ADMINISTRATOR'S REPORT
Kevin Bronson
OFFICE OF THE CITY ADMINISTRATOR
WESTMINSTER, SOUTH CAROLINA

March 22, 2024

GENERAL INFORMATION

COMPLETED: Water Repair on Long Creek Highway – Please Take Note -

The 14" water line leak on highway 76 was repaired on Thursday, March 21st. Staff had isolated the area and cut into the line, however, water returned to pipe before the breach was closed, forcing staff to isolate areas additional areas of the water system. This extended period without water through the main line resulted in two of our four tanks being depleted, resulting in loss of pressure, most of the system with low pressure or no water, and a boil water advisory. Payne, McGinn, and Cummins assisted with the repair. To follow the protocols set by the SCDHEC, the boil water advisory will remain in effect until two consecutive 24 hour-separated testing samples have indicted no contamination. This is expected to continue until Sunday morning (March 24, 2024).

We sincerely apologize for the disruption in service.

This Week in Rec: An Update from Recreation Director Herb Poole

- Volleyball games and practices resumed this week, following a break for Spring break. Games are held on Monday, Tues, Thursday, and some Fridays.
- Baseball, Softball, and Tee-ball practices have begun.
- Participants in need of spring sports equipment may reach out to the Recreation Department for assistance on an as-needed basis.
- The Recreation Department fed over 300 youth over Spring Break. The week was completely funded by donations.
- Spring sports team sponsorships are still available for the 19U Baseball Teams. Please visit https://westminstersc.org/departments/recreation/ for more information.

On the horizon:

- Baseball, Softball, and Tee-ball games will begin on April 8.

USDA-RD Water System Projects

Two contractors are being utilized to install the water system improvements funded by the USDA-RD. Both contractors are on schedule. No changes from last week where the following was reported.

Arrowood General Contracting is responsible for a grouping of projects entitled Division 1.

- The project areas for Division 1 are: Dawn Drive; Dixon Rd; Phillip Lear; and Dr. Johns Rd.
- Dawn Drive is complete.
- Dixon road is complete, and all customers are now hooked on the new line and one new customer has been connected.
- They have finished laying pipe along Phillip Lear and have begun going south on Dr. Johns Rd toward Tabor Road. Once they reach the intersection of Tabor, they will come back to the intersection of Phillip Lear and begin Laying pipe north on Dr. Johns Rd toward Campbell.

- Pipe continues to be laid along Dr. John's Road toward Tabor Road. This is a long, uninterrupted stretch so progress should be good. Arrowood is less than 1000 feet from the end of this section at Tabor Road as of March 7th. Bacteriological testing will be the next step in the process. Arrowood is trying to make the connection at Tabor Road before beginning bacteriological testing.

Payne, McGinn, and Cummins is responsible for Division 2.

- The project areas in Division 2 are: two sections of Highway 76; Welcome Church Rd to Berry Farm Rd; and Berry Farm Rd to Cleveland Pike Rd.
- PMC continues to install pipe on Welcome Church Rd and have installed approximately 2 miles so far. The two sections of line on 76 have been flooded and chlorinated. Both sections have been pressure tested and passed. Both sections have passed bacteriological samples and DHEC has issued approval to operate these sections. Service connections on this section should begin in the next few weeks.
- All sections that have been skipped over so far due to rock have been connected.
- The connection of this new section to the existing line at Cleveland Pike Road occurred this week. Two Crews are now laying pipe, one from each end working toward each other.
- Flooding of the lines on Welcome Church Rd that have been completed began on Thursday afternoon. This process is being done in approximately 4,000 feet sections. Once the lines are flooded and blown off, pressure testing will occur followed by bacteriological testing on these sections.
- The Section of line on US 76 has been opened to the system and is operating. 7 new fire hydrants are now in operation.

Westminster Planning Commission

The Planning Commission met on Monday, March 18, 2024. The agenda is attached.

OJRSA

The Operations & Planning Committee met March 20, 2024, the agenda is attached.

PMPA

The PMPA Board is scheduled to meet on March 27, 2024. The agenda is attached which includes the annual audit.

PLEASE MARK YOUR CALENDARS

March 25, 2024 at 5:00 pm Oconee County Municipal Association Meeting at the Depot
March 26, 2024 at 9:00 am OJRSA Finance & Administration Committee at OJRSA
March 28, 2024 at 10:00 am PMPA Board Meeting at PMPA
March 29, 2024 City Hall closed in observation of Good Friday
April 2, 2024 at 2:00 pm Westminster City Council Special Called Meeting at City Hall
April 8, 2024 at 2:30 pm to 3:30 pm City Hall Closure to observe the Solar Eclipse.
April 9, 2024 at 4:00 pm Westminster City Council Budget Workshop at the Westminster Fire Department
April 9, 2024 at 6:00 pm Westminster City Council Meeting at the Westminster Fire Department

City Council Meeting Schedule

~~*January 9, 2024*~~	~~*6:00 PM*~~	*(Special Called for Police Chief Interviews)*
~~*February 13, 2024*~~	~~*6:00 PM*~~	
~~*March 19, 2024*~~	~~*6:00 PM*~~	
April 2, 2024	**2:00 PM**	
April 9, 2024	6:00 PM	
May 14, 2024	6:00 PM	
June 11, 2024	6:00 PM	

July 9, 2024	6:00 PM	October 8, 2024	6:00 PM
August 13, 2024	6:00 PM	November 12, 2024	6:00 PM
September 10, 2024	6:00 PM	December 10, 2024	6:00 PM

Special Events Calendar

March 22, 2024 Retreat Rosenwald School 100 Year Celebration, Retreat Rosenwald School
(4:00pm, Celebration of 100 years)

March 29, 2024 Three Crosses, Retreat Street Park
(6:30pm until, Cross Roads Church #2 hosting Good Friday Event)

March 30, 2024 Easter Egg Hunt, Anderson Park
(1:00 pm until)

April 6, 2024 Back to the Roots Pop-up Market Event, Retreat Street Park
(9:00am to 4:00pm, festival style vendors at Retreat Street)

April 20, 2024 Westminster Music Centre presents - Music on Main
(more details to come)

May 4, 2024 El Charro's Cinco de Mayo Celebration, Main Street
(4:00pm to 11:00pm, food vendors and music on Main Street)

May 18, 2024 Westminster Music Centre presents – Music on Main
(more details to come)

June 18, 2024 Juneteenth Celebration and lecture, the Depot
(more details to come)

October 11-12, 2024 South Carolina Bigfoot Festival – downtown Westminster
(more details to come)

AGENDA

PLANNING COMMISSION

City of Westminster

Monday, March 18, 2024

6:00PM

Regular Meeting

Westminster City Hall

100 E. Windsor St,

Westminster, SC 29693

Westminster Planning Commission

March 18, 2024 Meeting

6:00pm- City Hall

Swearing in of Planning Commission Members by Rebecca Overton, City Clerk:

- Mr. Jarrod Brucke, completing the term ending in 2025.

Call to Order

Invocation and Pledge of Allegiance

Certification of Quorum

Comments from Staff

- Update: HWY 123 Masterplan through SCAPA's Community Planning Assistance Program.
- Update: Zoning Ordinance
- Next Scheduled meeting will be April 15, 2024 at 6:00pm at City Hall.

Routine Business

Item #1: Consideration of Minutes from February 26, 2024

New Business (Moved)

None for consideration.

Old Business

Item #2: Future Land Use Map Quadrant 2 Workshop (Materials to be provided at meeting)

Adjourn

City of Westminster
MINUTES OF THE PLANNING COMMISSION
February 26, 2024, 6:00 pm
Westminster City Hall

The meeting was called to order at 6:00pm. In attendance were Sandra Powell, Ben Lewis, Lacey Moore and Truman Holbrooks.

Staff:
Assistant to the City Administrator, Regan Osbon

Swearing in of Planning Commission Members

Mr. Reagan Osbon swore in Planning Commission Member Sandra Powell.

Certification of Quorum

Reagan Osbon certified a quorum.

Comments from Staff

Mr. Osbon reminded the Board that there is an upcoming opportunity to participate in a Highway 123 Masterplan through SCAPA's Community Planning Assistance Program and that the City is applying for a Grant to assist with that project.

Agenda Amendment

Upon a motion by Mr. Lewis and seconded by Mr. Holbrooks, the motion to remove item #2: Public Hearing and Consideration of Zoning Amendment Application #2024-001 from the agenda passed unanimously.

Approval of Minutes

Upon a motion by Mr. Holbrooks and seconded by Mrs. Moore, the motion to approve the January 22, 2024, meeting minutes passed unanimously.

Future Land Use Map Quadrant 2 Review

Mr. Osbon reminded the Board that over the past year they had been updating and reviewing the Future Land Use Map which is part of the Comprehensive Plan. Mr. Osbon led the Board in more review of the Quadrant 2 area.

The Board reviewed the Quadrant 1 areas and made recommendations that will be documented in an updated map.

Mr. Randy Holbrooks spoke to the Board about current needs for affordable housing and bringing energy-efficient homes to the city in the form of single and double wide homes.

Adjourn

Upon a motion by Mr. Lewis and seconded by Mr. Holbrooks, the motion to adjourn the meeting passed unanimously.

(Minutes prepared by Rebecca Overton)

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Sandra Powell, Chairperson

Operations & Planning Committee Meeting

OJRSA Operations & Administration Building
Lamar Bailes Board Room
March 20, 2024 at 8:30 a.m.

Agenda

A. **Call to Order** – Bob Faires, Committee Chair

B. **Public Session** – Receive comments relating to topics on this agenda. Session is limited to a maximum of 30 minutes with no more than 5 minutes per speaker.

C. **Presentation and Discussion Items** *[May include Vote and/or Action on matters brought up for discussion]*

1. Update on current projects (Exhibit A) – Chris Eleazer, Director
2. Discuss and consider adoption of agency standard design, construction, operation, and maintenance specifications and details, which shall be referred to as the OJRSA Development Policy (Exhibit B) – Chris Eleazer

D. **Action Items to Recommend to the Board for Consideration**

- None

E. **Executive Director's Discussion and Compliance Concerns** – Chris Eleazer, Director

1. Environmental and regulatory compliance
2. Miscellaneous *(if any)*

F. **Committee Members' Discussion** – Bob Faires, Committee Chair
Discussion can be related to matters addressed in this meeting or for future consideration by this or another Committee. Voting is not permitted during this session.

G. **Upcoming Meetings** *All meetings to be held in the Lamar Bailes Board Room unless noted otherwise.*

1. Finance & Administration Committee – March 26, 2024 at 9:00 a.m.
2. Board of Commissioners – April 1, 2024 at 4:00 p.m.
3. Operations & Planning Committee – April 17, 2024 at 8:30 a.m.

H. **Adjourn**

FY2024 O&M Fund Projects 3/15/2024 14:02

	O&M Project *(Project Number (if applicable); PM)* ***CANNOT CARRY OVER TO NEXT FISCAL YEAR WITHOUT BUDGET APPROVAL***	% Complete	Anticipated Completion	PO/Contract Amount ($)	O&M PROJECT MILESTONES: Bids/RFQ/etc. Issue/Advertised	Req/Contract Signed	Started Work	Completed	Obligated/ Spent ($)	Budget Remaining ($)	GL Code *(XXXXX = get from Office Mgr)*	Comp. Performing (and Project Mgr)
FY 2023 O&M Fund Projects *Consent Order Engineering and Assessment Tasks*	**Consent Order 21-025-W Project: Sewer Use Regulation Revision and Adoption** *(CE)*	100%	6/30/2023	N/A	N/A	N/A	1/26/2022	9/11/2023	0	0	N/A	Michael Traynham OJRSA Counsel
	Consent Order 21-025-W Project: Biannual Report *(CE)*	0%	5/9/2024	0	N/A	N/A	11/3/2023	11/9/2023	0	0	N/A	Chris Eleazer OJRSA
	CCTV for CMOM/Consent Order YEAR 2 *(#2024-04; KL)*	100%	12/15/2023	117,010	7/31/2023	10/11/2023	10/11/2023	12/4/2023	127,591	(10,581)	ConSys: Prof Svcs 601-02430	David Blizzard Blizzard Consulting
	Engineering Projects WKD TO#10 (PS Evals: CON/PERK/MART/CHOE) *(KL, CE)*	100%	8/30/2023	5,106	9/28/2022	12/19/2022	1/17/2023	10/6/2023	5,106	0	ConSys: Prof Svcs 601-02430	WK Dickson Joe Swaim
	Engineering Projects WKD TO#11 (COLSYS Eval of FY 2023 CCTV/SSES) *(KL, CE)*	100%	8/30/2023	4,580	9/28/2022	1/3/2023	1/17/2023	8/11/2023	4,580	0	ConSys: Prof Svcs 601-02430	WK Dickson Joe Swaim
	Engineering Projects WKD TO#9 (COLSYS Inspect Report/Recommend) *(KL, CE)*	100%	8/30/2023	18,590	9/28/2022	1/3/2023	1/17/2023	8/1/2023	8,555	10,035	ConSys: Prof Svcs 601-02430	WK Dickson Joe Swaim
	GIS Improvements -- Easement Importation *(CE)*	90%	12/1/2023	13,200	N/A	9/12/2023	10/3/2023		3,468	9,732	Admin: Admin Svcs 501-02420	Weston & Sampson Jason Gillespie
	Hydraulic Model Update *(CE)*	100%	1/30/2023	45,000	2017 Project Continued	2017 Project Continued	8/1/2022	7/14/2023	31,600	13,400	ConSys: Prof Svcs 601-02430	Will Nading GMC
	Install Fence and Gate at GCCP PS *(MD)*	100%	N/A	N/A	N/A	N/A	N/A	N/A	0	0	Contr Svcs: Bldg Grnd 1201-02550	Jamie Gilbert OEA
	Install Radar Level Indicators and Repair Pipes on Digesters *(MD)*	100%	2/1/2024	5,680	1/3/2024	1/3/2024	1/3/2024	1/10/2024	5,680	0	WRF: R&M 701-03000	Mark Dain OJRSA
	NPDES Permit Renewal Phase 2 *(JM, KL)*	100%	6/30/2024	17,350	4/19/2022	8/22/2022	7/1/2022	1/29/2024	17,350	0	WRF: Prof Svcs 701-02430	Goldie Associates Amy Anderson
	PAA Study Phase 3 (30 day full scale test) *(KL, JM)*	100%	2/30/2023	20,750	4/1/2022	8/2/2023	8/2/2023	12/15/2023	8,000	12,750	WRF: Prof Svcs 701-02430	Goldie Associates Bob Schmitt
	Paving Around Solids Pad and Dewatering Building *(JM)*	0%	TBD	TBD	ON HOLD - HIGH BIDS	ON HOLD - HIGH BIDS	ON HOLD - HIGH BIDS	ON HOLD - HIGH BIDS	0	0	WRF: Bldgs Grnds 701-02550	TBD
	Install Bypass ~~Replace 3-way Valve~~ at Millbrook PS *(MD)*	100%	2/2/2024	14,745	9/29/2023	10/5/2023	1/22/2024	1/23/2024	14,745	0	ConSys: Millbrook PS 601-05110	Cove Utilities Jeff Caffary
	Replace/Paint Walkway Handrails *(JM)*	0%	5/31/2024	12,500	N/A	N/A			371	12,129	WRF: Bldgs Grnds 701-02550	Johnny McCall OJRSA
	Seneca Creek Pump Station and Force Main Replacement Design *(#2023-05; CE, KL)*	95%	6/1/2023	339,400	Took over from SL&W	8/17/2022	8/16/2022		310,575	28,825	O&M CIP: ConSys 1401-06071	GMC Will Nading
	Streambank & Easement Repairs *(KL)*	80%	6/30/2024	40,000	N/A	N/A	7/3/2023		29,139	10,861	Consys: Grav & FM 601-05230	OJRSA ConSys Michael McClain
	Transformer/Switchgear Cleaning and Inspection at Pump Stations *(MD)*	100%	12/15/2023	0	N/A	N/A	N/A	N/A	0	0	ConSys: Prof Svcs 601-02430	Instel Stewart Reynolds
	Transformer/Switchgear Cleaning and Inspection at WRF *(MD)*	100%	12/15/2023	8,000	N/A	N/A	12/6/2023	12/6/2023	8,500	(500)	WRF: Prof Svcs 701-02430	Instel Stewart Reynolds
	H2S Control Investigation at Martin Creek PS/FM *(KL)*	10%	6/30/2024	TBD	TBD	TBD	2/14/2024		0	0	TBD	TBD
	Utility Water Engineering Assessment *(JM, KL)*	20%	5/31/2024	21,000	11/17/2023	1/22/2024			0	21,000	WRF: Prof Svcs 701-02430	Weston & Sampson Jason Gillespie
				682,911	TOTAL FUNDS OBLIGATED/ACTUAL TO DATE:				**575,260**	**-107,651**	TOTAL AWARDED BUDGET REMAINING	

FY2024 O&M Fund Projects 3/15/2024 14:02

O&M Project *(Project Number (if applicable); PM)* ***CANNOT CARRY OVER TO NEXT FISCAL YEAR WITHOUT BUDGET APPROVAL***	**Notes**
Consent Order 21-025-W Project: Sewer Use Regulation Revision and Adoption *(CE)*	7/10: Presented to OJRSA Board for consideration. Plan to approve for public notice at 8/7 Board meeting. 8/7: Board approved for public notice. Hearing scheduled for 9/11. 9/11: Board approved after receiving no public comments. **COMPLETE**.
Consent Order 21-025-W Project: Biannual Report *(CE)*	**DUE TO DHEC EVERY SIX MONTHS.** Reports submitted: 11/14/2021, 5/9/2022, 11/10/2022, 5/9/2023, 11/9/2023. **Next due 5/10/2024**.
CCTV for CMOM/Consent Order YEAR 2 *(#2024-04; KL)*	10/11: Mobilized and began work. 10/16: Has completed 4 line segments, very little sediment and issues found so far. 11/13: Have 2 segments left to CCTV then finished. 11/17: Completed field work, still owes evaluation and CCTV footage. 12/15: **COMPLETE**.
Engineering Projects WKD TO#10 (PS Evals: CON/PERK/MART/CHOE) *(KL, CE)*	**For SCIIP Match. CONTINUATION OF FY 2023 PROJECT (Spent FY 2023: $64,894 of $70,000)**. 9/5: KL and MD reviewing. 9/15: KL sent comments to WK Dickson. 10/6: Received report. KL confirmed it is complete. **COMPLETE.**
Engineering Projects WKD TO#11 (COLSYS Eval of FY 2023 CCTV/SSES) *(KL, CE)*	**For SCIIP Match. CONTINUATION OF FY 2023 PROJECT (Spent FY 2023: $36,920 of $41,500)**. 8/11: **COMPLETE**.
Engineering Projects WKD TO#9 (COLSYS Inspect Report/Recommend) *(KL, CE)*	**For SCIIP Match. CONTINUATION OF FY 2023 PROJECT (Spent FY 2023: $30,410 OF $49,000)**. 9/5: **COMPLETE**. This was used to go out for bid that was awarded to Tugaloo.
GIS Improvements -- Easement Importation *(CE)*	12/15: Working with L Brandt's office to locate missing easements (if they are indeed missing, otherwise no easements exist for several sewers within system) 2/16: Met with consultant and they showed the system. Looks very good. Nearing end of project.
Hydraulic Model Update *(CE)*	FY 2023 project that was finalized in early FY 2024. 6/8: Received draft report. 7/14: **COMPLETE**
Install Fence and Gate at GCCP PS *(MD)*	9/29: J Gilbert mentioned at OEA meeting they will be installing. 10/3: Emailed J Gilbert and Kyle. JG responded and said they're taking care of it and no assistance is needed from OJRSA. Considered **COMPLETE**.
Install Radar Level Indicators and Repair Pipes on Digesters *(MD)*	11/13: Still waiting. Have repaired pipes. 12/15: Negotiating prices, expect to order next week. 1/2: Got quote today. 1/16: Equipment has arrived from Clearwater. **COMPLETE**
NPDES Permit Renewal Phase 2 *(JM, KL)*	*Continued from Phase 1 FY 2023.* 1/16: KL going over to Goldie to enter info into ePermitting once OJRSA approves of draft. 1/29: Application submitted to DHEC. **COMPLETE**
PAA Study Phase 3 (30 day full scale test) *(KL, JM)*	**CONTINUATION OF FY 2023 PROJECT (Spent FY 2023: $29,250).** 11/13: Goldie having to now do toxicity. Should be finished by end of month. 12/15: **COMPLETE**. Passed all criteria. Goal is to have it included in next NPDES permit.
Paving Around Solids Pad and Dewatering Building *(JM)*	10/16: Spoke with King, waiting to hear from Doug. 11/13: King finally showed up. Came in substantially over budget. **ON HOLD.** 2/15: KL talking with another paving company to see what their price will be. 3/15: Can't get the other company to come over.
Install Bypass ~~Replace 3-way Valve~~ at Millbrook PS *(MD)*	10/3: Got back quote, it's within budget. Now will work on scheduling. MD gathering parts. 10/5: Authorized Cove to perorm work. 10/16: Waiting on parts. 11/13: Still waiting on parts. 12/15: Scheduled for 1/24/2024. 1/24: **COMPLETE.** Waiting on invoice.
Replace/Paint Walkway Handrails *(JM)*	11/13: Scheduling person to come out. We have all paint. 1/2: Sherwin Williams said we will have to wait until temps are above 60. 3/15: JM going to wait until April to start.
Seneca Creek Pump Station and Force Main Replacement Design *(#2023-05; CE, KL)*	Continued from FY 2023. FY 2024: $120,000. 2/28: GMC CA&Insp contract needed $140,000. 3/4: Board approved contract development b/t OJRSA and Fountain Residential. To be presented to Board 4/1. Still need easements.
Streambank & Easement Repairs *(KL)*	1/16: Repaired at MH 451 (9 total). 2/8: Had to perform emergency repair related to 2/6 SSO. 3/15: Had to purchase a lot to repair trench where 2/6 SSO occurred. Still have more to do on this project.
Transformer/Switchgear Cleaning and Inspection at Pump Stations *(MD)*	8/17: Need to schedule. 9/5: MD called Instel to set up schedule 10/3: Scheduled for 12/6-7. 12/15: Not needed because all transformers are owned by Blue Ridge Electric Co-op and it is their responsibility to maintain these, not ours. **COMPLETE**
Transformer/Switchgear Cleaning and Inspection at WRF *(MD)*	8/17: Need to schedule. 9/5: MD called Instel to set up schedule 10/3: Scheduled for 12/6-7. 12/6: **COMPLETE**. Will need to budget to correct deficiencies found during inspection.
H2S Control Investigation at Martin Creek PS/FM *(KL)*	Added 2/14/2024 to address H2S and odors associated with Martin Creek PS/FM in the Friendship Rd/Wells Hwy area. 3/15: Next milestone is to determine issue(s) by 4/30. KL working with consultant to develop scope, expect to hear by end of March.
Utility Water Engineering Assessment *(JM, KL)*	1/16: KL said his review team selected Weston & Sampson. 2/29: W&S conducted site visit and inspection. 3/15: W&S to begin hydraulic model and concept development soon.

FY2024 Restricted Fund Projects

3/15/2024 14:02

FY 2024 Restricted Funds Capital Projects *Projects may carry across budget years*

Restricted Fund Projects *(Project Number (if applicable); Project Manager)*	% Complete	Anticipated Completion	PO/Contract Amount ($)	RESTRICTED FUND PROJECT MILESTONES: Bids/RFQ/etc. Issue/Advertised	PO/Contract Signed	Started Work	Completed	Obligated/ Spent ($)	Budget Remaining ($)	GL Code *(XXXXX = get from Office Mgr)*	Comp. Performing (and Project Mgr)
Central Oconee County Sewer Basin Study *(CE)*	35%	6/3/2024	317,800	N/A	8/9/2023	9/12/2023		118,190	199,610	PROJ & CONT 1501-09007	Weston & Sampson Kip Gearhart
Consent Order Projects 2022 CONSTRUCTION SCIIP MATCH *(#2024-02; CE, KL)*	60%	2/28/2024	351,291	7/28/2023	10/17/2023	12/4/2023		95,438	255,853	PROJ & CONT 1501-09008	Tugaloo Pipeline Ed Hare
Consent Order Projects 2023 ENGINEERING (WKD TO#13) SCIIP MATCH *(#2021-01; CE, KL)*	50%	8/31/2025	398,000	N/A	9/15/2023	10/3/2023		81,119	316,881	PROJ & CONT 1501-09009	WK Dickson Joe Swaim
Consent Order Projects 2023 CONSTRUCTION SCIIP PROJECT *(#20XX- XX ; CE, KL)*	0%	8/31/2025	TBD	TBD				0	0	PROJ & CONT 1501-TBD	TBD
Dewatering Equipment Replacement ENGINEERING SCIIP MATCH *(#2024-06; KL)*	20%	PHASE I 5/31/2024	73,200	9/15/2023	12/19/2023	1/11/2024		45,930	27,270	PROJ & CONT 1501-09011	KCI Technologies Tom Vollmar
Dewatering Equipment Replacement CONSTRUCTION SCIIP PROJECT *(#2024- XX ; KL)*	0%	TBD	TBD	MUST	COMPLETE	ENGINEERING	FIRST	0	0	PROJ & CONT 1501-TBD	TBD
Exit 4/Oconee Manufacturing Park PS/Sewer ENGINEERING *(Oconee County #TBD; CE)*	90%	TBD	N/A OCONEE CO PROJ	N/A OCONEE CO PROJ	N/A OCONEE CO PROJ	Sometime in 2022		0	0	TBD	Thomas & Hutton Lee Brackett
Flat Rock PS Replacement ENGINEERING/ CONST SVCS SCIIP MATCH *(#2022-03; CE)*	60%	9/30/2024	177,800	2/14/2022	7/5/2055	7/1/2022		110,137	67,663	PROJ & CONT 1501-09005	KCI Technologies Tom Vollmar
Flat Rock PS Replacement CONSTRUCTION *(#2024-03; CE)* **SCIIP PROJECT**	3%	9/30/2024	1,293,500	6/7/2023	8/29/2023			34,200	1,259,300	PROJ & CONT 1501-09005	Cove Utilities Jeff Caffery
Regional Sewer Feasibility Study RIA GRANT *(#2024-01; CE)*	30%	11/29/2024	100,000	5/26/2023	10/10/2023	11/8/2023		46,336	53,664	PROJ & CONT 1501-09010	WK Dickson Angie Mettlen
Sewer South Phase II ENGINEERING/ CONSTRUCTION/INSPECT SVCS *(CE)*	65%	6/30/2024	480,850	N/A	5/4/2023	5/4/2023		231,696	249,154	SSF: CIP 1401-06050	Davis & Floyd John Reynolds
Sewer South Phase II CONSTRUCTION *(CE)*	65%	6/30/2024	11,843,452	9/27/2022	3/23/2023	6/1/2023		5,675,056	6,168,396	SSF: CIP 1401-06050	Kevin Moorhead Moorhead Construct
Thickener Sludge Pump (P-113), Including Install *(MD)*	100%	5/30/2023	29,571	8/1/2022	12/13/2023	6/29/2023	8/4/2023	37,949	(8,378)	PROJ & CONT 1501-09002	Greenstone Drew Goldie
	0%							0	0		
	0%							0	0		
			15,065,464	TOTAL RESTRICTED FUNDS OBLIGATED/ACTUAL TO DATE:				**6,476,050**	**-8,589,414**	TOTAL AWARDED BUDGET REMAINING	

FY2024 Restricted Fund Projects 3/15/2024 14:02

Restricted Fund Projects *(Project Number (if applicable); Project Manager)*	**Notes**
Central Oconee County Sewer Basin Study *(CE)*	To continue under #2022-01 (Southern Oconee/Western Anderson Sewer Master Plan). 2/8: Began public workshops. Others to be held 2/15 and 2/22. 3/15: Workshops held, survey open thru end of March, still collecting and analyzing data.
Consent Order Projects 2022 CONSTRUCTION SCIIP MATCH *(#2024-02; CE, KL)*	Carryover from FY 2023. 2/15: All eastern side repairs are complete and tested. Preparing for pipe replacement + 2 point repairs. 3/15: Supposed to core manholes for pipe replacement next week. Behind schedule due to weather.
Consent Order Projects 2023 ENGINEERING (WKD TO#13) SCIIP MATCH *(#2021-01; CE, KL)*	10/3: Kickoff meeting held. 12/8: Received plans from WK Dickson. CE, KL, MM need to review these. 1/2: Still need to review. 1/12: Provided comments to J Swaim. 3/6: WKD finalizing drawings and development of front end and specs documents.
Consent Order Projects 2023 CONSTRUCTION SCIIP PROJECT *(#20XX-XX; CE, KL)*	8/17: To be bid upon design (WKD TO#13). 10/3: Ancitipated bidding to begin 5/2024 and construction to begin around 8/2024.
Dewatering Equipment Replacement ENGINEERING SCIIP MATCH *(#2024-06; KL)*	3/5: Received alternatives/options from engineer. 3/14: Received feedback from RIA. They need a revision to RFP before advertisement.
Dewatering Equipment Replacement CONSTRUCTION SCIIP PROJECT *(#2024-XX; KL)*	FY 2024 O&P Fund project "Dewatering Equipment Assessment FOR EVENTUAL SCIIP PROJECT" must be completed first.
Exit 4/Oconee Manufacturing Park PS/Sewer ENGINEERING *(Oconee County #TBD; CE)*	12/19: Received updated drawings w/ request for letter to go to DHEC. Responded that I will need Board approval for this. 3/15: A Brock mentioned several weeks ago that there may be a slight modification to the route of this; if so, OJRSA will need to review.
Flat Rock PS Replacement ENGINEERING/ CONST SVCS SCIIP MATCH *(#2022-03; CE)*	Work performed in conjunction with Flat Rock PS Replacement CONSTRUCTION.
Flat Rock PS Replacement CONSTRUCTION *(#2024-03; CE)* **SCIIP PROJECT**	11/13: Scheduled to begin construction in 3/2024 due to electrical/genset. 3/14: Mobilization scheduled to begin week of 3/15 and bypass pumping week of 4/1.
Regional Sewer Feasibility Study RIA GRANT *(#2024-01; CE)*	11/8: Stakeholder meetings today. 12/15: RFI to cities, county, OJRSA due today. 1/2: Meetings set up for later this month. 2/14: AM said all meetings with cities, county complete. On schedule.
Sewer South Phase II ENGINEERING/ CONSTRUCTION/INSPECT SVCS *(CE)*	*Also see Sewer South Phase II Construction for additional information.* 10/6: County approved additional $6,350 to survey access road. Contract total increased by this amount.
Sewer South Phase II CONSTRUCTION *(CE)*	1/31: Pipe underneath lake complete and started work on pump stations. 2/28: On schedule. And we were able to obtain the additional easement that was necessary.
Thickener Sludge Pump (P-113), Including Install *(MD)*	*Carryover from FY 2023. Some costs may have been paid during previous FY.* 9/15: **COMPLETE.**

CONTENTS

Section 0 – Definitions, Acronyms, and Format 1
0.1 Definitions 1
0.2 Symbols, Acronyms, and Abbreviations 5
0.3 Document Format 7
0.4 Revision History 7
Section 1 – Policy as Regulation and Administrative Items 8
1.1 Authority and Adoption 8
1.2 Applicability 8
1.3 Substitutions 8
1.4 Items Not Addressed Within This Policy 8
1.5 Appeals 8
Section 2 – General Requirements 9
2.1 General 9
2.2 Fees 9
2.3 Sewer Availability, Capacity Approval, and Request for Service 10
2.4 Ownership 11
2.4.1 Easements 11
2.4.2 Public Sewers and Pump Stations 12
2.4.3 Sewer Services (Laterals) 12
2.4.4 Grinder Pumps (Individual) and Affiliated Force Mains 13
2.5 Review of Plans 14
2.6 Approval of Plans and Submittals 14
2.7 Project Construction 14
2.8 Final Inspection 15
2.9 Project Closeout 16
2.9.1 General 16
2.9.2 Certifications and Records 16
2.9.3 GIS Submittals 18
Section 3 – Design Criteria 21
3.1 Minimum Design Standards 21
3.2 Sewer System Infrastructure Sizing 21
3.3 Gravity Sewer Design Criteria 21
3.3.1 General 21
3.3.2 Minimum Slope 22
3.3.3 Minimum Flow Depths 22
3.3.4 Gravity Sewer Main Sizing 22
3.3.5 Manholes 23
3.3.6 Gravity Sewer in Proximity to Water Mains & Storm Drainage Structures 24
3.3.7 Gravity Sewer in Proximity to Sources of Energy or Corrosive Soils 25
3.3.8 Sewer Services (Laterals) 25
3.4 Sewer Force Main Design Criteria 26
3.4.1 General 26
3.4.2 Sewer Force Main Sizing 26
3.4.3 Force Main in Proximity to Water Mains & Storm Drainage Structures 27
3.4.4 Force Main in Proximity to Sources of Energy or Corrosive Soils 28
3.4.5 Force Main Valves 28
3.4.6 Connections to Existing Systems 28
3.5 Sewer Pump Station Design Criteria 28

DRAFT

3.5.1 Pump Station Site 28
3.5.2 Pump Station Type and Pumps 29
3.5.3 Wet Wells 29
3.5.4 Electrical 30
3.5.5 Supervisory Control and Data Acquisition (SCADA) 31
Section 4 – Materials of Construction 32
4.1 Gravity Sewer Pipe 32
4.1.1 Referenced Standards 32
4.1.2 Submittals 32
4.1.3 Preferred Manufacturers 32
4.1.4 Materials of Construction 32
4.2 Force Main Sewer Pipe 33
4.2.1 Polyvinyl Chloride (PVC) Pipe Force Mains 33
4.2.2 Ductile Iron Pipe (DIP) Force Mains 35
4.3 Horizontal Directional Drilling 37
4.3.1 Referenced Standards 37
4.3.2 Submittals 37
4.3.3 Preferred Manufacturers 37
4.3.4 Materials of Construction 37
4.4 Boring Encasement 40
4.4.1 Referenced Standards 40
4.4.2 Submittals 40
4.4.3 Preferred Manufacturers 40
4.4.4 Materials of Construction 40
4.5 Manholes 41
4.5.1 Precast Concrete Manholes 41
4.5.2 Polymer Concrete Manholes 43
4.6 Sewer Service (Lateral) Pipe and Connections 45
4.6.1 Referenced Standards 45
4.6.2 Submittals 45
4.6.3 Approved Manufacturers 45
4.6.4 Materials of Construction 45
4.7 Wet Wells and Vaults 45
4.7.1 Precast Concrete Wet Wells and Vaults 45
4.7.2 Polymer Concrete Wet Wells and Vaults 47
4.8 Pump Stations 49
4.8.1 Centrifugal Suction Lift Pump Stations 49
4.8.2 Submersible Pump Stations 61
4.8.3 Grinder Pumps for Individual Users 69
4.9 Standby Generators 72
4.9.1 Referenced Standards 72
4.9.2 Submittals 72
4.9.3 Approved Manufacturer 73
4.9.4 Materials of Construction 73
4.10 Transfer Switches 77
4.10.1 Referenced Standards 77
4.10.2 Submittals 77
4.10.3 Approved Manufacturers 78
4.10.4 Materials of Construction 78
4.11 Surge Protection for Low-Voltage (less than 480 V) Electrical Power Circuits 80
4.11.1 Referenced Standards 80
4.11.2 Submittals 80

DRAFT

4.11.3 Approved Manufacturers 80
4.11.4 Materials of Construction 80
4.12 Supervisory Control and Data Acquisition (SCADA) 82
4.13 General Electrical Provisions 82
4.13.1 Referenced Standards 82
4.13.2 Submittals 82
4.13.3 Approved Manufacturers 82
4.13.4 Materials of Construction 82
4.14 Flow Meters 83
4.14.1 Referenced Standards 83
4.14.2 Submittals 83
4.14.3 Approved Manufacturers 83
4.14.4 Materials of Construction 83
4.15 Valves, Pressure Gauges, and Associated Appurtenances 85
4.15.1 Referenced Standards 85
4.15.2 Submittals 85
4.15.3 Approved Manufacturers 85
4.15.4 Materials of Construction 86
4.16 Painting 90
4.16.1 Referenced Standards 90
4.16.2 Submittals 90
4.16.3 Approved Manufacturers 90
4.16.4 Materials of Construction 90
4.17 Protective Coatings for Concrete Wet Wells, Vaults, and Manholes 97
4.17.1 Referenced Standards 97
4.17.2 Submittals 97
4.17.3 Approved Manufacturers 97
4.17.4 Materials of Construction 97
4.18 Chain Link Fences and Gates 98
4.18.1 Referenced Standards 98
4.18.2 Submittals 99
4.18.3 Approved Manufacturers 99
4.18.4 Materials of Construction 99
Section 5 – Installation 101
5.1 Gravity Sewer Pipe 101
5.1.1 General 101
5.1.2 Pipe Handling 101
5.1.3 Pipe Installation 101
5.1.4 Testing 102
5.2 Force Main Sewer Pipe 104
5.2.1 Polyvinyl Chloride (PVC) Pipe Force Mains 104
5.2.2 Ductile Iron Pipe (DIP) Force Mains 106
5.3 Horizontal Directional Drilling 108
5.3.1 General 108
5.3.2 Delivery and Off-Loading 108
5.3.3 Handling and Storage 108
5.3.4 Fusion Process 109
5.3.5 Drilling Operations 109
5.3.6 Pipe Pullback and Insertion 111
5.3.7 Installation Cleanup 111
5.3.8 Testing 111
5.4 Boring and Tunneling 113

DRAFT

5.4.1 General Requirements 113
5.4.2 Boring 113
5.5 Manholes 113
5.5.1 Precast Concrete Manholes 113
5.5.2 Polymer Concrete Manholes 115
5.6 Service Pipe and Connections 117
5.6.1 General 117
5.6.2 Approved Manufacturers 117
5.6.3 Installation for New Sewer Mains 117
5.6.4 Service Line Installation for Existing Sewer Mains 117
5.7 Wet Wells and Vaults 120
5.7.1 Precast Concrete Wet Wells and Vaults 120
5.7.2 Polymer Concrete Wet Wells and Vaults 122
5.8 Pump Stations 124
5.8.1 Centrifugal Suction Lift Pumps 124
5.8.2 Submersible Pumps 125
5.8.3 Grinder Pumps for Individual Users 126
5.9 Standby Generators 127
5.9.1 General 127
5.9.2 Inspection 127
5.9.3 Installation 127
5.9.4 Connections 127
5.9.5 Identification 127
5.9.6 Field Quality Control 127
5.9.7 Battery Equalization 128
5.9.8 Cleaning 128
5.9.9 Demonstration 128
5.10 Transfer Switches 129
5.10.1 General 129
5.10.2 Wiring to Remote Components 129
5.10.3 Connections 129
5.10.4 Field Quality Control 129
5.10.5 Cleaning 129
5.10.6 Demonstration 130
5.11 Surge Protection 130
5.11.1 General 130
5.11.2 Installation 130
5.11.3 Field Quality Control 130
5.11.4 Startup Service 130
5.11.5 Demonstration 130
5.12 Supervisory Control And Data Acquisition (SCADA) 131
5.12.1 Surface Conditions 131
5.12.2 Installation 131
5.12.3 Applications Software Development 131
5.12.4 Training 131
5.12.5 Start-Up Services 132
5.13 General Electrical Provisions 132
5.13.1 General 132
5.13.2 Work Included 132
5.13.3 Supervision and Scheduling 132
5.13.4 Additions, Renovations, and Demolitions 132
5.13.5 Cutting, Drilling, and Patching 133

DRAFT

5.13.6 Touch-Up Painting 133
5.13.7 Demonstration of Completed Electrical Systems 133
5.13.8 Warranty 133
5.14 Flow Meters 133
5.14.1 General 133
5.14.2 Inspection 133
5.14.3 Installation 133
5.14.4 Inspection and Testing 134
5.14.5 Service 134
5.14.6 Operator Training 134
5.14.7 Equipment Protection 134
5.14.8 Warranty 134
5.15 Valves 134
5.15.1 General 134
5.15.2 Inspection 134
5.15.3 Installation 135
5.16 Painting 135
5.16.1 General 135
5.16.2 Installation Conditions 135
5.16.3 Inspection 135
5.16.4 Preparation of Surfaces 135
5.16.5 Materials Preparation 136
5.16.6 Application 136
5.16.7 Clean-Up and Protection 137
5.17 Protective Coatings for Concrete Wet Wells, Vaults, and Manholes 138
5.17.1 General 138
5.17.2 Acceptable Applicators 138
5.17.3 Examination 138
5.17.4 Surface Preparation 138
5.17.5 Application of Repair Materials 139
5.17.6 Application of Protective Coating 139
5.17.7 Testing and Inspection 139
5.17.8 Clean-Up 140
5.18 Chain Link Fences and Gates 140
5.18.1 General 140
5.18.2 Installation 140
5.18.3 Erection Tolerances 141
Section 6 – Commercial Pretreatment Users 142
6.1 General 142
6.2 References 142
6.3 Installation, Ownership, Operation, and Maintenance of Special Devices 142
6.4 Approvals for Installation and Operation 143
6.5 Variances and Deviations 143
6.6 Fats, Oils, and Grease (FOG) Control Devices 143
6.6.1 Applicability 143
6.6.2 Applicable Details 144
6.6.3 Requirements 144
6.6.4 Required Connections 144
6.6.5 Prohibitions 144
6.6.6 Mop Basin Installation 145
6.6.7 FOG Traps 145
6.6.8 FOG Interceptors 145

DRAFT

6.7 Other Special Devices **147**
6.7.1 Applicability 147
6.7.2 Applicable Details 148
6.7.3 Requirements 148
6.7.4 Submittals 148
Section 7 – Referenced Standards **149**
7.1 SCDHEC Regulation 61-67, Appendix A [June 26, 2015 version], *with exceptions noted* **149**
7.2 Referenced Standards – Non-SCDHEC **151**
Section 8 – Forms **156**
8.1 Downstream Wastewater Modeling Analysis Request **157**
8.2 Surety Bond Form **159**
8.3 Standard Easement Agreement **159**
8.4 Project Closeout Checklist **160**
8.5 CCTV Inspection Report **163**
8.6 Gravity Sewer Low-Pressure Air Test **164**
8.7 Force Main Hydrostatic Pressure Test **165**
8.8 Manhole Vacuum Test **166**
8.9 Pump Station Drawdown Test (Circular Wet Well) **167**
8.10 Pump Station Drawdown Test (Rectangular Wet Well) **168**
8.11 Fats, Oils, & Grease (FOG) Interceptor Installation Checklist **169**
8.12 Fats, Oils, and Grease (FOG) Interceptor Inspection & Waste Disposal Form **170**
8.14 Fats, Oils, & Grease (FOG) Control Device Inspection Form **172**
Section 9 – Standard Details **174**

DRAFT

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.

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.

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

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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, churches, 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.

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:

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

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.

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.

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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.

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 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.

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Registered Professional Engineer shall mean a person who is registered as a professional engineer in the State of South Carolina. 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 SCDHEC (or other such permit issued by SCDHEC 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.

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.

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 Health and Environmental Control (SCDHEC) shall mean the government agency, or its successor agency, responsible for environmental regulations and enforcement in the State of South Carolina.

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.

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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 as *Unit Contributory Loadings to All Domestic Wastewater Treatment Facilities* (SCDHEC 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)
CPVC: Chlorinated Polyvinyl Chloride

DRAFT

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

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PVCO: Molecularly Oriented Polyvinyl Chloride
rpm: Revolutions per Minute (unit of speed)
RTU: Remote Terminal Unit
SCADA: Supervisory Control and Data Acquisition
SCCR: Short Circuit Current Rating
SCDHEC: South Carolina Department of Health and Environmental Control or any successor agency
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
Italic 'Cambria Math' Font	Mathematic or chemistry formula
Dashed Underline	Name of a form to use for documenting a task referenced in the document
Italics	Title of books, manuals, and other documents
MIX-SIZED CAPITAL LETTERS	Name of sections or appendices in a book, manual, or other document
Underlined Blue Font	Hyperlink to section within the document
Underlined Italics	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	XX/XX/XXXX	Comprehensive policy update adopted by *OJRSA Resolution 2024-XX*.

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SECTION 1 – POLICY AS REGULATION AND ADMINISTRATIVE ITEMS

1.1 AUTHORITY AND ADOPTION

The *OJRSA Development Policy* (Policy) shall become effective in accordance with OJRSA Resolution 2024-XXX with an effective date of _____.

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 a 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.*

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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 (SCDHEC) 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 2.9 of this manual.

2.2 FEES

A. The fee(s) due are based on when the project is approved as stated in SECTION 2.6.

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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.

2.3 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 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 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

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

2.4 OWNERSHIP

2.4.1 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

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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).

2.4.2 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-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.

2.4.3 Sewer Services (Laterals)

A. For service connections eight inches (8 in.) and larger, see SECTION 2.4.2.

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 2.4.4.

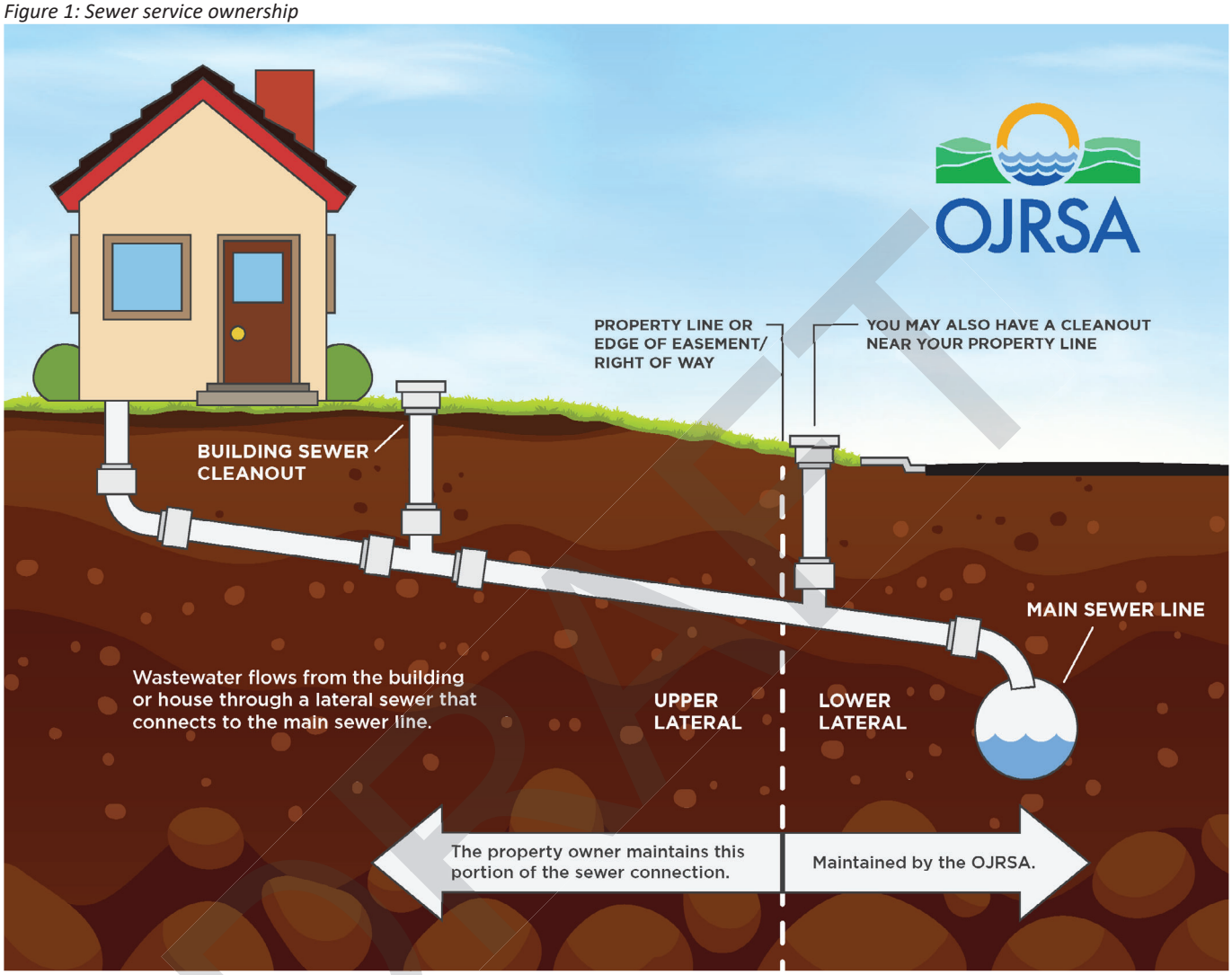
C. A cleanout shall be installed on the lateral at the edge of the right of way to provide access to inspect and clean the sewer lateral.

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

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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



2.4.4 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.

2.5 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.

2.6 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.

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 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 Construction Permit Application package to SCDHEC for approval.

2.7 PROJECT CONSTRUCTION

A. Prior to the beginning of construction, the Engineer of Record (EOR) shall submit a copy of the SCDHEC 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.

DRAFT

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.

2.8 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

DRAFT

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.

2.9 PROJECT CLOSEOUT

2.9.1 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.

2.9.2 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

DRAFT

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)

DRAFT

(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

2.9.3 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 (.lpkx)
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

DRAFT

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

DRAFT

(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

DRAFT

SECTION 3 – DESIGN CRITERIA

3.1 MINIMUM DESIGN STANDARDS

Unless specifically addressed within this Policy, all designs must comply with SCDHEC 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:

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

$$Where\ P\ is\ Average\ Daily\ Flow\ (ADF)\ in\ gallons\ per\ day\ (gpd)\ \div 100$$

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.

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

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

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:

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

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

DRAFT

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 *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 Slope

Under no scenario shall the slope of a gravity sewer main values fall below the minimum values listed in Table 1.

Table 1: Minimum 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 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

3.3.4 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.

DRAFT

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		

3.3.5 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 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.)

DRAFT

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.

3.3.6 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 *State Primary Drinking Water Regulations* 61-58.4(D)(12) and SCDHEC *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.

DRAFT

3.3.7 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

3.3.8 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 residential 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

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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 section (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

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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 *State Primary Drinking Water Regulations* 61-58.4(D)(12) and SCDHEC *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.
      (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.

[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.

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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 3.3.5(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 3.3.5.
G. Unless otherwise approved by OJRSA, the electric meter shall be located outside of the perimeter fence of the pump station site.

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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

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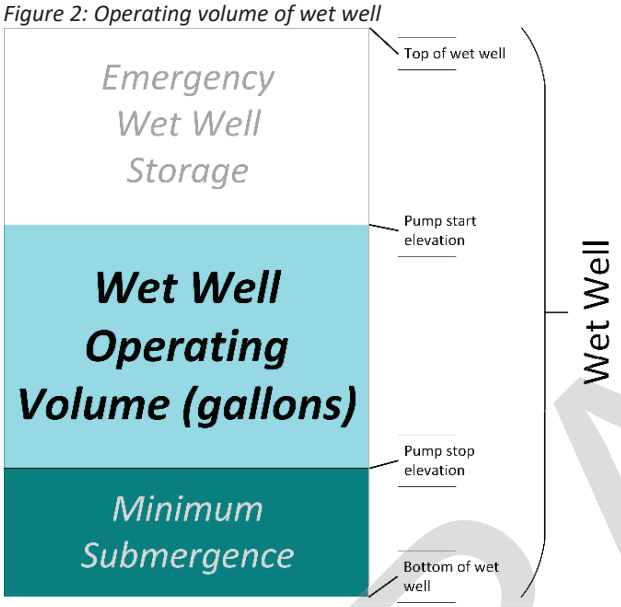
B. The wet well diameter shall be at least six feet (6 ft). **THE OJRSA MAY REQUIRE A RECTANGULAR WET WELL BASED ON ITS ENGINEER'S RECOMMENDATION.**
C. The top of the wet well slab shall be sloped to facilitate drainage away from the pump station.
D. The wet well size shall be determined according to 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.

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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

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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, 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. Permox-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.

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(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, 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,

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2. Permox-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; *fittings 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).

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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, 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

DRAFT

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

DRAFT

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.

DRAFT

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.

DRAFT

(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

DRAFT

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.

DRAFT

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 year (564 lb/yd^3).
        (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.

DRAFT

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 3.3.5(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.

DRAFT

(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

DRAFT

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

DRAFT

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, 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.

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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 year (564 lb/yd^3).
    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.

DRAFT

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.

DRAFT

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

DRAFT

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.

DRAFT

(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 unscreened 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.

DRAFT

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.

DRAFT

(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

DRAFT

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

DRAFT

(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 lighting.

F. Station Fiberglass Enclosure and Base
   1. Small Pump Station (as defined in Table 8 on page 29)
      (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.

DRAFT

(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 29)

(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

DRAFT

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

DRAFT

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 29)

(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

DRAFT

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.

DRAFT

(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

DRAFT

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

DRAFT

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

DRAFT

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

DRAFT

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 Brinnel
   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.

DRAFT

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 relubrication 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

DRAFT

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.

DRAFT

(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).

DRAFT

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 watertight 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

DRAFT

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 turn 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

DRAFT

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*.

DRAFT

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.

DRAFT

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 receptable 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.

DRAFT

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 date 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%).

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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).

DRAFT

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 µm) 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

DRAFT

dBA).

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 (±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

DRAFT

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 (±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%).

DRAFT

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 date needed to prove compliance with the specified requirements.

DRAFT

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 (±2%) or better over an operating temperature range of negative twenty degrees Celsius (-20°C) to positive seventy degrees Celsius (+70°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

DRAFT

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 (±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)

DRAFT

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 date 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:

DRAFT

(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)

DRAFT

(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, 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

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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 (±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 (±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 (±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.

DRAFT

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.

DRAFT

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:

DRAFT

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 repackable 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

DRAFT

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

DRAFT

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

DRAFT

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

DRAFT

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-

DRAFT

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 ft^2/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

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(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 ft^2/gal) to three hundred square feet per gallon (300 ft^2/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 ft^2/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

DRAFT

(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 ft^2/gal)
(b) 2nd Coat: 46-465 H.B. Tnemecol, ninety-four square feet per gallon (94 ft^2/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,

DRAFT

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.

DRAFT

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 ft^2/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-eight inch (0.125 in.) textured finish, broadcast to rejection of 5310-8 into wet slurry.

(c) 3rd Coat: Grout Coat, for the one-eight inch (0.125 in.) textured version, Resuflor 3746 one hundred square feet per gallon (100 ft^2/gal) to one hundred fifty square feet per gallon (150 ft^2/gal)

(d) 4th Coat: Topcoat Resuflor 4638 applied at one hundred square feet per gallon (100 ft^2/gal) to one hundred fifty square feet per gallon (150 ft^2/gal)

(S) Concrete Flumes, Launders, 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

DRAFT

(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 Egshell 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

DRAFT

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 3.3.5(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.

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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/ft^2) determined in accordance with ASTM A90.
D. Accessories
    1. Reinforcing Wire: Not lighter that 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

DRAFT

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*.

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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)*.

DRAFT

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 manholes.

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.

DRAFT

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

DRAFT

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,

DRAFT

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

DRAFT

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:

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

DRAFT

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

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.

DRAFT

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

DRAFT

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	$Pipe\ Diameter + 4\ in.$
8-to-24	$Pipe\ Diameter \times 1.5$

DRAFT

Greater than 24	$Pipe\ Diameter + 12\ in.$

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.

DRAFT

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

DRAFT

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.

DRAFT

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 3.3.5(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

	Allowable Leakage (in inches based on manhole diameter)		
Manhole Depth (feet)	**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

DRAFT

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

DRAFT

(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 3.3.5(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

	Allowable Leakage (in inches based on manhole diameter)		
Manhole Depth (feet)	**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.

DRAFT

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 2.4.4)
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

DRAFT

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

DRAFT

(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 D010 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

DRAFT

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-

DRAFT

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 ft^2) OF STRUCTURE WALL PER FOUR (4) HOUR PERIOD**.

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

	Allowable Leakage (in inches based on manhole diameter)		
Manhole Depth (feet)	**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

	Manhole or Wet Well Diameter (inches)								
	36	**42**	**48**	**54**	**60**	**66**	**72**	**84**	**96**
Structure Depth (feet)	**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

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	Manhole or Wet Well Diameter (inches)								
	36	42	48	54	60	66	72	84	96
Structure Depth (feet)	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*

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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 ft^2) OF STRUCTURE WALL PER FOUR (4) HOUR PERIOD**.

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

	Allowable Leakage (in inches based on manhole diameter)		
Manhole Depth (feet)	**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

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

DRAFT

	Manhole or Wet Well Diameter (inches)								
	36	**42**	**48**	**54**	**60**	**66**	**72**	**84**	**96**
Structure Depth (feet)	**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.

DRAFT

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.

DRAFT

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.

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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

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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

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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 microohms (500 μΩ) 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.

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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

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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.

DRAFT

(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.

DRAFT

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.

DRAFT

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.

DRAFT

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

DRAFT

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

DRAFT

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

DRAFT

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-

DRAFT

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.

DRAFT

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.

DRAFT

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.

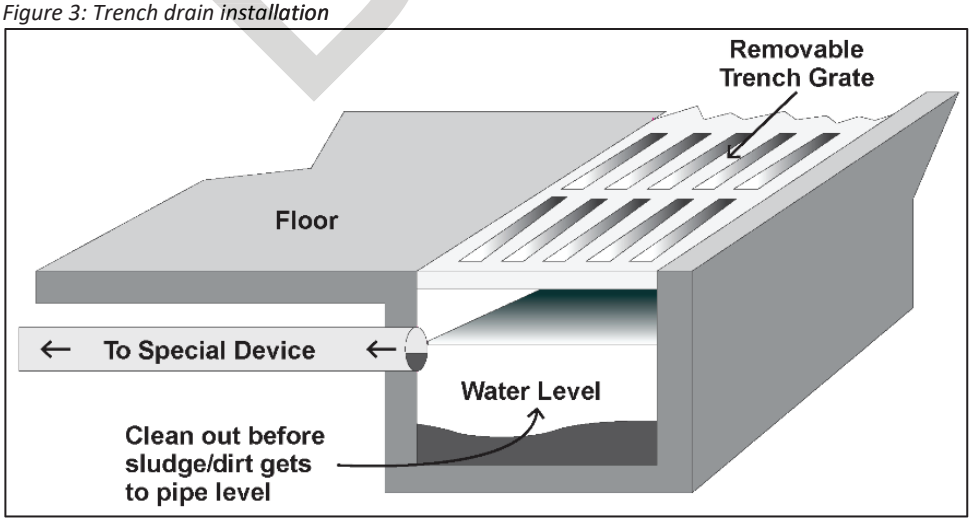
6.2 REFERENCES

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



DRAFT

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 Nonresidential Food Service Establishments (FSE), Multi-Family Developments, and FOG Generators as defined in SECTION 9 of the *OJRSA Sewer Use Regulation*.
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 dwellings.
    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

[1] 2018 IPC Chapter 10 Section 1003.1

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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 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 CLOSES 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. Wastewater discharged from a dishwasher that has a prerinse sink; [6]
    2. Water from refrigerator drain lines, beverage dispenser drain lines, ice machines, or handwashing sinks;
    3. Water from showers, toilets, bathroom sinks, washing machines, and baths/showers; and
    4. Wastewater discharged from a Garbage Grinder.[7]

[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
[6] 2018 IPC Chapter 10 1003.3.1
[7] 2018 IPC Chapter 10 1003.3.2

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D. Additives to FOG Control Devices: Dispensing systems that introduce additives to FOG Control Devices shall not be installed.

6.6.6 Mop Basin Installation

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.

6.6.7 FOG Traps

A. Sizing
   1. FOG Traps shall be sized in accordance with fixture flows per the 2018 IPC.
   2. 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).[1]

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.[2]
   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.

6.6.8 FOG Interceptors

A. Sizing
   1. FOG Interceptor sizing shall be based on SECTION 9 in the *OJRSA Sewer Use Regulation*. Calculation sheets will be provided by OJRSA, as applicable.

[1] 2018 IPC Chapter 10 1003.3.5.1
[2] 2018 IPC 1003.3.1

DRAFT

2. Minimum FOG Interceptor size requirement is one thousand gallons (1,000 gal).
3. 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.
4. Capacity of FOG Interceptors.
    (a) The required hydraulic capacity of FOG Interceptors shall be determined based on the OJRSA Grease Interceptor Sizing Worksheet.
    (b) (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]

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) 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.
    (b) Thermoplastic: FOG Interceptors manufactured from thermoplastic material are acceptable if the construction of the unit complies with all other standards contained herein.
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.
    (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.
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.

[1] 2018 IPC Chapter 10 1003.3.5.1

DRAFT

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.

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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 available[1] 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 regulatory changes and/or changes to Non-SCDHEC 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 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 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.

DRAFT

	Type of Establishment Per SCDHEC 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.

DRAFT

	Type of Establishment Per SCDHEC 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

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 (RFP) 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.

DRAFT

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

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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 Appli-cations
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) Pres-sure 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)

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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

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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”)

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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 begin 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

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8.1 Downstream Wastewater Modeling Analysis Request

Reset Form

OJRSA

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

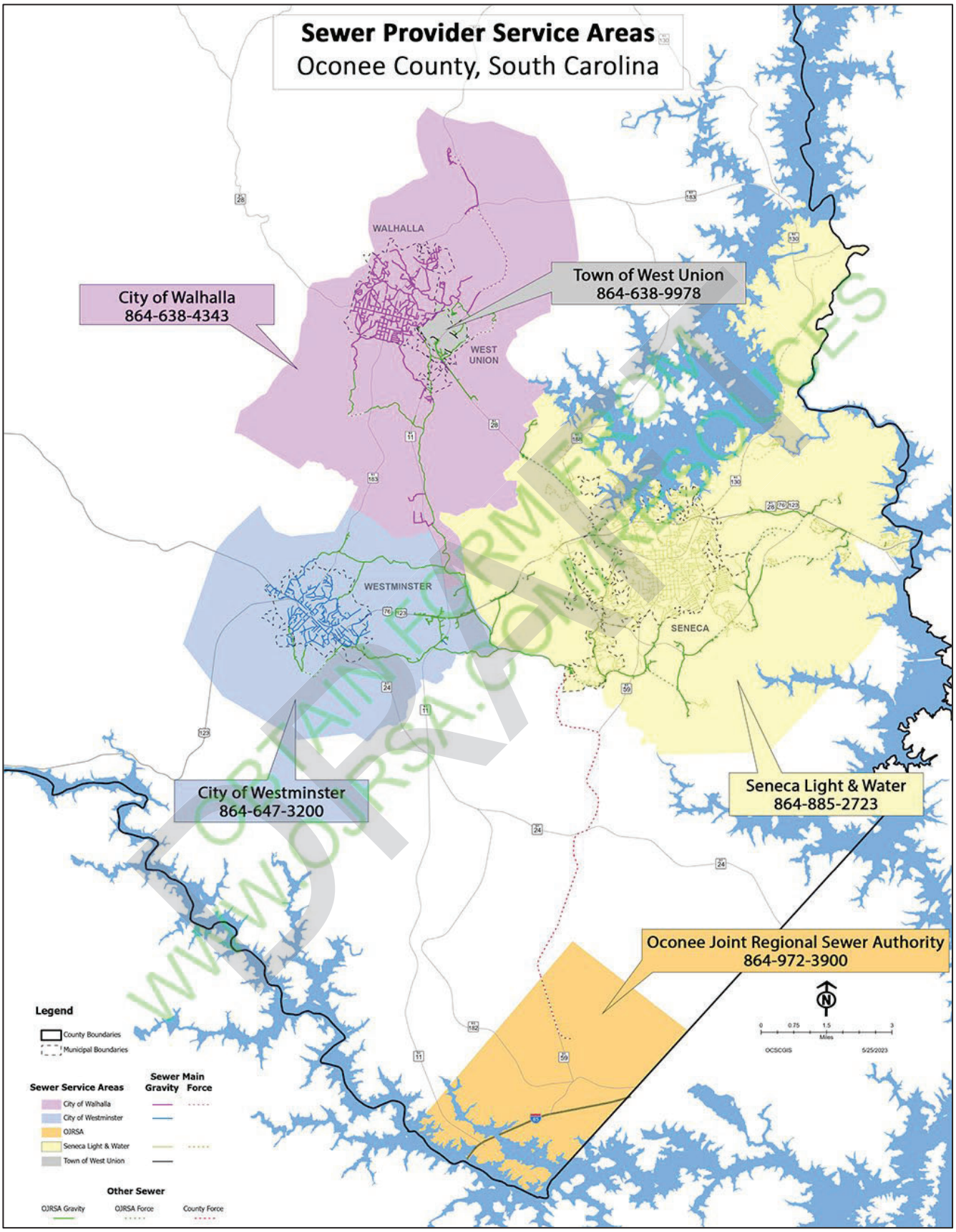
Project Will Connect to Sewer (nearest street address, GPS coordinates, etc.):

_____

Comments

05/17/2023 (rev. 10/06/2023) Page 1 of 1

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WWW.OJRSA.COM



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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.

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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 Applicable	Engineer Complete	OJRSA Complete	OJRSA 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

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For Record Drawings

General Items	Not Applicable	Engineer Complete	OJRSA Complete	OJRSA Incomplete
Each sheet of record drawings signed and sealed by Engineer of Record				
Cover sheet include the statement required as stated in *OJRSA Development Policy* 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	OJRSA 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	OJRSA 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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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	**OJRSA** 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	**OJRSA** 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 anu usual 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:** _____

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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: _____

02/26/2024

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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:** _____

PAGE 1 OF 1

02/26/2024

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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:** _____

PAGE 1 OF 1

02/26/2024

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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:** _____

PAGE 1 OF 1

02/26/2024

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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.)

Wet Well Volume Pumped

$V = 7.48\frac{gal}{ft^3} \times 0.785D^2 \times (E_1 - E_2)$

V= Volumed pumped (gal)
D= Wet well diameter (ft)
E_1= Pump start elevation (ft)
E_2= Pump stop elevation (ft)

Pumping Rate

$Q = \frac{V}{T}$

Q= Pumping rate (gpm)
V= Volume pumped (gal)
T= Test rate (min)

Total Dynamic Head (TDH)

$TDH = (Z_G - Z_W) + P\frac{144\frac{in^2}{ft^2}}{62.4\frac{lb}{cf}}$

TDH= Total pumping head (ft)
Z_G= Gauge elevation (MSL)
Z_W= Wet well water elevation (MSL)
P= Gauge pressure (psig)

Contractor Representative: _____ **Date:** _____

Engineer Representative: _____ **Date:** _____

OJRSA Representative: _____ **Date:** _____

PAGE 1 OF 1

02/26/2024

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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.)

Wet Well Volume Pumped

$V = 7.48\frac{gal}{ft^3} \times L \times W \times (E_1 - E_2)$

V= Volumed pumped (gal)
L= Wet well length (ft)
W= Wet well width (ft)
E_1= Pump start elevation (ft)
E_2= Pump stop elevation (ft)

Pumping Rate

$Q = \frac{V}{T}$

Q= Pumping rate (gpm)
V= Volume pumped (gal)
T= Test rate (min)

Total Dynamic Head (TDH)

$TDH = (Z_G - Z_W) + P\frac{144\frac{in^2}{ft^2}}{62.4\frac{lb}{cf}}$

TDH= Total pumping head (ft)
Z_G= Gauge elevation (MSL)
Z_W= Wet well water elevation (MSL)
P= Gauge pressure (psig)

Contractor Representative: _____ **Date:** _____

Engineer Representative: _____ **Date:** _____

OJRSA Representative: _____ **Date:** _____

PAGE 1 OF 1

02/26/2024

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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

02/15/2023

SAMPLE DRAFT
CONTACT OJRSA REGULATORY SERVICES COORDINATOR FOR COPY

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: _____

Hauler Company Name: _____ **Email:** _____

Hauler Address: _____ **Phone:** _____

Hauler Employee Name Performing Work: _____

Waste Disposal Site: _____ **Phone:** _____

Disposal Site Address: _____

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: _____

Were the settled solids in the inlet side of the interceptor checked? ☐ YES ☐ NO
If so, was there 25% settled solids in the inlet liquid depth? ☐ YES ☐ NO
Comments: _____

Is there a 2-way sweep cleanout installed on the inlet side of the interceptor? ☐ YES ☐ NO
Comments: _____

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: _____

02/15/2023

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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 2-way sweep cleanout on effluent side 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:

Additional Comments

Generator: _____ (Print Name) _____ (Signature)

Waste Hauler: _____ (Signature)

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8.14 Fats, Oils, & Grease (FOG) Control Device Inspection 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, & 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)

12/13/2019 (revised 06/08/2020)

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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: _____

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SECTION 9 – STANDARD DETAILS

Sheet Number	Sheet Title
-	Cover
D000	Sheet Index
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
FOG-1	Typical Grease Trap Plumbing Plan
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

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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

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OJRSA

STANDARD DETAILS

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JUNE 2023

Sheet List Table

Sheet Number	Sheet Title
--	COVER
D000	SHEET INDEX
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 CASING 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 CLEAN OUT
D031	SEWER LATERAL ON EXISTING GRAVITY SEWER
D032	SADDLE CONNECTION FOR LIVE WASTE WATER MAINS
D033	SADDLE CONNECTION FOR LIVE STREAM WASTEWATER MAINS
D034	STEEL DOUBLE GATE FOR EASEMENTS
FOG-1	TYPICAL GREASE TRAP PLUMBING PLAN
FOG-2	FATS, OILS & 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
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 AND ELEVATIONS
E-1	DUPLEX PUMP STATION ELECTRICAL STANDARDS
E-2	YARD LIGHT
E-3	PUMP STATION ONE-LINE DIAGRAM

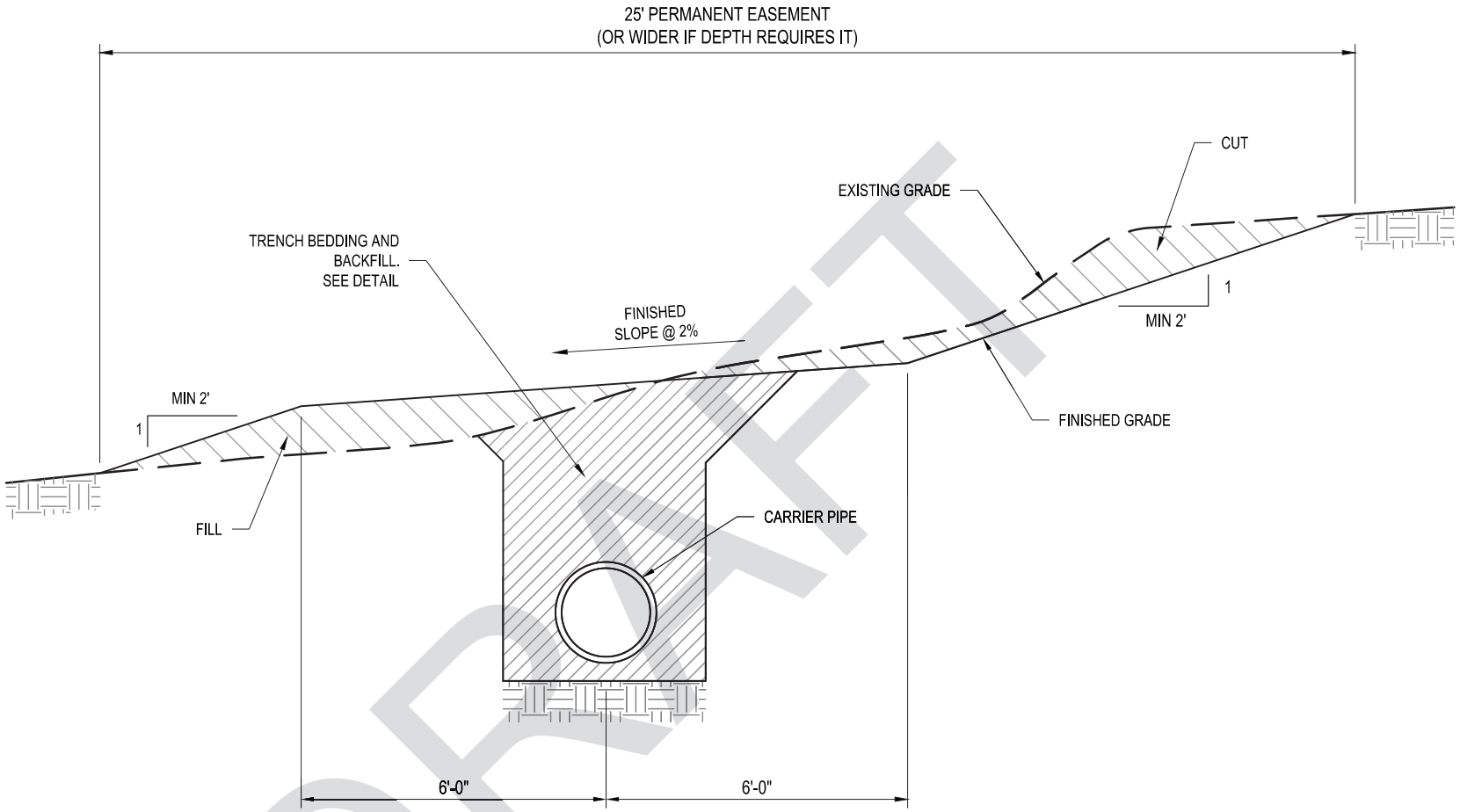
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OCONEE JOINT REGIONAL SEWER AUTHORITY

INDEX SHEET

OJRSA

DATE:	DRAWING NO.:
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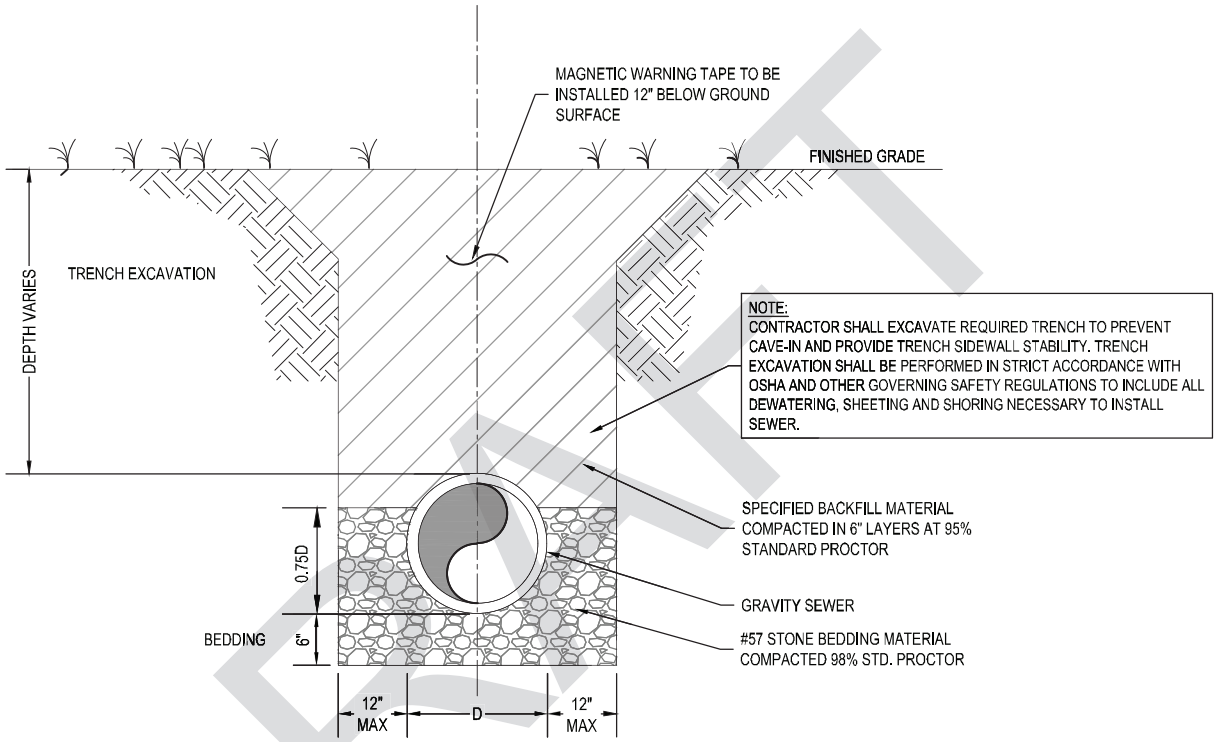


EASEMENT GRADING

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EASEMENT GRADING		
OJRSA	DATE: 06/2020	DRAWING NO.: D 001
	REVISED:	SCALE: NTS



GRAVITY SEWER TRENCHING & BEDDING

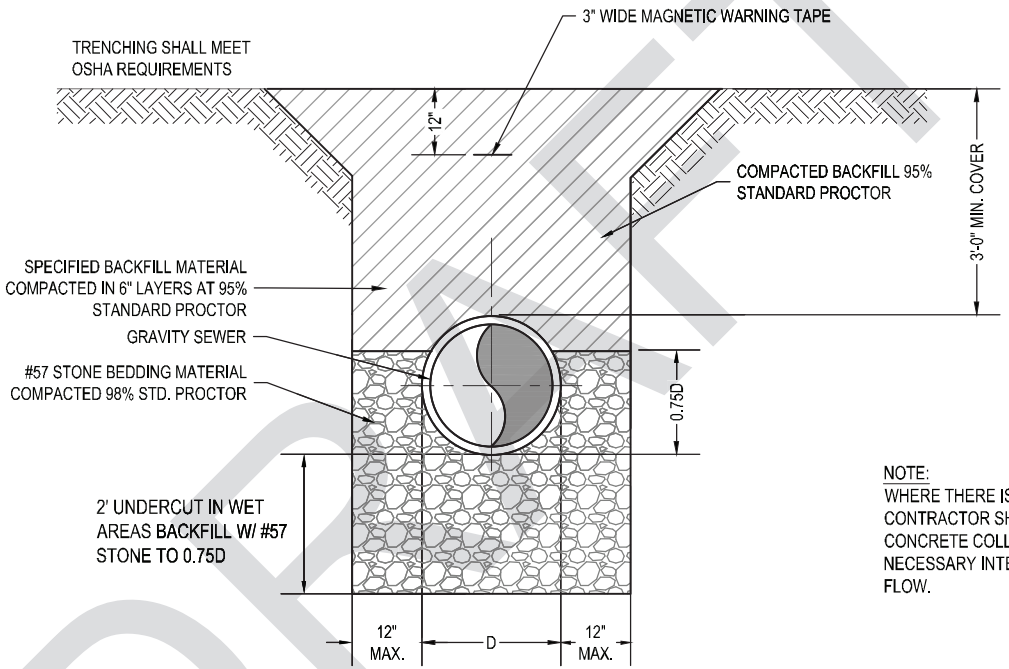
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GRAVITY SEWER TRENCHING & BEDDING

OJRSA	DATE: 06/2020	DRAWING NO.: D 002
	REVISED:	SCALE: NTS



NOTE:
WHERE THERE IS EXCESSIVE GROUNDWATER, CONTRACTOR SHALL INSTALL ANTI SEEPAGE CONCRETE COLLAR IN TRENCH AROUND THE PIPE AT NECESSARY INTERVALS TO DIVERT GROUNDWATER FLOW.

TRENCH BEDDING FOR PIPE IN WET LOCATIONS

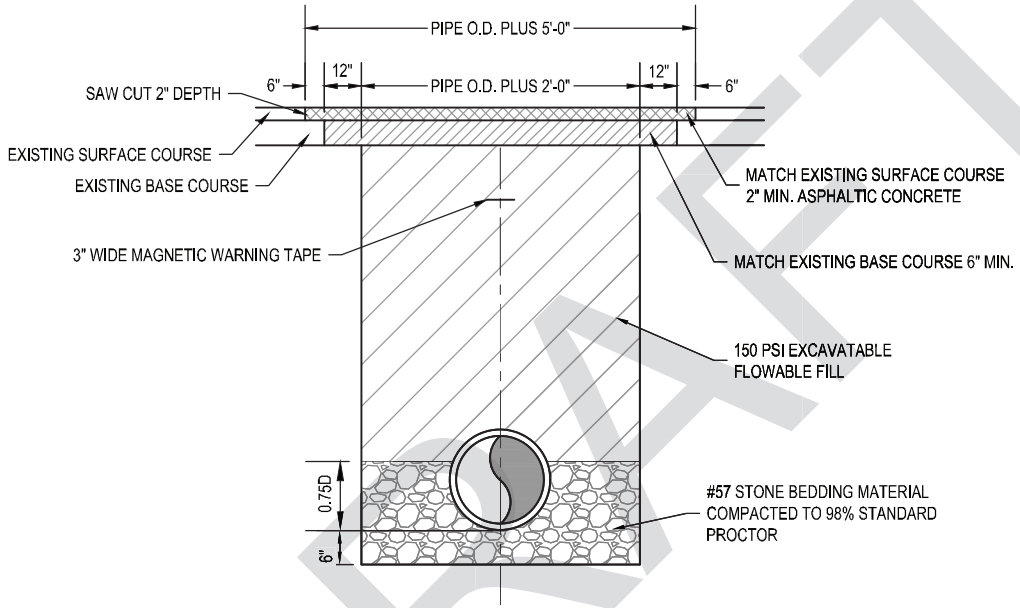
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GRAVITY SEWER TRENCHING & BEDDING - WET LOCATIONS

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OJRSA	06/2020	D 003
	REVISED:	SCALE:
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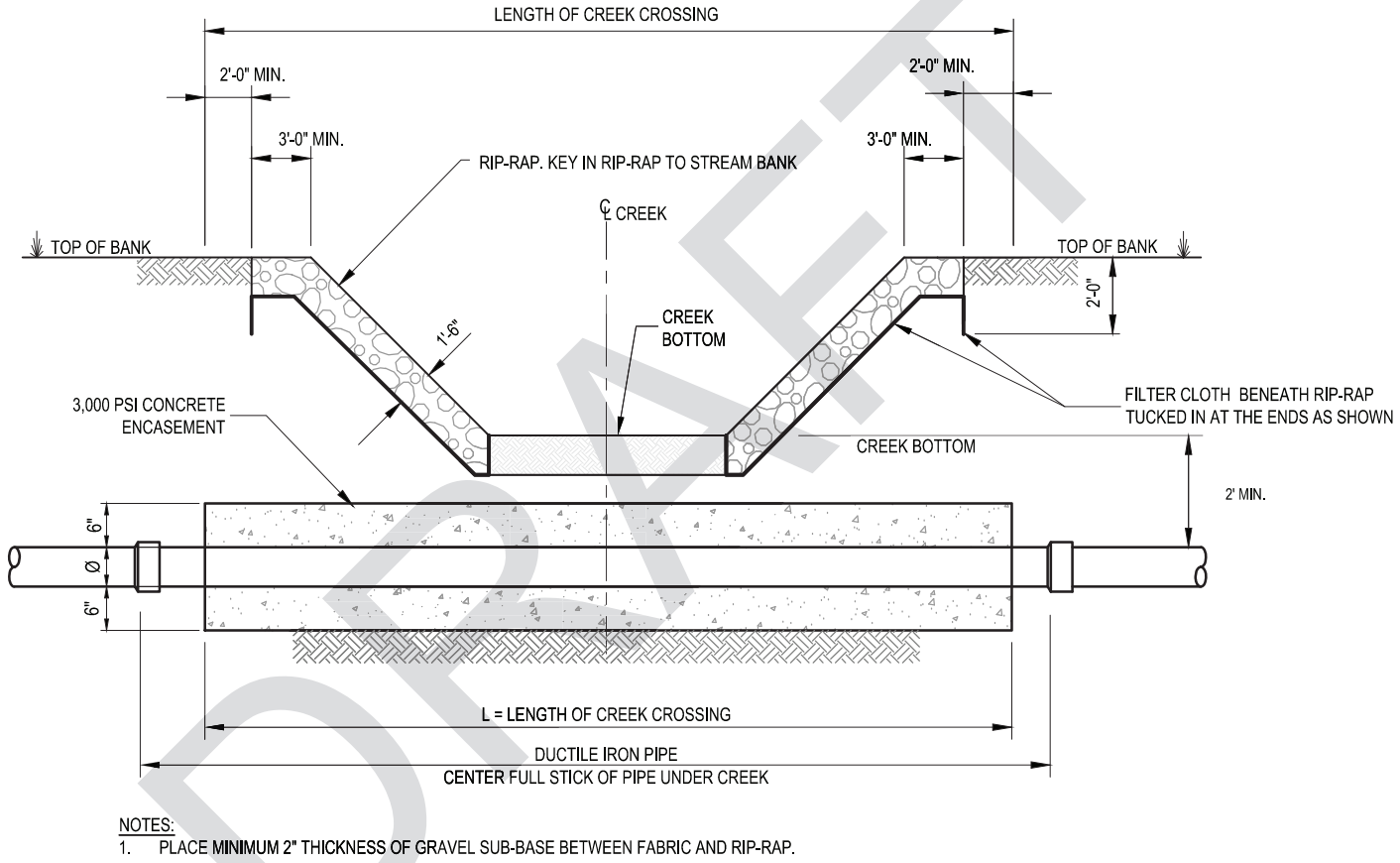


ASPHALT PAVEMENT REPLACEMENT AT PIPE TRENCH

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ASPHALT PAVEMENT REPLACEMENT AT PIPE TRENCH		
OJRSA	DATE: 06/2020	DRAWING NO.: D 004
	REVISED:	SCALE: NTS



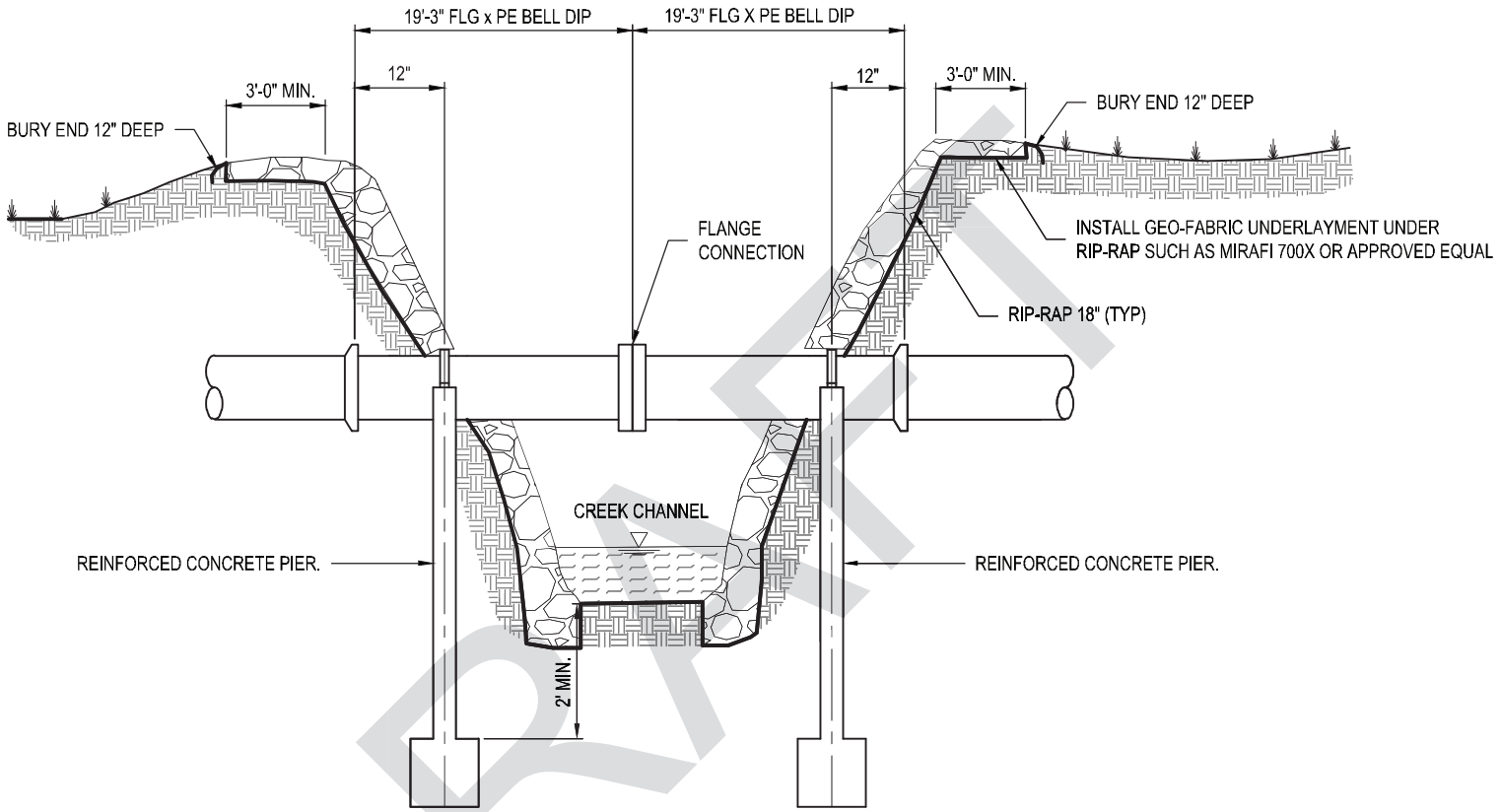
NOTES:
1. PLACE MINIMUM 2" THICKNESS OF GRAVEL SUB-BASE BETWEEN FABRIC AND RIP-RAP.

STREAM CROSSING

Scale: NTS

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STREAM CROSSING		
OJRSA	DATE: 06/2020	DRAWING NO.: D 005
	REVISED:	SCALE: NTS



NOTES:
1. NO PIERS SHALL BE PLACED IN NORMAL FLOW OF CREEK.
2. ANY DESIGNS DEVIATING FROM THIS DETAIL MUST BE SUBMITTED TO OJRSA FOR REVIEW AND APPROVAL.

LONG SPAN CREEK CROSSING

Scale: NTS

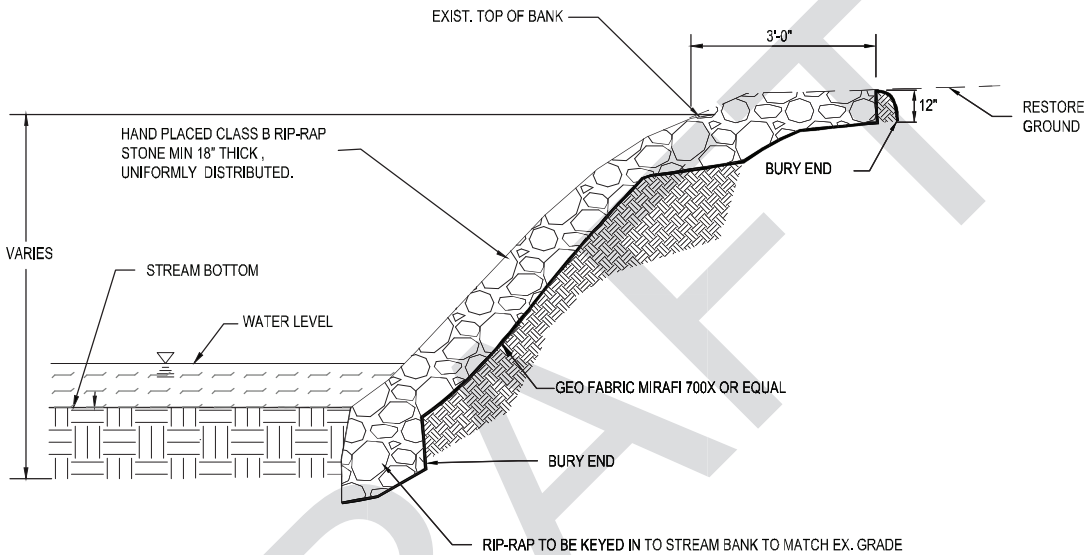
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LONG SPAN STREAM CROSSING

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06/2020	D 006
REVISED:	SCALE:
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STREAM BANK PROTECTION

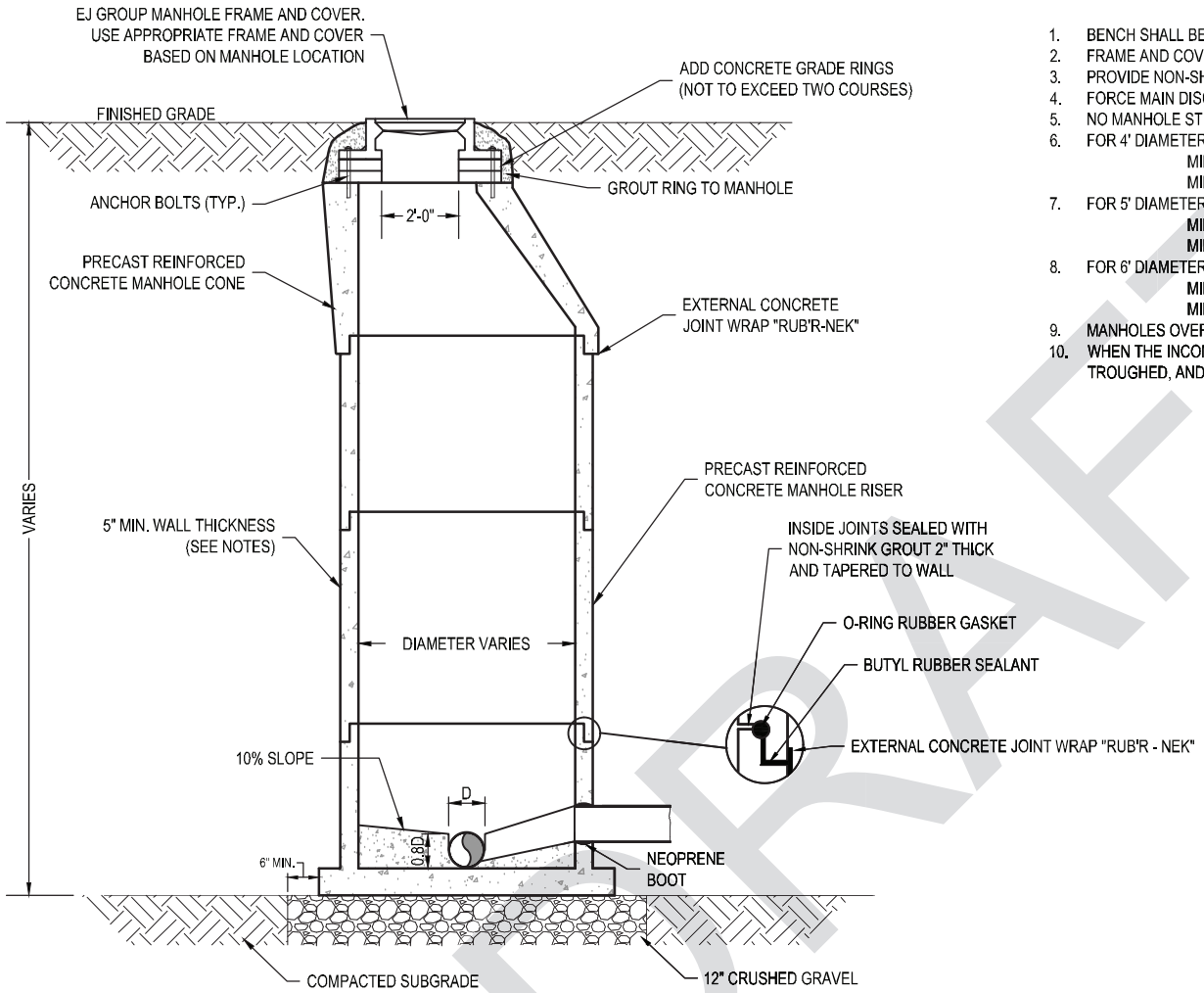
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STREAM BANK PROTECTION

OJRSA	DATE: 06/2020	DRAWING NO.: D 007
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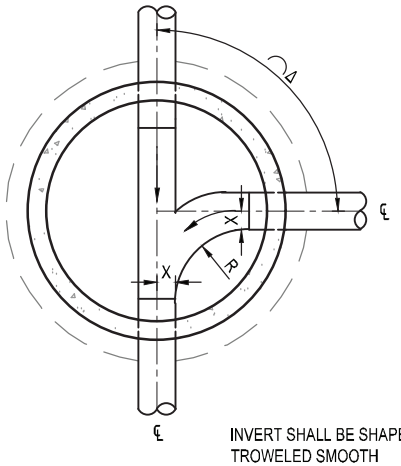


STANDARD PRECAST CONCRETE MANHOLE - SECTION

Scale: NTS

NOTES:

1. BENCH SHALL BE PRECAST.
2. FRAME AND COVER SHALL BE SET ON BUTYL RUBBER AND SHALL BE BOLTED TO MANHOLE CONE.
3. PROVIDE NON-SHRINK GROUT ON OUTSIDE OF GRADE RINGS AND MANHOLE FRAME OVERLAPPING CONE BY 6 INCHES.
4. FORCE MAIN DISCHARGE MANHOLES SHALL BE COATED.
5. NO MANHOLE STEPS WILL BE ALLOWED.
6. FOR 4' DIAMETER MANHOLES:
   MIN. WALL THICKNESS = 5"
   MIN. BASE SLAB THICKNESS = 6"
7. FOR 5' DIAMETER MANHOLES:
   MIN. WALL THICKNESS = 5"
   MIN. BASE SLAB THICKNESS = 8"
8. FOR 6' DIAMETER MANHOLES:
   MIN. WALL THICKNESS = 6"
   MIN. BASE SLAB THICKNESS = 8"
9. MANHOLES OVER 8' DEEP SHALL HAVE A 60" MIN. INSIDE DIAMETER.
10. WHEN THE INCOMING INVERT IS LESS THAN 24" ABOVE THE OUTGOING INVERT, THE LINE SHALL BE BENCHED , TROUGHED, AND MORTAR TROWELED SMOOTH TO ENTER AT THE MANHOLE INVERT.



INVERT SHALL BE SHAPED AND TROWELED SMOOTH

STANDARD PRECAST CONCRETE MANHOLE - PLAN

Scale: NTS

STANDARD MANHOLE SCHEDULE				
PIPE SIZE	INSIDE DIAMETER	ANGLE (Δ)	'R'	'X'
8" - 15"	4'-0"	0° - 90°	2'-0"	0"
18" - 30"	5'-0"	0° - 90°	2'-0"	6"
36" & LARGER	6'-0"	0° - 60°	3'-0"	9"
36" & LARGER	6'-0"	60° - 90°	3'-0"	1'-2"

OCONEE JOINT REGIONAL SEWER AUTHORITY

STANDARD MANHOLE

OJRSA

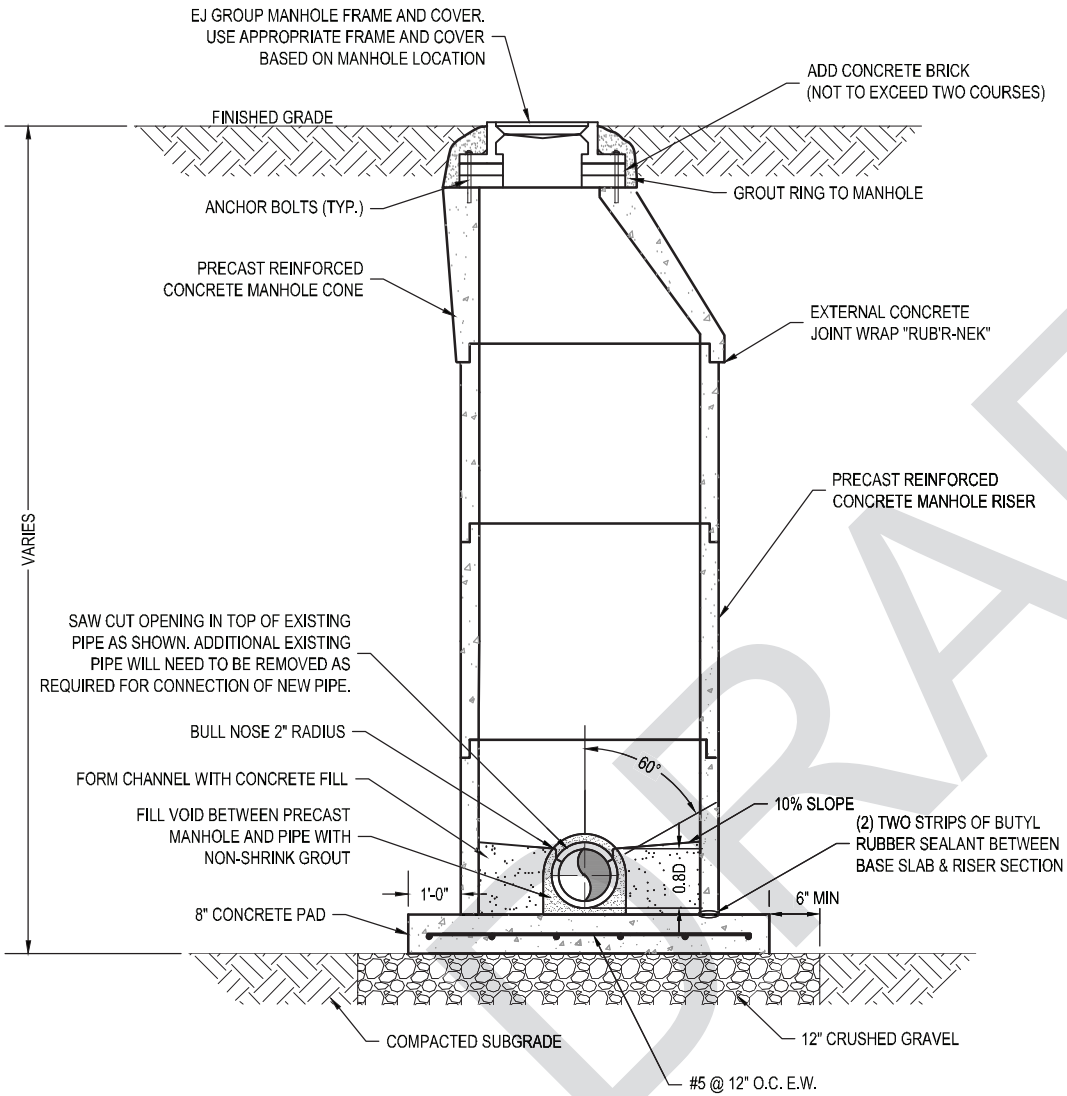
DATE: 06/2020

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DOGHOUSE MANHOLE - SECTION

Scale: NTS

NOTES:

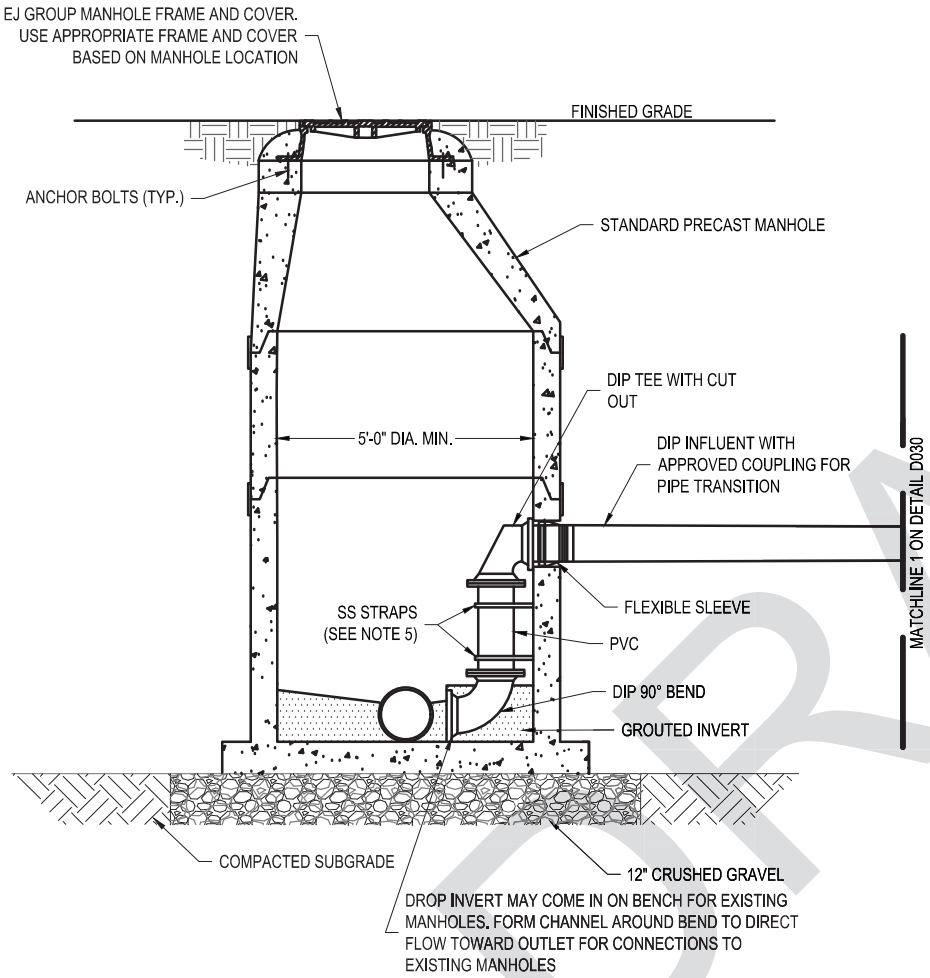
1. USE OF DOGHOUSE TYPE MANHOLE MUST BE APPROVED BY OJRSA.
2. SEE STANDARD PRECAST MANHOLE DETAIL FOR ADDITIONAL REQUIREMENTS.

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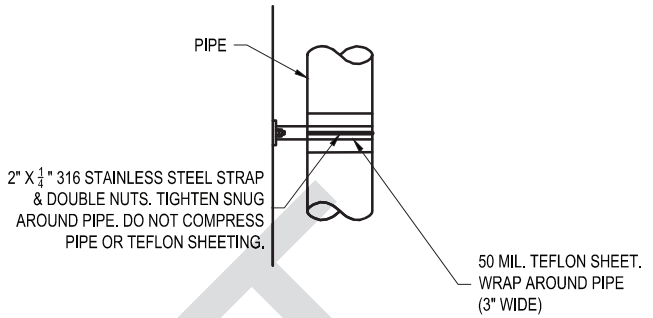
DOGHOUSE MANHOLE

OJRSA	DATE: 06/2020	DRAWING NO.: D 009
	REVISED:	SCALE: NTS



STANDARD INSIDE DROP MANHOLE

Scale: NTS



STAINLESS STEEL PIPE SUPPORT STRAP

Scale: NTS

NOTES:

1. PIPE SIZE FOR DROP TO EQUAL INFLOW SEWER PIPE SIZE.
2. MECHANICAL JOINT FITTINGS TO BE USED.
3. SAW-CUT OR DRILL ALL HOLES FOR PIPE AND BOLTS.
4. DROP-MANHOLE MANDATORY WHEN DIFFERENTIAL BETWEEN INVERTS IS GREATER THAN 24". DROP-MANHOLES WILL BE ALLOWED ONLY WHEN IT IS NOT FEASIBLE TO STEEPEN SLOPE SO THAT THE DROP IS LESS THAN 24".
5. INSTALL 316 STAINLESS STEEL STRAPS WITHIN 12" OF EACH PIPE JOINT AND AT 18" MAX SPACING.
6. PVC TO BE C900.
7. FITTINGS SHALL BE STANDARD AWWA-C110 FITTINGS.
8. SEE STANDARD PRE-CAST MANHOLE DETAIL FOR ADDITIONAL REQUIREMENTS.
9. SEE DETAIL D030 FOR SEWER LATERAL AND CLEANOUT.

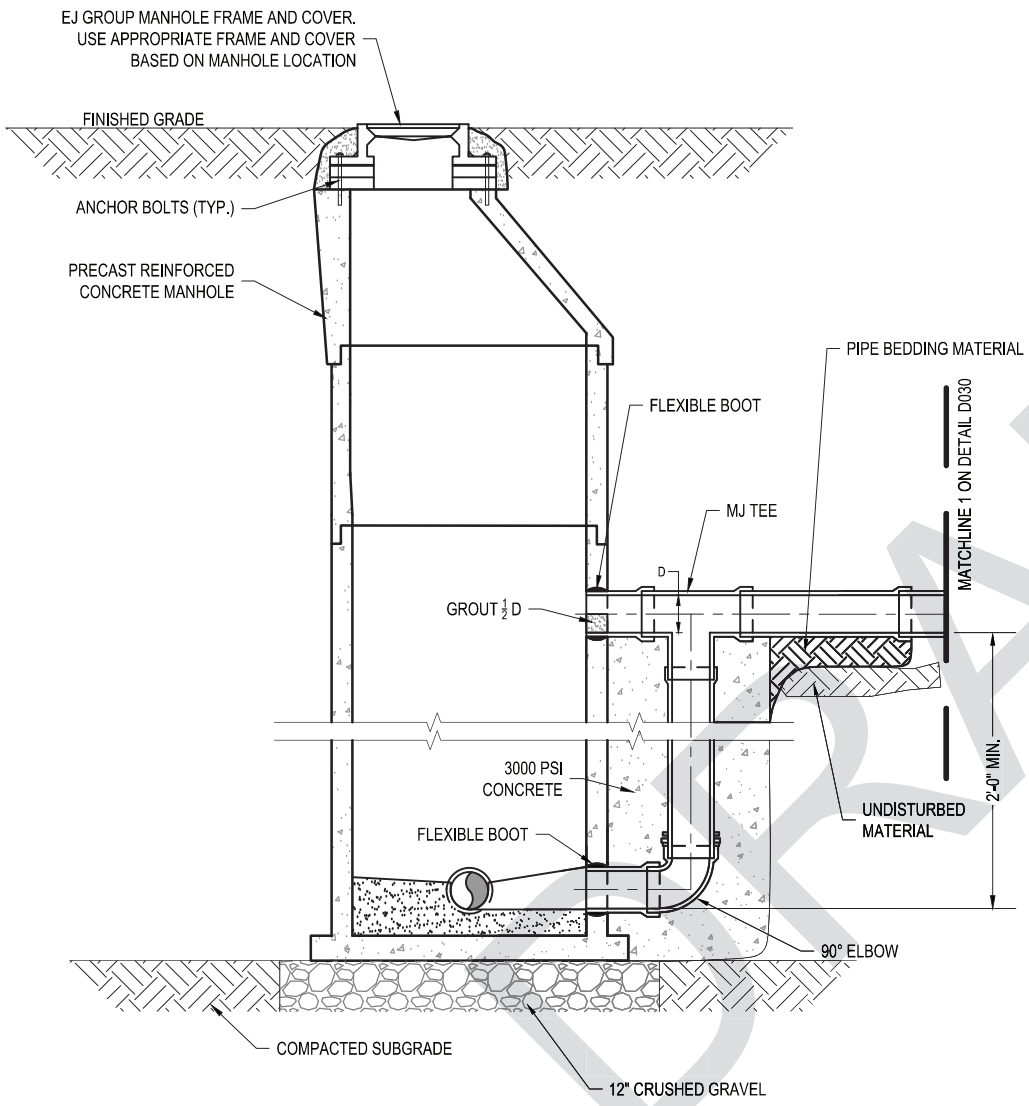
PIPE SIZE	MANHOLE CORE DIAMETER
4"	8"
6"	12"
8"	16"
10"	20"
12"	24"
15"	27"
18"	30"

OCONEE JOINT REGIONAL SEWER AUTHORITY

STANDARD INSIDE DROP MANHOLE

	DATE:	DRAWING NO.:
OJRSA	11/2022	D 010
	REVISED:	SCALE: NTS

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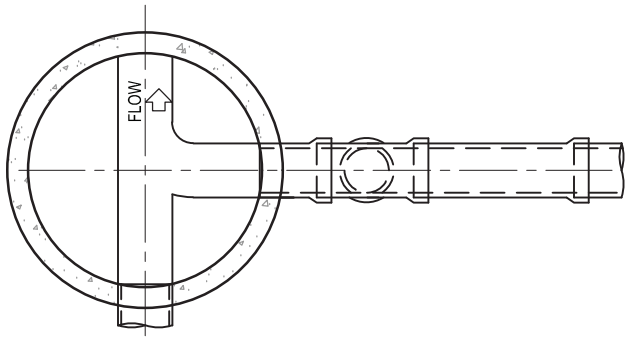
STANDARD OUTSIDE DROP MANHOLE

Scale: NTS

NOTES:

1. A DROP MANHOLE IS REQUIRED FOR DROPS OVER 24".
2. DROP ASSEMBLY SHALL BE DIP PRESSURE CLASS 150 MINIMUM.
3. SEE STANDARD PRE-CAST MANHOLE DETAIL FOR ADDITIONAL REQUIREMENTS.
4. SEE DETAIL D030 FOR SEWER LATERAL AND CLEANOUT.

PIPE SIZE	MANHOLE CORE DIAMETER
4"	8"
6"	12"
8"	16"
10"	20"
12"	24"
15"	27"
18"	30"



OUTSIDE DROP MANHOLE - PLAN

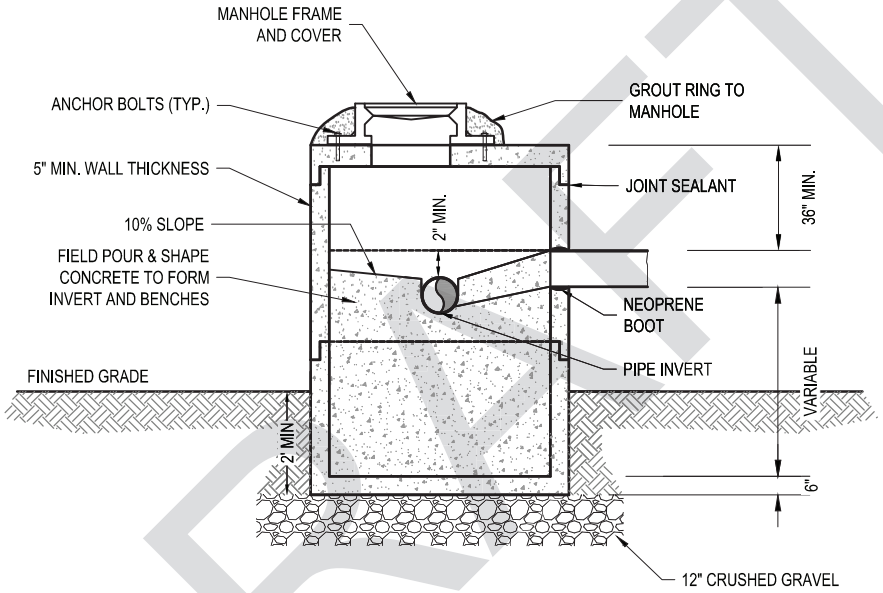
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OCONEE JOINT REGIONAL SEWER AUTHORITY

OUTSIDE DROP MANHOLE

	DATE:	DRAWING NO.:
OJRSA	11/2022	D 011
	REVISED:	SCALE:
		NTS

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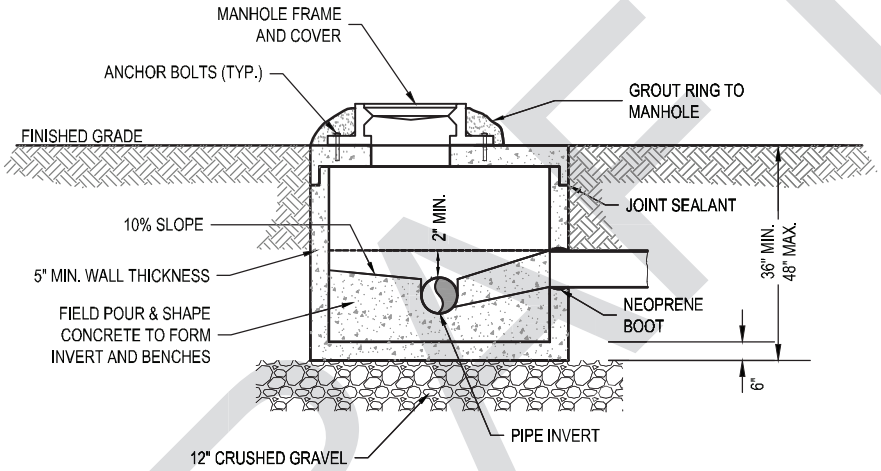


PRECAST MANHOLE FOR AERIAL GRAVITY SEWER DETAIL

Scale: NTS

DRAFT

OCONEE JOINT REGIONAL SEWER AUTHORITY		
PRECAST MANHOLE FOR AERIAL GRAVITY SEWER		
OJRSA	DATE: 06/2020	DRAWING NO.: D 012
	REVISED:	SCALE: NTS



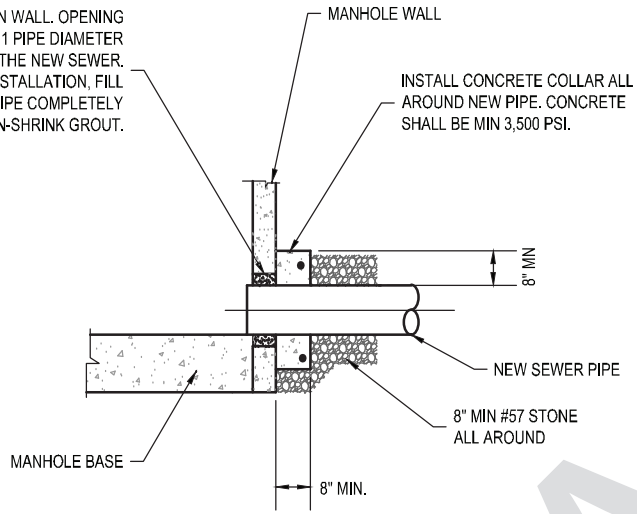
NOTES:
1. SHALLOW MANHOLE DETAIL APPLIES TO MANHOLES BETWEEN 36" AND 48" IN DEPTH. MANHOLES LESS THAN 36" SHALL BE PER AERIAL SEWER MANHOLE.

SHALLOW PRECAST MANHOLE

Scale: NTS

DRAFT

OCONEE JOINT REGIONAL SEWER AUTHORITY		
SHALLOW PRECAST MANHOLE		
OJRSA	DATE: 06/2020	DRAWING NO.: D 013
	REVISED:	SCALE: NTS



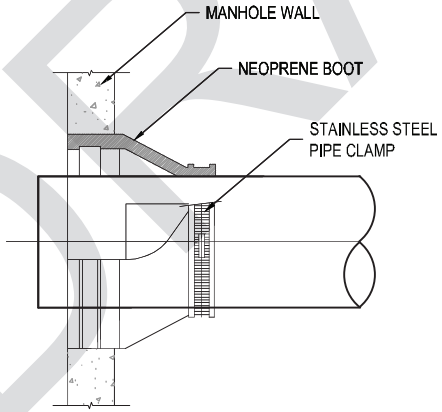
NOTES:

1. REFER TO THIS DETAIL WHEN CONNECTING NEW SEWER PIPES TO EXISTING MANHOLES.

2. THIS DETAIL DEPICTS THE NEW SEWER ENTERING AT THE EXISTING INVERT ELEVATION. THIS WILL NOT BE THE CASE FOR ALL MAIN SEWERS. PROVIDE A SMOOTH TRANSITION AND INVERT CHANNEL FOR ANY INCOMING ELEVATION FOR SEWER LINES ENTERING MANHOLES ON TOP OF THE BENCH. PROVIDE AN INVERT CHANNEL ON THE BENCH, BY GROUTING NEW CHANNEL.

NEW PIPE CONNECTION AT EXISTING MANHOLE

Scale: NTS



NOTES:
1. NEOPRENE BOOTS TO BE PROVIDED FOR ALL PIPE CONNECTIONS TO NEW MANHOLES.

RUBBER BOOT PIPE CONNECTOR FOR NEW MANHOLE

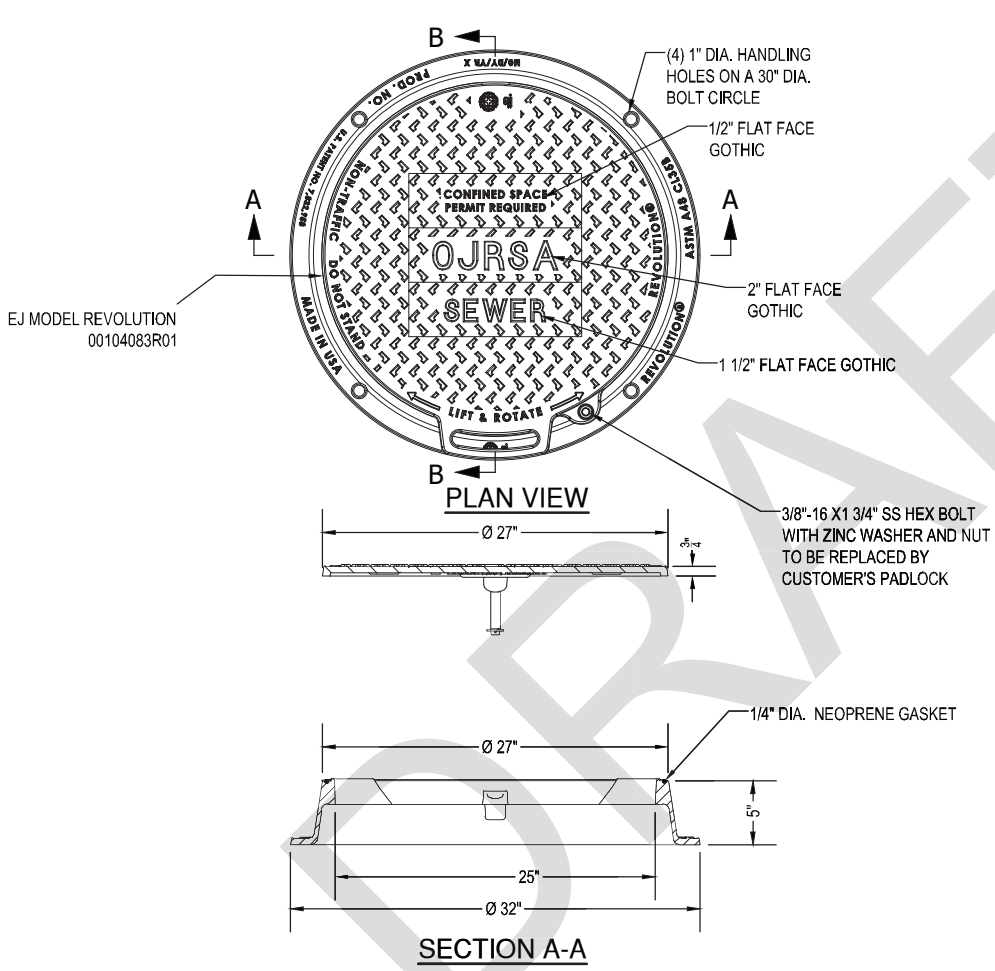
Scale: NTS

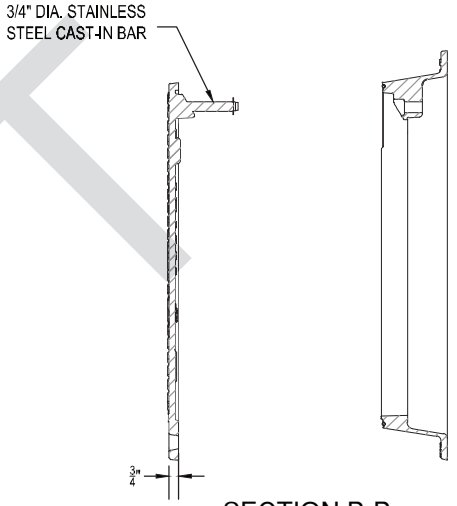
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OCONEE JOINT REGIONAL SEWER AUTHORITY

PIPE CONNECTION AT MANHOLE

OJRSA	DATE: 06/2020	DRAWING NO.: D 014
	REVISED:	SCALE: NTS





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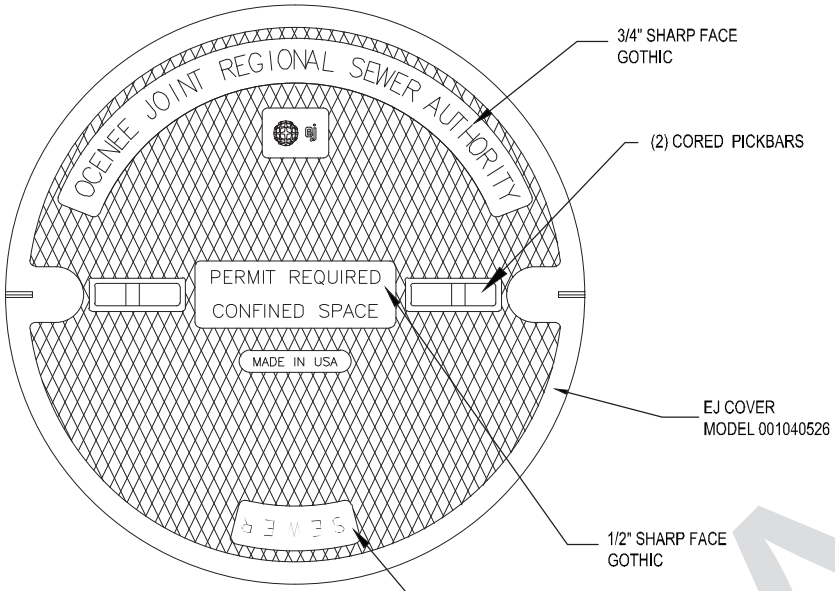
STANDARD MANHOLE FRAME & COVER MIN. 2' ABOVE GRADE

Scale: NTS

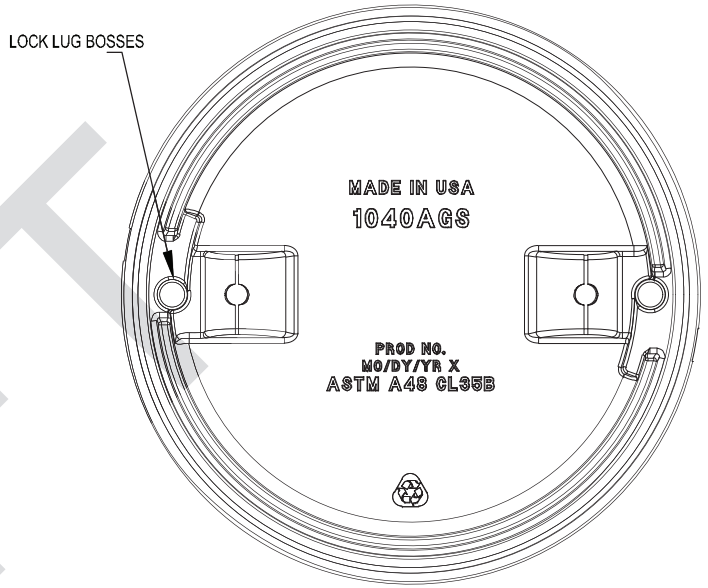
OCONEE JOINT REGIONAL SEWER AUTHORITY

STANDARD MANHOLE FRAME & COVER. MIN. 2' ABOVE GRADE

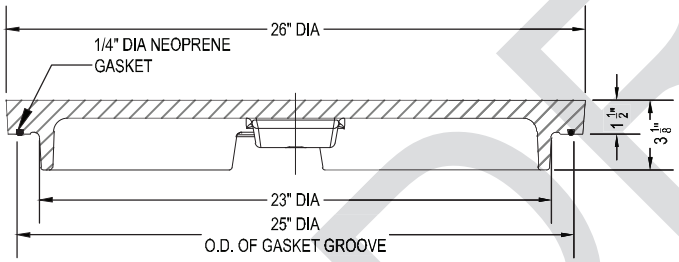
DATE:	DRAWING NO.:
06/2020	D 015
REVISED:	SCALE:
	NTS



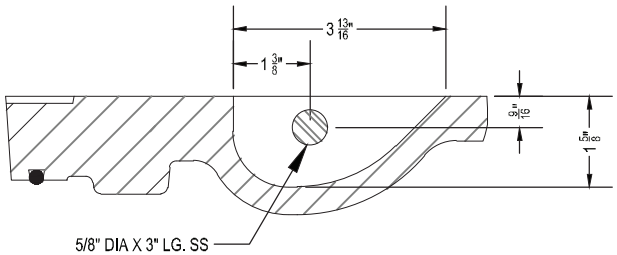
PLAN VIEW



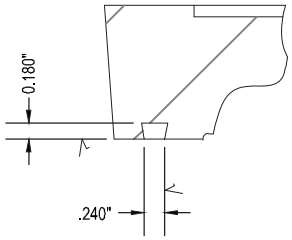
BOTTOM VIEW OF COVER



COVER SECTION



PICKBAR DETAIL



GASKET GROOVE DETAIL

HEAVY DUTY MANHOLE COVER FOR PAVED AREAS

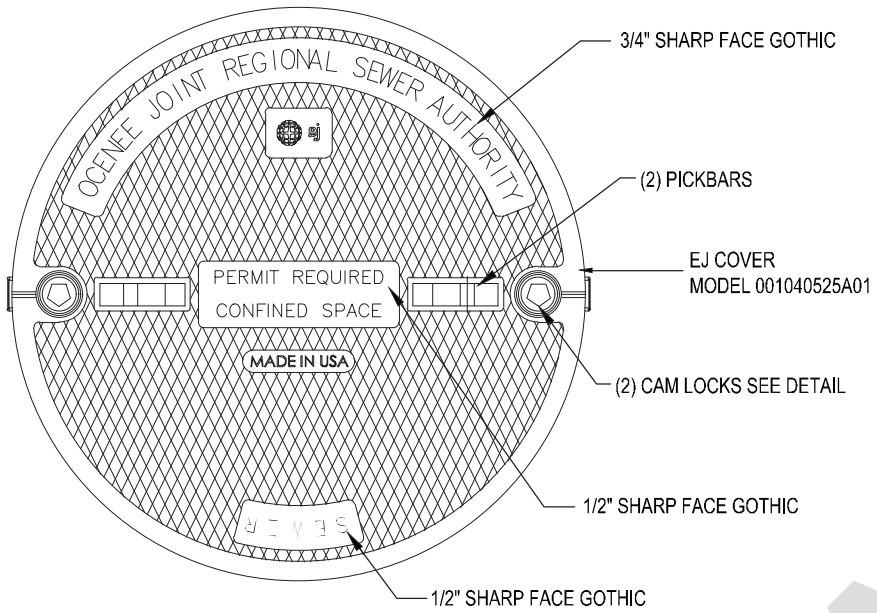
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OCONEE JOINT REGIONAL SEWER AUTHORITY

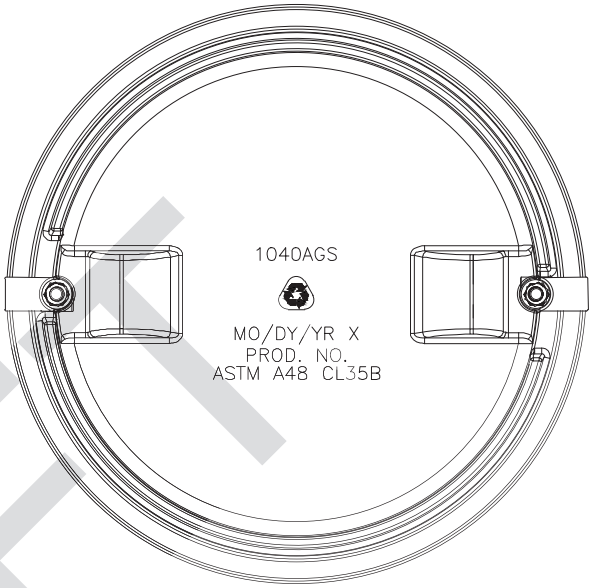
HEAVY DUTY MANHOLE COVER FOR PAVED AREAS

OJRSA	DATE: 06/2020	DRAWING NO.: D 016
	REVISED:	SCALE: NTS

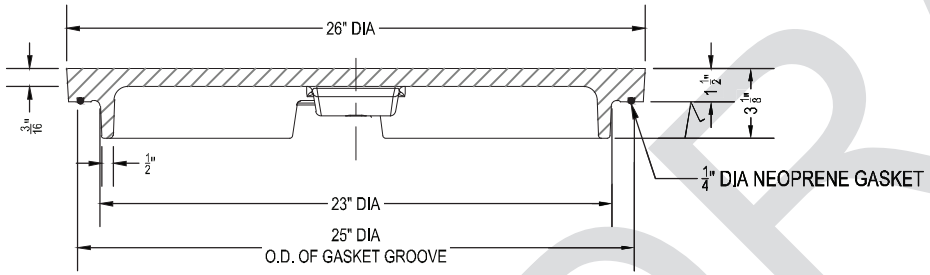
DRAFT



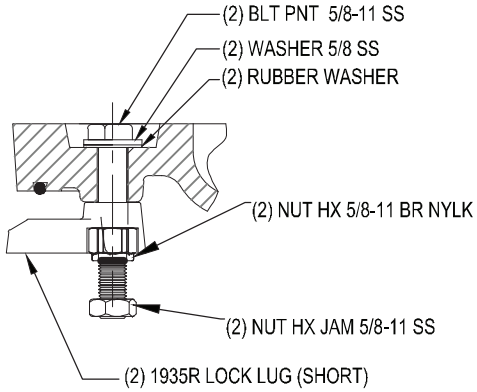
PLAN VIEW



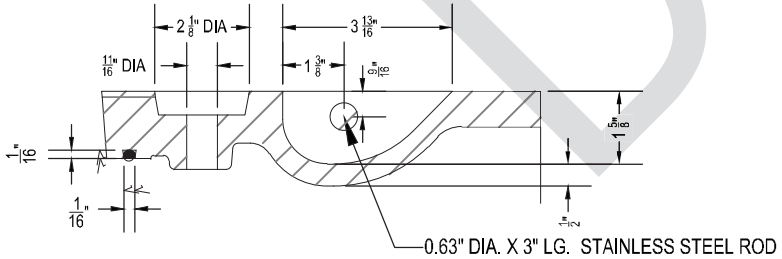
BOTTOM VIEW



SECTION VIEW



LOCK LUG ASSEMBLY



PICKBAR & LOCKLUG HOLE DETAIL

HEAVY DUTY MANHOLE COVER WITH CAM LOCK FOR NON-PAVED AREAS LESS THAN 2' ABOVE GROUND

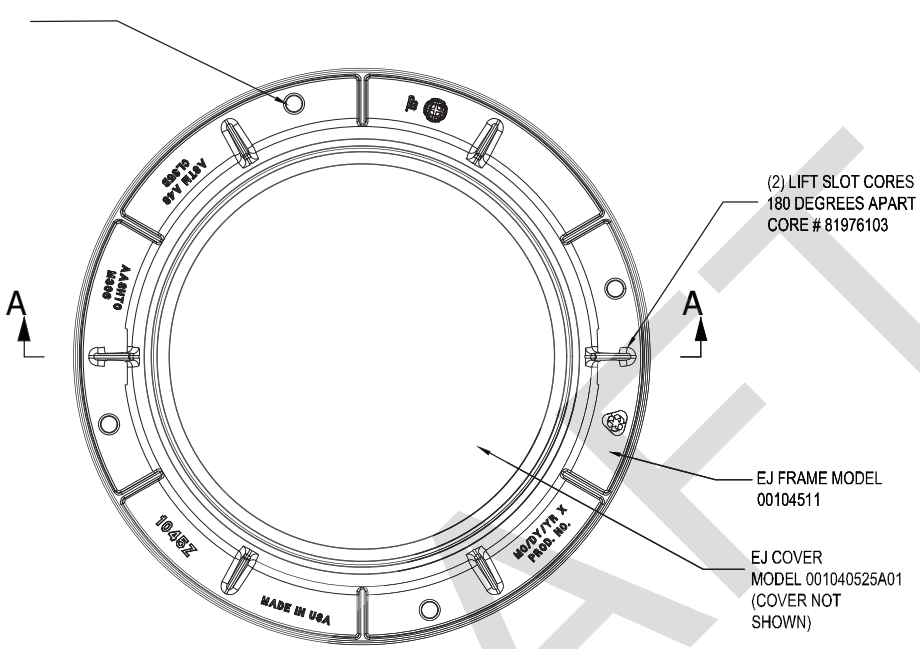
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OCONEE JOINT REGIONAL SEWER AUTHORITY

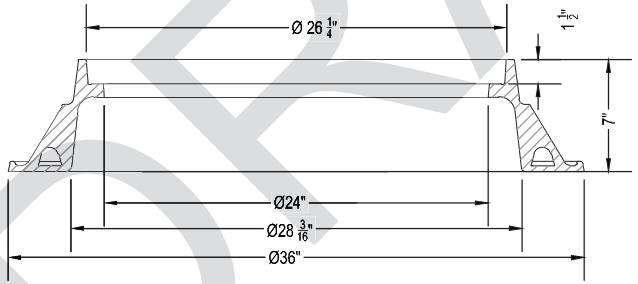
HEAVY DUTY MANHOLE COVER WITH CAM LOCK

	DATE:	DRAWING NO.:
OJRSA	06/2020	D 017
	REVISED:	SCALE:
		NTS

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PLAN VIEW



SECTION A-A

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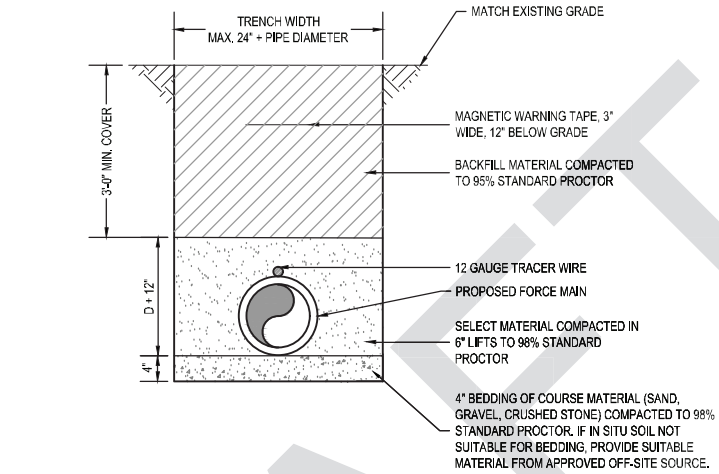
HEAVY DUTY MANHOLE FRAME FOR PAVED AREAS & MANHOLES LESS THAN 2' ABOVE GRADE

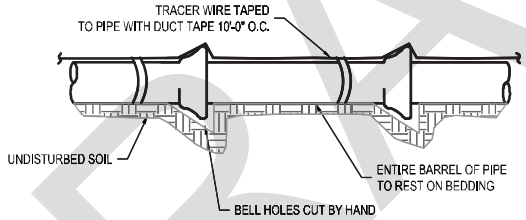
Scale: NTS

OCONEE JOINT REGIONAL SEWER AUTHORITY

HEAVY DUTY MANHOLE FRAME

OJRSA	DATE: 06/2020	DRAWING NO.: D 018
	REVISED:	SCALE: NTS





FORCE MAIN TRENCHING & BEDDING

Scale: NTS

NOTES:

1. REFER TO SCDOT, CITY, OR COUNTY PERMITS FOR ADDITIONAL REQUIREMENTS.
2. IF UNSUITABLE MATERIAL BENEATH FINAL PIPE GRADE IS ENCOUNTERED, SUCH MATERIAL SHALL BE REMOVED AND REPLACED WITH CRUSHED STONE AND COMPACTED TO PROPER GRADE.
3. ANY DEBRIS ENCOUNTERED IN THE TRENCH EXCAVATION SHALL BE REMOVED.
4. AT APPURTENANCES, VALVES, OR WHERE PIPE ENTERS STRUCTURES, CONTRACTOR TO BRING TRACER WIRE TO A POINT ABOVE GROUND ELEVATION. LOCATION ABOVE GROUND ELEVATION WILL BE CONSPICUOUS AND EASY TO ACCESS.

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OCONEE JOINT REGIONAL SEWER AUTHORITY

FORCE MAIN TRENCHING & BEDDING

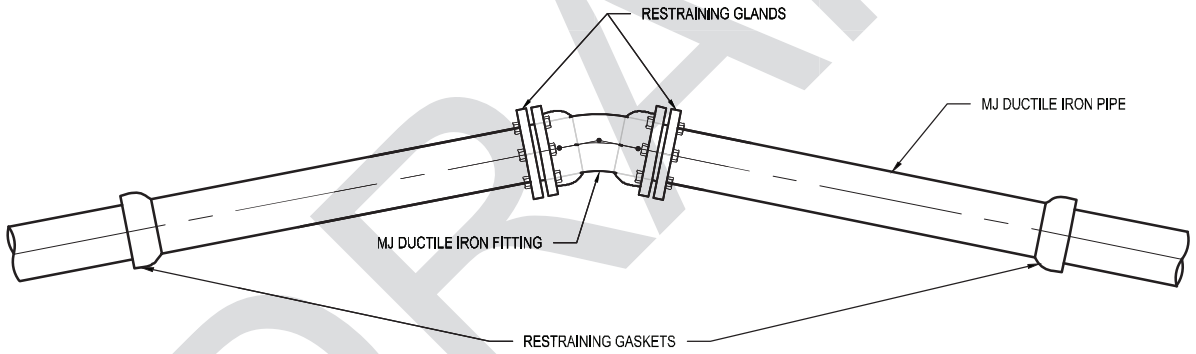
OJRSA	DATE: 06/2020	DRAWING NO.: D 019
	REVISED:	SCALE: NTS

DIP PIPE RESTRAINT JOINT TABLE							
RESTRAIN ALL JOINTS WITH THESE LENGTHS (IN L.F. EACH SIDE OF FITTING)							
SIZE (INCH)	11 ¼°	22 ½°	45°	90°	TEE BRANCH	DEAD END	REDUCER
4	1	2	4	10	1	18	6
6	2	3	6	14	3	25	13
8	2	4	8	18	4	33	14
10	3	5	9	21	13	40	14
12	3	5	11	25	13	47	25
16	4	7	14	32	27	61	36
20	4	8	16	39	40	74	47
24	5	9	19	45	27	87	48

* RESTRAINED JOINTS SHALL BE IN ACCORDANCE WITH THE DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA) STANDARDS FOR ALL FITTINGS. FITTINGS OF OTHER SIZES, CHANGES IN CONDITIONS, ETC. NOT IN THIS TABLE SHALL BE IN ACCORDANCE WITH DIPRA STANDARDS.

PVC RESTRAINT JOINT TABLE							
RESTRAIN ALL JOINTS WITH THESE LENGTHS (IN L.F. EACH SIDE OF FITTING)							
SIZE (INCH)	11 ¼°	22 ½°	45°	90°	TEE BRANCH	DEAD END	REDUCER
4	2	3	5	12	1	34	13
6	2	4	7	17	1	47	13
8	3	5	9	22	1	62	24
10	3	6	11	26	1	75	25
12	3	7	13	31	1	89	25
16	4	8	17	40	1	115	36
20	5	10	20	48	11	141	50
24	6	12	23	56	34	165	50

* RESTRAINED JOINTS SHALL BE IN ACCORDANCE WITH THE DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA) STANDARDS FOR ALL FITTINGS. FITTINGS OF OTHER SIZES, CHANGES IN CONDITIONS, ETC. NOT IN THIS TABLE SHALL BE IN ACCORDANCE WITH DIPRA STANDARDS.



RESTRAINED JOINT FITTING (HORIZONTAL PIPE ONLY)

Scale: NTS

DRAFT

NOTES:

1. THE FOLLOWING CONDITIONS WERE USED TO CALCULATE THE RESTRAINED LENGTHS SHOWN IN THE TABLE:
   * LAYING CONDITION IS TYPE 4.
   * SOIL DESIGNATED AS SANDY-CLAY.
   * DEPTH IS 3 FT.
   * DESIGN PRESSURE (TEST) IS 150 P.S.I..
   * SAFETY FACTOR IS 1.5.

   FOR THE TEE BRANCH AND REDUCER, LENGTHS ARE BASED ON BRANCHING AND REDUCING FROM THE NEXT LARGER SIZE IN THE TABLE. TEE BRANCH LENGTH BASED ON RUN LENGTH TO FIRST JOINT OF 10 FT. DEVIATIONS FROM THESE CONDITIONS MUST BE BASED ON THE ABOVE PARAMETERS.

OCONEE JOINT REGIONAL SEWER AUTHORITY

HORIZONTAL RESTRAINED JOINT FITTING

OJRSA

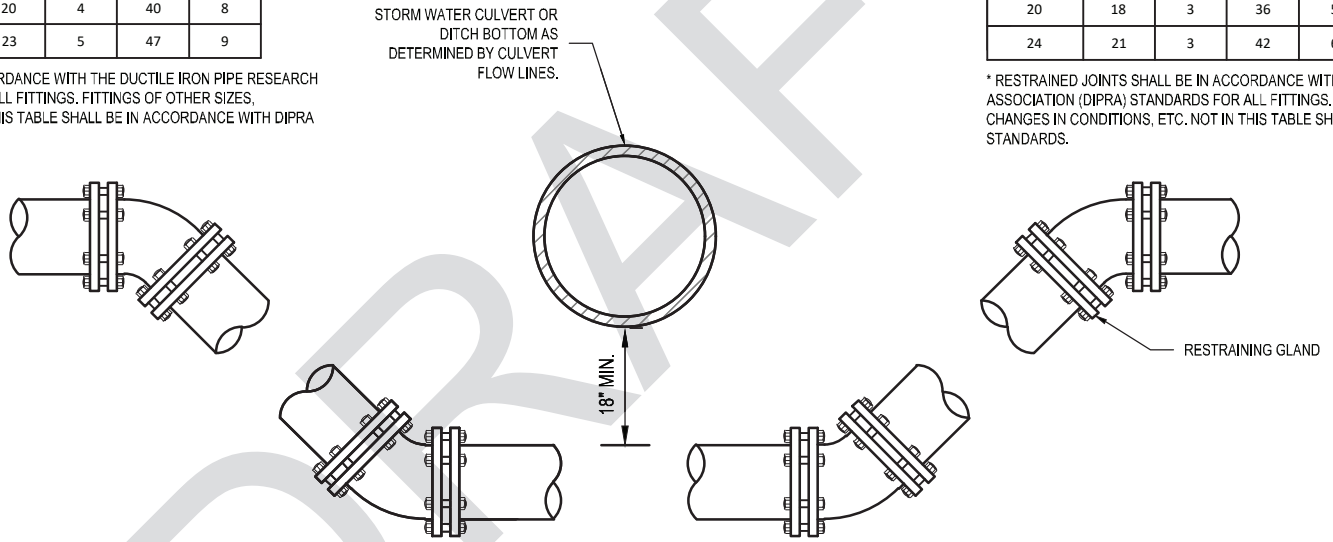
DATE:	DRAWING NO.:
06/2020	D 020
REVISED:	SCALE:
	NTS

DIP VERTICAL RESTRAINT JOINT TABLE						
RESTRAIN ALL JOINTS (UPPER & LOWER) WITH THESE LENGTHS (IN L.F. EACH SIDE OF FITTING)						
SIZE (INCH)	11 1/4°		22 1/2°		45°	
RESTRAINT	UPPER	LOWER	UPPER	LOWER	UPPER	LOWER
4	3	1	5	1	10	2
6	4	1	7	2	14	3
8	5	1	9	2	18	4
10	6	1	11	2	22	4
12	6	2	13	3	26	5
16	8	2	16	3	33	7
20	10	3	20	4	40	8
24	12	3	23	5	47	9

* RESTRAINED JOINTS SHALL BE IN ACCORDANCE WITH THE DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA) STANDARDS FOR ALL FITTINGS. FITTINGS OF OTHER SIZES, CHANGES IN CONDITIONS, ETC. NOT IN THIS TABLE SHALL BE IN ACCORDANCE WITH DIPRA STANDARDS.

PVC PIPE VERTICAL RESTRAINT JOINT TABLE						
RESTRAIN ALL JOINTS (UPPER & LOWER) WITH THESE LENGTHS (IN L.F. EACH SIDE OF FITTING)						
SIZE (INCH)	11 1/4°		22 1/2°		45°	
RESTRAINT	UPPER	LOWER	UPPER	LOWER	UPPER	LOWER
4	5	1	9	2	18	3
6	6	2	13	2	26	4
8	8	2	16	2	34	4
10	**10**	2	20	3	40	5
12	12	3	23	3	47	6
16	15	3	30	4	61	8
20	18	3	36	5	74	10
24	21	3	42	6	87	11

* RESTRAINED JOINTS SHALL BE IN ACCORDANCE WITH THE DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA) STANDARDS FOR ALL FITTINGS. FITTINGS OF OTHER SIZES, CHANGES IN CONDITIONS, ETC. NOT IN THIS TABLE SHALL BE IN ACCORDANCE WITH DIPRA STANDARDS.



RESTRAINED JOINT FITTING (VERTICAL PIPE ONLY)

Scale: NTS

NOTES:

1. THE FOLLOWING CONDITIONS WERE USED TO CALCULATE THE RESTRAINED LENGTHS SHOWN IN THE TABLE:
   * LAYING CONDITION IS TYPE 4.
   * SOIL DESIGNATED AS SANDY-CLAY.
   * DEPTH IS 3 FT.
   * DESIGN PRESSURE (TEST) IS 150 P.S.I..
   * SAFETY FACTOR IS 1.5.

   FOR THE TEE BRANCH AND REDUCER, LENGTHS ARE BASED ON BRANCHING AND REDUCING FROM THE NEXT LARGER SIZE IN THE TABLE. TEE BRANCH LENGTH BASED ON RUN LENGTH TO FIRST JOINT OF 10 FT. DEVIATIONS FROM THESE CONDITIONS MUST BE BASED ON THE ABOVE PARAMETERS.

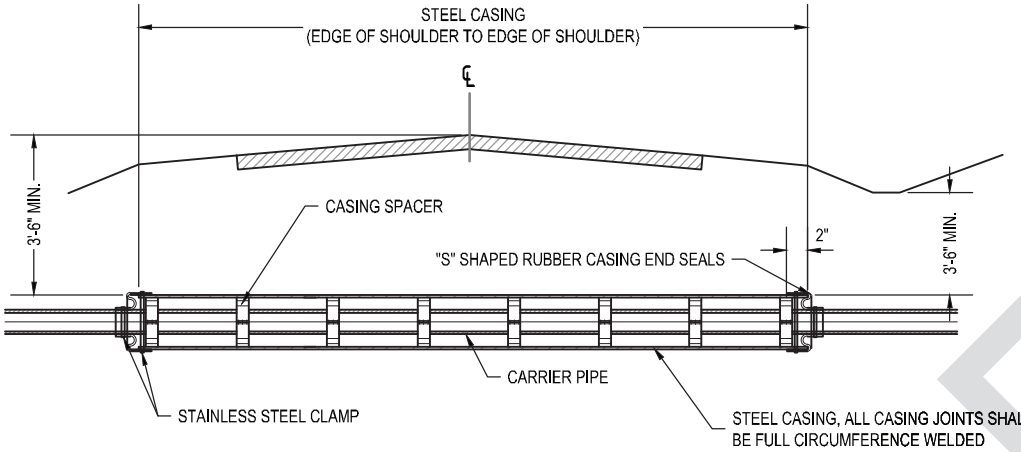
OCONEE JOINT REGIONAL SEWER AUTHORITY

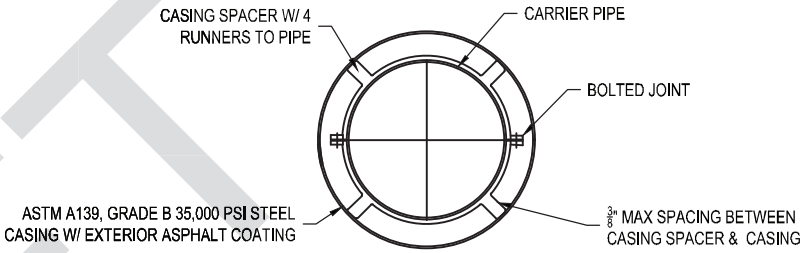
VERTICAL RESTRAINED JOINT FITTING

OJRSA

DATE:	DRAWING NO.:
06/2020	D 021
REVISED:	SCALE:
	NTS

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SECTION

Scale: NTS

NOTES:
1. STAINLESS STEEL CASING SPACERS SHALL BE CASCADE CCS MODEL OR EQUAL, SPACED ALONG THE PIPE AT 10'-0" OC.
2. RUBBER CASING END SEALS SHALL BE "TYPE KG" WITH 316 STAINLESS STEEL BANDS. INSULATORS, END SEALS AND BANDS SHALL BE MANUFACTURED BY: PIPELINE SEAL AND INSULATOR, INC. HOUSTON, TEXAS 77021 OR APPROVED EQUAL.

CARRIER PIPE	CASING PIPE	
	DIA.	WALL
36" DIP	48"	0.688"
30" DIP	42"	0.625"
24" DIP	36"	0.532"
20" DIP	36"	0.532"
18" DIP	30"	0.469"
16" DIP	30"	0.469"
12" DIP	24"	0.375"
10" DIP	20"	0.344"
8" DIP	20"	0.344"
6" DIP	16"	0.281"

PIPE CASING UNDER PAVED AREAS

Scale: NTS

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OCONEE JOINT REGIONAL SEWER AUTHORITY

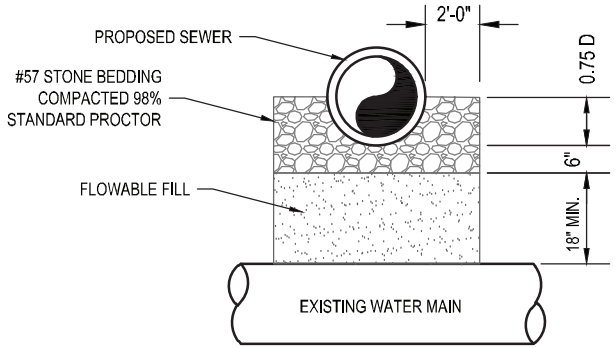
PIPE CASING UNDER PAVED AREAS

OJRSA

DATE:	DRAWING NO.:
06/2020	D 022
REVISED:	SCALE:
	NTS

NOTES FOR SEWER OVER WATER MAIN:

1. INSTALL A FULL JOINT OF PIPE FOR WHICHEVER MAIN IS LAID SECOND. IT IS TO BE CENTERED AT CROSSING.
2. IF THE WATER IS EXISTING AND THE MINIMUM CLEARANCE IS NOT MET, THE SEWER SHALL BE DUCTILE IRON PIPE. PROVIDE RESTRAINED JOINT FITTINGS WHEN TRANSITIONING FROM DIP TO PVC. PLACE FLOWABLE FILL BETWEEN TOP OF WATER MAIN AND BOTTOM OF SEWER.
3. IF THE SEWER IS EXISTING, THE WATER MAIN SHALL MEET THE MINIMUM CLEARANCE.

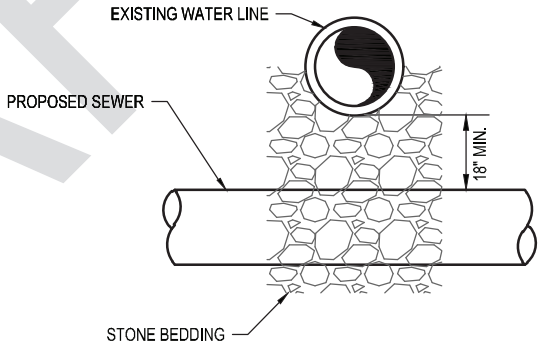


SEWER CROSSING ABOVE WATER MAIN

Scale: NTS

NOTES FOR SEWER UNDER WATER MAIN:

1. REPLACE SOIL UNDER THE WATER MAIN WITH STONE BEDDING.
2. IF CLEARANCE IS LESS THAN 18" DUCTILE IRON SHALL BE USED. PROVIDE RESTRAINED JOINT FITTINGS WHEN TRANSITIONING FROM DIP TO PVC. PLACE STONE BETWEEN TOP OF SEWER AND BOTTOM OF WATER MAIN.
3. INSTALL A FULL LENGTH OF PIPE FOR WHICHEVER MAIN IS LAID SECOND. IT IS TO BE CENTERED AT CROSSING.



SEWER CROSSING UNDER WATER MAIN

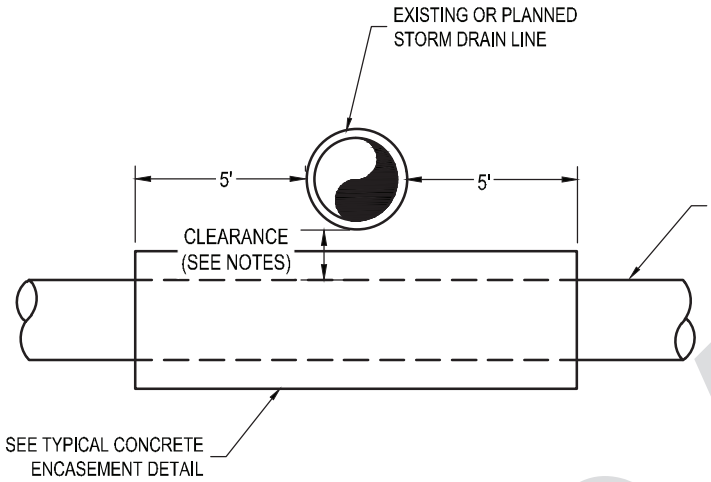
Scale: NTS

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OCONEE JOINT REGIONAL SEWER AUTHORITY

SEWER LINE CROSSING WATER LINE

	DATE:	DRAWING NO.:
OJRSA	06/2020	D 023
	REVISED:	SCALE:
		NTS



NOTES:

1. USE DUCTILE IRON IF CLEARANCE IS LESS THAN 18". CENTER FULL JOINT OF PIPE ON STORM DRAIN LINE. PROVIDE RESTRAINED JOINT FITTINGS WHEN TRANSITIONING FROM DIP TO PVC.
2. IF CLEARANCE IS LESS THAN 18", USE CONCRETE ENCASEMENT ON PIPE. USE POLYWRAP ON DUCTILE IRON PIPE PRIOR TO POURING CONCRETE.
3. WHERE SEWER LINE CROSSES ABOVE A STORM DRAINAGE PIPE OR STRUCTURE WITH LESS THAN 18" VERTICAL SEPARATION, USE DUCTILE IRON PIPE.

SEWER LINE CROSSING UNDER STORM DRAINAGE

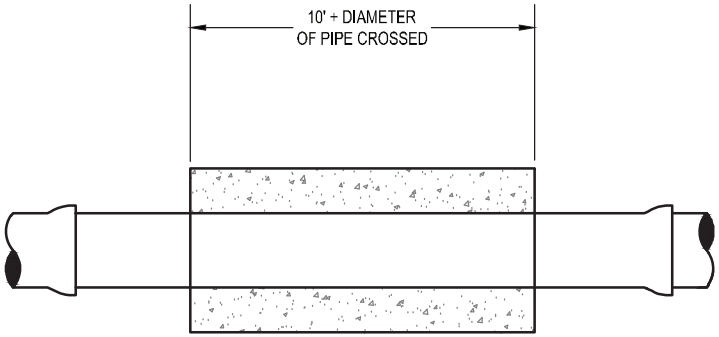
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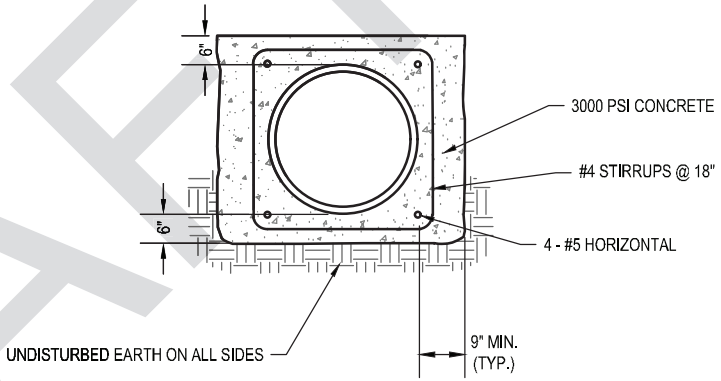
OCONEE JOINT REGIONAL SEWER AUTHORITY

SEWER LINE CROSSING STORM DRAINAGE

OJRSA	DATE: 06/2020	DRAWING NO.: D 024
	REVISED:	SCALE: NTS



PROFILE



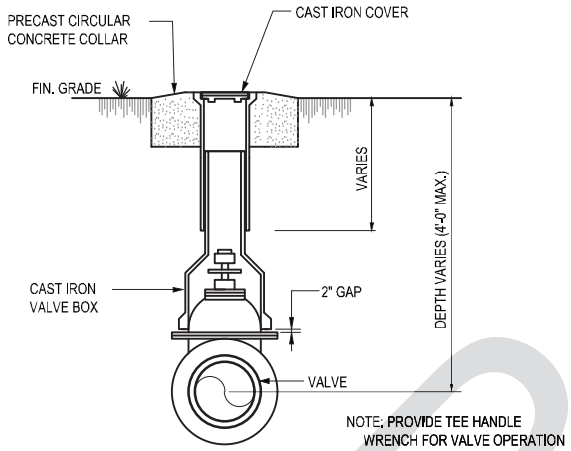
SECTION

TYPICAL CONCRETE ENCASEMENT

Scale: NTS

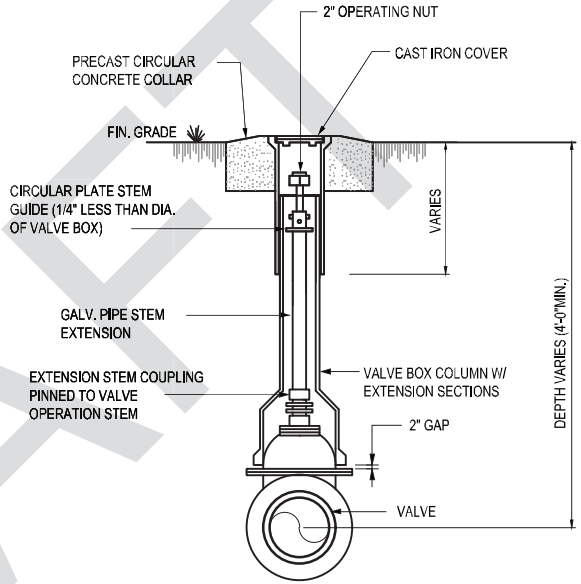
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OCONEE JOINT REGIONAL SEWER AUTHORITY		
CONCRETE ENCASEMENT		
OJRSA	DATE: 06/2020	DRAWING NO.: D 025
	REVISED:	SCALE: NTS



NOTE: VALVES SHALL BE MECHANICAL JOINT WITH MEGALUG RESTRAINTS

VALVE BOX - DEPTH - LESS THAN 4'-0"



NOTE: VALVES SHALL BE MECHANICAL JOINT WITH MEGALUG RESTRAINTS

VALVE BOX - GREATER THAN 4'-0"

DETAIL - VALVE BOX INSTALLATION

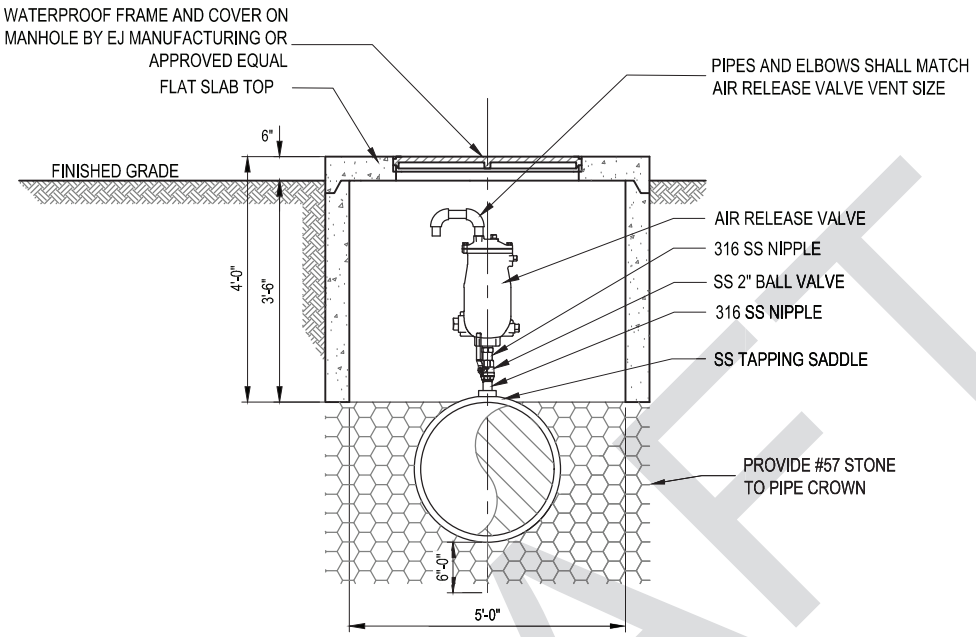
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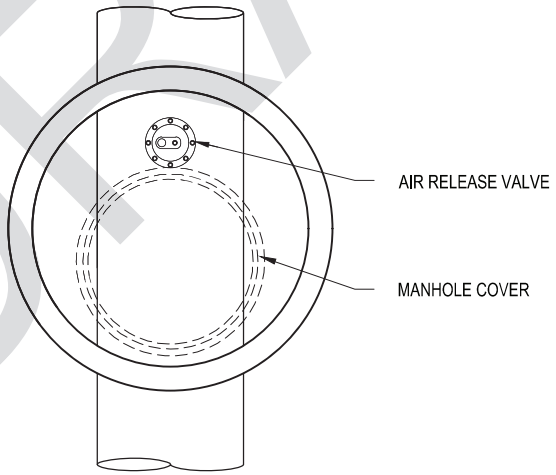
OCONEE JOINT REGIONAL SEWER AUTHORITY

VALVE BOX

OJRSA	DATE: 06/2020	DRAWING NO.: D 026
	REVISED:	SCALE: NTS



SECTION



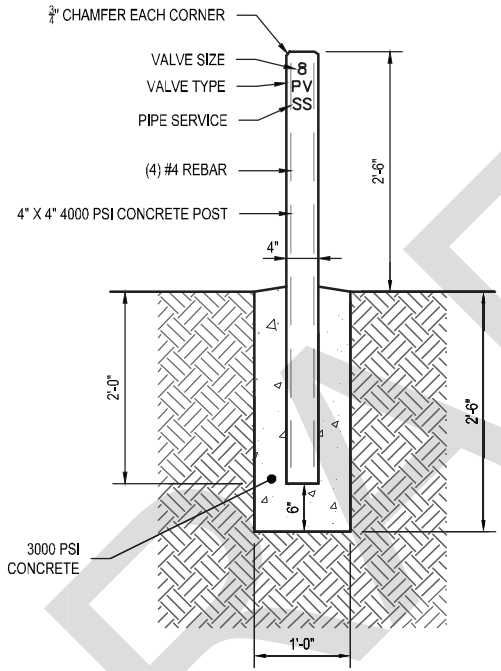
PLAN

AIR RELEASE VALVE

Scale: NTS

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OCONEE JOINT REGIONAL SEWER AUTHORITY AIR RELEASE VALVE		
OJRSA	DATE: 03/2022	DRAWING NO.: D 027
	REVISED:	SCALE: NTS



VALVE KEY
AV - AIR RELEASE VALVE
CV - CHECK VALVE
PV - PLUG VALVE
TV - TAPPING VALVE
BLANK - PIPE LINE MARKER

PIPE SERVICE KEY
SS - SANITARY SEWER

COLOR KEY
GREEN - SANITARY SEWER

NOTE:
1. MARKERS ARE REQUIRED AT EACH VALVE AND AT EVERY 1,000 FEET (MAX) ALONG PIPE LINE AND AT EVERY DIRECTIONAL CHANGE, UNLESS OTHERWISE SHOWN ON THE DRAWINGS.

PIPELINE & VALVE MARKER

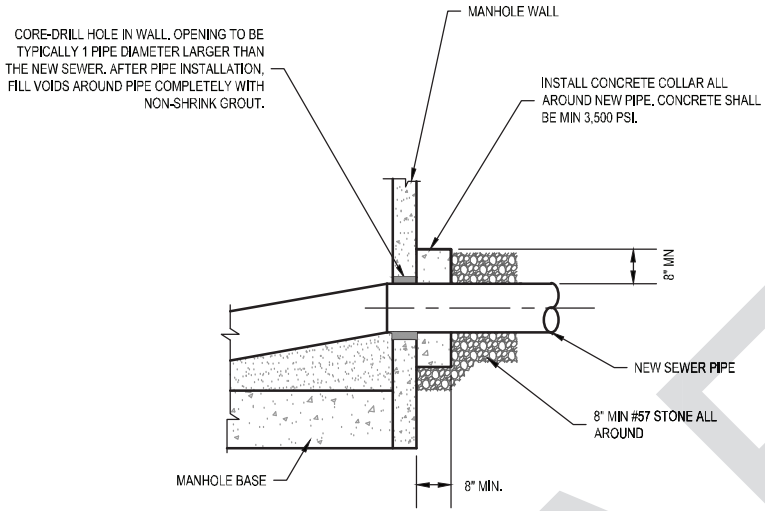
Scale: NTS

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OCONEE JOINT REGIONAL SEWER AUTHORITY

PIPELINE & VALVE MARKER

OJRSA	DATE: 06/2020	DRAWING NO.: D 028
	REVISED:	SCALE: NTS



NOTES:

1. REFER TO THIS DETAIL WHEN CONNECTING NEW SEWER FORCE MAIN TO EXISTING MANHOLES.

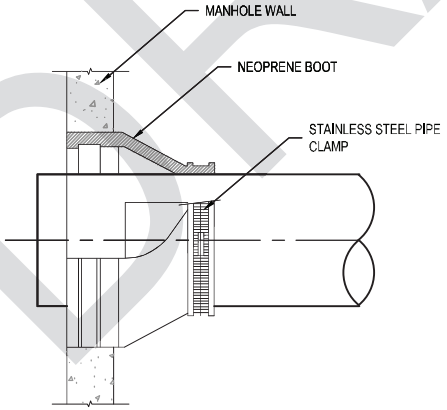
2. PROVIDE A SMOOTH TRANSITION AND INVERT CHANNEL FOR ANY INCOMING ELEVATION. FOR SEWER FORCE MAINS ENTERING MANHOLES ON TOP OF THE BENCH, PROVIDE AN INVERT CHANNEL ON THE BENCH BY GROUTING NEW CHANNEL.

3. FORCE MAIN CONNECTION TO EXISTING MANHOLE SHALL INCLUDE COATING MANHOLE WITH MAINSTAY SOLIDS EPOXY.

4. FORCE MAIN CONNECTIONS TO NEW MANHOLES SHALL BE POLYMER CONCRETE MANHOLES.

NEW FORCE MAIN CONNECTION AT EXISTING MANHOLE

Scale: NTS



RUBBER BOOT PIPE CONNECTOR FOR NEW MANHOLE

Scale: NTS

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OCONEE JOINT REGIONAL SEWER AUTHORITY

FORCE MAIN CONNECTION AT MANHOLE

OJRSA	DATE: 06/2020	DRAWING NO.: D 029
	REVISED:	SCALE: NTS

NOTES:

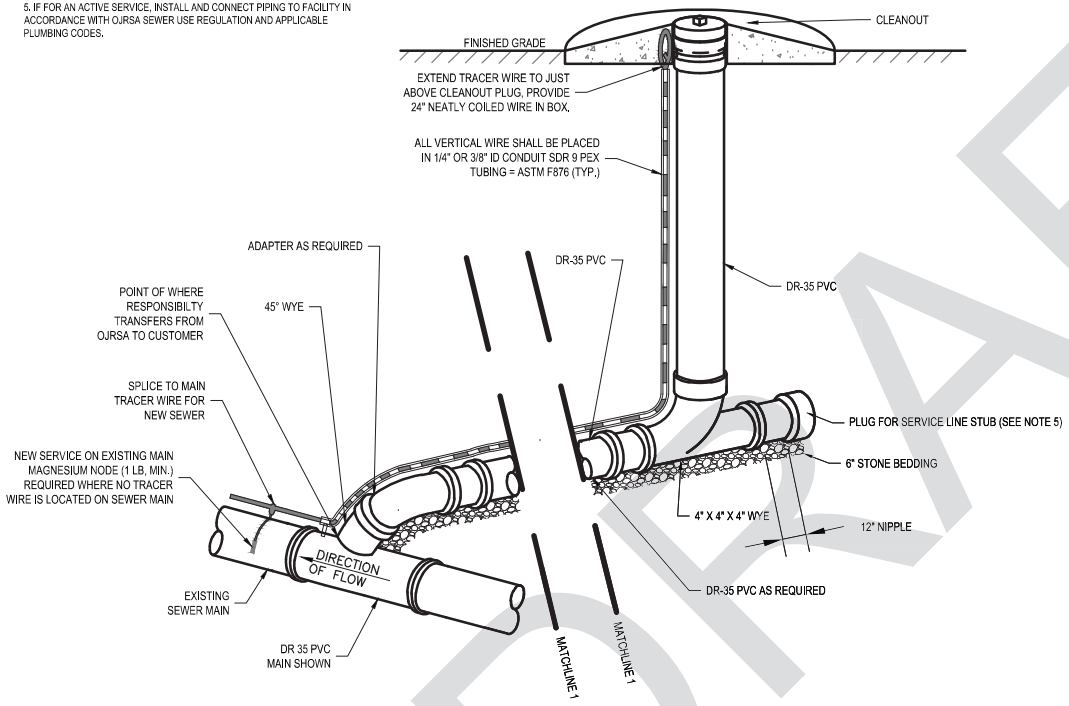
1. OJRSA NOT RESPONSIBLE FOR OPERATION AND MAINTENANCE BEYOND THE CLEANOUT WYE.

2. DETAIL APPLIES ONLY TO 4-INCH AND 6-INCH CONNECTIONS PER OJRSA DEVELOPMENT POLICY.

3. CLEANOUT IS TO BE INSTALLED AT THE EDGE OF OJRSA, SCDOT, OR OTHER EASEMENT AS APPROPRIATE, CONTACT OJRSA AT 864-972-3900 FOR INFORMATION.

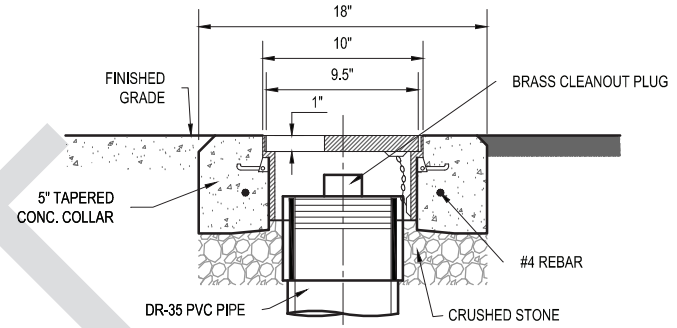
4. THE OJRSA WILL PERFORM AN INSPECTION OF THE TAP AND CLEANOUT INSTALLATION AT THE TIME THE WORK IS PERFORMED. THIS WILL NEED TO BE SCHEDULED NO SOONER THAN 48 HOURS IN ADVANCE OF WHEN THE TAP IS TO BE MADE BY CALLING OJRSA AT 864-972-3900.

5. IF FOR AN ACTIVE SERVICE, INSTALL AND CONNECT PIPING TO FACILITY IN ACCORDANCE WITH OJRSA SEWER USE REGULATION AND APPLICABLE PLUMBING CODES.

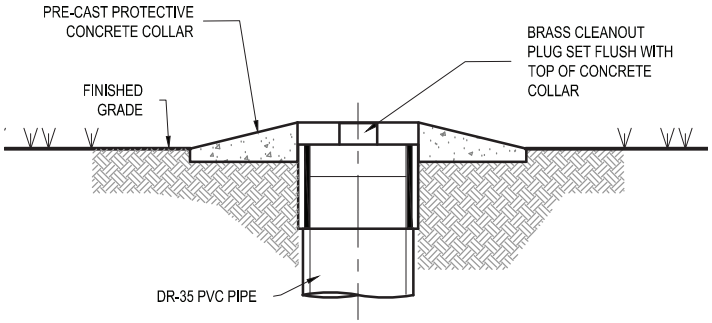


TYPICAL SEWER SERVICE LATERAL

Scale: NTS



CLEANOUT HANDHOLE FOR CONCRETE OR ASPHALT AREAS



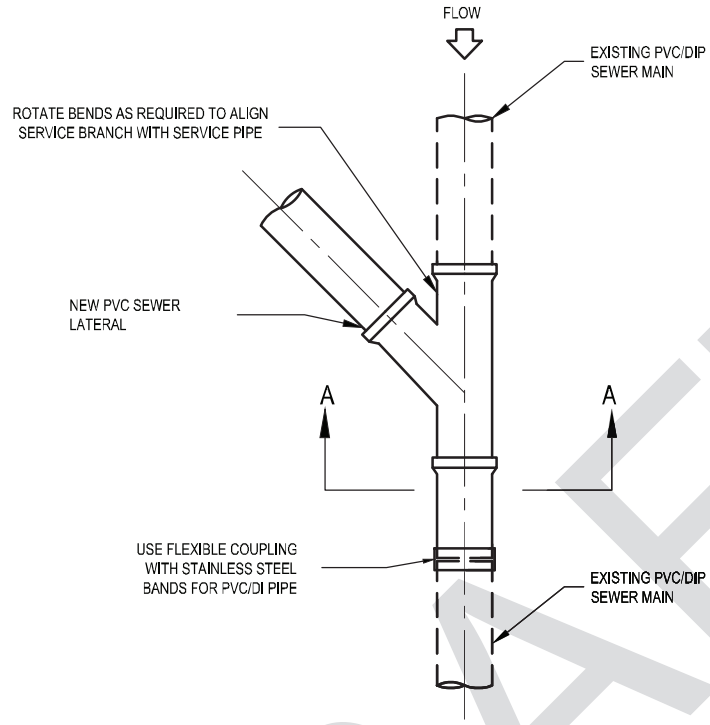
CLEANOUT HANDHOLE FOR GRASSY AREAS

SEWER CLEANOUT

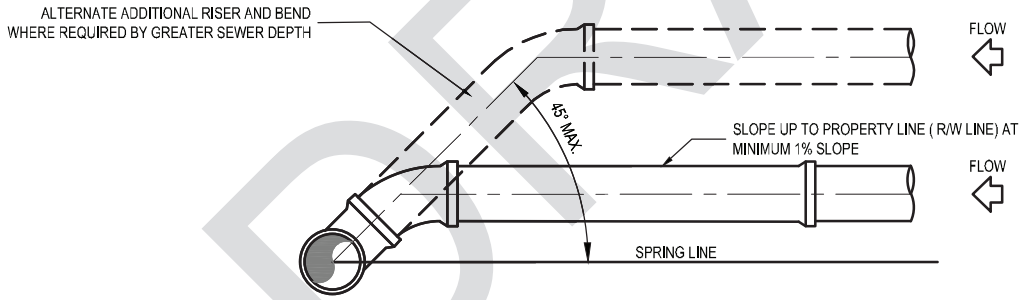
Scale: NTS

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OCONEE JOINT REGIONAL SEWER AUTHORITY		
SEWER LATERAL AND CLEAN OUT		
OJRSA	DATE: 11/2022	DRAWING NO.: D 030
	REVISED:	SCALE: NTS



PLAN



SECTION

1. SERVICE CONNECTIONS SHALL USE 4" OR 6" DR 35 PVC PIPE AND FITTINGS.
2. SERVICE CONNECTIONS BELOW 12 FEET DEPTH SHALL BE C-900 PVC PIPE AND FITTINGS UNTIL SERVICE IS LESS THAN 12 FEET DEEP.
3. USE RISER CONNECTIONS WHERE INVERT OF SEWER IS MORE THAN 7'-0" DEEP.
4. WHERE BELL OF WYE AND SPIGOT OF EXISTING MAIN ARE NOT COMPATIBLE, USE A SECOND FLEXIBLE COUPLING.
5. RIGID COUPLINGS MAY BE USED IN LIEU OF FLEXIBLE COUPLINGS.
6. MAINTAIN 36" MINIMUM COVER FROM TOP OF SERVICE TO FINISH GRADE. WHERE NOT TECHNICALLY FEASIBLE CONTACT OJRSA.
7. PVC SERVICES SHALL BE INSTALLED IN ACCORDANCE WITH MINIMUM STANDARDS OF THE UNI-BELL HANDBOOK OF PVC PIPE DESIGN AND CONSTRUCTION, LATEST EDITION.

SEWER LATERAL ON EXISTING GRAVITY SEWER

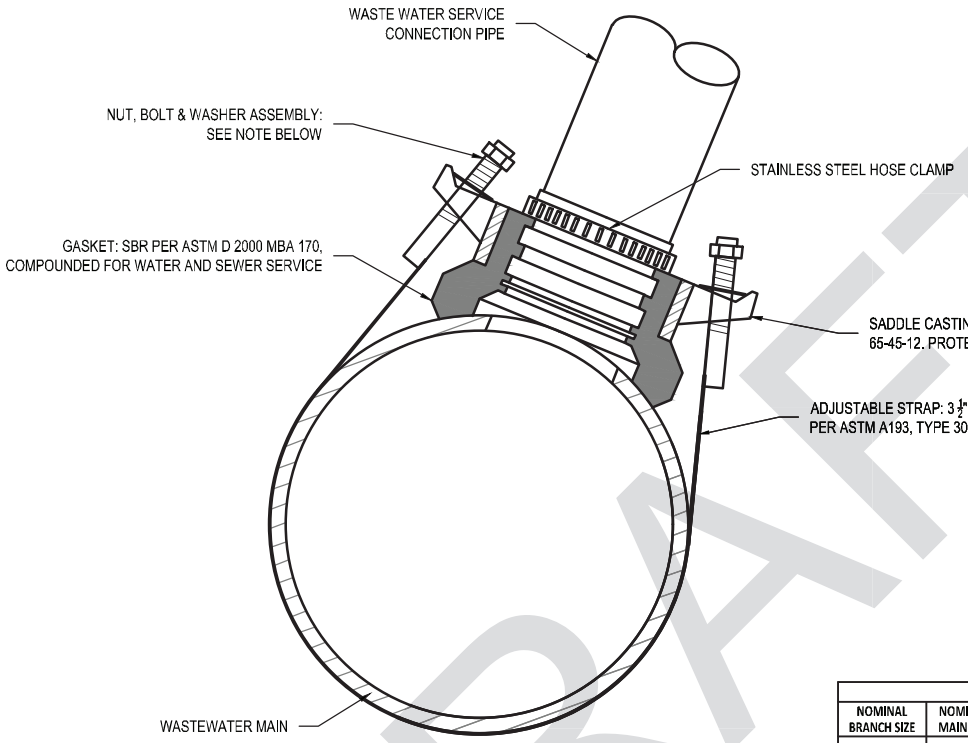
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OCONEE JOINT REGIONAL SEWER AUTHORITY

SEWER LATERAL ON EXISTING GRAVITY SEWER

	DATE:	DRAWING NO.:
OJRSA	06/2020	D 031
	REVISED:	SCALE:
		NTS

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NOTE:

1. ALL WORK TO BE COMPLETED IN ACCORDANCE WITH OJRSA SPECIFICATIONS.
2. ALL SERVICE CONNECTIONS SHALL BE INSPECTED BY OJRSA INPSECTOR.
3. THE APPLICATION SHOWN HERE IS ONLY FOR TAPPING EXISTING LIVE WASTEWATER MAINS.
4. TAPPING SADDLE SHALL BE ROMAC INDUSTRIES TYPE CB SEWER SADDLE OR APPROVED EQUAL. ALTERNATIVES SHALL BE PRE-APPROVED BY OJRSA PRIOR TO INSTALLATION.
5. CARE SHALL BE TAKEN TO PROHIBIT NEW CONNECTION FROM ENTERING INTO EXISTING PIPE.
6. HAMMER TAPS ARE PROHIBITED. EXISTING PIPE SHALL BE CORED AND REMAINDER SHALL BE PROPERLY DISPOSED.
7. SERVICE CONNECTION SHALL BE MADE NO LESS THAN 2 FEET FROM A PIPE JOINT.
8. SEWER MAIN SHALL BE SUPPORTED DURING THE WORK AS NECESSARY. EXCAVATE BELOW THE EXISTING MAIN A MINIMUM OF 6 INCHES BELOW THE PIPE AND FILL WITH SCDOT #57 STONE.

NUT, BOLT & WASHER ASSEMBLY:
NUTS TO BE STAINLESS STEEL PER ASTM A 194, TYPE 304. BOLTS TO BE ½" UNC ROLLED TREAD, LUBRICANT COATED, STAINLESS STEEL PER ASTM A 193, TYPE 304. WASHERS TO BE STAINLESS STEEL PER ASTM A 240, TYPE 304 AND PLASTIC LUBRICATING WASHERS.

ROMAC INDUSTRIES, INC. STYLE CB SEWER SADDLE 1-800-426-9341					
NOMINAL BRANCH SIZE	NOMINAL MAIN SIZE	RANGE	BRANCH TYPE	BRANCH O.D.	CATALOG NUMBER
4"	6"-12" (48" STRAP)	6.27 - 14.40 (REGULAR GASKET)	UNIVERSAL (PVC SDR 35 & SCH. 40)	4.20 - 4.63	CB-4.63UN
			DUCTILE IRON PIPE	4.80	CB-4.80
	14"-24" (96" STRAP)	14.40 - 25.80 (LARGE O.D. GASKET)	UNIVERSAL (PVC SDR 35 & SCH. 40)	4.20 - 4.63	CB-4.63UNLS
			DUCTILE IRON PIPE	4.80	CB-4.80LS
6"	8"-12" (48" STRAP)	8.00 - 14.40 (REGULAR GASKET)	UNIVERSAL (PVC SDR 35 & SCH. 40)	6.27 - 6.66	CB-6.66UN
			DUCTILE IRON PIPE	6.90	CB-6.90LS
	14"-24" (96" STRAP)	14.40 - 25.80 (LARGE O.D. GASKET)	UNIVERSAL (PVC SDR 35 & SCH. 40)	6.277 - 6.66	CB-6.66UNLS
			DUCTILE IRON PIPE	6.90	CB-6.90LS

SADDLE CONNECTION FOR LIVE WASTEWATER MAINS

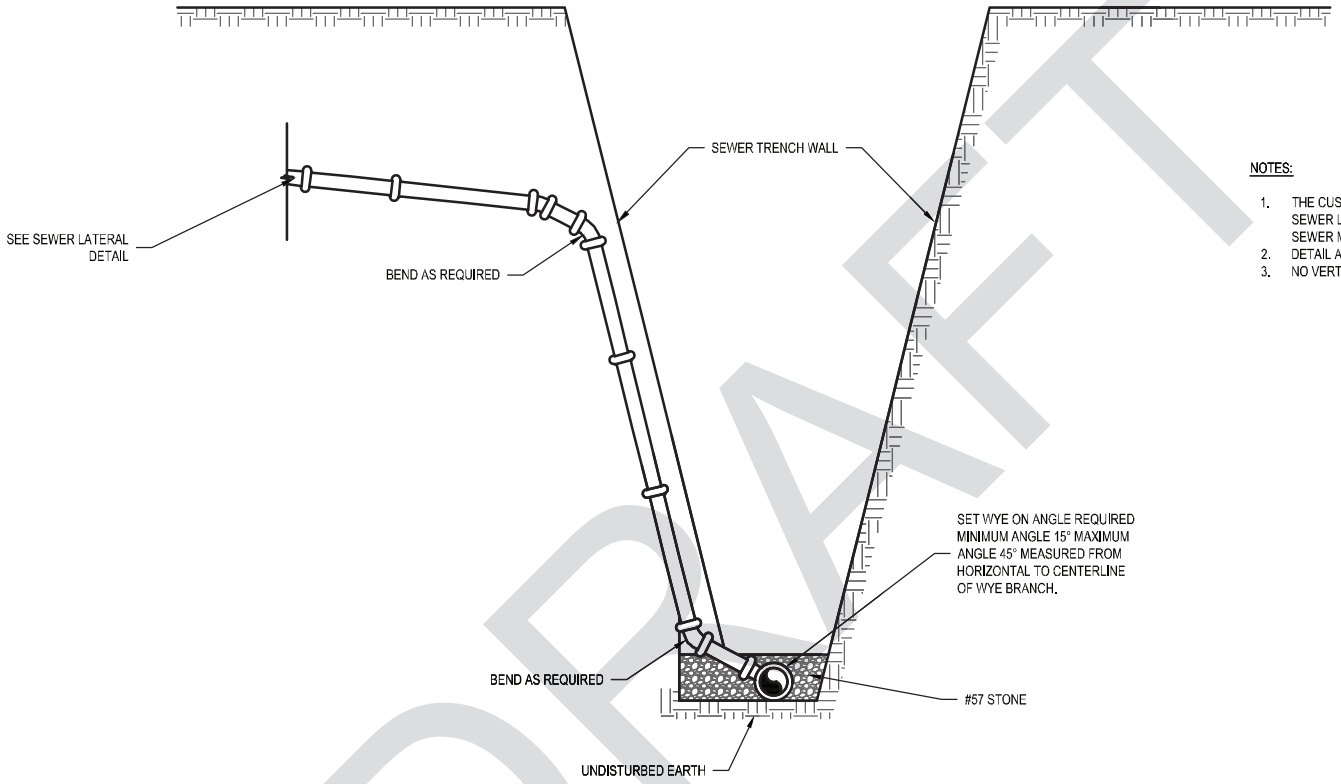
Scale: NTS

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OCONEE JOINT REGIONAL SEWER AUTHORITY

SADDLE CONNECTION FOR LIVE WASTEWATER MAINS

	DATE:	DRAWING NO.:
OJRSA	06/2020	D 032
	REVISED: 06/2021	SCALE: NTS



NOTES:

1. THE CUSTOMER SHALL OWN AND BE RESPONSIBLE FOR THE SEWER LATERAL FROM THE POINT OF CONNECTION WITH THE SEWER MAIN.
2. DETAIL APPLIES TO SEWER OVER 12' DEEP TO INVERT.
3. NO VERTICAL STACKING WILL BE ALLOWED.

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DEEP SEWER SERVICE LINE

Scale: NTS

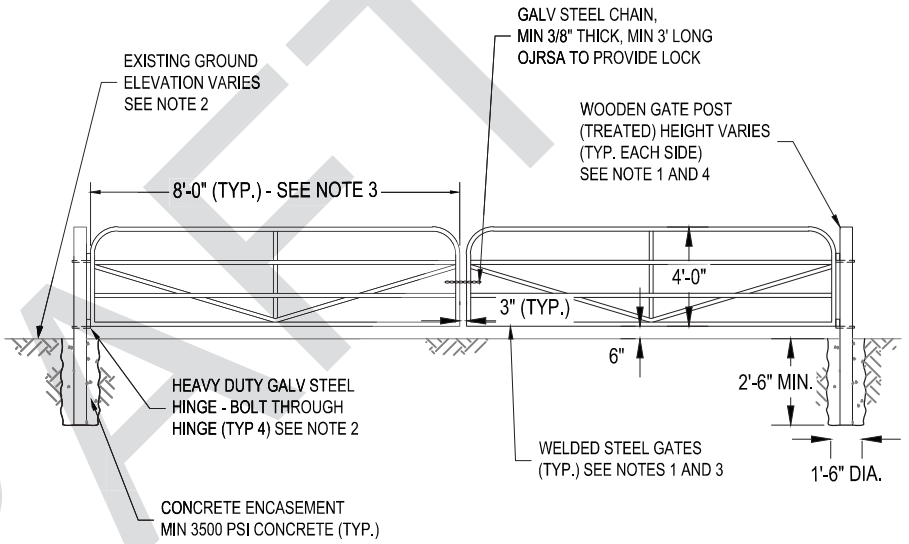
OCONEE JOINT REGIONAL SEWER AUTHORITY

DEEP SEWER SERVICE LINE

OJRSA	DATE: 06/2020	DRAWING NO.: D 033
	REVISED:	SCALE: NTS

NOTES:

1. DOUBLE STEEL GATES WILL BE REQUIRED UNDER A VARIETY OF CIRCUMSTANCES AND SITUATIONS TO PROVIDE ACCESS TO SEWERS AND TO PREVENT UNAUTHORIZED PERSONNEL FROM ACCESSING THE SEWERS AND RIGHT-OF-WAY. OJRSA AND / OR THE INDIVIDUAL PROPERTY OWNER SHALL APPROVE THE LOCATION OF ALL GATES. GATES MAY BE INSTALLED IN AN EXISTING FENCE OR OVER NEW SEWER RIGHT-OF-WAY WHERE NO FENCE CURRENTLY EXISTS. WHEN INSTALLING GATES IN AN EXISTING FENCE, THE CONTRACTOR SHALL NEATLY CUT THE EXISTING FENCE AND CONNECT THE FENCE TO THE NEW GATE POSTS IN A MANNER APPROVED BY OJRSA. THE CONNECTION SHALL BE SECURE AND PERMANENT. EXISTING FENCES MAY BE WIRE, BARBED WIRE, WOOD, OR A COMBINATION OF SUCH. WHEN INSTALLING A GATE OVER A NEW SEWER RIGHT-OF-WAY, THE GATE WILL BE TYPICALLY CENTERED OVER RIGHT-OF-WAY. THE CONTRACTOR WILL BE REQUIRED TO INSTALL NEW FENCE ON EACH SIDE OF GATE TO A LOCATION DETERMINED BY OJRSA TO BLOCK USE OF THE RIGHT-OF-WAY BY UNAUTHORIZED VEHICLES. THE EXTENT OF THE NEW FENCE WILL VARY WITH EACH INSTALLATION. THE NEW FENCE MATERIAL WILL BE DETERMINED BY OJRSA BASED ON EACH INSTALLATION AND / OR DESIRES OF PROPERTY OWNERS. FENCE MAY WIRE, BARBED WIRE, WOOD OR A COMBINATION OF SUCH. NEW FENCE POSTS SHALL BE 6"X6" TREATED WOOD POSTS OR APPROVED EQUAL INSTALLED AND ANCHORED AS SPECIFIED FOR THE GATE POSTS.
2. GROUND ELEVATIONS WILL VARY AND WILL TYPICALLY NOT BE LEVEL. CONTRACTOR TO ADJUST GATE ELEVATION AND HINGE LOCATIONS TO ACCOMMODATE THE EXISTING GROUND ELEVATIONS TO PROVIDE 6" OF CLEARANCE. DOUBLE GATE INSTALLATION MAY BE REQUIRED IN MANY SITUATIONS DUE TO SIGNIFICANT GROUND ELEVATION CHANGES AT THE GATE.
3. GATES TO BE FABRICATED FROM 1-1/2" DIA MIN HIGH-STRENGTH STEEL TUBING WITH ALL WELDED JOINTS. GATES TO BE SAND-BLASTED AND PRIME COATED AT FACTORY AND FINISH COATED AFTER INSTALLATION. COLOR SHALL BE STANDARD PRIMER RED. EACH GATE TO BE 8'-0" WIDE UNLESS OTHERWISE APPROVED BY OJRSA.
4. WOODEN GATE POSTS TO BE 6" NOM X 6" NOM TREATED POSTS OR APPROVED EQUAL. THE HEIGHT OF POSTS WILL VARY WITH EACH INSTALLATION BUT SHOULD BE AT LEAST EQUAL TO THE TOP OF THE GATE UNLESS OTHERWISE APPROVED BY OJRSA. WHEN DETERING THE HEIGHT OF THE GATE POSTS, CONSIDERATION MUST BE GIVEN TO THE EXISTING GROUND ELEVATIONS, THE LOCATIONS AND ELEVATIONS OF EXISTING OR NEW FENCES THAT WILL CONNECT TO THE GATE POSTS, AND PROPERTY OWNER CONCERNS. THE HEIGHT OF THE POSTS SHALL BE APPROVED BY OJRSA.

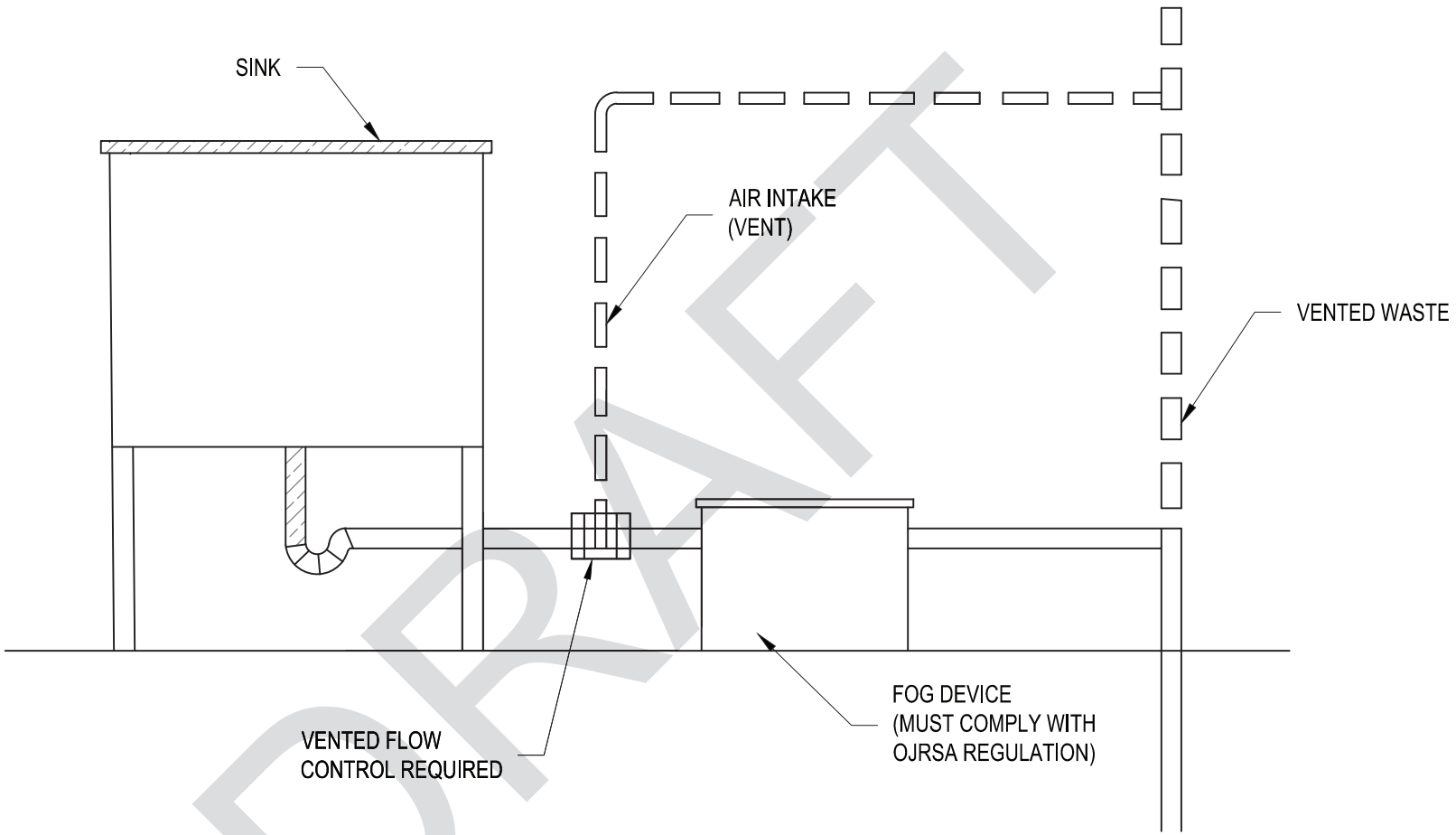


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OCONEE JOINT REGIONAL SEWER AUTHORITY

STEEL DOUBLE GATE FOR EASEMENTS

	DATE:	DRAWING NO.:
OJRSA	05/2022	D 034
	REVISED:	SCALE:
		NTS



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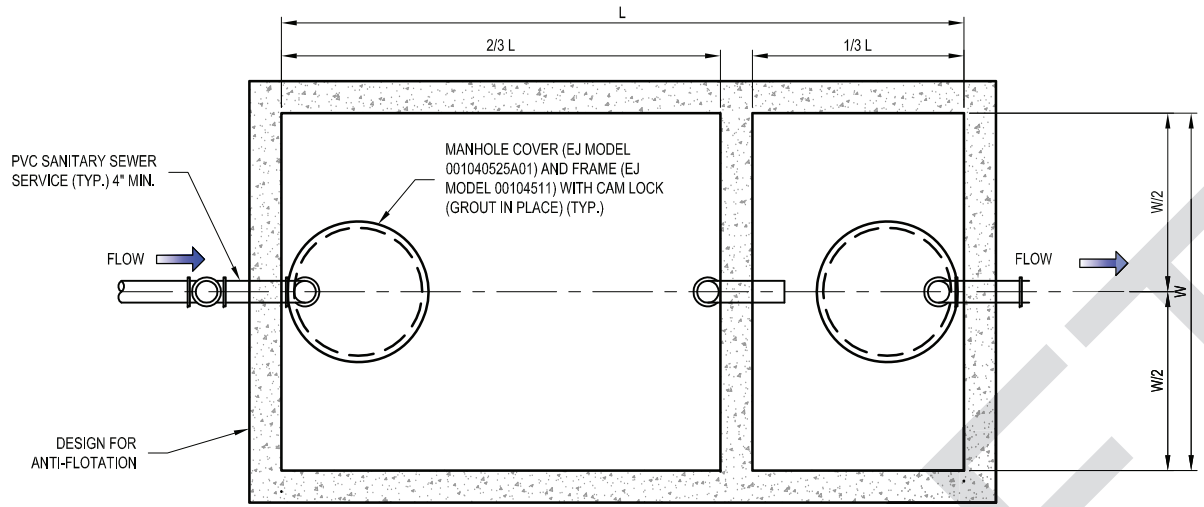
TYPICAL GREASE TRAP PLUMBING PLAN

Scale: NTS

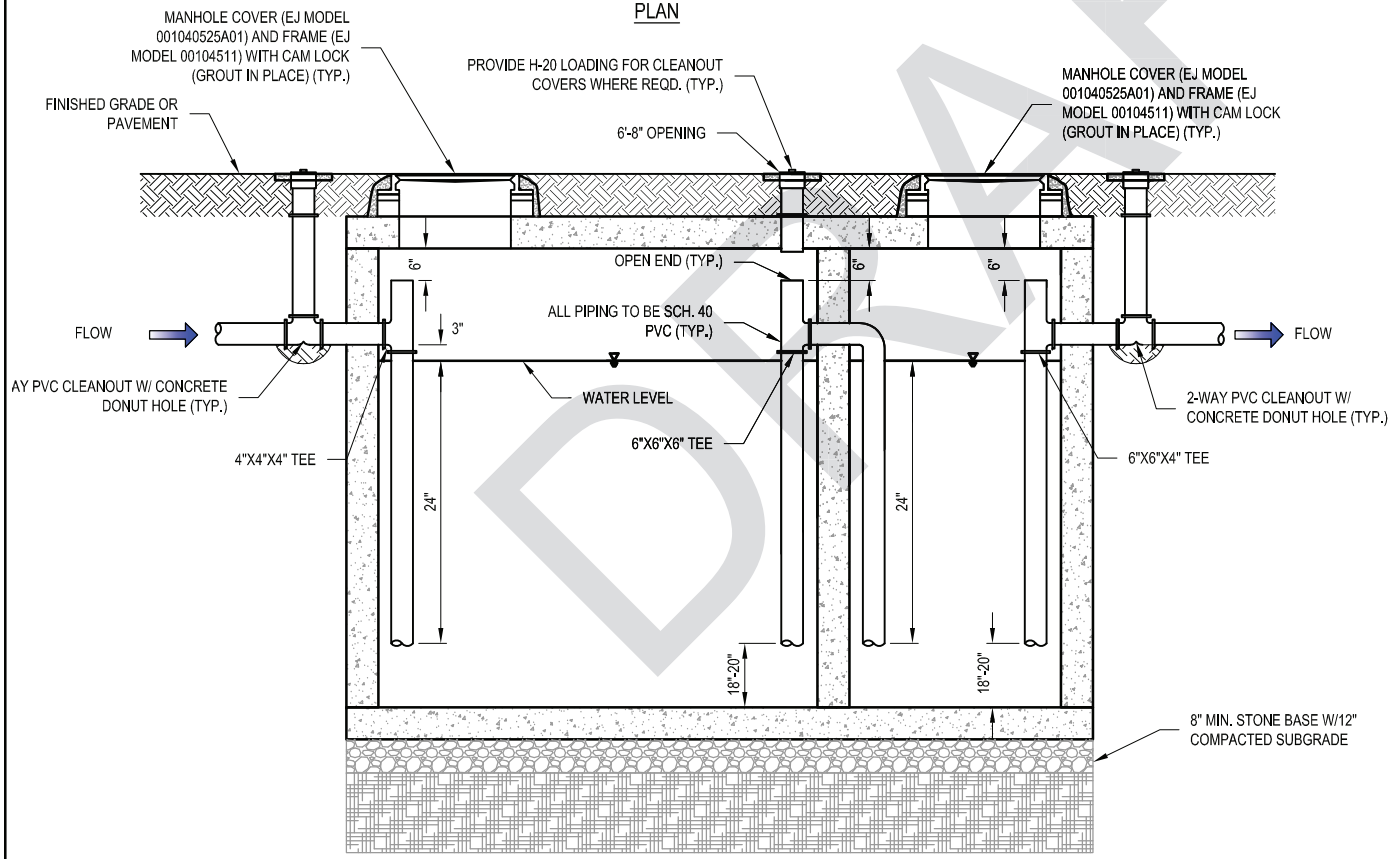
OCONEE JOINT REGIONAL SEWER AUTHORITY

TYPICAL GREASE TRAP PLUMBING PLAN

	DATE:	DRAWING NO.:
OJRSA	09/2021	FOG-1
	REVISED:	SCALE:
		NTS



PLAN



PROFILE

NOTES:
1. USE NON-SHRINK GROUT AT ALL PENETRATIONS.
2. PROVIDE BUTYL RUBBER SEAL BETWEEN ALL SECTIONS AND TOP
3. ALL TEES THROUGHOUT TANK MUST BE DWV PVC 40

INTERCEPTOR DIMENSIONS		
LIQUID CAPACITY (GALLONS)	WIDTH (W)	LENGTH (L)
1,000	5'-1"	8'-2"
1,200	5'-9"	8'-6"
1,500	5'-7"	10'-8"
2,000	4'-11"	15'-11"
OTHERS AS APPROVED BY OJRSA		

OCONEE JOINT REGIONAL SEWER AUTHORITY

FATS, OILS & GREASE INTERCEPTOR

OJRSA

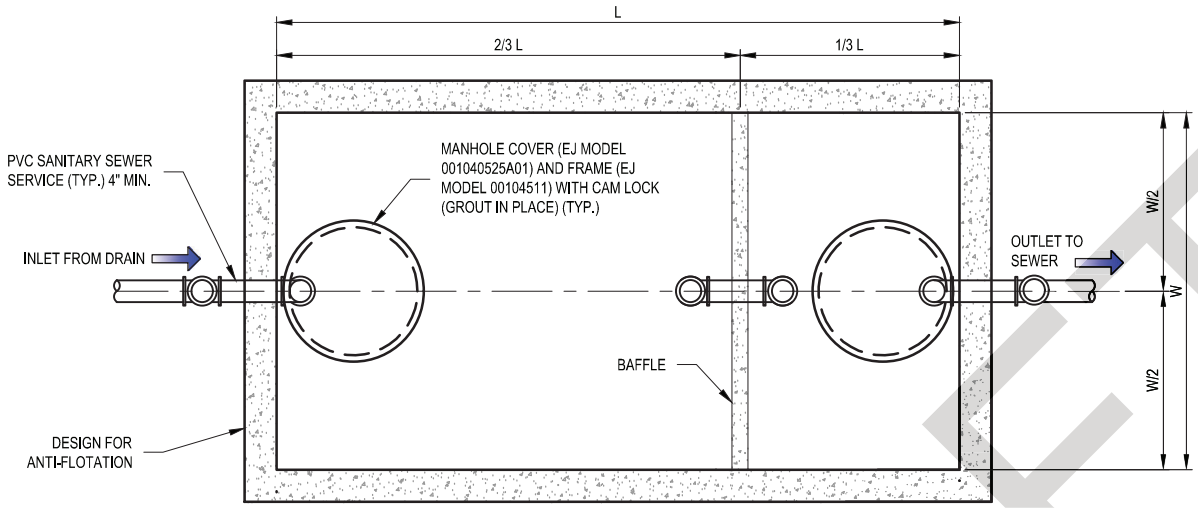
DATE: 06/2022

DRAWING NO.: FOG-2

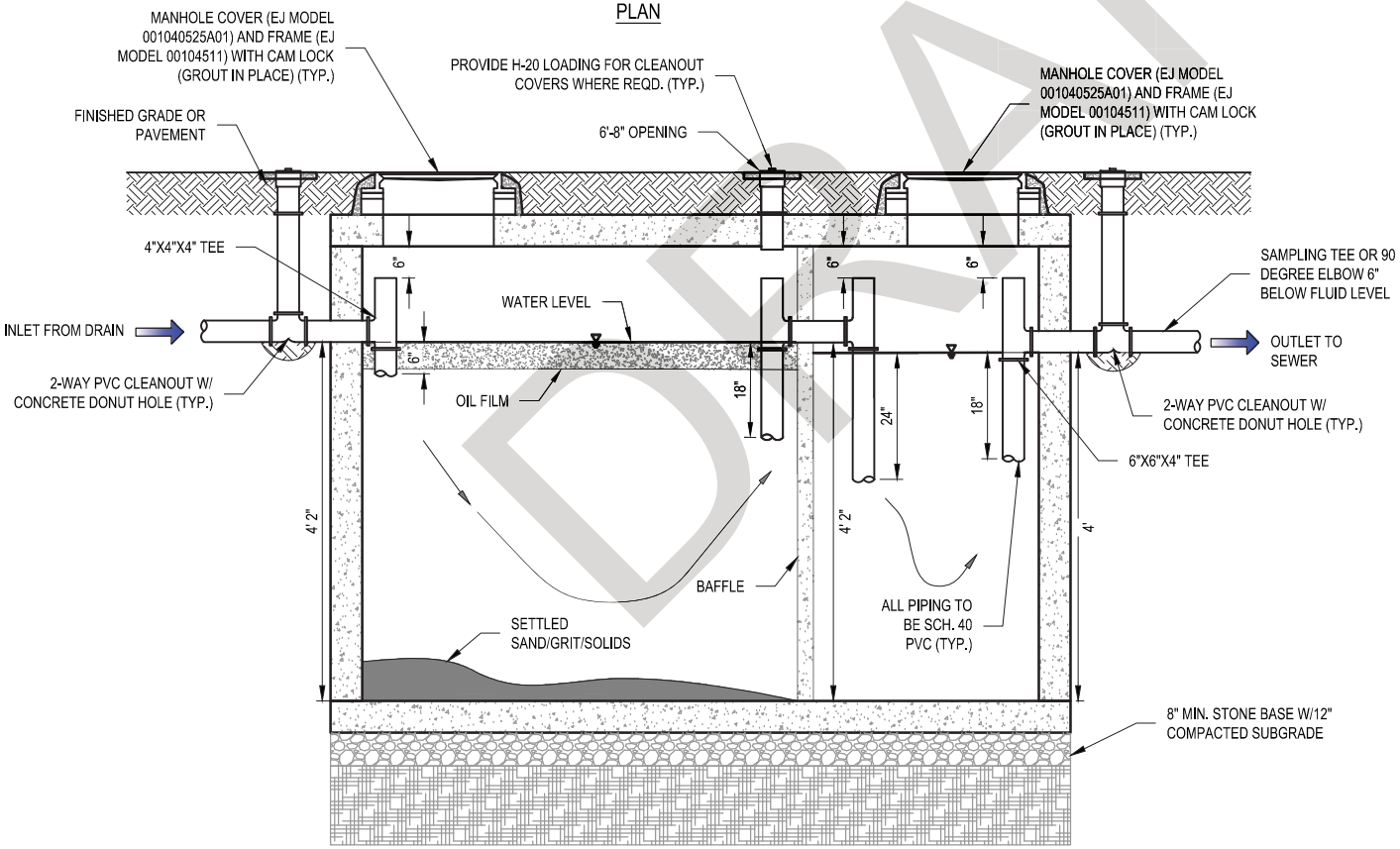
REVISED:

SCALE: NTS

DRAFT



PLAN



PROFILE

NOTES:

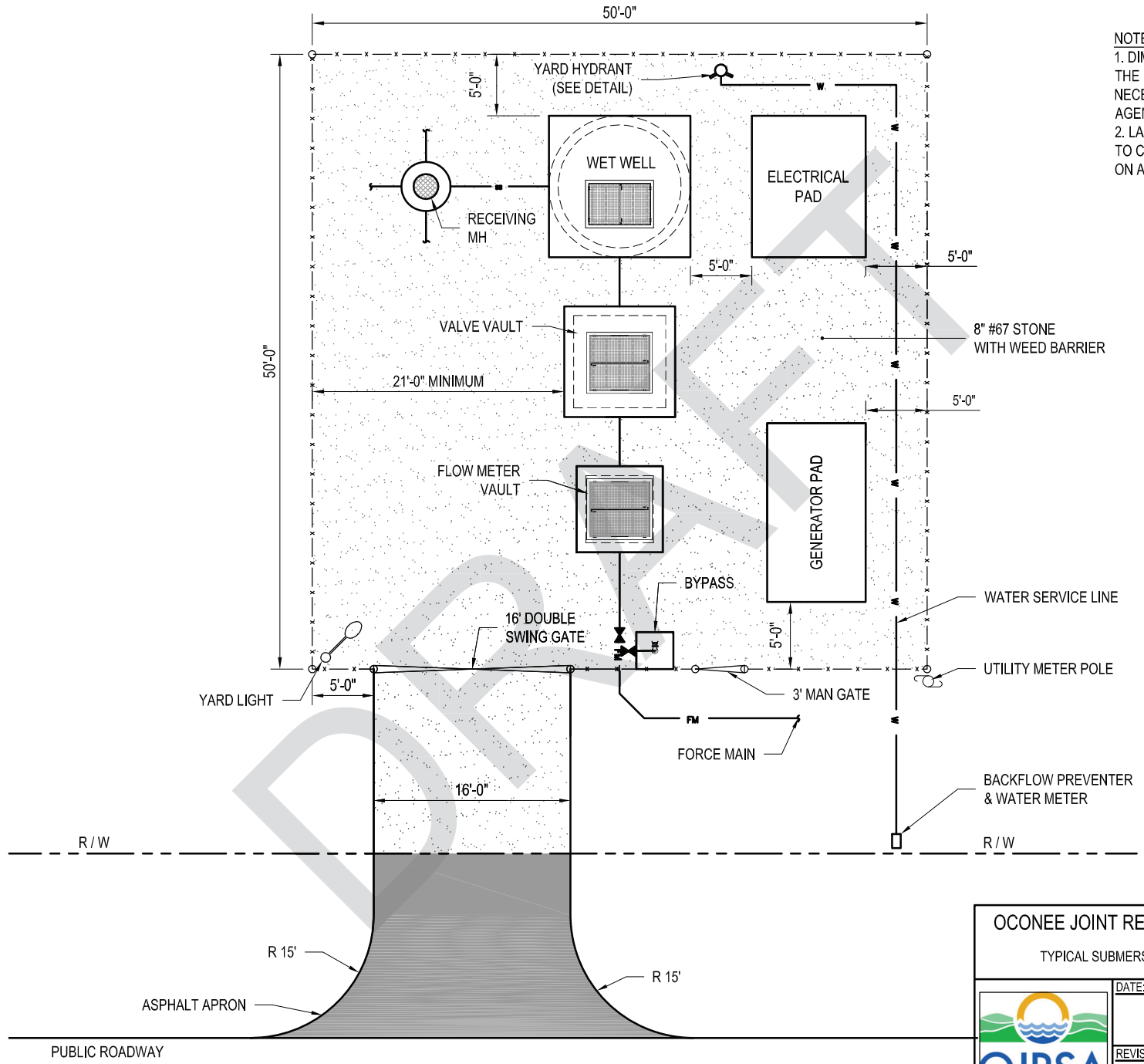
1. USE NON-SHRINK GROUT AT ALL PENETRATIONS.
2. PROVIDE BUTYL RUBBER SEAL BETWEEN ALL SECTIONS AND TOP
3. ALL TEES THROUGHOUT TANK MUST BE DWV PVC 40

OCONEE JOINT REGIONAL SEWER AUTHORITY

OIL/WATER SEPARATOR

	DATE: 06/2023	DRAWING NO.: FOG-3
OJRSA	REVISED: 01/2024	SCALE: NTS

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NOTE:
1. DIMENSIONS SHOWN IN DETAIL ARE THE MINIMUM. OJRSA WILL DETERMINE NECESSARY SIZE BASED ON THE AGENCY'S NEED.
2. LAYOUT ARRANGEMENT IS SUBJECT TO CHANGE BASED ON NEED BY OJRSA ON A CASE-BY-CASE BASIS.

DRAFT

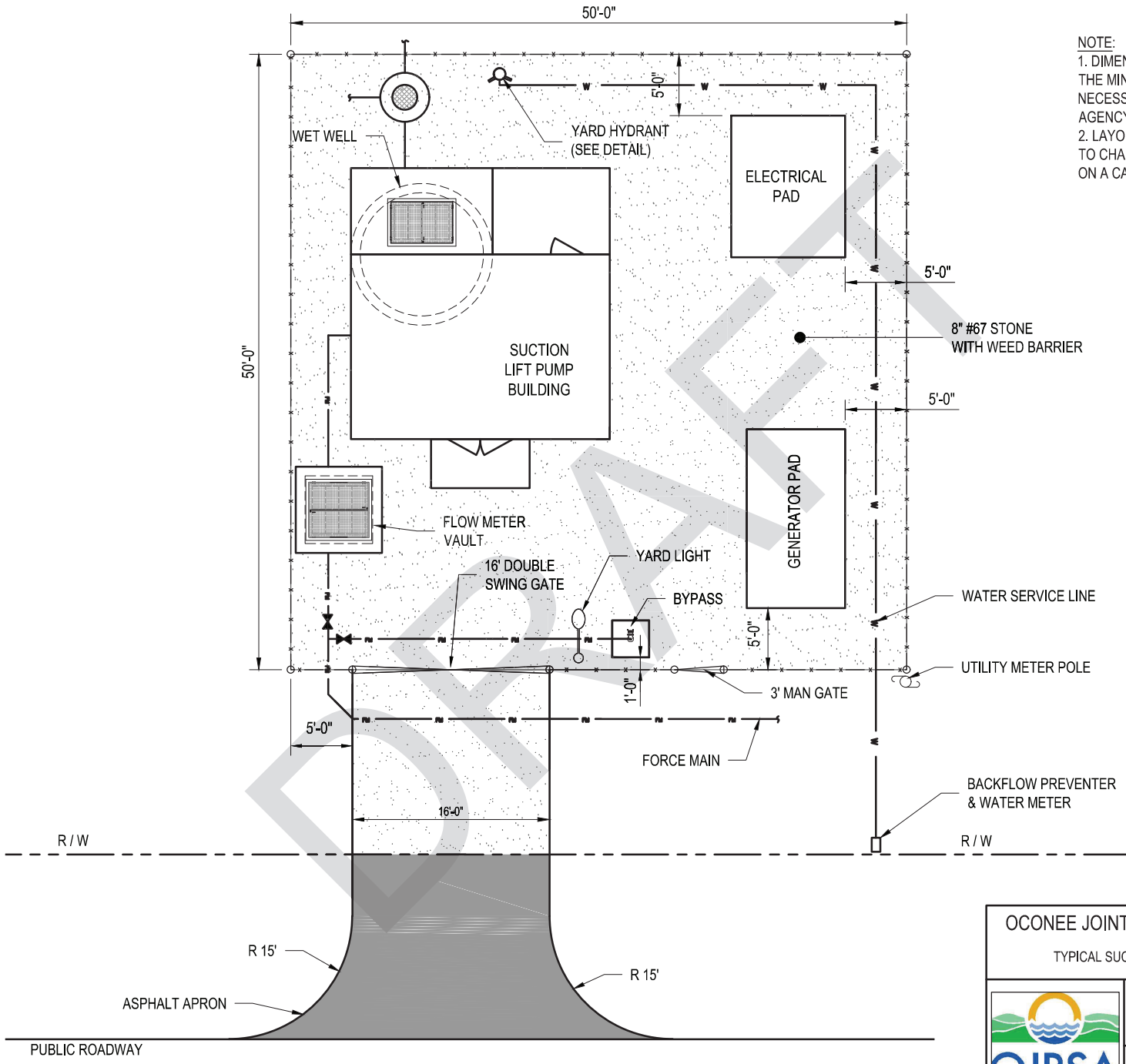
TYPICAL SUBMERSIBLE PUMP STATION SITE PLAN

Scale: NTS

OCONEE JOINT REGIONAL SEWER AUTHORITY

TYPICAL SUBMERSIBLE PUMP STATION SITE PLAN

DATE:	DRAWING NO.:
06/2020	PS-1
REVISED:	SCALE:
	NTS



NOTE:
1. DIMENSIONS SHOWN IN DETAIL ARE THE MINIMUM. OJRSA WILL DETERMINE NECESSARY SIZE BASED ON THE AGENCY'S NEED.
2. LAYOUT ARRANGEMENT IS SUBJECT TO CHANGE BASED ON NEED BY OJRSA ON A CASE-BY-CASE BASIS.

DRAFT

TYPICAL SUCTION LIFT PUMP STATION SITE PLAN

Scale: NTS

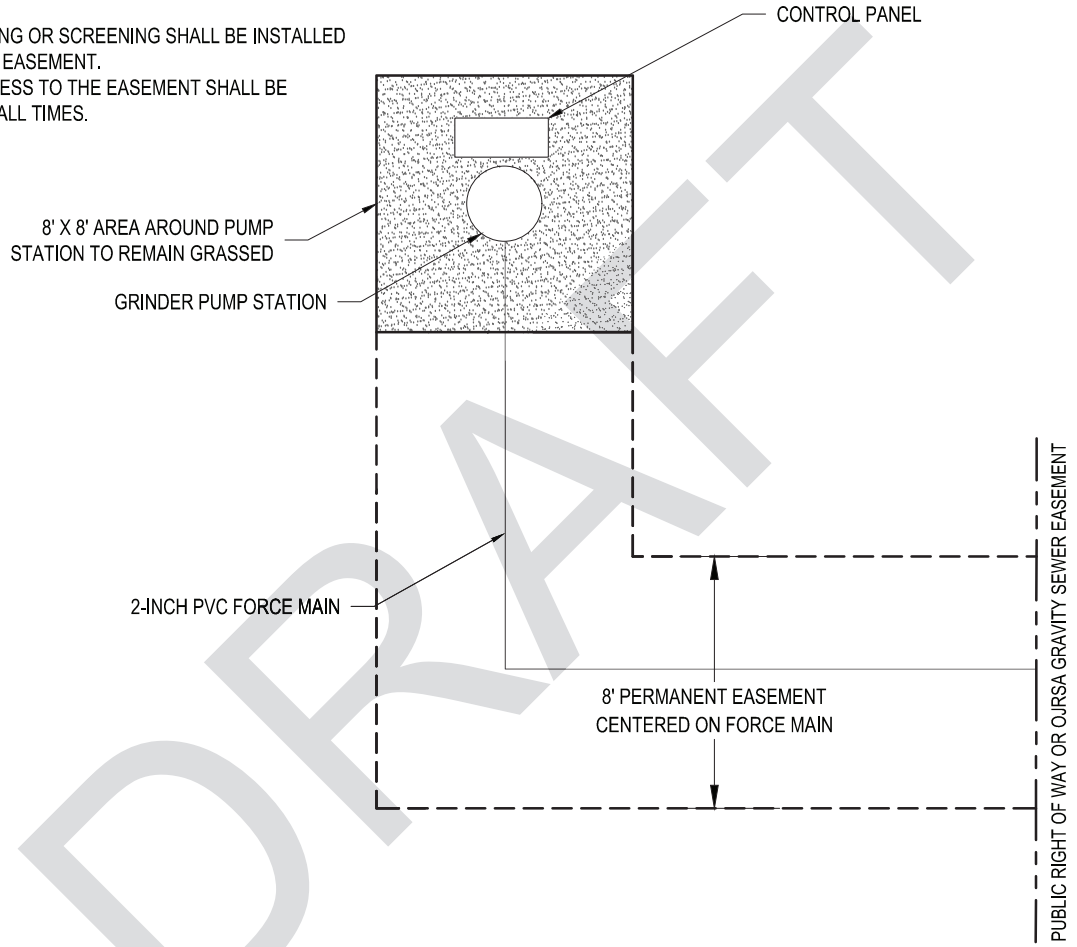
OCONEE JOINT REGIONAL SEWER AUTHORITY

TYPICAL SUCTION LIFT PUMP STATION SITE PLAN

DATE:	DRAWING NO.:
06/2020	PS-2
REVISED:	SCALE:
	NTS

NOTES:

1. ANY LANDSCAPING OR SCREENING SHALL BE INSTALLED OUTSIDE OJRSA EASEMENT.
2. VEHICULAR ACCESS TO THE EASEMENT SHALL BE MAINTAINED AT ALL TIMES.

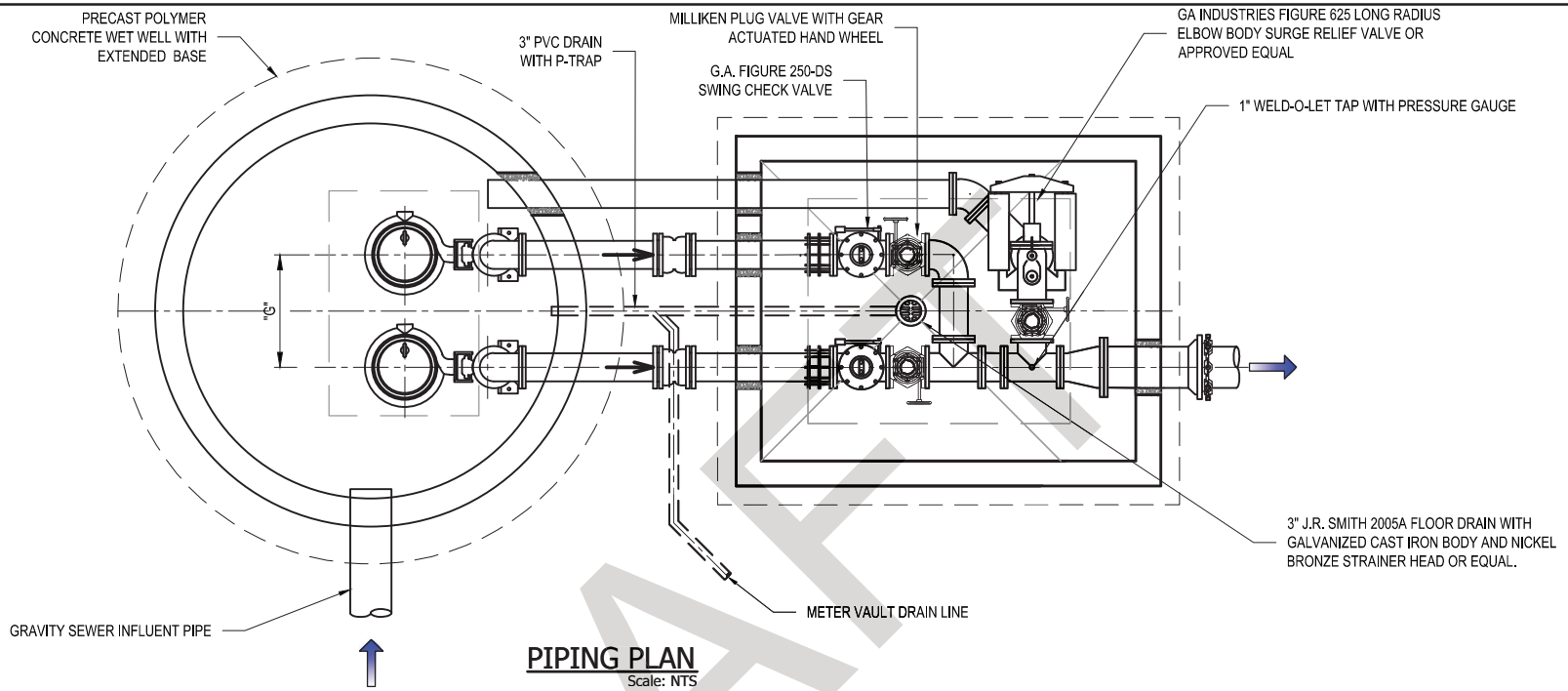


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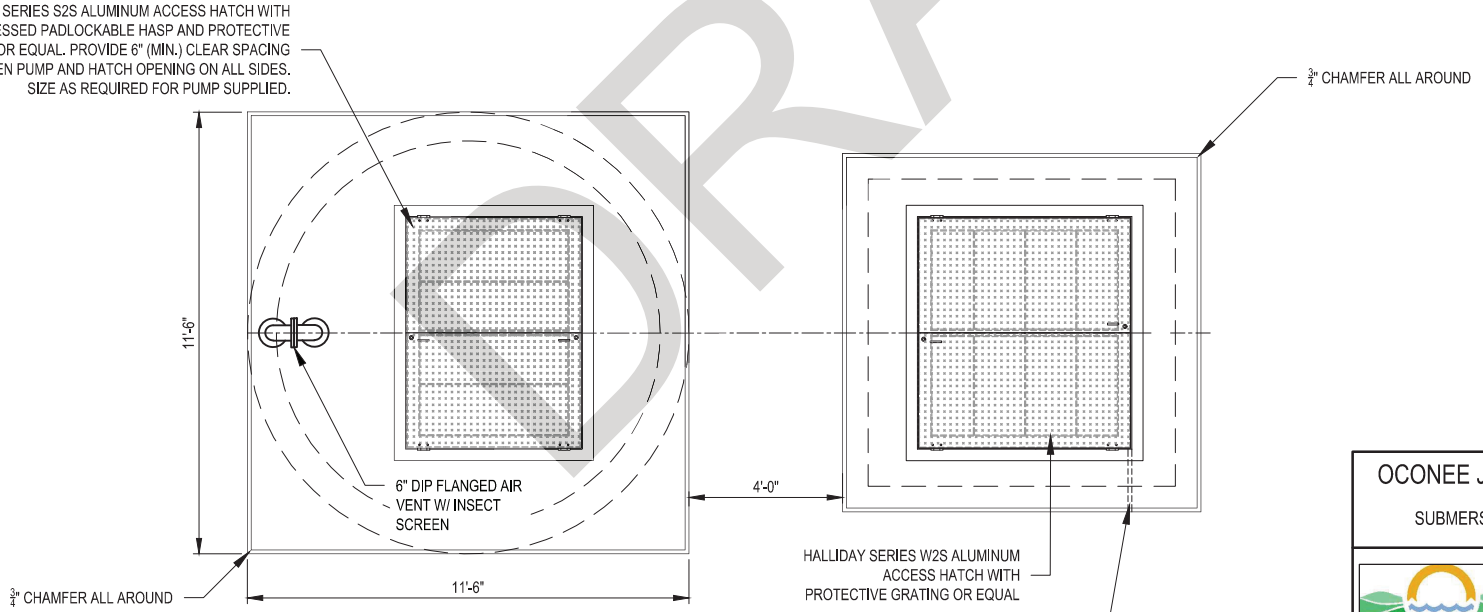
OCONEE JOINT REGIONAL SEWER AUTHORITY

GRINDER PUMP STATION SITE PLAN

	DATE:	DRAWING NO.:
OJRSA	11/2022	PS-3
	REVISED:	SCALE:
		NTS



PIPING PLAN
Scale: NTS



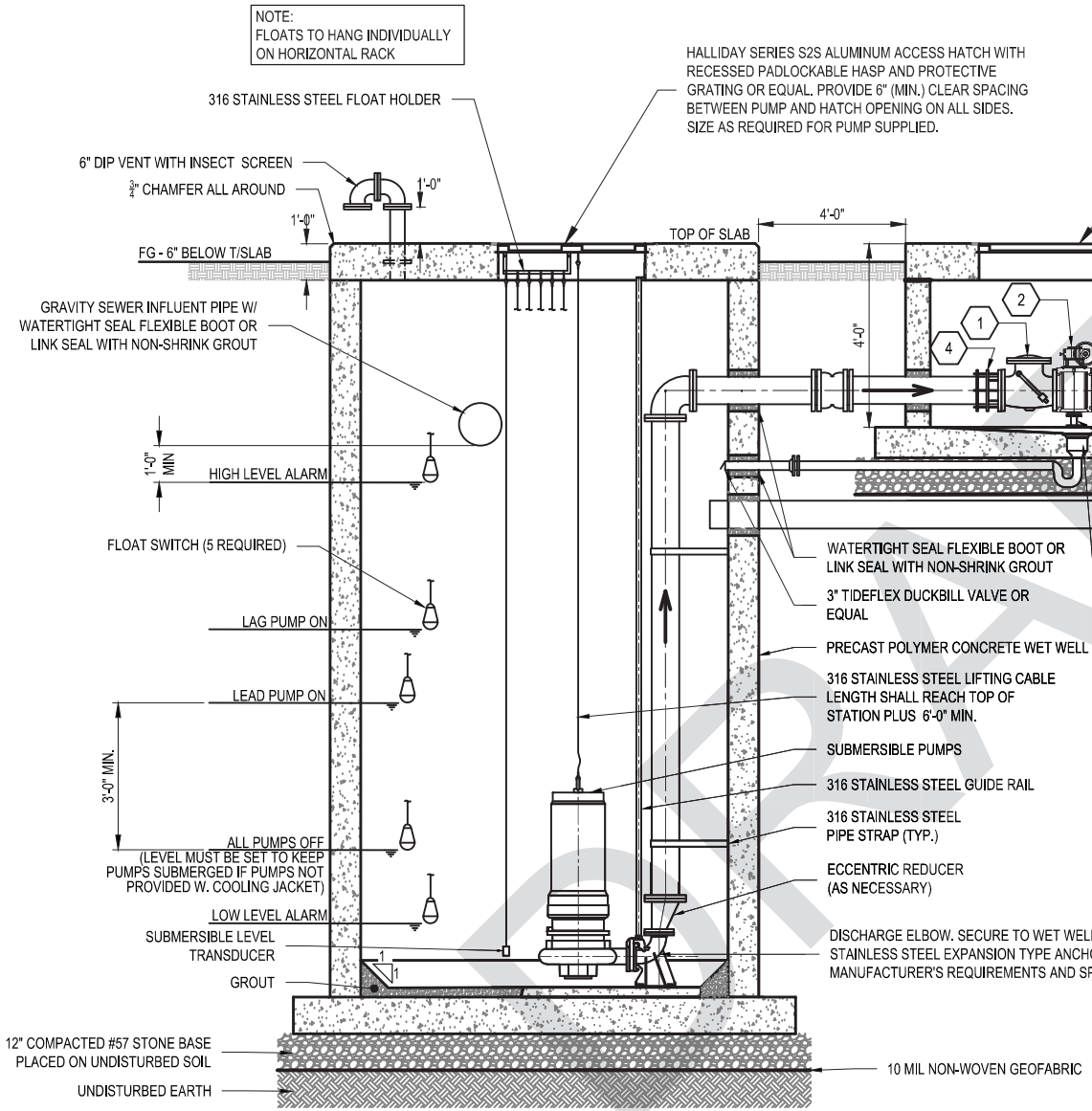
TOP PLAN
Scale: NTS

OCONEE JOINT REGIONAL SEWER AUTHORITY

SUBMERSIBLE PUMP STATION TOP PLAN & PIPING PLAN

	DATE:	DRAWING NO.:
OJRSA	06/2020	PS-4
	REVISED: 02/2020	SCALE: NTS

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SUBMERSIBLE PUMP STATION ELEVATION

Scale: NTS

EQUIPMENT SCHEDULE:

1. G.A. FIGURE 250-DS CUSHIONED SWING CHECK VALVE OR APPROVED EQUAL.
2. MILLIKEN HAND WHEEL GEAR ACTUATED ECCENTRIC PLUG VALVE.
3. 1" 316 STAINLESS STEEL BALL VALVE AND 1" WELD-O-LET TAPPED BOSS W/ GLYCERINE FILLED PRESSURE GAUGE W/ DIAPHRAGM SEAL.
4. FLANGED COUPLING ADAPTER.
5. GA INDUSTRIES FIGURE 625 LONG RADIUS ELBOW BODY SURGE RELIEF VALVE OR APPROVED EQUAL.

PUMP DESIGN CRITERIA	
PUMP H.P.	
CAPACITY (GPM)	
TOTAL HEAD (FT)	
MOTOR RPM	
IMPELLER NO.	
VOLTS	
PHASE	
AMPS	
MANUFACTURER	
MODEL NO.	
SERIAL #1	
SERIAL #2	

NOTE:

1. ALUMINUM PUMP IDENTIFICATION PLATE TO BE ATTACHED TO INSIDE OF CONTROL PANEL DOOR

PUMP IDENTIFICATION PLATE

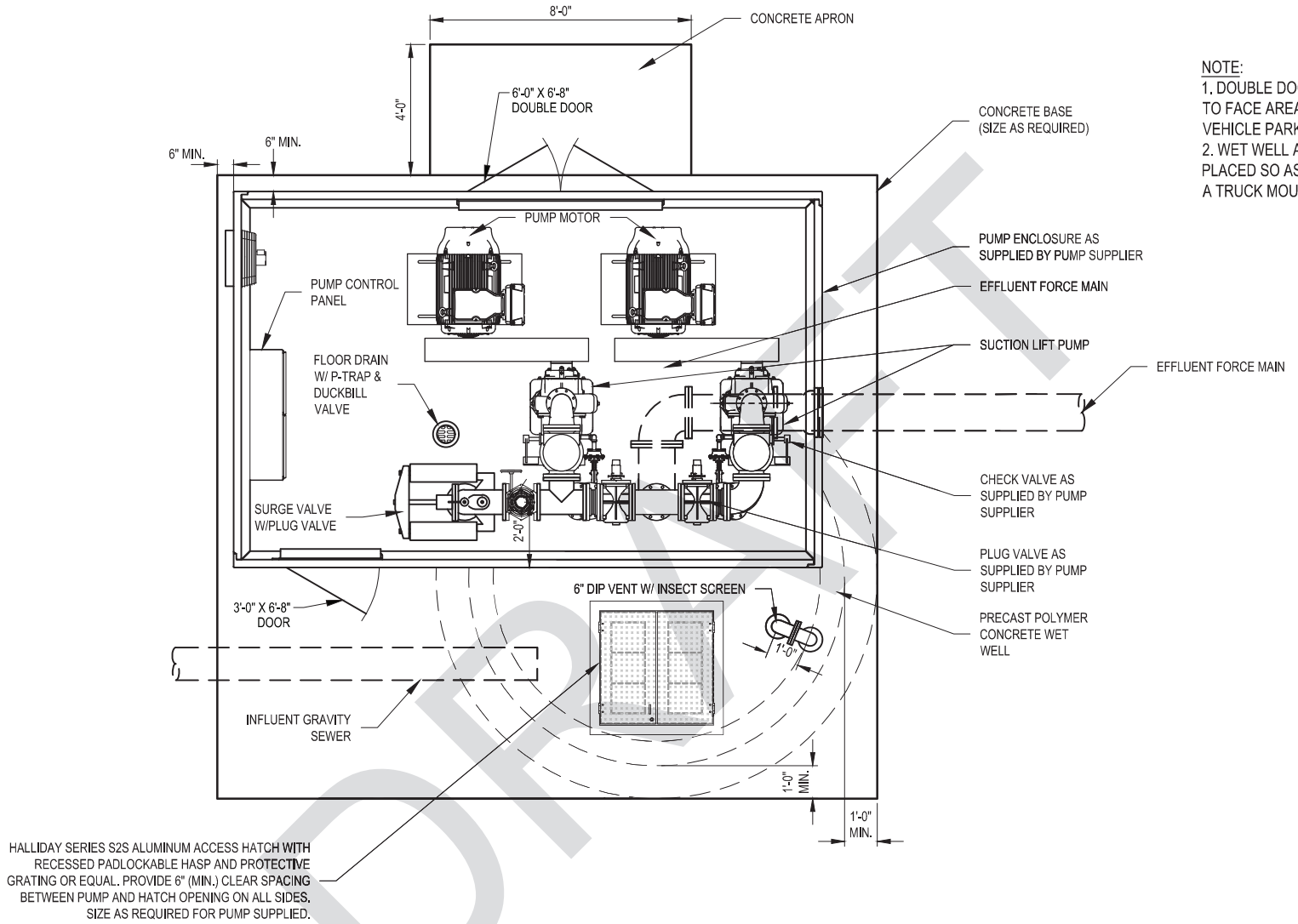
Scale: NTS

OCONEE JOINT REGIONAL SEWER AUTHORITY

SUBMERSIBLE PUMP STATION ELEVATION

	DATE:	DRAWING NO.:
OJRSA	06/2020	PS-5
	REVISED: 02/2020	SCALE: NTS

DRAFT



NOTE:
1. DOUBLE DOORS TO BE PLACED SO AS TO FACE AREA THAT WILL BE USED FOR VEHICLE PARKING AND ACCESS.
2. WET WELL ACCESS HATCH TO BE PLACED SO AS TO ENSURE ACCESS WITH A TRUCK MOUNTED CRANE.

SUCTION LIFT PUMP STATION PLAN

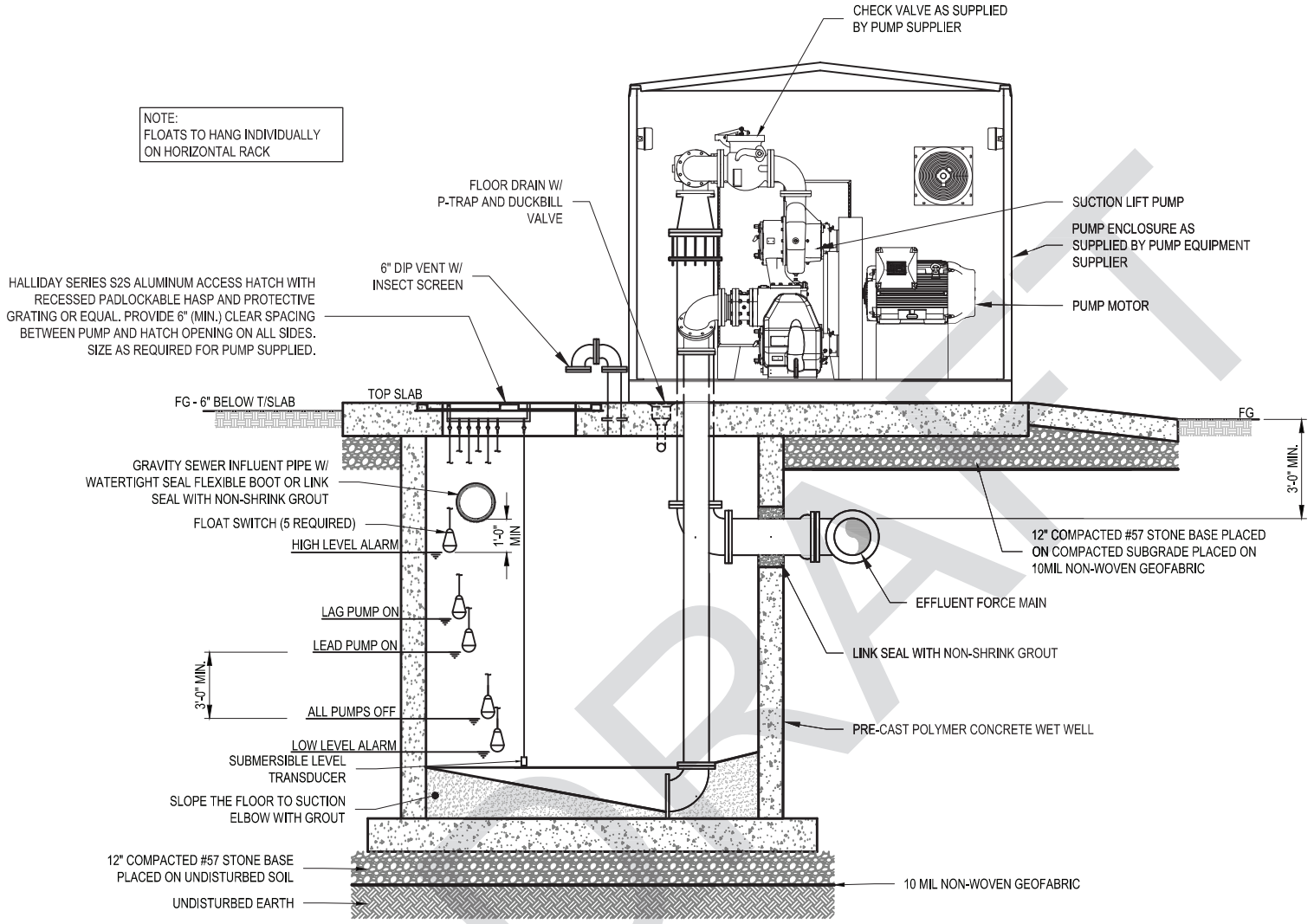
Scale: NTS

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OCONEE JOINT REGIONAL SEWER AUTHORITY

SUCTION LIFT PUMP STATION PLAN

	DATE:	DRAWING NO.:
OJRSA	06/2020	PS-6
	REVISED: 02/2020	SCALE: NTS



SUCTION LIFT PUMP STATION SECTION

Scale: NTS

PUMP DESIGN CRITERIA	
PUMP H.P.	
CAPACITY (GPM)	
TOTAL HEAD (FT)	
MOTOR RPM	
IMPELLER NO.	
VOLTS	
PHASE	
AMPS	
MANUFACTURER	
MODEL NO.	
SERIAL #1	
SERIAL #2	

NOTE:
1. ALUMINUM PUMP IDENTIFICATION PLATE TO BE ATTACHED TO INSIDE OF PUMP CONTROL PANEL DOOR.

PUMP IDENTIFICATION PLATE

Scale: NTS

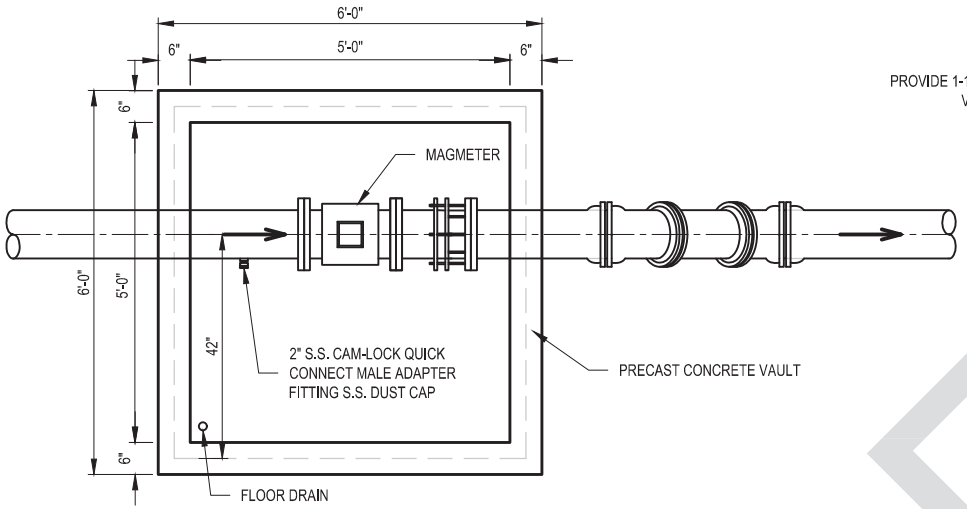
OCONEE JOINT REGIONAL SEWER AUTHORITY

SUCTION LIFT PUMP STATION SECTION

OJRSA

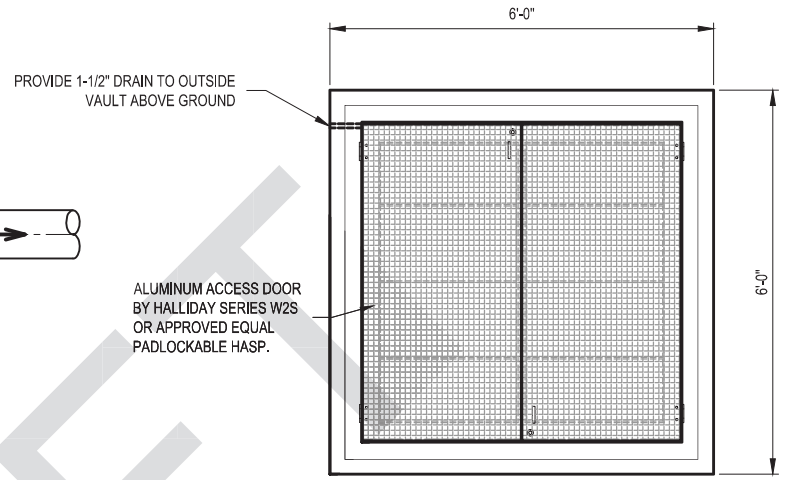
DATE:	DRAWING NO.:
06/2020	PS-7
REVISED:	SCALE:
02/2020	NTS

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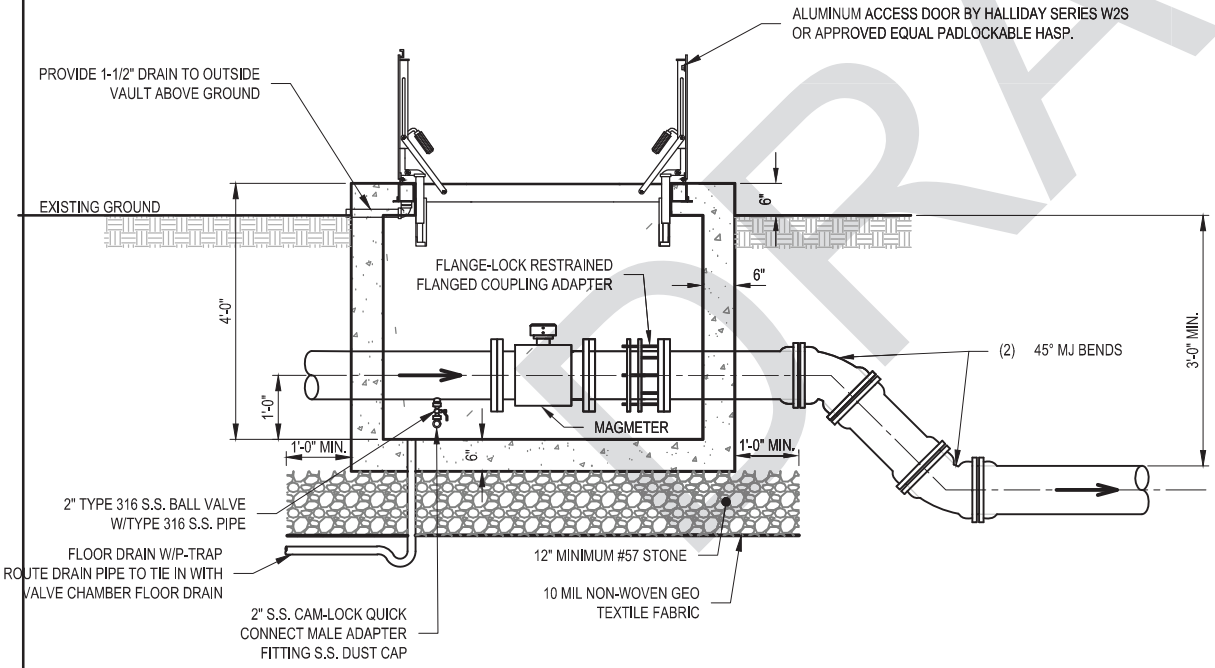
MAGMETER VAULT VAULT AND PIPING PLAN

Scale: NTS



MAGMETER VAULT TOP PLAN

Scale: NTS



MAGMETER VAULT SECTION

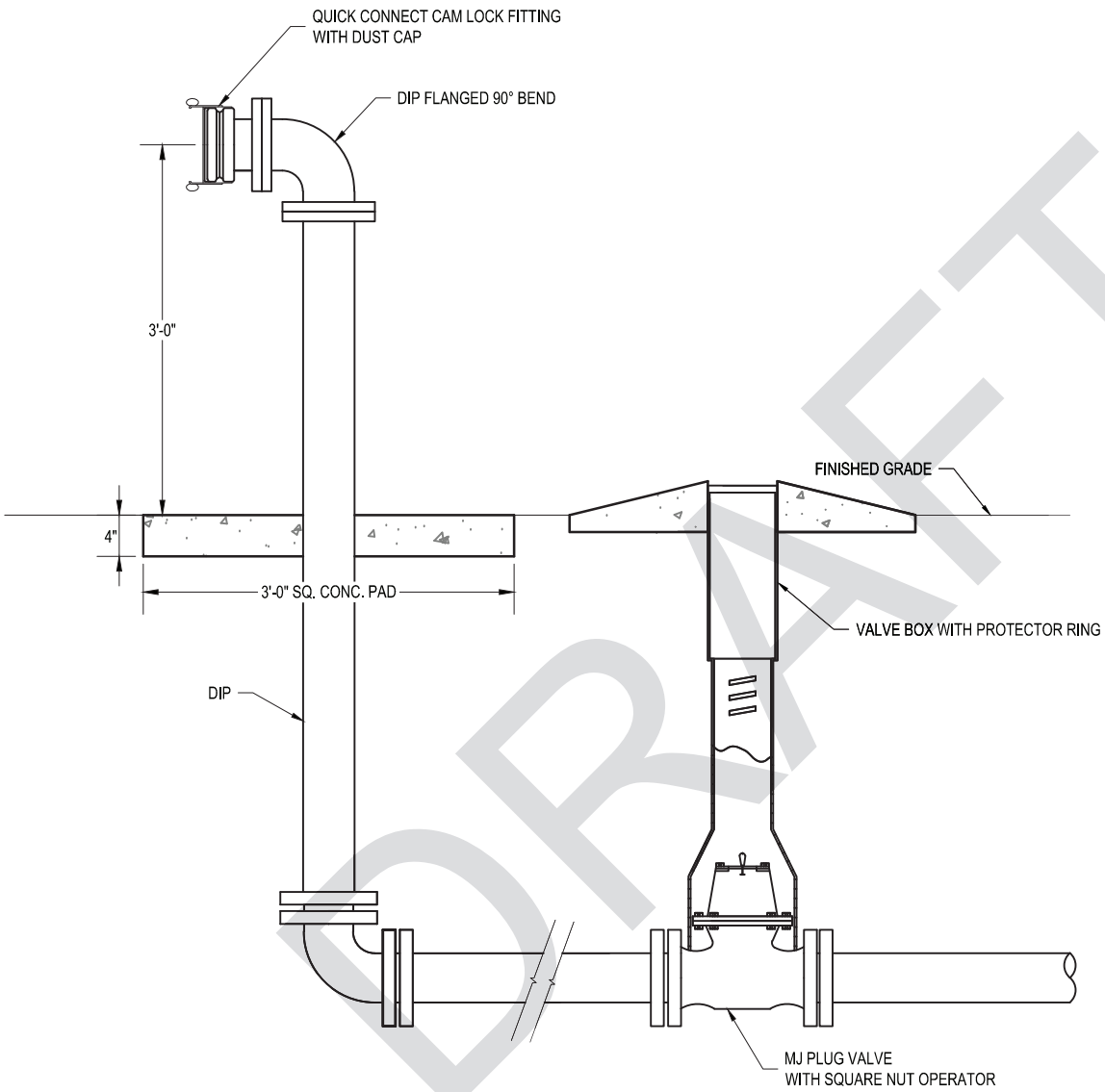
Scale: NTS

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OCONEE JOINT REGIONAL SEWER AUTHORITY

MAGMETER VAULT

	DATE:	DRAWING NO.:
OJRSA	06/2020	PS-8
	REVISED:	SCALE:
		NTS

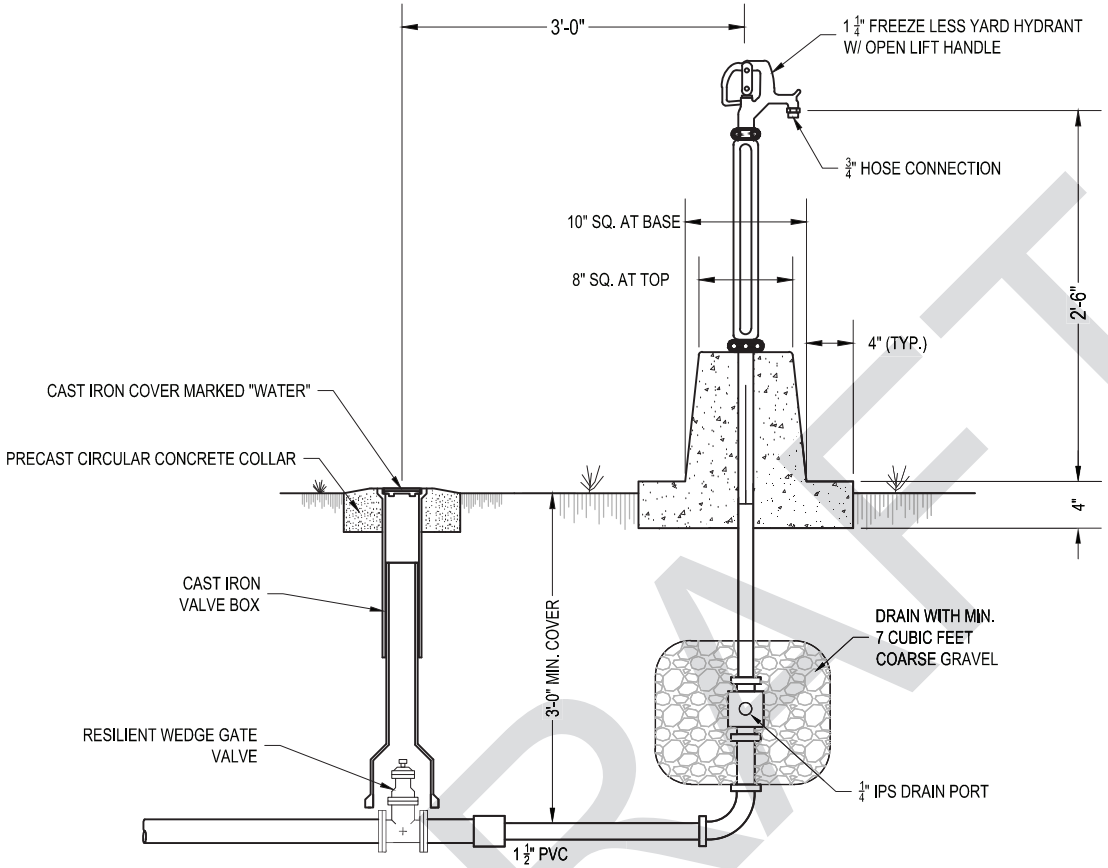


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TYPICAL BYPASS

Scale: NTS

OCONEE JOINT REGIONAL SEWER AUTHORITY		
TYPICAL BYPASS		
OJRSA	DATE: 06/2020	DRAWING NO.: PS-9
	REVISED:	SCALE: NTS



NOTES:

1. YARD HYDRANT SHALL HAVE 1 1/4" INLET AND 3/4" HOSE BIB CONNECTION. OPERATING PARTS OF THE HYDRANT SHALL BE SERVICEABLE OR REPLACEABLE WITHOUT DIGGING UP THE HYDRANT OR DISTURBING THE SUPPLY LINE CONNECTION.

2. YARD HYDRANT SHALL BE MANUALLY OPERATED BY PERMANENTLY MOUNTED OPEN LIFT HANDLE . POST HYDRANT SHALL CLOSE AGAINST THE PRESSURE AND SHALL BE SELF-DRAINING, NON-FREEZE, COMPRESSION TYPE.

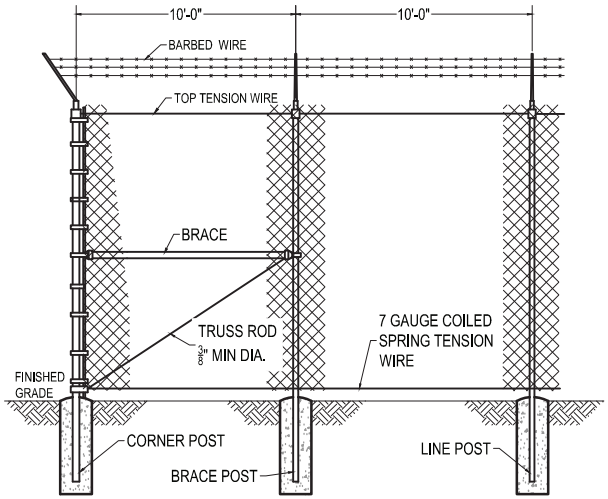
3. YARD HYDRANT SHALL PREVENT BACKFLOW WHEN OPEN BY AUTOMATIC ACTION OF THE NOZZLE VACUUM BREAKER AND THROUGH THE DRAIN BY THE BALL CHECK VALVES. THE BACKFLOW PREVENTION SYSTEM SHALL NOT INTERFERE WITH THE NORMAL SELF-DRAINING, NON-FREEZE OPERATION OF THE HYDRANT.

TYPICAL YARD HYDRANT

Scale: NTS

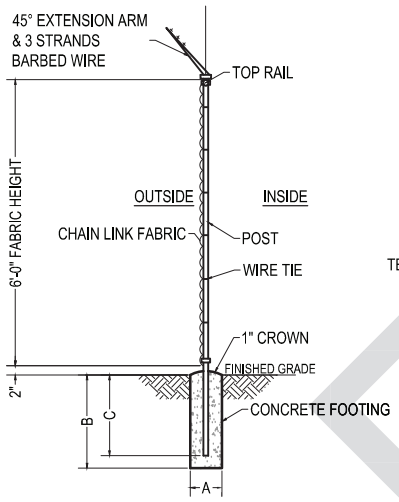
DRAFT

OCONEE JOINT REGIONAL SEWER AUTHORITY		
TYPICAL YARD HYDRANT		
OJRSA	DATE: 06/2020	DRAWING NO.: PS-10
	REVISED:	SCALE: NTS



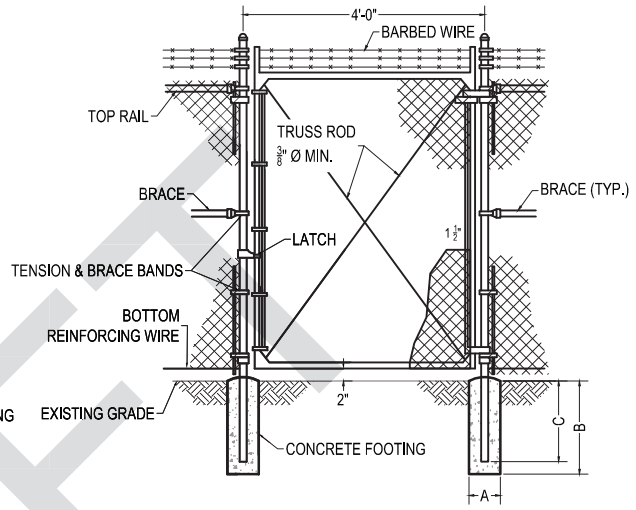
TYPICAL FENCE - ELEVATION

Scale: NTS



TYPICAL FENCE - SECTION

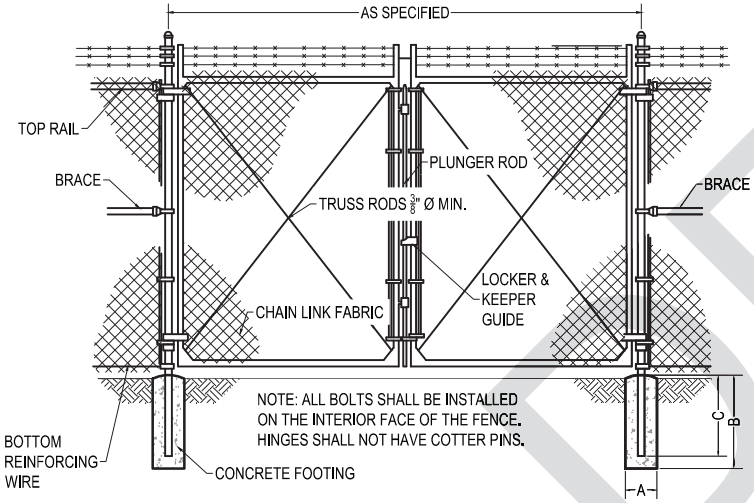
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NOTE:
1. OJRSA WILL PROVIDE PUMP STATION SIGNAGE TO BE INSTALLED BY CONTRACTOR

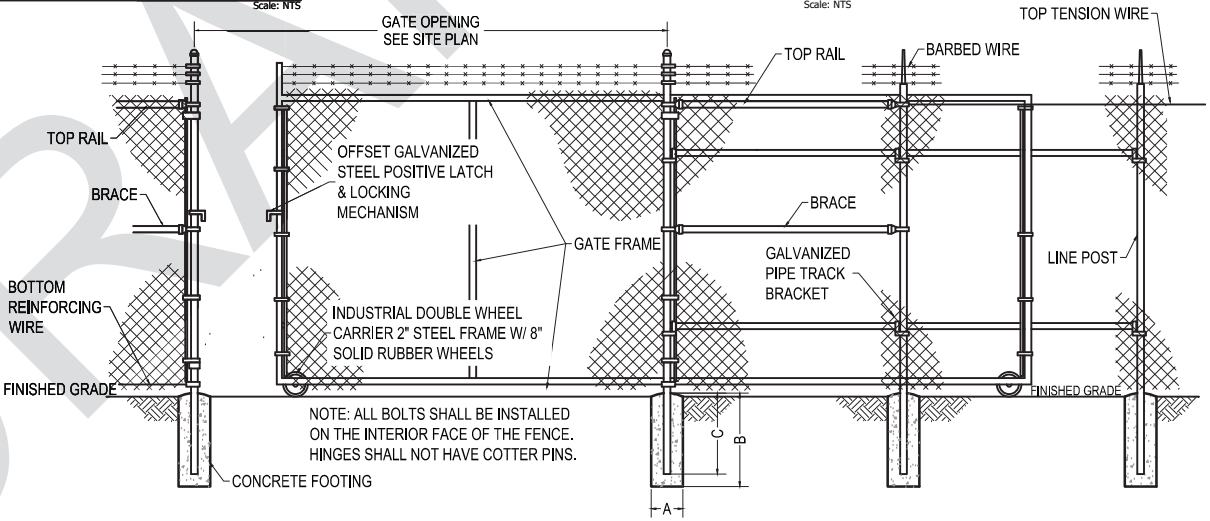
PEDESTRIAN GATE

Scale: NTS



DOUBLE SWING GATE

Scale: NTS



SLIDE GATE

Scale: NTS

GATE POST				
GATE LEAF WIDTH	GATE POST (OD)	"A" DIA.	"B" DEPTH	"C" POST EMBED.
3' - 6'	2.875"	14"	48"	42"
> 6' - 12'	4.000"	16"	48"	42"
> 12' - 18'	6.625"	16"	48"	42"

LINE & TERMINAL POSTS			
TYPE POST	"A" DIA.	"B" DEPTH	"C" POST EMBED.
LINE	12"	42"	36"
TERMINAL	12"	42"	36"

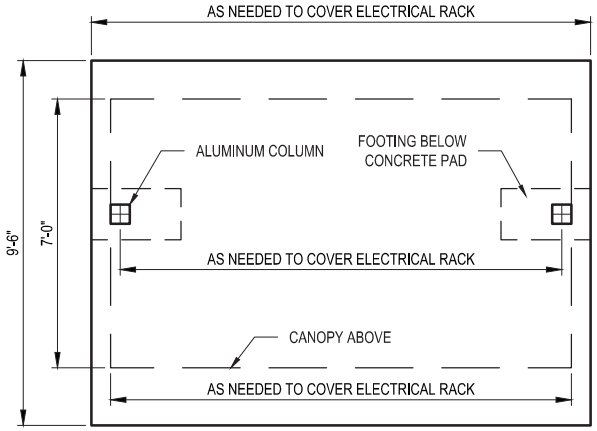
OCONEE JOINT REGIONAL SEWER AUTHORITY

STANDARD CHAIN LINK FENCING

OJRSA

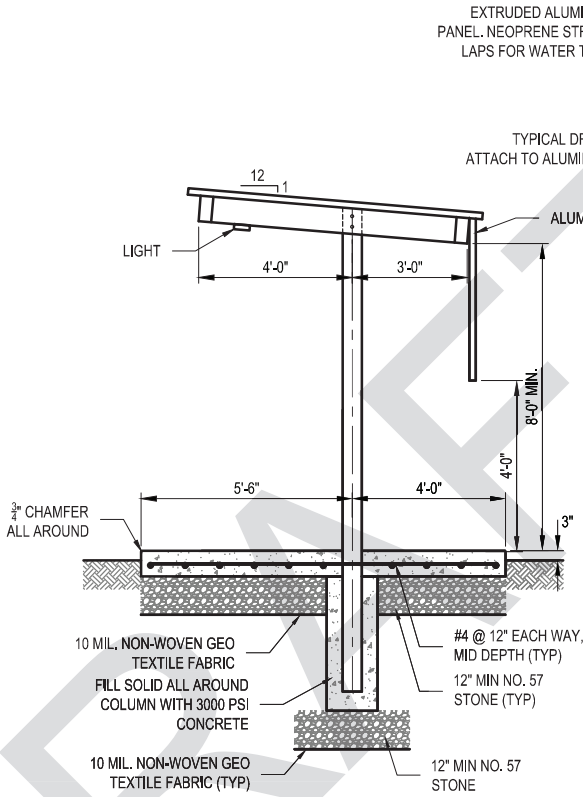
DATE:	DRAWING NO.:
06/2020	PS-11
REVISED:	SCALE:
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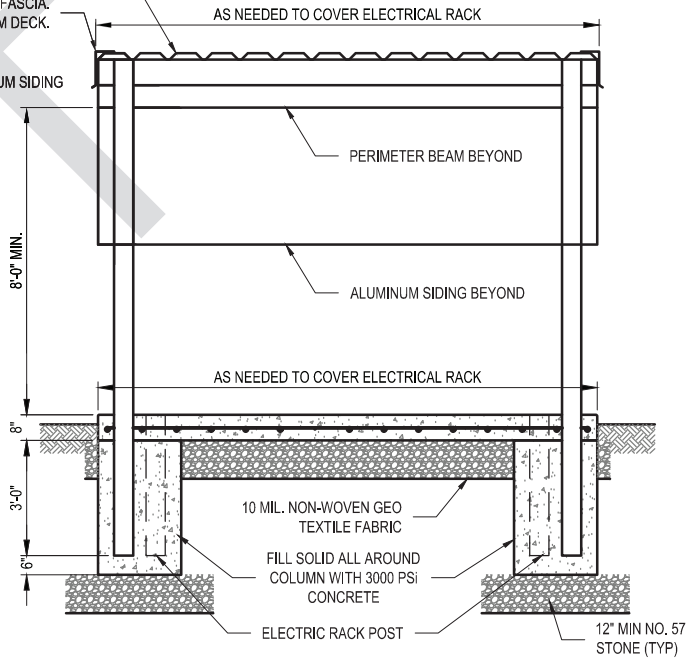
CANOPY & ELECTRICAL PAD PLAN

Scale: NTS



CANOPY & ELECTRICAL PAD SIDE ELEVATION

Scale: NTS



CANOPY & ELECTRICAL PAD FRONT ELEVATION

Scale: NTS

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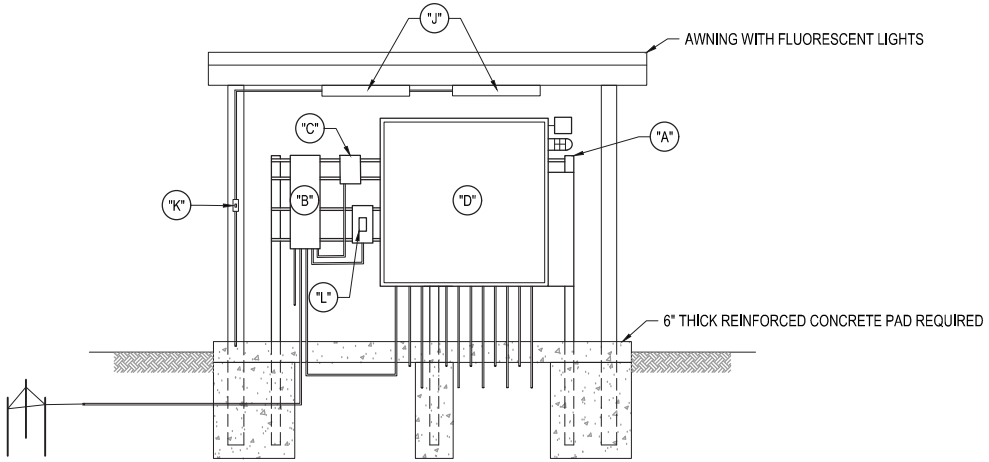
NOTES:

1. ALL NUTS, BOLTS, AND MISC. HARDWARE SHALL BE 316 STAINLESS STEEL PRIMED AND PAINTED WITH INDUSTRIAL GRADE ENAMEL TO MATCH CANOPY.
2. ALUMINUM CANOPY SHALL HAVE FACTORY COATED BAKED ENAMEL FINISH. COLOR TO BE MEDIUM BRONZE.
3. MINIMUM DESIGN LOADS:
   a). 90 MPH WIND LOAD.
   b). 20 LB/FT ² LIVE LOAD.
   c). ACTUAL DEAD LOAD.
   d). 10 LB/FT² SNOW LOAD.
   e). SEISMIC LOAD BASED ON SITE GEOTECHNICAL CONDITIONS AND IN ACCORDANCE WITH ASCE 7
4. CANOPY DESIGN SHALL BE STAMPED BY A SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER.

OCONEE JOINT REGIONAL SEWER AUTHORITY

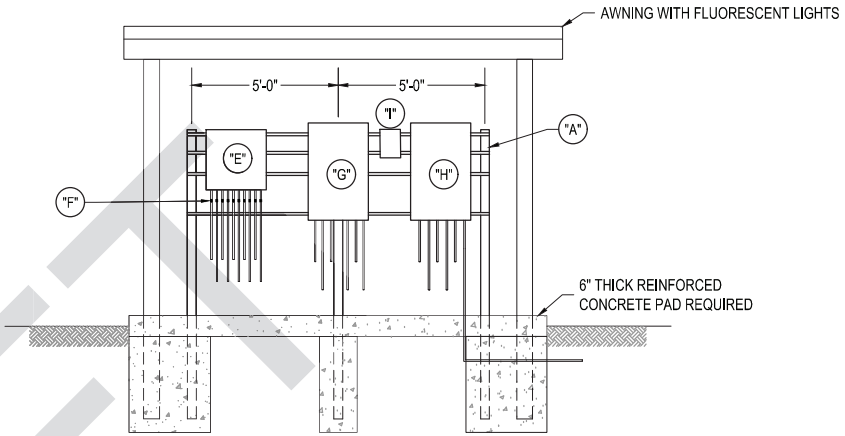
CANOPY AND ELECTRICAL PAD PLAN AND ELEVATIONS

	DATE:	DRAWING NO.:
OJRSA	06/2020	S-1
	REVISED: 02/2020	SCALE: NTS



FRONT ELECTRICAL RACK RISER

Scale: NTS



REAR ELECTRICAL RACK RISER

Scale: NTS

ELECTRICAL NOTES:

1. ALL MATERIALS AND WORK SHALL COMPLY WITH NFPA 70-NEC (LATEST EDITION), NATIONAL ELECTRICAL SAFETY CODE, UTILITY COMPANY REQUIREMENTS, AND APPLICABLE LOCAL CODES AND REGULATIONS.
2. ALL MATERIALS SHALL BE NEW AND SHALL CONFORM WITH THE REQUIREMENTS OF THE UNDERWRITERS' LABORATORIES INC., AMERICAN NATIONAL STANDARDS INSTITUTE, NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION, INSULATED CABLE ENGINEERS ASSOCIATION, AND INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS IN EVERY CASE WHERE A STANDARD HAS BEEN ESTABLISHED.
3. ALL ELECTRICAL EQUIPMENT SHALL BE LOCATED 2 FEET (MINIMUM) ABOVE THE 100 YEAR FLOOD ELEVATION.
4. ELECTRICAL SYSTEM SHALL BE DESIGNED TO HANDLE THE LOAD OF BOTH PUMPS RUNNING AT THE SAME TIME.
5. SHOW CONDUIT/CONDUCTOR SIZES AND RUNS ON PUMP STATION ELECTRICAL PLANS.
6. ALL WIRING SHALL BE IN CONDUIT. MINIMUM CONDUIT SIZE SHALL BE $\frac{3}{4}$" AND MINIMUM CONDUCTOR SIZES SHALL BE #12 FOR POWER CONNECTIONS AND #14 FOR CONTROL WIRING.
7. ALL BURIED CONDUIT SHALL BE SCH.40 PVC. ALL EXPOSED CONDUIT AND CONDUIT INSIDE THE WET WELL SHALL BE PVC-COATED GRC.
8. ALL EQUIPMENT SUBJECT TO VIBRATION SHALL BE CONNECTED WITH A SECTION OF SEALTITE FLEXIBLE CONDUIT.
9. PANEL LAYOUT IS SCHEMATIC ONLY. ADJUST LAYOUT WITH OJRSA'S APPROVAL, TO ACCOMMODATE EQUIPMENT PROVIDED. MAINTAIN 4" MINIMUM CLEARANCE BETWEEN PANELS.
10. ALL ENCLOSURES SHALL BE NEMA 4X RATED 316 STAINLESS STEEL AND SHALL BE LOCKABLE , UNLESS OTHERWISE NOTED.
11. ALL CONDUIT PENETRATIONS SHALL BE MADE THROUGH THE BOTTOM OF PANELS.
12. THE PUMP STATION SHALL BE PROVIDED WITH A MISSION RTU FOR REMOTE MONITORING OF ALL PUMP STATION EQUIPMENT.
13. ALL PUMP STATION CONTROL PANELS SHALL HAVE TERMINAL BLOCKS WITH DRY CONTACTS FOR CONNECTION TO SCADA RTU.
14. EXTEND CONDUITS INSIDE WET WELL TO HATCH OPENING FOR EASE OF ACCESS. PROVIDE STRAIN RELIEF GRIPS ON ALL CABLES INSIDE WET WELL HANGING ON CABLE RACK.

RTU I/O SCHEDULE

I/O	SIGNAL DESCRIPTION
DI-01	POWER (PHASE) FAILURE
DI-02	UTILITY POWER FAILURE
DI-03	HIGH LEVEL ALARM (FLOAT)
DI-04	PUMP #1 RUNNING
DI-05	PUMP #1 FAILURE (OVERTEMPERATURE ALARM, SEAL FAILURE ALARM, OVERLOAD ALARM, VFD FAULT ALARM)
DI-06	PUMP #2 RUNNING
DI-07	PUMP #2 FAILURE (OVERTEMPERATURE ALARM, SEAL FAILURE ALARM, OVERLOAD ALARM, VFD FAULT ALARM)
DI-08	GENERATOR RUN
DI-09	GENERATOR FAULT ALARM
DI-10	GENERATOR FUEL TANK LOW LEVEL ALARM
DI-11	ATS IN EMERGENCY POSITION
AI-01	WET WELL LEVEL
AI-02	PUMP #1 AMPS
AI-03	PUMP #2 AMPS
AI-04	PUMP STATION FLOW

ELECTRICAL EQUIPMENT SCHEDULE

I.D.	DESCRIPTION	NOTES
A	ELECTRICAL RACK	4" DIAMETER 316 SS POSTS AT 5' (MAX.). 12 GAUGE 316 SS UNISTRUT FOR MOUNTING PANELS. ALL HARDWARE TO BE 316 SS.
B	MAIN DISCONNECT	NON-FUSED, 3-POLE MAIN DISCONNECT IN LOCKABLE 316 SS NEMA 4X ENCLOSURE.
C	TVSS	EATON PTX-160 TVSS WITH INTEGRAL DISCONNECT IN 316 SS NEMA 4X ENCLOSURE.
D	PUMP CONTROL PANEL	PROVIDED BY PUMP SUPPLIER. (APPLIES TO SUBMERSIBLE PUMPS ONLY . PUMP CONTROL PANEL FOR SUCTION LIFT PUMPS SHALL BE IN PUMP ENCLOSURE)
E	JUNCTION BOX	30"(H) x 30"(W) x 8"(D) 316 SS NEMA 4X ENCLOSURE WITH 3-PT LOCKING LATCH. PROVIDE TERMINAL BLOCKS FOR POWER AND CONTROL CONDUCTORS. INSTALL RUBBER CORD CONNECTIONS ON END OF CONDUITS FROM WET WELL.
F	SEAL-OFF	INSTALL ON CONDUITS AS SHOWN.
G	MANUAL TRANSFER SWITCH	3-POLE MTS IN 316 SS NEMA 4X ENCLOSURE. SEE SPECIFICATIONS
H	AUTOMATIC TRANSFER SWITCH	3-POLE ATS IN 316 SS NEMA 4X ENCLOSURE. SEE SPECIFICATIONS
I	PORTABLE GENERATOR RECEPTACLE	SEE SPECIFICATIONS FOR MODEL NUMBER
J	CANOPY LIGHTING	4' LED LIGHT (H.E. WILLIAMS 96-4-L62/850-HIAFR-DRV-UNV OR EQUAL)
K	CANOPY LIGHTING SWITCH	PROVIDE WEATHERPROOF ENCLOSURE. MOUNT ON CANOPY COLUMN 48" ABOVE CONCRETE PAD.
L	RECEPTACLE	20A, 120V GFI WITH WEATHERPROOF ENCLOSURE

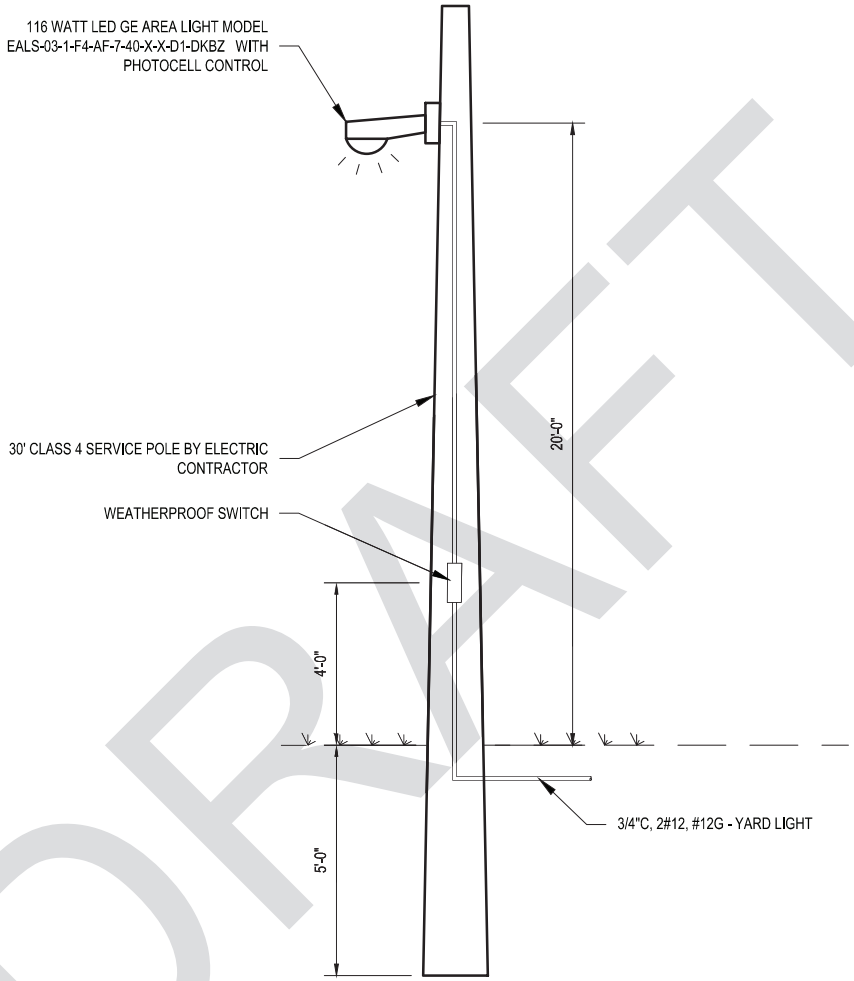
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OCONEE JOINT REGIONAL SEWER AUTHORITY

DUPLEX PUMP STATION ELECTRICAL STANDARDS

OJRSA

DATE:	DRAWING NO.:
06/2020	E-1
REVISED:	SCALE:
	NTS



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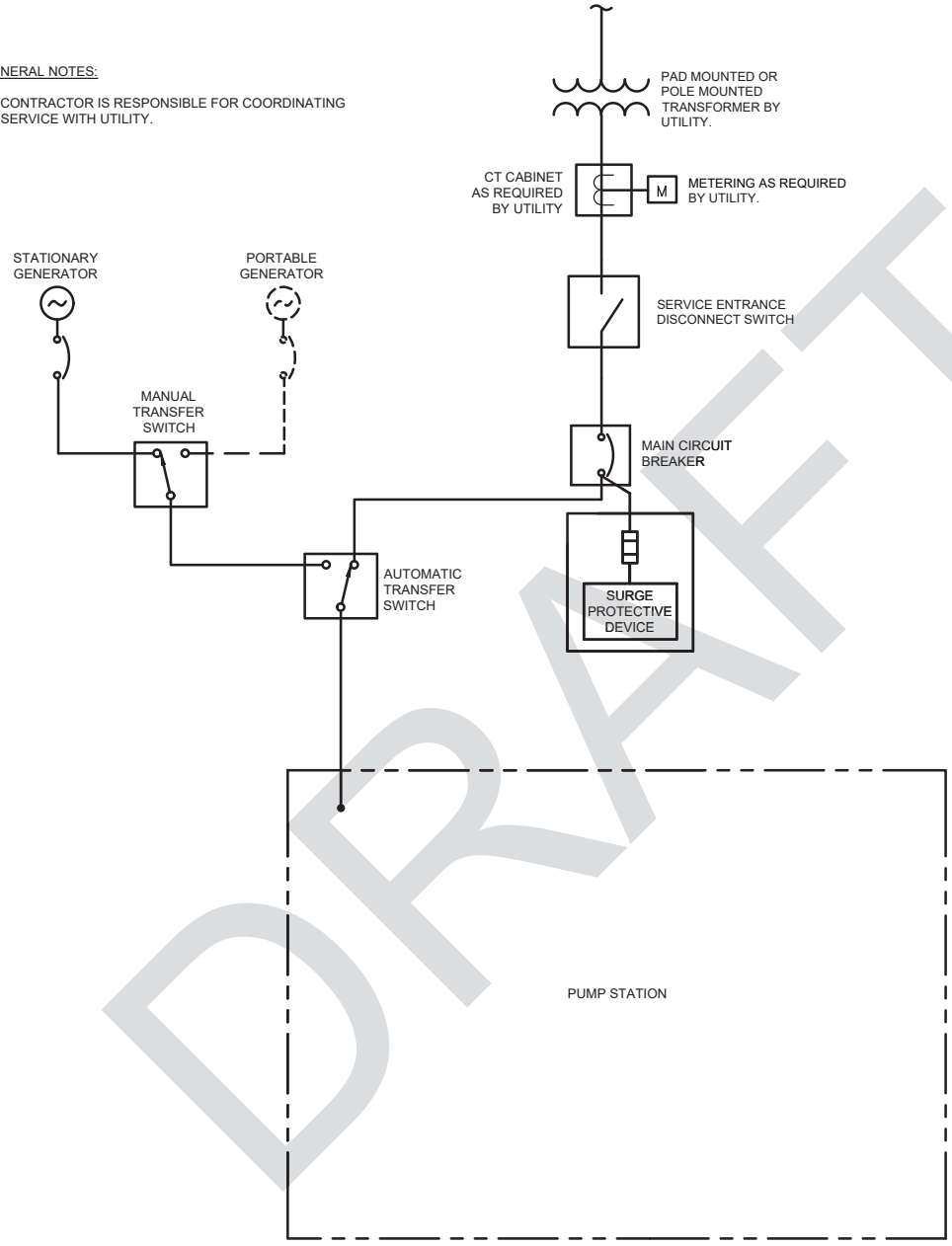
YARD LIGHT DETAIL

Scale: NTS

OCONEE JOINT REGIONAL SEWER AUTHORITY YARD LIGHT		
OJRSA	DATE: 06/2020	DRAWING NO.: E-2
	REVISED:	SCALE: NTS

GENERAL NOTES:

- CONTRACTOR IS RESPONSIBLE FOR COORDINATING SERVICE WITH UTILITY.



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PUMP STATION ONE-LINE DIAGRAM

Scale: NTS

OCONEE JOINT REGIONAL SEWER AUTHORITY

PUMP STATION ONE-LINE DIAGRAM

	DATE:	DRAWING NO.:
OJRSA	03/2022	E-3
	REVISED:	SCALE:
		NTS

Piedmont Municipal Power Agency

BOARD PACK

for

PMPA Board Meeting

Wednesday, March 27, 2024

10:00 AM (EDT)

Held at:

PMPA Office

121 Village Drive, Greer, SC 29651

Generated: 2024-03-20 15:44:29

INDEX

Cover Page

Index

Agenda

Attached Documents:

2.1 a	Minutes : PMPA Board Meeting - 22 Feb 2024	6
3.1 a	Piedmont Municipal Power Agency 12-31-2023 Audit Presentation.pdf	12
3.1 b	PDF of Signed Financial Statements.pdf	33
4.1 a	February 2024 Board Financials.pdf	85
5.1 a	2024_01_LSGReport.pdf	92
5.1 b	2024_01_Energy Report_rev1.pdf	93
5.1 c	2024_02_Energy Report.pdf	94
5.1 d	2024_02_Demand Response Report.pdf	95
5.2 a	2024 03 27 Catawba Board Report.pdf	96
5.3 a	FILOT Letter to PMPA Board of Directors.pdf	97
6.1 a	Policy for Sale of Excess Catawba Output_Rev. 03272023.pdf	102
6.1 b	Policy for Sale of Excess Catawba Output_Rev. 03272023_Redline.pdf	104

AGENDA

PMPA BOARD MEETING

Name:	Piedmont Municipal Power Agency
Date:	Wednesday, March 27, 2024
Time:	10:00 AM to 2:00 PM (EDT)
Location:	PMPA Office, 121 Village Drive, Greer, SC 29651 https://pmpa.zoom.us/j/85090271157?pwd=RtH2q0zuvWniaf2xjV7a7L9AFDDrnR.1
Board Members:	Blake Stone (Chair), Andy Sevic, Donnie Hardin, Jimmy Bagley, Joe Nichols, John Young, Kevin Bronson, Mike Richard, Tim Baker, Tom Brooks, Mayor Brian Ramey, David Vehaun, Eric Goodwin, Foster Senn, Keith Wood, Lance Davis, Marc Regier, Ronnie Roth, Steve Bratton, Tim Hall
Attendees:	Angie Hoover, Brandon Audet, Cindy Frierson, Dedra Howell, Dennis Cameron, Gary Brunault, Joel Ledbetter, JulieAnne London, Kenny Bradley, Lynn Price, Mike Frazier, Rion Foley, Tracy Quinn, Will Blanton, Tom Gressette

1. Call to Order

1.1 Identify Virtual Attendees

1.2 Declaration of Quorum

1.3 Invocation

2. Approval of Minutes

2.1 Confirm Minutes

Supporting Documents:

2.1.a	Minutes : PMPA Board Meeting - 22 Feb 2024	6

2.2 Vote to Approve Minutes of February 22, 2024

To approve minutes as submitted.

3. Presentations

3.1 Presentation and Acceptance of the 2023 Financial Audit

Supporting Documents:

3.1.a	Piedmont Municipal Power Agency 12-31-2023 Audit Presentation.pdf	12
3.1.b	PDF of Signed Financial Statements.pdf	33

4. Acceptance of Financial Report

4.1 February 2024

Supporting Documents:

4.1.a	February 2024 Board Financials.pdf	85

5. Reports

5.1 Engineering

Supporting Documents:

5.1.a	2024_01_LSGReport.pdf	92
5.1.b	2024_01_Energy Report_rev1.pdf	93
5.1.c	2024_02_Energy Report.pdf	94
5.1.d	2024_02_Demand Response Report.pdf	95

5.2 Catawba

Supporting Documents:

5.2.a	2024 03 27 Catawba Board Report.pdf	96

5.3 Management

Supporting Documents:

5.3.a	FILOT Letter to PMPA Board of Directors.pdf	97

6. Action Items

6.1 Consideration of Policy for the Sale of Excess Catawba

Supporting Documents:

6.1.a	Policy for Sale of Excess Catawba Output_Rev. 03272023.pdf	102
6.1.b	Policy for Sale of Excess Catawba Output_Rev. 03272023_Redline.pdf	104

7. Executive Session

7.1 Vote to enter into Executive Session

7.2 Discussion of matters pertaining to litigation

7.3 Vote to return to Regular Session

8. Actions to be taken based on discussion in Executive Session

9. Adjourn

9.1 Adjourn

Next meeting: PMPA Board Meeting - Apr 18, 2024, 10:00 AM

MINUTES (in Review)

PMPA BOARD MEETING

Name:	Piedmont Municipal Power Agency
Date:	Thursday, February 22, 2024
Time:	10:00 AM to 12:10 PM (EST)
Location:	PMPA Office, 121 Village Drive, Greer, SC 29651
Board Members:	Blake Stone (Chair), Andy Sevic, Donnie Hardin, Jimmy Bagley, Joe Nichols, John Young, Kevin Bronson, Tim Baker, Tom Brooks, Mayor Brian Ramey, David Vehaun, Eric Goodwin, Keith Wood, Lance Davis, Marc Regier, Ronnie Roth, Steve Bratton
Attendees:	Dennis Cameron, Gary Brunault, Joel Ledbetter, JulieAnne London, Kenny Bradley, Lynn Price, Mike Frazier, Rion Foley, Tracy Quinn, Will Blanton, Tom Gressette
Apologies:	Mike Richard, Angie Hoover, Brandon Audet, Cindy Frierson, Dedra Howell, Foster Senn, Tim Hall
Guests:	Gary Baysinger, Bob Faries, and Andrea Kelley
Notes:	Virtual Attendees: Gary Brunault, Tom Gressette, and Andrea Kelly

1. Call to Order

1.1 Identify Virtual Attendees

1.2 Declaration of Quorum

Chairman Stone declared that a quorum is present and the Board can conduct business.

1.3 Invocation

Mr. Ledbetter gave the invocation.

2. Approval of Minutes

2.1 Confirm Minutes

PMPA Board Meeting Jan 18, 2024, the minutes were confirmed as presented.

2.2 Vote to Approve Minutes of January 18, 2024

Motion approved.

Motion approved.

Decision Date: Feb 22, 2024
Mover: Andy Sevic

Seconder: Tom Brooks
Outcome: Approved

Vote to Approve Minutes of January 18, 2024

To approve minutes as submitted.
0 Supported
0 Opposed
0 Abstained
Decision Date: Feb 22, 2024
Outcome: Approved

3. Acceptance of Financial Report

3.1 January 2024

Motion approved.

Motion approved.
Decision Date: Feb 22, 2024
Mover: Jimmy Bagley
Seconder: John Young
Outcome: Approved

January 2024

0 Supported
0 Opposed
0 Abstained
Decision Date: Feb 22, 2024
Outcome: Approved

4. Presentations

4.1 Introduction of SCAMPS Member Liaison - Gary Baysinger

Mr. Young introduce Mr. Bob Faries, Director of Utilities at Seneca Light & Water and current president of SCAMPS, and Mr. Gary Baysinger, SCAMPS Manager.

5. Reports

5.1 Engineering

Mr. Frazier reviewed the standard engineering reports for January that were included in the Board Pack.

Mr. Frazier also advised the Board that Rock Hill notified PMPA that they will remove their last ED customer from the ED rate. This will leave only two ED customers in Greer remaining on the ED rate.

Mr. Frazier gave a progress report on the load forecast. Initial forecasts can be expected in March with the final forecasts and reports in April

5.2 Catawba

Mr. Cameron reviewed the Catawba and McGuire report that was included in the Board Pack.

Mr. Cameron also reviewed information that was included in Duke Energy's Supplemental Analysis, submitted in January 2024, to its 2023 Integrated Resource Plan.

5.3 Management

Mr. Ledbetter advised the Board that several documents requested by the Board had been uploaded to BoardPro.

Mr. Ledbetter discussed several upcoming meetings, including the APPA National Conference and the APPA Legislative Rally.

Mr. Ledbetter also discussed several State legislative issues and reviewed specific items in H. 5118. He encouraged the Board to review the legislative issues posted to BoardPro.

5.4 Executive Committee

Chairman Stone reviewed the Report of the Executive Committee Meeting that was held on January 29, 2024.

6. Action Items

6.1 Consideration of Establishing Board Committees and Members

Chairman Stone made a motion on behalf of the Executive

Chairman Stone made a motion on behalf of the Executive Committee to establish the Board Committees and Members as recommended as follows:

Finance Committee
Donnie Hardin - Chairman
Andy Sevic
David Vehaun
Kevin Bronson

Power Supply/Transmission
Jimmy Bagley - Chairman
Keith Wood
Joe Nichols

Legislative
Tom Brooks - Chairman
John Young
Foster Senn
Brian Ramey
Mike Richard

Training/Technical Advisory
Tim Baker - Chairman

Other members of the Training/Technical Advisory Committee are to be named by the Board from participant cities.

Supplemental Power Supply

Abolished

The motion was approved 9 to 1, with Mr. Regier dissenting.

Decision Date: Feb 22, 2024
Outcome: Approved

Consideration of Establishing Board Committees and Members

0 Supported:
0 Opposed:
0 Abstained:

Decision Date: Feb 22, 2024
Outcome: Approved

6.2 Consideration of Policy for the Sale of Excess Catawba

Motion to table Consideration of Policy for the Sale of Excess Catawba

Motion was made to table Consideration of Policy for the Sale of Excess Catawba.

Decision Date: Feb 22, 2024
Mover: Tim Baker
Seconder: Marc Regier
Outcome: Approved

Consideration of Policy for the Sale of Excess Catawba

0 Supported:
0 Opposed:
0 Abstained:

Decision Date: Feb 22, 2024
Outcome: Approved

7. Executive Session

7.1 Vote to enter into Executive Session

Motion approved.

Motion approved.

Decision Date: Feb 22, 2024
Mover: Jimmy Bagley
Seconder: Andy Sevic
Outcome: Approved

Vote to enter into Executive Session

0 Supported:
0 Opposed:
0 Abstained:

Decision Date: Feb 22, 2024
Outcome: Approved

7.2 Discussion of matters pertaining to litigation

7.3 Vote to return to Regular Session

Motion approved.

Motion approved.

Decision Date: Feb 22, 2024
Mover: Jimmy Bagley
Seconder: Marc Regier
Outcome: Approved

Vote to return to Regular Session

0 Supported:
0 Opposed:
0 Abstained:

Decision Date: Feb 22, 2024
Outcome: Approved

8. Actions to be taken based on discussion in Executive Session

8.1 Settlement Financing

Motion to negotiate final terms with JP Morgan regarding the settlement financing

Motion was made to negotiate final terms of Working Capital financing with JP Morgan.

Motion approved 8 to 0 with Messer's Regier and Bagley abstaining.

Decision Date: Feb 22, 2024
Mover: Tom Brooks
Seconder: Donnie Hardin
Outcome: Approved

Settlement Financing

0 Supported:
0 Opposed:
0 Abstained:

Decision Date: Feb 22, 2024
Outcome: Approved

9. Adjourn

9.1 Adjourn

Next meeting: PMPA Board Meeting - Mar 27, 2024, 10:00 AM

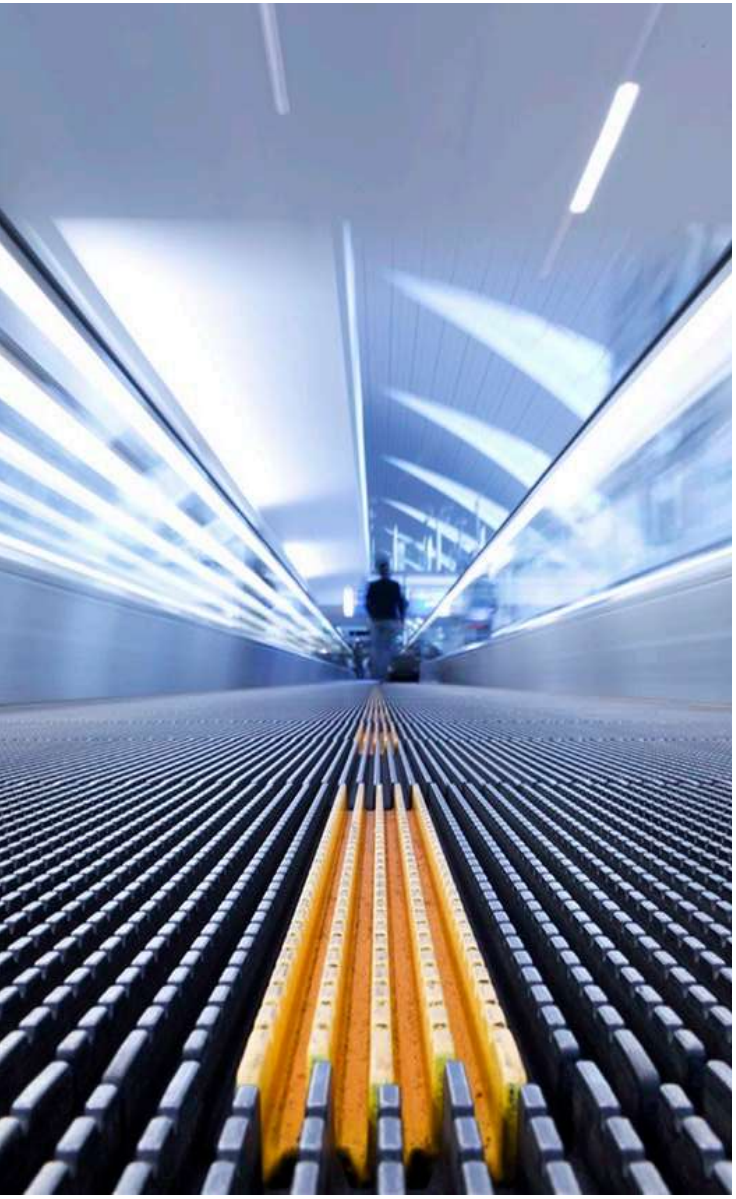
Signature:_____ **Date:**_____

Piedmont Municipal Power Agency

Audit Executive Summary

March 6, 2024

Cherry Bekaert LLP
Your Guide Forward

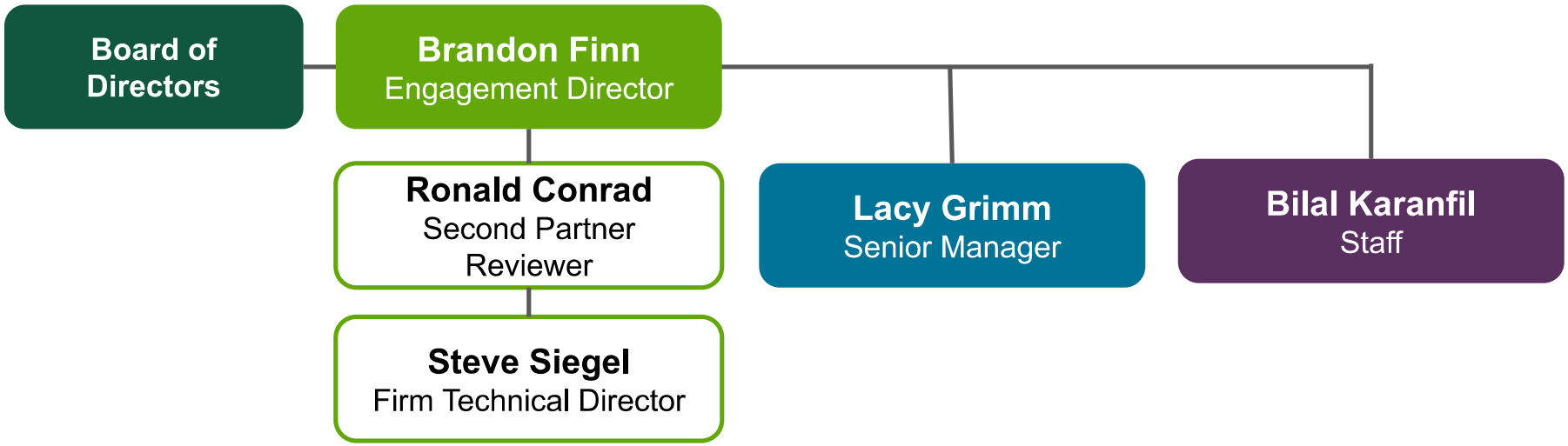


Agenda

- Client Service Team
- Results of the Audit
- Internal Control Communication
- Corrected and Uncorrected Misstatements
- Qualitative Aspects of Accounting Practices
- Independence Considerations
- Other Required Communications
- Other Matters
- Upcoming Financial Reporting Changes

This information is intended solely for the use of the Board of Directors and management of Piedmont Municipal Power Agency and is not intended to be, and should not be, used by anyone other than these specified parties.

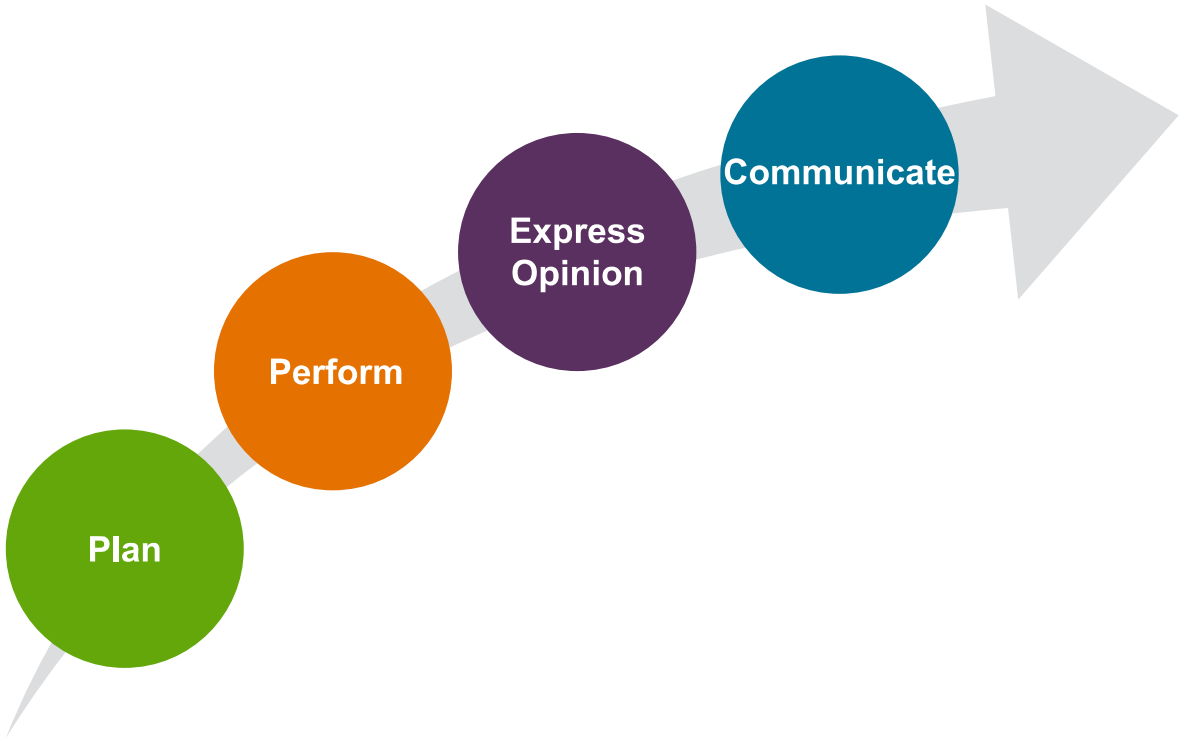
Client Service Team



Results of the Audit

We have audited the financial statements of Piedmont Municipal Power Agency (“PMPA”) for the year ended December 31, 2023, and we have issued our report thereon dated March 6, 2024.

We have issued an unmodified opinion on the financial statements



Internal Control Communication

In planning and performing our audit, we considered internal control over financial reporting ("internal control") as a basis for designing audit procedures that are appropriate in the circumstances for the purpose of expressing our opinion on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of PMPA's internal control. Accordingly, we do not express an opinion on the effectiveness of PMPA's internal control.

Our consideration of internal control was for the limited purpose described in the preceding paragraph and was not designed to identify all deficiencies in internal control that might be material weaknesses or significant deficiencies and, therefore, material weaknesses or significant deficiencies may exist that were not identified. In addition, because of inherent limitations in internal control, including the possibility of management override of controls, misstatements due to error or fraud may occur and not be detected by such controls.

A deficiency in internal control exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, misstatements on a timely basis.

Internal Control Communication

Material Weakness

- A material weakness is a deficiency, or a combination of deficiencies in internal control, such that there is a reasonable possibility that a material misstatement of PMPA's financial statements will not be prevented, or detected and corrected, on a timely basis.

Significant Deficiency

- A significant deficiency is a deficiency, or a combination of deficiencies, in internal control that is less severe than a material weakness, yet important enough to merit attention by those charged with governance.

We did not identify any control deficiencies that we believe to be material weaknesses.

Internal Control Communication

Other Control Recommendations

Certain controls lack segregation of duties due to the size of the accounting staff. PMPA should, when possible, have a second person involvement in approval and review of transactions to reduce the possibility that errors, either unintentional or intentional, would not be detected in a timely fashion.

We recommend duties be segregated to the extent practical and cost beneficial with an emphasis on review, approval, and oversight of transactions that may be incompatible with other duties.

Corrected and Uncorrected Misstatements

Professional standards require us to accumulate all misstatements identified during the audit, other than those that are clearly trivial, and communicate them to the appropriate level of management.

Corrected and Uncorrected Misstatements

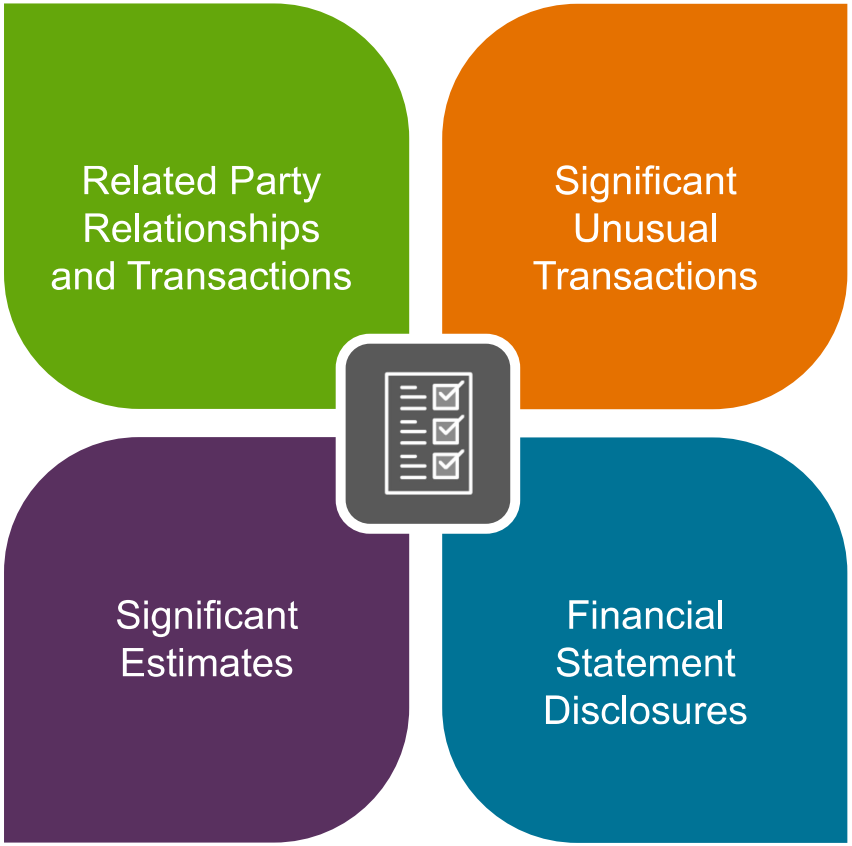
- None noted.

Qualitative Aspects of Accounting Practices

Management is responsible for the selection and use of appropriate accounting policies. The significant accounting policies used by PMPA are described in Note 2 to the financial statements.

During the year ended December 31, 2023, PMPA adopted Government Accounting Standards Board ("GASB") Statement No. 96, *Subscription-Based Information Technology Arrangements.* There was no material impact to the financial statements as a result of adopting this standard.

The application of other existing policies was not changed during the year. We noted no inappropriate accounting policies or practices.

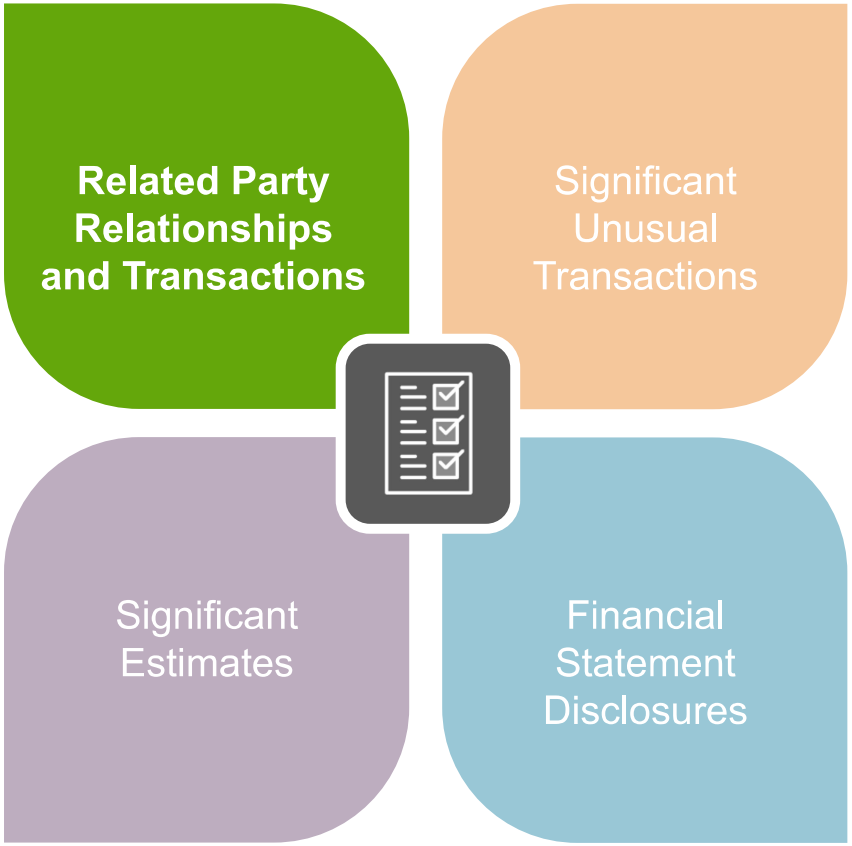


Qualitative Aspects of Accounting Practices

As part of our audit, we evaluated PMPA's identification of, accounting for, and disclosure of PMPA's relationships and transactions with related parties as required by professional standards.

We noted none of the following:

- Related parties or related party relationships or transactions that were previously undisclosed to us;
- Significant related party transactions that have not been approved in accordance with PMPA's policies or procedures or for which exceptions to PMPA's policies or procedures were granted;
- Significant related party transactions that appeared to lack a business purpose;
- Noncompliance with applicable laws or regulations prohibiting or restricting specific types of related party transactions;
- Difficulties in identifying the party that ultimately controls PMPA.

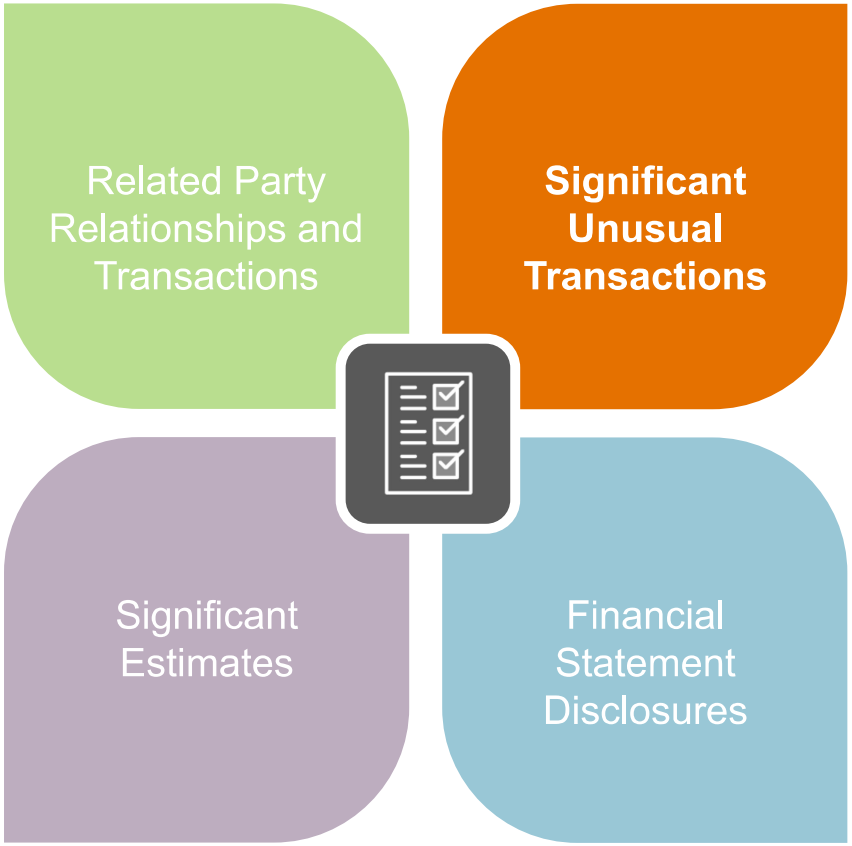


Qualitative Aspects of Accounting Practices

We noted no transactions entered by PMPA during the year for which there is a lack of authoritative guidance or consensus. All significant transactions have been recognized in the financial statements in the proper period.

For purposes of this presentation, professional standards define significant, unusual transactions as transactions that are outside the normal course of business for PMPA or that otherwise appear to be unusual due to their timing, size, or nature. We noted the following significant unusual transaction during our audit:

- The recognition of $10 million of settlement expense and a related liability resulting from the settlement agreement pertaining to the lawsuit by certain Participants.

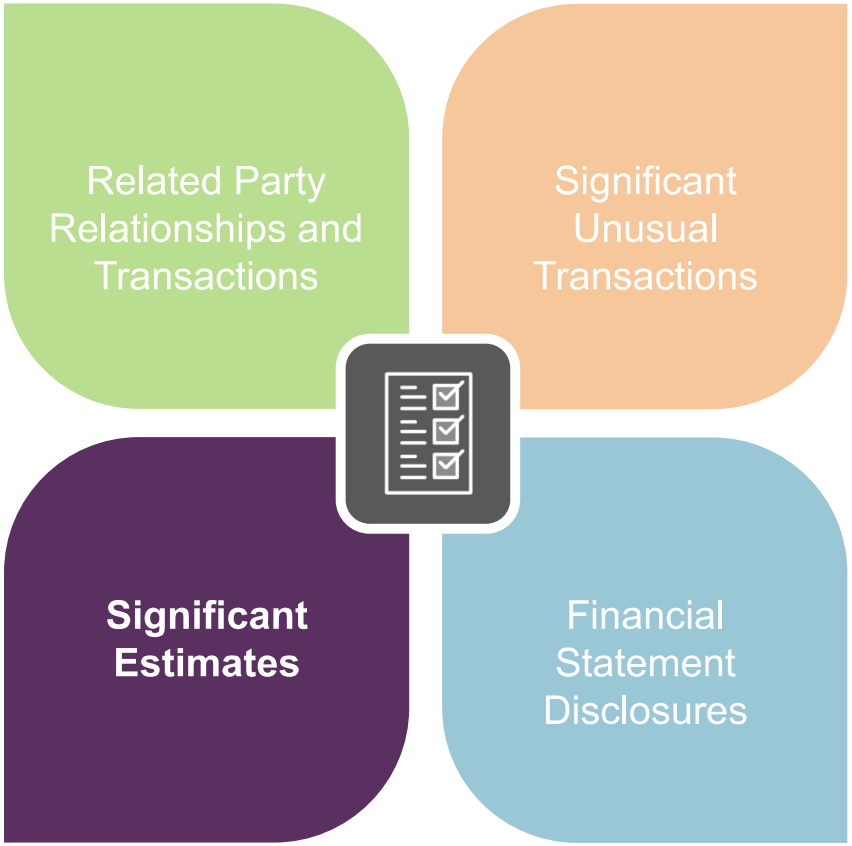


Qualitative Aspects of Accounting Practices

Accounting estimates are an integral part of the financial statements prepared by management and are based on management's knowledge and experience about past and current events and assumptions about future events. Certain accounting estimates are particularly sensitive because of their significance to the financial statements and because of the possibility that future events affecting them may differ significantly from those expected. The most sensitive estimates affecting the financial statements were:

- Management's estimate of the net cost to be recovered from future participant billings is based on an analysis of cost and billing information available at the present time, as well as current and anticipated economic conditions. We evaluated the key factors and assumptions used to develop the net cost to be recovered from future participant billings, determining that amounts seem reasonable in relation to the financial statements taken as a whole. While the procedures used by management and the amount of the net cost to be recovered from future participant billings seem reasonable at this time, there will usually be differences between the amount recorded and actual results, and these differences may be material.

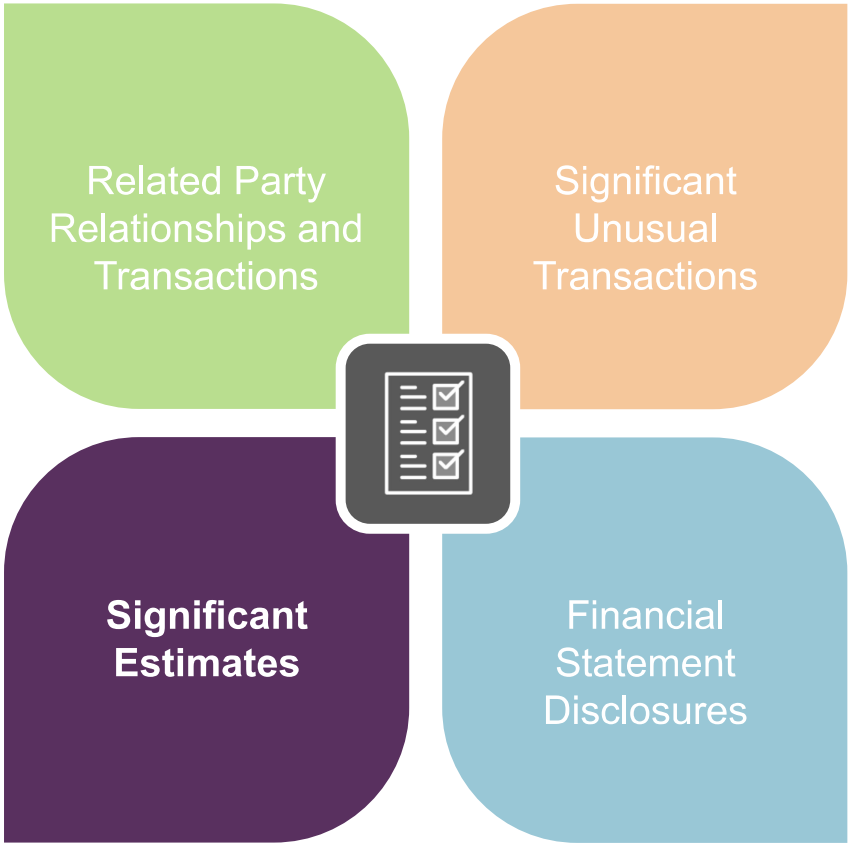
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Qualitative Aspects of Accounting Practices

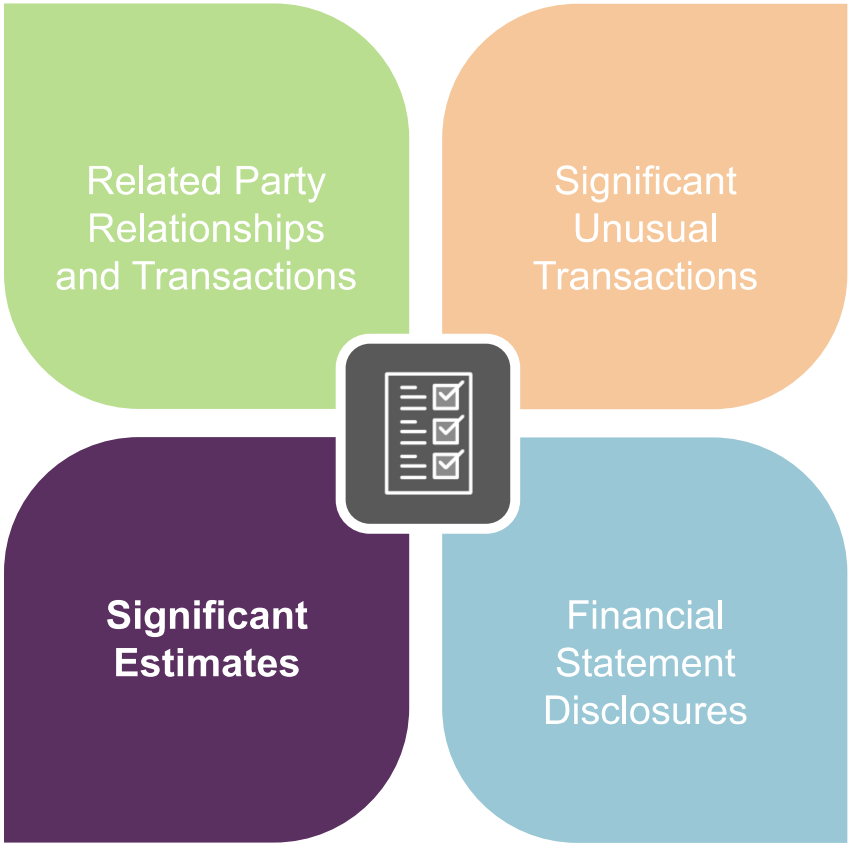
- Management's estimate of the reserve for decommissioning is based on an analysis of cost to decommission and current inflation and discount rates. The expected cost to decommission is updated every five years (latest as of October 2023) and inflation and discount rates are reviewed annually for reasonableness as compared to each five-year study. We evaluated key factors and assumptions used to develop the reserve for decommissioning, determining that amounts seem reasonable in relation to the financial statements taken as a whole. While the procedures used by management and the amount of the reserve for decommissioning seem reasonable at this time, there will usually be differences between the amount recorded and the actual results, and these differences may be material.
- Management's estimate of depreciation lives and methods is based on standard business practices and guidelines. We evaluated the lives and methods used to maintain the fixed asset records in determining that they seem reasonable in relation to the financial statements taken as a whole. While the lives and methods used by management seem reasonable at this time, there may be differences between the estimated lives and methods used and actual experience, and these differences may be material.

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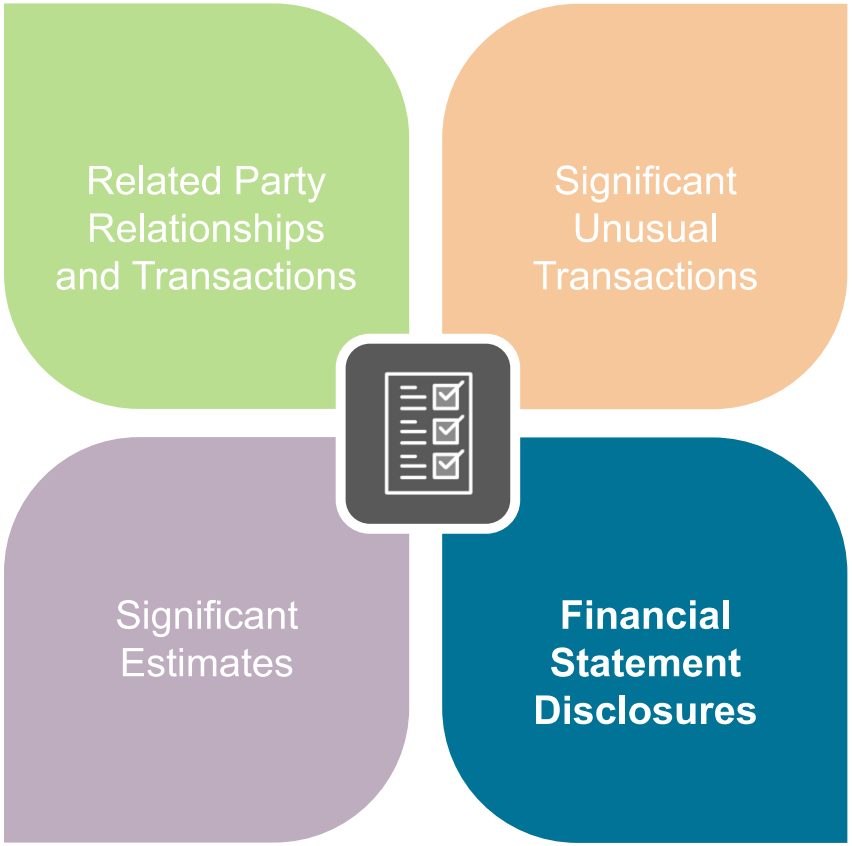
Qualitative Aspects of Accounting Practices

- Management's estimate of investment valuation is based on analysis of information gathered readily available market data and from fund managers and advisors. We evaluated the key factors and assumptions used to develop the fair values in determining that they seem reasonable in relation to the financial statements taken as a whole. While the procedures used by management and the valuation seems reasonable at this time, there may be differences between the amount recorded and the actual results, and these differences may be material.



Qualitative Aspects of Accounting Practices

The financial statement disclosures are neutral, consistent, and clear.



Independence Considerations

Nonattest Services

- Assistance with formatting of the financial statements.
- For all nonattest services we perform, you are responsible for designating a competent employee to oversee the services, make any management decisions, perform any management functions related to the services, evaluate the adequacy of the services, and accept overall responsibility for the results of the services.

Independence Conclusion

- We are not aware of any other circumstances or relationships that create threats to auditor independence.
- We are independent of PMPA and have met our other ethical responsibilities in accordance with the relevant ethical requirements relating to our audit.

Other Required Communications

Difficulties Encountered

We encountered no significant difficulties in dealing with management in performing and completing our audit.

Disagreements with Management

Includes disagreements on a financial accounting, reporting, or auditing matter, whether or not resolved to our satisfaction, that could be significant to the financial statements or the auditor's report.

We are pleased to report that no such disagreements arose during the course of our audit.

Auditor Consultations

We noted no matters that are difficult or contentious for which the auditor consulted outside the engagement team.

Management Representations

We have requested certain representations from management that are included in the management representation letter dated March 6, 2024.

Other Required Communications

Management Consultations

In some cases, management may decide to consult with other accountants about auditing and accounting matters, similar to obtaining a "second opinion" on certain situations.

To our knowledge, there were no such consultations with other accountants.

Other Findings or Issues

We generally discuss a variety of matters, including the application of accounting principles and auditing standards, with management each year.

These discussions occurred in the normal course of our professional relationship and our responses were not a condition to our retention.

Fraud and Illegal Acts

As of the date of this presentation, no fraud, illegal acts, or violations of laws and regulations noted.

Going Concern

No events or conditions noted that indicate substantial doubt about PMPA's ability to continue as a going concern.

Other Matters

Supplementary Information

Required Supplementary Information ("RSI")
We applied certain limited procedures to RSI (management's discussion and analysis), which supplements the financial statements. Such information, although not a part of the basic financial statements, is required by the Governmental Accounting Standards Board, who considers it to be an essential part of financial reporting for placing the basic financial statements in an appropriate operational, economic, or historical context. Our procedures consisted of inquiries of management regarding the methods of preparing the information and comparing the information for consistency with management's responses to our inquiries, the financial statements, and other knowledge we obtained during our audit of the financial statements. We did not audit the RSI and do not express an opinion or provide any assurance on the RSI.

Other Supplementary Information
With respect to the supplementary information accompanying the financial statements (schedules 1 and 2), we made certain inquiries of management and evaluated the form, content, and methods of preparing the information to determine that the information complies with U.S. generally accepted accounting principles, the method of preparing it has not changed from the prior period, and the information is appropriate and complete in relation to our audit of the financial statements. We compared and reconciled the supplementary information to the underlying accounting records used to prepare the financial statements or to the financial statements themselves.

Upcoming Financial Reporting Changes

These standards will be effective for PMPA in the upcoming years and may have an impact on PMPA's financial reporting.

We would be happy to discuss with management the potential impacts on PMPA's financial statements and how we may be able to assist in the implementation efforts.

GASB Statement No. 101, *Compensated Absences*



GASB Statement No. 102, *Certain Risk Disclosures*

Questions

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Your Guide Forward

PIEDMONT MUNICIPAL POWER AGENCY

Financial Statements and Supplementary Information

December 31, 2023 and 2022

(With Report of Independent Auditor Thereon)

Cherry Bekaert LLP

Your Guide Forward

PIEDMONT MUNICIPAL POWER AGENCY

Table of Contents

	Page
Report of Independent Auditor	1-2
Management's Discussion and Analysis	3-9
Financial Statements	
Statements of Net Position	10-11
Statements of Revenues, Expenses and Changes in Net Position	12
Statements of Cash Flows	13-14
Notes to Financial Statements	15-47
Supplementary Information	
1 Schedule of Revenues and Expenses Actual and Budget Per the Bond Resolution and Other Agreements	49
2 Schedule of Revenues and Expenses Per the Bond Resolution and Other Agreements	50

Cherry Bekaert LLP
Your Guide Forward

Report of independent Auditor

To the Board of Directors
of Piedmont Municipal Power Agency

Opinion

We have audited the accompanying financial statements of Piedmont Municipal Power Agency ("PMPA") (a South Carolina corporation), which comprise the statements of net position as of December 31, 2023 and 2022, and the related statements of revenues, expenses and changes in net position, and cash flows for the years then ended, and the related notes to financial statements.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of PMPA as of December 31, 2023 and 2022, and the changes in its financial position and its cash flows for the years then ended in accordance with accounting principles generally accepted in the United States of America.

Basis for Opinion

We conducted our audits in accordance with auditing standards generally accepted in the United States of America. Our responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of our report. We are required to be independent of PMPA and to meet our other ethical responsibilities in accordance with the relevant ethical requirements relating to our audits. We believe the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Responsibilities of Management for the Financial Statements

Management is responsible for the preparation and fair presentation of the financial statements in accordance with accounting principles generally accepted in the United States of America, and for the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is required to evaluate whether there are conditions or events, considered in the aggregate, that raise substantial doubt about PMPA's ability to continue as a going concern for one year beyond the financial statement date, including any currently known information that may raise substantial doubt shortly thereafter.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance but is not absolute assurance and, therefore, is not a guarantee that an audit conducted in accordance with generally accepted auditing standards will always detect a material misstatement when it exists. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control. Misstatements are considered material if there is a substantial likelihood that, individually or in the aggregate, they would influence the judgment made by a reasonable user based on the financial statements.

In performing an audit in accordance with generally accepted auditing standards, we:

- Exercise professional judgment and maintain professional skepticism throughout the audit.
- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, and design and perform audit procedures responsive to those risks. Such procedures include examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of PMPA's internal control. Accordingly, no such opinion is expressed.
- Evaluate the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluate the overall presentation of the financial statements.
- Conclude whether, in our judgment, there are conditions or events, considered in the aggregate, that raise substantial doubt about PMPA's ability to continue as a going concern for a reasonable period of time.

We are required to communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit, significant audit findings, and certain internal control related matters that we identified during the audit.

Required Supplementary Information

Accounting principles generally accepted in the United States of America require that the management's discussion and analysis on pages 3 through 9 be presented to supplement the basic financial statements. Such information, although not a part of the basic financial statements, is required by the Governmental Accounting Standards Board, who considers it to be an essential part of financial reporting for placing the basic financial statements in an appropriate operational, economic, or historical context. We have applied certain limited procedures to the required supplementary information in accordance with auditing standards generally accepted in the United States of America, which consisted of inquiries of management about the methods of preparing the information and comparing the information for consistency with management's responses to our inquiries, the basic financial statements, and other knowledge we obtained during our audits of the basic financial statements. We do not express an opinion or provide any assurance on the information because the limited procedures do not provide us with sufficient evidence to express an opinion or provide any assurance.

Supplementary Information

Our audits were conducted for the purpose of forming an opinion on the financial statements as a whole. Schedules 1 and 2 are presented for purposes of additional analysis and are not a required part of the financial statements. Such information is the responsibility of management and was derived from and relates directly to the underlying accounting and other records used to prepare the financial statements. The information has been subjected to the auditing procedures applied in the audit of the basic financial statements and certain additional procedures, including comparing and reconciling such information directly to the underlying accounting and other records used to prepare the basic financial statements or to the basic financial statements themselves, and other additional procedures in accordance with auditing standards generally accepted in the United States of America. In our opinion, Schedules 1 and 2 are fairly stated, in all material respects, in relation to the basic financial statements as a whole.

Cherry Bekaert LLP

Greenville, South Carolina
March 6, 2024

PIEDMONT MUNICIPAL POWER AGENCY

Management's Discussion and Analysis

December 31, 2023 and 2022

Overview of the Financial Statements

This section of Piedmont Municipal Power Agency's ("PMPA") annual financial statements presents our analysis of PMPA's financial performance during the fiscal years ended December 31, 2023 and 2022. Please read this discussion and analysis in conjunction with the financial statements that follow this section.

Financial Highlights

Year Ending December 31, 2023:

- PMPA's wholesale rates to Participants remain unchanged in 2023. Sales of electricity to Participants did not include a billing credit to return excess working capital generated in prior years to the Participants.
- In 2023, net cash generated from operating activities was $133.3 million, offsetting cash used in investing and financing activities of $5.6 million and $128.8 million, respectively.
- On January 1, 2023, PMPA made a principal payment of $51.3 million, reducing its long-term debt outstanding. PMPA's next principal payment of $52.1 million is due on January 1, 2024.

Year Ending December 31, 2022:

- PMPA's wholesale rates to Participants remain unchanged in 2022. Sales of electricity to Participants included a $10.8 million billing credit to return excess working capital generated in prior years to the Participants.
- In 2022, net cash generated from operating activities was $123.9 million, offsetting cash used in investing and financing activities of $33.5 million and $89.8 million, respectively.
- On January 1, 2022, PMPA made a principal payment of $26.0 million, reducing its long-term debt outstanding.

PIEDMONT MUNICIPAL POWER AGENCY

Management's Discussion and Analysis

December 31, 2023 and 2022

Overview of the Financial Activities

The following is an overview of the financial activities of PMPA for the years ended December 31, 2023 and 2022.

PMPA's financial statements, which include the statements of net position, the statements of revenues, expenses and changes in net position, and the statements of cash flows, are presented to display information about the reporting entity as a whole in accordance with GASB Statement No. 34, as amended. The statements are prepared using the economic resources measurement focus and the accrual basis of accounting.

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PIEDMONT MUNICIPAL POWER AGENCY

Management's Discussion and Analysis

December 31, 2023 and 2022

Financial Information

The following summarizes the activities of PMPA for the years ended December 31, 2023, 2022, and 2021:

	2023	2022	2021
		(In thousands)	
Revenues:			
Sales of electricity to Participants	$ 220,132	$ 215,668	$ 190,501
Sales of electricity to other utilities and other operating revenues	18,833	23,161	21,165
Total operating revenues	238,965	238,829	211,666
Interest income	7,230	2,890	2,393
Net change in fair value of investments and derivative instruments	5,202	(9,143)	(292)
Total Revenues	251,397	232,576	213,767
Expenses:			
Operation, maintenance, and nuclear fuel amortization	37,539	38,322	39,308
Purchased power, transmission, and power delivery	54,443	65,683	50,889
Administrative, general, and payments in lieu of property taxes	25,554	24,001	23,480
Depreciation	9,450	10,634	9,609
Interest and amortization expense	30,448	31,894	38,754
Other	22,543	13,882	14,221
Total Expenses	179,977	184,416	176,261
Revenues over expenses before deferred items	71,420	48,160	37,506
Net decrease in net costs recoverable from future Participant billings	(46,721)	(48,055)	(100,859)
Postemployment benefits	(132)	-	(82)
	(46,853)	(48,055)	(100,941)
Revenues over (under) expenses	24,567	105	(63,435)
Net position at beginning of year	116,475	116,370	179,805
Net position at end of year	$ 141,042	$ 116,475	$ 116,370

PIEDMONT MUNICIPAL POWER AGENCY

Management's Discussion and Analysis

December 31, 2023 and 2022

Results of Operations

Revenues

- Sales of electricity to Participants, PMPA's primary source of revenue, increased in 2023 by 2.1%, or approximately $4.5 million. In 2023, sales of electricity to Participants did not include any billing credits to Participants, resulting in a $10.8 million increase in revenue from 2022. This increase was partially offset by a decrease in energy sold to Participants. Sales of electricity to Participants increased in 2022 by 13.2%, or approximately $25.2 million. The 2022 billing credit to Participants totaled $10.8 million compared to a credit of $28 million in 2021, resulting in a $17.2 million increase in revenue. The remaining increase was driven by increased energy sold to Participants.

- Sales of electricity to other utilities and other operating revenues decreased by 18.7% in 2023 due to a decrease in surplus energy rates, partially offset by an increase in energy available to sell in the market. Sales of electricity to other utilities and other operating revenues increased by 9.4% in 2022 due to an increase in surplus energy rates, partially offset by a decrease in energy available to sell in the market. PMPA's surplus energy was contractually sold to Santee Cooper and The Energy Authority as part of supplemental purchased power agreements and Duke Energy Carolinas, LLC.

Expenses

- Purchased power, transmission and power delivery expenses decreased by 17.1%, or approximately $11.2 million, in 2023 due to a decrease in purchase prices coupled with a decrease in supplemental energy purchased in the market during 2023. Purchased power, transmission, and power delivery expenses increased by 29.1%, or approximately $14.8 million, in 2022 due to an increase in purchase prices coupled with an increase in supplemental energy purchased in the market during 2022.

- Other Expenses increased $8.7 million in 2023 due to the recording of a $10.0 million settlement liability associated with a 2019 lawsuit naming PMPA a defendant by two Participants with respect to the allocation of costs amongst all Participants. In January 2024, the lawsuit was settled with two Participants receiving a combined cash payment of $55 million, of which $10 million is to be paid by PMPA out of working capital funds and $45 million is to be paid by the remaining eight Participants. The $45 million cash payment is contingent upon PMPA securing financing, on behalf of the remaining eight participants, and will be included in PMPA's financial statements once the financing is secured. Because PMPA's portion of the settlement was reasonably estimable and probable on December 31, 2023, PMPA has included a $10 million settlement liability in the accompanying statements of financial position and a related $10 million expense included in other nonoperating expenses in the accompanying statements of revenues, expenses and changes in net position. The financing associated with the $45 million cash payment will be excluded from PMPA's wholesale rates and net costs recoverable from future Participant billings, and will be paid by the remaining eight Participants during the life of the to be acquired financing.

PIEDMONT MUNICIPAL POWER AGENCY

Management's Discussion and Analysis

December 31, 2023 and 2022

Net Position

The following summarizes the net position of PMPA for the years ended December 31, 2023, 2022, and 2021:

	2023	2022	2021
		(In thousands)	
Assets:			
Capital assets, net	$ 411,492	$ 403,029	$ 399,965
Current unrestricted assets	123,023	117,133	118,593
Current restricted assets	252,035	240,123	207,968
Other noncurrent assets	279,921	326,671	374,755
Total Assets	$ 1,066,471	$ 1,086,956	$ 1,101,281
Deferred outflows:	$ 11,670	$ 16,366	$ 21,353
Liabilities:			
Long-term liabilities	$ 678,899	$ 739,068	$ 793,845
Current liabilities	258,012	247,779	212,419
Total Liabilities	$ 936,911	$ 986,847	$ 1,006,264
Deferred inflows:	$ 188	$ -	$ -
Net position:			
Net investment in capital assets	$ (165,602)	$ (231,065)	$ (266,625)
Restricted for other	1,600	1,600	1,600
Unrestricted	305,044	345,940	381,395
Total Net Position	$ 141,042	$ 116,475	$ 116,370

Current unrestricted assets fluctuate with the changes in working capital. Working capital decreased by $1.4 million and $4.6 million in 2023 and 2022, respectively.

Current restricted assets primarily include assets restricted for decommissioning and debt service. Assets restricted for decommissioning increase each year due to PMPA's regular deposits into the decommissioning fund. Assets restricted for debt service fluctuate each year depending on PMPA's debt service obligation on January 1 of the following year. As such, PMPA's assets restricted for debt service decreased on December 31, 2023 when compared to December 31, 2022 and increased on December 31, 2022 when compared to December 31, 2021.

Other noncurrent assets primarily include net costs recoverable from future Participant billings, which decreased by $46.7 million and $48.0 million in 2023 and 2022, respectively. This decrease was driven by the $52.1 million and $51.3 million of principal deposits made during 2023 and 2022, respectively, which were partially offset by the deferrals of interest, depreciation, and amortization expenses.

Long-term liabilities primarily include bonds payable, net and the reserve for decommissioning. Long-term bonds payable, net decreased by $61.2 million and $61.9 million in 2023 and 2022, respectively, due to bond payments and the amortization of bond premiums. The reserve for decommissioning increased by $1.5 million and $7.0 million in 2023 and 2022, respectively, due to the continued accretion to the PMPA's total decommissioning requirement. The 2023 increase was partially offset by the decrease resulting from the updated decommissioning study.

Current liabilities primarily reflect PMPA's debt service requirement on January 1 of the following year. As such, current liabilities increased by $10.2 million and $35.4 million in 2023 and 2022, respectively.

PMPA calculates net investment in capital assets as the difference between capital assets and bonds payable, including loss on advance refunding of debt. Capital assets includes $411.0 million and $405.3 million of accumulated depreciation and amortization as of December 31, 2023 and 2022, respectively, causing the net investment in capital assets to reflect a negative balance.

Capital Assets

Capital assets include structures and improvements, reactor plant equipment, turbo-generator units, other equipment, and nuclear fuel. Such amounts are detailed as follows:

	2023	2022	2021
		(In thousands)	
Structures and improvements	$ 176,047	$ 174,077	$ 171,977
Reactor plant equipment	297,657	297,376	289,491
Turbo generator units	83,259	76,988	76,642
Other equipment	116,280	116,233	113,508
Nuclear fuel	79,063	73,348	69,578
Other	36,099	46,625	49,752
Construction work-in-progress	34,083	23,688	25,090
Total	822,488	808,335	796,038
Less accumulated depreciation and amortization	(410,996)	(405,306)	(396,073)
Total, net	$ 411,492	$ 403,029	$ 399,965

PMPA's investment in capital assets on December 31, 2023 totaled $411.5 million (net of accumulated depreciation and amortization), an $8.5 million increase from 2022. Significant capital transactions during 2023 included $15.4 million in nuclear fuel purchases and $21.0 million of capital additions, partially offset by depreciation and amortization expense of $22.2 million and a decommissioning adjustment of $5.8 million resulting from the updated study.

PMPA's investment in capital assets on December 31, 2022 totaled $403.0 million (net of accumulated depreciation and amortization), a $3.1 million increase from 2021. Significant capital transactions during 2022 included $12.8 million in nuclear fuel purchases and $15.0 million of capital additions, partially offset by depreciation and amortization expense of $24.0 million and a construction work-in-progress write off of $0.8 million.

PIEDMONT MUNICIPAL POWER AGENCY

Management's Discussion and Analysis

December 31, 2023 and 2022

Economic Factors and Next Year's Rates

Because the retail customers of PMPA Participants are primarily residential and small commercial accounts, PMPA is much less affected by economic downturns than a utility with larger commercial and industrial retail customers. The 2024 budget does not include an increase in PMPA's wholesale rates to the Participants.

Request for Information

This financial report is provided as an overview of PMPA's finances. Questions concerning any of the information in this report or requests for additional information should be directed to the Office of the Finance Director, Piedmont Municipal Power Agency, 121 Village Drive, Greer, South Carolina 29651.

PIEDMONT MUNICIPAL POWER AGENCY

Statements of Net Position

December 31, 2023 and 2022

(Dollars in thousands)

Assets	2023	2022
Capital Assets (Note 5):		
Utility plant assets being depreciated	$ 787,869	$ 784,111
Accumulated depreciation and amortization	(410,996)	(405,306)
Total utility plant assets being depreciated, net	376,873	378,805
Utility plant assets not being depreciated	34,619	24,224
Total Capital Assets, net	411,492	403,029
Current Unrestricted Assets:		
Cash	47	1,151
Marketable debt securities	84,516	78,355
Accrued interest receivable	1	1
Participant accounts receivable	17,488	16,813
Other accounts receivable	955	1,427
Materials and supplies	20,016	19,386
Total Current Unrestricted Assets	123,023	117,133
Current Restricted Assets (Note 7):		
Restricted for debt service	124,255	126,691
Restricted for decommissioning	126,180	111,832
Restricted for other	1,600	1,600
Total Current Restricted Assets	252,035	240,123
Total Current Assets	375,058	357,256
Noncurrent Assets:		
Net costs recoverable from future Participant billings (Note 8)	279,894	326,615
Other	27	56
Total Other Noncurrent Assets	279,921	326,671
Total Assets	$ 1,066,471	$ 1,086,956
Deferred Outflows:		
Redemption losses, net	$ 4,928	$ 5,754
Losses on advance refundings of debt, net	6,742	10,149
Postemployment benefits	-	463
Total Deferred Outflows	$ 11,670	$ 16,366

See accompanying notes to financial statements.

PIEDMONT MUNICIPAL POWER AGENCY

Statements of Net Position (continued)

December 31, 2023 and 2022

(Dollars in thousands)

Liabilities	**2023**	**2022**
Long-Term Liabilities:		
Bonds payable, net (Notes 9 and 10)	$ 531,750	$ 592,953
Reserve for decommissioning (Note 11)	145,510	143,992
Other postemployment benefits (Note 13)	1,639	2,123
Total Long-Term Liabilities	678,899	739,068
Current Liabilities:		
Accounts payable and other accrued liabilities	11,889	11,877
Accrued settlement liability (Note 16)	10,000	-
Total Current Liabilities	21,889	11,877
Current Liabilities Payable from Restricted Assets:		
Accrued interest payable	184,037	184,612
Current installments of bonds payable	52,086	51,290
Total Current Liabilities Payable from Restricted Assets	236,123	235,902
Total Current Liabilities	258,012	247,779
Total Liabilities	$ 936,911	$ 986,847
Deferred Inflows:		
Postemployment benefits	$ 188	$ -
Net Position		
Net investment in capital assets	$ (165,602)	$ (231,065)
Restricted for other	1,600	1,600
Unrestricted	305,044	345,940
Total Net Position	$ 141,042	$ 116,475

See accompanying notes to financial statements.

PIEDMONT MUNICIPAL POWER AGENCY

Statements of Revenues, Expenses and Changes in Net Position

Years Ended December 31, 2023 and 2022

(Dollars in thousands)

	2023	2022
Operating Revenues:		
Sales of electricity to Participants	$ 220,132	$ 215,668
Sales of electricity to other utilities	17,412	21,629
Other	1,421	1,532
Total Operating Revenues	238,965	238,829
Operating Expenses:		
Operation and maintenance	24,837	24,987
Nuclear fuel amortization	12,702	13,335
Purchased power	44,974	56,798
Transmission	8,861	8,295
Power delivery	608	590
Administrative and general	15,672	15,996
Depreciation	9,450	10,634
Decommissioning reserve accretion	7,313	6,960
Payments in lieu of property taxes	9,882	8,005
Total Operating Expenses	134,299	145,600
Net Operating Income	104,666	93,229
Other Income (Expense):		
Interest income	7,230	2,890
Net change in fair market value of investments	5,202	(9,143)
Interest expense	(36,660)	(39,041)
Amortization	6,212	7,147
Other	(15,230)	(6,922)
Total Other Expense, Net	(33,246)	(45,069)
Revenues over expenses before deferred items	71,420	48,160
Net decrease in net costs recoverable from future Participant billings	(46,721)	(48,055)
Postemployment benefits	(132)	-
	(46,853)	(48,055)
Revenue over expenses	24,567	105
Net position at beginning of year	116,475	116,370
Net position at end of year	$ 141,042	$ 116,475

See accompanying notes to financial statements.

PIEDMONT MUNICIPAL POWER AGENCY

Statements of Cash Flows

Years Ended December 31, 2023 and 2022

(Dollars in thousands)

	2023	2022
Cash flows from operating activities:		
Receipts from customers	$ 238,762	$ 235,651
Payments for operations and maintenance	(25,467)	(24,703)
Payments for purchased power, transmission, and power delivery	(64,325)	(73,688)
Payments for administration and general	(15,660)	(13,396)
Net cash from operating activities	133,310	123,864
Cash flows from investing activities:		
Purchase of investment securities	(424,189)	(438,181)
Proceeds from sales and maturities of investments	409,805	401,335
Interest received on investments	8,743	3,390
Net cash used in investing activities	(5,641)	(33,456)
Cash flows from capital and related financing activities:		
Payment of bond principal	(51,290)	(25,959)
Interest payment on bonds	(35,906)	(30,178)
Expenditures for utility plant in service	(21,009)	(14,963)
Expenditures for nuclear fuel	(15,401)	(12,804)
Payment to Duke Energy for other charges	(5,339)	(5,958)
Other	172	53
Net cash used in capital and related financing activities	(128,773)	(89,809)
Net change in cash	(1,104)	599
Cash, beginning of year	1,151	552
Cash, end of year	$ 47	$ 1,151
Noncash investing and financing activities:		
Loss on sale of investment	$ (1,796)	$ (817)
Amortization expense on discounts and premiums	$ 9,117	$ 10,587
Amortization of net redemption loss	$ (4,233)	$ (4,874)
Net change in fair value of investments	$ 5,202	$ (9,143)
Change in decommissioning liability due to updated cost study	$ 5,795	$ -

See accompanying notes to financial statements.

PIEDMONT MUNICIPAL POWER AGENCY

Statements of Cash Flows (continued)

Years Ended December 31, 2023 and 2022

(Dollars in thousands)

	2023	2022
Reconciliation of net operating income to net cash from operating activities:		
Net operating income	$ 104,666	$ 93,229
Adjustments to reconcile net operating income to net cash from operating activities:		
Depreciation	9,450	10,634
Nuclear fuel amortization	12,702	13,335
Decommissioning reserve accretion	7,313	6,960
(Increase) decrease in:		
Participant accounts receivable	(675)	(2,778)
Other accounts receivable	472	(400)
Materials and supplies	(630)	284
Increase in:		
Accounts payable and other accrued liabilities	12	2,600
Net cash from operating activities	$ 133,310	$ 123,864

See accompanying notes to financial statements.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(1) Description of the Entity, Industry Restructuring Developments, and Related Uncertainties

(a) Description of the Entity

Piedmont Municipal Power Agency ("PMPA") was incorporated in 1979 under the South Carolina Joint Municipal Electric Power and Energy Act (the "Act"). The Act, adopted in April 1978, enabled the formation, by South Carolina municipalities and municipal commissions of public works, of a joint agency to plan, finance, develop, own, and operate electric generation and transmission facilities. Ten municipal utility systems ("Participants") comprise PMPA's membership. The Participants, located in northwestern South Carolina, are the cities of Abbeville, Clinton, Easley, Gaffney, Greer, Laurens, Newberry, Rock Hill, Union, and Westminster. PMPA is not a component unit of any other governmental entity.

PMPA has a 25% undivided ownership interest in Unit 2 of the Catawba Nuclear Station ("Catawba"). Pursuant to the Operating and Fuel Agreement between PMPA and Duke Energy Carolinas, LLC ("Duke"), Duke operates both Units 1 and 2 at Catawba. PMPA's power output entitlements (approximately 272 MW) come from both Catawba Units. PMPA pays 12.5% of the costs and receives 12.5% of the power output associated with each of these 1,145 MW units. The operating licenses for Catawba Unit 1 and Unit 2 expire on December 5, 2043.

Additionally, the terms of the McGuire Reliability Exchange Agreement ("MREA") allow transfers of energy between PMPA's entitlements from the Catawba Units and Duke's two nuclear units at the McGuire Nuclear Station ("McGuire"). The result spreads PMPA's entitlements across four similar nuclear units. The operating license for McGuire Unit 1 expires on June 12, 2041 and the operating license for McGuire Unit 2 expires on March 3, 2043.

(b) Industry Restructuring Developments and Related Uncertainties

There is no deregulation debate underway in the South Carolina General Assembly. The well-publicized complexities of deregulation in other parts of the country have caused the legislators and regulators in South Carolina to continue a regulated retail electricity market.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(2) Summary of Significant Accounting Policies

(a) Basis of Accounting

The financial statements have been prepared in accordance with the provisions of the Governmental Accounting Standards Board ("GASB") Statement No. 34, *Basic Financial Statements – and Management's Discussion and Analysis – for State and Local Governments* as amended by GASB Statement No. 37, *Basic Financial Statements – and Management's Discussion and Analysis – for State and Local Governments: Omnibus,* GASB Statement No. 38, *Certain Financial Statement Disclosures* and GASB Statement No. 61, *The Financial Reporting Entity – Omnibus – An Amendment of GASB Statement No. 14 and No. 34.* Statement No. 34 requires as supplementary information Management's Discussion and Analysis, which includes an analytical overview of PMPA's financial activities.

PMPA's accounting records are maintained on an accrual basis in conformity with accounting principles generally accepted in the United States of America ("U.S. GAAP") and substantially in conformity with the Federal Energy Regulatory Commission's Uniform System of Accounts.

PMPA follows the accounting practices set forth in U.S. GAAP, Accounting for the Effects of Certain Types of Regulation, as amended. This standard allows PMPA to capitalize or defer certain costs or revenues based on PMPA's ongoing assessment that it is probable that such items will be recovered through future revenues based on the rate-making authority of PMPA's Board of Directors. The criteria require consideration of anticipated changes in levels of demand or competition during the recovery period for any capitalized cost.

PMPA's General Bond Resolution requires that its rate structure be designed to produce revenues sufficient to pay operating, debt service, and other specified costs. PMPA's Board of Directors, which is comprised of representatives of the Participants, is responsible for reviewing and approving the rate structure. The application of a given rate structure to a given period's electricity sales may produce revenues not intended to pay that period's costs, and conversely, that period's costs may not be intended to be recovered in period revenues. The affected revenues and/or costs are, in such cases, deferred for future recognition. The ultimate recognition of deferred items is correlated with specific future events, primarily payment of debt principal.

PMPA maintains a single enterprise fund to record its activities, which consists of a self-balancing set of accounts. Enterprise funds are used to account for activities similar to those found in the private sector, where the determination of net income is necessary or useful for sound financial administration.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(2) Summary of Significant Accounting Policies – Continued

(b) Losses on Advanced Refundings of Debt and Redemption Losses, net

Losses on advanced refundings of debt and redemption losses, net at December 31, 2023 and 2022 of $11,670 and $15,903, respectively, (net of accumulated amortization of $253,678 and $265,804, respectively) have been deferred in accordance with U.S. GAAP and are being amortized over the term of the debt issued on refunding using the effective interest method. The remaining costs on advanced refundings will be amortized over the next 10 years (2024 through 2033) based on the shorter of the original debt maturity dates or the maturity dates of the new debt.

(c) Discounts on Bonds Payable

The discounts on bonds payable at December 31, 2023 and 2022 of $81 and $134, respectively, (net of accumulated amortization of $1,007 and $954, respectively) are being amortized on the bonds outstanding method, which approximates the effective interest method.

(d) Premiums on Bonds Payable

The premiums on bonds payable at December 31, 2023 and 2022 of $44,921 and $54,091, respectively, (net of accumulated amortization of $31,455 and $22,285, respectively) are being amortized on a method that approximates the effective interest method.

(e) Income Taxes

PMPA is recognized as a public utility for federal income tax purposes. As such, the gross income of PMPA is excluded from federal income taxes under Internal Revenue Code ("IRC") Section 115.

(f) Marketable Debt Securities

As authorized by the General Bond Resolution, investment securities at December 31, 2023 and 2022 consist only of direct obligations of the United States government and obligations of United States government agencies. These investments are uninsured and unregistered and are held by PMPA's trustee in PMPA's name.

Marketable debt securities are recorded at fair value based on market prices. Unrealized holding gains and losses on marketable debt securities are included in income. Interest income is recognized when earned.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(2) Summary of Significant Accounting Policies – Continued

(g) Capital Assets, net

Utility plant assets, including unclassified assets, are stated at cost and are depreciated on a straight-line basis at rates calculated to depreciate the composite assets over their respective estimated useful lives. Depreciation begins when assets are placed into service. PMPA's annual provision for depreciation expressed as a percentage of the average balance of depreciable utility plant was 1.2% and 1.4% in 2023 and 2022, respectively.

PMPA's capital assets are currently being depreciated according to the following table:

	Years		Years
Structures and improvements	40	Station equipment	40
Reactor plant equipment	40	Transmission equipment	40
Turbo generator units	40	Other	35-40
Accessory electric equipment	40	Unclassified	40
Miscellaneous plant equipment	40	Nuclear fuel	4-5

(h) Materials and Supplies

Materials and supplies inventories are stated at the lower of cost or net realizable value using the average cost method.

(i) Use of Estimates

The preparation of financial statements in conformity with U.S. GAAP requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. Actual results could differ from those estimates.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(2) Summary of Significant Accounting Policies – Continued

(j) Net Position

Equity is classified into net positions and is displayed in three components:

- *Net Investment in Capital Assets* – consists of capital assets, net of accumulated depreciation and amortization and reduced by the outstanding balances of any bonds, notes, or other borrowings that are attributable to the acquisition, construction, or improvement of those assets.

- *Restricted for Other* – consists of net position with constraints placed on the use either by (1) external groups such as creditors, grantors, contributors, or laws or regulations of other governments or (2) law through constitutional provision or enabling legislation.

- *Unrestricted* – all other net position that does not meet the definition of "restricted for other" or "net investment in capital assets."

(k) Revenue Recognition

PMPA recognizes revenue on sales when the electricity is delivered to the Participants and other utilities.

(l) Operating and Non-operating Expenses

PMPA distinguishes operating revenues and expenses from non-operating items. Operating revenues and expenses generally result from providing services in addition to producing and delivering goods in connection with the principal ongoing operations. The principal operating revenues of PMPA are charges to Participants and other utilities for sales and services. Operating expenses for PMPA include the costs of sales and services, general and administrative services, and depreciation of capital assets. All revenues and expenses not meeting this definition are reported as non-operating revenues and expenses.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(2) Summary of Significant Accounting Policies – Continued

(m) Recent Pronouncements

In May 2020, the GASB issued Statement No. 96, *Subscription-Based Information Technology Arrangements*. This Statement (1) defines a subscription-based information technology arrangement ("SBITA"); (2) establishes that a SBITA results in a right-to-use subscription asset – an intangible asset – and a corresponding subscription liability; (3) provides the capitalization criteria for outlays other than subscription payments, including implementation costs of a SBITA; and (4) requires note disclosures regarding a SBITA. PMPA adopted this statement effective January 1, 2023. There was no material impact on PMPA's financial statements as a result of the adoption.

In June 2022, the GASB issued Statement No. 101, *Compensated Absences*. This Statement aligns the recognition and measurement guidance for compensated absences under a unified model and amends certain previously required disclosures. The requirements of this Statement are effective for fiscal years beginning after December 15, 2023. This Statement is not expected to have a material impact on PMPA.

In December 2023, the GASB issued Statement No. 102, *Certain Risk Disclosures*. The objective of this Statement is to provide users of government financial statements with information about risks related to a government's vulnerabilities due to certain concentrations or constraints that is essential to their analyses for making decisions or assessing accountability. The requirements of this Statement are effective for fiscal years beginning after June 15, 2024. This Statement is not expected to have a material impact on PMPA.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(3) Power Sales Agreements

(a) Catawba Project Power Sales Agreements

PMPA and each Participant are parties to Catawba Project Power Sales Agreements ("Power Sales Agreements"). These Power Sales Agreements obligate PMPA to provide each Participant a share of the undivided 25% interest in Unit 2 of Catawba power output. In turn, each Participant must pay its share of the Catawba costs. Participants make their payments on a "take-or-pay" basis whether or not Catawba is operable or operating. Such payments are not subject to reduction or offset and are not conditioned upon performance by PMPA or any given Participant. The Power Sales Agreements are in effect until the earlier of August 1, 2035 or the completion of payments on the bonds and satisfaction of obligations under the Project agreements.

Each Participant is entitled to the following percentages of PMPA's Catawba output:

Abbeville	2.68
Clinton	7.84
Easley	13.24
Gaffney	10.05
Greer	9.34
Laurens	6.49
Newberry	10.47
Rock Hill	28.04
Union	10.01
Westminster	1.84
	100.00

(b) Supplemental Power Sales Agreements

PMPA and each Participant are also parties to Supplemental Power Sales Agreements ("Supplemental Agreements") under which each Participant has agreed to pay, in exchange for All Requirements Bulk Power Supply, its share of All Requirements Bulk Power Supply costs. The Supplemental Agreements terminate on December 20, 2034; however, a Participant may terminate its Supplemental Agreement with ten years advance notice. On December 31, 2018 the Participants Greer, Rock Hill and Westminster turned in the ten-year written notice to terminate their Supplemental Agreements with PMPA. The effective date of termination will be December 31, 2028. In December 2019, the remaining seven Participants turned in the ten-year written notice to terminate their Supplemental Agreements with PMPA. The effective date of termination will be December 31, 2029.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(4) Project and Other Agreements

Project Agreements between PMPA and Duke consist of the Purchase, Construction, and Ownership Agreement ("Sales Agreement"), the Operating and Fuel Agreement (the "Operating Agreement"), the Joint Ownership Support Agreement, (the "JOSA"), and the MREA.

(a) Sales Agreement

The Sales Agreement generally provides for (i) the purchase of Catawba by PMPA; (ii) PMPA's contract with Duke to act as engineer contractor for PMPA for completion of construction, initial fueling, and placing Catawba into commercial operation; (iii) PMPA's payment to Duke for construction completed to the date of closing on Catawba and for construction thereafter; and (iv) PMPA's payment to Duke of certain profits and fees.

(b) Operating Agreement

The Operating Agreement generally provides that PMPA employs Duke, as operator of Catawba, to be responsible for the (i) operation, maintenance, and fueling of Catawba; (ii) making of renewals, replacements, and capital additions to Catawba; and (iii) ultimate decommissioning of Catawba at the end of its useful life.

(c) JOSA

The JOSA generally provides for certain joint ownership rights and obligations, including the Catawba Reliability Exchange. This agreement became effective on January 1, 2006.

(d) MREA

The MREA generally provides for the continued exchange of energy from PMPA's entitlements to the Catawba units for energy from Duke's McGuire Nuclear Station units. This agreement became effective January 1, 2006, and can be terminated by either party by giving a three-year written notice.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(4) Project and Other Agreements – Continued

Other Agreements

(a) Requirements Service Agreement

On December 13, 2010, PMPA entered into a Power Sales Agreement with the South Carolina Public Service Authority ("Santee Cooper"). This agreement became effective on January 1, 2014. The contract requires that PMPA purchase power from Santee Cooper to meet all of its load demand beyond the amounts served by Catawba, the Participants' share of electricity, excluding backstand services, from SEPA ("Southeastern Power Administration") hydroelectric facilities, and load requirements met by individual generating resources owned by certain Participants. On January 28, 2020, PMPA provided the required ten-year notice of termination to Santee Cooper for the Requirements Service Agreement. This cancellation is a result of all Participants providing notice to cancel their Supplemental Agreements, as discussed in Note 3.

(b) Transmission Services

PMPA entered into a service agreement with Duke to begin taking transmission service under Duke's Open Access Transmission Tariff ("OATT") on January 1, 2006.

(c) The Energy Authority Resource ("TEA") Management Agreement

Effective January 1, 2021, PMPA entered into a Resource Management Agreement with TEA. The Resource Management Agreement generally provides for PMPA to purchase capacity and energy from TEA to obtain backstand services for PMPA's entitlement to capacity and energy from the Catawba and McGuire Nuclear Stations. The TEA agreement has an initial term of three years and, unless terminated, shall renew on an annual basis for successive one-year terms, starting in 2024.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(5) Capital Assets

The following is a summary of capital asset activity for the years ended December 31, 2023 and 2022:

	December 31, 2023			
	Beginning Balance	Increase	Decrease	Ending Balance
Utility plant being depreciated:				
Structures and improvements	$ 174,077	$ 2,651	$ (681)	$ 176,047
Reactor plant equipment	297,376	1,305	(1,024)	297,657
Turbo generator units	76,988	8,219	(1,948)	83,259
Accessory electric equipment	66,526	1,028	(237)	67,317
Miscellaneous plant equipment	35,988	1,044	(6)	37,026
Station equipment	7,536	146	(1,928)	5,754
Transmission equipment	6,183	-	-	6,183
Other	19,375	-	(5,848)	13,527
Unclassified	26,714	9,631	(14,309)	22,036
Nuclear fuel	73,348	15,401	(9,686)	79,063
Total utility plant assets being depreciated	784,111	39,425	(35,667)	787,869
Less accumulated depreciation and amortization	(405,306)	(22,152)	16,462	(410,996)
Total utility plant assets being depreciated, net	378,805	17,273	(19,205)	376,873
Utility plant assets not being depreciated:				
Land	536	-	-	536
Construction work-in-progress	23,688	21,009	(10,614)	34,083
Total utility plant assets not being depreciated	24,224	21,009	(10,614)	34,619
Total capital assets, net	$ 403,029	$ 38,282	$ (29,819)	$ 411,492

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(5) Capital Assets – Continued

	December 31, 2022			
	Beginning Balance	Increase	Decrease	Ending Balance
Utility plant being depreciated:				
Structures and improvements	$ 171,977	$ 2,439	$ (339)	$ 174,077
Reactor plant equipment	289,491	9,515	(1,630)	297,376
Turbo generator units	76,642	663	(317)	76,988
Accessory electric equipment	65,297	1,470	(241)	66,526
Miscellaneous plant equipment	33,945	2,601	(558)	35,988
Station equipment	8,083	87	(634)	7,536
Transmission equipment	6,183	-	-	6,183
Other	19,832	30	(487)	19,375
Unclassified	29,384	14,019	(16,689)	26,714
Nuclear fuel	69,578	12,804	(9,034)	73,348
Total utility plant assets being depreciated	770,412	43,628	(29,929)	784,111
Less accumulated depreciation and amortization	(396,073)	(23,969)	14,736	(405,306)
Total utility plant assets being depreciated, net	374,339	19,659	(15,193)	378,805
Utility plant assets not being depreciated:				
Land	536	-	-	536
Construction work-in-progress	25,090	14,963	(16,365)	23,688
Total utility plant assets not being depreciated	25,626	14,963	(16,365)	24,224
Total capital assets, net	$ 399,965	$ 34,622	$ (31,558)	$ 403,029

Unclassified assets are in service and being depreciated but are not yet classified to specific plant accounts.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(5) Capital Assets – Continued

Nuclear fuel represents costs associated with acquiring and processing reload fuel assemblies as well as the cost of nuclear fuel in the reactor. Nuclear fuel is amortized based on burn rates using a unit of production basis. PMPA regularly removes fully amortized nuclear fuel costs when fuel batches are replaced during core refueling operations. Fully amortized fuel costs of $9,686 and $9,034 were removed during 2023 and 2022, respectively.

A summary of accumulated depreciation and amortization on December 31, 2023 and 2022 is as follows:

	2023	2022
Accumulated depreciation of utility plant assets	$ 370,959	$ 368,285
Accumulated amortization of nuclear fuel	40,037	37,021
	$ 410,996	$ 405,306

The depreciation charge for the year on PMPA's generation plant has been determined based on revised estimated useful lives for these assets. The remaining estimated useful lives were revised to recognize a 19-year extension of the operating license for Catawba Unit 1 and a 17-year extension of the operating license for Catawba Unit 2 through 2043, which Duke received during 2003.

(6) Cash and Investments

On December 31, 2023, the carrying value of deposits included in cash was $47. Insured and collateralized bank deposits were $173 on December 31, 2023.

As of December 31, 2023, PMPA had the following investments (all are listed at fair value):

	Time Segmented Distribution					
Investment Type	Under 1 Year	1-2 Years	2-3 Years	3-4 Years	>4 Years	Total
Cash/Money Market	$ 153,552	$ -	$ -	$ -	$ -	$ 153,552
Government Agency	-	13,913	-	-	-	13,913
Government Treasury	15,701	40,721	40,454	38,001	33,071	167,948
Mortgage Backed Securities	-	-	-	-	252	252
Total fair value	$ 169,253	$ 54,634	$ 40,454	$ 38,001	$ 33,323	$ 335,665

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(6) Cash and Investments – Continued

On December 31, 2022, the carrying value of deposits included in cash was $1,151. Insured and collateralized bank deposits were $299 on December 31, 2022.

As of December 31, 2022, PMPA had the following investments (all are listed at fair value):

	Time Segmented Distribution					
Investment Type	Under 1 Year	1-2 Years	2-3 Years	3-4 Years	>4 Years	Total
Cash/Money Market	$ 163,184	$ -	$ -	$ -	$ -	$ 163,184
Government Agency	7,644	3,028	13,505	-	-	24,177
Government Treasury	-	45,152	26,894	30,409	27,760	130,215
Mortgage Backed Securities	-	30	101	151	18	300
Total fair value	$ 170,828	$ 48,210	$ 40,500	$ 30,560	$ 27,778	$ 317,876

Interest Rate Risk

Interest rate risk is the risk that rising interest rates will adversely affect the fair value of PMPA's investments. As outlined in PMPA's investment policy, investment maturities shall be less than 20 years and maturities shall be staggered in a way that avoids undue concentration in a specific maturity sector and provides for stability of income and reasonable liquidity.

Credit Risk

PMPA's investment policy for managing credit risk is in accordance with the statutes of the State of South Carolina. The policy allows for the investment of money in the following investments:

a) Direct obligations of, or obligations for, which the principal and interest are unconditionally guaranteed by the United States or its Agencies.

b) Direct and general obligations, to the payment of which the full faith and credit of the issuer is pledged, of the State of South Carolina or any political subdivision thereof that at the time of investment are assigned a rating of at least "A."

c) Certificates of deposit issued by any bank, trust company, or national banking association whose principal place of business is in the State of South Carolina or that is a member of the Federal Reserve System and authorized to do business in any state of the United States.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(6) Cash and Investments – Continued

d) Bills of exchange or time drafts drawn on and accepted by a domestic or foreign bank, otherwise known as Bankers' Acceptances, which are eligible for purchase by the Federal Reserve, the short-term commercial paper of which is rated in the highest category.

e) Investments in repurchase agreements and reverse repurchase agreements with any bank, savings and loan association, credit union, or trust company organized under the laws of any state of the United States or any national banking association or government bond dealer reporting to, trading with and recognized as a primary dealer by the Federal Reserve Bank of New York, which are collateralized by securities as set forth in (a) and (b).

PMPA's investments in U.S. Agencies and U.S. Government Sponsored Enterprises, including Federal Home Loan Bank System, Federal National Mortgage Association, and Federal Home Loan Mortgage Corporation, are rated AA+ by Standard and Poor's and Aaa by Moody's Investors Service. U.S. Treasury and Agency Mortgage-Backed Securities are unrated but are considered equivalent to an AAA rating.

The following represents securities in an unrealized loss position as of December 31, 2023:

Less than 12 months		12 months or more		Total	
Fair Value	Unrealized Loss	Fair Value	Unrealized Loss	Fair Value	Unrealized Loss
$ 10,544	$ (57)	$ 92,439	$ (5,121)	$ 102,983	$ (5,178)
$ 10,544	$ (57)	$ 92,439	$ (5,121)	$ 102,983	$ (5,178)

The following represents securities in an unrealized loss position as of December 31, 2022:

Less than 12 months		12 months or more		Total	
Fair Value	Unrealized Loss	Fair Value	Unrealized Loss	Fair Value	Unrealized Loss
$ 12,547	$ (530)	$ 91,104	$ (7,779)	$ 103,651	$ (8,309)
$ 12,547	$ (530)	$ 91,104	$ (7,779)	$ 103,651	$ (8,309)

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(6) Cash and Investments – Continued

Custodial Credit Risk

PMPA's policy for managing custodial risk requires all securities owned by PMPA to be held in safekeeping by a third party custodian bank in PMPA's name under a custody agreement. For an investment, custodial credit risk is the risk that in the event of the failure of the counterparty, PMPA will not be able to recover the value of its investments or collateral that is in the possession of an outside party.

Concentration of Credit Risk

The investment policy of PMPA permits a maximum portfolio percentage of 100% for U.S. Treasuries, Federal Agencies and U.S. Government-sponsored enterprises and permits a maximum portfolio percentage of 50% in any one federal agency or government-sponsored enterprise.

As of December 31, 2023, 4.1% of the portfolio was held in Federal Agency bonds and 0.1% was held in Agency Mortgage-Backed Securities. As of December 31, 2022, 7.6% of the portfolio was held in Federal Agency bonds and 0.1% was held in Agency Mortgage-Backed Securities.

A reconciliation of cash and investments for PMPA on December 31, 2023 and 2022 shown in the statements of net position is as follows:

	2023	2022
Fair value of investments	$ 335,665	$ 317,876
Accrued interest receivable	886	602
Total	$ 336,551	$ 318,478
Statements of Net Position:		
Marketable debt securities	$ 84,516	$ 78,355
Restricted for debt services	124,255	126,691
Restricted for decommissioning	126,180	111,832
Restricted for other	1,600	1,600
Total investments, including accrued interest receivable	$ 336,551	$ 318,478

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(7) Restricted Assets

The General Bond Resolution and Project agreements restrict the use of bond proceeds, PMPA revenues, and PMPA funds on hand. Certain restrictions define the order in which available funds may be used to pay costs; other restrictions require minimum balances or accumulation of balances for specific purposes. On December 31, 2023 and 2022, management believes PMPA was in compliance with all such restrictions and held the following restricted assets:

	2023		2022	
	Fair Value	Amortized Cost	Fair Value	Amortized Cost
Debt services - bond principal	$ 64,562	$ 64,562	$ 65,388	$ 65,388
Debt services - bond fixed rate interest	10,862	10,862	11,812	11,812
Debt service reserve	44,263	45,679	44,724	47,671
Reserve and contingency	4,568	4,568	4,767	4,767
Decommissioning	126,180	129,411	111,832	118,730
Special reserve	1,600	1,600	1,600	1,600
	$ 252,035	$ 256,682	$ 240,123	$ 249,968
Funds are comprised of:				
Marketable debt securities	$ 251,149	$ 255,796	$ 239,521	$ 249,366
Accrued interest receivable	886	886	602	602
	$ 252,035	$ 256,682	$ 240,123	$ 249,968

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(8) Net Costs Recoverable from Future Participant Billings

As described in Notes 1 and 2, rates charged to Participants are structured to systematically provide for debt requirements and operating costs of PMPA. The expenses and revenues excluded from rates are capitalized and expensed in such periods as they are intended to be included in rates.

Net costs recoverable from future Participant billings on December 31, 2023 and 2022 are as follows:

	2023	2022	Change
	(Cumulative totals)		
Items to be recovered in future Participant billings:			
Interest expense	$ 509,088	$ 494,783	$ 14,305
Depreciation expense	411,681	408,061	3,620
Amortization of redemption and defeasance losses	366,125	361,891	4,234
Debt issuance costs and amortization of bond discounts and premiums	54,858	63,975	(9,117)
Nuclear fuel expenses	873	873	-
Letter of credit fees	5,649	5,649	-
Other	2,390	2,390	-
	1,350,664	1,337,622	13,042
Items reducing future Participant billings:			
Investment income	(76,528)	(76,528)	-
Reserve and contingency deposits	(117,840)	(117,840)	-
	(194,368)	(194,368)	-
Revenues (expenses) recognized:			
Interest, depreciation, amortization expense included in Participant billings for debt principal payments	(899,530)	(847,444)	(52,086)
Capital appreciation bond interest deposits	(37,735)	(25,426)	(12,309)
Reserve and contingency revenue applied to expenses	60,863	56,231	4,632
	(876,402)	(816,639)	(59,763)
Net costs recoverable from future Participant billings	$ 279,894	$ 326,615	$ (46,721)

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(8) Net Costs Recoverable from Future Participant Billings – Continued

The following expenses will be recognized in future periods when rates charged to Participants produce revenues sufficient to retire the debt that funded those costs:

- Interest expense on PMPA's bonds and variable rate demand obligations along with an associated letter of credit, banking, and remarketing fees (except interest and fees related to capital appreciation bonds) paid from bond proceeds during a defined "Construction Period" (net of income earned on the temporary investment of those bond proceeds);
- Interest expense on capital appreciation bonds accrued but not paid until maturity;
- Debt issuance expenses, amortization of bond discounts and premiums, defeasance losses, redemption losses, and organization costs paid from or included in bond proceeds;
- Depreciation on utility plant constructed with bond proceeds and amortization of nuclear fuel acquired with bond proceeds; and
- Certain other project costs paid from bond proceeds.

Additionally, PMPA's General Bond Resolution requires Participant revenues to be established at levels sufficient to provide specified deposits into a Reserve and Contingency fund. Monies in that fund are used to construct or acquire utility plant assets. The recognition of such revenues is considered unearned until the depreciation is recorded on the assets constructed or acquired with those monies.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(9) Bonds Payable

Bonds payable, net on December 31, 2023 and 2022 consist of the following:

	2022	Additions	Reductions	2023	Due within one year
1993 Refunding Series Electric Revenue Bonds, payable from 2023 to 2025 with interest at 5.38%	$ 32,185	$ -	$ 425	$ 31,760	$ 450
2004A Capital Appreciation Electric Revenue Bonds, payable annually from 2023 to 2024, 2026 to 2032 and 2034 with interest ranging from 5.46% to 5.80%	95,091	-	8,230	86,861	6,531
2009B Electric Revenue Bonds (Build America Bonds), payable 2031 to 2034 with interest at 7.036% (35% interest federally refunded yielding net interest at 4.57%)	26,490	-	-	26,490	-
2012C Refunding Series Electric Revenue Bonds	4,485	-	4,485	-	-
2015A Series Electric Revenue Bonds, payable annually from 2023 to 2034 with interest ranging from 3.50% to 5.00%	50,460	-	5,165	45,295	5,425
2017A Series Electric Revenue Bonds, payable annually from 2024 to 2025 with interest at 5.00%	9,565	-	-	9,565	7,755
2017B Series Electric Revenue Bonds, payable annually from 2024 to 2025 with interest at 5.00%	22,625	-	-	22,625	19,135

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(9) Bonds Payable – Continued

	2022	Additions	Reductions	2023	Due within one year
2021A Refunding Series Electric Revenue Bonds, payable annually from 2023 to 2025 with interest at 4.00%	$ 38,870	$ -	$ 10,975	$ 27,895	$ 10,870
2021B Refunding Series Electric Revenue Bonds, payable annually from 2027 to 2034 with interest ranging from 4.00% to 5.00%	97,420	-	-	97,420	-
2021C Refunding Series Electric Revenue Bonds, payable annually from 2027 to 2034 with interest at 5.00%	90,520	-	-	90,520	-
2021D Refunding Series Electric Revenue Bonds, payable annually from 2026 to 2034 with interest at 4.00%	91,410	-	-	91,410	-
2021E Refunding Series Electric Revenue Bonds, payable annually from 2023 to 2025 with interest at 5.00%	31,165	-	22,010	9,155	1,920
Total bonds payable	590,286	-	51,290	538,996	52,086
Less unamortized discounts	(134)	-	(53)	(81)	-
Plus unamortized premiums	54,091	-	9,170	44,921	-
Bonds payable, net	$ 644,243	$ -	$ 60,407	$ 583,836	$ 52,086

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(9) Bonds Payable – Continued

Bonds payable, net on December 31, 2022 and 2021 consist of the following:

	2021	Additions	Reductions	2022	Due within one year
1993 Refunding Series Electric Revenue Bonds, payable from 2022 to 2025 with interest at 5.38%	$ 32,590	$ -	$ 405	$ 32,185	$ 425
2004A Capital Appreciation Electric Revenue Bonds, payable annually from 2022 to 2024, 2026 to 2032 and 2034 with interest ranging from 5.38% to 5.80%	102,670	-	7,579	95,091	8,230
2009B Electric Revenue Bonds (Build America Bonds), payable 2031 to 2034 with interest at 7.036% (35% interest federally refunded yielding net interest at 4.57%)	26,490	-	-	26,490	-
2012C Refunding Series Electric Revenue Bonds, payable 2023 with interest at 4.25%	4,485	-	-	4,485	4,485
2015A Series Electric Revenue Bonds, payable annually from 2022 to 2034 with interest ranging from 3.50% to 5.00%	51,935	-	1,475	50,460	5,165
2017A Series Electric Revenue Bonds, payable annually from 2024 to 2025 with interest at 5.00%	9,565	-	-	9,565	-
2017B Series Electric Revenue Bonds, payable annually from 2024 to 2025 with interest at 5.00%	22,625	-	-	22,625	-

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(9) Bonds Payable – Continued

	2021	Additions	Reductions	2022	Due within one year
2021A Refunding Series Electric Revenue Bonds, payable annually from 2022 to 2025 with interest ranging from 3.00% to 4.00%	$ 55,370	$ -	$ 16,500	$ 38,870	$ 10,975
2021B Refunding Series Electric Revenue Bonds, payable annually from 2027 to 2034 with interest ranging from 4.00% to 5.00%	97,420	-	-	97,420	-
2021C Refunding Series Electric Revenue Bonds, payable annually from 2027 to 2034 with interest at 5.00%	90,520	-	-	90,520	-
2021D Refunding Series Electric Revenue Bonds, payable annually from 2026 to 2034 with interest at 4.00%	91,410	-	-	91,410	-
2021E Refunding Series Electric Revenue Bonds, payable annually from 2023 to 2025 with interest at 5.00%	31,165	-	-	31,165	22,010
Total bonds payable	616,245	-	25,959	590,286	51,290
Less unamortized discounts	(186)	-	(52)	(134)	-
Plus unamortized premiums	64,730	-	10,639	54,091	-
Bonds payable, net	$ 680,789	$ -	$ 36,546	$ 644,243	$ 51,290

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(9) Bonds Payable – Continued

The bonds are special obligations of PMPA and are secured by future revenue and pledged monies and securities as provided by the Bond Resolution. Proceeds from these bonds provided financing for the construction of Catawba. The bonds are payable solely from electrical net revenues and are payable through 2034.

PMPA has advanced refunded certain bond issues as described in Note 10. PMPA is in compliance with its covenants under the Bond Resolution.

The following is a summary of bonds outstanding as of December 31, 2023. All principal payments are due on January 1 and are required to be deposited during the year prior.

Payment Due 1/1	Principal	Interest	Total
2024	$ 52,086	$ 33,334	$ 85,420
2025	66,565	18,855	85,420
2026	27,065	56,245	83,310
2027	37,397	46,276	83,673
2028	37,863	45,807	83,670
2029-2033	239,457	178,784	418,241
2034	78,563	5,069	83,632
	$ 538,996	$ 384,370	$ 923,366

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(10) Refunding and Defeasance of Debt

In prior years, PMPA defeased in-substance certain Electric Revenue Bonds by placing the proceeds of new bonds in an irrevocable trust fund to provide for future debt service payments on the old debt. Accordingly, the trust account asset and the liability for the defeased bonds are not included in the accompanying financial statements. On December 31, 2023 and 2022, $24,695 and $25,030 of the bonds are considered defeased in-substance, respectively.

(11) Reserve for Decommissioning

The owners of Catawba, including PMPA, have an obligation to decommission the station after its operating licenses expire. Management believes PMPA complies with the Nuclear Regulatory Commission requirements for funding future decommissioning costs. Since 1985, PMPA has been making regular deposits to segregated decommissioning accounts. Deposits pertaining to contaminated portions of the Project are held by a trustee. As of December 31, 2023 and 2022, the fair value of PMPA's assets that are legally restricted for settling the decommissioning obligation is $126,180 and $111,832, respectively.

Planned deposits into the decommissioning fund, together with interest earnings, are expected to be sufficient to pay PMPA's share of the projected cost of decommissioning the entire Catawba Station.

During 2003, Duke received a 19-year extension of the operating license for Catawba Unit 1 and a 17-year extension of the operating license for Catawba Unit 2 through 2043. In connection with the license extensions, PMPA received an updated decommissioning study in 2003 and has subsequently received updated decommissioning studies in December 2008, 2013, 2018, and 2023. The latest study, as of December 2023, estimates total decommissioning costs of $1,846,942 in 2023 dollars and presumes the Catawba Nuclear Station will be decommissioned as soon as possible following the expiration of its operating licenses in 2043. PMPA used the estimates from this study to determine its decommissioning liability in accordance with U.S. GAAP accounting for asset retirement obligations.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(11) Reserve for Decommissioning – Continued

PMPA used the following assumptions in determining its reserve for decommissioning:

	2023	2022
Period in which decommissioning liability was incurred	1985	1985
Agency's share of decommissioning costs per study (in 2023 and 2018 dollars, respectively)	$230,868	$225,319
Estimation of inflation	2.75%	2.4%
Credit adjusted risk-free interest rate	3.0%	5.0%
Estimated life of corresponding asset	20 years	25 years

The following is a roll forward of the reserve for decommissioning for the years ended December 31, 2023 and 2022:

	2023	2022
Reserve for decommissioning at January 1	$ 143,992	$ 137,032
Decomissioning reserve accretion	7,313	6,960
Change in decommissioning liability due to updated cost study	(5,795)	-
Reserve for decommissioning at December 31	$ 145,510	$ 143,992

(12) Employee Benefit Plans

PMPA maintains a defined contribution money purchase plan in compliance with Section 401(a) of the IRC. On behalf of all full-time employees, PMPA contributes 10% of the base salary to the money purchase plan. PMPA contributions totaled $179 and $165 in 2023 and 2022, respectively. Employee contributions may also be made to the Plan, providing combined employer and employee annual contributions do not exceed 25% of eligible employee compensation, or $30, whichever is less.

PMPA also maintains a deferred compensation plan under Section 457 of the IRC. In the past, on behalf of selected employees, PMPA has contributed to the deferred compensation plan; however, no such contribution was made in 2023 or 2022. Employee contributions may also be made to the deferred compensation plan providing combined employer and employee annual contributions do not exceed certain limitations.

Assets of the money purchase and deferred compensation plans are held by Empower Retirement, administrator, and trustee for PMPA, for the exclusive benefit of the employees.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(13) Other Postemployment Benefits ("OPEB")

PMPA's Postemployment Benefit Plan (the "Plan") provides other retiree medical benefits to qualified retirees. To qualify, a retiree must be 59½ years of age, have ten years of service and be an active employee of PMPA at the time of retirement. Medical benefits to qualified retirees are as follows: PMPA will maintain and pay up to 100% of premiums for group medical and dental insurance for each eligible retiree and up to 60% of premiums for the retiree's dependent spouse and children for the retiree's lifetime. After qualifying for Medicare, the covered individual will be covered under a supplemental insurance plan secondary to Medicare.

Membership in the healthcare benefit plan consisted of the following on December 31:

	2023	2022
Retirees	5	4
Active Employees	11	14
Total	16	18

Funding Policy

The required contribution is based on pay-as-you-go financing requirements.

Actuarial Assumptions and Other Inputs

The following actuarial assumptions and other inputs were used in calculating the OPEB liability for the years ended December 31, 2023 and 2022:

	2023	2022
Valuation date	December 31, 2023	December 31, 2021
Actuarial cost method	Entry age normal	Entry age normal
Discount rate	4.0% per annum	2.25% per annum
Salary increases	2.5% per annum	2.5% per annum
Mortality rates	1994 Group Annuity Mortality Static Table	1994 Group Annuity Mortality Static Table
Healthcare trend rates (Medical)	7% grading to 5.6% over 3 years and following the Getzen model thereafter to an ultimate rate of 4.04% by 2075	6% grading to 5.5% over 2 years and following the Getzen model thereafter to an ultimate rate of 4.04% by 2075
Healthcare trend rates (Vision)	5% per annum	5% per annum
Participation rates	100% of active participants are assumed to elect coverage in retirement 50% of active participants are assumed to cover a spouse in retirement	100% of active participants are assumed to elect coverage in retirement 50% of active participants are assumed to cover a spouse in retirement

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(13) Other Postemployment Benefits ("OPEB") – Continued

The following is a schedule of changes in the OPEB liability for the years ended December 31, 2023 and 2022:

	2023	2022
OPEB liability at January 1	$ 2,123	$ 1,983
Service cost	118	115
Interest	50	46
Experience gains	(24)	-
Changes of assumptions	(599)	-
Benefit paids	(29)	(21)
OPEB liability at December 31	$ 1,639	$ 2,123

The following table represents the net OPEB liability calculated using the stated medical trend assumption, as well as what the net OPEB liability would be if it were calculated using a medical trend rate that is one percentage point lower or one percentage point higher than the assumed medical trend rate.

	Medical Trend Rate		
	1% Decrease (6.0% to 4.6% over 3 years following Getzen model thereafter)	Current (7.0% to 5.6% over 3 years following Getzen model thereafter)	1% Increase (8.0% to 6.6% over 3 years following Getzen model thereafter)
OPEB Liability	$1,298	$1,639	$1,887

The following table represents the net OPEB liability calculated using the stated discount rate, as well as what the net OPEB liability would be if it were calculated using a discount rate that is one percentage point lower or one percentage higher than the current rate.

	Discount Rate		
	1% Decrease (3.0%)	Current (4.0%)	1% Increase (5.0%)
OPEB Liability	$1,970	$1,639	$1,375

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(13) Other Postemployment Benefits ("OPEB") – Continued

OPEB Expense and Deferred Outflows of Resources Related to OPEB

Experience gains or losses as well as changes in actuarial assumptions are recognized over the average working lifetime of all participants, which is 7.4 years and 8.1 years for the years ended December 31, 2023 and 2022, respectively. The following table summarizes OPEB expense for the years ended December 31, 2023 and 2022:

	2023	2022
Service cost	$ 118	$ 115
Interest	50	47
Experience gains	(3)	-
Changes of assumptions	(82)	-
Amortization of deferrals	112	112
Total OPEB expense	$ 195	$ 274

On December 31, 2023, the deferred inflows of resources related to OPEB was $188. On December 31, 2022, the deferred outflows of resources was $463. The deferred inflows of resources related to OPEB will be recognized in pension expense as follows:

Year ending December 31,	
2024	$ 28
2025	28
2026	(24)
2027	(54)
2028	(54)
Thereafter	(112)
	$ (188)

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(14) Disclosures Regarding Fair Value of Financial Instruments

U.S. GAAP requires disclosure of fair value information about financial instruments, whether or not recognized in the statement of net position, for which it is practicable to estimate fair value. Fair value estimates are made as of a specific point in time based on the characteristics of the financial instruments and the relevant market information. Where available, quoted market prices are used. In other cases, fair values are based on estimates using present value or other valuation techniques. These techniques involve uncertainties and are significantly affected by the assumptions used and the judgments made regarding risk characteristics of various financial instruments, discount rates, prepayments, estimates of future cash flows, future expected loss experience and other factors. Changes in assumptions could significantly affect these estimates. Derived fair value estimates cannot be substantiated by comparison to independent markets and, in many cases, may or may not be realized in an immediate sale of the instrument.

Under U.S. GAAP, fair value estimates are based on existing financial instruments without attempting to estimate the value of anticipated future business and the value of the assets and liabilities that are not financial instruments. Accordingly, the aggregate fair value amounts presented do not represent the underlying value of PMPA.

The following describes the methods and assumptions used by PMPA in determining carrying value and estimated fair value of financial instruments:

(a) Cash

Carrying value equals estimated fair value.

(b) Marketable Debt Securities

Marketable debt securities are reported at fair value and categorized within the fair value hierarchy established under U.S. GAAP. The hierarchy is based on the valuation inputs used to measure the fair value of the asset. Level 1 inputs are quoted prices in active markets for identical assets; Level 2 inputs are significant other observable inputs; Level 3 inputs are significant unobservable inputs. Gains or losses that result from market fluctuation are reported in the current period. As of December 31, 2023 and 2022, the Agency's investments included money market investments of $153,552 and $163,184, respectively, which were valued at amortized cost approximate fair value, and marketable debt securities of $182,113 and $154,692, respectively, which were valued at fair value using significant other observable inputs (Level 2 inputs).

(c) Participant Accounts Receivable and Other Accounts Receivable

Carrying amount approximates fair value due to the short-term nature of these instruments.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(14) Disclosures Regarding Fair Value of Financial Instruments – Continued

(d) Long-Term Debt

Carrying value of long-term debt coupon securities includes par, less unaccreted discounts, plus unamortized premiums, plus accrued interest payable. Carrying value also includes capital appreciation term bonds valued at the original price plus accrued interest payable.

The estimated fair value of long-term debt securities is derived from quoted market prices and includes accrued interest.

The estimated fair values of PMPA's long-term debt with carrying amount on December 31, 2023 and 2022 are as follows:

	2023		2022	
	Carrying Amount	Estimated Fair Value	Carrying Amount	Estimated Fair Value
1993 Electric Revenue Refunding Bonds	$ 32,567	$ 33,363	$ 32,955	$ 34,549
2004A-2 Electric Revenue Refunding Bonds	260,078	288,621	267,932	297,027
2009B Build America Bonds	27,422	30,892	27,422	31,159
2012C Electric Revenue Refunding Bonds	-	-	4,580	4,580
2015A Electric Revenue Refunding Bonds	47,825	47,163	53,687	53,307
2017A Electric Revenue Refunding Bonds	9,843	9,841	10,073	10,030
2017B Electric Revenue Refunding Bonds	23,286	23,261	23,946	23,709
2021A Electric Revenue Refunding Bonds	29,062	28,631	41,219	40,059
2021B Electric Revenue Refunding Bonds	116,555	108,120	119,163	107,241
2021C Electric Revenue Refunding Bonds	105,681	98,689	107,640	99,771
2021D Electric Revenue Refunding Bonds	105,844	97,929	107,552	97,074
2021E Electric Revenue Refunding Bonds	9,710	9,530	32,686	32,274
	$ 767,873	$ 776,040	$ 828,855	$ 830,780

The carrying amount of the bond is net of all discounts, premiums, and accrued interest on capital appreciation bonds.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(15) Nuclear Insurance and Other Risk Management

Nuclear Insurance. Duke owns and operates McGuire with two nuclear reactors. In addition, Duke operates and has a partial ownership interest in Catawba with two nuclear reactors. Nuclear insurance coverage is maintained in three program areas: nuclear liability coverage; property, decontamination and premature decommissioning coverage; and business interruption and/or extra expense coverage. The other joint owners of Catawba reimburse Duke for certain expenses associated with nuclear insurance premiums per the Catawba joint owner agreements. The Price-Anderson Act requires Duke to provide for public nuclear liability claims resulting from nuclear incidents to the maximum total financial protection liability. The maximum total financial protection liability, which currently is $13,700,000, is subject to change every five years for inflation and for the number of licensed reactors.

Primary Liability Insurance. Duke has purchased the maximum reasonably available private primary nuclear liability insurance as required by law, which currently is $450,000 per station.

Excess Liability. This policy currently provides $13,200,000 of coverage through the Price-Anderson Act's mandatory industry-wide excess secondary financial protection program of risk pooling. The $13,200,000 of coverage is the product of the current potential cumulative retrospective premium assessments of $138,000 times the current 96 licensed commercial nuclear reactors in the U.S. Under this program, operating unit licensees could be assessed retrospective premiums to compensate for public nuclear liability damages in the event of a nuclear incident at any licensed facility in the U.S. Retrospective premiums may be assessed at a rate not to exceed $20,500 per year per licensed reactor for each incident. The assessment may be subject to state premium taxes.

Duke is a member of Nuclear Electric Insurance Limited ("NEIL"), which provides property and accidental outage insurance coverage for Duke's nuclear facilities under the following two policy programs:

Accidental Property Damage, Nuclear Accident Decontamination and Premature Decommissioning Liability Insurance. This policy has limits of $1,500,000 for Catawba and McGuire. Catawba has a dedicated $1,250,000 of additional nuclear accident insurance limit above their dedicated underlying limit. McGuire also shares an additional $1,250,000 nuclear accident insurance limit above their underlying limit with other nuclear stations. This shared limit is not subject to reinstatement in the event of a loss. Catawba also has an additional $750,000 of non-nuclear accidental property damage limit.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(15) Nuclear Insurance and Other Risk Management – Continued

Accidental Outage Insurance. This policy provides some coverage, similar to business interruption, for losses in the event of a major accident property damage outage of a nuclear unit. Coverage is provided on a weekly limit basis after a significant waiting period deductible and at 100% of the applicable weekly limits for 52 weeks and 80% of weekly limits for up to the next 110 weeks. Coverage is provided until these applicable weekly periods are met, where the accidental outage policy limit will not exceed $490,000 for Catawba and McGuire. NEIL sub-limits the accidental outage recovery up to the first 104 weeks of coverage not to exceed $328,000 from non-nuclear accidental property damage. Coverage amounts decrease in the event that more than one unit at a station is out of service due to a common accident. All coverages are subject to sublimits and deductibles.

Losses resulting from acts of terrorism are covered as a common occurrence, such that if terrorist acts occur against one or more commercial nuclear power plants insured by NEIL within a 12-month period, they would be treated as one event and the owners of the plants, where the acts occurred, would share one full limit of liability (currently $3,200,000). NEIL sub-limits the total aggregate for all of their policies for non-nuclear terrorist events to approximately $1,800,000.

In the event of NEIL losses, NEIL's Board of Directors may assess companies' retroactive premiums of amounts up to ten times their annual premiums for up to six years after a loss. NEIL has never exercised this assessment. The maximum aggregate annual retrospective premium obligations for Duke are $151,000.

Pursuant to regulations of the Nuclear Regulatory Commission, each company's property damage insurance policies provide that all proceeds from such insurance be applied, first, to place the plant in a safe and stable condition after a qualifying accident and second, to decontaminate before any proceeds can be used for decommissioning, plant repair or restoration.

In the event of a loss, the amount of insurance available might not be adequate to cover property damage and other expenses incurred. Uninsured losses and other expenses, to the extent not recovered by other sources, could have a material adverse effect on Duke's results of operations, cash flows or financial position.

The maximum assessment amounts include 100% of Duke's potential obligation to NEIL for Catawba. However, the other joint owners of Catawba are obligated to assume their pro rata share of liability for retrospective premiums and other premium assessments resulting from the Price-Anderson Act's excess secondary financial protection program of risk pooling or the NEIL policies.

PIEDMONT MUNICIPAL POWER AGENCY

Notes to Financial Statements

December 31, 2023 and 2022

(Dollars in thousands)

(15) Nuclear Insurance and Other Risk Management – Continued

PMPA also carries building and personal property insurance for the administrative offices, health insurance for all active employees, and workers' compensation insurance in accordance with statutory requirements. The policy limit for the building and personal property insurance is $6,581.

(16) Commitments and Contingencies

The Agency is subject to lawsuits, claims, investigations, and proceedings, which arise in the ordinary course of business. If management believes that a loss arising from these matters is probable and can be reasonably estimated, a loss is recorded. As additional information becomes available, these matters are assessed and the estimates are revised, if necessary. Based on the currently available information, management believes the ultimate outcome of these matters, individually and in the aggregate, will not have a material, adverse effect on the Agency's business, financial condition, or results of operation.

In 2019, PMPA was named a defendant in a lawsuit by two Participants with respect to the allocation of costs amongst all Participants. In January 2024, the lawsuit was settled with two Participants receiving a combined cash payment of $55 million, of which $10 million is to be paid by PMPA out of working capital funds and $45 million is to be paid by the remaining eight Participants. The $45 million cash payment is contingent upon PMPA securing financing, on behalf of the remaining eight participants, and will be included in PMPA's financial statements once the financing is secured. Because PMPA's portion of the settlement was reasonably estimable and probable on December 31, 2023, PMPA has included a $10 million settlement liability in the accompanying statements of financial position and a related $10 million expense included in other nonoperating expenses in the accompanying statements of revenues, expenses and changes in net position. The financing associated with the $45 million cash payment will be excluded from PMPA's wholesale rates and net costs recoverable from future Participant billings, and will be paid by the remaining eight Participants during the life of the to be acquired financing.

In July 2023, PMPA was named a defendant in a lawsuit by a Participant regarding the terms of the Project Sales Agreements. The lawsuit seeks a declaratory judgment regarding final accounting procedures set forth within the Project Sales Agreements. The impact of this lawsuit, if any, on the PMPA financial statements is currently unknown and no provision for this litigation has been made in the accompanying financial statements.

(17) Subsequent Events

As referenced in Note 16, PMPA entered into a settlement agreement in January 2024 related to the lawsuit filed by two Participants with regards to the allocation of costs amongst all Participants. The associated $10 million settlement liability, accrued at December 31, 2023, was paid in February 2024.

SUPPLEMENTARY INFORMATION

PIEDMONT MUNICIPAL POWER AGENCY

Schedule of Revenues and Expenses Actual and Budget

Per the Bond Resolution and Other Agreements

Year Ended December 31, 2023

(Dollars in thousands)

	Actual Revenues and Expenses	Budgeted Revenues and Expenses	Actual Over (Under) Budget
Revenue:			
Sales of electricity to Participants	$ 220,132	$ 231,379	$ (11,247)
Sales of electricity to Duke	11,200	12,136	(936)
Sales of electricity to Others	6,212	3,222	2,990
Interest income	7,230	7,248	(18)
Other	1,421	1,572	(151)
Total Revenue	$ 246,195	$ 255,557	$ (9,362)
Expenses:			
Catawba operating expenses:			
Operation and maintenance	$ 24,837	$ 27,470	$ (2,633)
Nuclear fuel amortization	12,702	13,048	(346)
Purchased power-Duke	11,349	12,656	(1,307)
Payments in lieu of taxes	9,882	8,406	1,476
Purchased power:			
Supplemental Suppliers	17,727	28,831	(11,104)
Participants	13,401	14,297	(896)
Other	2,497	2,499	(2)
Transmission services	8,861	9,142	(281)
Distribution services	608	600	8
Administrative and general:			
Agency	5,922	5,980	(58)
Duke	9,750	10,577	(827)
Other	15,164	6,215	8,949
Special fund deposits(withdrawals):			
Bond fund:			
Deposits from revenues	85,421	85,420	1
Decommissioning fund:			
Deposits from revenue	9,237	9,237	-
Interest income(1)	1,444	1,018	426
Revenue fund:			
Working capital	(1,421)	(2,441)	1,020
Net change in fair market value	(5)	-	(5)
Fuel	(15,401)	(16,370)	969
Debt service reserve release	(2,190)	(4,561)	2,371
Plant additions:			
Generation plant	20,863	25,253	(4,390)
General plant	46	55	(9)
Transmission plant	47	1,725	(1,678)
LDMSS/SCADA	53	130	(77)
Fuel acquisitions	15,401	16,370	(969)
Total Expenses	$ 246,195	$ 255,557	$ (9,362)

(1) Included in "Revenue: Interest Income."

PIEDMONT MUNICIPAL POWER AGENCY

Schedule of Revenues and Expenses

Per the Bond Resolution and Other Agreements

Year Ended December 31, 2023

(Dollars in thousands)

		FUNDS						
		Revenue	Operating	Bond		Reserve Contingency	Decommission	Supplemental Power
		Working Capital	Fuel Account	Principal Interest Retirement	Reserve			
Balances at beginning of year:								
Assets		$ 109,248	$ 7,885	$ 77,200	$ 44,724	$ 4,767	$ 111,832	$ 1,600
Liabilities		(11,877)	-	-	-	-	-	-
Net		97,371	7,885	77,200	44,724	4,767	111,832	1,600
Project revenues:								
Participants-Electric	(1)	220,132						
-Facilities rent	(1)	339						
-Other	(1)	1,082						
Duke Power-Electric	(1)	11,200						
Other-Surplus Electric	(1)	6,212						
Interest income	(1)	5,786					1,444	
Project costs:								
Operations and maintenance	(2)	(24,837)						
Nuclear fuel amortization	(3)	(12,702)	12,702					
Purchased power-Duke	(2)	(11,349)						
Decommissioning	(3)	(9,237)					9,237	
Administrative and general	(2)	(14,155)						
Payments in lieu of taxes	(2)	(9,759)						
Other	(2)	(15,164)						
Debt service	(3)	(83,231)		86,035	(1,991)	(199)		
Supplemental power costs:								
Purchased power:								
-Supplemental Suppliers	(2)	(17,727)						
-Participants	(2)	(13,401)						
-Other	(2)	(2,497)						
Transmission services	(2)	(8,861)						
Distribution services	(2)	(608)						
Administrative and general	(2)	(1,517)						
Payments in lieu of taxes	(2)	(123)						
Other fund changes:								
Net change in fair market value		5			1,530		3,667	
Payments:								
Capital additions	(2)	(21,009)	(15,401)	(87,811)				
Balances at December 31, 2022		$ 95,950	$ 5,186	$ 75,424	$ 44,263	$ 4,568	$ 126,180	$ 1,600
Assets		117,839						
Liabilities		(21,889)						
		$ 95,950						

(1) Deposited in appropriate fund

(2) Paid to third parties

(3) Transfers between funds