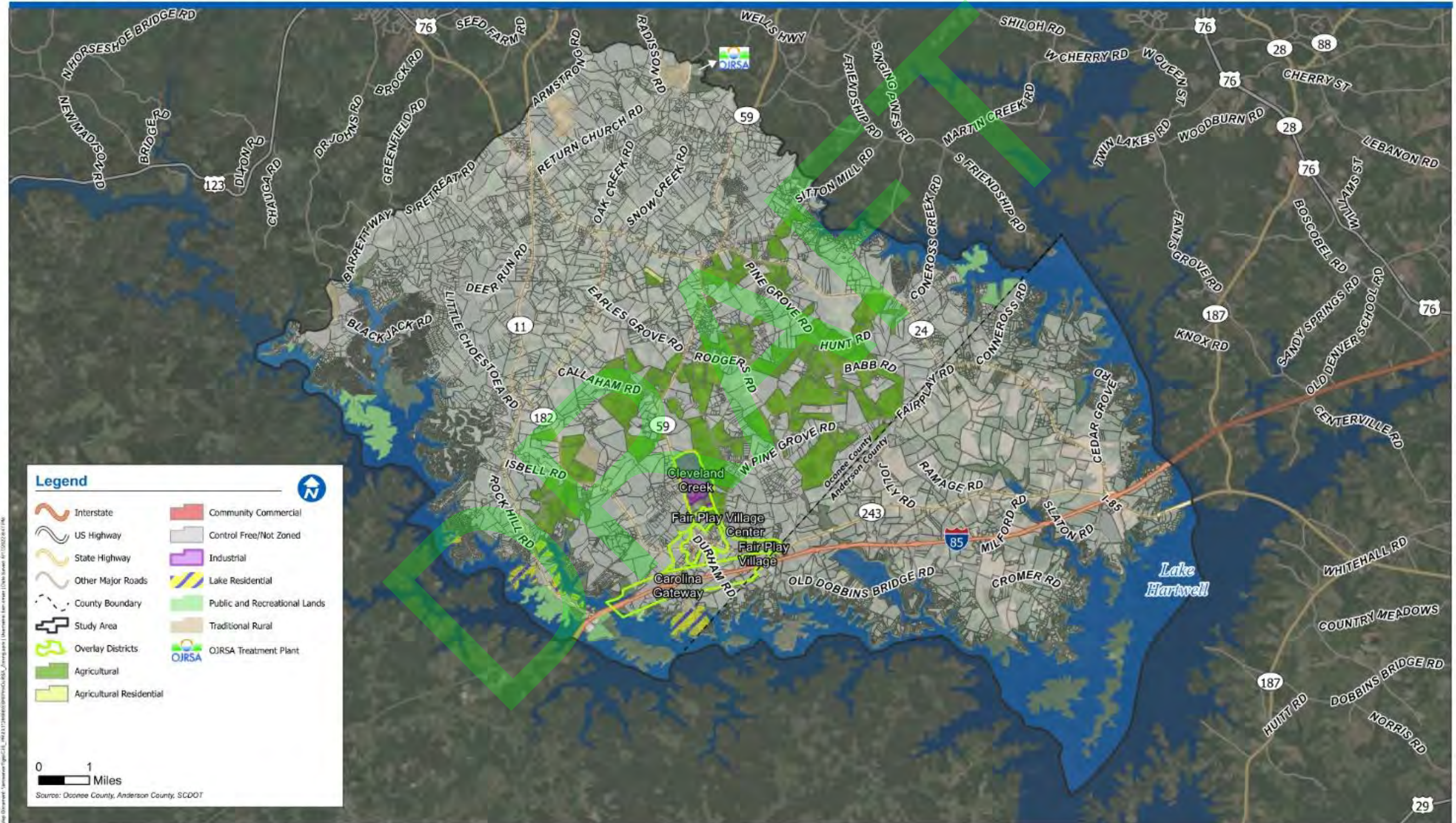


Figure 5. Current Zoning

Fair Play and Townville Area Sewer Basin Plan

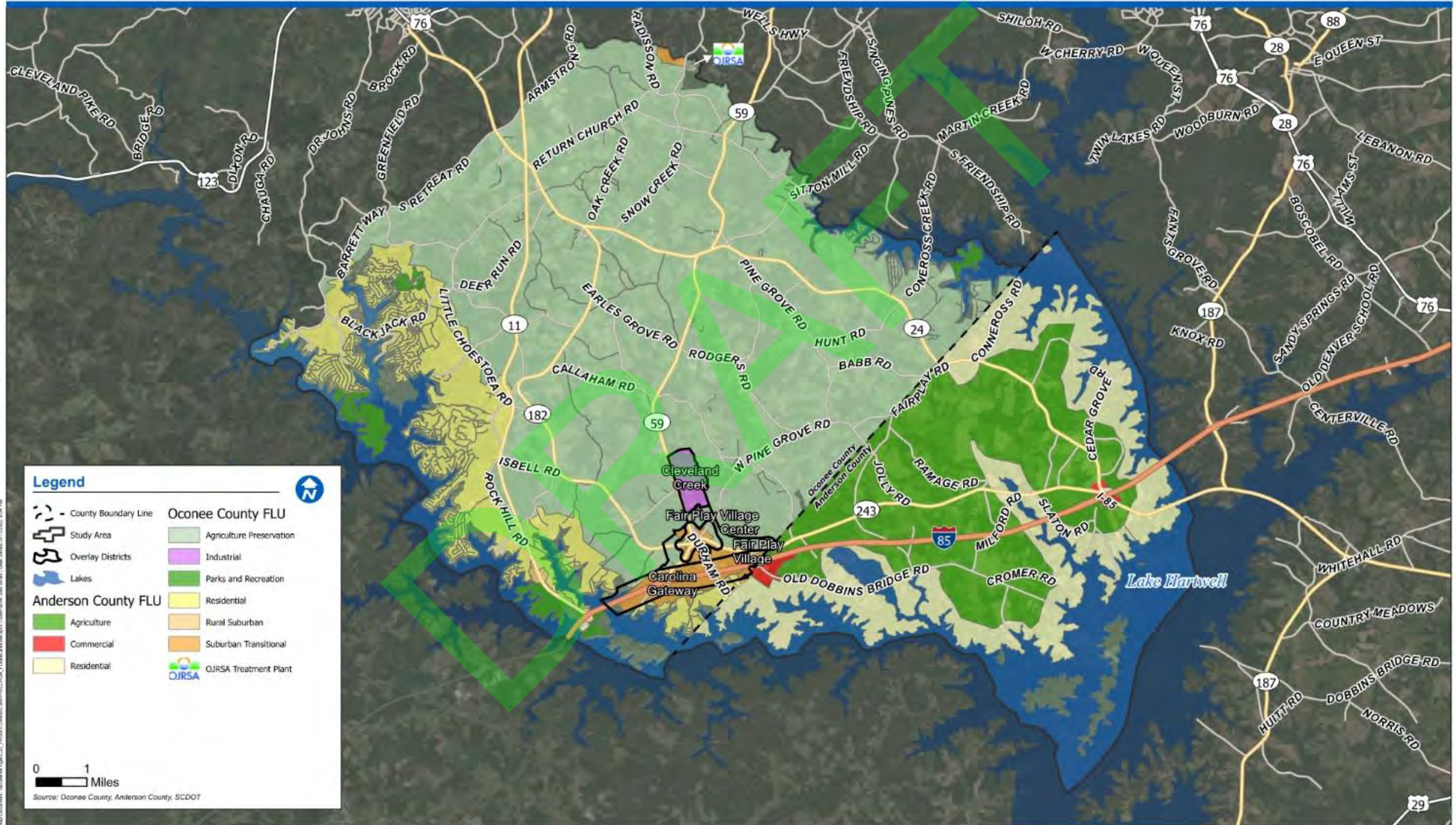


Figure 6. Future Land Use

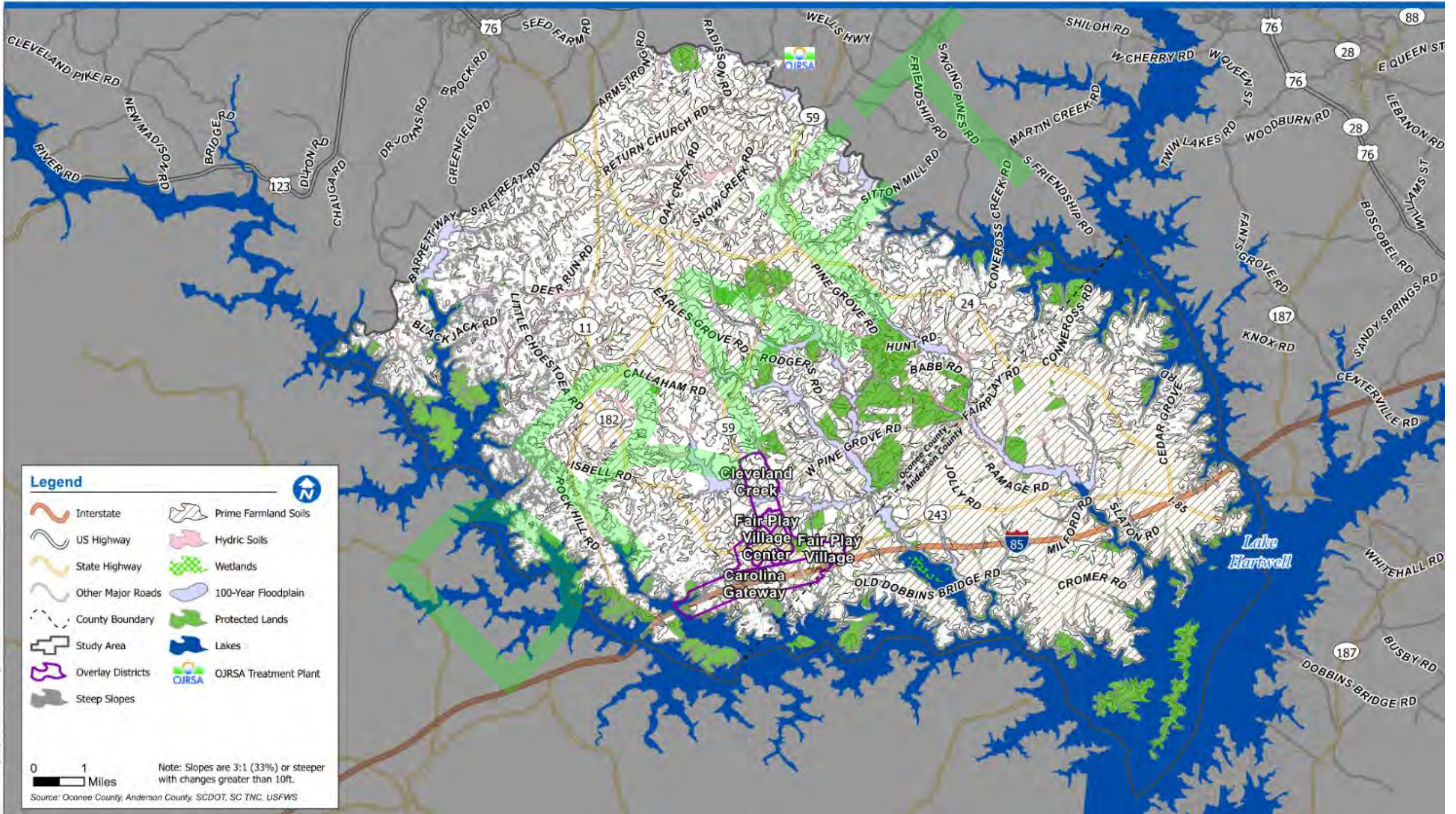


Figure 7. Constraints

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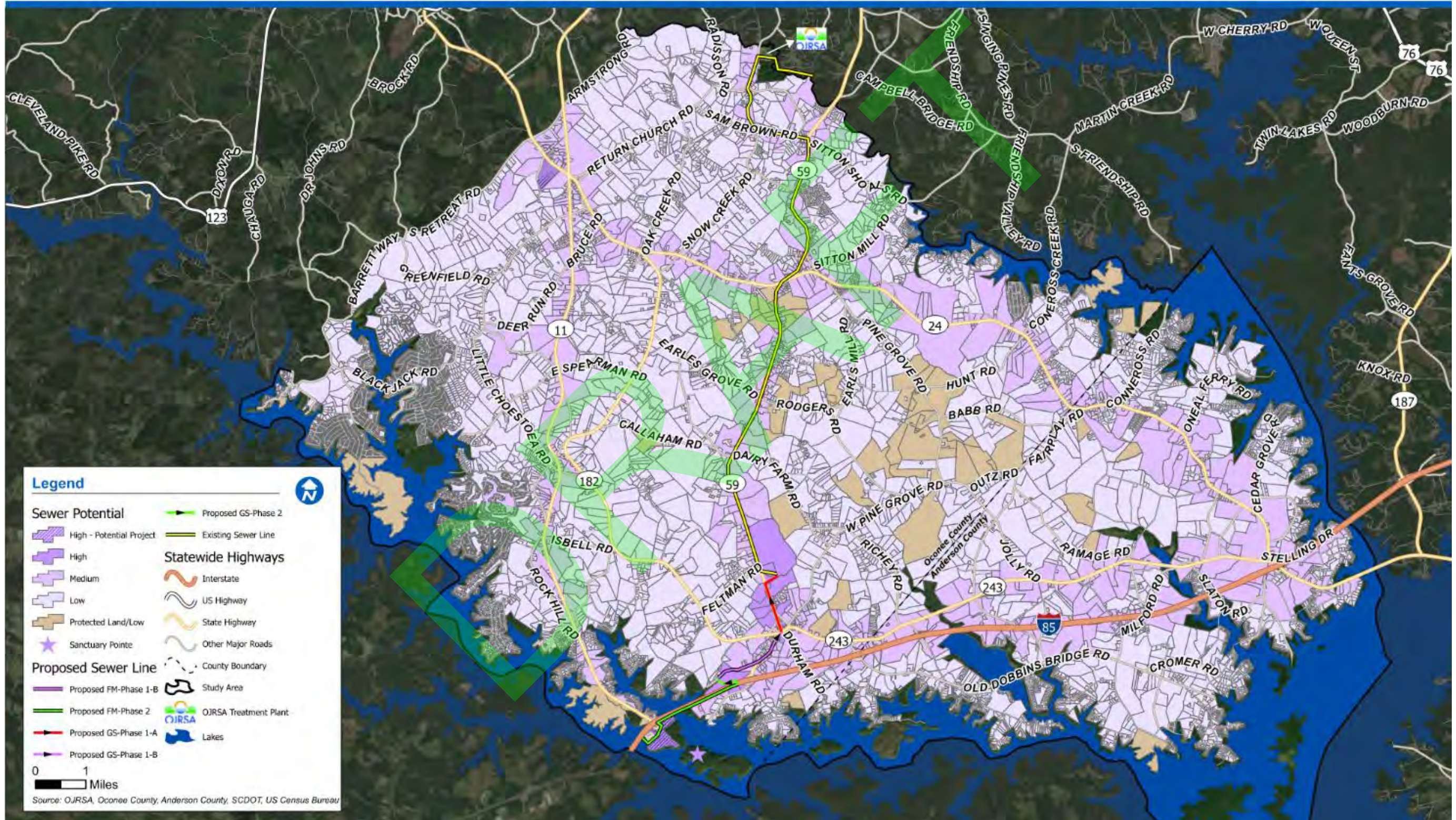


Figure 8. Sewer Potential

Fair Play and Townville Area Sewer Basin Plan

Figure 9. Sub-basin Boundaries for Study Area

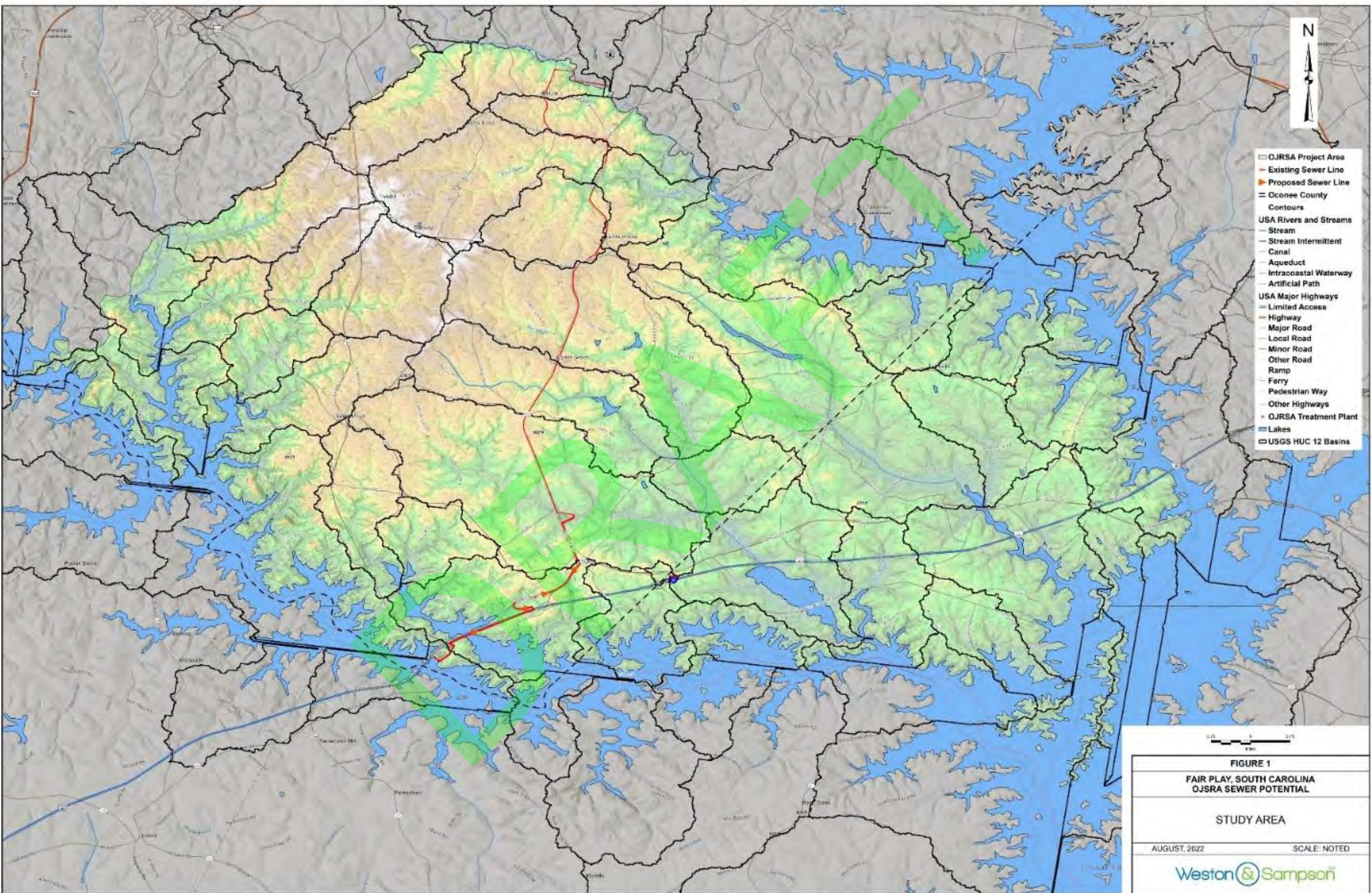


Figure 10. Sub-basin Boundaries for Study Area with Labels

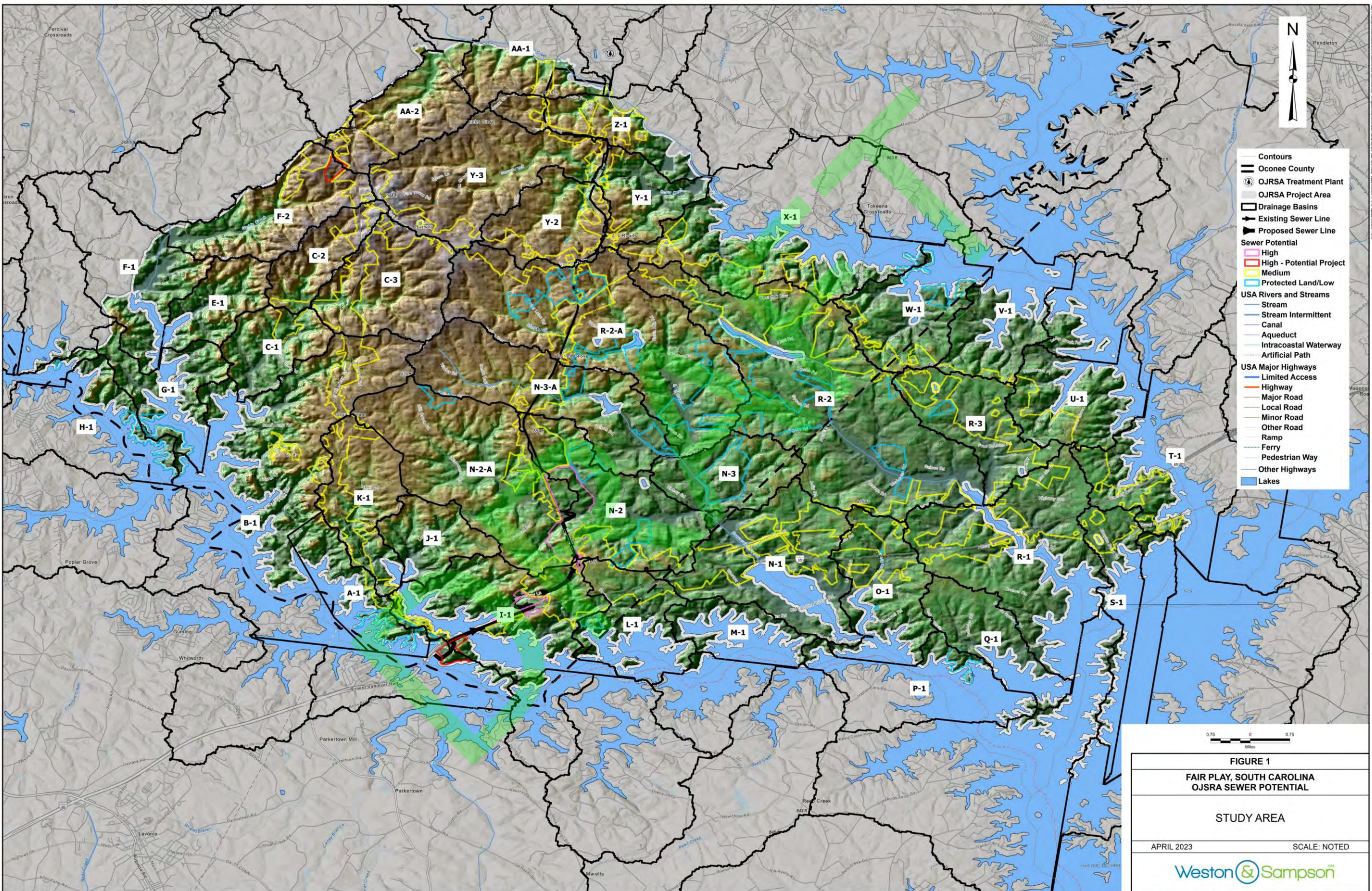


Figure 11. Basin Population Growth Estimates

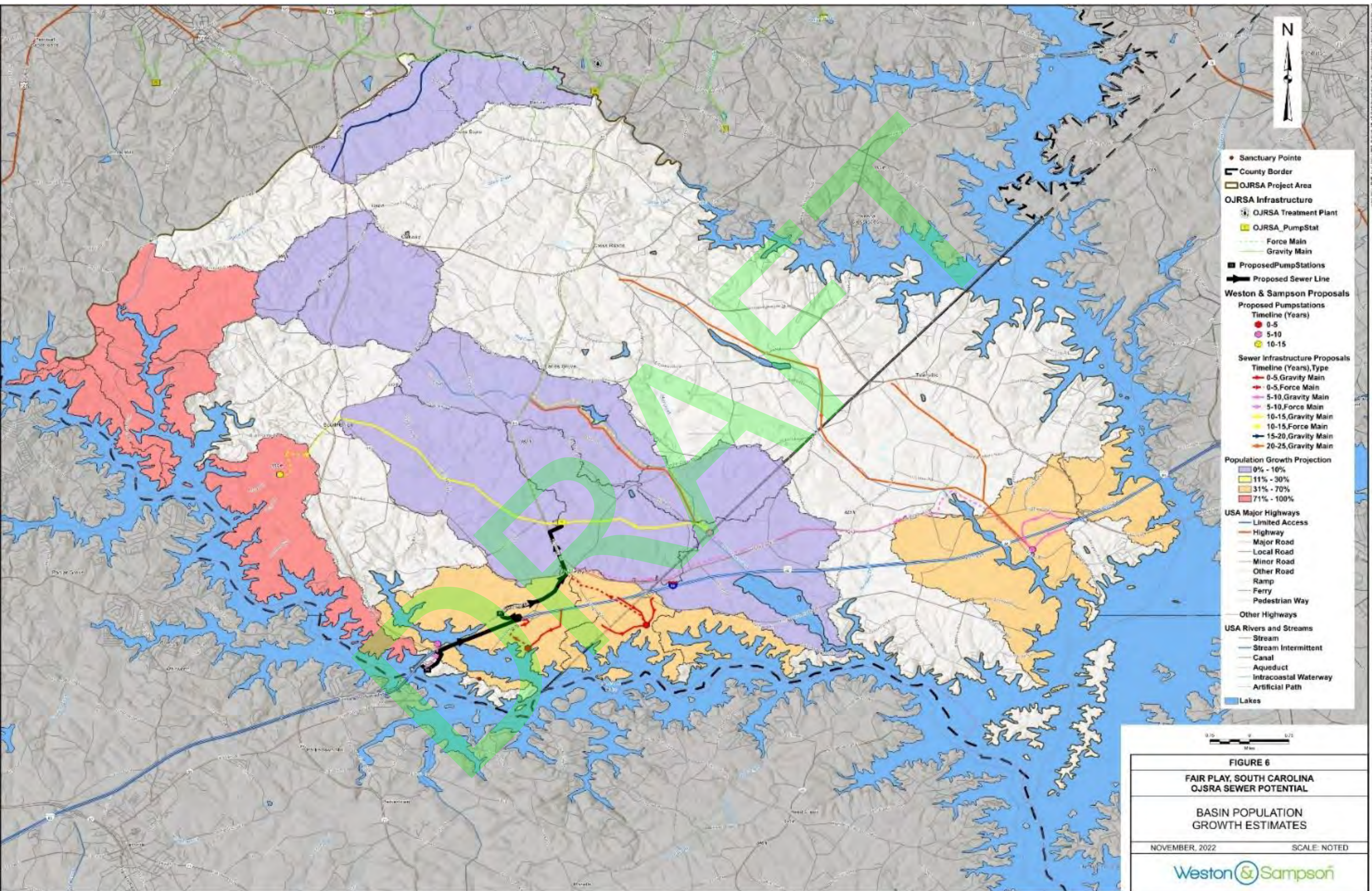


Figure 12. Scenario 1: 0-5 Years

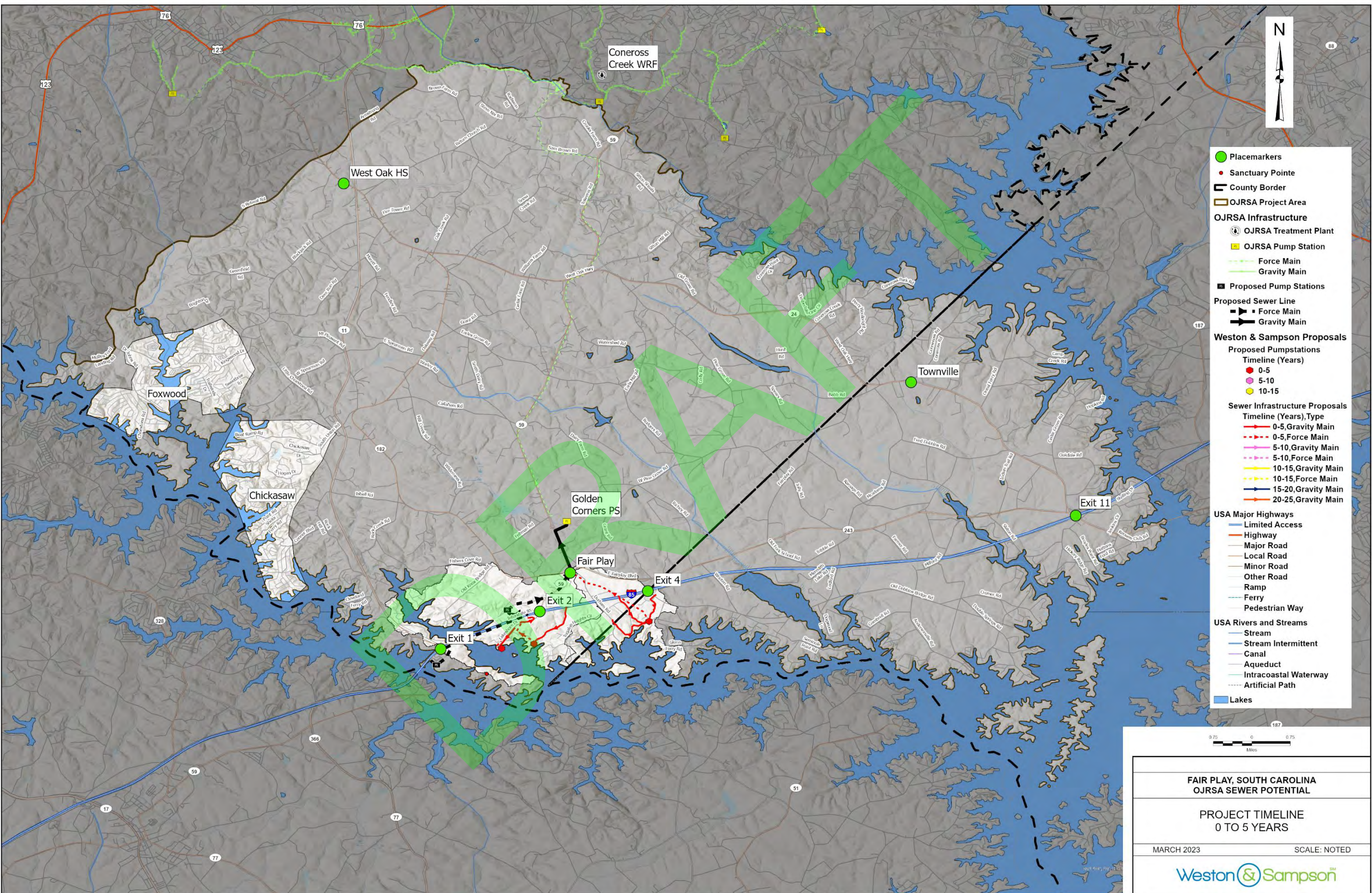
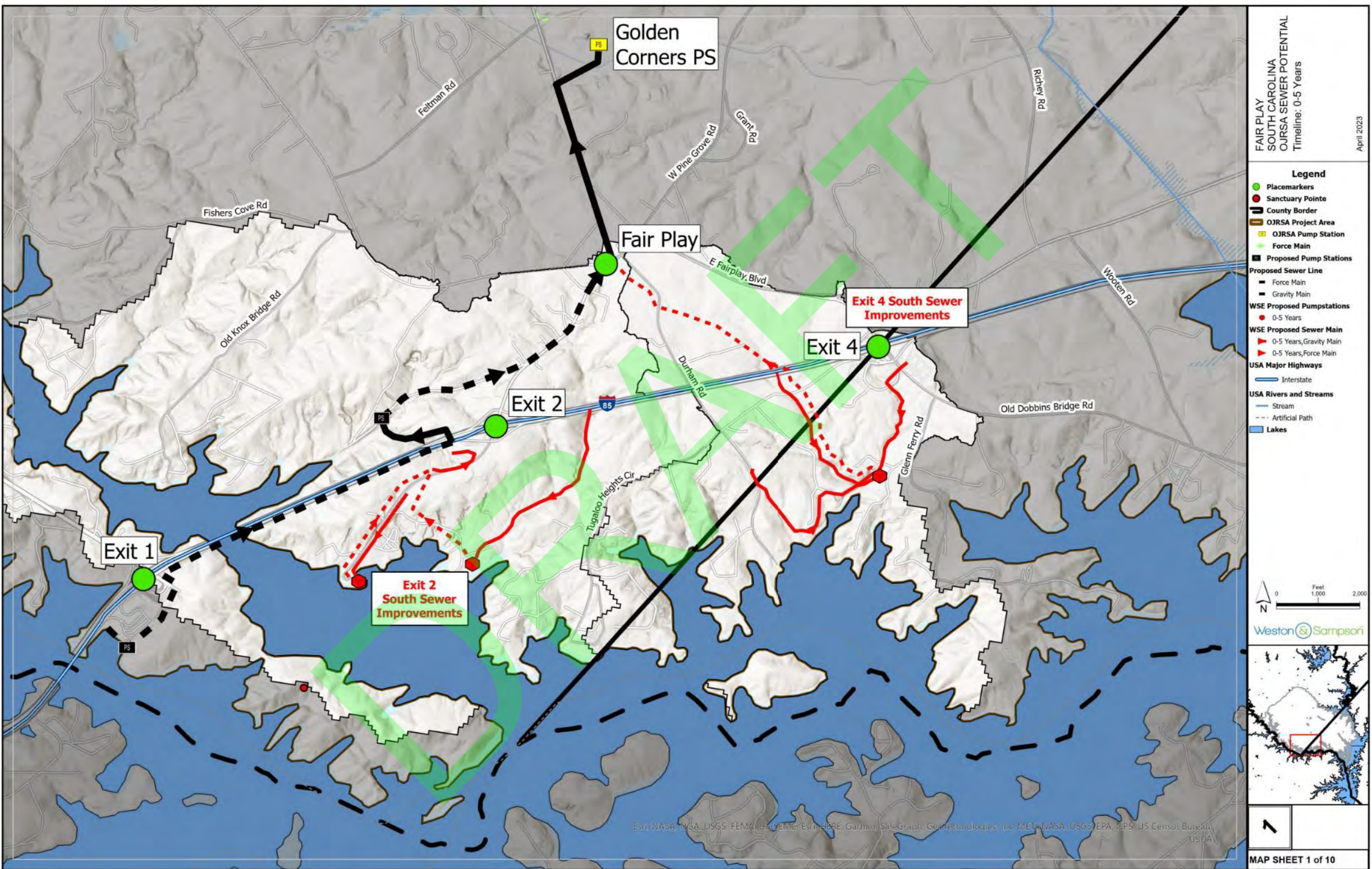


Figure 13. Scenario 1: 0-5 Years Zoomed



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Figure 14. Scenario 1: 5-10 Years

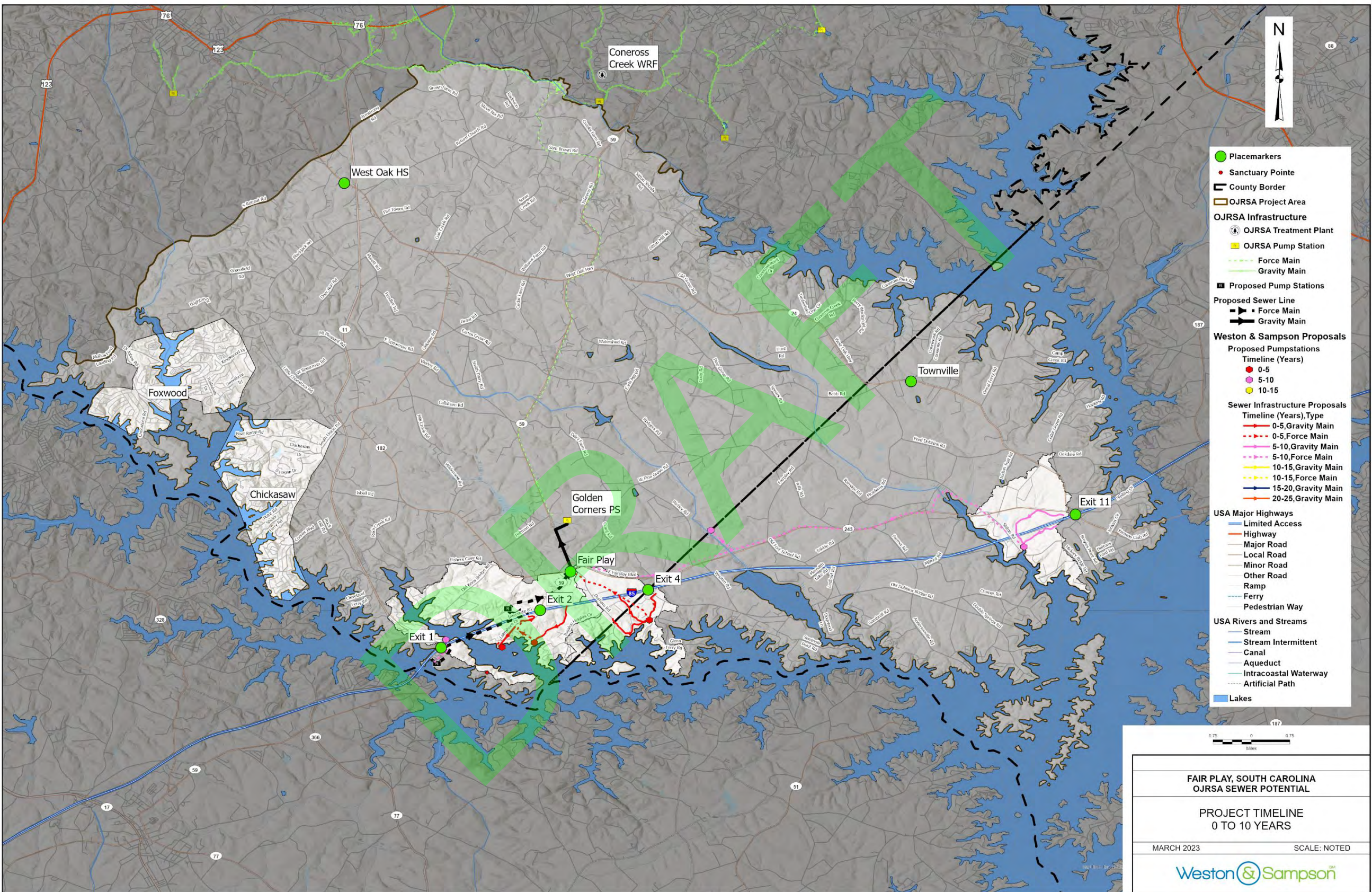
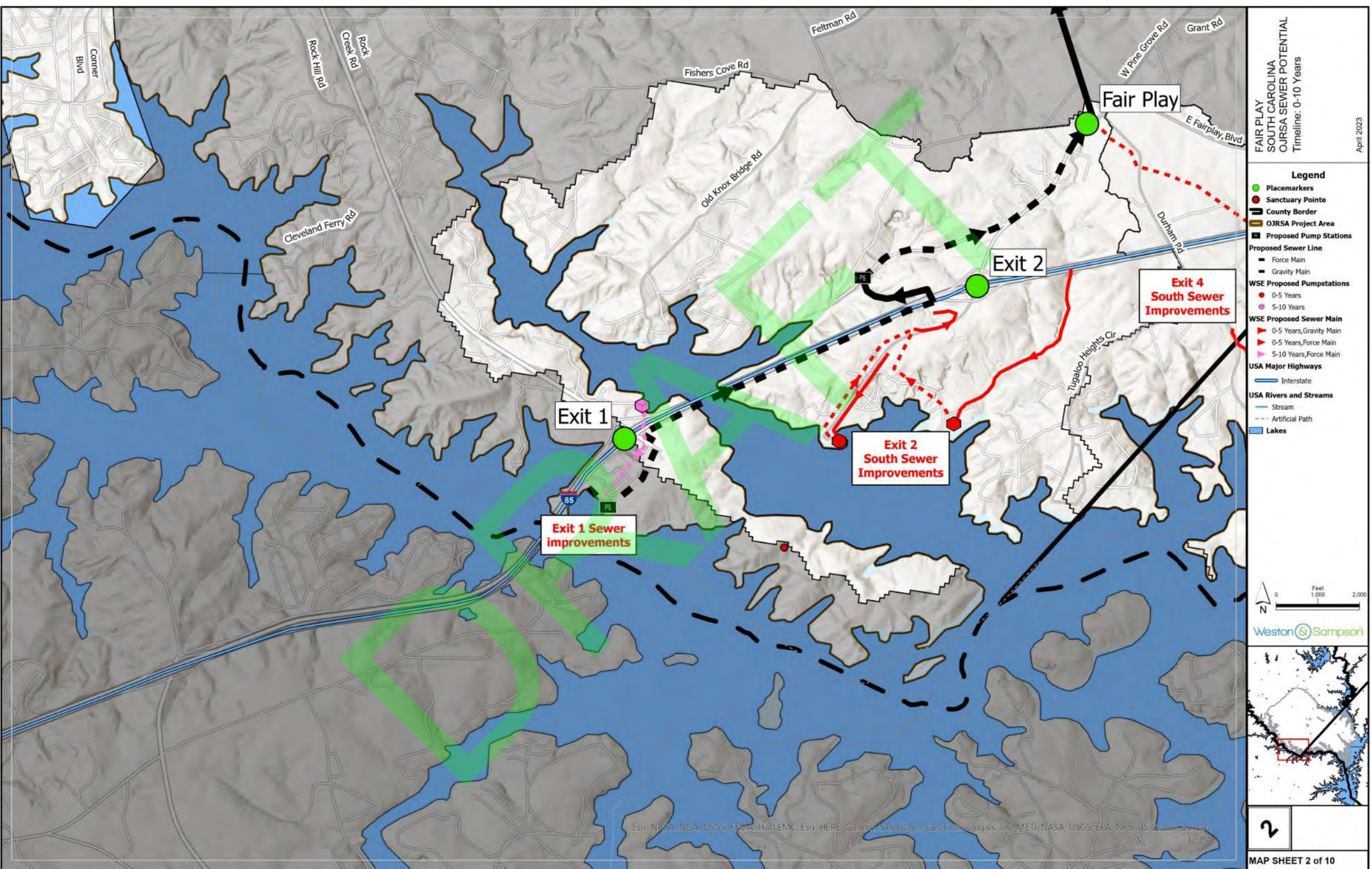


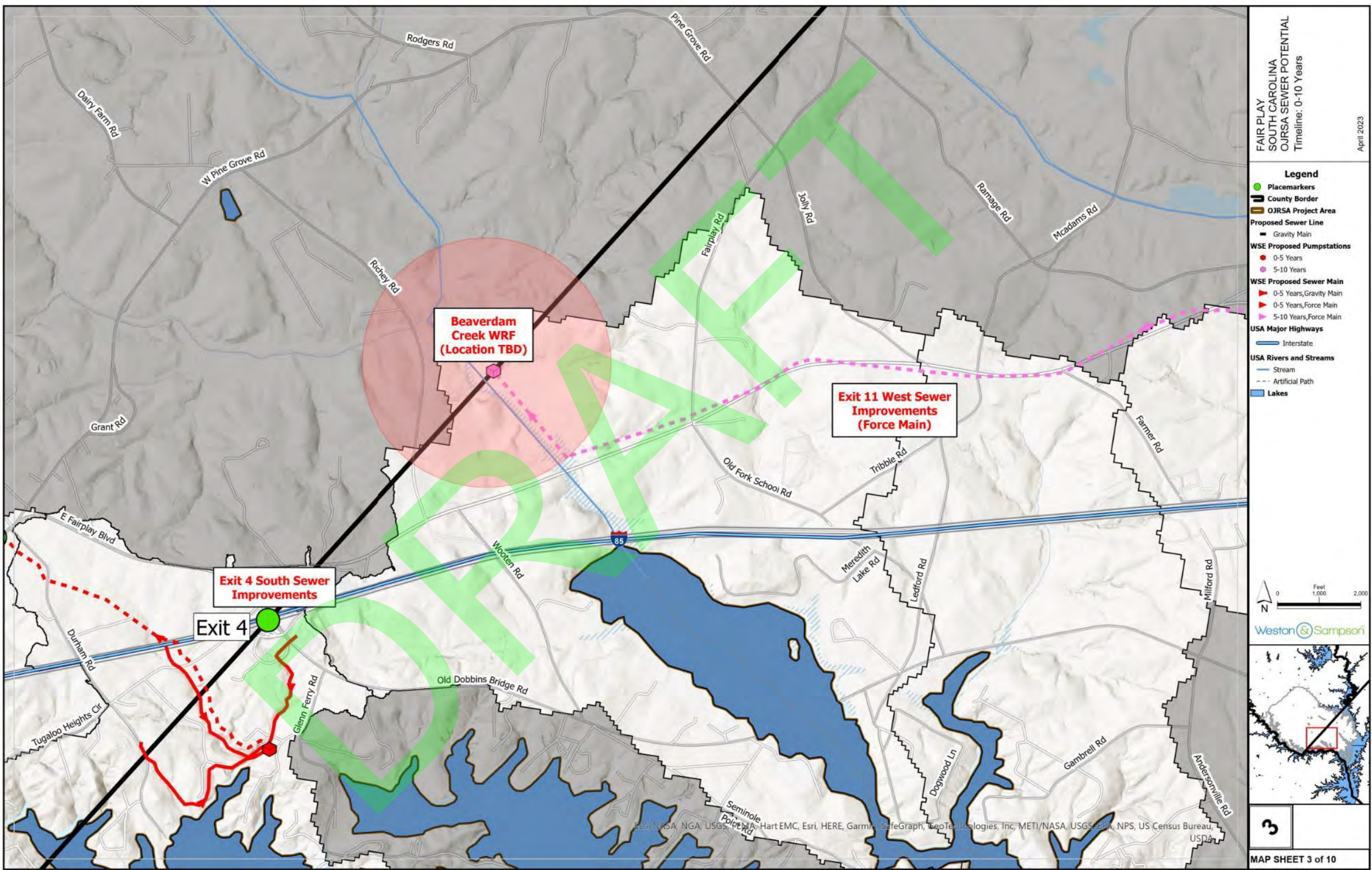
Figure 15. Scenario 1: 5-10 Years Zoomed



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Figure 16. Scenario 1: 5-10 Years Zoomed



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Figure 17. Scenario 1: 5-10 Years Zoomed

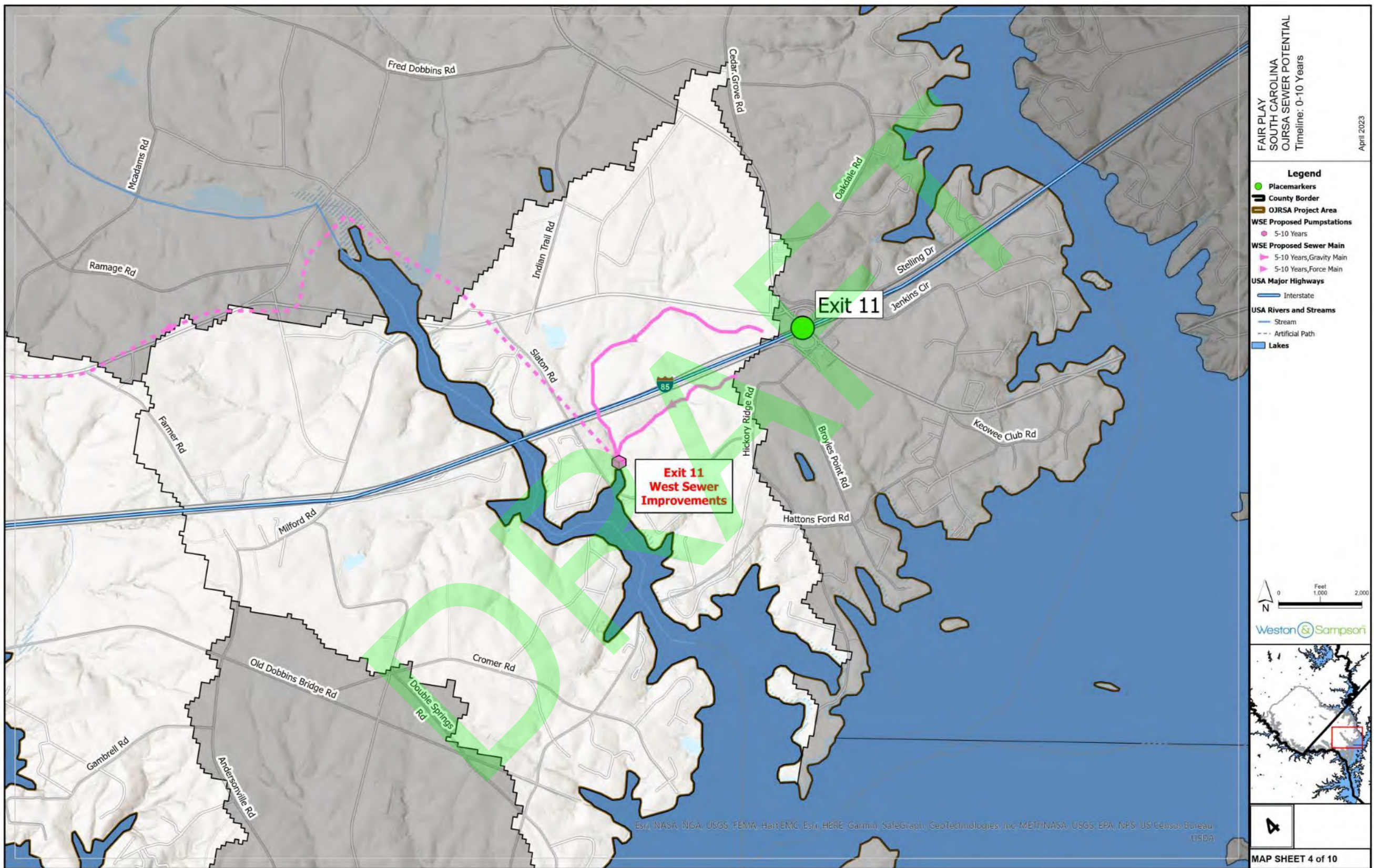


Figure 18. Scenario 1: 10-15 Years

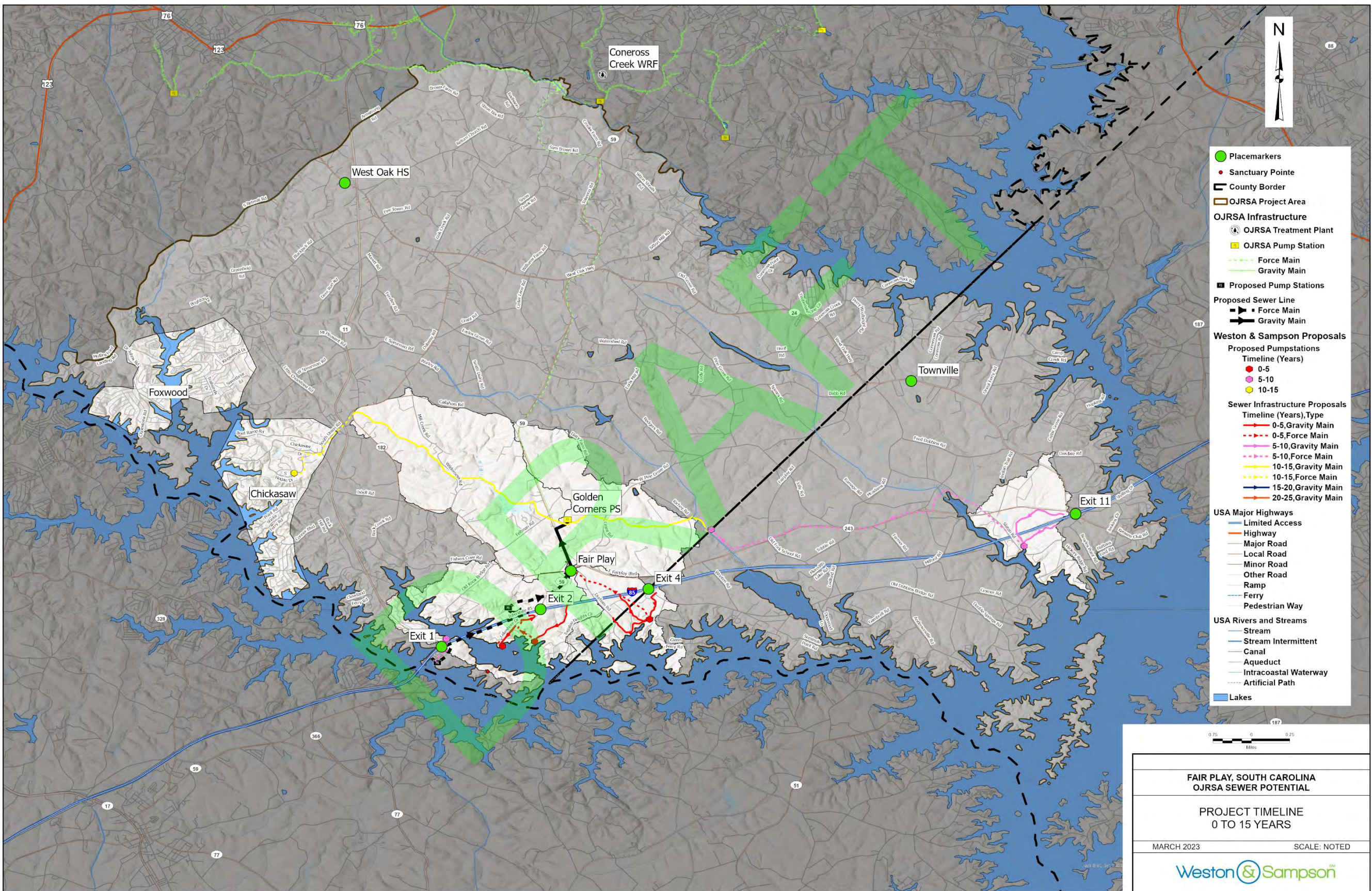
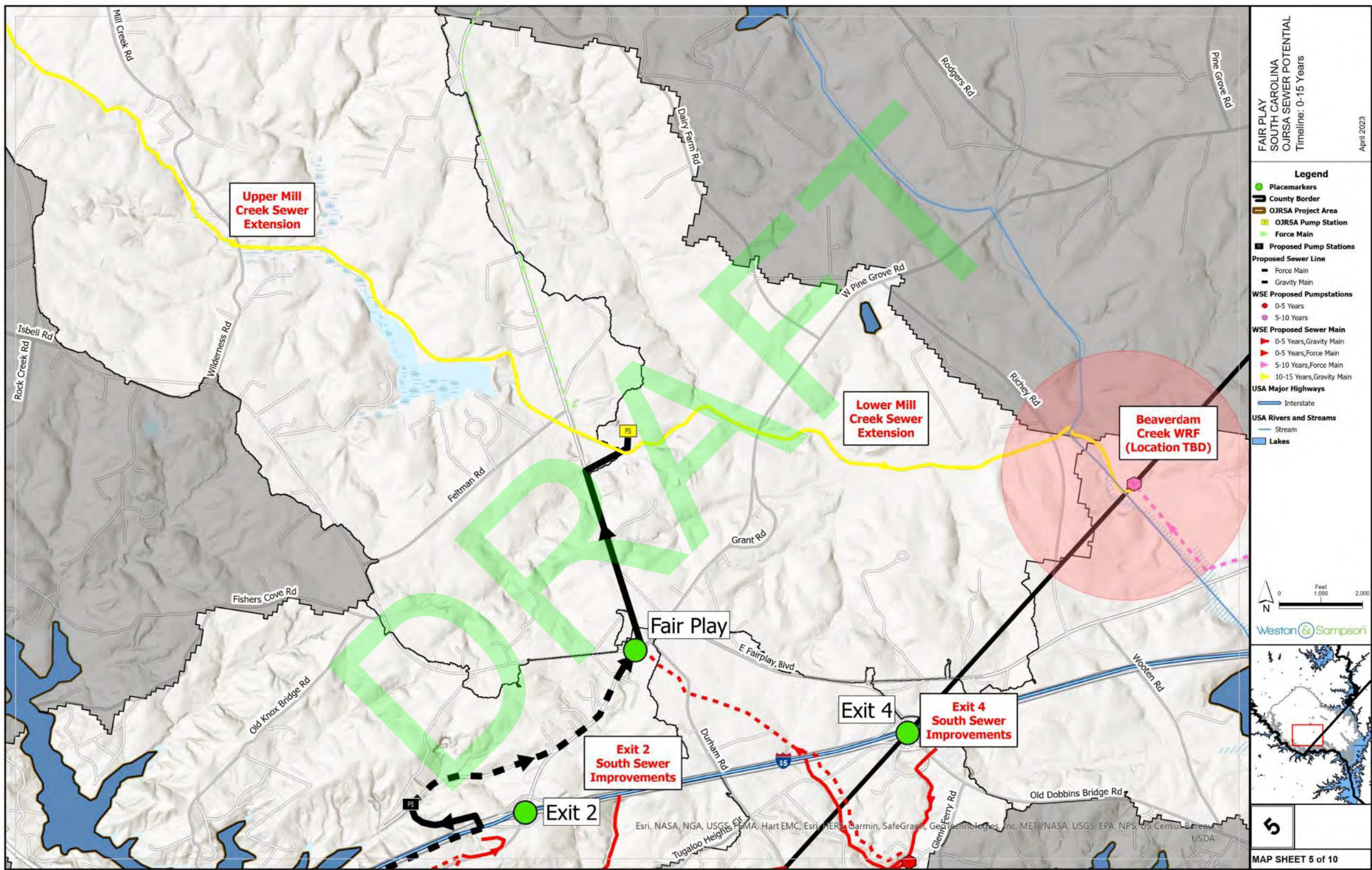
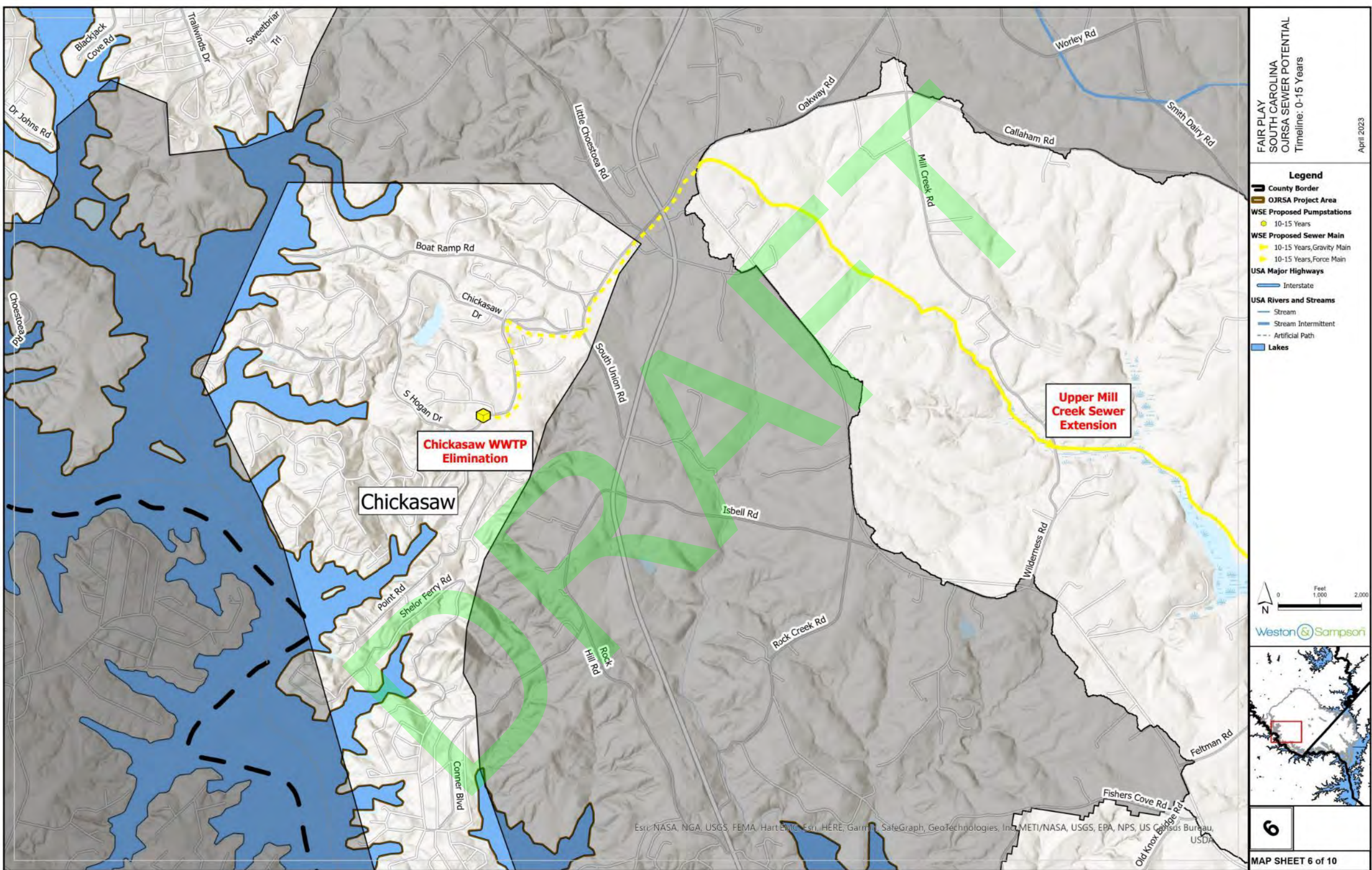


Figure 19. Scenario 1: 10-15 Years zoomed



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Figure 20. Scenario 1: 10-15 Years zoomed



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Figure 21. Scenario 1: 15-20 Years

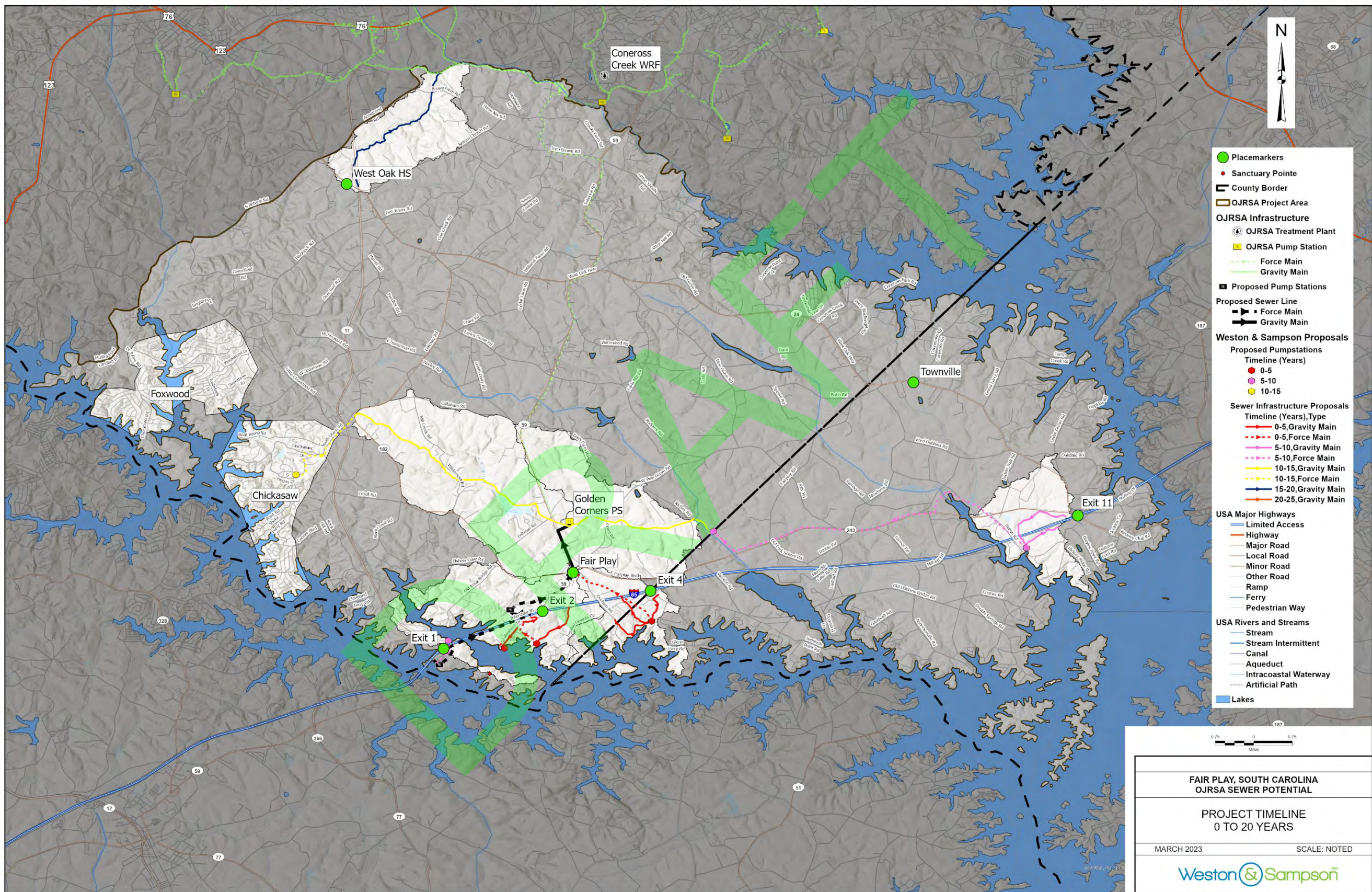
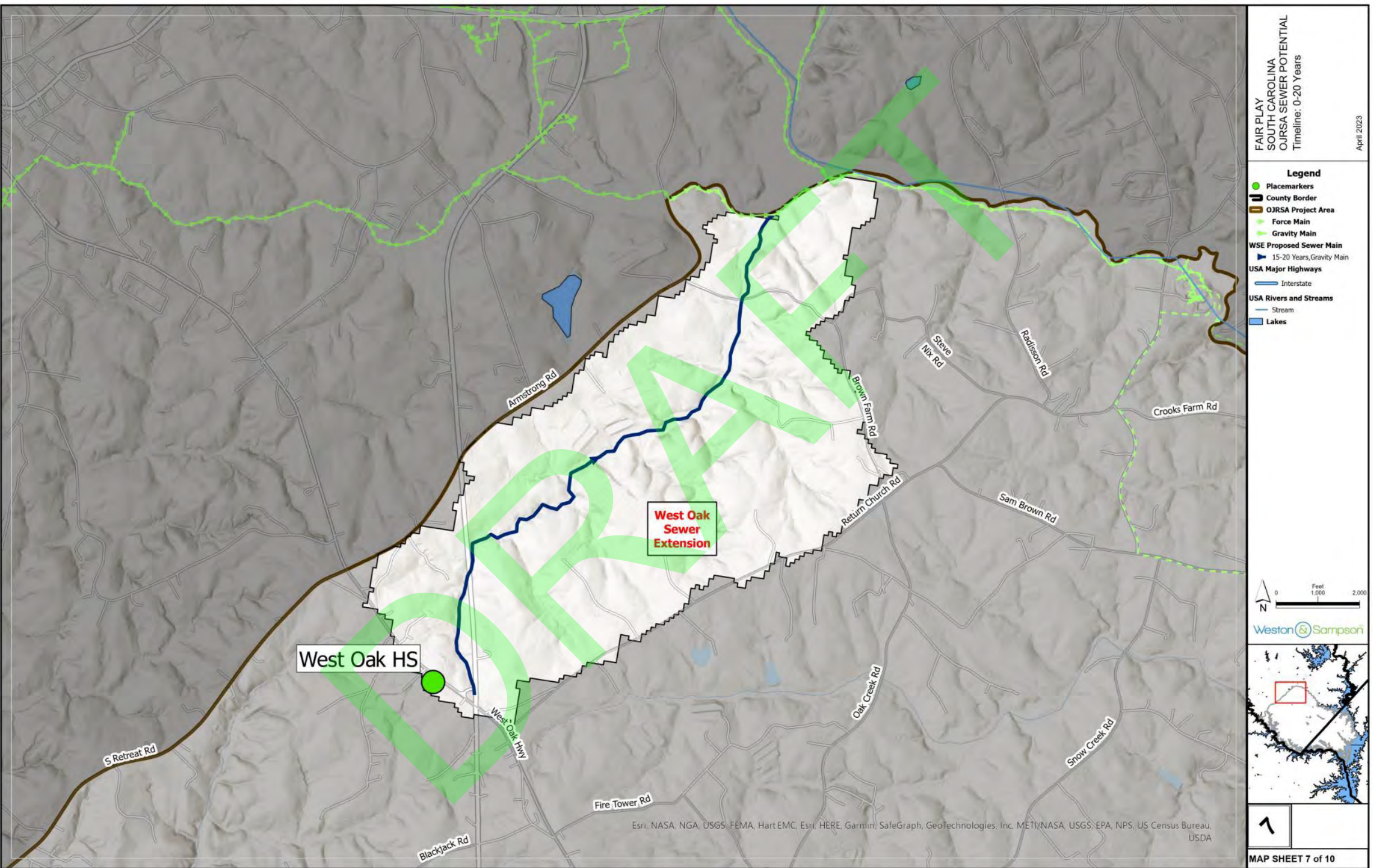
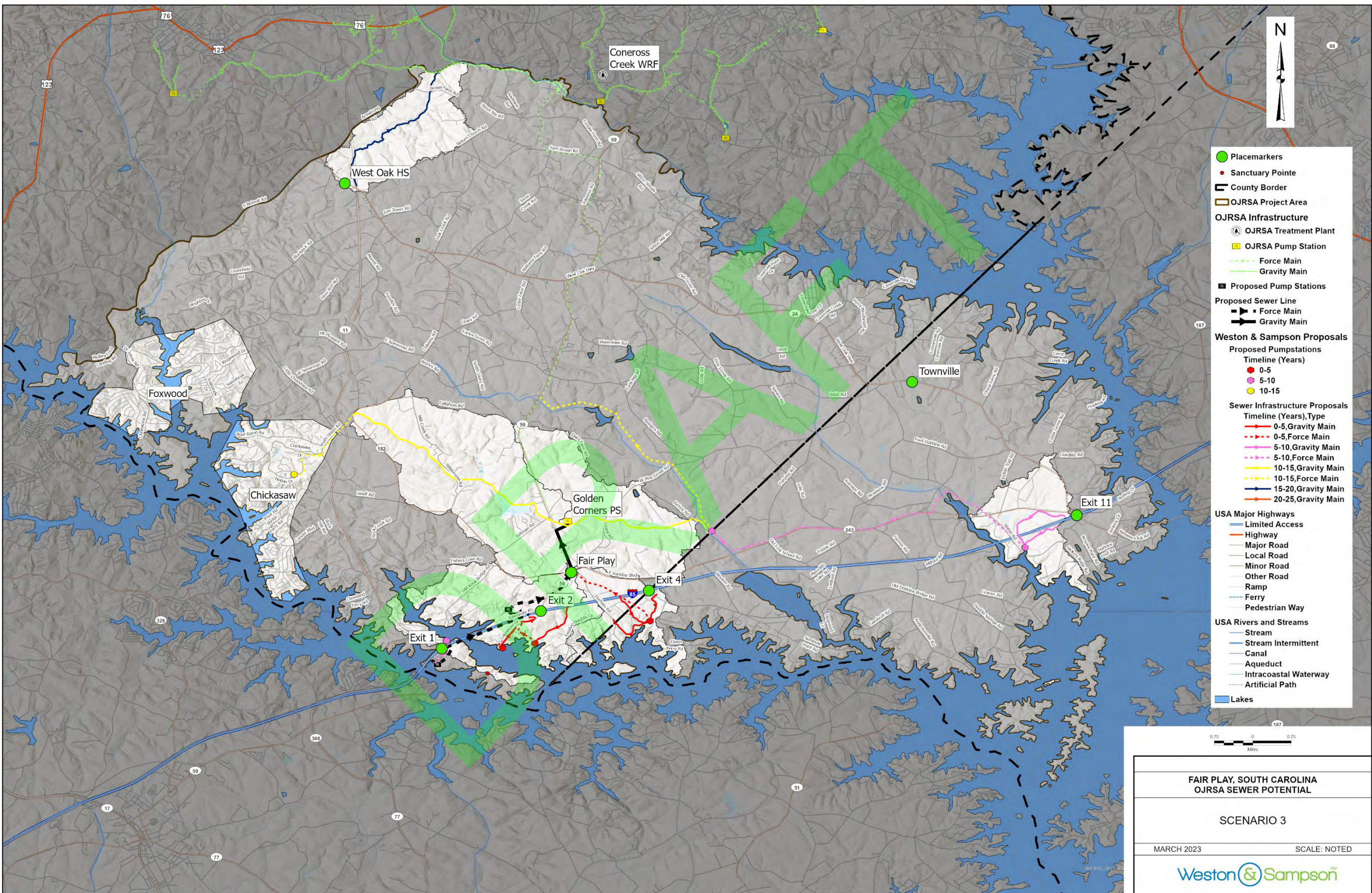


Figure 22. Scenario 1: 15-20 Years Zoomed



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Figure 23. Scenario 2



Fair Play and Townville Area Sewer Basin Plan

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APPENDIX B

Public Survey Advertisement and Results

Fair Play / Townville Area Sewer Basin Study



? WHY SANITARY SEWER INFRASTRUCTURE?

Having a thoughtful conversation about future publicly provided sewer needs is an important aspect as a community considers plans for growth. Sewer infrastructure has both costs and benefits, and where to invest is a critical question and decision makers consider the following:

- Current infrastructure and needs
- Location for future growth areas
- Economic development goals
- Population growth potential
- Commercial and industrial needs
- Feasibility of sewer by location
- Cost for installation and maintenance
- Environmental concerns
- Cost/benefit for both the sewer provider and customers

👉 THE FOLLOWING OUTLINES SEVERAL BENEFITS TO PUBLIC SEWER:

- The presence of sewer can lead to considerable increases in property value, as it can significantly increase the potential scale and value of site development.
- Presence of sewer can help attract new residential and commercial/industrial investment in areas with service.
- Public sewer provides environmental benefits by replacing septic systems that are old and in areas with poor soil drainage.
- By avoiding the need for new septic tanks and removing existing septic tanks, both ground water and surface water can be better protected, which in turn helps protect drinking water systems and bodies of water that provide recreational benefit to residents and visitors.
- Typically, private septic systems are not maintained as frequently or as well as publicly owned systems. Publicly owned sewer systems are permitted and must meet stringent federal/state requirements.
- Publicly owned sewers may allow for new connections to be added in the future, which if planned thoughtfully, can help with growth demands in the area.
- Septic systems typically place the cost and maintenance on the individual or smaller group of individuals, while public sewer costs are a shared responsibility.

Do you have any questions prior to filling out the survey?

Please email the project public engagement lead, Katherine.Amidon@bolton-menk.com



! FOR CONSIDERATION:

- Septic systems - which are found throughout the study area – will continue to be a good solution for handling wastewater in certain areas. Infrastructure costs need to be considered – if extending a sewer line will only serve a few properties over a larger area that would likely be an inefficient use of resources and will **not** be cost effective.
- Future growth planning may dictate larger pipe than is required to serve a few properties. While growth is happening, those larger pipes may not receive the adequate flushing velocities expected when full buildout occurs, causing routine maintenance issues. Installing smaller pipe in the interim may lead to infrastructure upsizing long before the full life cycle of the pipe, which can contradict sustainability planning.
- Topography may influence the ability for sewer to be feasibly installed in a cost-effective way in certain areas.
- Oconee Joint Regional Sewer Authority Sewer Use **Regulation Section 2.4** states: *“The Owner of all houses, buildings, or properties used for human occupancy, employment, recreation, or other purposes, abutting on any street, alley, or right-of-way in which there is a public sanitary sewer, is hereby required at the expense of the Owner to install suitable toilet facilities therein, and to connect such facilities directly with the public sewer in accordance with the provisions of these Regulations, within ninety (90) calendar days after date of official notice to do so, provided that said public sewer is within three hundred (300) feet of the property line. Under unusual or specific circumstances, the Director may waive this provision.”* **What this means is that if public sewer is available within a reasonable distance (300 feet or less) to your home or business property line, that you will be required to tie into the service unless due to an extreme circumstance there needs to be an exception.**



Do you have any questions prior to filling out the survey?

Please email the project public engagement lead, Katherine.Amidon@bolton-menk.com

Fair Play and Townville Area Sewer Basin Plan

Fair Play/Townville Area Sewer Basin Study

COMMUNITY SURVEY



1. How would you classify your relationship to the study area? (Select all that apply)

- Full-Time resident
- Seasonal/weekend resident
- Business owner or employee
- Rental property/investment owner
- Agricultural
- Open space/vacant property owner
- Concerned citizen residing outside the study area

2. How do you feel about sanitary sewer expansion within the Study Area?

- Strongly Support
 - Moderately Support
 - Neither Support nor Oppose
 - Moderately Oppose
 - Strongly Oppose
- Depends (please comment below): _____
- _____
- _____

3. Where would you like to see sewer investment made? (Select all that apply)

- Residential (general)
- Commercial/Industrial (general)
- I-85 corridor
- Along other main corridors (examples Hwy-24, Hwy-11, Hwy-59, Old Dobbins Bridge Road)
- Village of Fair Play
- Townville
- Western Anderson County
- Along Lake Hartwell
- I would prefer no sanitary sewer in the area

4. What concerns do you have about sewer expansion in this area?

Fair Play and Townville Area Sewer Basin Plan



COMMUNITY SURVEY

5. What opportunities do you identify with sewer expansion in the area?

6. Is there a specific address that you would like to comment on regarding sanitary sewer?

Please list the address below and clearly state what you hope occurs at that address. If you do not have a comment about a specific location, please go to the next question.

Address: _____

Comment: _____

7. Would you like to be contacted by the project team to share additional information?

Yes No, thank you

If yes, please provide your name, email address, and phone number and a project team member will be in touch with you.

Name: _____

Email: _____

Phone: _____

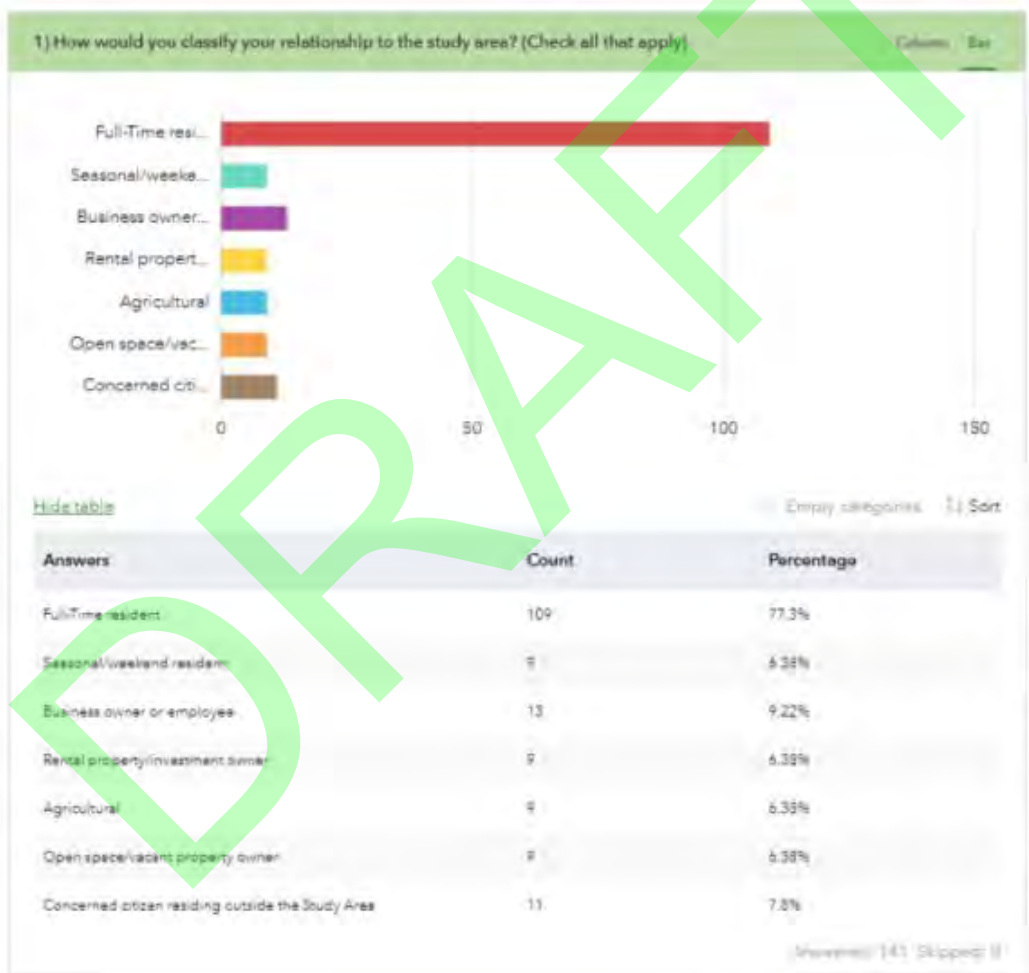
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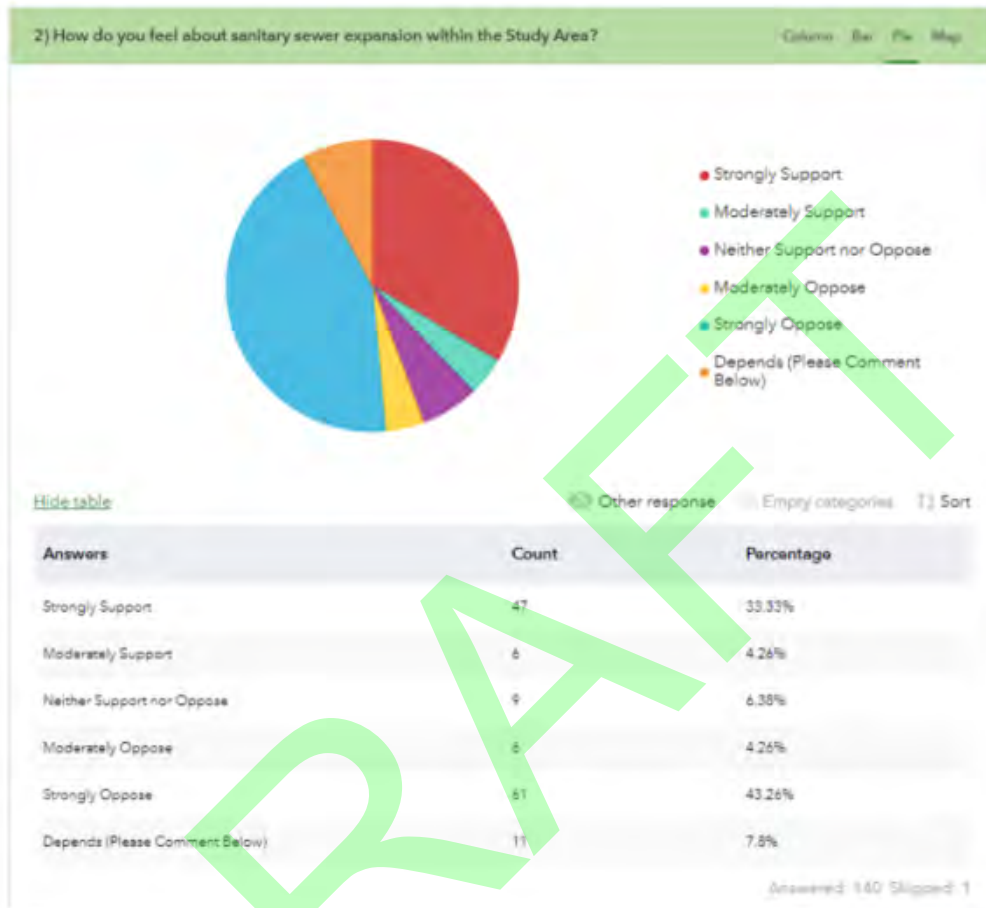
200 South Tryon Street, Suite 1400
Charlotte, NC 28202
Office: 704-376-1555
colejeneststone.com

Public Engagement – Survey Results Summary
04808.00 – OJRSA Fair Play Area Sewer Basin Plan
September 18, 2022

Comments made herein have not been edited from their original response and may contain spelling mistakes or grammatical errors.



Fair Play and Townville Area Sewer Basin Plan



Details are included below

04808.00 | September 18, 2022

PLANNING | LANDSCAPE ARCHITECTURE | CIVIL ENGINEERING | URBAN DESIGN

Fair Play and Townville Area Sewer Basin Plan

2) How do you feel about sanitary sewer expansion within the Study Area?	Depends (Please Comment Below) - 2) How do you feel about sanitary sewer expansion within the Study Area? Depends: please provide additional information
Neither Support nor Oppose	Concerned about too much growth
Moderately Support	Regional sewer for quality planned development I am all for, I also want to see us move away from septic tanks being the only disposal solution around Lake Hartwell.
Strongly Oppose	This is nothing but gross mismanagement from day one. How many customers or industries were committed before starting this project? Why has it taken so long? Now that you have it almost there do they realize the new tap and impact fees? This should have been package plant. Now you have line to nowhere with zero customers and have to maintain it. Also since you have zero commits it has zero capacity at the plant...per new rules.
other	How much is it gonna cost for the home owners? How much land are they gonna take?
other	Concerned with initial cost and monthly cost. As water bills rise and fall each month depending on usage and number of people living in the house hold. I am concerned with the cost of connecting to the sewer initially and the monthly cost we will have to pay thereafter. With costs rising of everything else and the fact that I live in an area that hasn't seen development in years, how would this benefit me as I have a septic tank already? I admit that I haven't kept up with this whole thing, but I'd like to know where my property would fall in the big picture.
other	I am not against the concept of the new sewer system or growth in the area. My concern is with the type of growth this system may bring. People love Townville and FairPlay because it is a rural community; the slower pace and less crowded area seems to be a large part of the appeal. Having grown up on a farm in Townville and still participating in agriculture there today, my fear is that the growth we see isn't just restaurants and retail but housing developments and industrial parks. I think the area around Pendleton High School is a prime example of growth gone wrong where infrastructure wasn't updated to support to growth, and it's aesthetically not appealing. On a larger scale, the growth in Greenville County is also a sign of what growth gone wrong can look like where values can increase so much that they're prohibitive for people still involved in production agriculture or even the "average" citizen.
Strongly Oppose	I moved to Townville 10 years ago to get away for the city. I don't want there to be big stores of factories here.
other	Sewer should be an option not a requirement for residents!
Strongly Oppose	The county having and expanding the sewer project is great but expecting and forcing new or existing homes to connect is not acceptable! Ours is maintained a this would be a financial burden on many of us senior citizens
other	Depends on cost to residence and projection of future costs.
other	How would this affect our existing septic system? Overall, in favor of sewer system.
other	Only if expansion of sewer is to increase business and progress in Fair Play/Townville proper. All properties that are on the lake or other primary residences that have established septic systems should not be forced into the system especially with all the costs that the homeowner would have to incur. Not to mention many are on fixed incomes at this stage of their lives. Many people have settled in this area and don't want the tranquil nature of lake and area where they have selected to live be overrun with ongoing construction and businesses.
other	would like to hear more details as the plan moves forward
other	Most residents in this community are retired and on fixed income, as this would be a positive growth for the community im certain not everyone could afford to have the said work to hook up to sewer service in the future! In addition most of the homeowners, Are all fixed incomes and would not be able to afford without loans or a true hardship to thier life style.
Strongly Oppose	Sparsely populated area doesn't need expensive expansion that has no real benefit. Anyone in the area has approved sewage
other	Home owner cost
Strongly Oppose	Our roadway easements have already been torn up multiple times just for just clean water problems and we don't need sewage issues also I... NO THANKS .
Strongly Oppose	Too expensive

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Strongly Oppose	Too Costly and the Septic Systems in our neighborhood work fine.
other	<p>1) If this project raises my property taxes then I am apposed. I am retiring in Fair Play and I am on a limited fixed income.</p> <p>2) I am building my full time retirement home in Edgewater and just put in a brand new septic system. If I will be forced to abandon this system (that I just put in) and tie into a new sewer system (at my own expense) then I am apposed 100%.</p> <p>3) I am also strongly apposed to this if I am forced to use this new system and I will be responsible to pump my waste to get to tie into your service.</p> <p>4) I would be supportive of this initiative if there was no direct cost to me or an increase in my taxes and this new service was targeted at commercial areas.</p>
Moderately Support	What additional cost is it to the residence and the enviromental impact to the community? What is the time ine and would the septic tanks be removed at no cost to the residences?
Strongly Oppose	The people that reside in this area, choose to live here knowing the commute. We want to maintain a rural life.
Strongly Oppose	I don't want the additional expenses required to connect to a sewage system and the monthly fee.
Strongly Support	Pastor at Earl's Grove Baptist Church. In future I could see sewer being beneficial for church, this community, and Fair Play area.
Strongly Support	will it be required to spend OJR \$\$ to hook JP or only with OJR soptic fails
Strongly Support	we need to put in the infrastructures
Strongly Oppose	What is the cost to residents in the area?

DRAFT



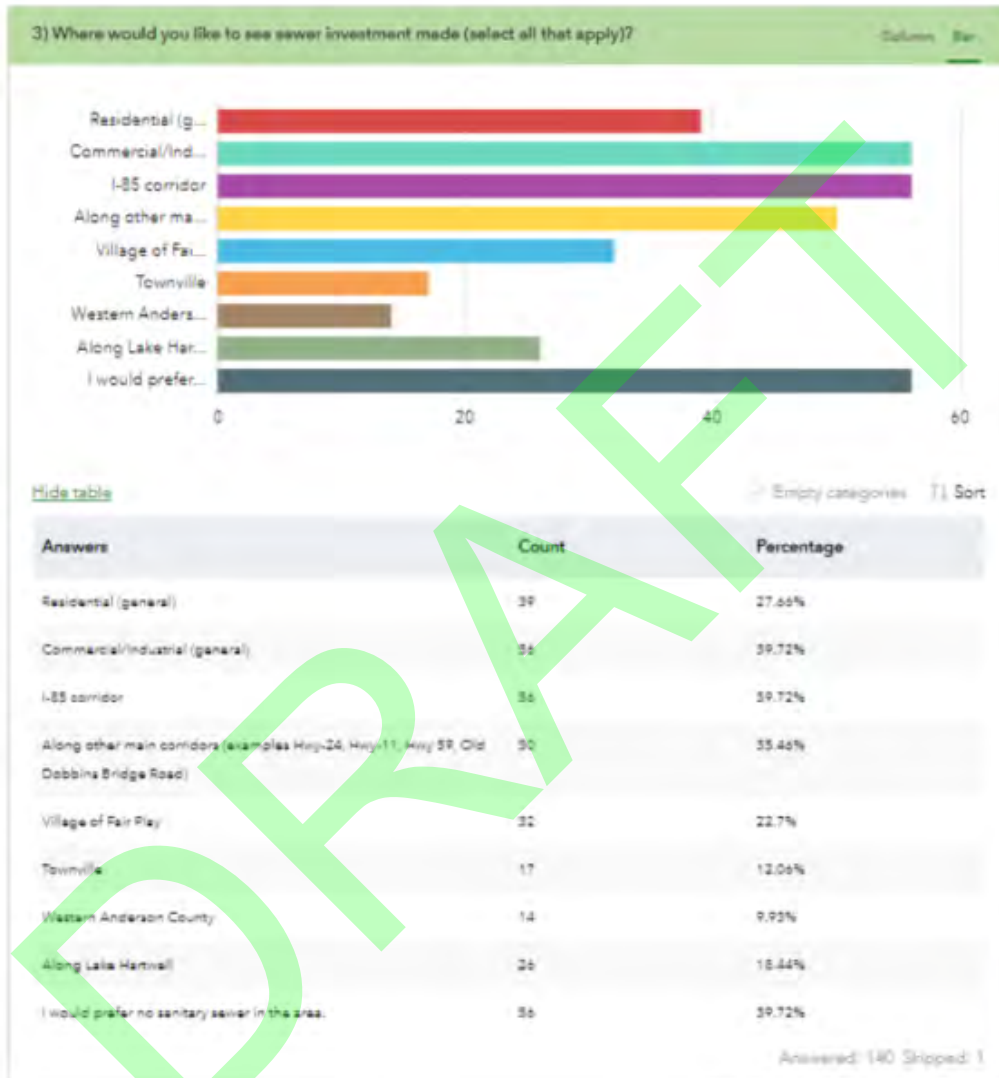
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Fair Play and Townville Area Sewer Basin Plan



ColeJenest&Stone
BOLTON & MENK, INC.

200 South Tryon Street, Suite 1400
Charlotte, NC 28202
Office: 704-376-1555
colejeneststone.com



Fair Play and Townville Area Sewer Basin Plan

4) What concerns do you have about sewer expansion in this specific study area?
Exit 4 appears to be an after thought
Eliminating septic tanks near the lake that could fail and enter the watershed.
Priority is 85
Uncontrolled population growth and loss of agriculture property
It will drive unwanted growth that doesn't add to the quality of life.
I am in favor of expansion but I am hope that it will not place a burden on the residential community that will be required to connect to it. Also, I have concerns that the system will be expensive to install and rates will not be competitive rates.
Nine
The upstate and Oconee County will experience considerable growth in the near future planning for this growth through sewer and water expansion will be critical to sustaining safe and desirable residential and commercial growth in our area.
None
Odor
Oconee is getting too crowded and I don't want it to be like the Easley or Clemson area.
Between Clemson and Seneca is the growth area and always will be. Clemson University is a world wide brand and always will be. FairPlay ? Townville? 185 ?
Costing me money.
Residents cannot afford the additional cost forced on them requiring connection at their own expense
Cost to residential homeowners.
Do not want to be required to run sewer to our home at our cost. Also would not want a large increase in development in the Fair Play area. We like that it is rural.
I like that Fair Play is small and am not interested in a bunch of businesses crowding out of the the farm and small business economy. I will not run sewer to my house at my cost.
Oconee Joint Regional Sewer Authority Sewer Use Regulation Section 2.4 states: "The Owner of all houses, buildings, or properties used for human occupancy, employment, recreation, or other purposes, abutting on any street, alley, or right-of-way in which there is a public sanitary sewer, is hereby required at the expense of the Owner to install suitable toilet facilities therein, and to connect such facilities directly with the public sewer in accordance with the provisions of these Regulations, within ninety (90) calendar days after date of official notice to do so, provided that said public sewer is within three hundred (300) feet of the property line. Under unusual or specific circumstances, the Director may waive this provision."
Enforcement of this is not feasible for much of the area population. Many cannot afford to pay for this themselves and moreover, have perfectly fine septic systems in place. If the county wants to require it, the county can pay for it.
My other concerns are maintenance and cleanup should there be a broken line. As we do not have this problem unless this is installed, how will that be dealt with?
See comment above for concerns. It is primarily regarding the type of growth that this system would ultimately bring.
I have concerns with the growth that could result from this system being installed. It could affect traffic, crowding, the strain on other infrastructure, and our tax burden.
As seniors we do not need the additional fees and taxes to cover these items.
Most people who live in Townville or Fairplay don't want to live in a city. We like the small town country life. A sewer expansion would change that.
I have seen lift stations fail due to storm caused power outages in the Pensacola FL area. The failures resulted in massive raw sewage contamination of recreational waters. That is my concern for sewer investment along the shore of Lake Hartwell.
Commercial growth

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I do not think the individual property owner should to be forced to pay for sewer when we have a septic system just to have water that we already pay for.
Not happening soon enough.
The natural beauty and peaceful living would be compromised. People who live in this area rely on farming and do all we can to preserve the quality of life we have enjoyed for generations. Sewer=increased population, manufacturing encroachment, infrastructure problems, pollution, crime, obliteration of all that our ancestors worked for.
Farm land being sold and developed
Growth of area, keep our small town SMALL! Potential effects of lake and wildlife. Odor!
Expansion without proper planning and zoning
Sewage backup and Townville growing. We love here because it is quiet and I believe that the majority of us prefer to keep it this way.
Too much commercial growth
It will destroy our small community and contaminate our Lake Hartwell !! WE do not want ur shitty sewer system!!!
Not having options. Being told we have to hook up to the sewer and not having the option to choose whether or not we would like to or not.
Backflow risks to lake hartwell. Imposing on resident property. Developed only for industrial use.
I am not interested in this at all.
Cost and forced connection of residential area with newer homes
I do not want to see the proposed hotel, etc. in the area near the SC Welcome Station on I-85.
Increased environmen resulting from commercial development.
The cost to connect, if connection would be needed if septic is in working order. Is there a cost advantage to connect now vs later (my septic was installed last year)
Costs to county residents
Forcing it on Seniors
Cost to convert from a perfectly good paid for septic, to an unwanted sewer system. I estimate it will cost me \$20,000 to connect to the sewer system which is ridiculous because I gain nothing from that expense that I don't already have.
If you make the change over FREE, I will reconsider.
Cost of impact fees to individual home/land owners
Not clear that septic systems are a big enough problem to justify a sewer system for the rural area.
Do NOT want it coming into our sub-division, Parkview South. The community is currently on septic tank. Do not want to incur all the additional expenses that individual property owners will have.
Have Septic Tank System. Do not like being forced to accept sewer system in Park View South Subdivision. Makes no sense what so ever.
Too expensive for us to pay. We are retired.
Potential contamination, higher costs, no clear need
How would roads and properties be affected by installation of new system? How would our taxes/fees be affected? What would timeline for start to finish completion be?
Cost
\$\$\$\$&
Sewer expansion leads to uncontrolled growth. We are so worried about growing that we forget proper planning and density is what leads to sustainable development. The moment you install sewer developers will start creating subdivision and expect the county to start providing services.
Ambiguities with coats for residents to remove/fill current septic tanks and any other hidden costs. Need transparency..

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Damage to roads and neighborhood.
Damage to personal property and roads
Excess expansion of business, ruining the existing tranquility for many who have selected this area for retirement
Costly to homeowners on fixed income.
Cost and damage to real estate
Owner cost
Prices
My concerns are the project will tear up the area and the roads and cost the property owners several thousand dollars out of pocket
LEAKS
Being forced to connect, expenses not well defined, fees to decommission existing septic not being included, etc, etc. etc.
Traffic delays, unsightly digs, unnecessary tree removal, digging up all the wild daffodils and not replacing them. Higher water bills.
I AM CONCERNED THAT RESIDENTIAL AREAS THAT HAVE PROPERLY FUNCTIONING SPETIC SYSTEMS WILL BE REQUIRED TO SPEND MONEY THAT THEY DO NO HAVE.
There are too many people here now as it is. My septic tank works just fine, and I do not want to be compelled to pay thousands more to hook into a line when I just build my house.
Increase in growth which also brings an increase in traffic and crime.
The nvironment what will the impact be and if it has an impact then no changes should be made as well as additional charges since for now we do not pay a fee for monthly maintenance.
The cost to connect my property to the public sewer. I would be a huge cost and completely destroy my landscaping and drive. I have spent 20 years and a lot on money on my property and would not want to be forced to spend this money on something I do not need. My septic system has been well maintained and serviced since installation. Being forced use a service I do not want of feel I need is wrong!!!
DEVELOPMENT. We CHOSE rural.
If sewerage needs to be pumped from my property to the sanitary connection, I would not support the project. I am concerned about the cost of connection to the line.
Extraordinary costs to the existing system without adding any additional value.
Expense
I live on fixed income and have concerns about the cost to hook up to the system.
Extremely high cost per lot
Forcing homeowners to connect to the sewer system.
Do not want to see businesses or subdivisions going up
It has taken some time to get to this point, the county as well as local residents will benefit greatly from sewer in the area.
No concerns.
None!
Expensive but worth it
no concerns. All positive!
The cities in control of aconcer sewer authority- how will they work with project
lack of commitment
being able to pay for it and not being able to implement the plans
contamination of drinking water
contamination of drinking water

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5) What opportunities do you identify with sewer expansion in the area?
Economic development
There is a very high incidence of septic tank failure in this area. I see this as a major benefit to the mitigation of bacterial pollution resulting from septic tank failure.
Industrial
Economic growth
Removal of failing septic system around the lake. Much needed economic development for Oconee County.
<ol style="list-style-type: none"> 1. Economic development opportunities along I-85 and Hwy 24 2. Upgrade and expand capacity for visitors center 3. Take over existing private systems at residential subdivisions on Hwy 11 to ensure long-term viability 4. Allow development of neighborhoods in Fair Play community 5. Protect the watershed in this community
Growth opportunities along with being environmentally safe as compared to septic
More restaurants in our area
Cleaner water, more commercial businesses. Proper quality for schools.
More businesses and housing development
New opportunities for business good jobs to keep our children close to home and managed growth keeping our Rhule atmosphere intact.
Business
Businesses and growth
Zero... total waste of money.
Hard to believe you did all this work and survey while you have over 200 million in development opportunities between Clemson and Seneca. Where is that basin study for that area?
New businesses
Make the hook up when available a discount while doing the project.
Increased traffic and industry. If you're going to do this, start with our roads. No one wants to come into the area and need an alignment because they chose to visit.
I'd agree that it may bring business and residential expansion opportunities to the area, though there have been other industrial sites that have been built, especially in Oconee County that have not succeeded even after extensive infrastructure additions. If I am correct, there was supposed to be an industrial park on Hwy 59 coming into Fairplay that an issue with water and sewer were prevalent, and there had been no development there at all.
I realize there are retail opportunities and opportunities for development of land into other purposes. I just don't agree that these types of growth are always a good thing. To the person or local government receiving the benefits of the increased tax base it sounds like it is all good, but to the citizen living in this area, I don't think we need to lose more farm land and more rural communities for the sake of building housing developments, industrial parks, and retail centers.
Access to retail
More people, more business, loss of small town relationships.
Non that I would like
The trend seems to be toward more and more residential housing construction radiating out from Seneca and Clemson into the Townville area. A sewer expansion would allow more efficient use of land and ease permitting time and costs.
Major growth for the Fair Play area's, retail and residential developments. Hospital and nursing home facilities.
None positive.
None
More industry and retail development

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Overdevelopment.
I get the idea for growth for our community. That's great. But don't like the idea of being told we have to do something we don't want/ need to do.
Opportunity for sustainable development and planning for overall ecological health to maintain our agricultural and recreational communities. Not opposed to growth as long as it dense residential substantial industrial development.
New business , restaurants
People trying to force me to hook up to it. I will not.
Industrial & commercial only
Sanitary sewer around Lake Hartwell would lessen the negative impact leaking/unattended septic tanks have on the water quality. Investments along I-85 for industrial purposes would lead to tremendous cash and job investments.
The area needs more infrastructure to support its residents: law enforcement, grocery stores, drug stores, medical offices, etc. Residents of Fair Play need to drive 30 minutes to Seneca or Anderson for anything that is not carried at the Dollar Store. There is a section of Durham Road between the I-85 overpass and the fire station that is VERY run down. It is my hope that building infrastructure will clean up this area.
business growth, increased tax base
Opportunity to expand business opportunities and bring a grocery store to the fair Play / Townville area.
Great for commercial properties
Commercial development along I-85.
worried about too much commercial development (hotels)
Businesses along the I-85 corridor
Only for commercial customers that could build in years to come or new subdivisions . Making older subdivision hook on is not right.
Convenience
Growth of infrastructure, including grocery/retail closer than Anderson or Seneca, possibly more of a "Main Street" feel for more small businesses, increased sense of community
Commercial growth
Expand the sewer in and around the cities and allow for dense development controlled by the cities
Please be transparent with residents. Overheads will be incurred. Currently no advantages.
Don't need it
Better for homeowners and new business.
More business into the general area.
None.
My concerns are the project will tear up the area and the roads and cost the property owners several thousand dollars out of pocket. I don't see any opportunities.
Cleaner lake.
I STRONGLY AGREE THAT COMMERCIAL DEVELOPMENT WOULD BE POSITIVELY IMPACTED BY SEWER EXPANSION.
None
Possible increase of services.
Possible increase in retail.
The maintenance perhaps
The possibility of commercial and industrial growth with business and services that would enhance our area.
None. We want to stay rural and enjoy those opportunities.
None
Commercial is fine but residential is not needed.

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growth
Jobs, housing increase, retail increase,
I support a planned effort to provide sewer service so the cost/benefits are analyzed ahead of development. The area under consideration is (I believe) often considered for development. Good planning will help direct growth.
Future Growth
1) provides greater potential for business and residential growth 2) Improved conditions of lake - less septic
positive growth
possible growth to area and unable to do it fast enough
restaurants, small businesses
it should help pull in and help build industry and smaller businesses
job growth planned residential green space public use commercial exits 1-2-4 & 3
planned growth and development
good commercial and industrial growth that will add to a diversified employment base and support county property taxes
property value, new businesses, fast food.
new businesses moving in area property value

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APPENDIX C

Stakeholder Meeting Summary

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Fair Play and Townville Area Sewer Basin Plan



2002 South Tryon Street, Suite 400
Charlotte, NC 28203
Office: 704.476.4500
colejeneststone.com

Stakeholder Engagement – Meeting Minutes
04808.00 – OJRSA Fair Play Area Sewer Basin Plan
September 16, 2022

Abbreviations:
ColeJenest & Stone (CJS)

Comments and observations made herein were reviewed for accuracy to the best of our ability. Some of the comments are opinion based and do not represent the opinion of OJRSA, Weston & Sampson, or ColeJenest & Stone.

Oconee Economic Alliance (OEA)

Virtual Meeting: Teams
Katherine Amidon (CJS)
Morgan Holcomb (OEA)
February 15, 2022

- A. Recommendations and Information
 - a. Speak to Tim Mays – unofficial mayor of Fair Play
 - b. The Golden Corner Commerce Park is an SC Department of Commerce certified industrial park
 - c. OEA has access to Emsi if any of these reports will be helpful
 - i. Easier to use than Esri data - OEA usually pulls both though to compare
 - ii. Emsi pulls from Census data and MLS as well
 - iii. Information can be searched by NAICS code – specific 51-000 manufacturing
 - iv. Information can also be searched by census tract, and drive time
 - v. OEA considers 11 counties to be within the labor shed

Blake Sanders (Studio Main)

Virtual Meeting: Teams
Katherine Amidon (CJS)
Blake Sanders (Studio Main)
February 16, 2022

- A. Village of Fair Play Strategic Master Plan (2022)
 - a. Almost final, presenting to the public March 10, 2022
 - b. Created in partnership with Arnett Muldrow & Associates
 - c. Overarching themes
 - i. Preserve the core, engage the public, identify infrastructure needs, consider infill development, consider center of town vehicular movement challenges, consider marketing for Fair Play
 - 1. Fair Play is a state of mind, but how can it be branded as a gateway to the Golden Corner
 - ii. Consideration to keeping the village intact, but acknowledging that farmland could get sold it is a matter of when

Fair Play and Townville Area Sewer Basin Plan

- iii. Blake used Claritas to gather consumer and business data for this region by zip code
- iv. There are plans for a new fire department
- v. SCDOT has some projects in the works in the area
 - 1. Plans to realign the intersection and construct turn lanes in Town of Fair Play at the intersection of SC-243 and SC-182 with SC-59
- vi. Blake will provide the final report to our team once it has been approved (provided March 11, 2022)

B. Recommendations

- a. Hardeeville could be a good case study for the OJRSA project, they recently had massive population growth for a small area
- b. Speak with Tim Mays who developed a Community Development Corporation, which enables this group to apply for grants
 - i. Parks and Recreation Development Fund (SC Department of Parks, Recreation, and Tourism)
- c. Yoders is an institution; many people drive in to work there, consideration to their parking needs should be considered, they already have a satellite loading yard

Appalachian Council of Governments (ACOG)

In-Person Meeting: ACOG office

Katherine Amidon (CIS)

Chip Bentley (ACOG)

Lance Estep (ACOG)

February 17, 2022

A. Background information

- a. Historically the three Cities ran OJRSA (Seneca, Walhalla, Westminster) and the County did not take a role in sewer
 - i. There are nine commissioners appointed by the councils of the three Cities:
 - 1. Seneca – 4
 - 2. Walhalla – 2
 - 3. Westminster – 2
 - 4. At-large for Walhalla and Westminster – 1
- b. There was a lawsuit at one time related to Fair Play developing. Someone sued because it would not benefit the full County and thus there is almost a defacto service boundary because expansions tend to not happen outside of the cities.
 - i. This has led to a disconnect with infrastructure and planning for that area
 - ii. Similar to the sewer need in Fair Play, north of SC-123 is also ripe for development but there is no sewer
- c. Chickasaw Point Property Owners Association (POA) and Foxwood POA - have their own individual sewer. These package plants could be potential sources of revenue down the road, and they will need a succession plan as this area grows

B. Recommendations

- a. Reach out to SCDOT about projects in the area
 - i. Check the SCDOT project preview page which has an interactive project viewer: <https://www.scdot.org/business/projectviewer.aspx>
 - ii. Brandon Wilson is the contact for this area. He will understand these projects at a development level and understanding of the needs
 - iii. Thomas Alexander is the president of the senate – District 1 South Carolina Senate brought the SCDOT project to the table

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- i. At this time, land has not been identified and it is not on council's long-term plan
 - ii. This could be an Oconee County driven project or a community project – this has yet to be determined
 - d. Phil is of the mindset that if and when sewer comes to Exits 1, 2, and 4, there will be drive for a hotel and anything along the Lake could have the potential for growth
- B. Recommendations:
- a. Reach out to the State PRT office. Start by calling the main line and ask to speak with Duane Parrish or a project engineer or facilities
 - i. Ask about Lake Hartwell Park expansion plans
 - b. Consider the current Lake Hartwell access points, which are all on septic
 - i. Some are managed by Oconee PRT on lease from the US Army Corps of Engineers
 - 1. 10-year lease for all except Seneca Creek Access Area which is on a 25-year lease and Oconee PRT is putting in capital improvements

South Carolina Parks, Recreation, & Tourism (SCPRT)

Phone Call

Katherine Amidon (CJS)

Jonathan Kent (SCPRT)

February 28, 2022

A. Background

- a. Jonathan is a state engineer, he recommended to email him, and he would ask around the office and follow up with our team
 - i. The only current project within the study area that would involve sewer is the Fair Play Welcome Center Replacement
- b. The State is working on a new Welcome Center project in Fair Play, and it is at the beginning phases of securing an engineer
 - i. They are hiring external for this work. This was publicly bid in the fall of 2021

Village of Fair Play Community Development Corporation (Fair Play CDC)

Phone Call

Katherine Amidon (CJS)

Tim Mays (Fair Play CDC)

March 2, 2022

A. Background

- a. In 2021 there was an effort to create a Fair Play overlay district
 - i. They went through a process of creating an overlay with standards along I-85 and the village center
 - ii. They also considered corridor buffers around the village center addressing building height, setbacks, etc.
- b. They have established as a Community Development Corporation (CDC).
 - i. The group is now considering what can they do now
 - ii. There is an understanding that no one wants to be told what to do with their property but there is a balance of being able to have choice over what you do and not being a burden to your neighbor
 - iii. They created this group to help determine how this area can grow
- c. Fair Play used to be a thriving area before I-85 split the community but now it is the fact that I-85 is there that Fair Play may have a chance to grow again

04888-00 | September 10, 2022

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B. Recommendations:

- a. Exit 4 – North of this is the Industrial Park – Golden Corner Commerce Park that Blue Ridge Electric owns.
- b. Along the I-85 corridor there is an opportunity for commercial and industrial development
- c. The area to the south could grow as residential
- d. Some of the property in these growth areas is pastureland and some owners may be hanging onto it until the timing makes sense to sell
- e. In general, the parcels around the I-85 corridor and especially by the Exits need to be considered
 - i. Some owners are going to hold onto this land, while others are just waiting to sell.
 1. Some of these key property owners (maybe just 3 people) should be engaged as part of this project
- f. There are some conservation easements in the area
 - i. Sammy Glenn (who is deceased) set them up and his son-in-law Steve Lawson would be good to talk to
- g. Need to get clarity on the sewer line that is being installed towards Exit 1 – according to Gary Gaulin only certain spots of that line will be eligible to be tapped
- h. Once we have maps, Tim Mays is willing to discuss this area with us and introduce us to key folks

School District of Oconee County (SDOC)

Virtual Meeting: Teams
Katherine Amidon (CJS)
Michael Thorsland (SDOC)
March 4, 2022

A. Current Status:

- a. Fair-Oak Elementary School is the only school in the Study Area and thus is likely on large septic, which is not unusual for elementary schools
- b. People have talked for years about potential growth in this area and there is some skepticism about when/if this growth will happen once sewer is in place
- c. The County looks at internal data and student enrollment mostly to predict future needs

B. Future School Needs:

- a. Rough statistics for the County: 60 years ago, Oconee had roughly 40,000 residents and there were approximately 10,000 K-12 students. Today the County has roughly 80,000 residents and still there are approximately 10,000 K-12 students
 - i. Historically people moving in have been retirees who are not bringing children with them. There has been some change with COVID-19 and families moving into the area
 1. As of right now the numbers have remained relatively flat.
- b. If the school district needed to expand it would likely be an elementary school in the Tokeena area where SC-24 intersects with SC-59. Residents in this study area would thus drive north to school
 - i. They would not likely put one at the southern end of the study area
 - ii. In Michael's opinion they are definitely not building a new school in this area in the next 5 years, within 10 years is extremely unlikely, within 15 years is unlikely, and within 20 years is hard to predict
- c. West-Oak High School, which is just to the north of the study area near the intersection of SC-11 and SC-24, serves the Fair Play area

1/18/2022 10:10 AM

Fair Play and Townville Area Sewer Basin Plan

- i. Currently there are approximately 850 students, but the facility can handle a student population of 1,400
- d. West Oak Middle School can add 2-300 students before reaching capacity
- e. One of the biggest aspects to growth that could really change the makeup of the demographics is the Golden Corner Commerce Park
 - i. An increase in jobs could influence growth and school population sizes

South Carolina Department of Transportation (SCDOT)

Phone Call

Katherine Amidon (CJS)

Brandon Wilson (SCDOT)

March 8, 2022

A. Background

- a. Currently the projects slated for the Study area are related to safety and resurfacing and not growth.
- b. There has been little to no growth in this area over the past five years
 - i. Growth is happening around Seneca
- c. SCDOT does not look across state borders for the growth happening in other states.
- d. Most of the time SCDOT is not involved early enough in a project and end up being reactive rather than proactive
- e. SCDOT does have traffic counts available to review, which can be found here:
<https://www.scdot.org/travel/travel-trafficdata.aspx>
 - i. 2021 numbers should be released soon (*posted in February*)
 - ii. <https://scdottrafficdata.drakewell.com/publicmultinodemap.asp> (through 2020)
- f. According to SCDOT—interested industrial development has chosen a different county even with the Golden Corner Commerce Park

Fort Hill Nature Gas

Virtual Call

Katherine Amidon (CJS)

Joey Hawkins

March 15, 2022

A. Background

- a. The Golden Corner Commerce Park is a continuous site, the site is a gem and unique not only to the area but the state
 - i. Its proximity to Charlotte and Atlanta is great and in his opinion the Greenville Spartanburg area is maxed out along the I-85 corridor
 - ii. It's also good for the labor market because it is hard to compete with BMW rates
- b. Joey suggested I reach out to Beth Land to connect about the site
 - i. A call and message were left on March 15th with her
- c. He also suggested I reach out to Burris Nelson regarding Anderson County Growth (notes follow this summary)
 - i. Terry Gilstrap with Anderson may also be helpful
- d. Industrial growth should be along the industrial corridor and should avoid sprawl

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PLANNING | LANDSCAPE ARCHITECTURE | CIVIL ENGINEERING | URBAN DESIGN

Fair Play and Townville Area Sewer Basin Plan

Anderson County Economic Development

Virtual Call

Katherine Amidon (CIS)

Burriss Nelson

March 15, 2022

A. Background

- a. Exit 4: There has been prior discussion about development around Exit 4, which is split by the county line. Lots of farmland is in this area. Smaller industry is interested here. There is a confidential project in this area that is likely 10 years out and the success of that would rely on the presence of sewer.
- b. There are some areas by the lake that might provide an opportunity for a conference center
- c. Exit 1 had the proposed Sanctuary Point development
- d. Exit 14: Anderson is working to develop this exit with a package plant or lift station to carry up SC-187
- e. Exit 11: There has been conversation with Oconee about sewer here. This could be a mega site for automotive
- f. Anderson did a market analysis for Asbury Park that Burriss can send if we are interested.

South Carolina Department of Health & Environmental Control (SCDHEC)

Phone Call

Katherine Amidon (CIS)

Bryan Ball (SCDHEC)

March 24, 2022

A. Background – Septic Data Availability

- a. They do not have GIS (according to Bryan this data isn't available anywhere in the state)
- b. They have two separate databases (one for less than 5 years and one that is older) that can be individually searched by parcel, person, street, city, etc.
- c. The Fair Play Area is a mix – some old, some new septic, but most are likely over 10 or maybe even 20 years old in our study area
- d. He brought up the lack of permit for repairs and only for full replacements – he doesn't have any news on that changing
- e. Just to give you an idea for Fair Play he has 266 total records since 2006 that were issued. Not all of these led to an install, some have been purged from DHEC's system and they don't have the full report.
- f. Bryan confirmed the process that Chris explained in the meeting that DHEC requires you to hook up to sewer if it's available, but relies on the supplying entity to determine what distance that is (for OJRSA it's 300 feet to the parcel boundary) and then holds the septic permit until there is a letter from the supplying entity saying sewer is not available.
- g. In Bryan's opinion, although helpful to consider, the USGS soil data isn't granular enough for our project of our size. He has seen drastically different percolation rates within ¼ mile of each other in this region and his experience is that the Village of Fair Play is worse than some parcels along Lake Hartwell.
- h. Some alternatives were installed in the 1990s that had a reduced drain field. These were advertised as being as effective but proved to fail within approximately 10 years. They were removed from the market, and most have been replaced by this point.

3/15/2022 | 3:45 PM EST

PLANNING | LANDSCAPE ARCHITECTURE | CIVIL ENGINEERING | URBAN DESIGN

Fair Play and Townville Area Sewer Basin Plan

Respectfully,

ColeJenest & Stone | Bolton & Menk

Katherine Amidon, AICP
Senior Environmental Planner
Katherine.amidon@bolton-menk.com

DRAFT



04806.00 | September 16, 2021

PLANNING | LANDSCAPE ARCHITECTURE | CIVIL ENGINEERING | URBAN DESIGN



May 14, 2021

First Class & Certified Mail 9214 8969 0099 9790 1419 5591 17

Mr. Christopher Eleazer
Oconee Joint Regional Sewer Authority
623 Return Church Road
Seneca, SC 29679

**OJRSA
MAY 17 2021
RECEIVED**

Re: **Executed Consent Order 21-025-W
Oconee Joint Regional Sewer Authority
NPDES Permit SC0033553
Oconee County**

Dear Mr. Eleazer:

Enclosed is fully executed Consent Order 21-025-W for the above referenced facility. The Order is considered executed on May 14, 2021.

The Order contains a civil penalty which may be paid online at scdhec.gov via invoice number **P3XY-NAMA-YM1R**, or via check to the following address:

Attn: Patrick Stivers
SCDHEC - Bureau of Water
WP Enforcement Section
2600 Bull Street
Columbia, S.C. 29201

If you have any questions regarding this matter, please contact me by telephone at (803) 898-0075 or by e-mail at stiverpb@dhec.sc.gov.

Sincerely,

Patrick Stivers
Enforcement Project Manager
Bureau of Water - WP Control Division
WP Enforcement Section

cc: Adam Cannon, WP Enforcement Section Manager
Melanie Hindman, SCDHEC, WP Compliance
Brenda Green, SCDHEC, Water Facilities Permitting
Paul Wilkie, SCDHEC, Anderson BEHS

Enclosure

**THE STATE OF SOUTH CAROLINA
BEFORE THE DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL**

**IN RE: OCONEE JOINT REGIONAL SEWER AUTHORITY
OCONEE COUNTY**

CONSENT ORDER

21-025-W

Oconee Joint Regional Sewer Authority (OJRSA) owns and is responsible for the proper operation and maintenance of the Coneross Creek wastewater treatment facility (WWTF) and the associated wastewater collection system (WWCS), located at 623 Return Church Road in Seneca, South Carolina, which serves the residences and businesses of its designated service area in Oconee County.

The Department alleges that OJRSA violated the Pollution Control Act, in that it discharged untreated wastewater into the environment, including waters of the State, in a manner other than in compliance with a permit issued by the South Carolina Department of Health and Environmental Control. The unauthorized discharges resulted from sewer system overflows (SSO) occurring October 12, 2019, December 23, 2019, and December 27, 2019, from locations within its WWCS. Additionally, OJRSA reported SSOs that occurred on February 6, 2020, April 13, 2020, April 15, 2020, April 21, 2020, June 4, 2020, and September 8, 2020.

The Department and OJRSA concur that in the interest of resolving this matter without delay and expense of litigation, OJRSA agrees to the entry of this Consent Order, but neither agrees with nor admits the Findings of Fact or the Conclusions of Law; and therefore, agrees that the Order shall be deemed an admission of fact and law only as necessary for enforcement of this Order by the Department or subsequent actions relating to OJRSA by the Department.

In accordance with approved procedures and based upon discussions with agents for OJRSA on April 28, 2020, the parties agree to the issuance of this Order to include the following Findings of Fact and Conclusions of Law:

FINDINGS OF FACT

1. OJRSA owns and is responsible for the proper operation and maintenance of the Coneross Creek WWTF and the associated WWCS, located at 623 Return Church Road in Seneca, South Carolina, which serves the residences and businesses of its designated service area in Oconee County. OJRSA is composed of 80.97 miles of sewer line. OJRSA is overseen by a Commission comprised of representatives from Member Cities – Seneca, Walhalla, and Westminster. The WWCS includes several customer satellite sewer collection systems, including those belonging to the Member Cities, that collect and convey wastewater to the Coneross Creek WWTF.
2. The South Carolina Department of Health and Environmental Control (Department) reissued NPDES Permit SC0033553 (Permit) to OJRSA, effective August 1, 2019, authorizing it to discharge treated wastewater to Coneross Creek in accordance with effluent limitations, monitoring requirements, and other permit conditions. The Permit expires July 31, 2024.
3. OJRSA reported an SSO on October 12, 2019, in Seneca, South Carolina, caused by a concrete section of a manhole blocking the pipe. The report further stated an estimated 15,600 gallons of untreated wastewater entered a wet weather ditch leading to Hartwell Lake.
4. OJRSA reported an SSO on December 23, 2019, from manholes #596 and #591 near 195 Heritage Drive, and manhole #588 near 190 Duck Pond Road in Walhalla, South

Carolina, caused by inflow and infiltration (I&I) from the City of Walhalla satellite sewer system (SSS) due to a rain event. The report further stated an estimated 51,500 gallons of untreated wastewater entered Duck Pond.

5. OJRSA reported an SSO on December 27, 2019, in Westminster, South Carolina, caused by a collapsed reinforced concrete pipe gravity sewer line due to erosion of a sharp bend in Coneross Creek resulting from heavy rains. The report further stated an estimated 195,000 gallons of untreated wastewater entered Coneross Creek.
6. On January 23, 2020, Department staff conducted a collection system inspection with representatives of OJRSA present. Department staff made the following observations during the inspection:
 - a) There are no procedures developed for scheduling inspections or routine maintenance;
 - b) A sewer cleaning program has not been developed;
 - c) Fencing was missing on one side of Flat Rock Pump Station;
 - d) Excessive amount of trash was present in the wet well of Flat Rock pump station and was unable to be pumped out due to a steep embankment next to the riser;
 - e) A manhole was cracked at the riser; and
 - f) Manholes above Flat Rock Pump Station contained trash and rags and sediment.
7. OJRSA reported three SSOs on February 6, 2020. In the reports, OJRSA stated the SSOs were caused by an estimated 4.84 inches of rain during a 12-hour period. According to OJRSA, the following amounts of untreated wastewater were released during the SSOs:
 - a) 213,250 gallons of untreated wastewater from a Flat Rock gravity sewer line and pump station at 190 Duck Pond Road in Walhalla, South Carolina;

- b) 22,000 gallons of untreated wastewater from Seneca Creek Pump Station at 1102 Wells Highway in Seneca, South Carolina; and
 - c) 305,750 gallons of untreated wastewater from manholes 1A, 2, and Junction Box at Coneross Creek pump station in Seneca, South Carolina.
8. On February 28, 2020, the Department issued a Notice of Alleged Violation and Notice of Enforcement Conference to OJRSA for the aforementioned SSOs.
9. OJRSA reported two SSOs that occurred on April 13, 2020. In the reports, OJRSA stated the SSOs were caused by a power outage due to a tornado event. Downed trees in the areas hindered response teams from accessing the facilities. According to OJRSA, the following amounts of untreated wastewater were released during the SSOs:
- a) 8,300 gallons of untreated wastewater from a manhole adjacent to the pump station at 1801 Davis Creek Road in Seneca, South Carolina. The generator failed to start due to an internal electrical computer fault; and
 - b) 88,610 gallons of untreated wastewater entered Speeds Creek from a Coneross Creek Pump Station at 380 Campbell Bridge Road in Seneca, South Carolina.
10. OJRSA reported an SSO that occurred on April 15, 2020, at 31804 Cross Creek Drive in Seneca, South Carolina, caused by a generator failure following several days without power caused by the April 13, 2020 tornado. The report further stated an estimated 57,192 gallons of untreated wastewater entered Perkins Creek.
11. OJRSA reported an SSO that occurred on April 21, 2020, at manhole #619 near 110 Commerce Way in Westminster, South Carolina, caused by rags and other non-woven fabrics placed into the system by an unknown source. The report further stated an estimated 4,050 gallons of untreated wastewater entered Miller Branch Creek.

12. On April 28, 2020, Department staff held an enforcement conference with representatives for OJRSA. During the conference, representatives for OJRSA provided the following explanations for the SSOs:

- a) October 12, 2019: the SSO was the result of a collapsed manhole that OJRSA identified prior to the incident and scheduled for repair; however, the SSO occurred prior to scheduled repair date;
- b) December 23, 2019: the SSO was attributed to excessive I&I from the Walhalla SSS;
- c) December 27, 2019: the SSO was the result of a collapsed creek bank on a concrete pipe;
- d) February 6, 2020: the SSO was attributed to a greater than 25-year rain event within a 24-hour period which forced OJRSA to turn off the pump at Duck Pond Road station, and created excessive I&I from the cities of Seneca and Walhalla.

The parties discussed the possibility of a Consent Order containing a civil penalty.

13. On May 29, 2020, the Department mailed the January 23, 2020 inspection report to OJRSA. The Department requested OJRSA to respond to the report within fifteen (15) days receipt of the letter. OJRSA received the inspection report on June 1, 2020.

14. OJRSA reported an SSO that occurred on June 4, 2020, at Seneca Creek Pumping Station, 1104 Wells Highway, Seneca, South Carolina, caused by a pinhole leak in the force main, caused by a rock left in contact with the iron piping when another utility backfilled a pipe installation. The report further stated an estimated 4,800 gallons was released into Seneca Creek.

15. On June 9, 2020, OJRSA submitted a response to the inspection report. In the response, OJRSA indicated it is in the process of upgrading its maintenance management program, approved funding to raise Flat Rock sewer manholes above the 100-year flood level, and approved funding for a comprehensive assessment of the Flat Rock pump station to determine how to improve or replace the station. The comprehensive assessment will address the missing fencing and the embankment preventing OJRSA from cleaning the wet well. OJRSA's response also stated that its Fiscal Year 2021 budget included funding for a capacity, management, operations, and maintenance (cMOM) audit intended to identify and correct deficiencies in the OJRSA system.
16. OJRSA reported an SSO that occurred on September 8, 2020, near 151 Wild Fern Road, Seneca, South Carolina, caused by a hole in the force main, possibly caused by hydrogen sulfide corrosion. The report further stated an estimated 19,350 gallons was released, with some entering Speeds Creek.
17. OJRSA contends that the SSOs on the following dates were caused by force majeure events as contemplated by S.C. Code Ann. § 48-1-300: December 23, 2019 (I&I from third party system); December 27, 2019 (erosion of creek bank from rain event and collapse of gravity line); February 6, 2020 (25-year rain event combined with I&I from third-party collection system); April 13 and 15, 2020 (tornado); April 21, 200 (third-party introduction of foreign material into system); June 4, 2020 (third-party placing rock backfill in direct contact with force main). Among other asserted force majeure causes are several instances of I&I from Member Cities' satellite sewer systems.
18. OJRSA operates pursuant to a Sewer Use Regulation (Regulation) which sets forth uniform requirements for discharges to its sewer conveyance system and wastewater

treatment system. The Regulation was effective March 1, 2019, and was revised August 23, 2019.

19. Section 1.2 of the Regulations defines “User” as any person (including by definition a company, association, or governmental entity) that directly or indirectly discharges, causes, or permits the discharges of wastewater to the POTW.
20. Section 2.14 of the Regulation provides that connection to OJRSA’s system constitutes “consent and agreement by the User to be bound by and to abide with all OJRSA Regulations and requirements.”
21. Section 8.1 of the Regulation provides that “the Director shall enforce the provisions of this Regulation in accordance with the current OJRSA [Enforcement Management Strategy].”
22. The customer satellite sewer systems which OJRSA asserts contributed I&I which caused some of the reported SSOs are defined as Users, who are bound by and must abide by OJRSA’s Regulation.

CONCLUSIONS OF LAW

Based upon the above Findings of Fact, the Department reaches the following Conclusions of Law with which OJRSA neither admits nor agrees:

1. OJRSA violated the Pollution Control Act, S.C. Code Ann. § 48-1-90(A)(1) (2008 & Supp. 2019), in that it discharged untreated wastewater into the environment, including waters of the State, in a manner other than in compliance with the Permit.
2. OJRSA violated the Pollution Control Act, S.C. Code Ann. § 48-1-110 (d) (2008 & Supp. 2019) and Water Pollution Control Permits, S.C. Code Ann Regs. 61-9.122.41(e) (2011) in that it failed to at all times properly operate and maintain in good working order and

operate as efficiently as possible all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the terms and conditions of NPDES Permit SC0033553.

3. The Pollution Control Act, S.C. Code Ann. § 48-1-95(D)(1) (2008 & Supp. 2019), provides in part, “If the wastewater utility has had more than two significant spills per one hundred miles of its aggregate collection system miles during a twelve-month period, the Department shall issue an order directing the utility to complete a comprehensive review of the sewage system and treatment works facility.”
4. The Pollution Control Act, S.C. Code Ann. § 48-1-330 (2008), provides for a civil penalty not to exceed ten thousand dollars (\$10,000.00) per day of violation for any person violating the Act or any rule, regulation, permit, permit condition, final determination, or Order of the Department.

NOW, THEREFORE, IT IS ORDERED, CONSENTED TO AND AGREED, pursuant to the Pollution Control Act, S.C. Code Ann. §§ 48-1-50 and 48-1-100 (2008 & Supp. 2019), that OJRSA shall:

1. Beginning with the effective date of the Order, submit to the Department copies of public notices issued by the Commission for all significant spills from the WWCS.
2. Within sixty (60) days of the effective date of this Order, submit to the Department a report which identifies the upstream publicly and privately owned satellite sewer systems (satellite systems) which are contributing excessive I&I into its conveyance system.
3. As determined necessary by OJRSA and pursuant to its Sewer Use Regulation, direct identified satellite systems to begin a comprehensive review of their WWCS by conducting a capacity, management, operations and maintenance audit (“cMOM Audit”) of the entity’s WWCS to include, but not be limited to: a) a financial plan detailing how

operation and maintenance of the WWCS will be funded; b) personnel charts, including job assignments; c) lift/pump station inspection and maintenance evaluations and schedules; d) a sewer inspection and cleaning program; e) inflow/infiltration evaluations; f) manhole inspections; g) detailed logs/records of daily operations; h) easement/right-of-way maintenance; i) sewer use and fats, oils and grease ordinance; j) spare parts inventory; k) customer complaints; l) line evaluations; m) work orders; n) system inventory; and o) any other components necessary for the proper operation and maintenance of the WWCS.

4. Within ninety (90) days of the effective date of this Order, begin conducting a cMOM Audit of the OJRSA WWCS and treatment works to include, but not be limited to: a) a financial plan detailing how operation and maintenance of the OJRSA WWCS will be funded; b) personnel charts, including job assignments; c) lift station inspection and maintenance schedules; d) a sewer inspection and cleaning program; e) Inflow/Infiltration evaluations; f) manhole inspections; g) detailed logs/records of daily operations; h) easement/right-of-way maintenance; i) sewer use and grease ordinance; j) a spare parts inventory; and k) any other components necessary for proper operation and maintenance of the OJRSA WWCS.
5. Within ninety (90) days of the effective date of this Order, begin conducting a comprehensive review of the OJRSA WWCS and treatment works, as a part of the cMOM Audit. The comprehensive review must include a complete technical assessment of the components and operation of the OJRSA WWCS and/or the treatment works that are contributing to, or may be contributing to, repetitive significant spills of untreated or partially treated domestic sewage and will be focused in the areas of the OJRSA WWCS where those spills have occurred. The comprehensive review shall be performed by a

licensed professional engineer registered in the state of South Carolina and shall be completed within 180 days of beginning the cMOM Audit.

6. Within thirty (30) days of the completion of the comprehensive review/technical assessment, submit to the Department a Preliminary Engineering Report (PER), prepared by a South Carolina licensed professional engineer, addressing planned improvements to the collection system. The PER shall include a full assessment and evaluation of the components and operations examined pursuant to the comprehensive review and technical assessment requirement above, and include recommendations for repairs and improvements to the collection system.
7. Within thirty (30) days of SCDHEC approval of the PER, submit to the Department a report of the findings and summary of all priority deficiencies identified in the WWCS or treatment works (pump stations, manholes, line breaks/deterioration, etc.). The report shall propose a Work Plan which incorporates benchmarks and target dates for priority corrective actions. The Work Plan will also identify a date (final completion date) on which all corrective actions and/or maintenance activities will be completed. The final completion date, upon acceptance by the Department, shall be incorporated into and become an enforceable part of this Order, with allowances for funding approvals and legally required procurement processes.
8. Within sixty days (60) days of SCDHEC approval of the PER and based on the findings of the OJRSA WWCS audit, finalize and submit a comprehensive management plan, covering operations, maintenance, and management of the collection system.
9. Within one hundred eighty (180) days of the effective date of this Order and every six (6) months thereafter until this Order is closed, submit to the Department a summary of corrective actions completed to date addressing deficiencies in the OJRSA WWCS and

- the satellite systems as applicable.
10. This Consent Order shall terminate upon OJRSA: completing a comprehensive review of the WWTF and WWCS; implementing all corrective actions identified through the comprehensive review and schedule of implementation; and fulfilling all other requirements detailed within this Consent Order (e.g., payment of assessed penalties, etc.).
 11. Within thirty (30) days of the execution date of this Order, pay to the Department a civil penalty in the amount of seven thousand, five hundred dollars (\$7,500.00).

PURSUANT TO THIS ORDER, communications regarding this Order and its requirements, including civil penalty payments, shall include the Order number and be addressed as follows:

Attn: Patrick Stivers
SCDHEC - Bureau of Water
WP Enforcement Section
2600 Bull Street
Columbia, S.C. 29201

IT IS FURTHER ORDERED AND AGREED that failure to comply with any provision of this Order shall be grounds for further enforcement action pursuant to the Pollution Control Act, S.C. Code Ann. § 48-1-330 (2008), to include the assessment of additional civil penalties.

IT IS FURTHER ORDERED AND AGREED that this Consent Order governs only the civil liability to the Department for civil sanctions arising from the matters set forth herein and constitutes the entire agreement between the Department and OJRSA with respect to the resolution and settlement of these civil matters. The parties are not relying upon any representations, promises, understandings or agreements except as expressly set forth within this Order.

THE PARTIES UNDERSTAND that the "execution date" of the Order is the date the Order is signed by the Director of Environmental Affairs.

[Signature Page Follows]

**FOR THE SOUTH CAROLINA DEPARTMENT
OF HEALTH AND ENVIRONMENTAL CONTROL**

Myra C. Reece
Myra C. Reece
Director of Environmental Affairs

Date: 5-14-2021

James M. Marcus
James M. Marcus, PhD, Chief
Bureau of Water

Date: 5-11-2021

Randy Stewart for Randy Stewart
Randy Stewart, Director
Water Pollution Compliance and
Enforcement Division
Bureau of Water

Date: 5-7-21

Reviewed By:

Denise Miller
DHEC Legal Counsel

Date: 5-11-2021

WE CONSENT:

OCONEE JOINT REGIONAL SEWER AUTHORITY

Christopher Elcazer
Christopher Elcazer, Executive Director

Date: 3 May 2021

Oconee Joint Regional Sewer Authority

Report of Findings

Summary of Deficiencies and Work Plan



August 24, 2022

Prepared for:
Oconee Joint Regional Sewer Authority
623 Return Church Road
Seneca, South Carolina 29678



Prepared by:
WK Dickson & Co., Inc.
5 Legacy Park Road, Suite A
Greenville, South Carolina 29607
WKD # 20210552.00.GV



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DRAFT

1. Introduction

This Report of Findings is in response to Consent Order 21-025-W dated May 14, 2021. It follows the Preliminary Engineering Report (PER) dated March 10, 2022, and approved by SC DHEC on July 25, 2022. The PER details the assessments and analysis completed and the recommended improvements to the Oconee Joint Regional Sewer Authority (OJRSA) system. This Report of Findings includes a summary of priority deficiencies identified in Oconee Joint Regional Sewer Authority's wastewater collection system and provides corrective action plans for each of the deficiencies. It identifies benchmarks and target dates, and a final completion date for each corrective action plan.

Prior assessments in response to this Consent Order have included identification of repetitive or significant spills and a comprehensive review of components and operational procedures that are or may be contributing to repetitive or significant spills. Based on the location of these spills and temporary flow monitoring data, focus areas were identified. The location of these significant spills and focus areas are plotted on a map of the collection system and are included in Figure 1.1, Collection System Overview.

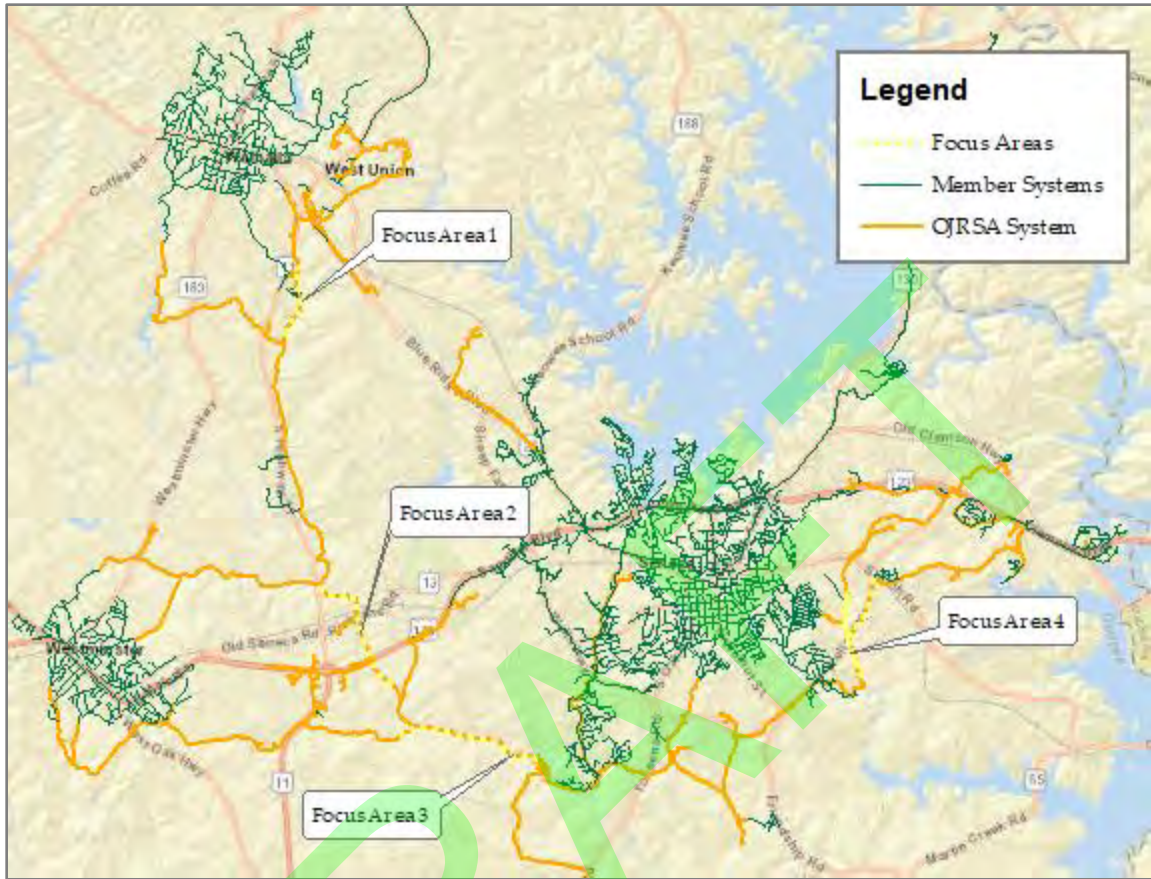


Figure 1 Collection System Overview

Focus areas were further evaluated with CCTV and visual manhole inspections to identify defects. All the identified defects were evaluated for their potential to contribute to repetitive or significant spills. Some of the defects identified have been considered as potentially contributing significant and repetitive overflows and are considered priority defects. These priority defects were assigned necessary corrective actions.

This report summarizes those corrective actions and their formulation into work plans.

End of Section

2. Summary of Findings

2.1 Review of Evaluations

The further evaluation of the assets located in Focus Areas No. 1 – 4 included CCTV and visual manhole inspections. These inspections were necessary to gain more specific information on the condition of these assets and their defects to determine if they may be contributing to significant spills.

The defects identified were compared against system performance criteria to determine if corrective actions are needed. The system performance criteria includes any defect or condition that may contribute to significant spills by:

- ◆ Contributing I/I
- ◆ Reducing Hydraulic Capacity
- ◆ Reducing Structural Integrity

For further details on the findings of the further evaluation of the assets in Focus Areas No. 1- 4 please refer to the Preliminary Engineering Report.

2.2 Review of Findings

Upon further evaluation of the assets in Focus Areas No. 1 – 4 the following defects that are or may be contributing to significant and repetitive spills have been identified and are listed in Table 1 below.

Table 1 Review of Findings			
Segments	Pipe Size & Material	Priority Defects	Findings
MH 157 - MH 156	15" VCP	CM, SMW, JSM, IR, RMJ, CU, SG	This pipe is in poor condition. There are visible cracks, root intrusions at joints, sections of missing wall, signs of groundwater infiltration, signs of pipe sags.
MH 53 – MH 52	30" VCP	SSS, RJF, LFDC, ISJ, LFD, MC, MCU, OBZ, CM, MSA, SG	The segment includes minor liner defects throughout. An obstruction at the bottom of a sag was found during CCTV. The obstruction has since been cleared, but the

			sag is still in need of repair. The pipe at the joints on either end of the sag are broken and cracked and have infiltration staining.
MH 912 – MH 911	10" PVC	DSC, DAR, OBZ, MGD, ID, IG, SG	This line appears to be severely coated in grease and sludge build up, there are defects that are consistent with pipe sag. At the connection to the downstream manhole, water is dripping from the top of the pipe and there is also one instance of an infiltration gusher.
MH 30 – MH 29	30" RCP	LFD, RJF, LFB, IR, OBZ	This line has some minor linear defects throughout this segment, typical grease buildup, and a handful of joints with minor root intrusion. There is one instance of an infiltration runner and one instance of an unknown obstacle.
MH 913 – MH 912	10" PVC	DSC, DAR, SG	This line appears to be severely coated in grease and sludge build up. There is also ragging of grease and debris from the top of the pipe that suggests full stagnant flow at some instances indicating a potential pipe sag.
MH 897 – MH 896	10" PVC	DSC, MCU, OBZ, DAAR, SG	CCTV camera was submerged during inspection indicating two potential pipe sags. There is substantial grease and sludge build up and after instances of sag there is ragging from the top of the pipe.
MH 893 – MH 892	10" PVC and DIP	DSC, MGD, OBZ, DAGS	Several unknown obstacles were found in the flow path, substantial grease and sludge build up. There was also an instance where the pipe appears to drop significantly, but there was no noticeable joint offset. Further investigation could prove useful.

Pump run times for each of the pump stations was also reviewed. It is generally recommended that pumps be designed to run no longer than 8 hour per day in dry weather conditions. It is also a general recommendation that wet weather peaking factors be less than 2. The pump stations that had dry weather pump runtimes higher

than 8 hours per day and wet weather peaking factors great than 2 have been included in the table below. This evaluation has identified several pump stations that have higher than recommended pump runtime or peaking factors. Those pump stations are listed below in Table 2.

Table 2 Review of Pump Station Findings	
Pump Station	Findings
Coneross Creek	High pump runtimes
Perkins Creek	High pump runtimes
Martin Creek	High pump runtimes
Choestoea	High peaking factor
Flat Rock	High peaking factor

2.2 Review of Recommendations

Based on the priority defects identified the following recommendations and projects, shown in Table 3 below, have been formulated to mitigate their contributions to significant and repetitive spills.

Table 3 Summary of Recommendations				
Project No.	Between Manholes	Recommendations	Priority	Focus Area
1	MH 157 - MH 156	Full replacement of the VCP segment. During replacement, ensure that the area of existing sagging pipe is fully supported by stabilized soils.	1	3
2	MH 53 - MH 52	Point Repair of a sagging segment. During replacement of the existing pipe, soil should be stabilized to prevent another sag.	2	2
3	MH 912 - MH 911	This line should be cleaned, plugged, and reinvestigated to confirm sags within the segment. If sags exist, they should be remedied by a point repair of the segment. The downstream manhole shall be inspected further to determine sources of I/I.	3	4 (10")

4	MH 30 – MH 29	This line should be cleaned to clear existing grease buildup and remove potential obstructions and eliminate potential sources of I/I.	4	3
5	MH 913 – MH 912	This line should be cleaned, plugged, and re-evaluated to confirm sags in the pipe. If sags are confirmed, they should be eliminated with point repairs.	5	4 (10")
6	MH 897 – MH 896	This line should be cleaned, plugged, and re-evaluated to confirm sags in the pipe. If sags are confirmed, they should be eliminated with point repairs.	6	4 (10")
7	MH 893 – MH 892	This line should be cleaned, plugged, and re-evaluated to confirm presence of defects. After confirmation of defects is made a corrective action work plan can be developed to address them.	7	4 (10")
8	FM 8 – 375 to Westminster	This line should be cleaned, plugged, and re-evaluated to confirm presence of defects. After confirmation of defect is made a corrective action work plan can be developed to address them.	8	3
9	Choestoea PS to Westminster	This line should be cleaned, plugged, and re-evaluated to confirm presence of defects. After confirmation of defect is made a corrective action work plan can be developed to address them.	9	3

Some of the assets within Focus Areas No. 1 -4 could not be fully assessed due to collection system conditions or a need for more information. In these cases, it is recommended to address these collection system conditions in a further evaluation so that priority defects can be identified and addressed. A list of these further evaluations is included in Table 4 below.

Table 4 Recommendation for Further Evaluation and Study	
Focus Area	Recommendation
Study: Additional Gravity Sewer Sections	Conduct further CCTV analysis of sections of the gravity sewer system likely to be in poor condition due to age and pipe material.

Study: Pump Station Evaluation	Conduct complete pump station inspection with drawdown test for each pump station listed in Table 2; Coneross Creek, Perkins Creek, Martin Creek, Choestoea, and Flat Rock.
Study: Force Main Evaluation	Inspect force mains for the Seneca Creek and Speeds Creek Pump Stations for corrosion and air release valves for proper functioning.

During the Pump Station and the Force Main Evaluations additional defects will likely be identified. These defects will be evaluated for their potential to contribute to repetitive significant spills and will be categorized as priority defects. Methods to address each of the priority defects will be evaluated and selected based on the most effective and economical way to eliminate the defect and reduce its potential to contribute to repetitive significant spills. Once a method has been selected it will be formulated into a project and added to this work plan for future implementation.

End of Section

3. Work Plans

3.1. Project 1: MH157 - MH156

This 15" VCP gravity sewer is in poor condition with visible cracks, root intrusions at the joints, section of missing pipe, and signs of groundwater infiltration. A portion of the pipe segment could not be CCTV inspected due to the camera being submerged in wastewater. This is an indication of a sag in the pipe segment.

It is recommended that the pipe be completely replaced from manhole 157 to manhole 156. By replacing the entire segment and not just the portions of the pipe that have defects it ensure a more complete and thorough repair. During the replacement, it should be ensured that the area with the sag is properly backfilled with stabilized soil to eliminate the current sag and prevent future sagging.



Figure 2. Project 1

It is estimated that associated engineering fees for the design of this project will be roughly \$40,000 and the construction costs will be roughly \$150,000. For additional detail on cost estimates for each of the projects, please refer to **Appendix A**, Budget Estimates.

3.2 Project 1.c Additional CCTV

In response to the CCTV results of MH157-MH156, it is recommended that all upstream segments of VCP between MH 157 and Choestoea Creek Pump Station, not including service connections or tributary sewers be CCTV inspected to determine if similar defects are present. These defects could be sources of I/I and should be addressed in future projects.

This is estimated to be roughly 11,000 LF of gravity sewer and will cost \$62,000 to inspect and \$15,000 to evaluate.

Based on evaluation, appropriate repairs and replacement of this section will be determined. If full replacement of this section is needed, the 11,000 LF of gravity sewer may cost approximately \$4,500,000 to replace.

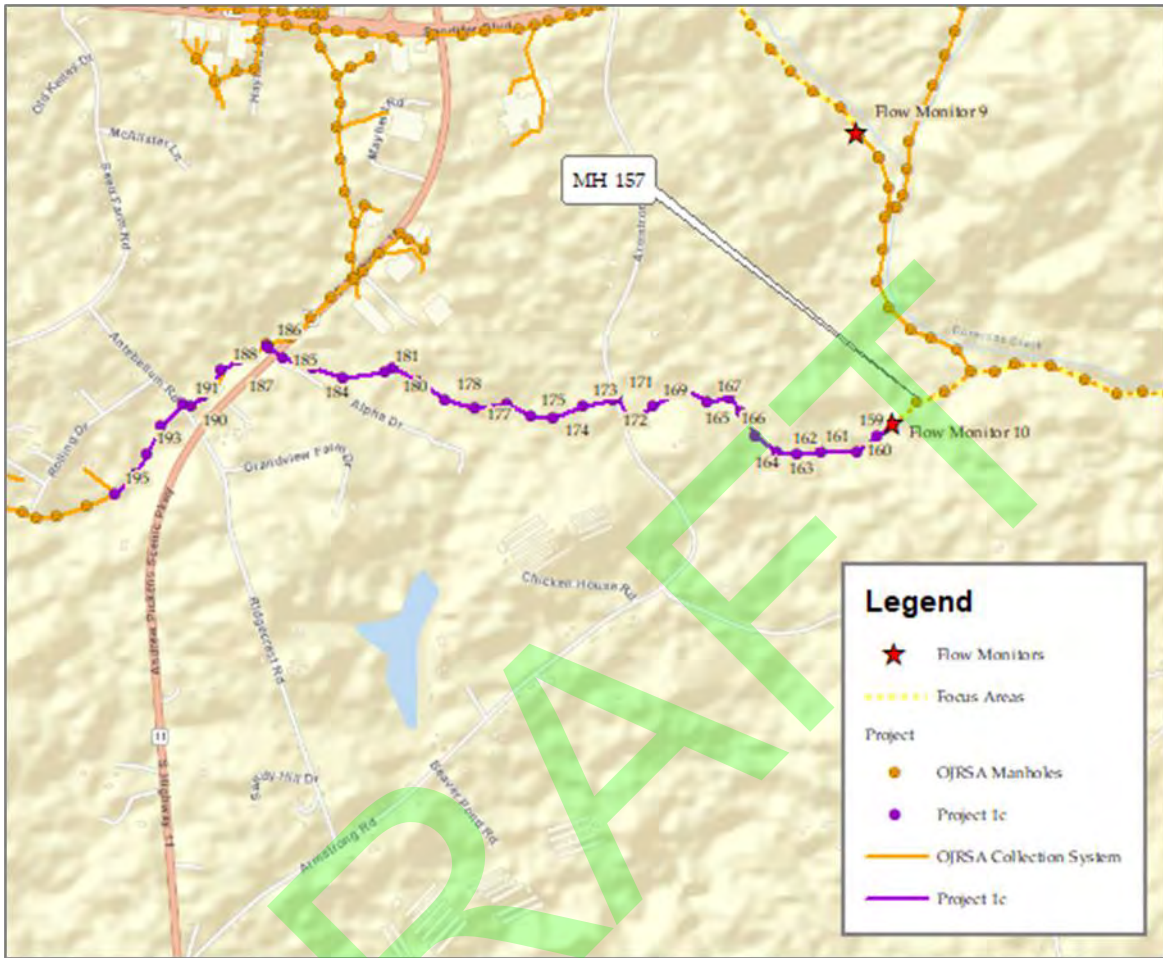


Figure 3. Project 1.c

3.2. Project 2: MH53 - MH52

This 30" VCP segment includes minor liner defects throughout. An obstruction at the bottom of a sag was found during CCTV. The obstruction has since been cleared, but the sag is still in need of repair. The pipe at the joints on either end of the sag are broken and cracked and have infiltration staining.

It is recommended that a point repair of the sagging segment to restore a uniform slope be completed. During replacement of the existing pipe, soil should be stabilized to prevent future sags.



Figure 4. Project 2

It is estimated that associated engineering fees for the design of this project will be roughly \$10,000 and the construction costs will be roughly \$17,000.

3.3. Project 3 MH912 – MH911

This 10" PVC line appears to be severely coated in grease and sludge build up, there are defects that are consistent with a pipe sag. At the connection to the downstream manhole, water is dripping from the top of the pipe and there is also one instance of an infiltration gusher.

It is recommended that this line be cleaned, plugged, and CCTV inspected to confirm sags within the segment. If sags exist, rehabilitative action should be conducted to address the sag. The downstream manhole, MH911, shall be inspected further to determine sources of I/I.



Figure 5. Project 3

It is estimated that associated engineering fees for the design of this project will be roughly \$15,000 and the construction costs will be roughly \$21,500.

3.4 Project 4 MH30 - MH29

This 30" RCP gravity line has some minor linear defects throughout this segment, typical grease buildup, and a handful of joints with minor root intrusion. There is one instance of an infiltration runner and one instance of an unknown obstacle.

It is recommended that this line be cleaned to clear existing grease buildup and remove potential obstructions and eliminate potential sources of I/I with a point repair.



Figure 6. Project 4

It is estimated that associated engineering fees for the design of this project will be roughly \$10,000 and the construction costs will be roughly \$27,800.

3.5 Project 5 MH913 – MH912

This 10" PVC line appears to be severely coated in grease and sludge build up. There is also ragging of grease and debris from the top of the pipe that suggests full stagnant flow at some instances indicating a potential pipe sag.

Segment MH913-MH912 is shown in Figure 6 below conveying wastewater in a southward direction adjacent to a parallel 18" PVC gravity sewer.

It is recommended that this line be cleaned, plugged, and inspected with CCTV to confirm sags in the pipe. If sags are confirmed, rehabilitative action should be taken to address the sags.

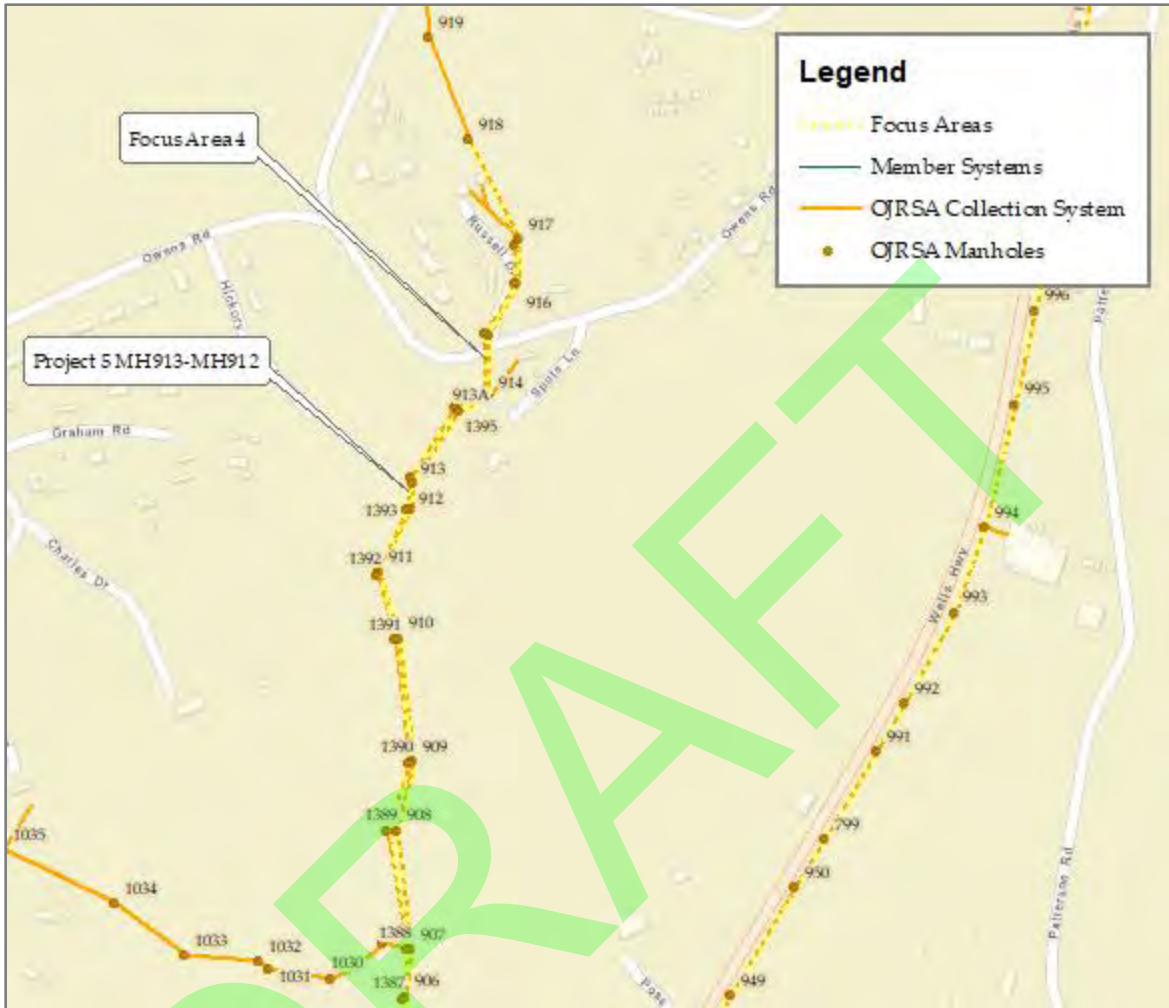


Figure 7. Project 5

It is estimated that associated engineering fees for the design of this project will be roughly \$12,000 and the construction costs will be roughly \$15,900.

3.6 Project 6 MH897 – MH896

During inspection of the 10" PVC line the CCTV camera was submerged indicating two potential pipe sags. There is substantial grease and sludge build up and after instances of sag there is ragging from the top of the pipe.

Segment MH897-MH896 is shown in Figure 7 below conveying wastewater in a southward direction adjacent to a parallel 18" PVC gravity sewer.

It is recommended that this line be cleaned, plugged, and re-evaluated to confirm sags in the pipe. If sags are confirmed, rehabilitative action should be taken to address the sags.

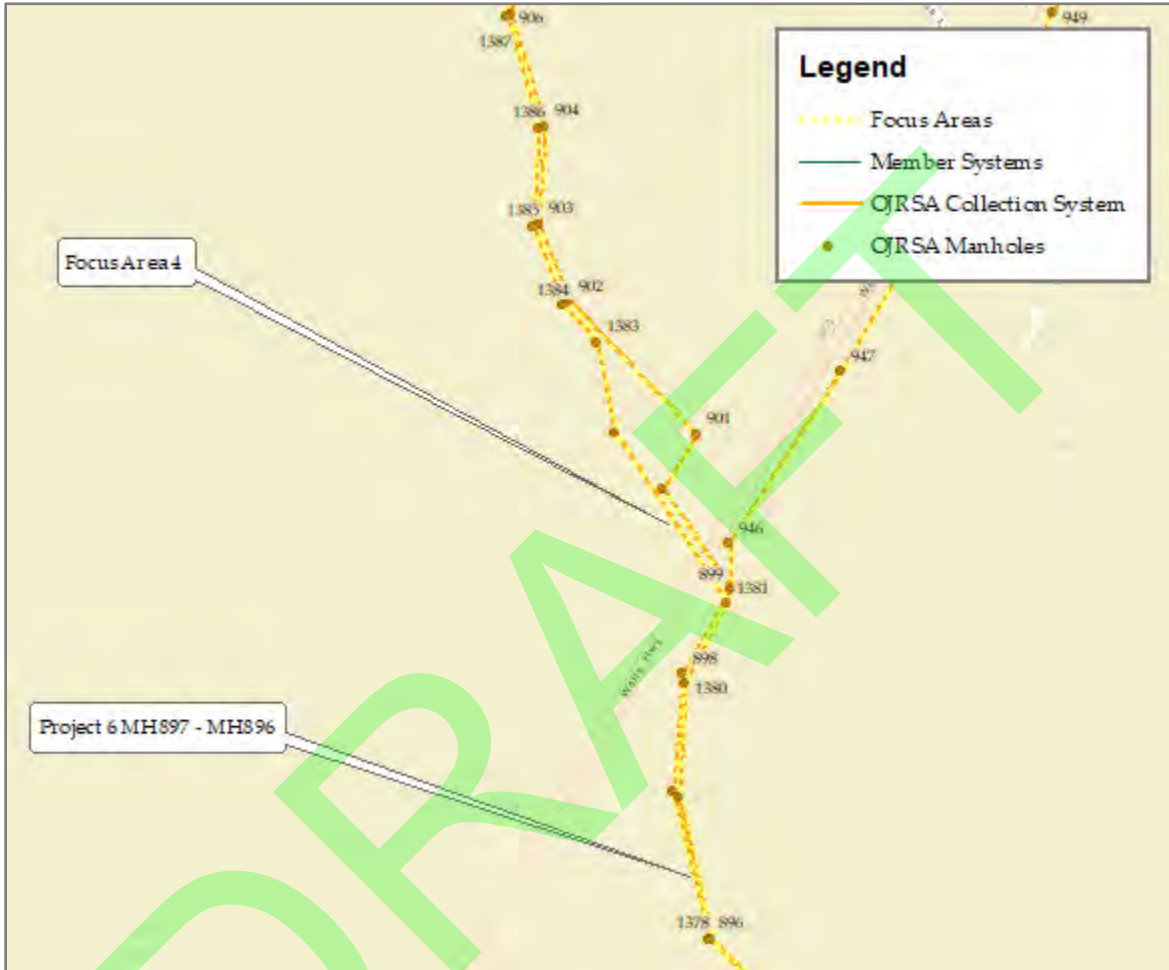


Figure 8. Project 6

It is estimated that associated engineering fees for the design of this project will be roughly \$15,000 and the construction costs will be roughly \$24,200.

3.7 Project 7 MH893 – MH892

During the inspection of this 10" PVC and DIP line, several unknown obstacles were found in the flow path, additionally substantial grease and sludge build up. There was also an instance where the pipe appears to drop significantly, but there was no noticeable joint offset. Further investigation could confirm the presence and extent of any defects.

It is recommended that this line be cleaned, plugged, and re-evaluated to confirm presence of defects. After confirmation of defects is made a corrective action work plan can be developed to address them.

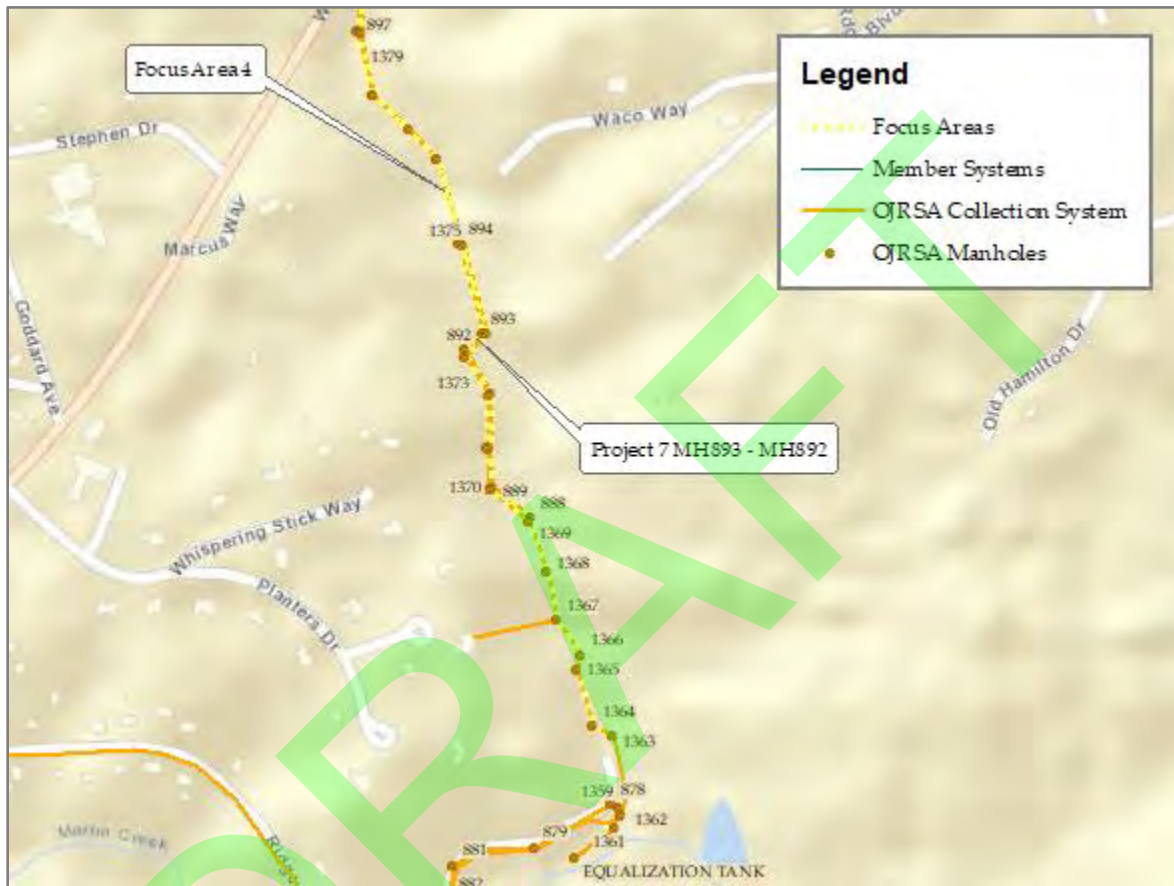


Figure 9. Project 7

It is estimated that associated engineering fees for the design of this project will be roughly \$12,500 and the construction costs will be roughly \$17,000.

3.8 Project 8 Additional CCTV

CCTV Evaluation from flow meter #8-375 to the connection with Westminster. This further investigation covers roughly 5,000 LF of gravity sewer.

This is estimated to be roughly 5,000 LF of gravity sewer and will cost \$30,600 to inspect and \$8,000 to in fees to evaluate.

Based on evaluation, appropriate repairs and replacement of this section will be determined. If full replacement of this section is needed, the 5,000 LF of gravity sewer may cost approximately \$2,250,000 to replace.

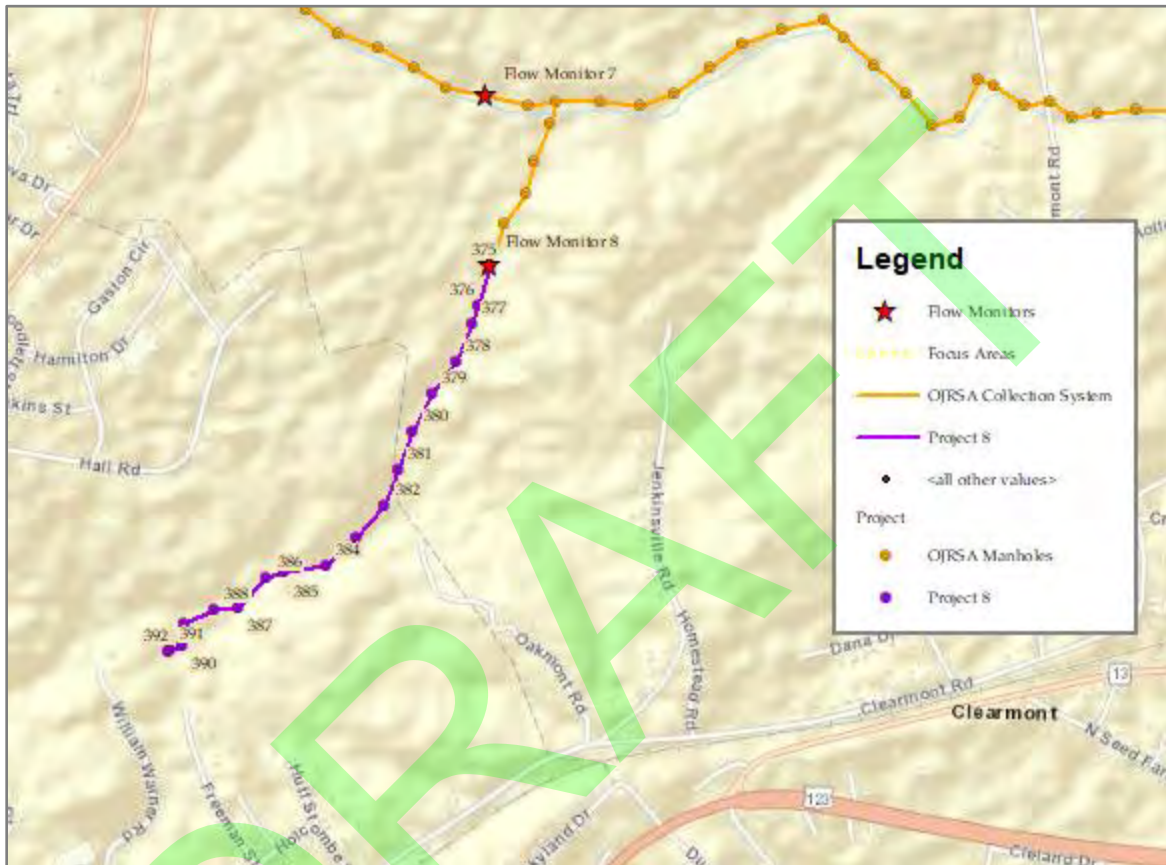


Figure 10. Project 8

3.9 Project 9 Additional CCTV

CCTV Evaluation from Choestoea Pump Station to the connection with Westminster. This is estimated to be roughly 9,000 LF of gravity sewer and will cost \$43,500 to inspect and \$13,000 to in fees to evaluate.

Based on evaluation, appropriate repairs and replacement of this section will be determined. If full replacement of this section is needed, the 9,000 LF of gravity sewer may cost approximately \$4,000,000 to replace.

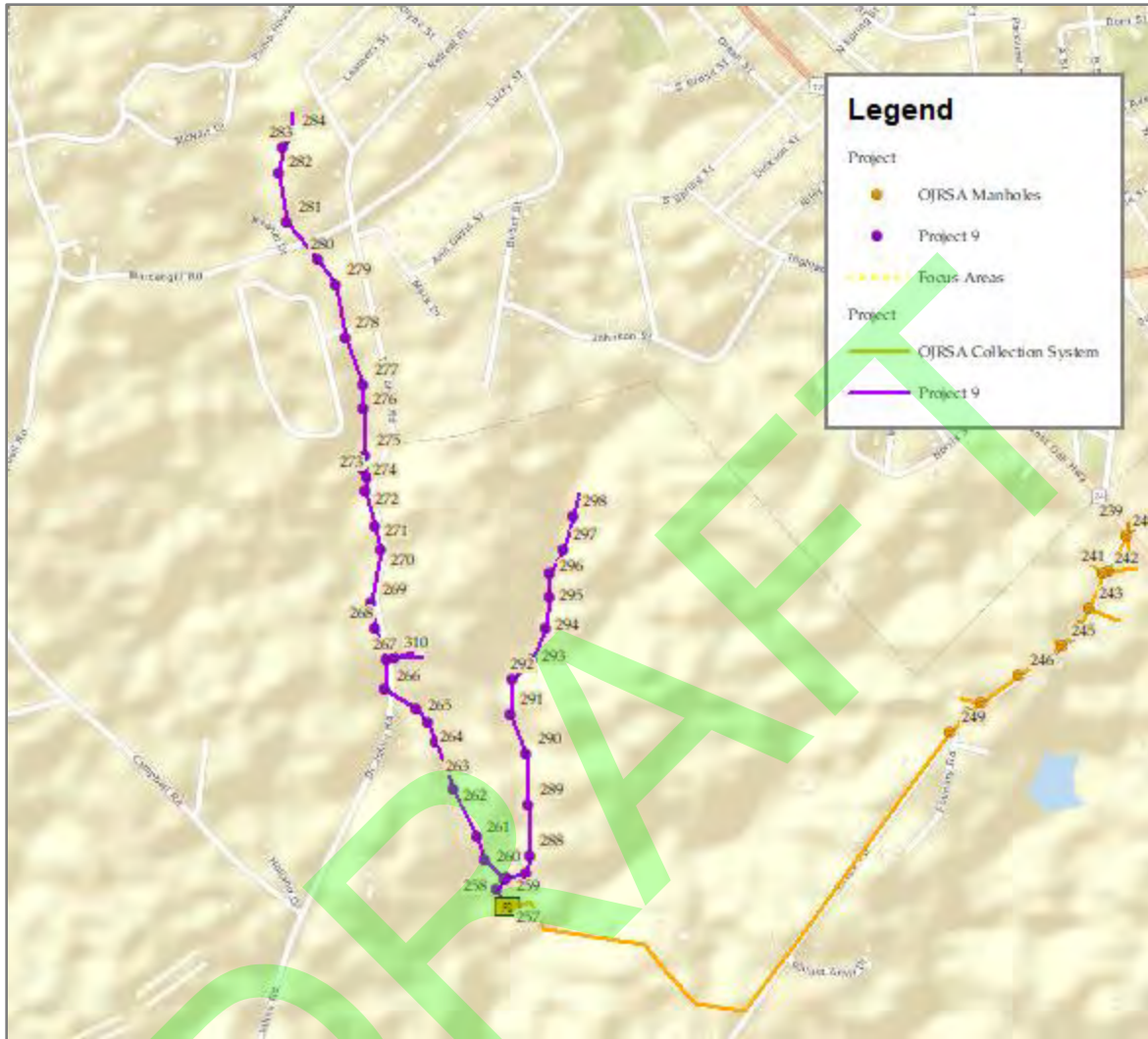


Figure 11. Project 9

3.11 Project 11 Pump Station Evaluation

Conduct pump station evaluations on the following pump stations:

- ◆ Coneross Creek Pump Station
- ◆ Perkins Creek Pump Station
- ◆ Martin Creek Pump Station
- ◆ Choestoea Pump Station
- ◆ Flat Rock Pump Station

These pump stations are also listed in Table 2 and shown in Figure 12 below. It should be noted that Coneross Creek Pump Station is located at the Coneross Creek Wastewater Treatment Facility.

These evaluations should seek to determine the causes of the high pump runtimes and high peaking factors. The estimated cost for this evaluation is \$90,000.



Figure 12. Project 11 Pump Station Evaluation

3.12 Project 12 Force Main Evaluation

Due to failures associated with force mains, Seneca Creek and Speeds Creek force mains were identified for further evaluation.

It is recommended that the force mains be inspected for corrosion and the ARVs be assessed for proper function. Additionally, due to historical, repetitive failures within Speeds Creek force main, an investigation to determine the cause of failures should be

made. Upon determination of the cause of these repeated failures, necessary actions to prevent future failures should be taken as part of the future projects.

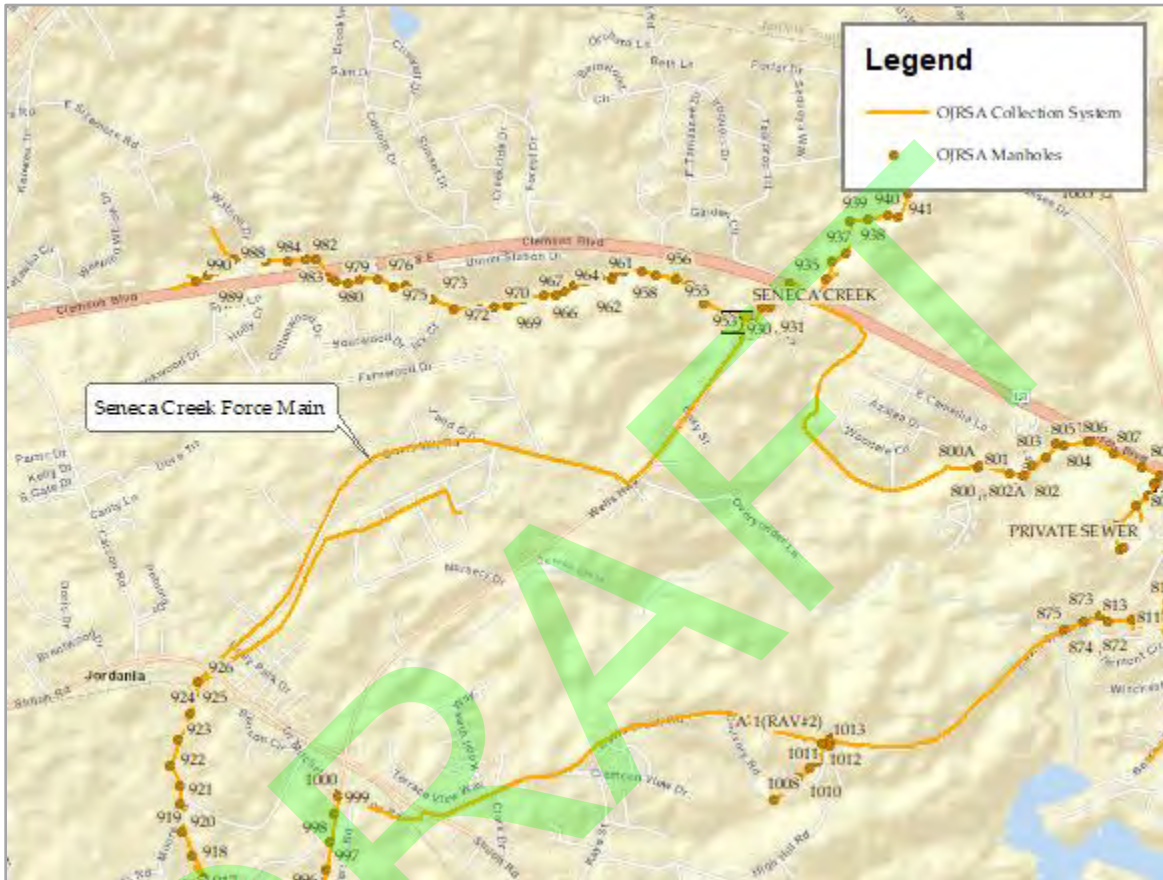


Figure 13. Project 12 Seneca Creek Force Main Evaluations

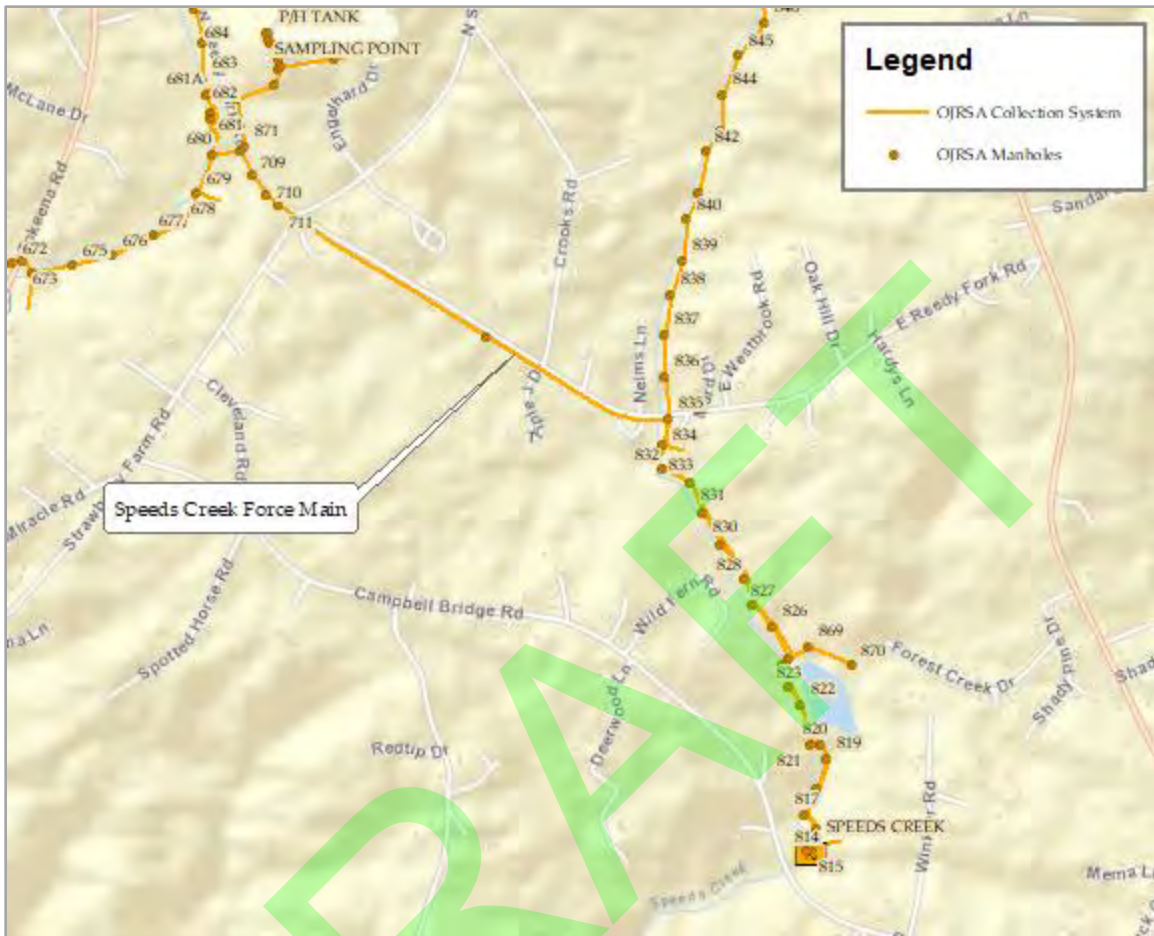


Figure 14. Project 13 Speeds Creek Force Main Evaluation

3.13 Project 13 Flat Rock Pump Station Rehabilitation

The Flat Rock Pump Station serves an area southwest of Walhalla and the Oconee County Detention Center. Recent drawdown tests indicate that the existing pumps are performing below the original design flow rate of 250 gpm. OJRSA plans to increase the capacity of this pump station to 300 gpm to relieve the stress on the sewer system in the area. Additionally, a large amount of debris enters the waste stream interfering with downstream wastewater operations including ragging and blockages at the pump station. By upgrading the pump station, the debris can be removed at the pump station prior to causing blockages in the waste stream.

The Flat Rock Pump Station Rehabilitation will include:

- ◆ Installation of a new wetwell
- ◆ Vertical Barscreen, compactor, and dumpster
- ◆ Duplex submersible pumps
- ◆ Permanent standby generator
- ◆ Demolition of existing wetwell, pump station structure, and radio communications towers
- ◆ Site work; including fencing, improved vehicle access, and water service

Flat Rock Pump Station Rehabilitation is expected to cost \$1,410,000 with engineering fees of \$130,000.

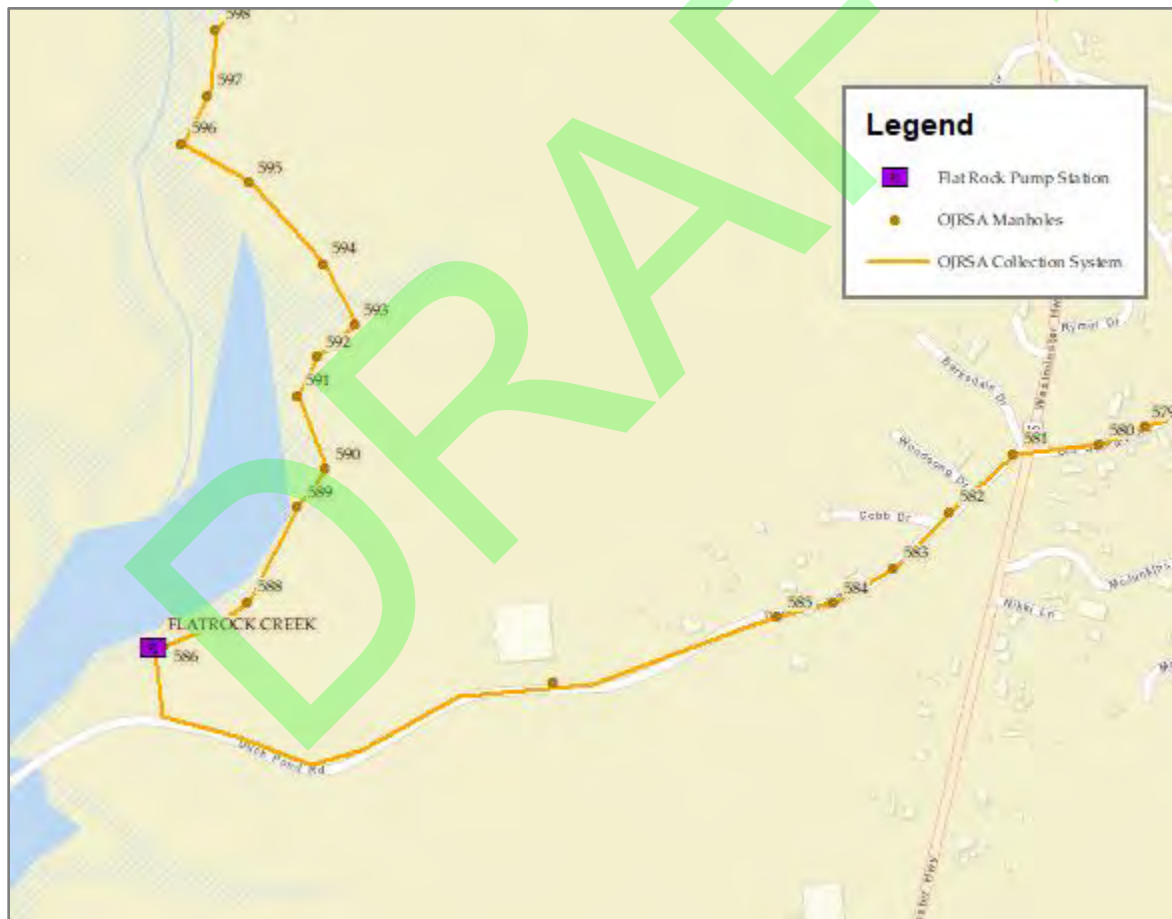


Figure 15. Project 13 Flat Rock Creek Pump Station

End of Section

4. Recommended Rehabilitation and Proposed Schedule

In summary, Table 5 includes a list of all the projects, the type of project, their expected costs, and their expected schedule.

Table 5 Summary of Projects				
Project	Project Type	Estimated Engineering Fees	Estimated Construction Costs	Estimated Completion Date
1	Rehabilitation	\$40,000	\$150,000	Summer 2024
1.c	Additional CCTV	\$15,000	\$62,000	Winter 2023
2	Rehabilitation	\$10,000	\$17,000	Summer 2024
3	Rehabilitation	\$15,000	\$21,500	Summer 2024
4	Rehabilitation	\$10,000	\$27,800	Summer 2024
5	Rehabilitation	\$12,000	\$15,900	Summer 2024
6	Rehabilitation	\$15,000	\$24,200	Summer 2024
7	Rehabilitation	\$12,500	\$17,000	Summer 2024
8	Additional CCTV	\$8,000	\$30,600	Winter 2023
9	Additional CCTV	\$13,000	\$43,500	Winter 2023
11	Evaluation	\$90,000	TBD	Winter 2023
12	Evaluation	\$60,000	TBD	Winter 2023
13	Flat Rock Pump Station	\$130,000	\$1,410,000	Winter 2024
		\$430,500	\$1,819,500	

Projects 1-7 are all rehabilitation projects of current known defects that do not require further evaluation. It is expected that these projects will be combined into one rehabilitation project. An extended timeline of 24 months is provided in order to account for funding cycles, supply chain difficulties, and contractor availability. Projects 8-12 and 1.c are for additional inspections and evaluations and will be bid at the same time as Project 1-7. Because this is not a design and construct project, a shorter timeline of 18 months is provided.

End of Section

5. Appendix A Budget Spreadsheets

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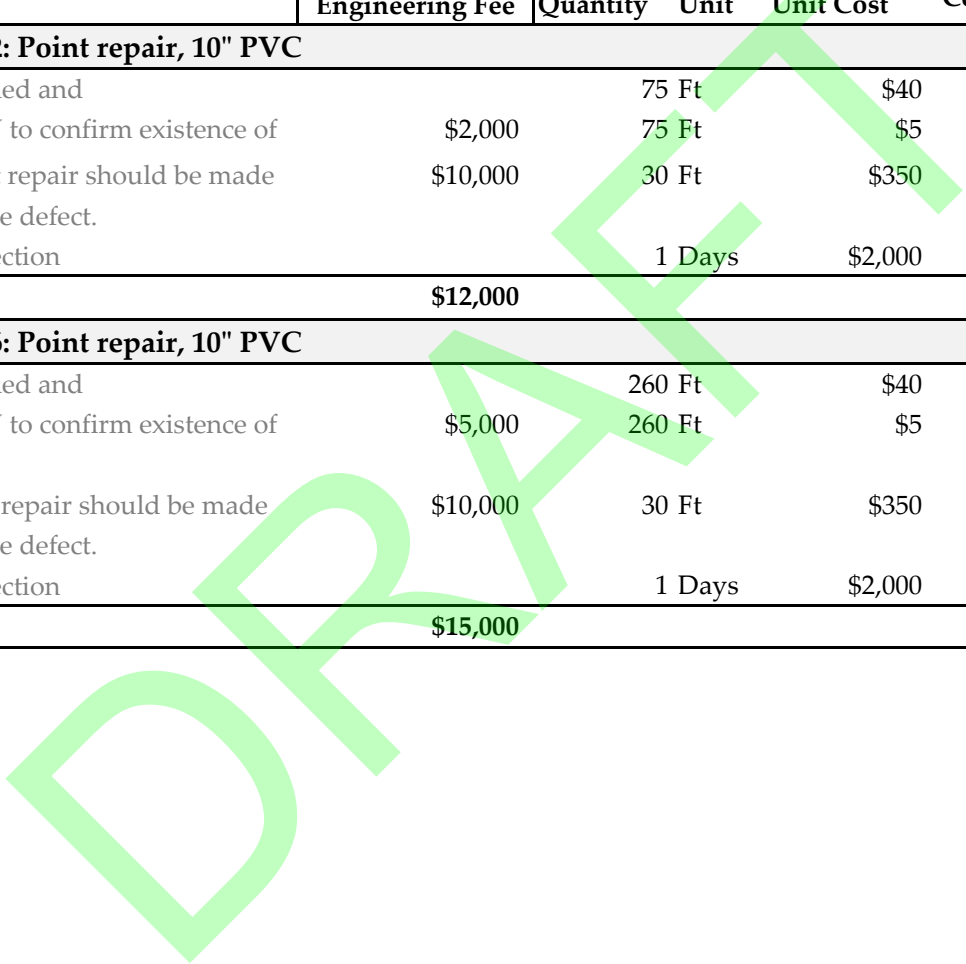
ID	Item Description	Estimated	Estimated Construction Costs			Estimated
		Engineering Fee	Quantity	Unit	Unit Cost	Construction Costs
CONSTRUCTION PROJECTS						
1	From MH 157 to MH 156 full removal and replacement of the 15" VCP pipe					
1.a.	Full removal and replacement of the 15" VCP pipe. Assuming RCP pipe to replace.	\$40,000	350	Ft	\$400	\$140,000
1.b.	Temporary Bypass of section			5	Days	\$2,000
Project Totals		\$40,000				\$150,000
1.c.	CCTV inspect VCP pipe segments upstream of MH 157 to determine if there are similar defects.	\$15,000	11,000	Ft	\$6	\$62,000
Project Totals		\$15,000				\$62,000
2	From MH 53 to MH 52: Point repair, 30" RCP					
2.a.	Point repair should be made on a sag within the line. During replacement, the surrounding soil shall be stabilized and the pipe shall be properly supported to prevent another possible sag.	\$10,000	30	Ft	\$500	\$15,000
2.b.	Temporary Bypass of section			1	Days	\$2,000
Project Totals		\$10,000				\$17,000



ID	Item Description	Estimated Engineering Fee	Estimated Construction Costs			Estimated Construction Costs
			Quantity	Unit	Unit Cost	
3	From MH 912 to MH 911: Point repair, 10"-PVC					
3.a.	Line shall be cleaned and cleared of all obstructions.		200	Ft	\$40	\$8,000
3.b.	Subsequently, CCTV should be performed to verify existence of a sag.	\$5,000	200	Ft	\$5	\$1,000
3.c.	If the defect does exist, a point repair should be made in the area to remedy the sag.	\$10,000	30	Ft	\$350	\$10,500
3.d.	Temporary Bypass of section		1	Days	\$2,000	\$2,000
Project Totals		\$15,000				\$21,500
4	From MH 30 to MH 29: Point repair, 30" RCP					
4.a.	this line should be cleaned and cleared of all obstructions.		270	Ft	\$40	\$10,800
4.b.	Additionally, a point repair should be made at the location of I/I.	\$10,000	30	Ft	\$500	\$15,000
4.c.	Temporary Bypass of section		1	Days	\$2,000	\$2,000
Project Totals		\$10,000				\$27,800



ID	Item Description	Estimated	Estimated Construction Costs			Estimated
		Engineering Fee	Quantity	Unit	Unit Cost	Construction Costs
5	From MH 913 to MH 912: Point repair, 10" PVC					
5.a.	this line should be cleaned and		75 Ft		\$40	\$3,000
5.b.	reinvestigated by CCTV to confirm existence of	\$2,000	75 Ft		\$5	\$400
5.c.	If the sag exists, a point repair should be made in the area to remedy the defect.	\$10,000	30 Ft		\$350	\$10,500
5.d.	Temporary Bypass of section		1 Days		\$2,000	\$2,000
Project Totals		\$12,000				\$15,900
6	From MH 897 to MH 896: Point repair, 10" PVC					
6.a.	this line should be cleaned and		260 Ft		\$40	\$10,400
6.b.	reinvestigated by CCTV to confirm existence of a possible sag.	\$5,000	260 Ft		\$5	\$1,300
6.c.	If the sag exists, a point repair should be made in the area to remedy the defect.	\$10,000	30 Ft		\$350	\$10,500
6.d.	Temporary Bypass of section		1 Days		\$2,000	\$2,000
Project Totals		\$15,000				\$24,200





ID	Item Description	Estimated Engineering Fee	Estimated Construction Costs			Estimated Construction Costs
			Quantity	Unit	Unit Cost	
7	MH 893 to MH 892: 10" PVC Line Cleaned/Reinvestigated by CCTV to Determine the Extent of Defects					
7.a.	this line should be cleaned and		100 Ft		\$40	\$4,000
7.b.	reinvestigated by CCTV to determine the extent of defects within the segment.	\$2,500	100 Ft		\$5	\$500
7.c.	If defects are confirmed within the segment, they shall be rehabilitated in the proper manner.	\$10,000	30 Ft		\$350	\$10,500
7.d.	Temporary Bypass of section		1 Days		\$2,000	\$2,000
Project Totals		\$12,500				\$17,000

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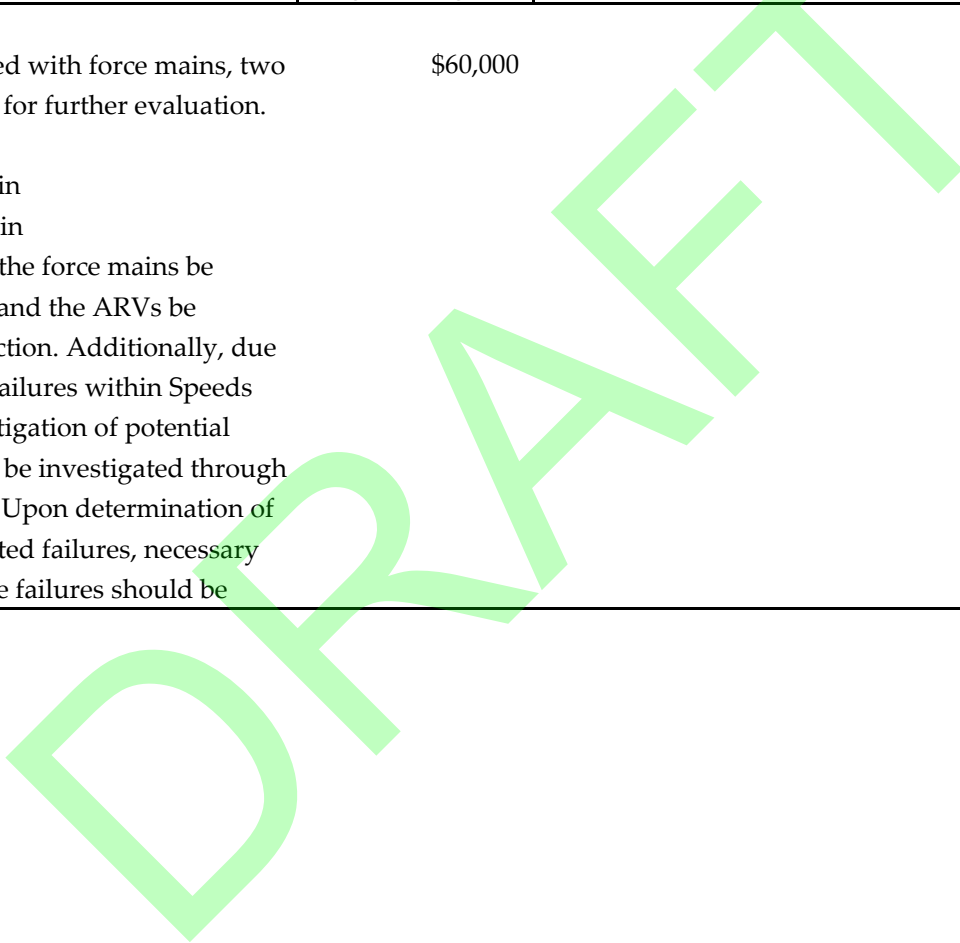


ID	Item Description	Estimated	Estimated Construction Costs			Estimated
		Engineering Fee	Quantity	Unit	Unit Cost	Construction Costs
STUDIES						
8	CCTV Evaluation from flow meter #8-375 upstream until the City of Westminster	\$8,000	5,000	Ft	\$6	\$30,600
9	CCTV Evaluation upstream of Choestoea PS until the City of Westminster (included as an area previously recommended by GMC. (#6 and #7))	\$13,000	9,000	Ft	\$5	\$43,500
11	Pump Station Drawdown Tests and Reports					
	Coneross Creek – High PS runtime	\$90,000				
	Perkins Creek – High PS runtime					
	Martin Creek – High PS runtime					
	Choestoea – High peaking factor					
	Flat Rock – High peaking factor					

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ID	Item Description	Estimated	Estimated Construction Costs			Estimated
		Engineering Fee	Quantity	Unit	Unit Cost	Construction Costs
12	<p>Force Main Evaluation</p> <p>Due to failures associated with force mains, two (2) lines were identified for further evaluation. They are listed below:</p> <ul style="list-style-type: none"> · Seneca Creek force main · Speeds Creek force main <p>It is recommended that the force mains be inspected for corrosion and the ARVs be assessed for proper function. Additionally, due to historical, repetitive failures within Speeds Creek force main, investigation of potential causes of failure should be investigated through a thorough assessment. Upon determination of the cause of these repeated failures, necessary actions to prevent future failures should be</p>	\$60,000				

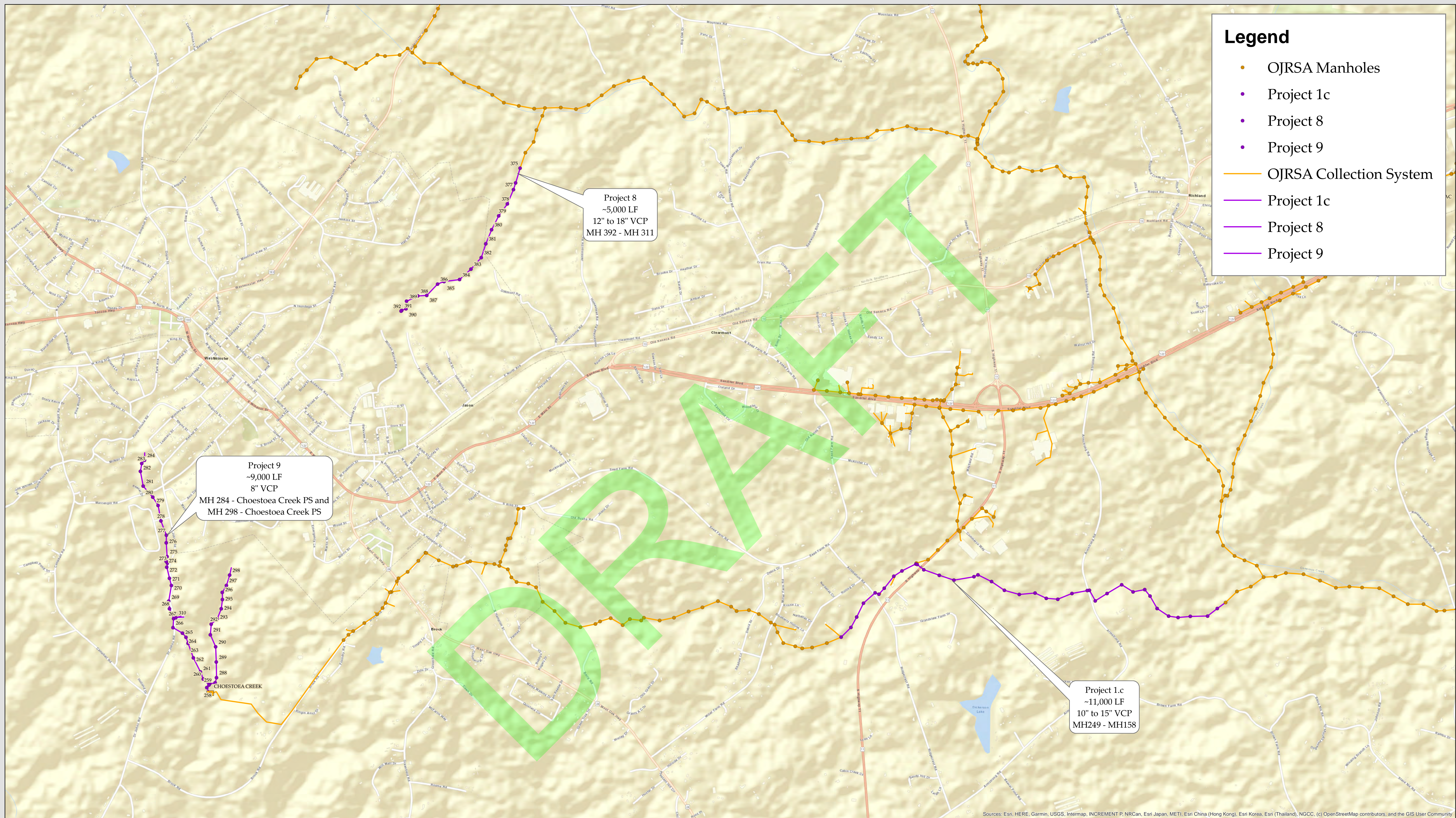




ID	Item Description	Estimated	Estimated Construction Costs			Estimated
		Engineering Fee	Quantity	Unit	Unit Cost	Construction Costs
13	Flat Rock Pump Station - Installation of a new wetwell - Vertical Barscreen, compactor, and dumpster - Duplex submersible pumps - Permanent standby generator - Improved vehicular access - Demolition of existing wetwell, pump station structure, and radio communications towers - Site work; including fencing, water service, etc. - Bypass pumping	\$130,000				\$1,410,000

NOTES

- 1 This is for budgetary purposes. Further detailed review will be necessary to finalize these estimates.
- 2 Cost efficiencies will be realized when multiple projects can be designed and bid at the same time.
- 3 Material costs are dynamic in these current market conditions and are our best estimates based on recent bid tabulations.
- 4 Force main analysis of data may conclude that full force main replacement is the best path forward.
- 5 Further discussions on funding these projects also may dictate when how you decide to package these projects, and when to execute them.



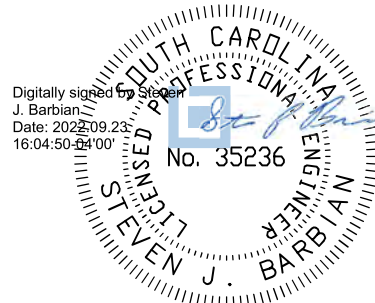
Oconee Joint Regional Sewer Authority

Comprehensive Management Plan: Operations, Maintenance, and Management



SEPTEMBER 2022

Prepared for:
Oconee Joint Regional Sewer Authority
623 Return Church Road
Seneca, South Carolina 29678



Digitally signed by J. Barbian
Date: 2022.09.23
16:04:50-04'00'

Prepared by:
WK Dickson & Co., Inc.
5 Legacy Park Road, Suite A
Greenville, South Carolina 29607
WKD # 20210552.00.GV



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1. Introduction

The Capacity, Management, Operations, and Maintenance (CMOM) Program outlined in this report was developed in response to Consent Order No. 21-025-W. The intent is to provide a process for the documentation of the condition of assets within the conveyance system and water reclamation facility (WRF) as well as prioritization of needed repairs.

1.1. Definitions

Basin – A smaller subset of the sanitary sewer system bounded by natural topography or sewer connectivity. By portioning off smaller subsets the utility can better monitor the condition of the sanitary sewer system and the performance of each basin.

Bypass – The intentional diversion of waste streams from any portion of a treatment facility.

Capacity Related Overflow – An overflow that occurs when a system is not able to convey all the wastewater to the treatment plant because of insufficient grade, pipe size, wet well size, pump capacity, force main size, or a design flaw and the overflow cannot be corrected through proper operation and maintenance.

Closed Circuit Television (CCTV) – used to identify and locate defects and other factors affecting the condition of the sanitary sewer system components.

Collection System – See definition for Conveyance System.

Combination Cleaners – Equipment that is most frequently used to flush and suction clean gravity sewer lines and manholes; often used to clear or collect wastewater and related debris from the sanitary sewer system.

Computerized Maintenance Management System (CMMS) – A workforce management system, that includes desktop management for dispatchers and GPS for crew location. Work orders may be directly sent to field crews through electronic communication to reduce response time. It also provides a place to input, store, and look up conditions of each portion of the sanitary sewer system.

Conveyance System – The network of gravity pipes, manholes, pumping stations, force mains, valves, and appurtenances associated with the transportation

of wastewater to the publicly owned treatment works (POTW). The conveyance system is considered to be a component of the POTW.

Corrosion – The deterioration of a material due to chemical reactions with its environment.

Critical Part – Any part of the utility’s collection, transmission, or treatment system for which the time required to acquire a replacement part would result in, or extend, a permit violation or a sanitary sewer overflow, including an un - permitted discharge. The replacement for a critical part is called a critical spare part.

Customer Service Program – The Utility’s program for responding to customer complaints which include a database program that electronically files customer complaints.

Discharge – Any release of untreated, partially treated, or treated wastewater or wastewater that is combined with stormwater or excessive I/I at any location other than the designated wastewater treatment plant discharge location.

Disruption of Service – Any damage, blockage, or repair work that results in an interruption of sanitary sewer service to a customer.

Dry Weather SSO – An SSO that is caused by flow restrictions or system disruptions, typically these occur in dry weather but can also be caused during wet weather conditions.

Emergency Standard Operating Procedures – The Utility’s procedure for responding to and mitigating SSOs.

Environmental Protection Agency (EPA) – United States Environmental Protection Agency.

Force Mains – A sanitary sewer line that is pressurized in order to convey wastewater from the pump station into a gravity main, or another pump station and force main.

Geographic Information System (GIS) – a software system that provides mapping services of the utility’s sanitary sewer system and other utility information.

Gravity Lines – The portion of the Utility’s sanitary sewer system that uses changes in elevation to convey wastewater.

Impacted Areas – Areas that have been affected by an SSO or discharge.

Infiltration – Water other than wastewater that enters a sewer system (including sewer service connections and foundation drains) from the ground through such means as defective pipes, pipe joints, connections, or manholes.

Inflow – Water other than wastewater that enters a sewer system (including sewer service connections) from sources such as, but not limited to, roof leaders, cellar drains, yard drains, area drains, drains from springs and swampy areas, manhole covers, cross connections between storm sewers and sanitary sewers, catch basins, cooling towers, storm waters, surface runoff, street wash waters, or drainage.

Inflow and Infiltration (I/I) – A summation of inflow and infiltration that has no distinction.

Manhole Assessment Certification Program (MACP) – A standardized manhole inspection procedure and form provided by NASSCO.

Manhole – The main access point to the sanitary sewer system as well as a point of connection for gravity lines, private laterals, or force mains.

Member City or Member Cities – Municipalities that are parties as included in the “Inter-Municipal Agreement and Joint Resolution Creating a Joint Authority Water and Sewer System” as filed with the Clerk of Court of Oconee County as of October 31, 2007, which are the cities of Seneca, Walhalla, and Westminster.

Monitored Locations – The location of installed flow monitors meant to identify wet weather problems, SSOs, and general flow conditions in the area.

Municipal or Municipality – A city, town, borough, county, parish, regional district, nonprofit, association, or other public body created by or under state law and having jurisdiction over disposal of sewage, industrial wastes, or other wastes, or an Indian tribe or Indian Tribal organization, or a designated and approved management agency under section 1288 of the CWA (33 U.S.C. § 1362 (4) and 40 CFR 122.2).

NASSCO – National Association of Sewer Service Companies.

OJRSA – Oconee Joint Regional Sewer Authority.

Operations and Maintenance Related Overflow – An overflow that occurs when an adequately designed and sized system that is well operated is not able to convey all the wastewater to the treatment plant because of poor maintenance. An overflow that occurs when an adequately designed and sized system that is well maintained is not able to convey all the wastewater to the treatment plant because of poor operation.

Pipeline Assessment and Certification Program (PACP) – Standard inspection and documentation procedure for pipelines.

Pump Station – A mechanical method of conveying wastewater to higher elevations.

Rainfall-Derived Infiltration and Inflow (RDII) is the increased portion of water flow in a sanitary sewer system that occurs during and after a rainfall as a source of operating problems in sanitary sewer systems. RDII is the main cause of sanitary sewer overflows (SSO) to basements, streets, or nearby receiving waters.

Rainfall Induced Infiltration (RII) – The portion of the infiltration (flows coming from infiltration sources) that enters the sewage system during and immediately after rainfall events. Rainfall induced infiltration does not include inflow.

Regional Collection and/ or Treatment System – A collection system or treatment system that accepts wastewaters from satellite collection systems. The OJRSA is a Regional Collection and/or Treatment System.

Sanitary Sewer – A conduit intended to carry wastewater from residences, commercial buildings, industrial plants, and institutions together with minor quantities of ground, storm, and surface waters that are not admitted intentionally, to wastewater treatment facilities.

Sanitary Sewer Overflow (SSO) – A sanitary sewer overflow is an overflow, spill, release, or diversion of wastewater from a sanitary sewer system. Sanitary sewer overflows include overflows or releases of wastewater that reach navigable waters, overflows or releases of wastewater that do not reach navigable waters, wastewater backups into buildings that are caused by blockages of flow conditions in a sanitary sewer other than a building lateral. Wastewater backups

into buildings caused by a blockage or other malfunction of a building lateral that is privately owned is not a sanitary sewer overflow.

Sanitary Sewer System – An infrastructure system including private laterals, gravity mains, manholes, pump stations, force mains, and wastewater treatment plants that collect, convey, transmit, and treat residential, commercial, and industrial wastewater.

Satellite Collection System – A collection system that is owned and operated by one entity that discharges to a regional collection and/or treatment system that is owned and operated by a different entity. Satellite collection systems can be publicly or privately owned and depend on a separate entity for wastewater treatment and discharge. Such systems *may* be issued a Satellite Sewer System permit by SCDHEC. Examples of publicly owned satellite sewer collection systems served by the OJRSA include the municipalities of Seneca, Walhalla, Westminster, West Union, and Oconee County. Privately owned examples are Royal Acres Mobile Home Park and Pelham Creek Apartments.

SCADA – Supervisory Control and Data Acquisition, which is a system of software or other such applications that allow for controlling and monitoring treatment and collection system processes remotely.

SCDHEC – South Carolina Department of Health and Environmental Control

SOP – Standard Operating Procedure- Steps defined by the organization that are to be followed by trained personnel in order to successfully complete an operating activity or task.

Structural Sanitary Sewer Overflows – Overflows that are a result of structural failures such as collapses of force mains, gravity sewers, and manholes.

Suspicious Substance – Any substance or material not normally found in a wastewater system including but not limited to caustic substances or fuel.

Unpermitted Discharge – The discharge of wastewater containing pollutants to the navigable waters directly or by way of the storm drainage without obtaining a proper NPDES Permit.

Utility – Oconee Joint Regional Sewer Authority

Wet Weather SSO – A discharge of untreated wastewater that has mixed with excessive amounts of I/I to cause an overflow of the sanitary sewer system.

1.2. Utility Information

The Utility provides services to five municipal satellite collection system customers – Seneca, Walhalla, Westminster, West Union, and Oconee County – as well as several privately owned satellite collection systems. The majority of flow treated at the Concross Creek Water Reclamation Facility (WRF) is conveyed through transmission lines from the three satellite collection systems. Most of the collection systems are owned and operated by each of the municipalities that are served by the satellite systems.

OJRSA owns roughly 71 miles of conveyance mains with 56 miles of gravity sewer and 15 miles of force mains being served by 16 pump stations. These conveyance mains convey the wastewater from each of the satellite collection systems to the wastewater treatment plant which currently has capacity to treat 7.8 million gallons per day (MGD).

The Utility will soon begin operating a retail sewer collection system in the southern portion of Oconee County that will serve the Interstate 85 corridor and Fair Play community.

1.3. Program Elements

The Utility's CMOM Program has ten main components:

- ◆ Financial Plan,
- ◆ Personnel Evaluation,
- ◆ Pump Station Inspection and Maintenance Program,
- ◆ Sewer Inspection and Cleaning Program,
- ◆ Inflow and Infiltration Evaluation Program,
- ◆ Manhole Inspection Program,
- ◆ Documentation and Records,
- ◆ Easement/ROW Maintenance Program,
- ◆ Sewer Use and Grease Regulation, and
- ◆ Spare Parts and Equipment Inventory.

Each of these programs utilize specific tools and methods to assess the condition of the respective attribute. The results of these assessments are then entered into the Utility Cloud and used to develop a list of priorities for repairs, rehabilitations, replacements, and capital improvement projects.

1.4. List of Priorities

The CMOM Program incorporates system wide information into the list of priorities for repair, rehabilitation, replacement, and capital improvement projects based on the following factors:

- ◆ Extent of damage or defect,
- ◆ Consequences of potential failure,
- ◆ Proximity to other defects,
- ◆ Relation to pipe segments in the Predictive Cleaning Program,
- ◆ Potential to contribute to SSO, and
- ◆ Number of odor complaints.

These factors will be used to rank each asset with the most dramatic defects and the most severe consequences of failure receiving the highest priority. Each year the priorities should be reassigned based on updated information collected from the previous year's assessments and inspections. Supporting information for the list of priorities comes from assessments, inspections, and evaluations completed as part of the Pump Station Inspection and Maintenance Program, Sewer Inspection and Cleaning Program, Inflow and Infiltration Evaluation Program, Manhole Inspection Program, as well as any other maintenance and repair history.

1.5. Performance Goals

The goal of the CMOM is to monitor and document the conditions of the various components of the sanitary sewer system and assign priorities to necessary repairs, rehabilitation, replacement, and capital improvement projects to transfer the maintenance efforts from reactive to proactive. The goal is to keep the list of priorities updated, including inspecting manholes and gravity sewers at least once every ten years, pump stations once every year, and force mains at least once every five years, while checking all potential corrosion defect areas annually. Information should be entered directly into a tracking database, so that at any point a report may be generated detailing the progress towards those goals.

1.6. Resources

The CMOM will require the use of many internal and some external resources. A complete list of resources that are available is included in Appendix A. These resources include manhole inspections, smoke testing, dye testing, CCTV inspections, gravity system defect analysis, corrosion defect analysis, pump station inspections, flow monitoring, and SL-RAT assessment. These tests, inspections, and assessments are part of the Utility's efforts to proactively address conveyance system issues before they result in SSOs.

In some instances, it may be more beneficial for the Utility to hire a third party to conduct asset inspections to allow the Utility's personnel more time to address other aspects of the CMOM Program. Any party internal or external conducting asset tests, inspections, or assessments on behalf of the Utility is expected to perform to the standards described herein.

End of Section

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2. Financial Plan

Oconee Joint Regional Sewer Authority owns and operates a collection system that receives its flow solely from satellite collection systems. Their user rates are not based on a cost per volume of wastewater treated but based proportional to flow received, which is referred to as the “pro rata share” revenue model. The user rates are the primary source of revenue for the Utility.

The annual budget is developed by both the Executive Director and Department Heads for Administration, Systems Operations, Reclamation Facility, Pretreatment, Laboratory, Contract Operations, and Capital Improvements. The Department heads develop a budget for their department based on the previous year’s operational budget and adding and subtracting one-time expenses as necessary. One-time expenses may include major equipment purchases, training events, conferences, and capital improvement projects. Once budget negotiations between the Department Heads and Executive Director are complete, the Executive Director submits the budget to the Board of Commissioners for approval.

Once the budget is approved, the user fees are developed using a pro rata share – meaning that the annual budget is divided among the satellite collections systems based on the proportion of the total flow received at the Coneross Creek Wastewater Treatment Facility. If a satellite system contributes 45% of the flow to the WRF, then they will be billed for 45% of the annual budget. The annual rate is distributed evenly across a 12 month calendar.

Because the annual budget is the basis for the next year’s budget and user fees, it is important to ensure that the expenses throughout the year are tracked and are used in conjunction with what was originally budgeted. This assessment has both an operational and budgetary benefit. By comparing the original budget to actual expenses each department may become aware of the changing trends which may indicate aging infrastructure, change in the wastewater characteristics, increase in chemical usage. The budgetary benefit is that the Department Head will keep in touch with current cost trends and how well each department operates within their budget.

It was recommended by Willdan Financial Services and First Tryon Financial Advisors in 2021 to raise rates by February 1, 2022 and implement additional 20% rate increases

over the next four fiscal years.¹ A 20% rate increase was implemented by the Board on March 1, 2022 but one was not approved for Fiscal Year 2023 (beginning July 1, 2022).

End of Section

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¹ OJRSA Finance & Administration Committee Meeting minutes, December 13, 2021.

3. Personnel Evaluation

The Utility is responsible for the operations and maintenance of the conveyance system and the Coneross Creek WRF. The EPA provides guidelines² for the number and type of personnel a utility should keep on staff in order to best maintain their assets; however, the OJRSA is unlike most other wastewater providers because it operates. These recommendations are based on several factors including:

- ◆ Population served
- ◆ Treatment capacity
- ◆ Number and types of equipment

3.1. Frequency and Type of Evaluation

We recommend that utility staffing requirements are re-evaluated as capacity changes, and as technology improves for remote monitoring and control. Having the appropriately trained and appropriate number of staff on hand ensures that maintenance is kept up while also being able to safely respond to emergencies.

Three types of evaluations may need to be conducted: one for the office/administrative staff, one for the conveyance system, and one for the WRF. Each will depend on the recent changes that need to be accounted for in a potential change in staffing.

OJRSA has completed a comprehensive review of the staff and estimated tasks needing completed. The full matrix of the assessment is included in Appendix B. OJRSA is in the process of adding additional remote, retail customers to the system. The staffing needs for that expansion is included in this analysis.

3.2. Evaluation for Office and Administrative Staff

OJRSA currently has four office staff. There are an estimated 11,325 man-hours of work that need completed by office and administrative staff. Each OJRSA staff is schedule for 1,800 hours per year after holidays, sick time, and personal time off. This equates to needing 6 full time staff in these roles.

The largest tasks that are not fully covered are Fats, Oils, and Grease (FOG) inspections and engineering oversight for the planned retail sewer expansion. These tasks will be covered by the two new positions of Engineering Project Manager and FOG and

² "Estimating Staffing for Municipal Wastewater Treatment Facilities" as published by US EPA, March 1973.

Engineering Inspector. The office and administrative staffing breakdown is summarized in Table 3-1 below.

Table 3-1 Office and Administrative Staff

Position	Current	Needed
Executive Director	1	1
Operations Director	1	1
Engineer/Project Manager	0	1
FOG and Engineering Inspector	0	1
Office Manager	1	1
Records Clerk	1	1
Total	4	6

3.3. Evaluation for Conveyance System Staff

OJRSA currently has seven conveyance system staff. There are an estimated 17,629 man-hours of work that need completed by conveyance system staff. Each OJRSA staff is schedule for 1,800 hours per year after holidays, sick time, and personal time off. This equates to needing 9-to-10 full time staff in these roles. The additional staffing will include a Conveyance System Supervisor, a Senior Maintenance Technician, and another Maintenance Technician. The maintenance department covers both the pump station maintenance as well as the maintenance needs at the WRF. The conveyance system staffing breakdown is summarized in Table 3-2 below.

Table 3-2 Office and Administrative Staff

Position	Current	Needed
Conveyance System Supervisor	0	1
Conveyance System Crew Leader (Tech III)	0	1
Conveyance System Tech II/I	2	1-to-2
Maintenance Supervisor	1	1
Maintenance Senior Tech (Tech III)	0	1
Maintenance Tech II/I	4	4
Total	7	9-to-10

3.4. Evaluation for Wastewater Treatment Plant Staff

OJRSA currently has five wastewater treatment plant staff. There are an estimated 10,247 man-hours of work that need completed by treatment plant staff. Each OJRSA

staff is schedule for 1,800 hours per year after holidays, sick time, and personal time off. This equates to needing 5.5 full time staff in these roles. It is anticipated with the implementation of increased automated controls through SCADA software at the WRF, some of the tasks may be reduced in the near future. OJRSA may be able to maintain the current staffing level of five staff.

The lab analysis work is subcontracted out and not performed by OJRSA staff at this time; however, the Utility has a fully functional laboratory that can be used to perform these functions internally for the agency with the proper staffing. The maintenance at the treatment plant is performed by the conveyance system staff. The water reclamation facility staffing breakdown is summarized in Table 3-3 below.

Table 3-3 Office and Administrative Staff

Position	Current	Needed
Water Reclamation Supervisor	1	1
WRF Senior Operator	2	2
WRF Operator II/I	2	2
Maintenance Tech II/I	0	1
Lab Analyst ³	0	1
Total	5	7

End of Section

³ The OJRSA began contracting out lab services on July 1, 2022; however, they retained the position and agency administration have elected not to fill it at this time. If the Utility decides in the future to bring laboratory services inhouse once again, they should assess their needs based on parameters listed in their NPDES permit and process control functions. Before performing any compliance sampling for reporting to SCDHEC, they will need to have their lab recertified for the necessary parameters prior to submitting analysis reports.

4. Pump Station Inspection and Maintenance

A Pump Station Inspection and Maintenance Program (PSIMP) is a crucial component to the success of a wastewater collection system. The PSIMP has several primary responsibilities:

- ◆ Ensures all pump stations are maintained in a reliable and ready condition,
- ◆ Outlines a routine inspection and preventive maintenance schedule, and
- ◆ Provides the appropriate checklist or form for pump station inspection or preventive maintenance.

4.1. Previous OJRSA Pump Station Inspection Procedure

Oconee Joint Regional Sewer Authority (OJRSA) operates and maintains sixteen (16) sanitary sewer pump stations throughout Oconee County. OJRSA performs pump station inspections on a weekly, monthly, quarterly, and annual basis. The frequency and type of inspections needed at each pump station is determined on a station-by-station basis that considers such factors as age, operating history, size and potential for negative environmental impact. Operations Department personnel perform inspections and the majority of the preventive and minor corrective maintenance tasks. Major electrical, mechanical and instrumental maintenance is contracted out as needed.

Routine pump station inspections are conducted by Operations Department personnel to check station operation. Inspection functions include looking and listening for malfunctioning equipment, observing wear/tear and checking standard operation. Care functions performed during inspections include cleaning, lubrication, exercising, and adjusting equipment.

The following is a narrative description of the Sewage Pump Station Inspection system as outlined in the OJRSA flow chart presented in Figure 3-1:

1. The Maintenance Supervisor schedules pump station inspection teams and determines assignments. If applicable, after initial assignment, inspection scheduling can be handled by OJRSA's chosen computerized maintenance management system (CMMS).

2. The inspection teams utilize the appropriate inspection form based on the type of inspection they are doing:
 - a. Weekly / Monthly / Quarterly / Annual inspection of an aboveground pump station
 - b. Weekly / Monthly / Quarterly / Annual inspection of generator at an aboveground pump station
 - c. Weekly / Monthly / Quarterly / Annual inspection of a belowground pump station with generator
3. Each team performs the tasks and inspections applicable to their specific pump stations. The inspectors are responsible for filling the inspection forms.
4. If immediate action is required, the inspector notifies the Operations Director and Maintenance Supervisor. If applicable, the appropriate measures can be taken within OJRSA's CMMS to note what actions were taken to solve the problem.
5. Before leaving the pump station, the inspectors record station information on the inspection form and in the station logbook including: observations, action taken, and station elapsed time meter readings.
6. The inspection form is routed to the appropriate supervisor for review and logged in the CMMS.
7. If additional maintenance is required as a result of the findings of the inspection, the Maintenance Supervisor or his/her designee will generate the appropriate work orders. If applicable, work orders can be generated and maintained within OJRSA's CMMS.
8. If the maintenance items can wait until the next scheduled preventive maintenance date, or if a work order to address the item is already open, the Operations Director or Maintenance Supervisor cross-references the maintenance item noted in the inspection with the existing work order.

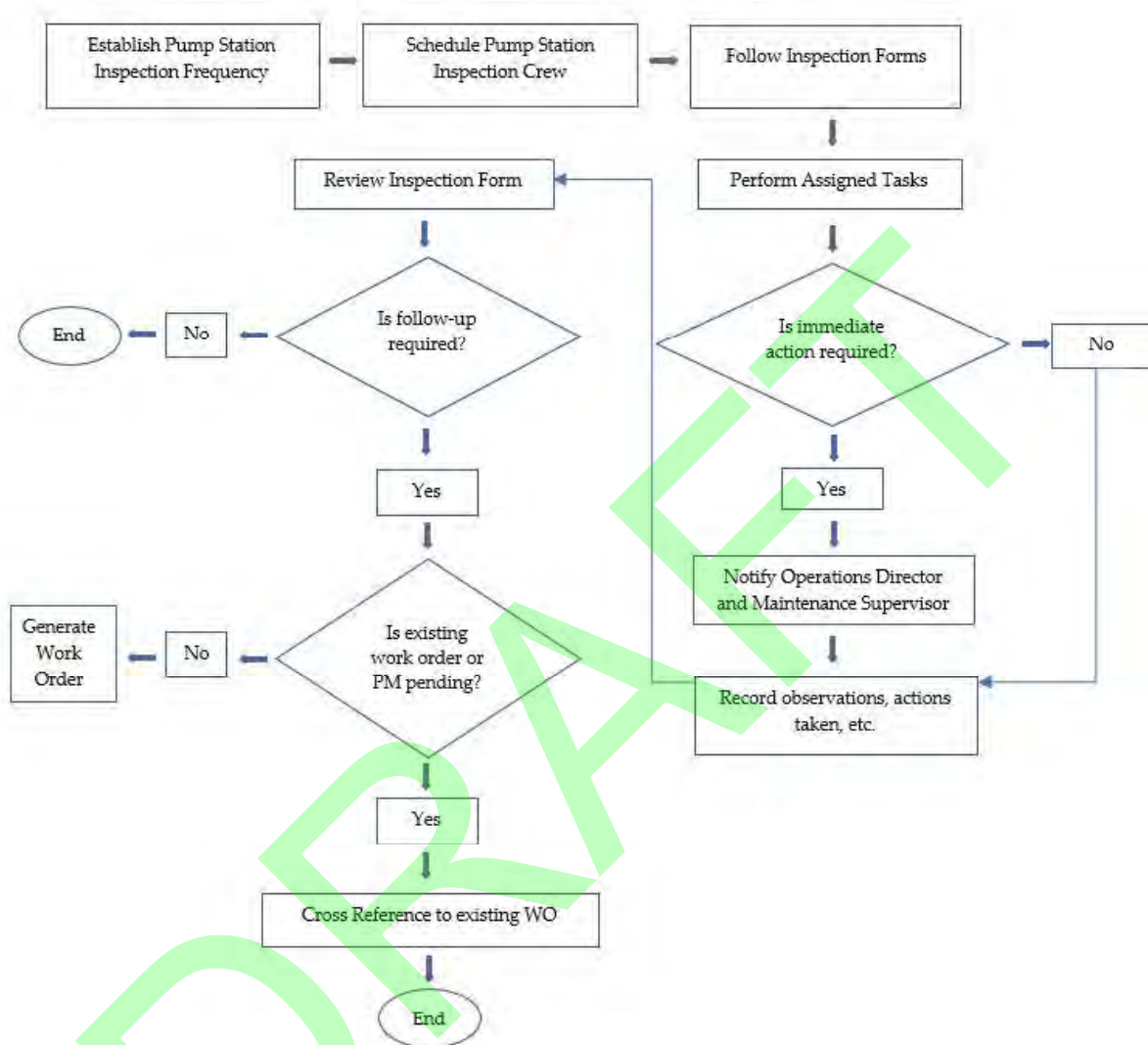


Figure 3-1 Operations Department Pump Station Inspection Flow Chart

Pump station maintenance inspectors follow a comprehensive checklist on an inspection form that is included in Appendix C.

The following is an outline of the general inspection tasks that should be performed and documented. Not all of these tasks are included on the inspection forms, but they should each be performed according to the schedule below.

Weekly:

- ◆ Visually inspect the access road and station for vandalism,
- ◆ Clean up trash and debris material,
- ◆ Record pump hours for each pump,
- ◆ Inspect and wash down wet well,
- ◆ Place pump controls back into auto position prior to leaving station,
- ◆ Visually inspect generator for fuel and ability to operate properly, and
- ◆ Complete all required paperwork/inspection forms.

Monthly:

- ◆ Operate pumps during generator operation to test load on generator,
- ◆ Hose/clean dry/well, if available,
- ◆ Transfer stand-by generator,
- ◆ Check and lube pressure relief valve,
- ◆ Operate and exercise all valves,
- ◆ Check emergency lighting,
- ◆ Check grass and cut,
- ◆ Clean battery tops and remove fill caps (wear eye protection and keep acid off hands and clothing),
- ◆ Maintain and clean rain gauges,
- ◆ Service battery cells with water, and
- ◆ Complete all required paperwork/inspection forms.

Quarterly:

- ◆ Lubricate pump bearings,
- ◆ Lubricate exhaust fan bearings,
- ◆ Lubricate U-joint, if available,
- ◆ Exercise all valves, and
- ◆ Complete all required paperwork/inspection forms.

Annually:

- ◆ Lubricate electric pump motors,
- ◆ Change generator oil,
- ◆ Perform a pump drawdown test, and
- ◆ Complete all required paperwork/inspection forms.

It is also important to keep detailed records of pump station visits and to file these records in an easily accessible location. Each inspection should be recorded in the logbook of the appropriate pump station and the associated report should be filed within OJRSA's CMMS, or an organized, hardcopy filing system.

4.2. Pump Station Preventive Maintenance

Preventive Maintenance (PM) is scheduled inspection and work performed to prevent equipment breakdown, reduce wear, improve efficiency, and extend the life of the equipment. The key to successful preventive maintenance is proper scheduling.

A schedule listing the PM and inspection frequency should be maintained at each pump station, as well as within OJRSA's CMMS. If applicable, the CMMS could also notify OJRSA when preventive maintenance is due based on programmed characteristics within the software.

PM should include both inspection and care activities and should be done in addition to the functions performed in pump station inspections. The preventive maintenance schedule should be based on manufacturers O&M manuals, pump station performance history, and corrective maintenance issues identified. PM activities typically include, but are not limited to the following:

- ◆ Visual inspection,
- ◆ General equipment inspection, cleaning, and lubrication as needed, and
- ◆ Check wet wells for floatables, grease, grit, and properly performing sensors/alarms.

4.3. Safety Considerations

It is important that all OJRSA staff conduct day-to-day tasks and activities safely through a combination of knowledge and awareness. Multiple hazards exist in the

performance of an employee's routine daily tasks and work assignments. Far more dangers prevail when conducting inspections and maintenance on sewage pump stations.

The following are some of the more common hazards to consider:

- ◆ Slips/falls,
- ◆ Strains/ruptures,
- ◆ Falling objects,
- ◆ Poisonous or toxic gases,
- ◆ Infections and infectious diseases,
- ◆ Confined space entry procedures and permit requirements, and
- ◆ Electrical shock and arc flash.

To combat these known risks and be prepared for unknown dangers, OJRSA should ensure the following:

- ◆ A minimum two-man crew should be utilized to conduct pump station inspection and maintenance, including during afterhours responses to emergencies;
- ◆ Employees entering a confined space must be trained and follow proper protocols including atmospheric monitoring and obtaining an entry permit;
- ◆ Wear appropriate Personal Protective Equipment (PPE) – hardhats, safety shoes, vests, gloves, ear plugs, harnesses, monitoring equipment, etc.; and
- ◆ Operation and maintenance activities on electrical equipment must be performed by a qualified electrician.

End of Section

5. Sewer Inspection and Cleaning Program

A Sewer Inspection and Cleaning Program (SICP) keeps a wastewater collection system operating efficiently by:

- ◆ Determining the condition of the sewer so lines can be repaired or replaced as necessary,
- ◆ Helping prevent blockages and backups, and
- ◆ Removing built-up debris, such as tree roots, grease, grit and sand.

5.1. Sewer Cleaning

Sewer system cleaning is used to remove accumulated material from the sewer. Cleaning helps to prevent blockages and is also used to prepare the sewer for inspections. Sewer cleaning is a process that is more often used on gravity lines. There are two main explanations for the lack of cleaning in force mains: 1) it is not usually practical to take a force main out of service; and 2) because force mains operate under pressure, they are less likely to experience buildup and blockages. In order to be proactive, however, both force mains and gravity mains will be cleaned on a routine basis as part of the SICP.

Blockages in gravity sewers are usually caused by a structural defect, poor design, poor construction, an accumulation of material in the pipe (especially grease), or root intrusion. Additionally, if the flow is less than 2 feet per second, grit and solids can accumulate leading to potential blockages.

Most operational defects, such as roots, sediment, fats, oils, and grease, reduce the hydraulic capacity of the pipe. Sewer cleaning and source control activities are directed toward preventing or reducing the impacts of operational defects on the collection system. Preventive cleaning is a better approach than reactive cleaning, and routine, planned sewer cleaning is crucial to maintaining clear lines and preventing potential blockages from occurring.

There are two key components to the cleaning portion of the SICP: The Predictive Cleaning (PC) Program and the Comprehensive Cleaning Program.

5.1.1. Predictive Cleaning (PC) Program

The Predictive Cleaning (PC) Program is an asset specific preventative maintenance approach for proactively addressing known operational issues. Line segments are added to the PC Program when they require more frequent cleaning than the other line segments in the collection system in order to maintain hydraulic capacity. Information from SSO records and CMOM inspection, tests, and assessments need to be used to determine which pipe segments will be added to the PC Program and which ones will continue to be included. This information may include a list of SSOs or Building Backup locations, and notes from condition assessment of gravity lines. Once the need for more frequent cleanings is reduced and the cause of previous blockages is removed, the line segments can be removed from the Predictive Cleaning Program and cleaned according to the schedule within the Comprehensive Cleaning Program.

While in the PC Program, lines will be cleaned using the same methods outlined in the Comprehensive Cleaning Program. Each line segment included in the program will be evaluated, and the appropriate cleaning method will be applied to address the operational issues at hand.

5.1.2. Comprehensive Cleaning Program

The Comprehensive Cleaning Program will utilize scheduled cleaning to maximize the operational capacity of the wastewater collection system by reducing debris buildup, grease, and root intrusion. The cleaning done as part of this program will be completed in addition to any cleaning performed by the Predictive Cleaning Program and will be executed as outlined in Table 5-1.

Table 5-1 Comprehensive Cleaning Schedule

Description	Frequency
Comprehensive Cleaning	Entire system cleaned in 10 years (maximum) then repeat process beginning with the first portion of system cleaned. The Comprehensive Cleaning process is to be performed and repeated indefinitely.
Mechanical Root Abatement	As determined by inspection/condition assessment
Chemical Root Abatement	As determined by inspection/condition assessment

Predictive Cleaning	As determined by inspection/condition assessment and outlined in the PC Program
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As shown in Table 5-1, there are several methods that can be utilized for sewer cleaning:

1. Hydraulic Cleaning (flushing) – any application of pressurized water to clean the pipe.
2. Mechanical Cleaning – use of a physical device to scrape, cut, or pull material from the sewer.
3. Chemical Cleaning – use of a chemical additive to facilitate the control of odors, grease buildup, root growth, corrosion, and insect and rodent infestation.

Hydraulic cleaning will be the primary method utilized by OJRSA in their scheduled cleanings. OJRSA will employ a crew to conduct routine cleanings of each segment according to the 10-year schedule. It typically takes a minimum of 3 staff to perform cleaning functions; however, it is best performed with 4.

Mechanical and chemical cleaning will be performed on an as-needed basis dependent on the findings of routine system inspections. Segments that are subject to more extensive root intrusion and grease buildup will be treated with the appropriate cleaning method to resolve the operational issue/ defect. ***IMPORTANT NOTE: Chemical cleaning should be done with care and in conjunction with the Operations Director and Water Reclamation Supervisor. There are many chemicals that can be extremely toxic to the biological processes performed at the water reclamation facility, which can lead to permit violations and environmental harm!***

Regardless of the method of cleaning performed, specific information will be documented. Cleaning forms, or records, will at a minimum include the following information:

- Date of cleaning,
- Location and identification of line cleaned,
- Pipe size and material,
- Name of personnel performing cleaning,
- Distance cleaned,

- Any obstacles encountered during cleaning, and
- How many passes were needed to properly clean the pipe.

Proper, in-depth documentation of cleanings will allow OJRSA to ensure that they are following the cleaning schedule set forth within this SCIP. Detailed documentation will also aid OJRSA in recognizing trends that may warrant adding a pipe segment to the PC Program.

5.2. Sewer Inspection

In addition to sewer cleaning, sewer inspection is a key component of a wastewater collection system operating successfully. Sewer inspection can range from visual checks to flow monitoring, to closed circuit television (CCTV).

Visual inspection of manholes and sewer lines are the first line of defense in the identification of existing or potential problem areas. Visual inspections can be performed on manholes and on above grade (or exposed) force mains and gravity mains. These inspections should take place on both a scheduled basis and as part of any preventive or corrective maintenance activities.

In addition to exterior visual inspections, there are a number of inspection techniques that may be employed to inspect the interior of a sewer system. Regardless of the technique chosen, it is important that inspection records contain key characteristics and information, including but not limited to the following:

- ◆ Location and identification of line being inspected,
- ◆ Pipe size and material,
- ◆ Name of personnel performing inspection,
- ◆ Distance inspected,
- ◆ Cleanliness of the line,
- ◆ Pipe defects identified from starting point to ending point of inspection, and
- ◆ Results of inspection, including estimates of I/I.

5.2.1. Gravity Main Inspection

Every segment of gravity sewer will be inspected at least once every ten years by CCTV inspections in accordance with NASSCO's Pipeline Assessment

Certification Program (PACP), which should be performed in conjunction with the Comprehensive Cleaning Program. While the PACP inspection focuses on the results of CCTV, additional assessments may include flow monitoring, smoke testing, dye testing, and SL-RAT inspections.

Flow monitoring results may be used to assess flow conditions and identify large sources of I/I. Smoke testing of sewer lines can also identify a range of I/I sources and can be conducted simultaneously with smoke testing of manholes and private laterals. Dye testing is typically a follow-up test to sources of I/I identified by smoke testing. In these cases, it is used to confirm a source as I/I. Once a source of I/I is confirmed by dye testing, it is inspected with CCTV to determine the extent of the problem.

It is important to note, however, that regardless of any identified problems, defects, or damages, or the lack thereof, all gravity sewer lines should be inspected by CCTV at least once every ten years.

5.2.1.1. Flow Monitoring

Flow monitoring is an important tool in the management of wastewater flows. Data collected from flow monitoring is analyzed for the following uses:

- ◆ Determining dry and wet weather flows,
- ◆ Prioritizing areas for rehabilitation,
- ◆ Determining the adequacy of the system to support both dry and wet weather flows,
- ◆ Determining available hydraulic capacity in the conveyance system,
- ◆ Quantifying the reduction of I/I in rehabilitated areas, and
- ◆ Providing data for development/calibration of the system hydraulic model and for flow trend analysis.

Flow monitoring can be categorized as permanent (long-term) or temporary (short-term). Permanent flow monitoring is used to monitor the effectiveness of sewer maintenance and rehabilitation programs and to provide long-term I/I data. Temporary flow monitoring uses portable equipment

to capture data over a specified period of time, with 60 days being the usual minimum period.

Currently, OJRSA utilizes three (3) permanent flow monitors for the purpose of billing their Member Cities. Additionally, OJRSA recently deployed 18 temporary flow monitors (for a 4 month period) to gain a better understanding on their system, and specifically areas of their system that may be contributing to excessive I/I. For such an assessment, accurate rain data is also necessary. This data is supplied by six (6) rain gauges located throughout the collection system. When needed, existing rainfall data is supplemented with Doppler data.

After the flow monitoring data and rainfall data are collected, the data is analyzed for the purpose of billing, updating a hydraulic model, and prioritizing areas within the collection system that may need cleaning, inspection, and/or rehabilitation.

It is recommended to install rain gauges throughout the system as the amount and intensity of rainfall during storms can vary greatly across a system.

5.2.1.2. Smoke Testing

Smoke testing is conducted to help identify I/I sources, cross-connections, and unauthorized connections. Excessive amounts of I/I can contribute to a significant amount of flow to the sanitary sewer system that the system may not be prepared to handle. The extent of I/I will vary from system to system, although it has been recommended by engineers the OJRSA use the following formula to determine excessive I/I⁴:

$$2,000 \text{ gpd} * [(Miles \text{ of } 8\text{-inch diameter pipe} * 8) + (Miles \text{ of } 10\text{-inch diameter pipe} * 10) + (Miles \text{ of } 12\text{-inch diameter pipe} * 12) \dots + (Miles \text{ of } X\text{-inch diameter} * X)]^5$$

⁴ Formula is based on one referenced in the “Quick Guide for Estimating Inflow and Infiltration” as published by US EPA, June 2014; however, the US EPA’s formula uses 1,500 gpd instead of 2,000 gpd. Recommendation provided by Weston & Sampson, Inc. and WK Dickson & Co., Inc.

⁵ Where “X” represents each diameter pipe in the sewer system.

Excessive I/I frequently causes SSOs; therefore, it is important to keep I/I at a minimum in the sanitary sewer system.

Smoke testing begins by placing a blower over a manhole and allowing it to channel non-toxic smoke into the sanitary sewer system. The smoke will travel through the manholes, gravity sewers, and private laterals and will penetrate any hole or opening along the way. As smoke rises it will work its way to the surface thus identifying the sources and / or locations of I/I. The largest sources of I/I are typically direct and indirect connections with stormwater infrastructure, although these connections may be minimal in number. The following are more common sources of I/I:

- ◆ Leaks in mainlines from cracks, holes, and even deformed pipe segments,
- ◆ Leaks in manholes,
- ◆ Cracked or vented manhole lids,
- ◆ Connected roof leaders and cellar drains,
- ◆ Abandoned service lines, and
- ◆ Broken or missing cleanout caps.

Results of smoke testing will be logged into OJRSA's CMMS as the test is being conducted. Once the smoke has entered the sanitary sewer system, crew members will look for smoke surfacing from catch basins, cracks in the roadway, along the side of the roads, through manhole lids, roof leaders, uncapped cleanouts, and roof sewer vents. There are even times when smoke can be seen emanating from what appears to be solid surfaces, such as the ground, which warrants further investigation. When crews have spotted a smoke source that indicates an I/I source they need to immediately take a picture to capture the smoke source and enter the geographic location in the CMMS. Then they need to complete the smoke test form to document details of the smoke source. Paper copies of the smoke test form need to be kept on hand in the event of technical difficulties. A copy of the smoke test form is in Appendix D.

Before smoke testing begins, a thorough explanation needs to be made to local emergency responders, particularly fire fighters, so that they are aware of the situation. Additionally, customers need to be made aware of the smoke testing in advance to reduce confusion and concern. Customers should be notified with door hangers indicating the approximate dates and areas to be smoke tested. An example door hanger is located in Appendix E. This is important, as from time to time, smoke can enter homes through leaky or unused plumbing and give the illusion of a fire.

A safety data sheet (SDS) for the chemical used to produce the smoke should be readily available for customers to review if they have any concerns.

5.2.1.3. Dye Testing / Dyed Water Flooding

Dye testing is used to identify I/I sources as well as to confirm sanitary sewer connectivity. Dye testing is often the first follow-up test in response to positive smoke testing results and visual investigation. In cases where dye testing is not possible or practical, a follow up inspection would likely include CCTV. Additionally, dyed water flooding can be used to identify sources of infiltration by dyeing the suspected source and then locating the point of entry of the dyed water in the downstream piping.

The use of dye testing for confirming connectivity of the pipes and appurtenances may be used to clarify current connections of roof leaders, storm drains, and other suspected sources of I/I as well as wastewater pathways.

The results of each dye test needs to be captured on the dye test form. A copy is included in Appendix F.

5.2.1.4. Sewer Line Rapid Assessment Tool

The Sewer Line Rapid Assessment Tool (SL-RAT) uses an audio signal to assess flow path within a pipe segment. This process will generate a number, ranging from zero (0) to ten (10), with zero (0) representing a completely blocked structure, and ten (10) indicating a clear, open pipe available for wastewater flow.

SL-RAT uses acoustic technology to transmit sounds of varying frequencies through gravity sewer pipe segments. The SL-RAT comes in two pieces: the sound generating piece and the listening piece. Each piece is placed on a manhole at either end of the gravity sewer segment to evaluate the relative blockage of the line in question. It takes roughly three minutes to complete a transmission between two manholes.

SL-RAT evaluations should be conducted on each gravity sewer line at least once every two years. While the SL-RAT locates potential trouble areas, it does not identify the problem, the extent or location of the problem, or provide solutions to the problem. Therefore, areas receiving low SL-RAT scores should be followed up with CCTV to gather all necessary information for developing a solution to the problem.

SL-RAT evaluations can even be useful to identify sags in the pipe, which can detrimentally impact the system's hydraulic capacity.

All pipe segments receiving a score of five (5) or less will be followed up with cleaning or CCTV inspection to clear the obstruction or identify the location of the blockage. Once the cause is identified, the crew leader will initiate a work order to address the problem. In situations where a score of zero is indicated, meaning a total blockage, or no apparent flow downstream, it may be more prudent to immediately notify the Operations Director so that actions can be taken to immediately mitigate a potential SSO.

5.2.1.5. Closed Circuit Television Inspection

Closed Circuit Television (CCTV) inspections involve crew members lowering a self-propelled remote-control camera into a manhole to navigate the sanitary sewer system. Crew members are able to view the inside of the pipe segments and log the location and extent of defects.

All CCTV inspections for OJRSA will be documented according to NASSCO's PACP standards including video recording of the line segments, still photos of defects, and a written record using the standard code for the description and location of the defects. By using NASSCO's standard code, information between crews and external parties may be shared

more accurately and concisely with internal staff as well as external consultants, such as engineers and contractors. Additionally, it helps OJRSA to categorize the severity of each defect and then prioritize corresponding maintenance, rehabilitation, and repair projects.

An information management software compatible with the camera hardware will be used to collect the CCTV video and log of defects. This database will be linked to OJRSA's CMMS so that crews making the repairs can access the CCTV video for reference if necessary.

CCTV inspections are most effective when they are conducted within a week of having the sewer lines cleaned, reducing the amount of debris or accumulation in the sewers that would otherwise interfere with visual inspection. Therefore, it is recommended that all lines that are CCTV inspected should be cleaned within one week prior of inspection.

If a full line blockage or complete structural collapse is identified by OJRSA while conducting CCTV inspections, OJRSA will restore functionality immediately to avoid additional adverse effects, such as a sanitary sewer overflow.

5.2.2. Force Main Inspection

Force mains can generally be more difficult to inspect due to limited access, small pipe diameter, and difficulty in taking out of service. Because of this, inspections need to be done in a manner that consider both probability of failure and consequence of failure. This simultaneous consideration constitutes a risk-based investigation (RBI). With this in mind, specific factors that will be considered when prioritizing pipes for inspection, include:

- ◆ Age of the force main,
- ◆ Location, especially if adjacent to roadways or waterways,
- ◆ Environmental impacts of a failure,
- ◆ Diameter,
- ◆ Leak history,
- ◆ Accessibility, and

- ◆ Time since last inspection.

Additionally, areas that are susceptible to corrosion will be routinely monitored to better schedule preventative maintenance. Early detection is key to preventing potential failures.

Force mains will be assessed for their condition at least once every five (5) years and annually for known corrosion defects.

Force main inspections should include the following items:

- Visual inspection of force main route. The inspection should look for any visible wastewater leaking to the surface, sags in the ground to indicate a collapsed pipe.
- Pump flow tests. The annual pump flow tests done with the pump station assessment will help determine if the force main is adding any additional head to the system.
- Pigging the line. Pigging a force main involves connecting a pig launcher to the force main and flushing a mechanical “pig” through the line. The pig will clean the line by dislodging any blockages. It also has a GPS unit to located any blockages too big to be cleaned internally. Any large blockages should be excavated, opened, and cleaned.

5.2.3. Air Release Valve (ARV) Inspection

Air release valves (ARVs) provide protection to the force mains and pump stations where they are installed. ARVs allow excess air to be discharged from the pump station as the force main fills with pump sewage. Other ARVs can also allow air back into the force main to prevent a siphon or vacuum effect on the force main and pumps. Due to their protective nature and mechanical components, ARVs should be inspected every year.

There are three types of ARVs on the market. These are:

- Air Release Valve: Include slow air release function only. These are typically placed at intermediate high points along the force main.
- Air Vacuum Valve: These valves include vacuum breaking and high-volume air release. This type of valve is located typically at absolute high

points where the HGL drops below the pipe and air must enter to eliminate vacuum conditions. It is also placed along force mains to facilitate proper filling.

- **Combination Air Valve:** It contains both small air release orifice and larger air/vacuum port in one assembly. It is commonly recommended for use in wastewater main force.

5.2.3.1. ARV Operation and Maintenance (O&M) Problems

Those functions described in earlier section make ARVs essential to many pressure systems. However, there are operation and maintenance (O&M) problems that can occur even if the valves are functioning properly. Following are examples of some of the problems that can occur:

Corrosion - Internal corrosion of a metallic pipe can occur when a vacuum breaking ARV introduces air into the pipe. For this reason, metallic FMs should use air release only ARVs wherever possible. Additionally, external corrosion can occur inside the ARV vault as the air from the pipe is released. If the air contains hydrogen sulfide, the external wall of the pipe, the ARV itself, the saddle and isolation valve attaching the ARV to the pipe, the vault, and the vault cover may all become corroded over time.

Surge - The sudden closure of an ARV after it rapidly releases air can create a surge event. This can be caused when the orifice is oversized. A too large orifice will increase the rate of flow of the air and reduce the time between its opening and closing. ARVs often are not effective surge control devices either because they do not react fast enough to allow air in to prevent vapor cavity formation or because they become plugged with grease and debris and fail to open.

Odor and noise - ARVs can be a nuisance to nearby residents if they emit odor or cause a whistling as the air is released from the FM (due to improper orifice sizing).

Siphoning - While this typically does not present a problem, flow can siphon over high points along a force main that are higher in elevation than the discharge. This may be a complete siphon or, more commonly, a partial siphon that reduces the effective static head on the pumps. This

becomes a problem if it causes the pumps to operate too far right on their curve (runout condition).

When selecting and/or replacing an ARV, the actual orifice diameters and optional features of the ARV should be selected for the specific conditions of that installation, which may be different even from other ARVs on the same FM. In order to ensure appropriate equipment replacements and spare parts inventory, the actual orifice diameters and optional features of each ARV should be documented at the time of installation.

Another consideration to note is that if ARVs are closed, particularly at intermediate high points along the force main, air binding may develop in the force main. Thus, if any ARVs are turned off, Operations should be certain to monitor the pumping capacity, pump run times and pump discharge pressures to identify any signs of air binding. Also, if an unexplained reduction in pumping capacity is observed-especially if this corresponds with an increased discharge pressure, any ARVs along the force main should be inspected for air binding.

5.2.3.2. ARV Inspection

Air valves shall be inspected annually assuming the initial inspection does not reveal significant problems. If significant problems are found, the valve shall be inspected every 6 months. Valves should be disassembled, cleaned and returned to service. A quick check of the need for back flushing would be to open the bottom drain valve on the side of the valve body. If sewage drains out easily, back flushing may not be required. The valve should still be disassembled and cleaned as grease or other debris may have accumulated in the top portion of the valve. If sewage does not drain out, the valve may need back flushing. It is highly recommended that distribution system potable water not be used as the flushing water source. Instead, clear water from a portable water tank and pump should be used as the flushing water source thus protecting against potential backflow.

Air valves with cast iron bodies should be removed, cleaned, corrosion removed, primed and painted at least every five years or more often

depending on inspection and need. Install a spare air valve to replace the removed valve. After the removed air valve has been rehabilitated, it should be placed in inventory.

Air valves with either stainless steel or plastic bodies should be removed, cleaned, and inspected at least every five years or more often depending on inspection and need. Install a spare air valve to replace the removed valve.

Always isolate and drain the valve and depressurize the valve before opening the cover/body or removing the valve.

5.2.3.3. ARV Common Issues and Possible Solutions

The following is a listing of common problems with Air Valves and possible solutions for resolution:

- **Leakage at Inlet Connection:** Tighten valve threaded connection or flange bolts. If leaks persist, remove valve and re-seal the threads with pipe sealant/tape, or reattach with new bolts and tighten as necessary. Check that the valve's actual operating pressure does not exceed its design Working Pressure as stamped on the valve's nameplate.
- **Leakage at Cover/Body joint:** Tighten bolts per the manufacturer's recommendations. It may be advisable to replace the cover/body gasket first. Check that the valve's actual operating pressure does not exceed its design Working Pressure as stamped on the valve's nameplate.
- **Orifice not Releasing Air Under Pressure:** Check that the valve's actual operating pressure does not exceed its design Working Pressure as stamped on the valve's nameplate. If the valve is operating within its design pressure range, isolate, drain and depressurize the valve for inspection and cleaning. Open the isolation valve and allow the ARV to refill. Once the valve is again pressurized, test the valve for proper operation by injecting air (with compressor) into the bottom drain connection line and see if the valve releases the injected air. If the valve does not release the injected air, the valve needs to be repaired or replaced.
- **Liquid Leakage through Air Blow Off:** Isolate valve from main line, and depressurize valve through bottom drain connection. Check for gravel or

other debris in the outlet at the top of the valve; clean as needed. Back flush the valve to remove debris. If back flushing is not effective, disassemble and inspect the internal seat, orifices, float and float guide for debris, wear, or damage. Replace as needed with a float kit or seat kit from the manufacturer. Check that the valve's actual operating pressure does not exceed its design Working Pressure as stamped on the valve's nameplate. Check that the valve's minimum operating pressure (typically 3-7 psi) is not less than the actual operating pressure of the line. If the minimum pressure is not met, leakage will occur until the valve is modified to seal better. Contact the ARV manufacturer on a case-by-case basis.

- Always isolate and drain the valve and depressurize the valve before opening the cover/body or removing the valve.
- Replace all valves as necessary that cannot be repaired in the field. Ensure replacement valves are provided with same functionality and orifice sizing as the original valves (unless an appropriate evaluation is performed to confirm suitability of another valve type and/or size).

End of Section

6. Inflow and Infiltration Evaluation Program

The term “inflow and infiltration” refers to stormwater runoff and groundwater that enters into the sanitary sewer system through holes in the infrastructure and stormwater infrastructure that is connected to the sanitary sewer system and thereby the conveyance system.

It is important to remove both sources of inflow and infiltration from the conveyance system and at the wastewater treatment plant when they are identified. It is especially important to remove connections from stormwater infrastructure as they are often large sources of inflow. Stormwater should not be discharged to the sanitary sewer system, because it typically does not require treatment and it adds to the surge of wastewater seen throughout the conveyance system and at the wastewater treatment plant. This surge of wastewater often creates capacity and treatment difficulties, and has led to significant SSOs on the OJRSA system in recent years.

Locating sources of inflow and infiltration can be achieved through flow monitoring as described in Section 6.1. By establishing a baseline of flow rates during dry conditions for a specific area and comparing them against the surge of flow during wet weather over the same specific area, one can derive a peaking factor. Areas with the highest peaking factors have more inflow and infiltration entering the collection system anywhere upstream of that point. Flow monitoring is the main component to any inflow and infiltration evaluation program.

Flow monitoring can be conducted with one or more flow monitors. The more monitors there are, the more beneficial and informative the results will be.

The following strategic factors will be considered:

6.1 Type of Flow Monitors

Both permanent and temporary flow monitors may be used to obtain a complete picture of the flow conditions in the sanitary sewer system.

6.1.1. Permanent Flow Monitors

Permanent monitors are used to gather baseline flow data over a long period of time to calibrate new flow monitors, identify and document new problems and

the success of projects in the sanitary sewer system. Typically, data from permanent flow monitors can be used to measure the long-term effects of rehabilitation and I/I source reduction. Once they are mounted, they are not typically moved. Permanent flow monitors are often mounted in strategic locations including where two sewer systems/districts merge and where two basins or sub-basins merge.

6.1.2. Temporary Flow Monitors

Temporary flow monitors are usually in place for 60 days or more and are located to collect data from specific projects or areas.

Typical flow monitoring programs will incorporate both permanent and temporary flow monitors to evaluate the volume of wastewater passing through key locations. The data will be stored so that it may be retrieved and reviewed if necessary.

In addition to collecting sewer flow data, collecting rainfall data will improve the usefulness of the data collected by estimating the amount of I/I entering the system during various wet weather events. A diagram depicting the different steps to be taken for effective flow monitoring can be found in Figure 6-1.

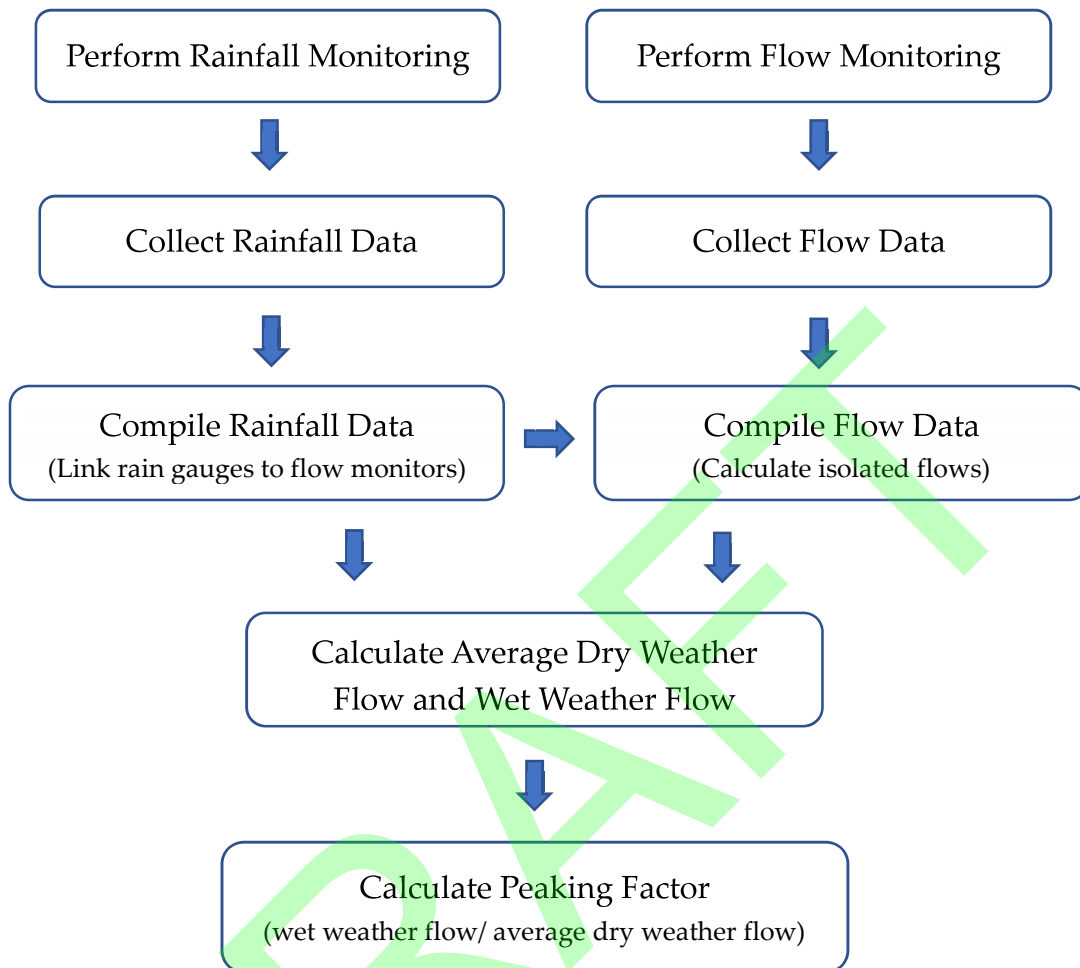


Figure 6.1 Flow Monitor Data Analysis

Both permanent and temporary flow monitors should be placed throughout the sanitary sewer system to collect flow rates at strategic points.

6.2. Data Quality Review

Once the data is collected, it should be analyzed to be sure that only quality data is used. The flow data should be plotted over time with rainfall data as a quality check. An increase in base flow should correspond to an increase in rainfall data, any other changes in the base flow should be given careful consideration before using. The flow rates should also be checked to be sure they are within the range of accurate measuring for the flow monitors.

Successful flow monitoring programs collect and review data weekly. The more frequently the data is collected and analyzed, the more quickly responses could be made to the data. Such responses may include prevention of potential SSOs or flow monitors in need of calibration. In cases where the data collected indicates that a downstream blockage may exist, the data should be verified as accurate. Upon verification the Conveyance System Supervisor should be notified, and a corresponding work order should be initiated to mitigate any SSO. In the case of inaccurate data, the flow monitors may need to be moved to sites that have better hydraulic conditions. The sooner they are identified the sooner they can be corrected.

6.3. Average Dry Weather Flow

After the flow monitoring and rainfall data are collected, the average dry weather flow is calculated. The average dry weather flow should be based on the flow from at least 5 dry weather days. Dry weather days should be verified with rainfall collection data. It is also important to wait until flow conditions return to normal after a wet weather event for use in calculating average dry weather flow.

6.4. Identifying Wet Weather Flow

A wet weather event is identified as the flow that occurs during and after the time periods the rain gauge measures precipitation. Typically, there is a delay between the time the rain gauge indicates wet weather and the increase in the wastewater flow. Depending on the intensity and duration of a wet weather event, the wastewater flow rates may remain elevated for more than 24 hours after the precipitation ceases. It is possible to measure a notable wet weather event but no increase in wastewater flow. This may indicate that there is not enough precipitation to infiltrate the sanitary sewer system. For that reason, only the most substantial rain events should be considered wet weather events and at least three wet weather events should be recorded to ensure a representative result.

Once the time frame for each wet weather event is identified, the wastewater flow rates over the same time periods will be measured. It is important that the same time frame for all flow monitors is used for each wet weather event.

6.5. Calculating Maximum Peaking Factor

The peaking factor is a comparison of the average dry weather flow and the wet weather flow. It is calculated by dividing the wet weather flow by the average dry

weather flow. In a perfect system with no I/I, the peaking factor will be one. The closer the peaking factor is to one, the less I/I there is upstream of the flow monitor. To calculate the maximum peaking factor, the wet weather event that measured the most flow during the event is divided by the average dry weather flow. This would be the same as calculating the peaking factor for all wet weather events for a given flow monitor and then selecting the highest value as the maximum peaking factor.

This maximum peaking factor will reflect the conditions of all the sanitary sewer system upstream unless another flow monitor is located upstream to isolate the flow conditions between the monitors. This may be done by subtracting the average dry weather flow of the upstream flow monitor from the downstream flow monitors average dry weather flow. The same thing should be done for each of the wet weather flows to obtain the isolated wet weather flow rates. The technique of measuring isolated flow rates can be used to identify areas where there are a lot of I/I sources or a large I/I source.

The March 2022 Preliminary Engineering Report (PER) done by WK Dickson determined that a wet weather peaking factor of 2.8 is high for the OJRSA system. Any area with a peak factor over 2.8 should be targeted for further investigation.

Once flow monitoring has been completed and target areas have been identified, OJRSA should further inspect for I/I. A comprehensive approach to locating defects involves inspecting all aspects of a collection system, including manholes, sewer mains and laterals. All inspections need to be conducted in accordance with the National Association of Sewer Service Companies (NASSCO). Manholes, sewer mains and laterals need to be inspected in accordance with the Manhole Assessment Certification Program (MACP), Pipeline Assessment Certification Program (PACP) and Lateral Assessment Certification Program (LACP), respectively. For further details on how to properly inspect manholes, sewer lines and laterals, refer to the Manhole Inspection Program (MIP) and the Sewer Inspection and Cleaning Program (SICP), located in Sections 7 and 5, respectively.

Sometimes the number, size, and type of defects observed through visual or video inspection will not justify the amount of I/I identified in flow monitoring. When this is the case, other methods may need to be employed to identify additional defects. Below are additional inspection methods that may prove beneficial:

Sewer Scanning Evaluation Technology (SSET) – Produces a 360- degree visual scan so that the entire surface of the pipe to be observed can be seen in flat view. This allows an engineer to measure joints and cracks and check for stains and deposits.

Electrical Leak Location – Identifies pipe defects by measuring the electrical resistance of the pipe wall. Most sewer pipes are electrical insulators and have high resistance to electrical currents. A defect in the pipe that leaks water will also leak electrical current, even if there is no visible infiltration.

Acoustic/Sonar Detection – Uses sensors to detect vibrations and sound wave variations caused by defects and leaks. Acoustic sensors can provide real-time verification of defects or problems.

Once sources and locations of I/I are confirmed, they will need to be mitigated or repaired. This can be accomplished through pipe replacement or rehabilitation on a case-by-case basis.

End of Section

7. Manhole Inspection Program

Manhole inspections are routinely conducted to identify manhole defects and potential safety hazards. Each manhole should be inspected once every ten (10) years *at a minimum*. These inspections should be performed in conjunction with the gravity main inspection program as described in 5.2.1. The purpose of the formal manhole inspection program is to collect the data on manhole conditions, check on manhole locations, pipe connectivity, and flow conditions in the area. Manholes are the primary access point to the conveyance system to check the flow conditions in the area. Therefore, manholes must be kept safe for the use of Utility Personnel.

Manhole inspections and inspection forms need to be conducted in accordance with the National Association of Sewer Service Companies' (NASSCO's) Manhole Assessment Certification Program (MACP). MACP inspections include removing the manhole lid and conducting a visual inspection of the internal components of each manhole. Inspections may often be conducted visually from the surface or with the use of a pole camera (perform a NASSCO MACP Level 1 inspection). Depending on manhole conditions and depths the inspector may need to enter the manhole to collect all necessary information (perform a NASSCO MACP Level 2 inspection). Manhole inspections are aided by regular cleaning, therefore, it maximizes the effectiveness of manhole inspections to clean them concurrently.

The inspection should be recorded at the time of the inspection and should include notes, an area picture, a picture looking straight down in the manhole, a picture zoomed in on the bottom of the manhole, at least one zoomed-in picture for each connection, and at least one zoomed-in picture for each defect found. The area picture can be used to help locate the manhole and should show house numbers, streets signs, or other identifying landmarks with the manhole lid clearly visible or marked with flagging. Another photo of the manhole lid with the manhole ID clearly labeled should also be added to the file. The picture looking into the manhole will give an overall look at the inside of the manhole and help piece together the zoomed-in photos of the bottom of the manhole, the connection points, and the defects.

Each manhole inspection should be recorded as it occurs. However, paper copies of the form should be available to inspection crews in the event that the network cannot be reached.

The crew leader conducting the manhole inspection will initiate a work order for each defect found. For infrastructure that does not appear in the field as it does in GIS (missing, incorrectly located, mislabeled, incorrect size, incorrect material, etc.) the collection

system supervisor needs to be contacted to verify conditions, and coordinate a GIS update. Additionally, if any surcharged manholes are encountered, the Conveyance System Crew needs to be contacted to mitigate the situation and the information should be entered into the Predictive Cleaning Program for a follow up visit. If a defect or potential failure of the manhole is immediately imminent and likely to cause an SSO then the Crew Leader needs to initiate a work order to remediate the problem and involve the Conveyance System Crew if necessary, to avoid an SSO.

End of Section

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8. Documentation and Records

It is important to maintain a variety of records, such as assets, evaluations, maintenance tasks, repairs and replacements, customer complaints, and work orders. These records will be maintained in a Computer Maintenance Management System (CMMS) for ease of use. This will allow for efficient evaluations, record keeping, search functions, and record recall. The software selected are recommended to be GIS-based to geographically view these records. For additional recommendations regarding the CMMS software recommendations, please refer to Appendix H, Computer Maintenance Management System Software Checklist.

All personnel responsible for issuing work orders, scheduling crews, and completing work orders in the field should have access to the CMMS in the field with mobile access devices.

For each work order issued and completed a record in the CMMS should be generated to document the work completed. At a minimum, each task requires the input of:

- ◆ Date and Time,
- ◆ Crew member performing work,
- ◆ ID Number of asset being evaluated, maintained, or repaired/replaced, and
- ◆ Condition information collected during inspection.

For each action there needs to be a specific form in IMMS that can prompt crews in the field to fill in the specific information necessary and relevant to that task. Each crew needs to keep hard copies of each form so that the work may continue regardless of any technical difficulties.

8.1. Record of Assets

It is important to maintain records of assets:

- ◆ Type of asset (pipe, manhole, gravity or force main, pump station),
- ◆ Installation date, material type, size and capacity,
- ◆ Unique ID, location, and basin information, and
- ◆ Make and model, and serial numbers of each asset, where applicable.

A benefit of maintaining these records is finding trends of premature failures of particular materials at a higher than expected failure rate. This allows for these materials to be proactively repaired or replaced.

8.2. Record of Evaluations

A variety of evaluation types should be occurring on regular intervals. Sometimes these evaluations are also considered inspections, or assessments. Results of all inspections, assessments, and evaluations should also be maintained in a CMMS including:

- ◆ Sewer Line – Rapid Assessment Tool (SL-RAT),
- ◆ Smoke Testing,
- ◆ Dye Testing,
- ◆ CCTV Inspections,
- ◆ Manhole Inspections,
- ◆ Pump Station Inspections,
- ◆ Lateral Connection Inspections, and
- ◆ High Priority Assets.

These records are important to maintain to ensure that each asset is evaluated according to schedule and evaluation type. For instance, each sewer line should be SL-RAT assessed once a year and CCTV inspected at least once every 10 years. Refer to Section 5.2.1 for further detail. The evaluation records should be used to ensure each asset is evaluated according to schedule and that no assets are overlooked. Assets that are overlooked can become liabilities to the Utility as defects go unnoticed and unaddressed.

Sometimes equipment used to evaluate assets comes with its own software to document the evaluation and its results. This is especially true for CCTV Inspections where gravity main inspections are facilitated using a camera and footage counter mounted on a small robot. This software needs to be NASSCO and PACP certified, fully conform to PACP standard data format and export and import guidelines as established by NASSCO. The software will provide a tabular space to input the footage, defect code, and photo link. It may also limit the number of errors by only allowing standard PACP defect codes to be entered, which may expedite field reviews. The software should also automatically enter condition ratings based on the defect code for each pipe segment.

A field review should be conducted for accuracy once the data has been collected from the field. A secondary review should be made to ensure that all necessary information

has been collected, that follow-up inspections are not needed to further identify the cause of any problems, and any work orders necessary are issued in order address any identified problems. Once it is determined that the CCTV inspection information is accurate and complete, it should be uploaded to the CMMS.

8.3. Record of Maintenance

There are many aspects of collection system maintenance that are required in order to keep it in good condition. Maintenance assets include:

- ◆ Manholes,
- ◆ Gravity Mains,
- ◆ Pump Stations,
- ◆ Force Mains and Air Release Valves (ARVs), and
- ◆ Easements.

The maintenance of these assets may include quick visual inspections to verify flow conditions, remove debris, roots, and FOG (fats, oil, and grease), lubricate mechanical components, and recalibrate instrumentation as necessary.

It is important to keep record of maintenance tasks to ensure that the schedule of proactive and reactive maintenance is maintained. Assets that routinely require reactive maintenance may need to be considered for more thorough evaluations to ensure it is appropriately designed for the current conditions.

8.4. Record of Repair or Replacement

All repairs should be recorded. This includes records of rehabilitation, point repairs, and replacements. These records should be reviewed on a regular basis to:

- ◆ Evaluate the effectiveness of recent rehabilitation efforts,
- ◆ Determine the need for future replacements, and
- ◆ Look for patterns in assets that require premature or overly frequent rehabilitation.

Specific assets that fail repeatedly despite adequate maintenance and repairs should be reviewed to determine the root cause of the problem. The root cause should be documented in the CMMS for future reference and work orders should be issued to address the cause.

8.5. Record of Customer Complaints

Most customer complains center around odors and sanitary sewer overflows. Both of these complains should be addressed as quickly as possible. Odor complaints are usually a sign of either an overflow or corrosive conditions in the sanitary sewer and should be considered a precursor to the failure of an asset if not addressed. Additionally, sanitary sewer overflows should be responded to in accordance with the Utilities' sewer overflow response program.

Both the customer complaint and the work orders issued to address the complains should be documented in CMMS. These records can be helpful in determining the location and extent of a problem area and the conditions that have caused a problem to arise. Records of the work orders issued to address the complaint provide a way to determine what has historically been most effective at addressing the problem.

8.6. Record of Work Orders

Once a work order is issued, a record of the work order should be automatically generated in the CMMS. The record should be updated as it progresses from being assigned to a crew, to being investigated, and then addressed. Follow-up work orders should be issued in such a way that they can be tracked as follow-ups to the original work order. Records of these work orders can be used to evaluate the performance of assets, ability to maintain maintenance schedules, effectiveness of repairs, and response to customer complaints.

The use of a compatible CMMS will greatly reduce the amount of work required to make, maintain, and use the records described in this section.

End of Section

9. Easement/ROW Maintenance Program

Easements and Right-of-Ways are crucial components of the conveyance system by providing access to the conveyance system to perform maintenance. It is necessary to maintain these easements to ensure ease of locating and accessing them and that the assets located within the easement are operating properly.

Easements should be maintained at least once every year. Maintenance is necessary to remove any trees, shrubs, brush, and other obstacles that may:

1. Obstruct Vehicular Traffic – Inspection and maintenance equipment need to be able to access each of the assets in order to keep the assets in good condition. Any obstacles that reduce vehicular access to a sanitary sewer system asset should be removed. Often times these may include sheds, fences, carports, playhouses, doghouses, vegetation and landscaping, yard art.
2. Remove Roots – Wastewater that leaks from pipes is sought out by roots that can enter the pipes and create blockages that reduce the pipe’s hydraulic capacity. Therefore, it is important to keep trees, large shrubs, other brush at a distance to reduce the potential of roots entering the pipes and reducing hydraulic capacity.

Upon discovering trees, shrubs, brush, and other obstacles located in the Easement the Utility will create work orders to have them removed from the easement. Where it is within the legal authority of the Utility, the Utility will have the trees, shrubs, and brushes removed promptly.

In the case where the obstacles appear to be property of the homeowner, like sheds, doghouses, and fences, the Utility will need to work with the homeowner to have them moved.⁶ The Utility should work with the homeowner to help them understand the importance of maintaining access to the easements in order to reduce future recurrences. Especially since sometime these obstacles are the results of attempts to hide or disguise sanitary sewer system assets. This is especially true for assets that are visible above grade or are in prominent locations.

Easements that contained personal property that has a higher likelihood of being returned to its original location should be added to next year’s list of easement inspections for a follow-up visit. Annual follow-up visits should continue until no personal property is found in the easement.

End of Section

⁶ An alternate remedy, if acceptable to the OJRSA, would be to have the property owner install a wide “drive-through” gate on the fences crossing the Easements. The OJRSA should have their own lock on the gate so they can gain access without having to cut another’s lock from the gate.

10. Sewer Use and Grease Regulation

Oconee Joint Regional Sewer Authority (OJRSA) developed a Sewer Use Regulation that became effective March 1, 2019. These Regulations present the requirements to discharge to the publicly owned treatment works (POTW) and allow OJRSA to comply with all applicable State and Federal laws and the Pretreatment Regulations (40 CFR Part 403 and R61-9 Part 403).

The Regulations include a Fats, Oils, and Grease (FOG) Control Program in Appendix H. The purpose of that document is to provide regulation of the collection, control, and transportation of non-hazardous FOG generated by users that derives from animal or vegetable products.

Each Member City has their own Sewer Use Regulation (SUR) and it must be at least as stringent as the SCDHEC-approved SUR of the OJRSA. Additionally, each Member City either has a FOG program or utilizes OJRSA's FOG program as their own. Furthermore, there is a memorandum of agreement between the Member Cities and OJRSA to comply with OJRSA's Sewer Use Regulation and FOG Program.⁷ This enables OJRSA and the satellite collection systems to operate under a set of uniform regulations for consistency in how they enforce and handle violations of the rules.

10.1. Sewer Use Regulations

Sewer Use Regulations are one of the most important documents that a sanitary sewer collection and treatment system can have. They lay the framework for what discharges are allowed and how they should be discharged to avoid disrupting the operation of the POTW or contaminate the resulting wastewater disposal system.

OJRSA is in the process of revising the Sewer Use Regulations. The revisions have the following goals:

1. To strengthen the FOG program,
2. Address deficiencies in the Enforcement Response Guide (ERG),

⁷ These agreements were executed by the Member Cities, Oconee County, and West Union on the following dates. There was no "sunset" date to the agreements, and they are automatically adopted by each municipality upon approved revision by the OJRSA Board of Commissioners. Seneca approved: December 10, 2019. Walhalla approved: November 15, 2019. Westminster approved: November 14, 2019. Oconee County approved: February 19, 2020. West Union approved: November 12, 2019.

3. Improve the hauled waste acceptance requirements,
4. Address excessive Inflow and Infiltration matters from upstream users.

Additionally, some items will be pulled from the Sewer Use Regulations to become stand alone policies. The stand alone policies will allow for easier updating of the policies by the OJRSA Board. The policies to be pulled from the Sewer Use Regulations include:

1. Schedule of Fees
2. Standard Design and Details

WKD recommends that the Member Cities continue to further align their SURs with OJRSA's as they go through periodic updates to reduce potential conflicts within the documents.

10.2. Fats, Oils, and Grease Control Program

A FOG Program is essential for a collection system to regulate substances that could be potentially harmful to the system. For OJRSA and its Member Cities specifically, as industrial and commercial growth continues, a strong FOG program will decrease the potential for sanitary sewer overflows (SSOs) due to clogs from regulated byproducts.

The following are recommended to be added to the FOG program to aid in enforcement/compliance:

1. Develop design standards for grease control equipment.
2. Add record keeping requirements of FOG device maintenance.
3. Add requirements for recorded employee training.
4. Add periodic effluent flow requirements.
5. Add requirements for non-Food Service Establishment FOG permits. (These would be for car washes, car repair garages, and laundromats).

End of Section

11. Spare Parts and Equipment Inventory

It is important to keep a current inventory of the tools, spare parts, and equipment available to the Utility's employees. The inventory should be stocked according to equipment manufacturer's recommendations, updated records of maintenance and equipment needs, any components with long lead times, and any critical component that does not have a backup or work around option. To reduce the Utility's risk and improve resiliency, it is key to keep critical components in stock. If failure of a component occurs and there is no replacement in stock, a long down-time or period of inefficient operation will occur.

11.1. Inventory

A current inventory will account for all items at the warehouse and will ensure crews have access to adequate tools and equipment. A system should be set up to sign out tools and equipment and to ensure accountability.

The inventory should document:

- ◆ Type, age, and description of the tool, spare part, or equipment,
- ◆ Manufacturer, model number, and serial number (if applicable),
- ◆ Fuel type or electrical connection requirements (if applicable),
- ◆ Repair history and operating costs,
- ◆ Storage location (if more than one storage location is used), and
- ◆ Presence of Operation and Maintenance Manual.

Tools and equipment should be inspected routinely and before each use. When tools are found to have reached the end of their useful service life, they should be replaced. The consistent replacement of worn out tools, equipment, and replacement of spare parts should be addressed in the annual budget.

11.2. Warehouse Location

An easily accessible and conveniently located warehouse should be maintained to store the tools, equipment, and spare parts where crews are dispatched. If the warehouse is shared with other departments or utilities, it should be clearly noted which tools, equipment, and spare parts are available to each group. Inventory logs should not include tools, equipment, and spare parts that are not available to the Utility.

11.3. Tools, Equipment, and Spare Parts

11.3.1. Tools

A set of tools are provided to Operators on a daily basis in order aid in the completion of work tasks. Over time as these tools become worn or otherwise need replacing, it is the Operator's responsibility to inform the Supervisor that the tool needs to be replaced. The tool should be replaced from inventory as soon as possible and the stock supply should be replenished.

For tools not routinely available, the Operator should check out the tool from the warehouse via the tool inventory tracking system. The tool should be returned as specified to the warehouse. If the tool was damaged, its current condition should be noted on the tracking form.

11.3.2 Equipment

Larger tools and equipment should be stored in the warehouse. These items may include portable generators, bypass pumps, and CCTV equipment. Adequate supply of each should be determined based on:

- ◆ Consequence of not having immediate access to equipment,
- ◆ Current access to this equipment,
- ◆ Potential for simultaneous need of this equipment throughout the collection system, and
- ◆ Available alternatives to having these equipment items including on call contractors and promptness of their response times.

Like the tools, a tracking system should be implemented to provide accountability, maintain an inventory list, condition of equipment, and adequate quantity.

11.3.3. Spare Parts

Spare parts should be kept in a clean, protected stock room.

When determining which spare parts to include the following factors should be considered as a minimum:

- ◆ Recommendations from manufacturer' manual aids,
- ◆ Frequency of usage of the part,

- ◆ Criticality of the part and of the equipment,
- ◆ Difficulty in obtaining the part, and
- ◆ Available equipment redundancies and bypass equipment or other work arounds.

Critical parts are those that are essential to the operation of the collection system. A list of critical spare parts should be kept with adequate quantities. A tracking system should be used to determine how frequently certain spare parts are needed and where they are needed to maintain adequate supply. The tracking system for the use of spare parts can also be used to determine if certain assets need an additional evaluation, are reaching the end of their service life, or need upgrading to a higher capacity. All utility staff should have access to the list of critical spare parts and be able to find and identify them in the warehouse.

11.4. Procurement

Having a well-established and well understood procurement policy, sometimes called a Purchasing Policy, serves as a backup plan for maintaining a spare parts and tools inventory. Sometimes during emergencies unexpected situations arise resulting in a need to quickly purchase additional materials. Having an established Purchasing Policy that is well understood and specifically outlines emergency purchases can make this process easier.

A Procurement Policy's purpose is to help balance value with price and to protect the utility from waste and abuse. A copy of the Oconee Joint Regional Sewer Authority's Purchasing Policy is included in Appendix I. This policy includes procedures for regular purchases, emergency purchases, purchasing contracts, cash purchases, and routine small purchase orders. This policy was reviewed and approved by the Oconee Joint Regional Sewer Authority.

It is recommended that Procurement Policies be reviewed on a routine basis to ensure that outlined procedures and established monetary limits are practical for the current environment.

End of Section