THOMAS & HUTTON

PRELIMINARY ENGINEERING REPORT ADDENDUM N0. 03

For

KIAWAH RIVER WWTP MBR UNITS ADDITION

J-25328.0006

Johns Island
CHARLESTON COUNTY, SOUTH CAROLINA

Prepared for
KIAWAH RIVER UTILITY COMPANY (KRUC)
May 2024

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1.0 INTRODUCTION

The original Preliminary Engineering Report (PER) for the Kiawah River wastewater treatment plant (WWTP) facility was approved by SCDHEC in LOA-004492 dated November 17, 2015. The subsequent discharge permit ND0088897 was issued December 30, 2015, and modified on September 19, 2016. After bidding the originally permitted project, it became necessary to modify the scope of the Phase 1 project to reduce the project cost and size the MBR treatment membranes to be a better match to actual flow. This would allow improved performance and easier operations. SCDHEC approved Addendum No. 01 which described components involved with the proposed reduction or change in scope for the new Phase 1 project. On October 10, 2023, SCDHEC approved Addendum No. 02 in LOA-0076781 for the additional equalization (EQ) storage and screening. The EQ Addition project is currently underway.

The purpose of this Addendum No. 03 is to increase the WWTP capacity to 129,000 gpd by adding new Kubota MBR treatment units and aerobic/anoxic swing zones for operational flexibility. The proposed Kubota MBR Units Addition project will provide a means to address higher than typical influent NH_3-N and TKN and will improve plant circulation for sludge operations.

This project is to address the high incoming NH_3-N and TKN which the current membranes cannot reduce enough to meet the ND permit limits for Total Nitrogen. This project is pursuant to the compliance schedule for Consent Order 23-039-W. The project will also address fecal coliform violations referenced in Consent Order 24-016-W by replacing damaged OVIVO MBR units with new Kubota MBR units. The proposed Kubota MBR Units Addition project will move forward as soon as possible upon SCDHEC approval for compliance with the Consent Order.

2.0 SITE PLAN

Exhibit A, Overall Site Plan-WWTP, shows the proposed modifications, including the location of two new Kubota MBR skids as integrated into the existing plant and the new EQ tank currently underway.

The Land Application System (LAS) installed in Phase 1 will remain the same and already has a built capacity of 129,037 gpd at an application rate approved by SCDHEC.

3.0 FLOW PROJECTIONS AND PHASING

Flow projections remain the same as explained in the original PER. However, the current thinking is the ultimate flow may be lower due to less development density in the service area. The Phase 1A LAS has sufficient capacity to serve this part of the treatment facility. Table 3-1 presents the anticipated phasing plan and respective permitted capacities. Table 3-2 shows proposed modifications to the phasing plan. See Section 4.0 for further discussion on the purpose of this phase of work.

Table 3-1: Original Phasing Plan			
Wastewater Treatment Plant		**Land Application System**	
Phase 1	0.110 mgd	Phase 1A	0.129 mgd
Phase 2	0.110 mgd	Phase 1B	0.127 mgd
Phase 3	0.110 mgd	Phase 2A	0.092 mgd
Phase 4	0.110 mgd	Phase 2B	0.096 mgd
Total	**0.440 mgd**		**0.444 mgd**

Table 3-2: Phasing Plan and Modifications			
Wastewater Treatment Plant		**Land Application System**	
Phase 1	0.110 mgd	Phase 1A	0.129 mgd
Phase 1A	0.019 mgd	N/A	N/A
Phase 2	0.137 mgd	Phase 1B & 2A	0.219 mgd *
Phase 3	0.133 mgd	Phase 2B	0.096 mgd
Phase 4	0.0410 mgd	N/A	N/A
Total	**0.440 mgd**		**0.444 mgd**

* If needed.

Realized incoming wastewater flows have been achieved in a quicker schedule over the last few years. So, in addition to addressing the high incoming NH_3-N and TKN, this project will bump treatment capacity slightly.

4.0 TREATMENT

As with the original PER, MBR technology will continue to be utilized for this project.

Historical sampling has been performed on actual incoming wastewater. Actual wastewater characteristics data shows that the WWTP receives high influent NH_3-N and TKN concentrations causing exceedances of the Total Nitrogen limit in the ND permit. Table 4-1 is a comparison of original textbook design parameters to actual raw influent sampling data at the WWTP. The data indicates the original parameters did not anticipate average influent loading as high as 69.5 mg/L for TKN and 60.8 mg/L for NH_3-N. This project will convert the existing Ovivo treatment train basins to be all anoxic and will include provisions to use the EQ tank as an anoxic zone to reduce the Nitrogen levels (if needed).

Influent wastewater is all domestic with no commercial and no industrial.

Table 4-1: Average Influent Concentration		
Parameter	**Textbook Design Values (mg/L)**	**Historical Data (mg/L)**
BOD_5	300	244
TSS	300	220
TKN	40	69.5
NH_3-N	25	60.8
TP	8.0	4.8

4.1 Modifications to Existing Treatment WWTP

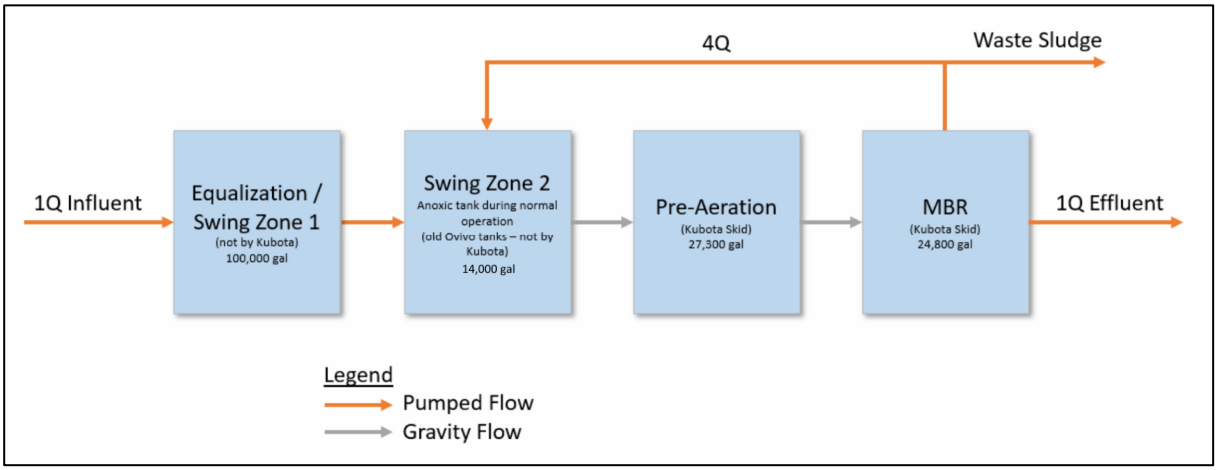
The existing Phase 1 plant includes one modular Ovivo MicroBLOX MBR treatment unit containing tankage for an anoxic basin and three MBR basins. The proposed project includes the addition of two new Kubota MBR treatment units. Each unit contains a pre-aeration zone, MBR zone and an enclosed equipment room.

Swing Zone 1: The EQ tank currently under construction is a 100,000-gallon storage tank. The EQ tank can be operated both aerobically, or anoxically by turning off the air and using jet mixing.

Swing Zone 2: Once the new Kubota MBR treatment units are operational, the existing membrane unit will be removed from the Ovivo MicroBLOX MBR basins, and the tankage will be converted to a mixed anoxic tank (swing zone).

Upon completion of the project, the treatment capacity of the Kiawah River WWTP will be 129,000 gpd. A straightforward process flow diagram is shown in Figure 4-1 below.

Figure 4-1: Process Flow Diagram



The Process Flow Diagram shown on Exhibit B illustrates the flow diagram for the entire treatment process. The existing Ovivo MicroBLOX MBR tankage will be converted and used as full anoxic zone treatment. New top mounted propeller mixers (such as Fusion FG-2M-1.0-70) will be added to each basin within the Ovivo train to function as anoxic.

The proposed project includes the installation of two different MBR system skids, with each skid containing one pre-aeration zone, one swing zone, one MBR zone, and one equipment room.

The existing MBR tanks at the facility will be re-worked to be converted into mixed anoxic tank volume. Based on the tank size estimate (14,000 gallons total) and biological design, this volume will be sufficient for current system flows and design loadings (excluding the flows listed for the optional adder third train).

The MBRs' permeate will be disinfected with a UV system and then will be pumped directly to the effluent storage lagoon and effluent pump station. The effluent pump station will pump to final discharge at the LAS.

4.2 Kubota MBR System Design

Table 4-2 below outlines the membrane specifications for the proposed Kubota MBR system.

Table 4-2:
Kubota MBR Specifications

Component	Specifications
Submerged Membrane Unit Model	SP337
Membrane Type	Flat Plate
Membrane Surface Area per Unit	3,627 ft^2
Design MLSS at MBR	13,000 mg/L
Total Number of Treatment Trains	2
Total Number of MBR Tank Areas	2
Total Number of Submerged Membrane Units	6 units (3 units per tank area)
Minimum Water Temperature	15 °C

Basis of design will remain the same as in the original PER and the effluent quality will be as indicated in Table 4-3. Influent wastewater will be all domestic with no commercial and no industrial.

Table 4-3:
MBR Effluent Quality

Parameter	Effluent	Unit
BOD_5	< 5	mg/L
TSS	< 5	mg/L
NH_3-N	< 1	mg/L
TN	< 9	mg/L

The package MBR treatment skids will be designed and configured to permit the modular expansion of the system.

5.0 FLOW EQUALIZATION (EQ) STORAGE

A 100,000-gallon EQ storage tank, transfer pumps and primary screen are underway at the Kiawah River WWTP. The Kiawah River WWTP EQ Addition project is described in Addendum No. 02 (LOA-0076781). The EQ tank will store incoming wastewater during peak events. The EQ tank will be equipped with an Air Jet Aeration System to maintain minimum dissolved oxygen (DO) of 1 mg/l. To provide operational flexibility, the EQ tank can be operated both aerobically, or anoxically by turning off the air and using jet mixing.

Flow into the EQ tank is pumped from the offsite master pump station. The wastewater will be transferred by offsite master pump through a new rotary drum screen and varies as the waste generation rate varies during the 24 hours of the day. Flow out of the EQ tank to the MBR treatment system will be accomplished by the equalization transfer pumps. The equalization transfer pumps will be equipped with Variable Frequency Drives (VFD). An air jet mixer is provided to prevent undesirable occurrences, such as settling out of solids, biological activity that would result in anaerobic conditions with consequent odor problems, or chemical or biological reactions that would change the nature of the wastewater.

6.0 EFFLUENT STORAGE

An effluent storage lagoon was constructed previously from compacted earth and lined with impervious HDPE material and was sized for more than 7-day storage of the Phase 1 effluent. The existing holding pond has a capacity of approximately 770,000 gallons at a 5.1-foot water depth. The full volume of the pond is 1,107,910 gallons. Following UV disinfection, treated tertiary effluent from the MBR plant is pumped into a junction box with outfalls to the lagoon and effluent pumping station wet well. The effluent storage lagoon will be expanded during future phases to provide 7-day storage of those future flows. This phase requires no modification to the existing effluent storage.

7.0 EFFLUENT PUMPING

The existing effluent pump station is located between the treatment facility and the effluent storage lagoon. Plant effluent is pumped into a junction box where it is distributed by gravity piping into both the effluent holding lagoon and pump station wet well. The pump station wet well is set at a lower elevation than the bottom of the lagoon and pumps are controlled by a level sensor mounted in the wet well. The pump station was designed as a triplex station with only two vertical turbine pumps installed during Phase 1. The pumps are designed for a flow of 360 gpm and deliver treated effluent directly to the LAS. Pump station flow to the LAS is measured with a mag meter and the signal will be transmitted to the SCADA system.

8.0 LAND APPLICATION

The spray land application system (LAS) will remain as previously permitted for Phase 1A. The five zones included in the Phase 1A LAS will have a combined capacity of 129,037 gpd at an application rate of 2"/acre/week. The zones are controlled by a SCADA system that will not allow any land application if the groundwater level in monitoring well #5 (located in Zone1.04 of the LAS) is less than 12 inches from the ground surface. The SCADA system alternates flow to the zones and limits application to each zone to no more than 1.2 hours per day. Other monitoring wells, as described in the ND Permit, have been installed and groundwater levels will continue to be monitored with transducers and data collection devices.

9.0 GROUNDWATER MONITORING WELLS

The original six groundwater monitoring wells, as previously permitted and installed, will remain the same except for MW #2. MW #2 was relocated due to a conflict with the spine road entering the development. MW #5 is the only well connected to SCADA. All other wells will be continuously monitored with transducers and data collectors which will be downloaded monthly, or as required.

10.0 EMERGENCY GENERATOR

An emergency generator was provided in Phase 1 and was sized to provide sufficient electrical power to operate the plant and effluent pump station, and a total of two generators will be provided for buildout.

11.0 WASTE SLUDGE HANDING AND PROCESSING

As incoming wastewater flows pick up, the waste frequency increases. To provide the operator with a redundant sludge waste dewatering container, the concrete pad will be expanded and another AquaCat 15 cy roll off dewatering container provided. This will allow alternating between the two containers and ensures one dewatering container will be onsite while one is emptied. The overall system was planned to be phased by adding additional containers. The contractor will provide additional supply piping to the new container with a switch valve.

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EXHIBITS

Kiawah River WWTP

J – 25328.0006
APRIL 2024

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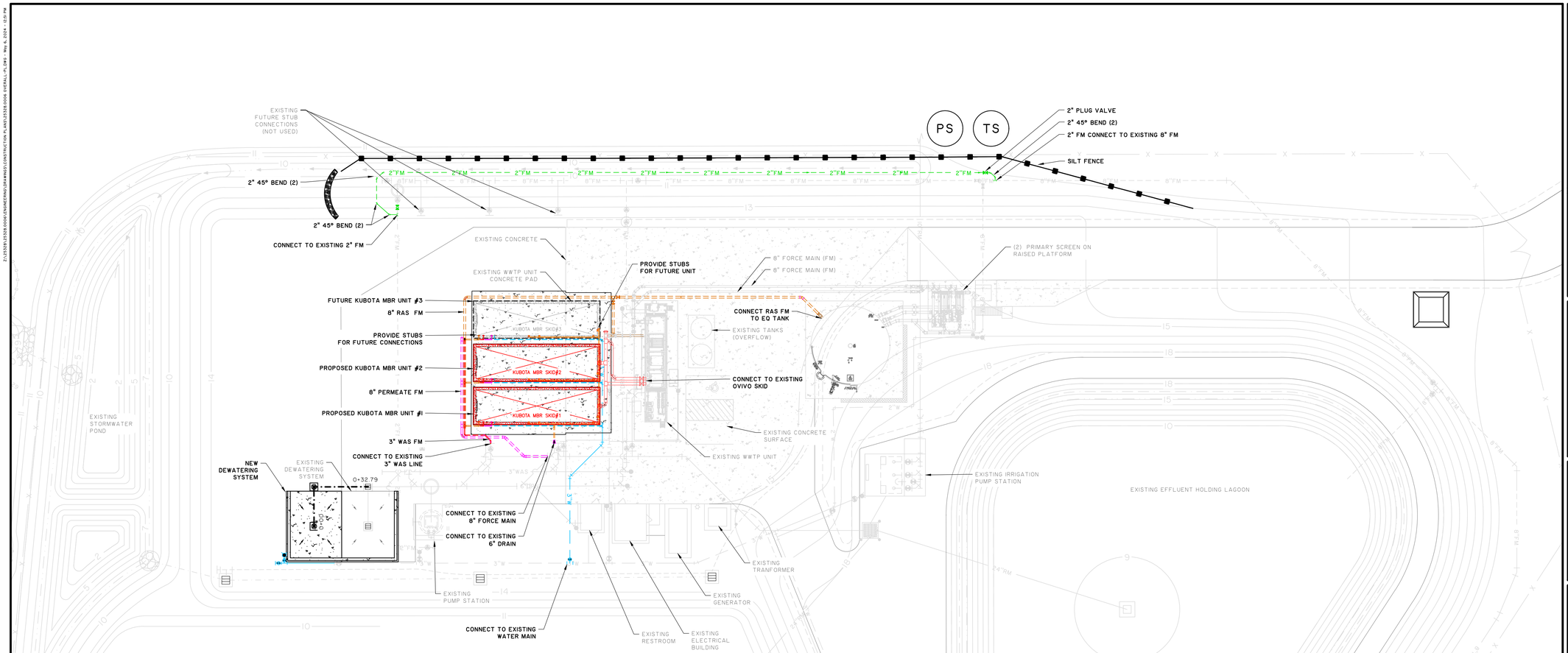
EXHIBIT A

OVERALL SITE PLAN – WWTP



EROSION CONTROL LEGEND

DESCRIPTION	PLAN SYMBOL
SILT FENCE	
CLEARING LIMITS	CL
TREE PROTECTION	
SURFACE ROUGHENING	OR LG
TEMPORARY SEEDING	TS
PERMANENT SEEDING	PS
SEDIMENT TUBE	
STABILIZED CONSTRUCTION ENTRANCE	
CONCRETE WASHOUT	

NOTES:
1. CONTRACTOR SHALL PROTECT EXISTING POWER, COMMUNICATION, WATER AND SEWER UTILITIES DURING CONSTRUCTION OF PROPOSED SYSTEM. ANY DAMAGE TO EXISTING SERVICES SHALL BE REPAIRED AT THE CONTRACTORS EXPENSE.
2. CONTRACTOR SHALL MAINTAIN ALL SERVICES (WATER, SEWER, ELECTRICAL) TO WWTP SYSTEM DURING CONSTRUCTION OF THE PROPOSED IMPROVEMENTS. ANY TEMPORARY WATER MAINS, SERVICES, SERVICE RELOCATIONS, AND REPAIRS SHALL BE CONSIDERED INCLUSIVE OF THE UTILITY RELOCATION PAY ITEM.

NO.	REVISIONS	BY	DATE

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25328.0006 OVERALL-PL - PER EXHIBIT A

KIAWAH RIVER WWTP - MBR UNITS ADDITION

PROJECT LOCATION:
KIAWAH RIVER DEVELOPMENT
JOHNS ISLAND, CHARLESTON COUNTY, SC

CLIENT/OWNER:
KIAWAH RIVER UTILITY COMPANY
3883 BETSY KERRISON PARKWAY
JOHNS ISLAND, SOUTH CAROLINA 29455

20 0 10 20
GRAPHIC SCALE:
1 INCH = 20 FEET

DATUM: HORIZ.: NAD 83 VERT.: NAVD 88

JOB NO:	25328.0006
DATE:	04/2024
DRAWN:	CGB
DESIGNED:	CGB
REVIEWED:	MFY
APPROVED:	MFY
SCALE:	1" = 20'

EX A

EXHIBIT B

PROCESS FLOW DIAGRAM

FUTURE PHASE

UTILITY WATER

FOR CIP

FOR WASHER SCREEN/SCREW PRESS

ROTARY DRUM SCREENS (FINE) AND SCREW PRESS

SCREENINGS TO OUTSIDE DISPOSAL

DUMPSTER

EXISTING EQ TRANSFER PUMPS (2 SKIDS, 4 PUMPS TOTAL)

EXISTING EQ TANK

MIXER (JET)

NEW MBR SKID 3

SWING ZONE

PRE AERATION

AEROBIC/MBR ZONE

PA/MBR BLOWERS (2 DUTY/I STANDBY)

WAS/RAS

DRAIN (4 TOTAL PER SKID)

PERMEATE

WAS/RAS PUMPS (I DUTY/ I STANDBY)

MBR PERMEATE (I DUTY/I STANDBY)

UV DISINFECTION

NEW MBR SKID 2

SWING ZONE

PRE AERATION

AEROBIC/MBR ZONE

PA/MBR BLOWERS (2 DUTY/I STANDBY)

WAS/RAS

DRAIN (4 TOTAL PER SKID)

PERMEATE

WAS /RAS PUMPS (I DUTY/ I STANDBY)

MBR PERMEATE (I DUTY/I STANDBY)

UV DISINFECTION

NEW MBR SKID 1

SWING ZONE

PRE AERATION

AEROBIC/MBR ZONE

PA/MBR BLOWERS (2 DUTY/I STANDBY)

WAS/RAS

DRAIN (4 TOTAL PER SKID)

PERMEATE

WAS/RAS PUMPS (I DUTY/ I STANDBY)

MBR PERMEATE (I DUTY/I STANDBY)

UV DISINFECTION

EXISTING PUMP STATION

EXISTING FINE SCREENS

MIXER (3)

MIXER (3)

ANOXIC BASIN

CONVERT ALL BASINS TO ANOXIC

CONVERT EXISTING TRAIN/UNIT TO ANOXIC BASIN (AEROBIC/MBR ZONE WILL BE ANOXIC BASIN) ONCE NEW KUBOTA UNITS (2) OPERATIONAL

WAS

DUMPSTER

SCREENINGS TO OUTSIDE DISPOSAL

SURGE TANKS (OVERFLOW)

DEWATERING HOPPER

POLYMER BLEND UNIT & TOTE

DEWATERING HOPPER

SLUDGE TO OUTSIDE DISPOSAL

CONNECT TO EXISTING 6-INCH DRAIN LINE

PLANT DRAIN PUMP STATION (2)

DRAIN

5' MH

DRAIN

EFFLUENT SAMPLER

EFFLUENT PUMP STATION (2)

NO.	REVISIONS	BY	DATE

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Mt. Pleasant, SC 29464 • 843.849.0200
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PROCESS FLOW DIAGRAM

KIAWAH RIVER WWTP - MBR UNITS ADDITION

PROJECT LOCATION:
KIAWAH RIVER DEVELOPMENT
JOHNS ISLAND, CHARLESTON COUNTY, SC

CLIENT/OWNER:
KIAWAH RIVER UTILITY COMPANY
3883 BETSY KERRISON PARKWAY
JOHNS ISLAND, SOUTH CAROLINA 29455

DATUM: HORIZ.: NAD 83 VERT.: NAVD 88

JOB NO:	25328.0006
DATE:	04/2024
DRAWN:	CGB
DESIGNED:	CGB
REVIEWED:	MFY
APPROVED:	MFY
SCALE:	NOT TO SCALE

EX B