Sheffield Gardens
SPDES Permit & WWTP
Engineer's Report

NYS Route 17k
Town of Montgomery
Orange County, NY 12549

PREPARED BY
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P&D #230014
December 2023
Revised March 2024
Revised March 2026

p+d Pitingaro & Doetsch Consulting Engineers

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1. INTRODUCTION

MILR, LLC has contracted Pitingaro & Doetsch Consulting Engineers, PC (P&D) to prepare an Engineer's Report and the design of a new wastewater treatment plant (WWTP) to serve the Sheffield Gardens project. A location map of the project is in **Appendix A.**

The project is located at NYS Route 17k (SBLs 29-1-5.1, 5.2, 5.3, 5.4 & 5.5) in the Town of Montgomery, Orange County, NY. The total area of the site is 53.08 acres. The site is located in the RA-1, RM-1, and B-2 zoning districts. The site will be used for open space, multi-family dwellings, and the WWTP. The existing uses of the site are vacant and single-family residential. The project proposes a facility that will serve multiple users for a mixed-use development, including 225 two-bedroom apartment units, 36 one-bedroom units and 31,000 sf of potential retail space. The development will comprise a population of approximately 625 people and therefore require wastewater treatment. All proposed facilities are to be serviced by central water and central sewer. There are three (3) existing drilled wells on site.

With this project comes a demand for and use of water. The nearest WWTP is the Village of Montgomery Sewage Treatment Plant about 2 miles to the west of the site. In 2021, the plant treated and discharged a daily average of 254,000 gallons per day (gpd). The existing SPDES permit flow limit for the plant is 0.75 million gallons per day (mgd). The new incoming flow could result in failure or permit limit excursions at the existing plant. It is also undesirable to pump the wastewater 2 miles west to the Village of Montgomery Sewage Treatment Plant; the topography will not support gravity sewers. Furthermore, the Village has rejected outside users. Thus, the only practical option is to design a new WWTP to serve Sheffield Gardens. The site is in the Town of Montgomery Sewer District No. 3.

The total proposed wastewater design flow is 58,000 gpd. To treat this flow, a new WWTP will be constructed. The treatment system will include a 60,000-gallon underground equalization (EQ) tank located upstream of the treatment process, followed by a fine screen for preliminary solids removal and a 9,000-gallon anoxic tank for biological nutrient removal. Flow will then be directed to four (4) Kubota membrane bioreactor (MBR) units to provide secondary treatment and additional nutrient removal. The treated effluent will subsequently pass through a UV disinfection system prior to discharge. A 2,000-gallon post-aeration tank will be installed downstream of the UV system to increase dissolved oxygen (DO) levels before discharge. A 10,000-gallon sludge holding tank will also be provided for the storage of waste activated sludge prior to off-site disposal.

The treated effluent will be discharged to a nearby tributary of the Wallkill River via an adjacent wetland that drains to the culvert crossing of NYS Route 17K. **Appendix B** presents the overall site plan. A SPDES permit will be required for discharge to the wetland.

This report has been prepared to obtain approval of the SPDES permit for the proposed facility from the New York State Department of Environmental Conservation (NYSDEC).

2. FLOW CALCULATION & WASTEWATER CHARACTERIZATION

Table 1 summarizes the proposed Sheffield Gardens facilities and their design flows. The 2014 New York State Design Standards for Intermediate Sized Wastewater Treatment Systems (2014 Standards) was used as design guidance. The total sewage flow is calculated to be 56,360. Given that there is no significant loss during the treatment process, we are proposing a discharge of 58,000 gpd of treated sanitary sewage for the SPDES permit.

Table 1. Sheffield Gardens Flow Calculation

No.	Facility	gpd
1	225 two-bedroom units	49,500
2	36 one-bedroom units	3,960
3	35-employee, 30,000 sf of potential retail	3,625
4	20% Reduction for Commercial Use water saving fixtures	-725
	Total	**56,360**
	Proposed SPDES	**58,000**

According to the 2014 New York State Design Standards for Intermediate Sized Wastewater Treatment Systems, the most important characteristics in the sewage are biological oxygen demand (BOD_5), total suspended solids (TSS), and fats, oils, and grease (FOG). Total phosphorus (TP) and ammonia (NH_4) are only considered in special cases. Nitrogen (N) and phosphorus (P) will be addressed in this case. The typical influent concentrations of these parameters are summarized in **Table 2**.

Table 2. Typical Concentrations (mg/L) of Residential Sewage Characteristics

Parameter	Residential Sewage Range	Residential Sewage Median
BOD_5	155 – 286	220.5
TSS	155 – 330	242.5
TP	6 – 12	9.0
NH_4-N	4 – 13	8.5

After determining the wastewater flow and characteristics, the organic loading and solid loading on the proposed WWTP are computed to be 98.4 lbs BOD_5/day and 108.2 lbs TSS/day. Organic loading and solid loading from the potential retail space is negligible as approximately 95% of the flow is residential. The calculation details are shown in **Table 4**.

Table 3. Sheffield Gardens BOD & TSS Loadings Calculation

No.	Facility	Flow (gpd)	mg BOD_5 /L	lb BOD_5/day	mg TSS/L	lb TSS/day
1	225 two-bedroom units	49,500	220.5	91.1	242.5	100.2
2	36 one-bedroom units	3,960	220.5	7.3	242.5	8.0
Total		-	-	**98.4**	-	**108.2**
Average		-	**220.5**	-	**242.5**	-

3. PROPOSED TREATMENT PROCESS

A Kubota MBR treatment system is proposed to achieve high effluent quality for BOD and nitrogen. The process utilizes the carbon present in the influent to biologically treat the sludge, eliminating the need for additional carbon-based chemicals such as methanol or acetate. The proposed MBR system consists of an equalization (EQ) tank, an anoxic tank, two MBR tanks operating in parallel, a UV disinfection unit, a re-aeration tank, and a sludge holding facility. Figure 1 shows the flow diagram of the proposed treatment process. Treated water will be discharged to Outfall 001 and ultimately into a minor tributary of the Middle Wallkill. **Appendix C** displays the WWTP layout.

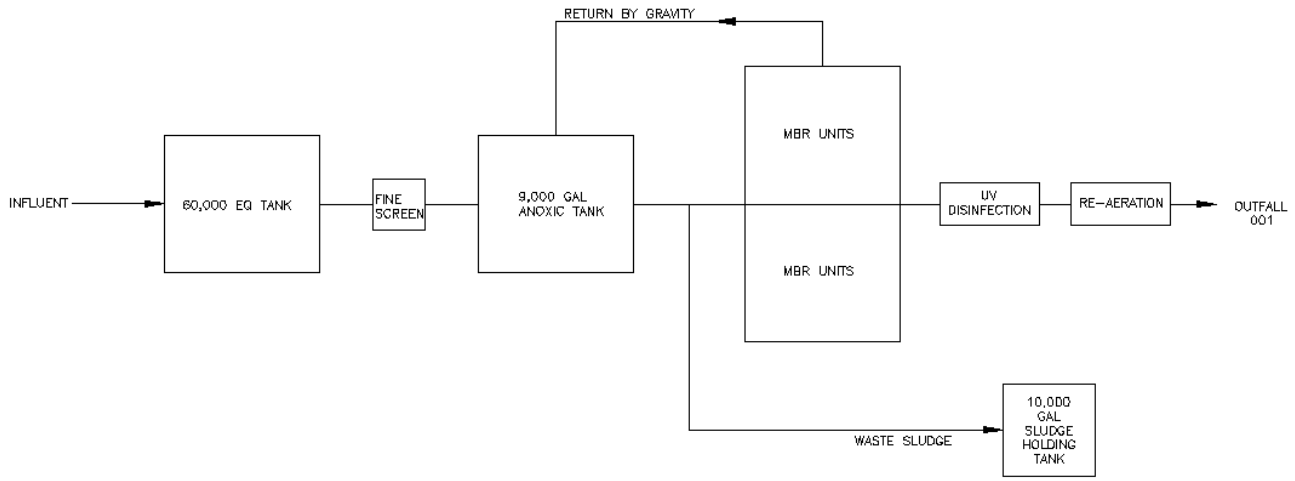


Figure 1. Process Flow Diagram

3.1. EQUALIZATION TANK

To comply with the NYS "Intermittent Stream Standard" for surface discharge, the EQ tank is designed to provide a minimum detention volume equal to the average daily flow. For the proposed SPDES design flow of 58,000 gpd, a 60,000-gallon equalization (EQ) tank will be installed upstream of the anoxic tank. The EQ tank will provide flow equalization, smoothing diurnal variations and protecting downstream processes from peak flows. Aeration will be provided to maintain solids in suspension and prevent septic conditions during detention. The tank will be installed underground and located outside of the WWTP building. With the EQ tank in place, the downstream MBR and anoxic tanks can be sized based on the average daily flow of 58,000 gpd rather than the peak daily flow, ensuring consistent biological treatment performance. **Table 7** summarizes the EQ tank specifications.

Table 4. EQ Specification

Parameter	Value	Unit	Reference
Total Volume	60,000	gallon	Proposed tank capacity
Influent BOD_5 Conc.	220.5	mg/L	Determined in Table 4
Influent TSS Conc.	242.5	mg/L	
Influent P Conc.	10	mg/L	
Estimated Effluent BOD_5 Conc.	154.35	mg/L	30% removal, 2002 EPA OWTS Manual
Estimated Effluent TSS Conc.	169.75	mg/L	30% removal, 2002 EPA OWTS Manual

3.2. FINE SCREEN

A fine screen will be installed upstream of the anoxic tank to remove rags, plastics, and other fine debris that could interfere with downstream biological treatment processes. The screening system will consist of two mechanically cleaned fine screens (one duty and one standby) to provide redundancy and ensure continuous operation during maintenance or equipment failure. Each screen will be designed to handle peak flow conditions and will automatically activate based on differential head levels. Screenings will be compacted and disposed of in accordance with applicable regulations. This configuration will protect pumps and mixers in the anoxic tank, reduce the risk of clogging, and enhance overall process reliability within the wastewater treatment plant.

3.3. ANOXIC TANK

A 9,000-gallon anoxic tank will be provided downstream of the fine screen and upstream of the membrane bioreactor (MBR) units to facilitate biological nutrient removal. The anoxic tank will promote denitrification by maintaining conditions without dissolved oxygen, allowing nitrate nitrogen to be converted to nitrogen gas through microbial activity. Mixed liquor from the aerobic treatment process will be recirculated to the anoxic tank to support the denitrification process. The tank will be sized to provide adequate detention time under

average design flow conditions and will be equipped with internal mixing to keep solids in suspension and ensure effective contact between microorganisms and influent wastewater.

$$Anoxic\ Volume = \frac{58{,}000\ gpd}{24\ hr/day} * Hydraulic\ Retention\ Time\ (HRT)$$

$$HRT = \frac{9{,}000\ gal * \frac{24\ hr}{day}}{58{,}000\ gpd} = 3.7\ hr$$

3.4. MEMBRANE BIOREACTOR UNITS

A preliminary design was based around the SP225 Submerged Membrane Unit (SMU). Kubota's SP series of SMUs offer state-of-the-art technology. The SP series was developed in 2011 to create a Submerged Membrane Unit which is more energy efficient and faster to assemble on-site then the preceding RM/RW series, while still maintaining the reliability and simplistic operation that is characteristic of Kubota's MBR systems. An overview of the structure of the SP series is provided below.

Table 5. Membrane Equipment Specifications

Component	MBR Specifications
Membrane Model	SP225
Membrane Surface Area per Unit	2,422 ft^2
Design MLSS* at MBR	11,000 mg/L
Number of Membrane Tanks	2 Tanks
Total Number of Submerged Membrane Units	4 units (2 units per tank)
Minimum Wastewater Temperature	10°C
Tank Dimension (Each)	12 ft × 12 ft × 10.5ft
Tank Volume (Each)	11,309 Gallons
Total Tank Volume	22,618 Gallons

* MLSS: Mixed liquor suspended solids

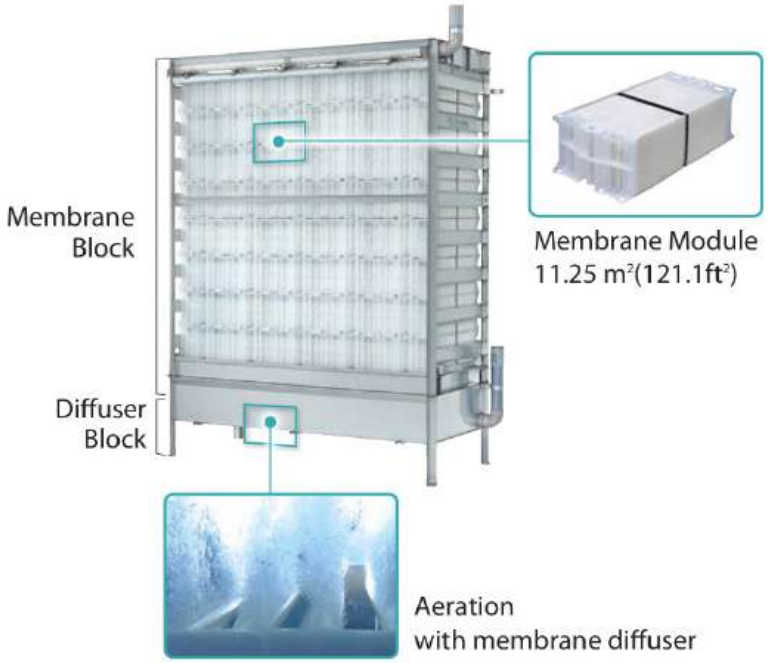


Figure 2. SP Series Unit Structure

One main takeaway is the cartridge structure of the SP series units, which differs from previous Kubota products. Forty individual membrane sheets are permanently fixed to each membrane module. Each module includes a permeate box and module joint on both ends. These modules are connected in a tubeless configuration by the integrated module joints to form a single cassette. Built-in retainers connect the assembled cassette to a permeate manifold which is connected to the permeate header. The SP series is suited for medium to large installations and offers fast assembly, easy maintenance, and up to 15% lower energy use for air scour in the MBR than other Kubota systems. An overview of the assembly and module connection is displayed below.

Kubota's membrane sheet is made from chlorinated polyethylene with an average pore size of 0.2 micron (maximum 0.4 micron). This membrane is much thicker than other membranes to provide long-lasting durability and features high porosity to enable high flows. This pore size has been designed as the optimum balance between water quality and quantity and will be a great option for the proposed flow of the new WWTP.

Each MBR uses the process of activated sludge (secondary treatment) and membrane filtration (tertiary treatment). Membrane units are installed in the activated sludge reactor, where sludge and treated water are separated by means of physical filtration. MBRs eliminate the need for gravity sedimentation that are required for conventional activated sludge (CAS), thereby eliminating the need for final clarifiers.

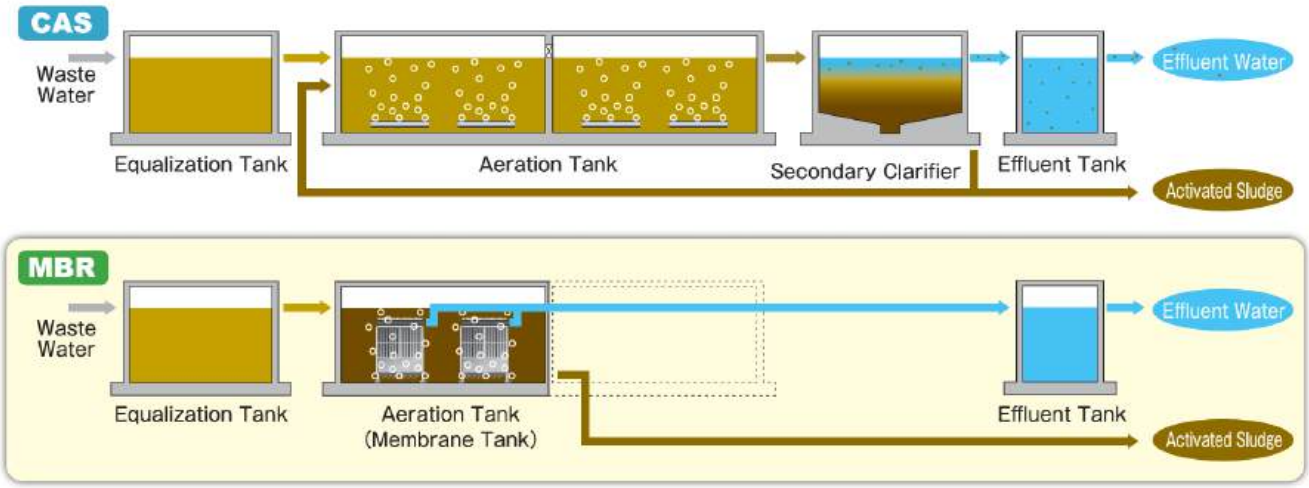


Figure 3. Comparison of CAS and MBR

The Kubota SP series can operate at mixed liquor concentrations ranging from 5,000 mg/L to 13,000 mg/L. This allows the system to withstand influent load fluctuations and reduces aeration and waste sludge volume.

The primary method of membrane cleaning for the Kubota MBR system is the air scour provided by the diffusers at the base of the membrane units. The chemical cleaning system eliminates the need for separate tanks or tank linings for immersive cleaning. The system consists of a venturi injector which feeds the cleaning solution through the permeate piping using portable water. The venturi system can be skid-mounted on a wall, as displayed below.

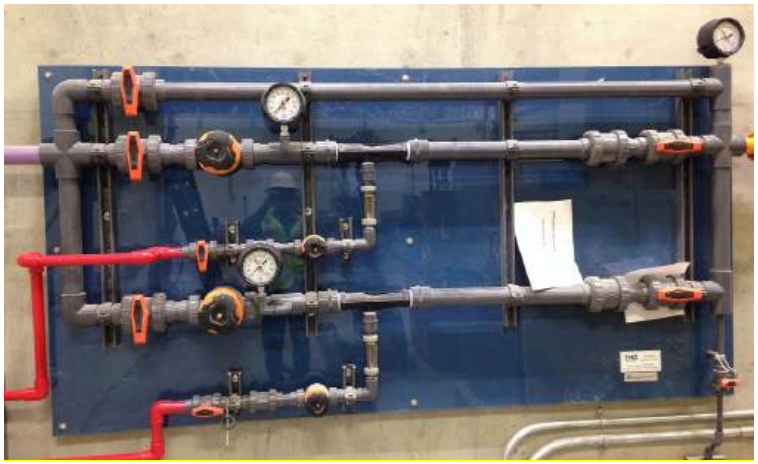


Figure 4. Skid-Mounted Clean-In-Place System

The cleaning process involves stopping the operation, opening a vent, injecting a chemical solution, and allowing that solution to soak in the membrane units for 2 to 4 hours.

Organic fouling can be cleaned with a 0.5% sodium hypochlorite (NaClO) solution two-four times a year. Inorganic fouling such as iron or aluminum can be cleaned by a 1% oxalic or citric acid solution once a year. If the residual chemical cannot be discharged from the system, it can be sent back to the raw water inlet or to the bioreactor to be neutralized. No recovery cleaning is necessary for operation of the Kubota MBR system.

Kubota membranes have a demonstrated service life of approximately 10 years or more under normal municipal wastewater conditions, and long-term installations have shown very low failure rates over that period. While actual lifespan depends on influent characteristics, fouling potential, cleaning practices, and operational control, properly operated systems commonly achieve a decade or more of reliable performance before membrane replacement is necessary. Membrane removal is not part of routine maintenance and typically occurs only at the end of the membrane's service life or in the event of damage.

Organic Compounds and Suspended Solids Treatment (BOD and TSS removal)

To meet nutrient level requirements, the influent concentrations were applied to the maximum monthly flow for determination of biological process volumes. **Table 8** below displays the anticipated effluent volumes using the MBR treatment process from the Kubota MBR proposal.

Table 6. Influent and Effluent Concentrations

Parameter	Max Month Influent Concentration	Anticipated Effluent Limit
Biological Oxygen Demand (BOD)	154.35 mg/L	<5 mg/L
Total Suspended Solids (TSS)	169.75 mg/L	<10mg/L
TKN	45 mg/L	-
Total Phosphorus (P)	8 mg/L	<1 mg/L
Total Nitrogen (N)*	-	<10 mg/L

* For fully nitrified effluent, Ammonia (as N) is typically < 1 mg/L, often around 0.1–0.5 mg/L.

According to the Kubota MBR design standards, the MBR system is designed to be capable of treating the maximum monthly flow for up to 3 months, peak daily flow for up to 24 hours, and peak hourly flow for up to 4 hours.

As calculated in **Table 7**, the influent concentrations of BOD and TSS into the MBR system after the septic tank will be 154.35 mg/L and 169.75 mg/L. Assuming each MBR unit treats equal amounts of BOD and TSS simultaneously, **Table 9** breaks down the percent removal rate of a MBR unit.

Table 7. MBR Units Calculation

Parameter	Influent Load (lbs/day) per MBR Unit	Anticipated Effluent Limit (lbs/day) per MBR Unit	Percent Removal per MBR Unit
Biological Oxygen Demand (BOD)	18.68	<0.605	96.8%
Total Suspended Solids (TSS)	20.54	<1.21	94.1%
Total P	1.21	<0.121	90.0%

After the waste has been processed in the septic tank, each MBR unit treats about 18.68 lbs/day of BOD, 20.54 lbs/day of TSS, and 1.21 lbs/day of P. Using the anticipated effluent limit values from **Table 8,** the percent removal of BOD and TSS of each MBR unit were calculated to be approximately 96.8% and 94.1%, respectively. The percent removal of P by each MBR unit is 90.0%. Assuming that there will need to be removal of N and P, the anticipated effluent limits for P and N are predicted to be well below the draft effluent limit (DEL). The efficient removal of nutrients makes the Kubota MBR system a favorable option for the proposed WWTP. The calculations for the percent removal are shown below:

Percent Removal per MBR Unit for BOD:

$$58{,}000\ gallons = 219{,}553.88\ L$$

$$Anticipated\ Effluent\ Limit\ per\ MBR\ Unit = \frac{5\ mg/L}{4} = 1.25\ mg/L$$

$$Influent\ load: 154.35\frac{mg}{L} \times 219{,}533.88L = 33{,}885{,}054.378\ mg = 74.71\ lbs\ BOD$$

$$Influent\ load\ per\ MBR\ unit = \frac{74.71\ lbs\ BOD}{4\ MBR\ units} = 18.68\ lbs\ BOD$$

$$Removal\ per\ MBR\ Unit = \frac{1.25\frac{mg}{L} \times 219{,}533.88\ L}{453{,}592\ mg/lb} = 0.605 \text{ lbs/day}$$

$$Percent\ Removal = 1 - (\frac{0.605}{18.68} \times 100) = 96.8\%$$

Percent Removal per MBR Unit for TSS:

$$Anticipated\ Effluent\ Limit\ per\ MBR\ Unit = \frac{10\ mg/L}{4} = 2.5\ mg/L$$

$$Influent\ load: 169.75\frac{mg}{L} \times 219{,}533.88L = 37{,}265{,}876.13\ mg = 82.16\ lbs\ TSS$$

$$Influent\ load\ per\ MBR\ unit = \frac{82.16\ lbs\ BOD}{4\ MBR\ units} = 20.54\ lbs\ TSS$$

$$Removal\ per\ MBR\ Unit = \frac{2.5\frac{mg}{L} \times 219{,}533.88\ L}{453{,}592\ mg/lb} = 1.21\ \text{lbs/day}$$

$$Percent\ Removal = 1 - (\frac{1.21}{20.54} \times 100) = 94.1\%$$

Percent Removal per MBR Unit for P:

$$Anticipated\ Effluent\ Limit\ per\ MBR\ Unit = \frac{1\ mg/L}{4} = 0.25\ mg/L$$

$$Influent\ load: 10.0\frac{mg}{L} \times 219{,}533.88L = 2{,}195{,}338.8\ mg = 4.84\ lbs\ P$$

$$Influent\ load\ per\ MBR\ unit = \frac{4.84\ lbs\ BOD}{4\ MBR\ units} = 1.21\ lbs\ P$$

$$Removal\ per\ MBR\ Unit = \frac{0.25\frac{mg}{L} \times 219{,}533.88\ L}{453{,}592\ mg/lb} = 0.121\ \text{lbs/day}$$

$$Percent\ Removal = 1 - (\frac{0.121}{1.21} \times 100) = 90.0\%$$

Nitrification

Nitrification will occur combined with the BOD removal in each MBR unit. The effluent limit for Total Nitrogen (N) is anticipated to be <10 mg/L (or 1 mg/L for Ammonia as N), meaning each MBR unit produces <2.5 mg/L of effluent. The Kubota MBR tank works as both a solid-liquid separation tank and an aeration tank. Kubota's stable air scour and infrequent chemical cleaning allows aeration from the air scour to be used as oxygen supply for biological treatment. This reduces the oxygen requirement in the aeration tank.

3.5. UV DISINFECTION SYSTEM & AERATION

Treated effluent will enter a UV disinfection system before discharge into the creek. UV light can eliminate many microorganisms such as bacteria, protozoa, and harmful pathogens that are not eliminated by chlorine. Two UV units are proposed after the MBR units.

3.6. POST-AERATION TANK

A 2,000-gallon post-aeration tank will be provided downstream of the UV disinfection system to increase dissolved oxygen (DO) levels in the treated effluent prior to discharge. The tank will supply supplemental aeration to ensure compliance with effluent DO requirements and to improve overall effluent quality. The system will be designed to provide adequate contact time and oxygen transfer under average and peak flow conditions. This process step will help prevent low-oxygen conditions in the receiving water and support regulatory compliance. Re-aeration will be accomplished using MBR blowers with positive displacement at 6.7 psig. The re-aeration system will provide approximately 175 scfm of air to maintain an effluent DO concentration of > 7 mg/L. There will be two (2) MBR blowers on duty and one (1) on standby.

3.7. SLUDGE HOLDING TANK

A 10,000-gallon sludge holding tank will be included to store waste activated sludge generated from the membrane bioreactor (MBR) process. The tank will provide temporary storage capacity prior to periodic removal and off-site disposal by a licensed hauler. The holding tank will be designed to accommodate anticipated sludge production rates and will allow for controlled withdrawal and transport. This component will support stable plant operation by providing adequate sludge management capacity and operational flexibility.

$$Sludge\ production = 74.7\ lbs/day \times 0.6\ lb\ VSS/lb\ BOD \approx 44.8\ lbs/day$$

Assuming a sludge solids concentration of 1.5% (15,000 mg/L), the daily sludge volume is:

$$Volume = \frac{44.8\ \text{lbs/day}}{15{,}000\ \text{mg/L} \times 8.34} \times 1{,}000{,}000 \approx 360\ gallons/day$$

$$Pump\ Out\ Schedule = 10{,}000/360\ \text{gallons/day} = 28\ \text{days or 4 weeks}$$

With this production rate, the 10,000-gallon tank provides sufficient storage for approximately four weeks of sludge accumulation.

3.8. FLOW MONITORING AND EFLUENT SAMPLING

Effluent flow will be monitored continuously using a flow meter installed upstream of the aeration tank. The flow meter will measure and totalize the discharge to document the volume of treated wastewater processed by the system.

Effluent sampling will be conducted at the aeration tank. Samples will be collected at a location representative of the treated effluent and in accordance with applicable permit requirements. Sampling frequency and analytical parameters will be consistent with the conditions of the SPDES permit.

Table 8. Anticipated Effluent Discharge

Parameter	Anticipated Effluent
pH	6.5-8.5
Temperature	Monitor (°F)
BOD_5	<5 mg/L
Total Suspended Solids (TSS)	<10 mg/L
Settleable Solids	<0.1 mL/L
Dissolved Oxygen	>7 mg/L
Ammonia (as N)	<1 mg/L
Phosphorus, Total	<1 mg/L
Coliform, Fecal	<200 No./100 mL

3.9. OUTFALL

Treated effluent from the wastewater treatment plant (WWTP) will be discharged to Outfall 001 (41°31'29.7"N 74°12'34.9"W), a wetland that is hydraulically connected to a minor tributary of the Middle Wallkill (Segment ID 1306-0061; Class C; Water Index Number H-139-13-20 through 53). Effluent will be conveyed from the WWTP to the outfall via a 6-inch PVC SDR-35 pipe. The pipe will be installed at a minimum depth of four (4) feet below finished grade to provide frost protection. The outfall will discharge above the normal water surface elevation and will be protected with appropriately sized riprap to prevent erosion, scour, and instability at the point of discharge.

4. WASTEWATER TREATMENT PLANT

The wastewater treatment plant (WWTP) will be housed in a 48' × 38' split-face block building, providing a durable and low-maintenance structure for the treatment processes. To manage air circulation and minimize odor, the building will be equipped with two air intake louvers and two exhaust fans, ensuring controlled airflow throughout the facility. A standby generator will be located outside the building within a protective enclosure, allowing for reliable backup power while maintaining safety and minimizing noise. This design provides a functional, secure, and odor-controlled environment for the operation of the WWTP.

5. CONCLUSION

A WWTP will be constructed for the Sheffield Gardens project, consisting of a 60,000-gallon EQ tank, a fine screen, a process train with a 9,000-gallon anoxic tank and two 11,309-gallon MBR tanks operating in parallel for organics and solids removal, a UV system, a 2,000-gallon re-aeration tank, and a 10,000-gallon sludge tank. The WWTP will be capable of treating 58,000 gpd of wastewater, producing effluent that meets all applicable water quality limits. The treated wastewater is proposed to be discharged to the wetland connecting to a tributary creek of the Wallkill River.

Appendix A. Location Map

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

WALDEN QUADRANGLE
NEW YORK
7.5-MINUTE SERIES

SITE LOCATION

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 18T

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, July 2017 - December 2017
Roads..... U.S. Census Bureau, 2016
Names.....GNIS, 1980 - 2023
Hydrography.....National Hydrography Dataset, 2002 - 2020
Contours.....National Elevation Dataset, 2016
Boundaries.....Multiple sources; see metadata file 2021 - 2022

Wetlands.....FWS National Wetlands Inventory 1984 - 2011

MN 12°42′ 226 MILS
GN 0°32′ 9 MILS
UTM GRID AND 2023 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
WM
WL
Grid Zone Designation 18T

SCALE 1:24 000
1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1 MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 FEET

CONTOUR INTERVAL 20 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard.

NEW YORK
QUADRANGLE LOCATION

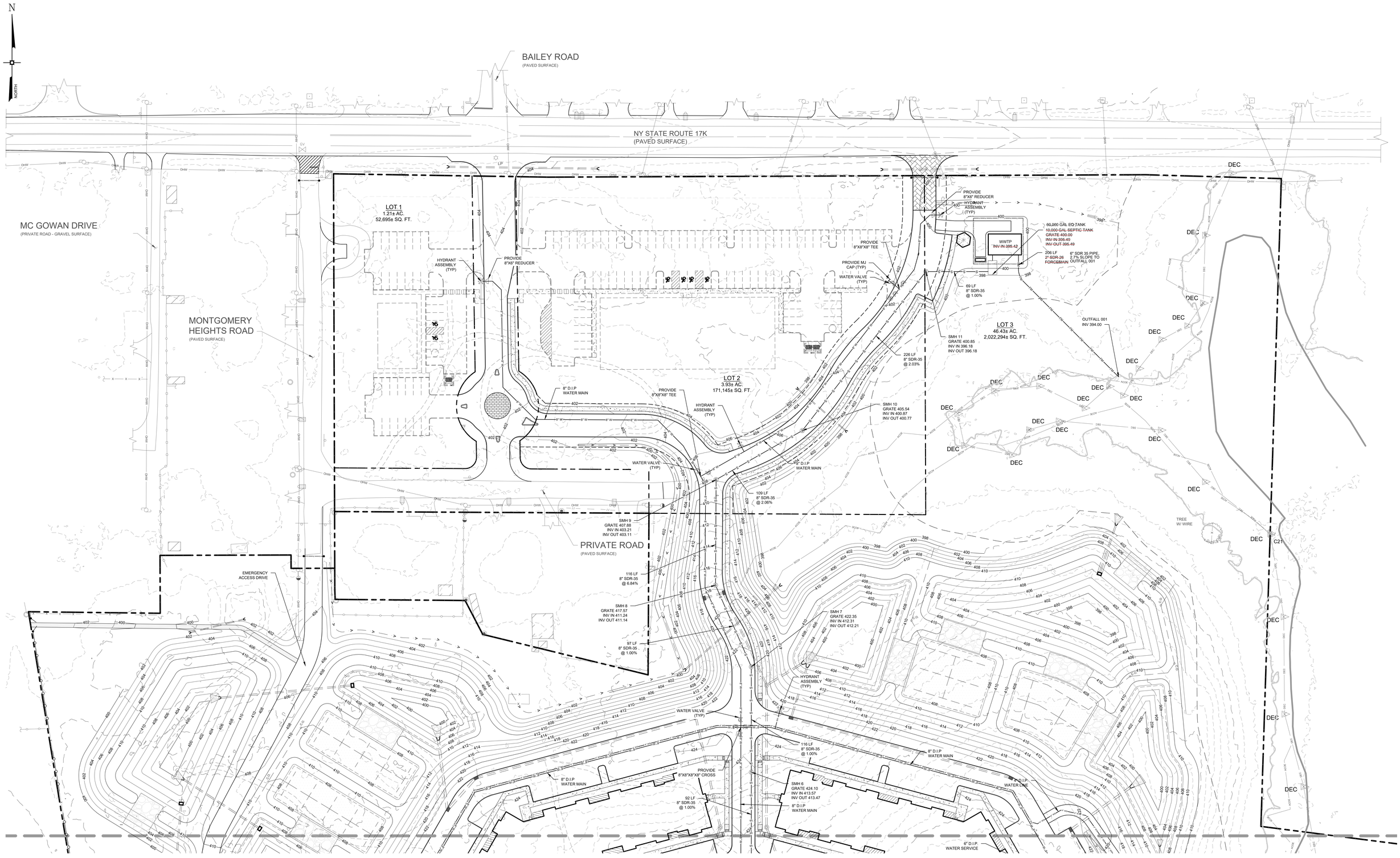
ADJOINING QUADRANGLES
1 Napanoch
2 Gardiner
3 Clintondale
4 Pine Bush
5 Newburgh
6 Goshen
7 Maybrook
8 Cornwall-on-Hudson

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

WALDEN, NY
2023

NSN 7643016387285
NGA REF NO. USGSX24K47223

Appendix B. General Site Plan



No.	DATE	DESCRIPTION
1	01/19/24	REVISED FOR DEIS SUBMISSION
2	06/28/24	REVISED PER DEIS TECHNICAL COMMENTS
3	09/20/24	REVISED PER DEIS TECHNICAL COMMENTS
4	12/02/24	REVISED PER DEIS TECHNICAL COMMENTS
5	12/19/25	REVISED FOR FEIS SUBMISSION

DRAWING STATUS — ISSUE DATE: 12/19/2025

THIS SHEET IS PART OF THE PLAN SET ISSUED FOR — SHEET NUMBER

☐ CONCEPT APPROVAL	N/A	OF	N/A
☑ PLANNING BOARD APPROVAL	7	OF	25
☐ OCDOH REALTY SUBDIVISION APPROVAL	N/A	OF	N/A
☐ OCDOH WATERMAIN EXTENSION APPROVAL	N/A	OF	N/A
☐ NYSDEC APPROVAL	N/A	OF	N/A
☐ NYSDOT APPROVAL	N/A	OF	N/A
☐ OTHER: _____	N/A	OF	N/A
☐ FOR BID / ~~CONSTRUCTION~~	N/A	OF	N/A

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40 0 20 40 80
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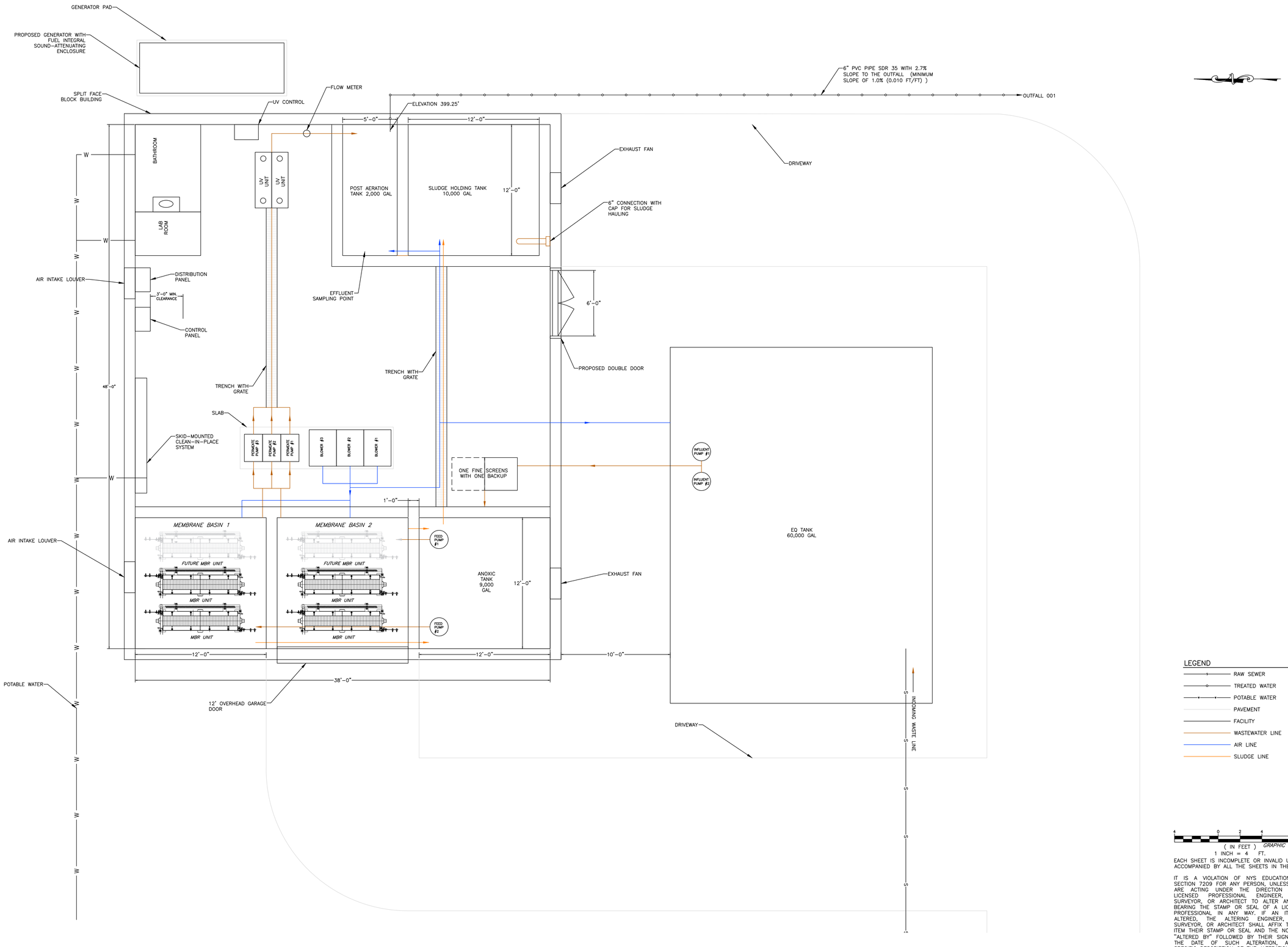
ORANGE COUNTY, NEW YORK

JOB #:	103.0301	DRAWN BY:	ZS
DATE:	04/17/2023	SCALE:	1" = 40'
REVISION:	5 - 12/19/2025	TAX LOT:	VARIOUS

C-106

Appendix C. WWTP Layout



LEGEND

- RAW SEWER
- TREATED WATER
- POTABLE WATER
- PAVEMENT
- FACILITY
- WASTEWATER LINE
- AIR LINE
- SLUDGE LINE

4 0 2 4 8

(IN FEET) GRAPHIC SCALE
1 INCH = 4 FT.

EACH SHEET IS INCOMPLETE OR INVALID UNLESS ACCOMPANIED BY ALL THE SHEETS IN THE SET.

IT IS A VIOLATION OF NYS EDUCATION LAW SECTION 7209 FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, LAND SURVEYOR, OR ARCHITECT TO ALTER AN ITEM BEARING THE STAMP OR SEAL OF A LICENSED PROFESSIONAL IN ANY WAY. IF AN ITEM IS ALTERED, THE ALTERING ENGINEER, LAND SURVEYOR, OR ARCHITECT SHALL AFFIX TO THE ITEM THEIR STAMP OR SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

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CONSULTING ENGINEERS, P.C.
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p+d

DATE:	REVISION:	BY:
02/25/2026	PLANNING BOARD COMMENTS	ZY

ENGINEER'S SEAL

ENGINEER'S SEAL

SHEET NO. 1 OF 1	DRAWING NAME:	WWTP Layout Plan (ZY) 2026-02-24	DRAWN BY: ZY	FOR APPROVAL	AS-BUILT
SCALE: 1" = 4'					
DATE: 02/20/2026	JOB NO.: 230014			FOR REVIEW & COMMENT	FOR BID & CONSTRUCTION

ENGINEER'S SEAL

WWTP LAYOUT

FOR

SHEFFIELD GARDENS

1127 NYS ROUTE 17K

TOWN OF MONTGOMERY

ORANGE COUNTY, NEW YORK

CONTRACT NO.

230014

SHEET NO.

1 OF 1

Appendix D. MBR Equipment Information

Unit Specification

The SP series has several unit types with different unit heights which can meet a **wide range of water depth requirements especially for retrofit projects**.
The combination of Membrane Blocks will allow you to meet ceiling height constraints and overhead crane capacity constraints.

Unit Type	Effective Membrane Surface Area	Dimensions			Dry (Mass)	Required Min. Water Depth*
		Height	Width	Length		
SP225 - A	225 m^2 / 2,421 ft^2	1,877 mm / 6.16 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	590 kg / 1,301 lbs	2.3 m / 7.55 ft
SP225 W - A	225 m^2 / 2,421 ft^2	2,117 mm / 6.95 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	670 kg / 1,477 lbs	2.5 m / 8.21 ft
SP337 - A	337.5 m^2 / 3,632 ft^2	2,401 mm / 7.88 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	790 kg / 1,742 lbs	2.8 m / 9.19 ft
SP450 - A	450 m^2 / 4,843 ft^2	2,923 mm / 9.59 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	990 kg / 2,183 lbs	3.3 m / 10.83 ft
SP450 W - A	450 m^2 / 4,843 ft^2	3,165 mm / 10.38 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	1,110 kg / 2,447 lbs	3.6 m / 11.82 ft
SP562 W - A	562.5 m^2 / 6,054 ft^2	3,689 mm / 12.10 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	1,310 kg / 2,888 lbs	4.1 m / 13.46 ft
SP675 - A	675 m^2 / 7,265 ft^2	4,213 mm / 13.82 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	1,510 kg / 3,329 lbs	4.6 m / 15.10 ft
SP675 T - A	675 m^2 / 7,265 ft^2	4,453 mm / 14.61 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	1,630 kg / 3,594 lbs	4.9 m / 16.08 ft
SP787 W - A	787.5 m^2 / 8,476 ft^2	4,735 mm / 15.53 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	1,710 kg / 3,770 lbs	5.1 m / 16.74 ft
SP787 T - A	787.5 m^2 / 8,476 ft^2	4,977 mm / 16.33 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	1,830 kg / 4,034 lbs	5.4 m / 17.72 ft
SP900 - A	900 m^2 / 9,687 ft^2	5,257 mm / 17.25 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	1,910 kg / 4,211 lbs	5.7 m / 18.71 ft
SP900 T - A	900 m^2 / 9,687 ft^2	5,501 mm / 18.05 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	2,030 kg / 4,475 lbs	5.9 m / 19.36 ft
SP900 Q - A	900 m^2 / 9,687 ft^2	5,741 mm / 18.84 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	2,150 kg / 4,740 lbs	6.1 m / 20.02 ft
SP200	200 m^2 / 2,152 ft^2	1,877 mm / 6.16 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	550 kg / 1,213 lbs	2.3 m / 7.55 ft
SP300	300 m^2 / 3,229 ft^2	2,401 mm / 7.88 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	730 kg / 1,609 lbs	2.8 m / 9.19 ft
SP400	400 m^2 / 4,305 ft^2	2,923 mm / 9.59 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	910 kg / 2,006 lbs	3.3 m / 10.83 ft
SP600	600 m^2 / 6,458 ft^2	4,213 mm / 13.82 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	1,390 kg / 3,065 lbs	4.6 m / 15.10 ft
SP800	800 m^2 / 8,611 ft^2	5,257 mm / 17.25 ft	944 mm / 3.10 ft	2,186 mm / 7.17 ft	1,750 kg / 3,858 lbs	5.7 m / 18.71 ft

* Extra water depth will be needed for gravity filtration.

SP [1][2] – [3]

Symbol	Definition
[1]	Membrane area XXX[m^2]
[2]	Nos of Membrane Blocks None = 1 (SMU with ≦ 450m^2) or 2 (SMU with ≧ 600m^2) W= 2 T = 3 Q = 4
[3]	Type of SP modules None = H025-40 (10m^2) A = H025-45 (11.25m^2)

SP450-A SP900-A SP900T-A SP900Q-A

KUBOTA Submerged Membrane Unit® models in all illustrations are with pickling treatment. KUBOTA Submerged Membrane Unit® design and specifications are subject to change without notice.
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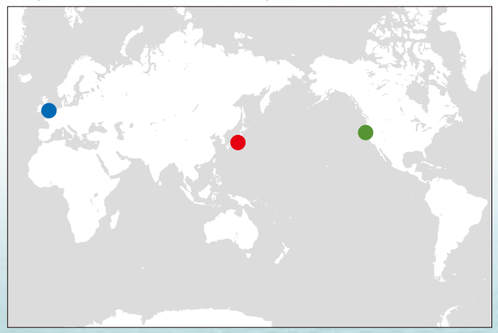
KUBOTA Corporation

Membrane Systems Dept.
https://www.kubota.com/products/solutions/



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2025.10.KES

For Earth, For Life
Kubota

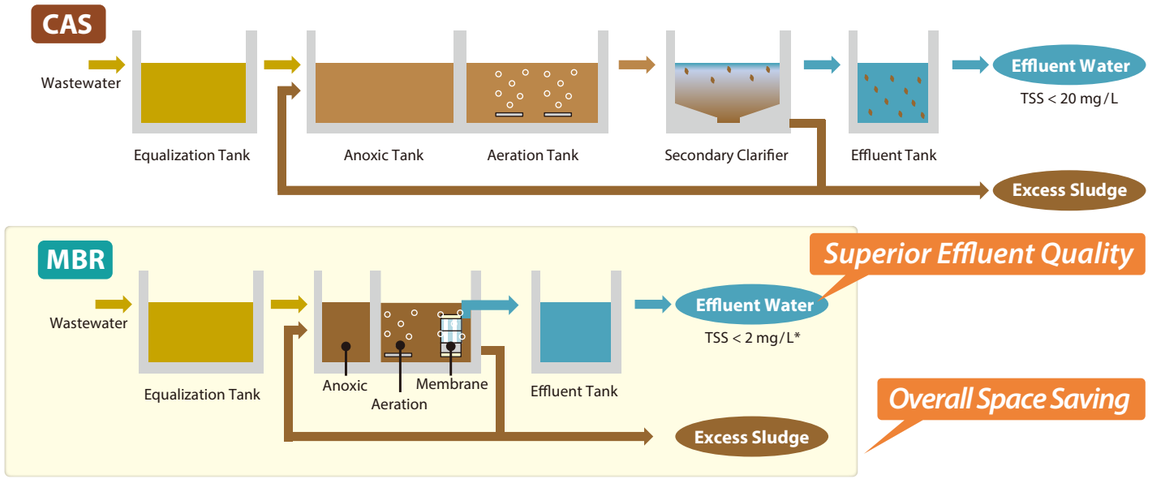
KUBOTA Submerged Membrane Unit®

SP series

SP450-A SP900-A

Combined Membrane Bioreactor

The Membrane Bioreactor (MBR) process is a proven wastewater treatment method which combines a biological treatment process and a membrane filtration process for final solid-liquid separation. The MBR perfectly eliminates the secondary clarifier and carry-over of the activated sludge. Therefore, the concentration of the activated sludge becomes higher and the process tank volume becomes smaller compared to the Conventional Activated Sludge (CAS) process.
KUBOTA Submerged Membrane Unit® (SMU) can supply air not only for membrane scouring, but also for the oxygen required in biological treatment. Thus, in the membrane zone, biological and filtration processes are combined and carried out at once reducing the necessary total tank volume and its land area. When SMU is installed with an additional fine bubble diffuser in the same tank, the aeration and membrane tanks can be physically combined.

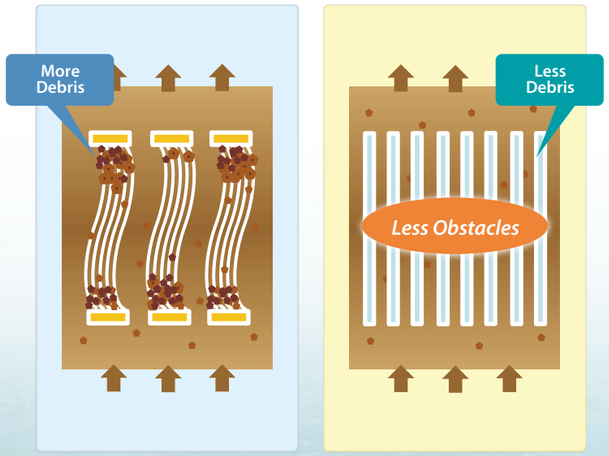


*TSS < 2mg/L is a typical achievable value, not a guaranteed value.

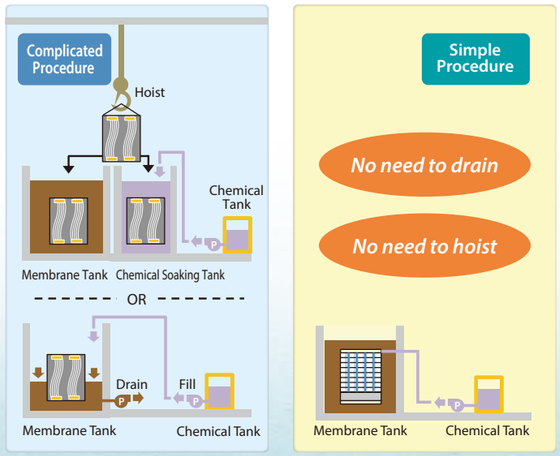
KUBOTA Submerged Membrane Unit®

The KUBOTA Submerged Membrane Unit® (SMU) is membrane equipment dedicated for the MBR process. The SMU can be directly submerged in activated sludge and allows only clean treated water to pass through its "**Flat and Rigid Plate**" type membrane. The membrane sheet has 0.2 µm pores which block fine particles and most microorganisms in the activated sludge.
The "Flat and Rigid Plate" configuration keeps the space between membranes clear and minimizes debris accumulation. ***In-situ*** chemical cleaning is the only maintenance typically required.

Trouble Free Operation



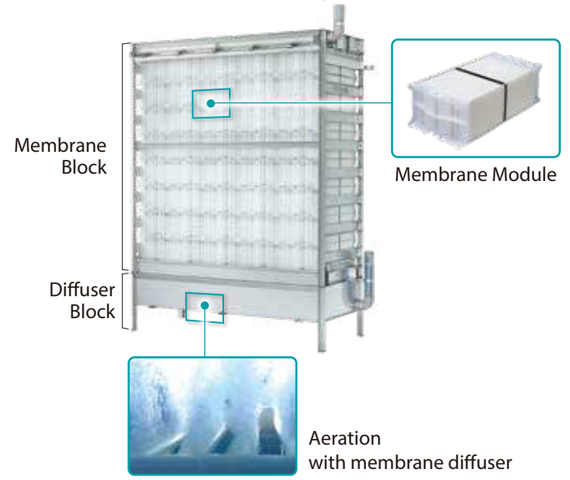
Easy Maintenance



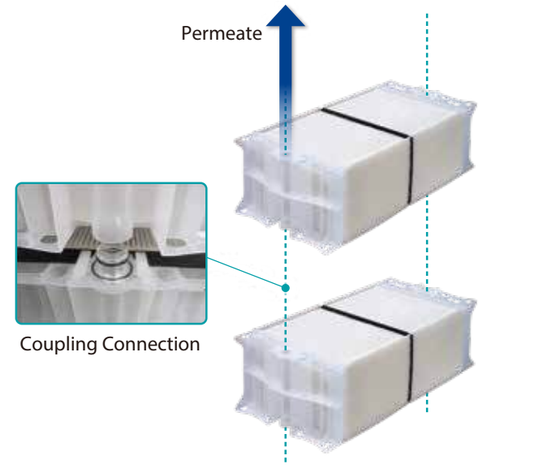
Structure of KUBOTA SP Series

The KUBOTA SP series is made up of SMU models optimized specifically for **medium to large scale wastewater treatment applications.** A plurality of flat membrane plates and permeate collection chambers are integrated into a compact "**Membrane Module**". This design improves packing density and reduces scour air requirements.
Multiple Membrane Modules are assembled into a Membrane Block using simple coupling connections. The coupling connection also serves as a conduit to the permeate header. This structure simplifies the assembling procedure of the SMU during field maintenance work. Moreover, the membrane diffuser contribute to reduce the oxygen supply blowers' power consumption due to their high oxygen transfer efficiency.

Simple Structure

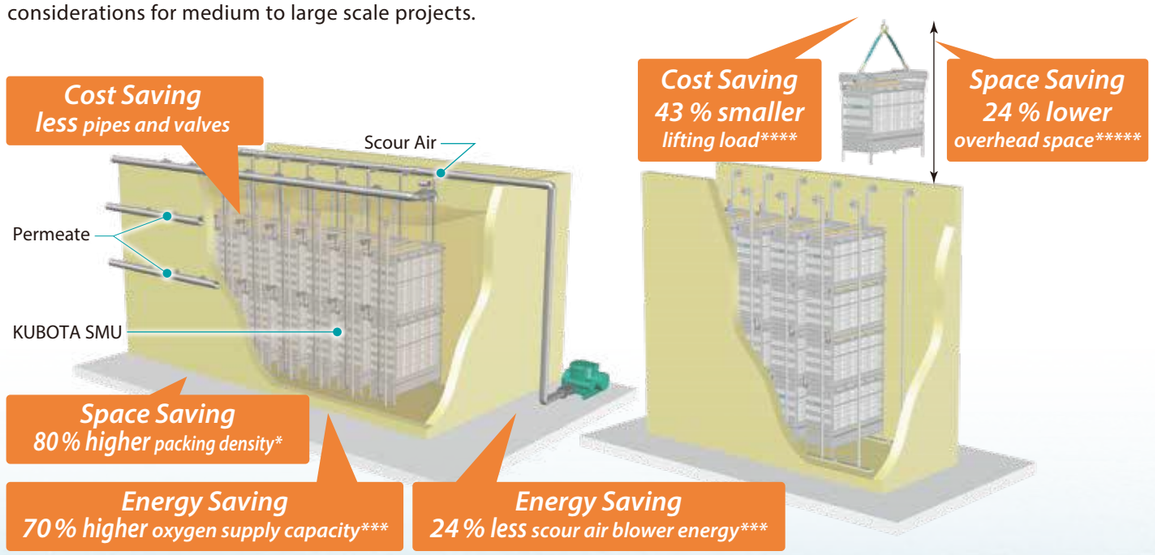


Simple Assembly



Advantages of KUBOTA SP Series

Based on its unique structure, the SP series reduces **required space** and **required scour air**; both of which are important considerations for medium to large scale projects.



* Comparing SP900-A to RW400 in terms of membrane area per required tank space for installation [m²/m³].
** Comparing SP900-A to RW400 in terms of required scour air blower energy consumption per membrane area [kWh/m²].
*** Comparing SP900-A to RW400 in terms of oxygen transfer efficiency per membrane unit [%].
**** Comparing SP900Q-A to SP900-A in terms of total max. mass of lifted lower membrane block
***** Comparing SP900Q-A to SP900-A in terms of required overhead space for lifting membrane unit