2023

CAWD WWTP Relocation Alternatives Analysis (Centralized & Decentralized Approaches)

Prepared By: Patrick Treanor, PE

Carmel Area Wastewater District and

Greeley and Hansen

5/19/2023

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Abbreviations

AACE – Association for the Advancement of Cost Engineering
ADWF – Average Dry Weather Flow
AWWF – Average Wet Weather Flow
AOP – Advanced Oxidation Process
CAWD – Carmel Area Wastewater District
DIAM – Diameter
EQ – Equalization
FR-RO – Flow Reversal Reverse Osmosis
MBR – Membrane Bioreactor
MGD – Million Gallons Per Day
OPCC – Opinion of Probable Construction Cost
PBCSD – Pebble Beach Community Services District
RO – Reverse Osmosis
UV – Ultra-Violet
WRRF – Water Resource Recovery Facility
WWTP – Wastewater Treatment Plant

Section 1: Introduction

This report presents conceptual level design information for relocation of the CAWD Wastewater Treatment Plant (WWTP) away from the coastal floodplain. Relocating the existing WWTP away from the coastal flood plain is an approach to mitigating long term coastal hazards associated with climate change and sea level rise.

The concepts developed for relocated treatment facilities described in this report are based on the latest advanced treatment processes for water resource recovery including: membrane bioreactors, reverse osmosis, and advanced oxidation disinfection. The advanced wastewater treatment process can produce treated water suitable for irrigation reuse, or for potable reuse. Given the high value of water resources in the Monterey Peninsula, recycling wastewater is a necessity for the region.

New advanced treatment processes can be built in a smaller footprint compared to conventional facilities such as the existing CAWD WWTP. The existing CAWD WWTP footprint is about 9 acres whereas a new centralized advanced treatment facility could be built on as little as 3 acres.

New raw water and treated water conveyance pipelines would be included in the conceptual relocation design, as well as an equalization basin strategically located within the CAWD sewer collection system to reduce wet weather peak flows into the new conceptual conveyance and treatment facilities.

Two general approaches were evaluated for future treatment infrastructure. The first approach was to build a centralized Water Resource Recovery Facility (WRRF), and the second approach was to build multiple smaller satellite treatment facilities in separate areas of the District. The first approach is called the “centralized” approach, and the second approach is called the “decentralized” approach.

Conceptual new facilities would be located away from coastal hazards. This study focuses on relocating the new facilities within the immediate Carmel/Carmel Valley service area. The concept site for the centralized WRRF is located inland in Carmel Valley; about 3 miles from the coast and outside of the Carmel River floodplain.

For more detailed information refer to the reports developed by Greeley and Hansen attached to this summary report.

Section 2: New Centralized Water Resource Recovery Facility

2.1 Conceptual Location of Centralized Water Resource Recovery Facility

A conceptual Centralized WRRF assumed the new wastewater treatment facilities would be located at a hypothetical site location off Carmel Valley Road, 3 miles inland from the coast. The site is called Roach Canyon and is an undeveloped canyon mouth which is currently used as a staging area for County road maintenance equipment and materials.

Figure 1 is a vicinity map showing Roach Canyon relative to the coast. Figure 2 is an aerial perspective of the Roach Canyon topography.

Figure 1 – Location of Roach Canyon for Centralized WRRF

Figure 2 – Aerial Perspective of Roach Canyon for Centralized WRRF

The roach canyon site has a flat area adjacent to Carmel Valley Road that is approximately 3 acres. This flat area is highlighted in red in Figure 2. The potential building area is set back sufficiently from Carmel Valley Road such that it is well screened by vegetation. Steep canyon slopes surround the back and sides of the site and further hide the location from view.

2.2 Conceptual Design of Conveyance

The conceptual alignments for new conveyance pipelines for a relocated CAWD WRRF are described in detail in the report by Greeley and Hansen in Appendix A.

A new pump station would be required in the vicinity of the existing CAWD WWTP in order to convey raw sewage to a relocated CAWD WRRF. Figure 3 below shows the conceptual alignments for a raw sewage force main to the new facility and a new Brine/Effluent line connecting to the existing Ocean Outfall.

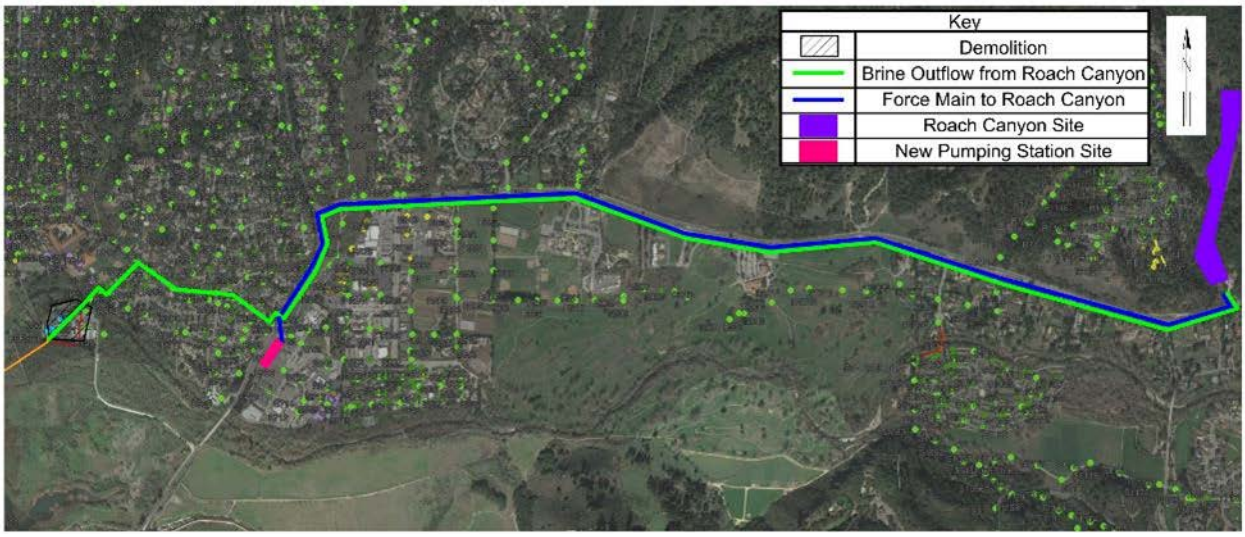


Figure 3 – Centralized WRRF Raw Water and Brine (Effluent) Conveyance Overview

Figure 4 below shows conceptual reclaimed water conveyance which would be an extension of the existing reclaimed water pipeline that sends recycled water to Pebble Beach. Figure 4 also shows how indirect potable reuse could be implemented by means of an injection well near the WRRF site.

Figure 4 – Centralized WRRF Reclaimed Water Conveyance

2.3 Conceptual Design of Sewage Pump Station/Equalization Basin

Several locations for a new pump station in the vicinity of the existing WWTP were evaluated in the Greeley and Hansen Technical Memo No. 1 in Appendix A. The location that was determined to be preferred based on available space and lower flooding risk was an empty lot East of Hwy 1 and adjacent to the Safeway shopping center parking lot. The property is an extension of the Hatton Canyon Park owned by State Parks. The pump station infrastructure would be almost entirely below ground and would include a large equalization (EQ) basin sized at 1.5 million gallons that would reduce wet weather peak flows that need to be conveyed and treated at the relocated WRRF. The chosen concept location for the EQ basin and pump station is shown in Figure 5.

Figure 5 – Site Layout of EQ Basin at Hatton Canyon Park for Centralized WRRF

2.4 Conceptual Design of Centralized Water Resource Recovery Facility

The conceptual design of a new relocated CAWD WRRF is described in detail in the report by Greeley and Hansen in Appendix A. Figures showing the layout design of the facility are shown in Figures 6 and 7. The new facility would produce treated water quality suitable for potable reuse and produce treated biosolids that can be utilized as Class A fertilizer.

The conceptual WRRF treatment process includes the following major components:

Liquid Treatment Process:

Headworks / Influent Screening: Coarse and Fine Screens

Biological Treatment / Membrane Micro-Filtration: Membrane Bioreactors

Dissolved Solids Removal: Reverse Osmosis with Brine Recovery

Disinfection Process:

Pathogen Inactivation/Reduction: Advanced Oxidation Process (Ultraviolet Light and Hydrogen Peroxide)

Disinfection Residual for Reuse Water Distribution System: Chloramination (Chlorine and Ammonia)

Solids Treatment Process:

Sludge Equalization: Storage Tank

Sludge Thickening: Rotary Drum Thickening

Digestion/Sludge Stabilization: Thermophilic and Mesophilic Digestion

Dewatering: Centrifuges

The new facility could incorporate a rustic ranch/farm style architectural design aesthetic that matches the bucolic character and look of Carmel Valley. Process buildings could be built to look like barns and/or farm buildings. Tanks would be built below ground to hide them from view.

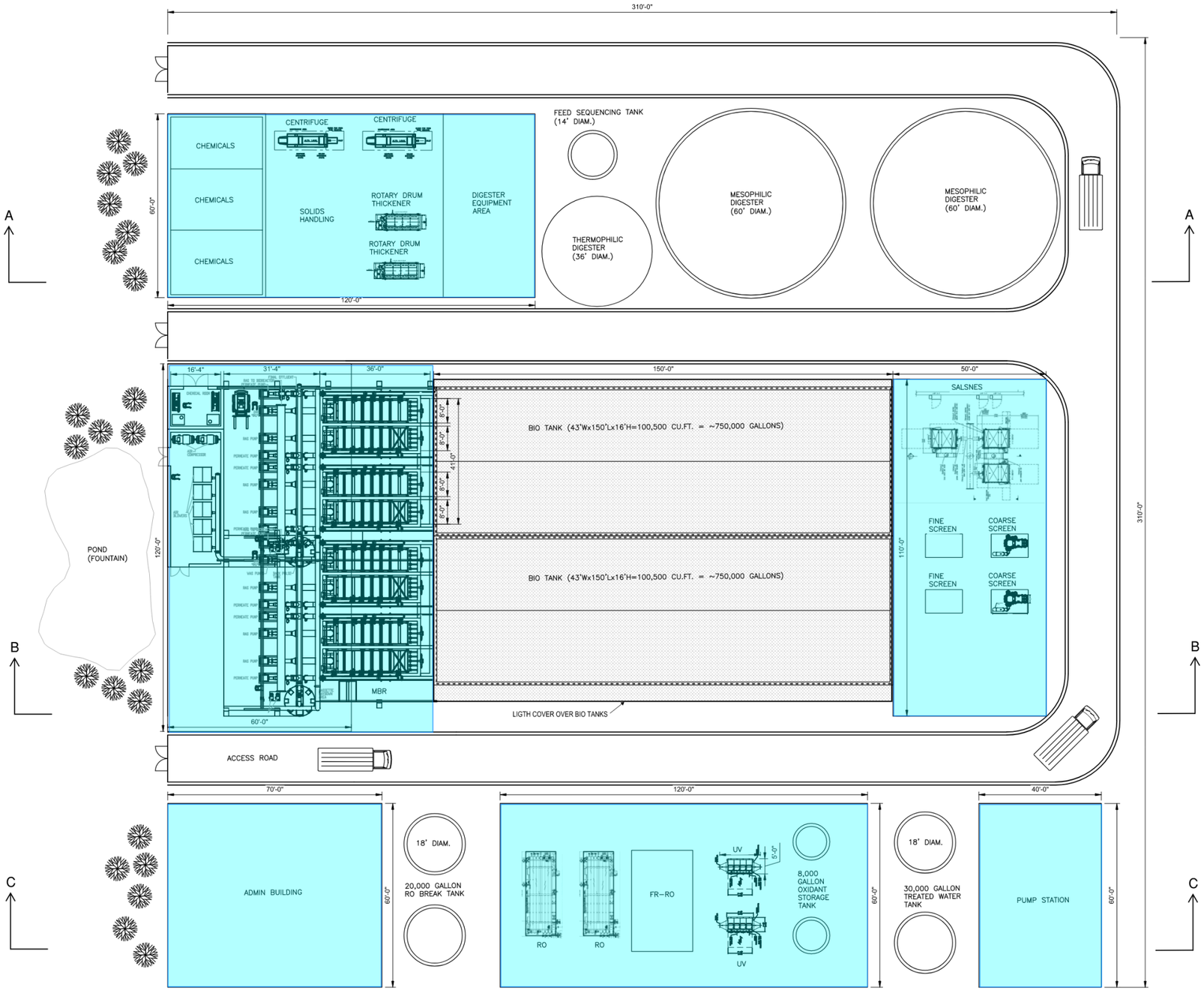


Figure 6 – Centralized WRRF Plan View

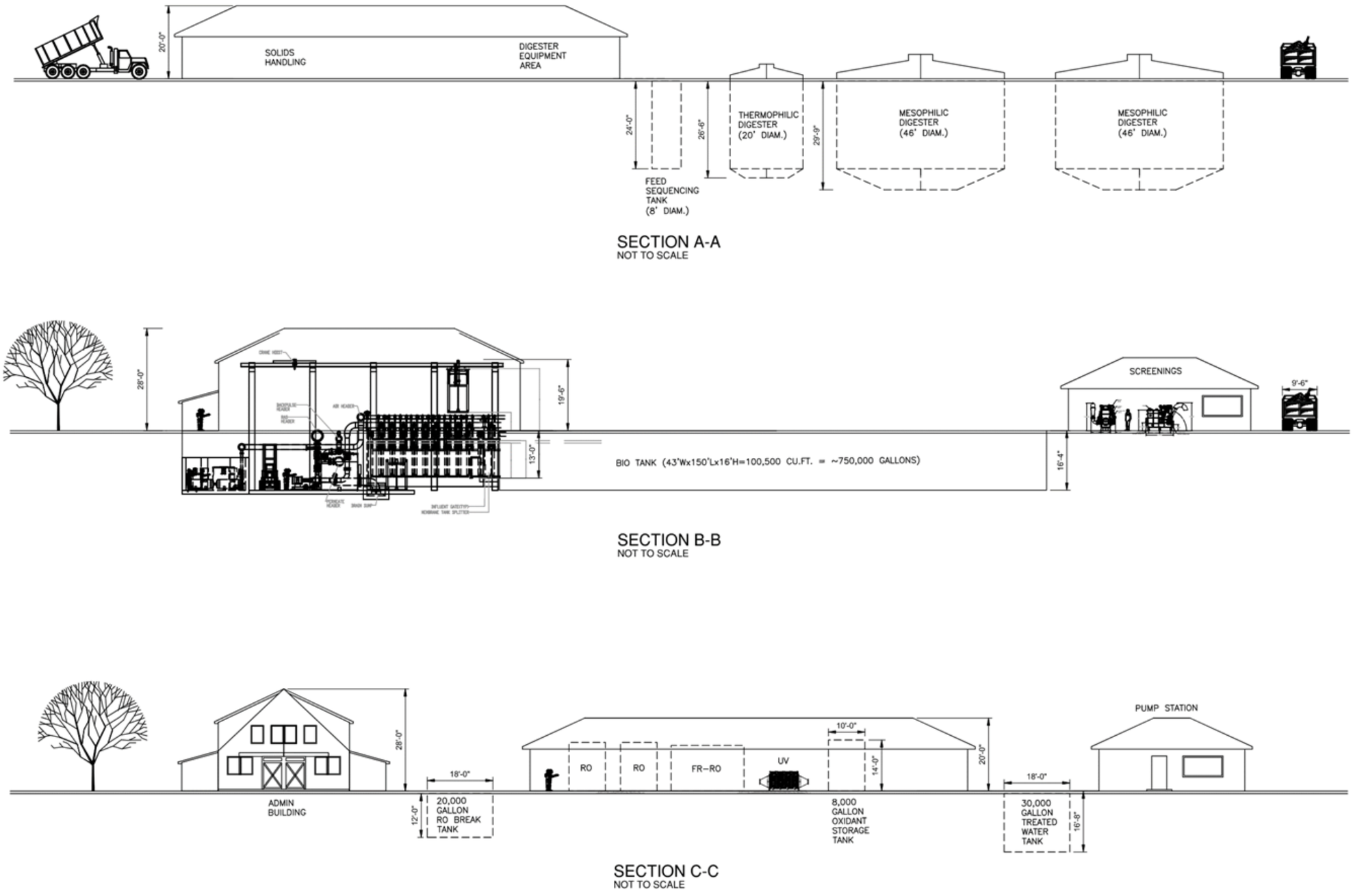


Figure 7 – Centralized WRRF Section Views

The conceptual layout shown in Figure 6 of a new CAWD WRRF is shown superimposed on the Roach Canyon site in Figure 8 to illustrate how the facility could fit into the existing landscape.

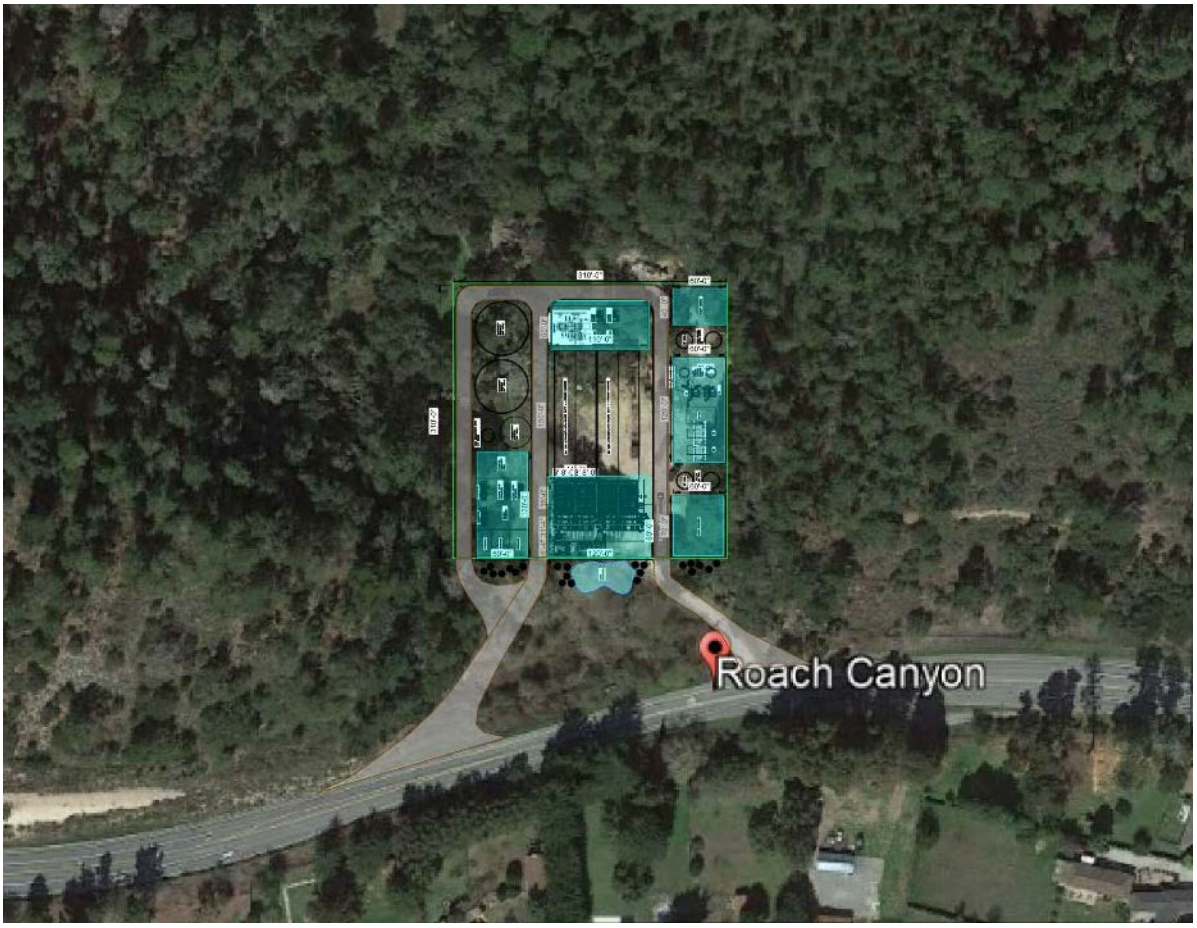


Figure 8 – Centralized WRRF Superimposed on Roach Canyon Aerial View

2.5 Conceptual Cost of Centralized Water Resource Recovery Facility

Estimated costs of the new conveyance pipelines, equalization basin, sewage pump station, treatment facility, and land acquisition were developed at a conceptual level. A summary of the preliminary Conceptual level Opinion of Probable Construction Cost (OPCC) is shown in detail in the Greeley and Hansen Technical Report No. 1 in Appendix A**.** The summary with the overall estimated project construction cost is included in Table 1 below**.**

Costs are provided for two different capacity scenarios. One scenario is for facilities' design capacity of 3.6 MGD Average Wet Weather Flows (AWWF) to match existing flows. The second

scenario is for facilities' design capacity of 2.4 MGD AWWF assuming Pebble Beach Community Services District (PBCSD) flows are not included in the project.

The OPCC is a conceptual level cost estimate developed at a "Class 4" level per the Association for the Advancement of Cost Engineering (AACE) International standard. This class represents a "study or feasibility" maturity level and has an expected accuracy range of -30% to +50%.

Table 1 – New Centralized WRRF Conceptual Cost Estimate

CAWD WWTP Relocation
Carmel Area Wastewater District
Project Construction Costs - ENR CCI = 11,620
Project Summary
New Centralized Water Resource Recovery Facility (WRRF)

AACE Class Number 4
Contingency: 25%

Element No.	Program Element Description	Project Cost (December 2020.75 ENR CCI = 11,620) $ (3.6 MGD)	$ (2.4 MGD)
1	New WRRF	37,690,900	33,496,600
2	New Equalization Basin	5,020,000	5,020,000
3	New Pump Station	1,496,300	1,496,300
4	Land Acquisition	6,118,200	6,118,200
5	New WRRF Electrical Supply	2,896,600	2,896,600
6	Conveyance Piping	29,430,700	23,434,900
	Construction Subtotal	82,652,700	72,462,600
	Bonds and Insurance (at 3%)	2,479,600	2,173,900
	Engineering (at 7%)	5,785,700	5,072,400
	Construction Management (at 5%)	4,132,600	3,623,200
	Permitting (at 2%)	1,653,100	1,449,300
	Commissioning (at 2%)	1,653,100	1,449,300
	Mobilization / Demobilization (at 5%)	4,132,600	3,623,200
	Contingency (at 25%)	20,663,200	18,115,700
	Contractor Overhead and Profit (at 15%)	12,397,900	10,869,400
	Sales Tax (at 9.5%)	7,852,000	6,884,000
	Construction Total	143,402,500	125,723,000

	-30% Estimate	Estimated	+50% Estimate
Construction Total Estimate Range of Accuracy (3.6 MGD AWWF Facility)	$100,381,750	$143,402,500	$215,103,750
Construction Total Estimate Range of Accuracy (2.4 MGD AWWF Facility)	$88,006,100	$125,723,000	$163,439,900

Section 3: New Decentralized Water Resource Recovery Facilities

3.1 Satellite Facility Service Areas

To develop the concept of having multiple smaller treatment facilities the CAWD service area was split into 4 separate areas that each comprised roughly 0.25 MGD of Average Dry Weather Flow (ADWF). Figure 9 shows the 4 areas which are as follows:

Area 1: Carmel Woods and Downtown Carmel-by-The-Sea
Area 2: Mission Canyon and Carmel Point
Area 3: Highway 1 South of Carmel
Area 4: Carmel Valley Phase 1

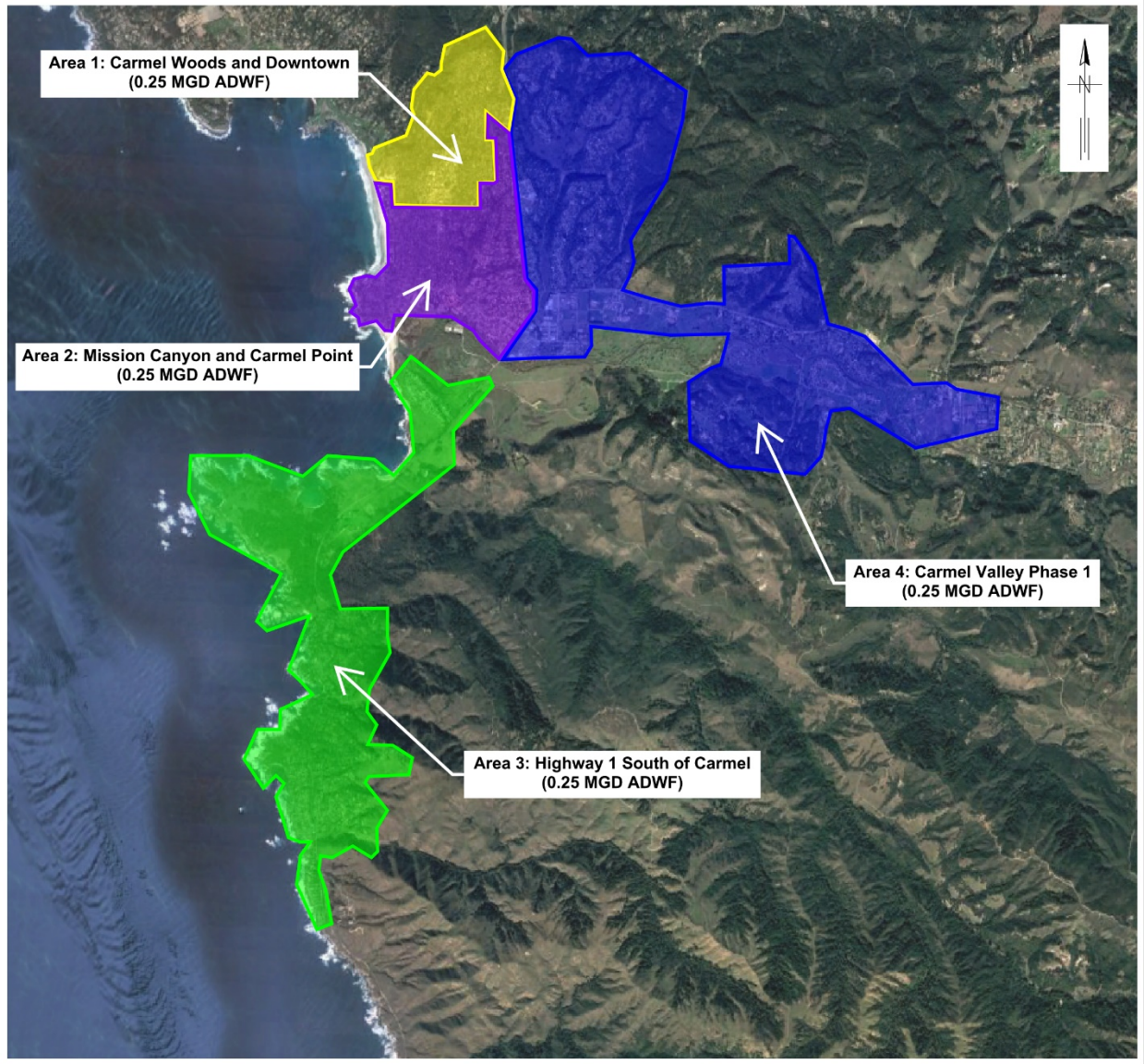


Figure 9 – Decentralized Service Area Division

Under the Decentralized Treatment Concept, each of these 4 areas would have liquid treatment facilities located somewhere within the area. Theoretical locations for the satellite facilities in each area were not determined as part of this study. Solids treatment facilities would only be incorporated at one of the facilities in order to keep the footprint size of the other facilities as small as possible. Limiting the footprint of decentralized facilities is the goal, so to reduce impacts on surrounding development (and fit on smaller potential available properties). It was assumed that the larger facility containing the solids treatment process would be located in Area 4: Carmel Valley because there is more available land in Carmel Valley. The solids collected at the liquid only treatment facilities in Areas 1, 2, and 3 would be transferred by tanker trucks to the WRRF located in Area 4.

The footprint of the liquid only treatment satellite facilities serving Areas 1, 2, and 3 could be built on a site as small as one (1) acre. The footprint of the larger facility in Area 4 that includes solids treatment could be built on a (2) acre site.

The Greeley and Hansen Technical Report No. 2 in Appendix B provides further details for the decentralized treatment alternative.

3.2 Conveyance Design of Conveyance

The satellite facilities in the 4 areas would collect wastewater from their respective collection system and treat the water to a level suitable for potable reuse or irrigation reuse. In the case of irrigation reuse the clean recycled water could be pumped from each facility via new reclaimed water pipes to the existing reclaimed water line that goes to Pebble Beach. Similarly, the concentrated brine waste stream from each satellite facility would be piped to the existing CAWD ocean outfall. The conceptual conveyance piping from the satellite facilities is shown in Figure 10.

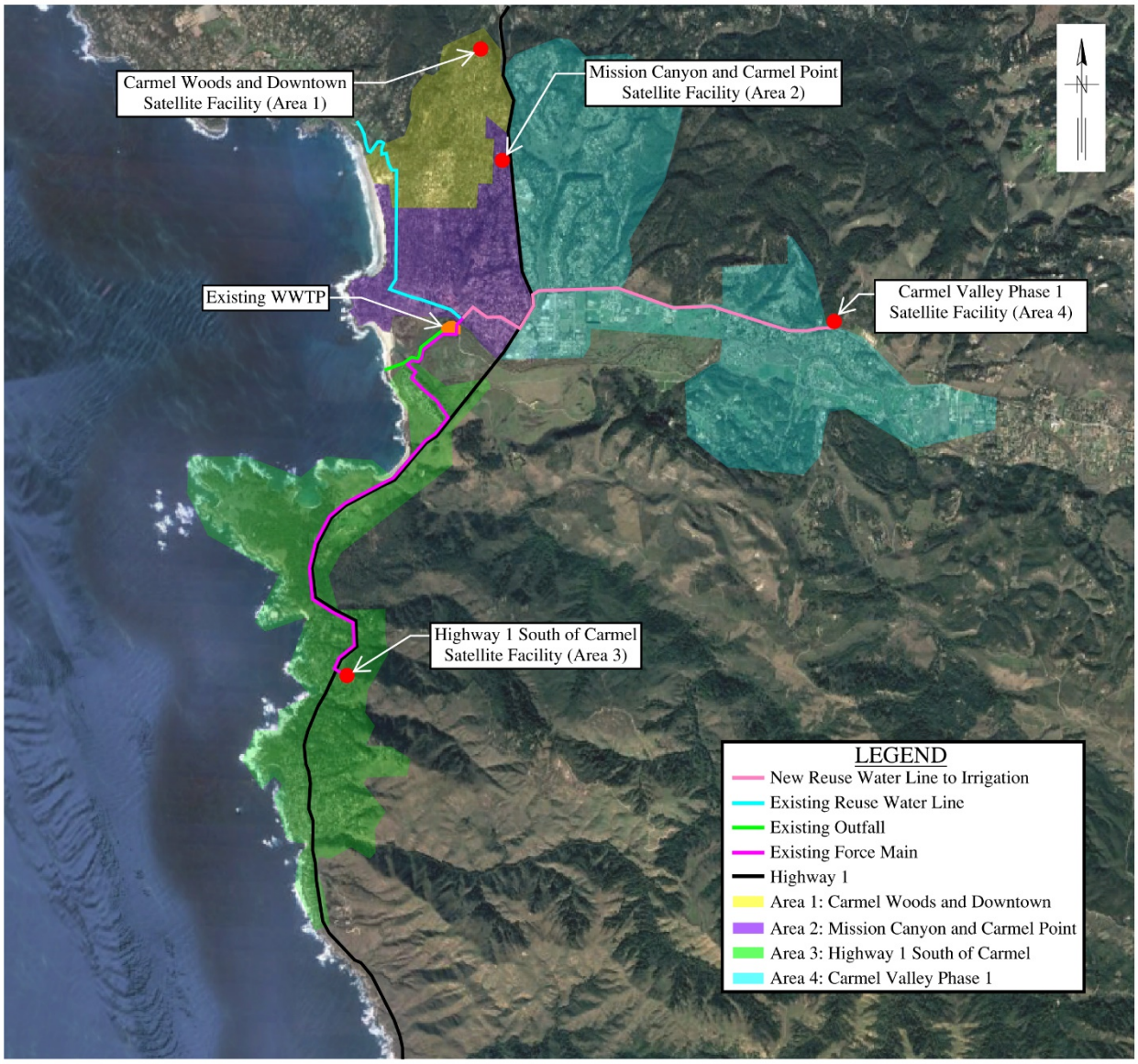


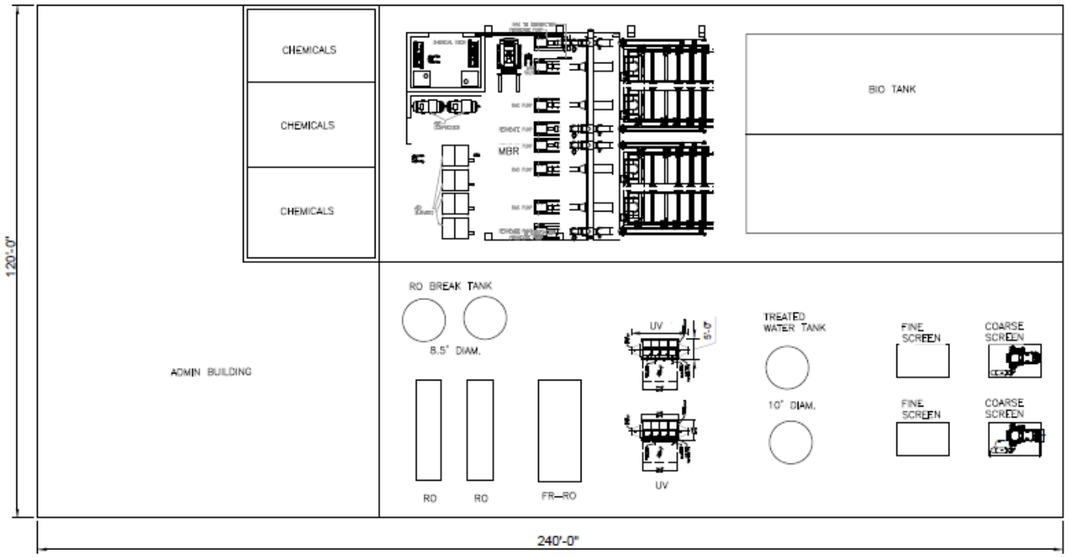
Figure 10 – Decentralized WRRF Conveyance Piping

3.3 Conceptual Design Decentralized Water Resource Recovery Facility

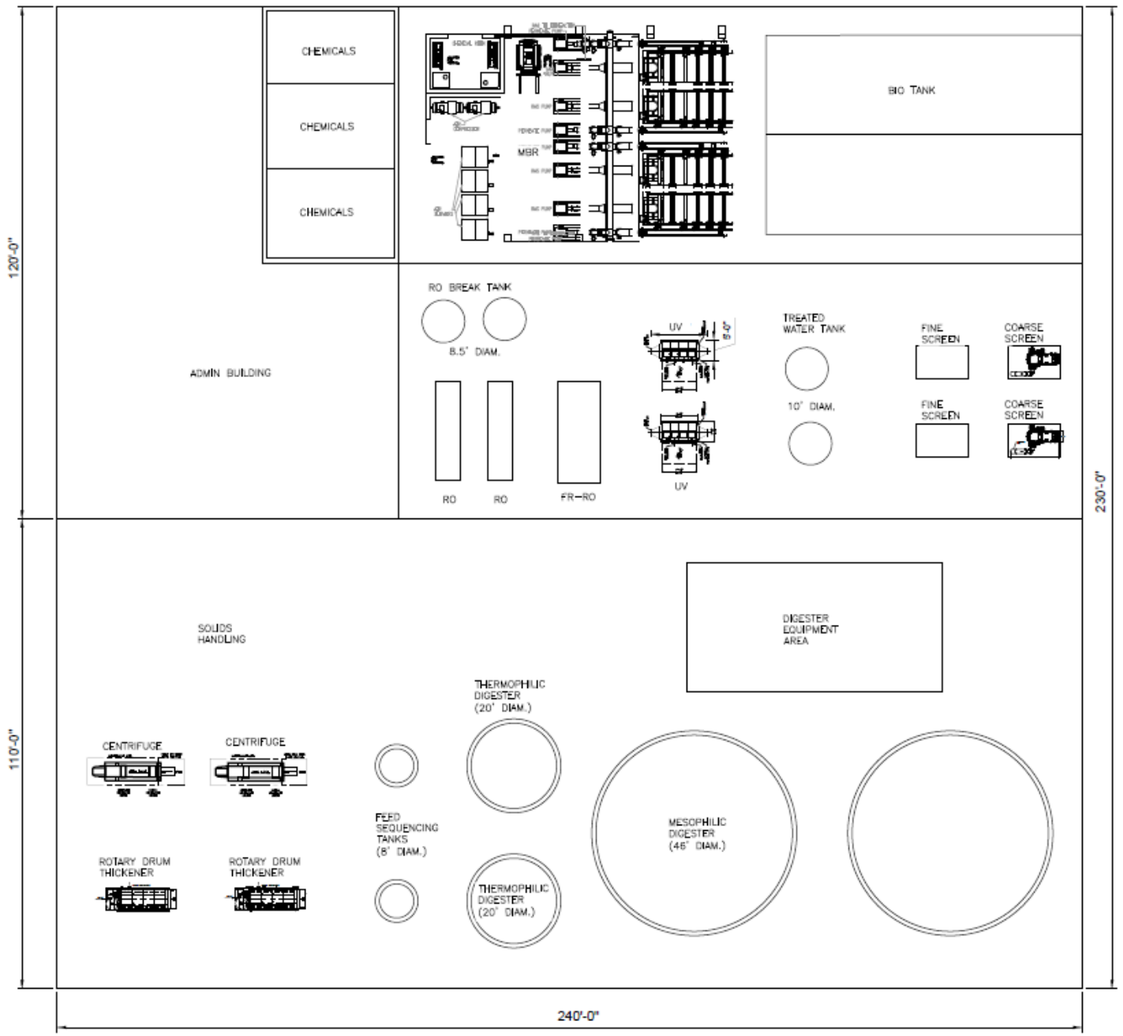
The conceptual design of the treatment process for the Decentralized WRRFs utilizes the same process technology as described in Section 2.4 for the Centralized WRRF. This includes coarse and fine screens in the Headworks, followed by a Membrane Bioreactor, Reverse Osmosis, and Advanced Oxidation/Chloramination. The larger Area 4 WRRF which includes solids treatment processes would have the same solids treatment design as the Centralized WRRF concept.

Each satellite Decentralized WRRF would include it's own equalization (EQ) basin in order to reduce treatment capacity requirements for wet weather peaking. The EQ basin sizing assumes a 0.25 MG maximum storage capacity with an additional 5-ft freeboard. The dimensions of the EQ basin were determined to be approximately 70' length, 40' width, and 17' depth

Figure 11 shows conceptual equipment layouts and estimated footprint sizes of the Decentralized WRRFs.



DECENTRALIZED WRRF PLAN – AREAS 1, 2, AND 3



DECENTRALIZED WRRF PLAN – AREA 4

Figure 11 – Decentralized WRRF Plan Views

3.4 Conceptual Cost of Decentralized Water Resource Recovery Facilities

Estimated costs of the new conveyance piping, equalization basins, treatment facilities, and land acquisition were developed at a conceptual level. A summary of the preliminary Conceptual level Opinion of Probable Construction Cost (OPCC) for the decentralized treatment facility concept is shown in detail in the Greeley and Hansen Technical Report No. 2 in Appendix B. The summary with the overall estimated project construction cost is included in Table 1 below.

Costs are provided for the Area 1, 2, and 3 WRRF separately from the Area 4 WRRF and all of the costs are combined for the total cost of the Decentralized WRRF alternative.

The OPCC is a conceptual level cost estimate developed at a "Class 4" level per the Association for the Advancement of Cost Engineering (AACE) International standard. This class represents a "study or feasibility" maturity level and has an expected accuracy range of -30% to +50%.

Table 2 – New Decentralized WRRF Conceptual Cost Estimate

CAWD WWTP Relocation
Carmel Area Wastewater District
Project Construction Costs - ENR CCI = 11,620
Project Summary
New Decentralized Water Resource Recovery Facility (WRRF)

AACE Class Number 4
Contingency: 25%

Project Cost (December 2020.75 ENR CCI = 11,620)			
Element No.	Program Element Description	$ WRRF Areas 1, 2, and 3 (EACH)	$ WRRF Area 4
1	New WRRF	12,435,600	20,331,400
2	New Equalization Basin	1,542,100	1,542,100
3	New Pump Station	609,900	609,900
4	Land Acquisition	2,549,200	4,078,800
5	New WRRF Electrical Supply	974,200	1,069,100
6	Conveyance Piping (Average)	16,258,475	23,396,475
	Construction Subtotal	34,369,475	51,027,775
	Bonds and Insurance (at 3%)	1,031,100	1,530,800
	Engineering (at 7%)	2,405,900	3,571,900
	Construction Management (at 5%)	1,718,500	2,551,400
	Permitting (at 2%)	687,400	1,020,600
	Commissioning (at 2%)	687,400	1,020,600
	Mobilization / Demobilization (at 5%)	1,718,500	2,551,400
	Contingency (at 25%)	8,592,400	12,756,900
	Contractor Overhead and Profit (at 15%)	5,155,400	7,654,200
	Sales Tax (at 9.5%)	3,265,100	4,847,600
	Construction Total	59,631,175	88,533,175

Construction Total for Areas 1, 2, and 3	$178,893,525	
Construction Total for Area 4		$88,533,175

	-30% Estimate	Estimated	+50% Estimate
Construction Total Estimate Range of Accuracy (Total for Areas 1, 2, 3, and 4)	$187,198,690	$267,426,700	$401,140,050

Section 4: Closing

There is a significant difference in the conceptual costs between the Centralized WWRF vs. Decentralized WRRF approaches, with the Decentralized concept being significantly more expensive. This is due to economies of scale associated with building a single centralized treatment facility, making the Centralized WRRF approach more cost efficient. Furthermore, the additional conveyance infrastructure for reclaimed water and brine effluent associated with multiple satellite liquid treatment facilities increases the cost of the Decentralized WRRF approach.

The Decentralized concept had to include at least one facility with solids treatment process structures which make this facility larger, almost to the point that it was comparable in size to the single Centralized WRRF. The Decentralized WRRF that included the solids treatment infrastructure was only 1 acre smaller than the full Centralized WRRF. Therefore, the land requirements for the Decentralized WRRF concept does not seem overly favorable when compared to the Centralized WRRF concept.

For more detailed information refer to the reports developed by Greeley and Hansen attached to this summary report.

Appendix A:

Technical Report – No. 1
Proposed Conceptual Design Centralized Water Resource Recovery Facility and Treated Water Conveyance (Greeley and Hansen)

Carmel-by-the-Sea, California
Carmel Area Wastewater District

WRRF Relocation Alternatives Planning

TECHNICAL REPORT – N0. 1

Proposed Conceptual Design
Centralized Water Resource Recovery Facility and Treated Water Conveyance

January 2023

GREELEY AND HANSEN

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SECTION 1 INTRODUCTION

1.1 PROJECT BACKGROUND

The existing Carmel Area Wastewater District (CAWD) Wastewater Treatment Plant (WWTP) is a 3.0 million gallons per day (MGD) average annual permitted discharge flow facility that uses conventional activated sludge (CAS) process for secondary treatment. The WWTP treats predominantly domestic wastewater. Current average dry weather flow (ADWF) is approximately 1.2 MGD, which represents 40% of the permitted capacity. CAWD has an agreement with the Pebble Beach Community Services District (PBCSD) whereby PBCSD has access rights to one-third of the CAWD's WWTP capacity. Of the 1.2 MGD ADWF, approximately 0.8 MGD (67%) is from CAWD and 0.4 MGD from PBCSD (33%).

Currently, CAWD is preparing a WWTP long-term coastal hazards planning roadmap, which includes alternatives analysis of relocating the WWTP to address sea level rise for the next 40 years. The feasibility and concept development of relocating the WWTP is the subject of this technical memorandum.

1.2 PROJECT GOALS

The goal of this project is to develop plant relocation concepts for the CAWD WWTP in response to climate change and resulting sea level rise. The conceptual new CAWD plant will be a Water Resource Recovery Facility (WRRF) and will take into consideration available advanced treatment technologies and will incorporate resource recovery to further serve the local community.

This memorandum includes the following:

- Summary of the relocated CAWD WRRF.
- Discussion of alternative pumping station sites information.

The new plant will likely handle similar flow conditions as the existing facility at the current location with hydraulic load 1.2 MGD ADWF and 3.6 MGD average wet weather flow (AWWF). This report is based on the above listed hydraulic loads. Additional consideration is made in the case that PBCSD chooses not to join CAWD in relocating the treatment facilities, which would reduce hydraulic load to the plant down to 0.8 MGD ADWF and 2.4 MGD AWWF. Economical calculations on the reduced hydraulic loads to the plant are included in this report. AWWF will govern the design and sizing of the new WRRF. The WRRF needs to be able to handle the AWWF that the facility might encounter. An equalization basin ahead of the WRRF will allow removing peak wet weather flows and providing an equalized flow that permits reducing the size of conveyance and treatment facilities. In the absence of a secured location for a future facility, a potential location for the WRRF was chosen at Roach Canyon off Carmel Valley Road. The new WRRF will address the long-term Climate Change impact on the existing CAWD WWTP by locating new facilities out of the coastal zone.

1.3 PROJECT SCOPE

The 2022 CAWD WWTP Relocation Project contains analysis of different piping, infrastructure, and design needed for a new WRRF near the existing CAWD WWTP. The following key infrastructure components are considered in the analysis:

- New CAWD WRRF
- New Raw Sewage Pump Station
- New Equalization (EQ) Basin
- Existing 24" Outfall Pipe
- Existing Reclaimed Water Pipe

Locations of the new infrastructure is further described in Section 3. Principally, Roach Canyon has been chosen to be the conceptual site location for the new WRRF, while several new EQ basin and raw sewage pump station locations have been evaluated through a set of criteria. This project seeks to address the growing concerns for the existing WWTP. Sea level rise, caused by Climate Change, may seriously threaten the site by 2080. An increase in the frequency and duration of drought in the area calls for advanced water reclamation technology to be used to maximize water recycling. The Carmel area also wishes to restore the existing site to natural habitat and incorporate it into the Carmel River Watershed.

SECTION 2 EXISTING CONDITIONS

2.1 CAWD SERVICES AREA

The existing CAWD WWTP serves Carmel-By-The-Sea, Lower Carmel Valley, and Carmel Highlands areas. Relative to the existing CAWD WWTP, Carmel-By-The-Sea is located to the north, Lower Carmel Valley is located to the east, and Carmel Highlands is located to the south. **Figure 2-1** shows the CAWD service area outlined in red and the major wastewater system components.

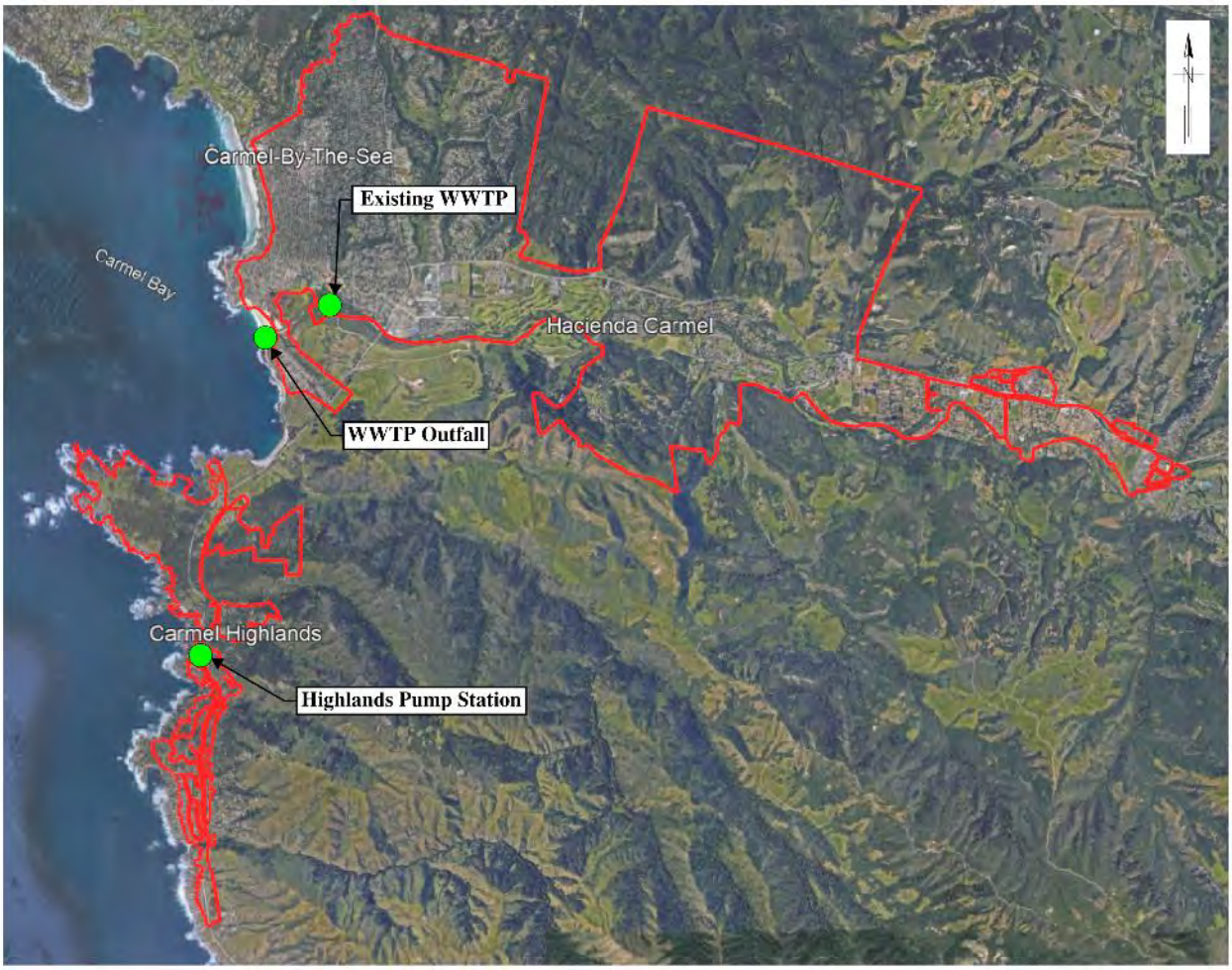


Figure 2-1: CAWD Service Area

The current CAWD WWTP has a 3.0 MGD discharge limit as per NPDES permit. A portion of the eastern communities in the CAWD service area rely on septic tanks and local sewage systems instead of the CAWD wastewater system.

2.2 EXISTING CAWD WWTP

The existing CAWD WWTP is located just south of Carmel River. Just north of the existing CAWD WWTP across the Carmel River are communities which include Carmel Point, Hatton Fields, and Mission Fields. **Figure 2-2** shows the location of the existing CAWD WWTP and the surrounding areas.

Figure 2-2: Aerial View of Existing CAWD WWTP and Surrounding Area

The existing CAWD WWTP utilizes a conventional treatment process, which includes physical, chemical, and biological mechanisms for treating wastewater. Conventional treatment typically consists of preliminary treatment, primary treatment, secondary treatment, solids handling, and disinfection. The existing CAWD WWTP also includes tertiary treatment for non-potable water reuse purposes. At the existing CAWD WWTP, preliminary treatment begins with the influent flow first entering through a coarse screening process at the headworks facility. Following screening, the influent then undergoes grit removal in a non-aerated grit tank. After grit removal, the wastewater enters the primary treatment process consisting of two (2) circular primary clarifiers to remove settleable solids. After the primary clarifiers, the flow begins secondary treatment and enters an anoxic selector where the flow is split between the equalization basin and three (3) aeration tanks. The equalization basin pumps flow back to the headworks facility during overnight hours to maintain constant flow through the WWTP. Following the aeration tanks, flow goes to the mixed liquor distribution box which distributes the flow into two (2) secondary clarifiers. The secondary effluent is then sent to disinfection and dechlorination and then is either discharged to Carmel Bay via an outfall or secondary effluent is sent for further advanced treatment in the tertiary and microfiltration/reverse osmosis (MF/RO) buildings. Reclaimed water from advanced treatment is then delivered to irrigate golf courses. RO reject water from the MF/RO process is

chlorinated, dechlorinated, and then sent to Carmel Bay via an outfall. A summary of the processes at the existing CAWD WWTP is provided in **Table 2-1** and a process flow diagram is shown in **Figure 2-3.**

Table 2-1 Summary of Existing Unit Processes

Unit Processes	Type	Quantity	Size
Preliminary Treatment			
Influent Screening	Perforated Screen Auger	1	0.3” openings
Grit Removal	Non Aerated Grit Tank	1	36’ diameter
Primary Treatment			
Primary Clarifiers	Circular, flat-bottom	2	60’ diameter, 9’ deep
Secondary Treatment			
Aeration Tanks 4A & 4B	Plug-flow tanks	1	50’ wide, 50x2’ long, 14’ SWD
Aeration Tanks 5 & 6	Plug-flow tanks	2	25’ wide, 110’ long, 15’ SWD
Secondary Clarifier No.1	Circular, flat-bottom	1	75’ diameter, 9’ SWD
Secondary Clarifier No.2	Circular, flat-bottom	1	65’ diameter, 12’ SWD
Solids Handling			
DAF Thickener	Dissolved Air Flotation	1	20’ diameter, 8’ SWD
Anaerobic Digester No.1		1	65’ diameter, 26’ depth
Anaerobic Digester No.2		1	55’ diameter, 25.5’ depth
Disinfection			
Chlorination	Gas Chlorinators	2	Chlorine Dosage: 2,000 lb./day
	Chlorine Contact Chamber	2	Contact tank size: 10’ wide, 210’ length, 3.6’ SWD

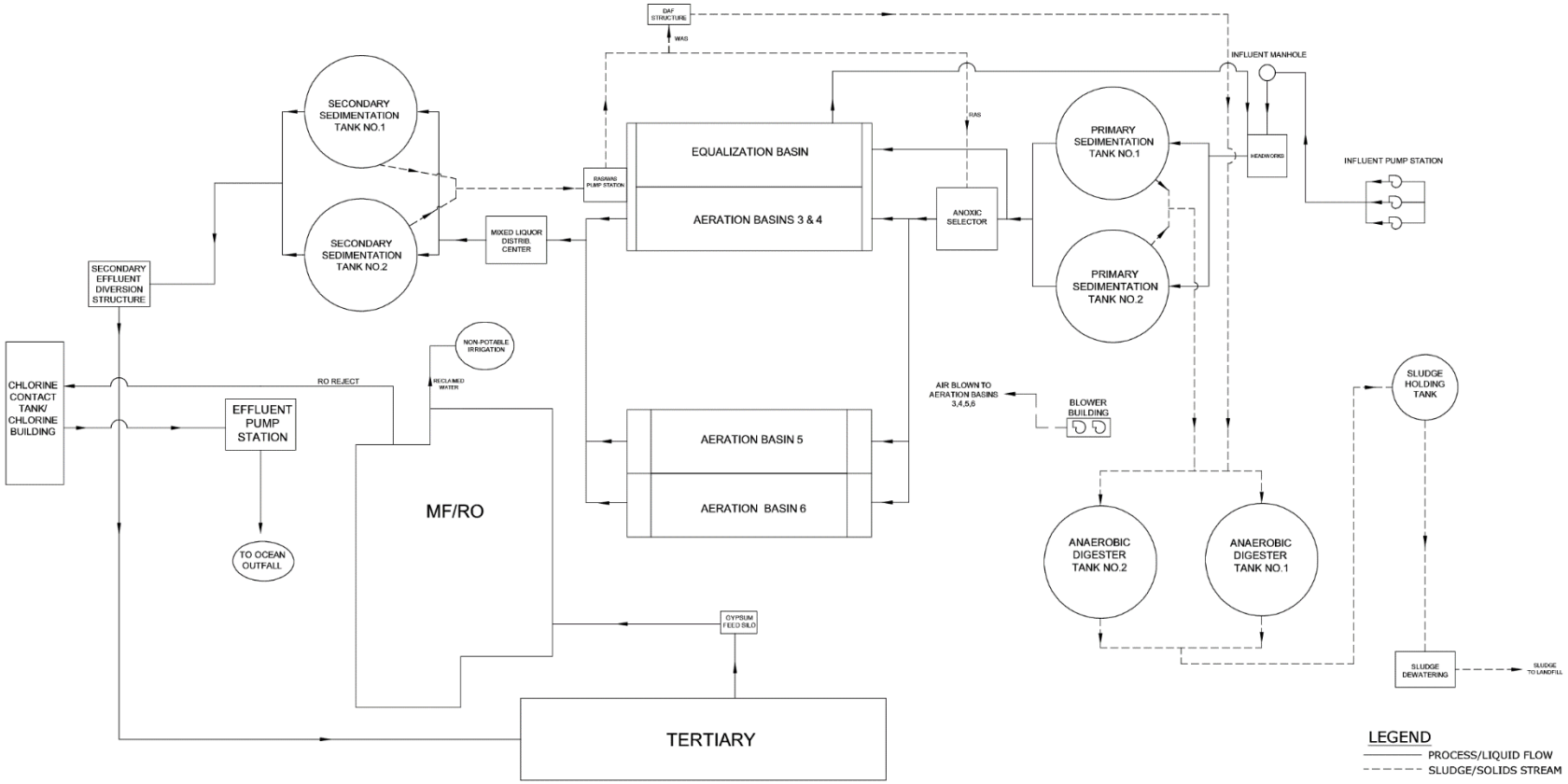


Figure 2-3: Existing CAWD WWTP Process Flow Diagram

2.3 CURRENT PERMIT

The CAWD WWTP was designed to treat 4.0 MGD of primarily domestic wastewater and has a permitted effluent dry weather flow monthly average of 3.0 MGD. The plant has an average dry weather flow of approximately 1.2 MGD (40% permitted capacity or 30% of the design capacity). The WWTP has a National Pollutant Discharge Elimination System Permit (NPDES No. CA0047996, adopted by the Central Coast Region Water Quality Control Board on May 22, 2014; effective on July 11, 2014; and expired on July 10, 2019) permitted effluent limits on BOD5, TSS, Oil & Grease, Settleable Solids, Turbidity, pH, Total Coliform Bacteria, Fecal Coliform Bacteria, and Enterococcus Bacteria. The current permit levels are outlined in **Table 2-2**.

Table 2-2 Current CAWD WPCP NPDES Permit

	Quantity or Loading				Quality or Concentration			
Parameter	**Monthly Average**	**Weekly Average**	**Maximum Daily**	**Units**	**Monthly Average**	**Weekly Average**	**Maximum Daily**	**Units**
BOD_5	750	1,130	2,250	lbs/day	30	45	90	mg/L
TSS	750	1,130	2,250	lbs/day	30	45	90	mg/L
Oil & Grease	630	1000	1,880	lbs/day	25	40	75	mg/L
Parameter	**Monthly Average**		**Weekly Average**		**Instantaneous Maximum**			**Units**
Settleable Solids	1.0		1.5		3.0			mg/L/hr
Turbidity	75		100		225			NTUs
pH	6.0 – 9.0 at all times				pH units			
Total Coliform Bacteria	230		-		10,000			MPN/100 mL
Fecal Coliform Bacteria	24,000		-		49,000			MPN/100 mL
Enterococcus Bacteria	4,300		-		13,000			MPN/100 mL

2.4 EXISTING CAWD WWTP DATA ANALYSIS

Greeley and Hansen received historical data from CAWD from April 2014 through June 2022 for flow, alkalinity, BOD_5 and TSS. Some additional historical data was available from a previous work that included performance data from July 2014 to July 2019 for the primary effluent. A summary of the data is presented in the subsequent tables.

2.4.1 Raw Influent Characteristics

The influent water quality characteristics are shown in **Table 2-3**; the table includes data for flow, alkalinity, BOD_5 and TSS.

Table 2-3 Raw Influent Data (July 2014 – June 2022)

	FLOW (MGD)	Alkalinity (mg/L)	Alkalinity (ppd)	BOD_5 (mg/L)	BOD_5 (ppd)	TSS (mg/L)	TSS (ppd)
Minimum 7-Day Running	0.80	160	-	91.85	-	123	-
Average	1.30	307	3162	367	3,753	601.3	6,256
Max 30-day Running	2.38	392	4,558	658	6,912	1241	12,564
Max 7-day Running	3.59	416	6,696	713	11,851	1,574	30,477
Maximum Day	4.87	494	6,696	775	11,851	2,576	30,477

Figure 2-4 presents influent flow data over the recent historical data period reviewed as part of this project. As shown in **Figure 2-4**, the influent flow increases seasonally during late winter/early spring from 2014-2022. Influent flow increases can be due to higher rates of precipitation during these months since they correspond with the wetter months of the year. Late winter/early spring of 2018 exhibits a smaller influent rise due to less precipitation that year.

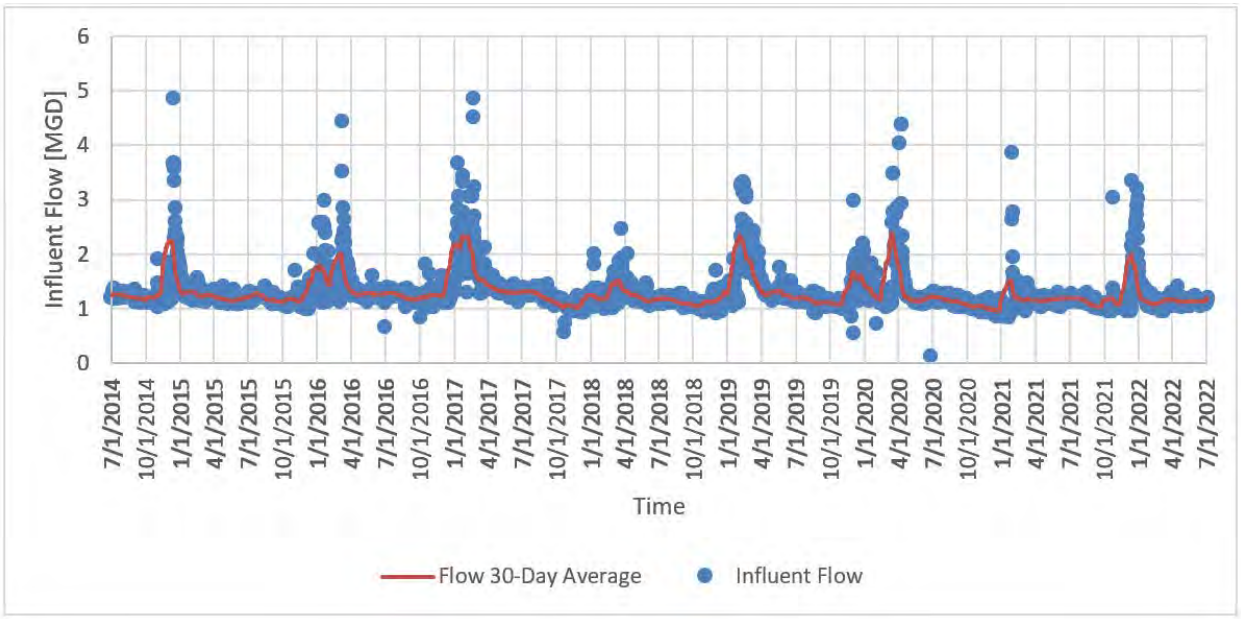


Figure 2-4: Influent Flow

Figure 2-5 to **Figure 2-10** present the influent Alkalinity, BOD, and TSS concentrations and loadings. As shown in **Figure 2-5**, alkalinity concentrations decrease during the winter/early spring, peak during the summer months, and then remain relatively stable for the rest of the year. The alkalinity decreases during late winter/early spring; however, coincides with the influent flow spikes during the year. As a result, the overall loading of alkalinity going into the plant is somewhat stable and alkalinity spikes in loading become less steep as seen in **Figure 2-6**.

The BOD and TSS concentrations and loadings are shown in **Figure 2-7** to **Figure 2-10**, but no obvious patterns were concluded. These variability in data can be attributed to the variability of influent flow going into the CAWD WWTP and overall diurnal/seasonal variations. Concentrations in BOD and TSS can be subject to more volatility and less consistency in data readings on a regular basis.

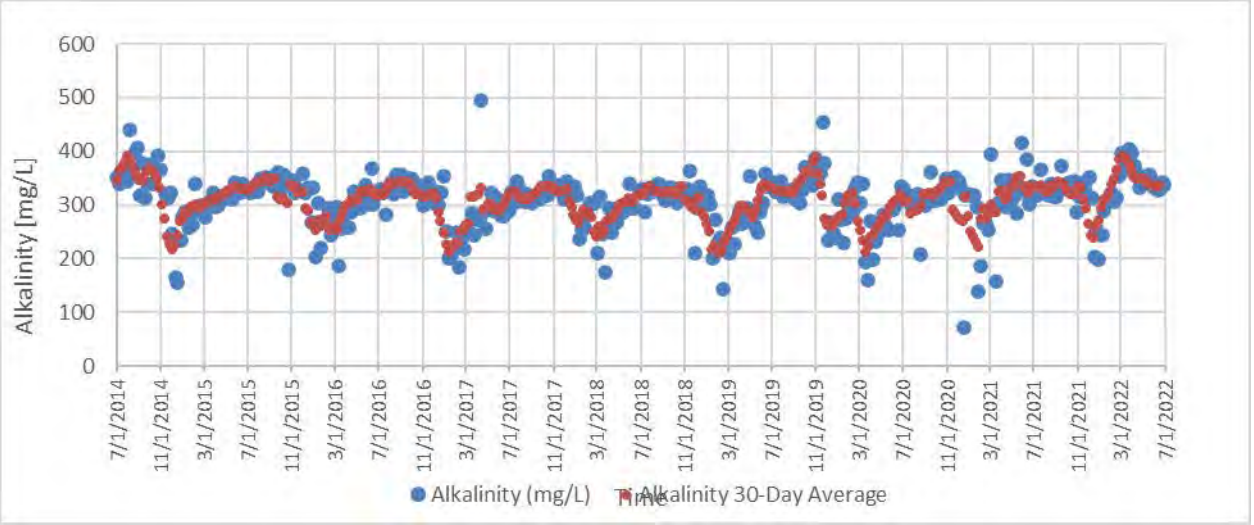


Figure 2-5: Influent Alkalinity Concentrations

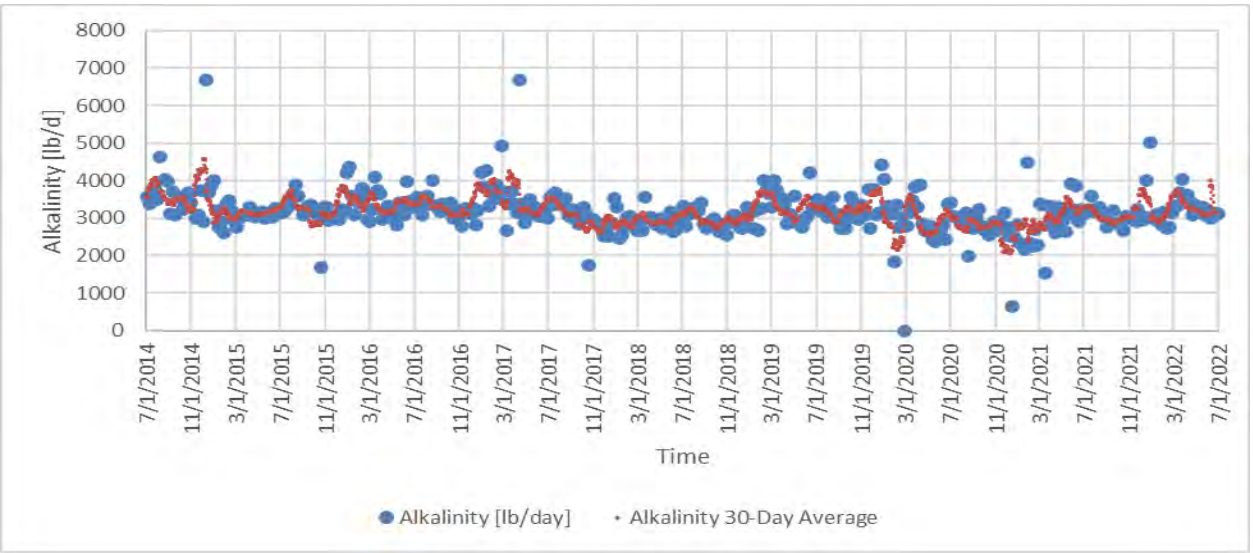


Figure 2-6: Influent Alkalinity Loadings

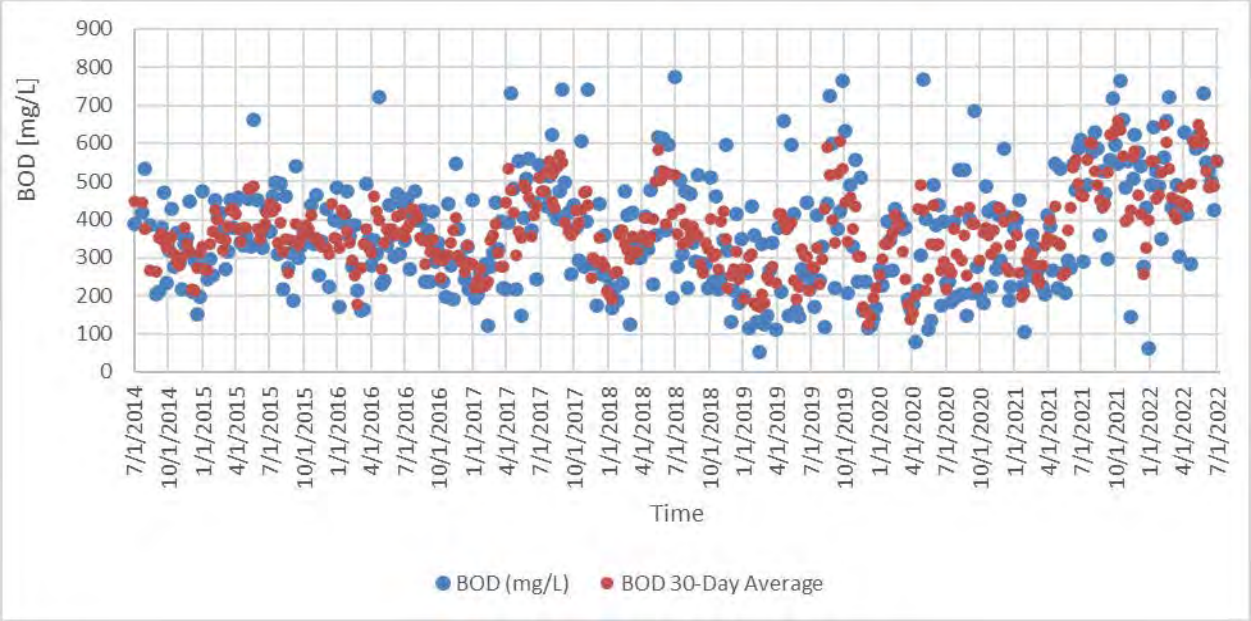


Figure 2-7: Influent BOD_5 Concentrations

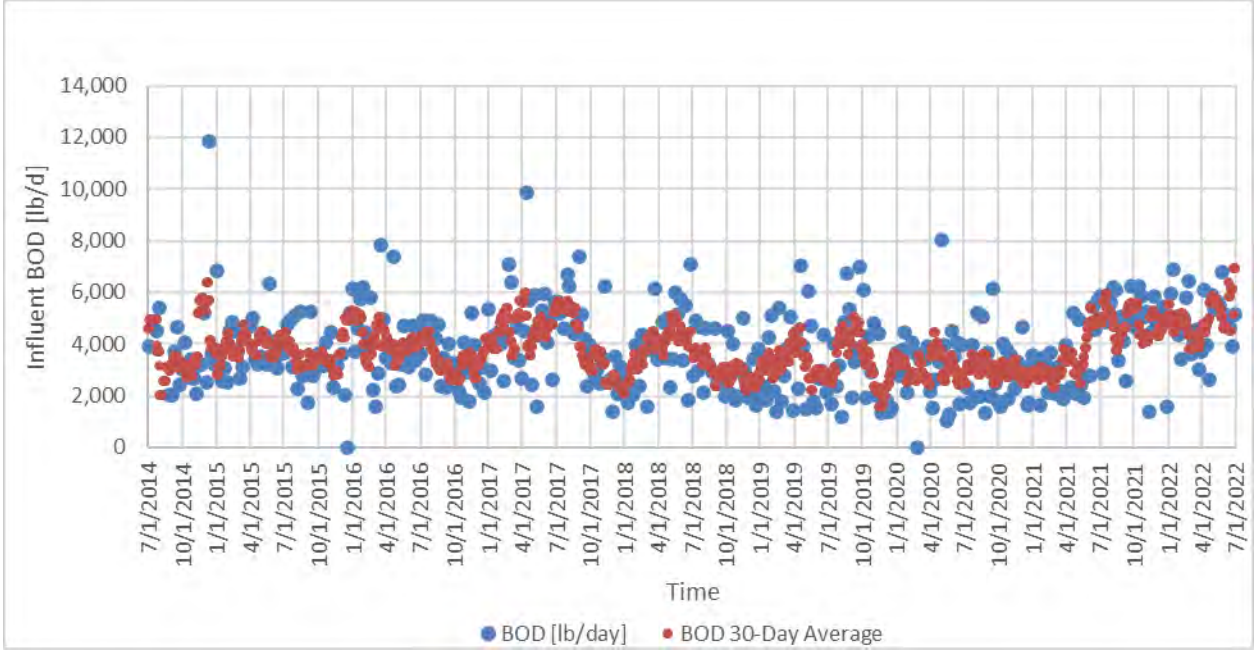


Figure 2-8: Influent BOD_5 Loading

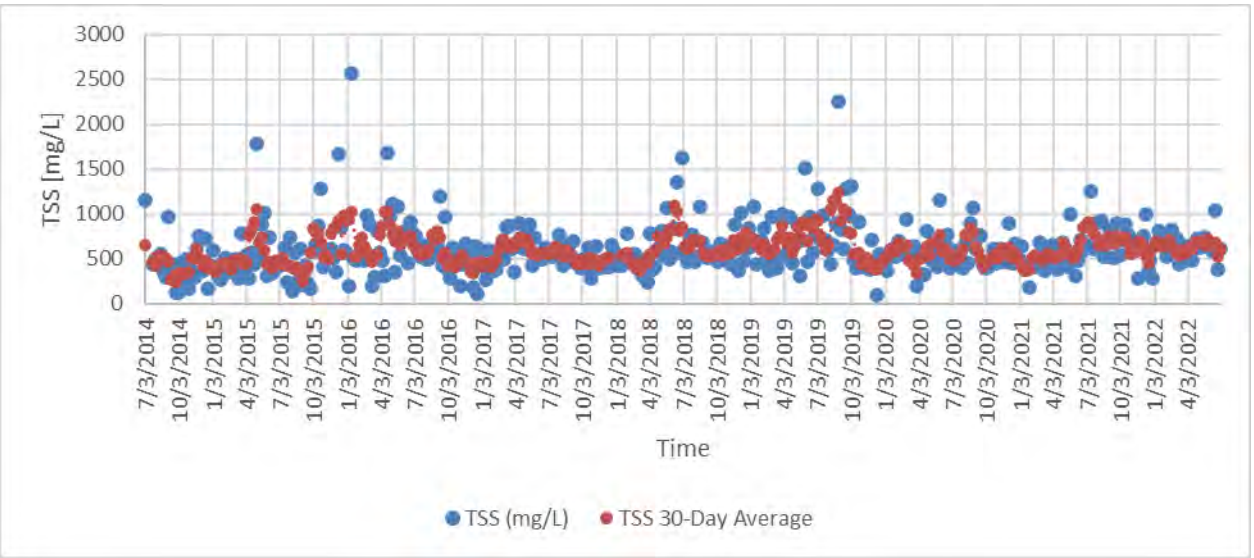


Figure 2-9: Influent TSS Concentrations

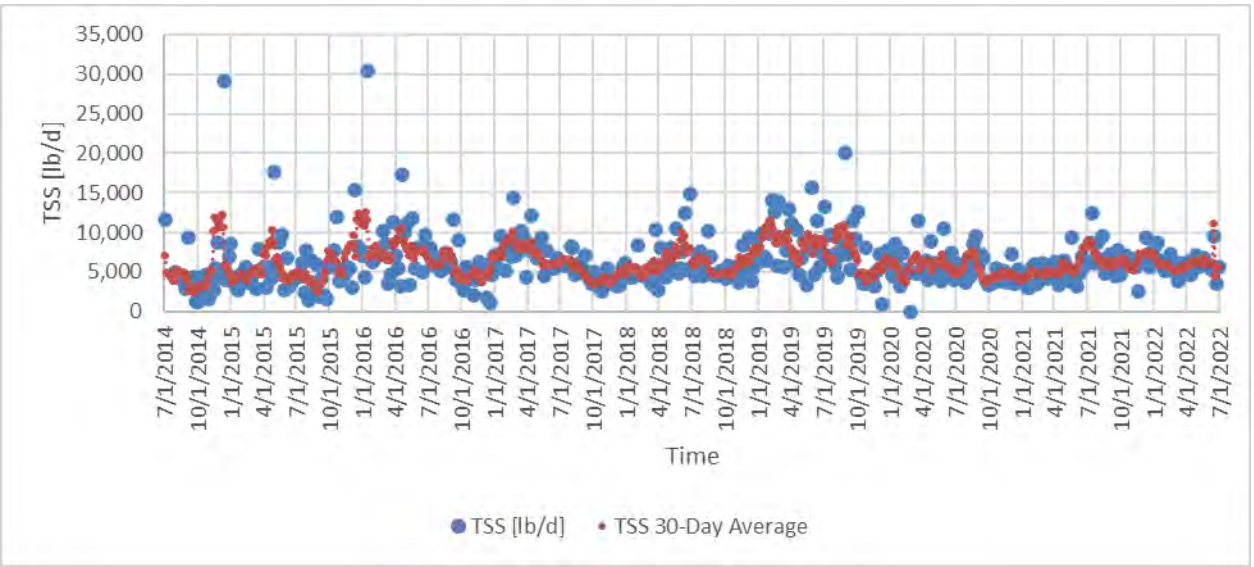


Figure 2-10: Influent TSS Loadings

SECTION 3 WRRF RELOCATION AND CONVEYANCE ALTERNATIVES

3.1 CONCEPTUAL WWRF LOCATION

Potential future WWRF locations were reviewed in the Carmel area and Roach Canyon was selected as a potential location for a new WWRF for consideration in this report. The site is located well outside the effects of sea level rise and is in a canyon that is well hidden from view. The location is about 3.5 miles from the ocean. While this location may not be the only viable option it serves as a good test case for this evaluation. **Figure 3-1** shows the location of Roach Canyon outlined in red.

Figure 3-1: Roach Canyon Location

Roach Canyon is at a higher elevation than the existing CAWD WWTP. Therefore, due to the difference in elevation, force mains will need to be installed to account for a higher degree of elevation change. Additionally, placing the new WRRF at Roach Canyon presents further opportunity for the surrounding communities who are not tied into the CAWD wastewater system to transfer away from septic tanks.

3.2 EQ BASIN DESIGN AND SITING ALTERNATIVES ANALYSIS

An equalization basin upstream of the WRRF will allow flow homogenization to the facility by removing peak wet weather flows and providing an equalized flow that allows reducing the size of the treatment plant. An EQ basin capacity of 1 million gallons was determined to be adequate for the purposes of the

conceptual estimates. The dimensions selected for the equalization basin were 80’ wide by 150’ length and 17’ depth. **Figure 3-2** shows the wet weather flow fluctuation for a representative storm event from March 2020. The EQ basin will provide the capacity to shave off peak wet weather flow, highlighted with the shaded area in **Figure 3-2**. The horizontal line displayed in orange is at 3.6 MGD AWWF that was considered for the conceptual design.

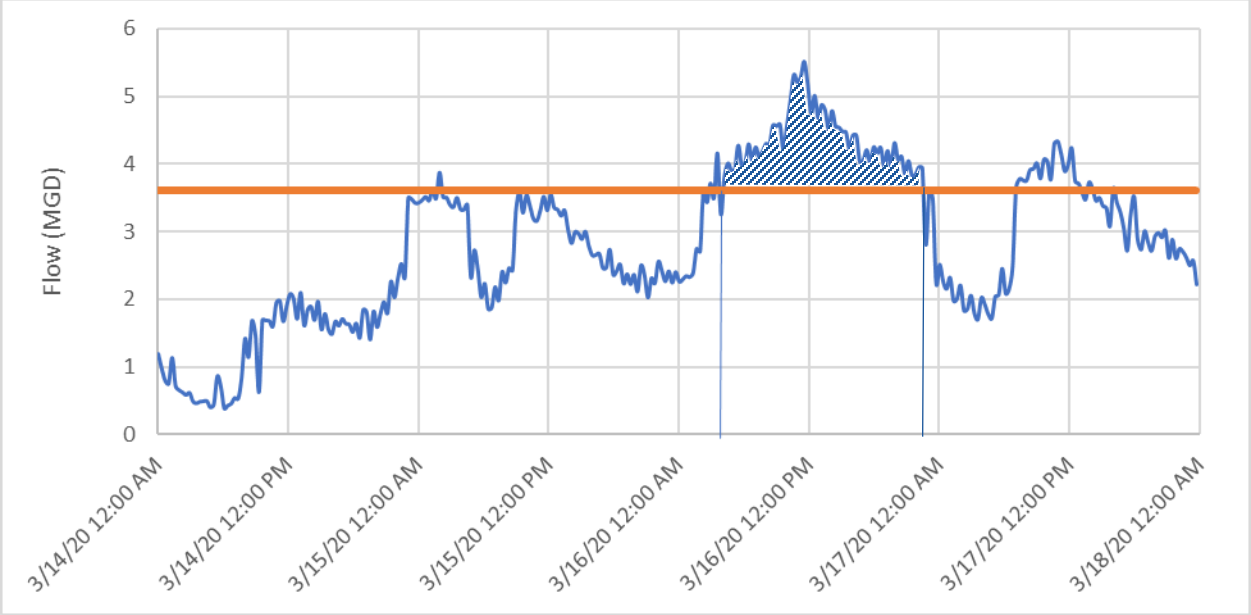


Figure 3-2: Storm Event on 3/16/2020

The following alternatives presented in this section will focus on potential locations for the new EQ basin and pump station under the assumption that the new WRRF will be located at Roach Canyon. These facilities would support the new WRRF. Potential locations include the existing WWTP site (Alternative 1), Rio Park Dolores (Alternative 2), and Hatton Canyon Park (Alternative 3). The locations for these three options are shown in **Figure 3-3.**

Figure 3-3: Potential Locations for the New EQ Basin and Raw Sewage Pump Station

The new WRRF will continue to discharge brine to the existing outfall. Therefore, the outfall will not change in location and will continue servicing CAWD.

3.2.1 Alternative 1: New EQ Basin and Pump Station Located at Existing WWTP Site

Alternative 1 would utilize the existing CAWD WWTP site as the location for the new EQ basin and pump station. The existing WWTP is shown in **Figure 3-4.**

Figure 3-4: Existing CAWD WWTP

The new EQ basin and pump station would have a footprint of approximately 150 feet x 80 feet, and the existing WWTP site has enough space to accommodate both facilities. If this alternative was selected, the overall footprint that would be occupied by the existing WWTP will be reduced by roughly 90% after the existing treatment facilities are demolished and the site restored to natural habitat. This would be the least expensive alternative in the short term due to potential reuse of some existing infrastructure. There is ample space for an EQ basin and there is no need to reroute gravity conveyance. New piping from Roach Canyon can connect to the new facilities at the existing site. Conceptual routing for Alternative 1 is presented in **Figure 3-5** and **Figure 3-6.**

Figure 3-5 shows a draft example of the new Sewage Force Main Line, WWTP demolition, and location of new EQ tank and pumping station and extensions of any other necessary piping. The path displayed in the figure required the least amount of construction effort due to existing infrastructure available in and around the site. Minimal extensions would be needed besides renovations to the existing outflow piping and Main Line.

Figure 3-6 shows where new piping must begin at the existing WWTP, and end at the Roach Canyon Park site.

Figure 3-5: Conceptual Routing for Alternative 1

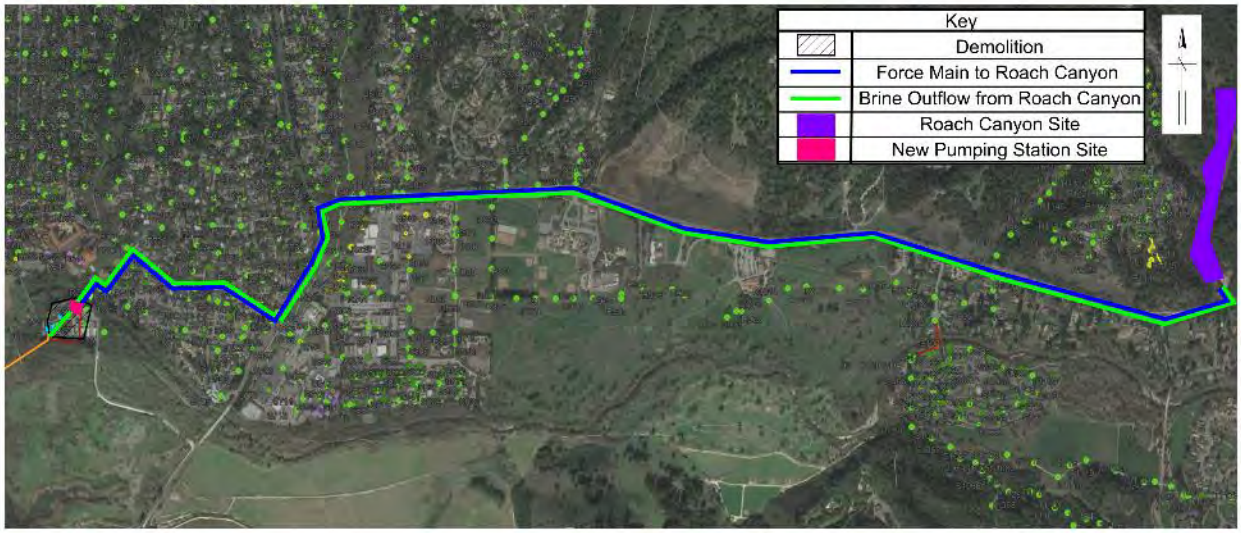


Figure 3-6: Conceptual Routing for Alternative 1 (Continuation)

Several important disadvantages exist for a new EQ and pump station located at the existing WWTP location. While the size and footprint of the new facilities on site would be smaller compared to the existing plant, the new EQ basin and pump station would still be in the Environmentally Sensitive Habitat Area (ESHA) and the Coastal Commission may not accept the plan. Also, the new pump station and EQ basin would still be subject to the risks posed by sea level rise and climate change. **Table 3-1** summarizes advantages and disadvantages of Alternative 1.

Table 3-1 Alternative 1 Advantages and Disadvantages

Advantages	Disadvantages
No need to reroute gravity conveyance system	Located in an ESHA
Plenty of space to accommodate EQ Basin and Pump Station	Flood risk

3.2.2 Alternative 2: New EQ Basin and Pump Station Located at Rio Park Dolores

Alternative 2 includes placing the new EQ basin and pump station at Rio Park Dolores across the river from the existing WWTP site. The proposed Rio Park Dolores site is outlined in red in **Figure 3-7**.

Figure 3-7: Rio Park Dolores Site

This would potentially be the second least costly alternative in the short-term due to the location of the new pump station and EQ tank near already existing infrastructure. There is a reasonable amount of space for an EQ basin and there is no need to reroute gravity conveyance. New piping from Roach Canyon can easily connect to the new facilities near the existing site.

Figure 3-8 shows a draft example of the new Sewage Force Main Line, WWTP demolition, and location of new EQ Tank and pumping station and extensions of any other necessary piping. The proposed path displayed requires the least amount of piping due to existing infrastructure in and around the site.

Figure 3-9 shows where new piping would begin at Rio Park Dolores and end at the Roach Canyon Park site.

Figure 3-8: Conceptual Routing for Alternative 2

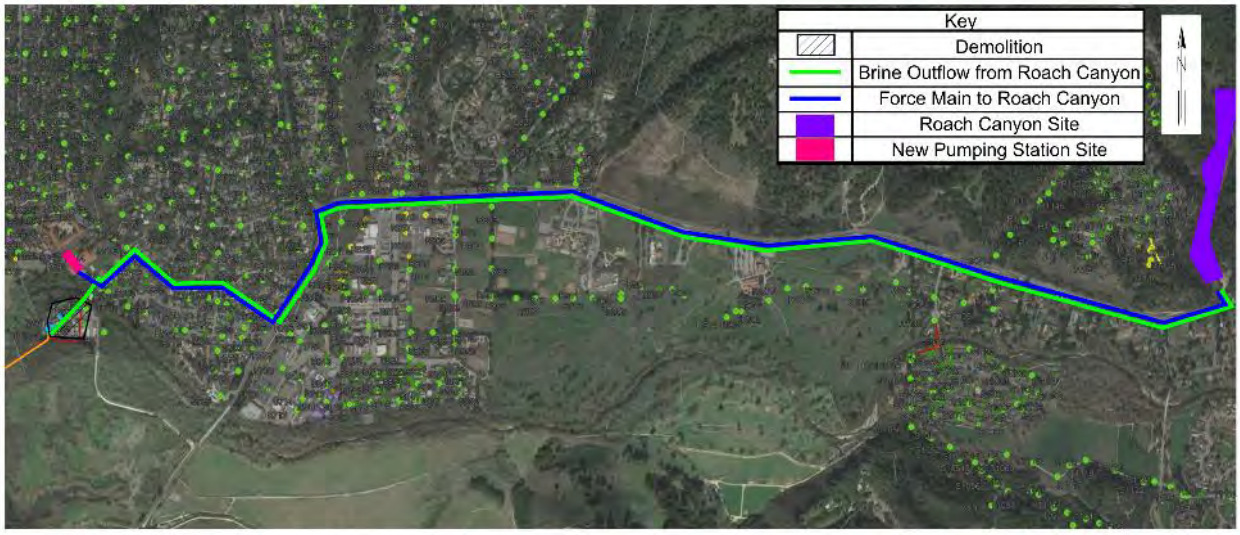


Figure 3-9: Conceptual Routing for Alternative 2 (Continuation)

Similar to Alternative 1, several criteria for a new facility are not met with Alternative 2. While the existing WWTP facility would be completely removed, possibly being added to the watershed as protected land, Rio Dolores Park has issues pertaining to its location near the Carmel River. The new EQ basin and pump station would still be near the Environmentally Sensitive Habitat Area (ESHA), and it would also be located within the County LCP Coastal Zone. Therefore, the Coastal Commission may not accept the plan outline for Alternative 2.

The new pump station and EQ basin would also be still subject to the risks posed by sea level rise and climate change, and the pump station would use more energy to pump effluent to the Roach Canyon WRRF due to the lower elevation at Rio Park Dolores. Access to Rio Park Delores for heavy machinery would also be more difficult due to smaller residential roads. Additional costs may arise due to community demands relating to architecture and design requirements within and around the nearby neighborhood and Carmel Mission. **Table 3-2** summarizes the advantages and disadvantages of Alternative 2.

Table 3-2 Alternative 2 Advantages and Disadvantages

Advantages	Disadvantages
No need to reroute gravity conveyance system	Located in riparian corridor
	Greater flood risk
	Relatively small site; limited space for EQ Basin
	Located in County LCP Coastal Zone

3.2.3 Alternative 3: New EQ Basin and Pump Station Located at Hatton Canyon Park

Alternative 3 includes abandonment of the existing WWTP site and placing the new EQ basin and pump station at Hatton Canyon Park adjacent to the Safeway parking lot. The proposed Hatton Canyon Park site is outlined in red in **Figure 3-10.**

Figure 3-10: Hatton Canyon Park

This would be the costliest alternative due to the location of the new pump station and EQ tank farther from the existing WWTP. This area is less regulated than the sites from Alternatives 1 and 2, and Highway 1 nearby provides access for heavy machinery to the site.

Figure 3-11 shows a draft example of the new Outflow and Main Line, necessary demolition, location of new pumping station and extensions of any other necessary piping. The proposed path required the most amount of new pipping and construction among the three alternatives explored due to distance from the

existing WWTP. Because this site is higher than the other two alternatives a new lift station would need to be built to serve the low-lying areas of the Mission Fields neighborhood.

Figure 3-12 shows where new piping would begin near the intersection between Rio Rd and Highway 1, and end at the Roach Canyon Park site.

Figure 3-11: Conceptual Routing for Alternative 3

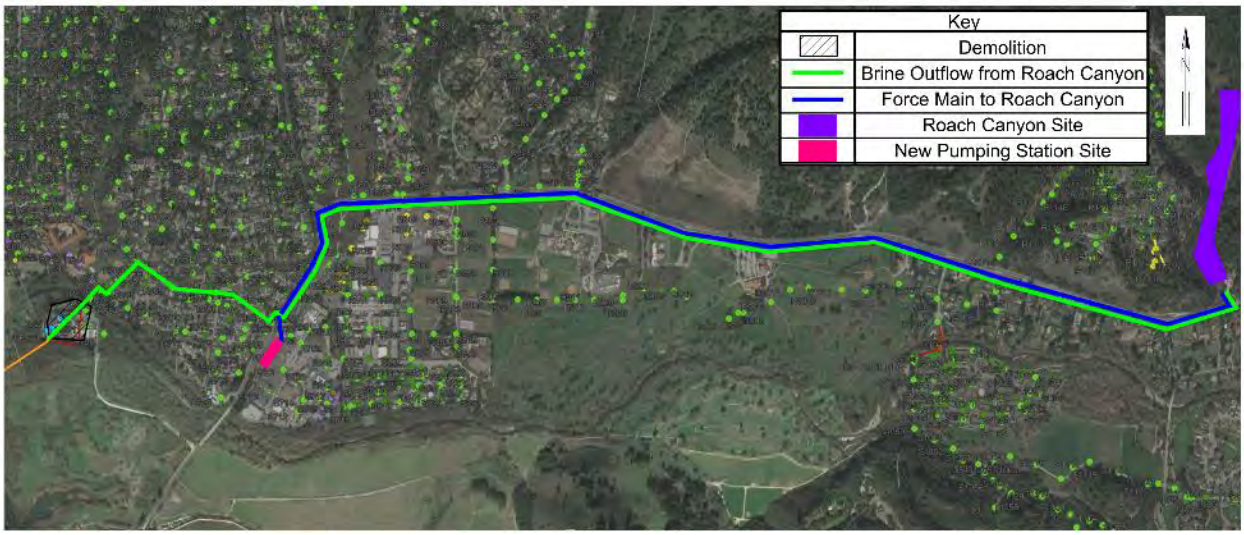


Figure 3-12: Conceptual Routing for Alternative 3 (Continuation)

The collection system and gravity conveyance would have to be rerouted and reconfigured. There is adequate space available for both the new EQ basin and pump station. Alternative 3 would be less exposed to flooding risks posed by climate change compared to Alternatives 1 and 2 due to commercial and residential zones around the site. The architecture of the facilities will need to match the surrounding commercial architecture. Additional costs may rise due to community demands. **Table 3-3** summarizes the advantages and disadvantages of Alternative 3.

Table 3-3 Alternative 3 Advantages and Disadvantages

Advantages	Disadvantages
Adequate space to accommodate EQ Basin	Requires reconfiguring gravity collection system
Located out of Coastal Zone	Requires a small lift station in Mission Fields neighborhood
Less flooding risk	

3.3 RECOMMENDATION

The proposed alternatives were presented to CAWD on July 22, 2022. Of the three alternatives, Alternative 3 was selected for further analysis. Alternative 3 includes the following components:

- New WRRF located at Roach Canyon
- New EQ Basin and Pump Station at Hatton Canyon Park

Several iterations for the Equalization (EQ) Basin were evaluated to determine the dimensions that would better fit the area available at Hatton Canyon Park and provide enough storage capacity to equalize the flow to the new WRRF. A storage capacity of 1 million gallons was determined to be adequate for the purposes of this conceptual design exercise. The dimensions selected for the equalization tank were 80’ wide by 150’ length and 17’ depth. **Figure 3-13** shows a preliminary layout of the flow EQ basin at Hatton Canyon Park. **Figure 3-14** shows a section view sketch of the EQ basin.

Figure 3-13: Conceptual Site Layout of EQ Basin at Hatton Canyon Park

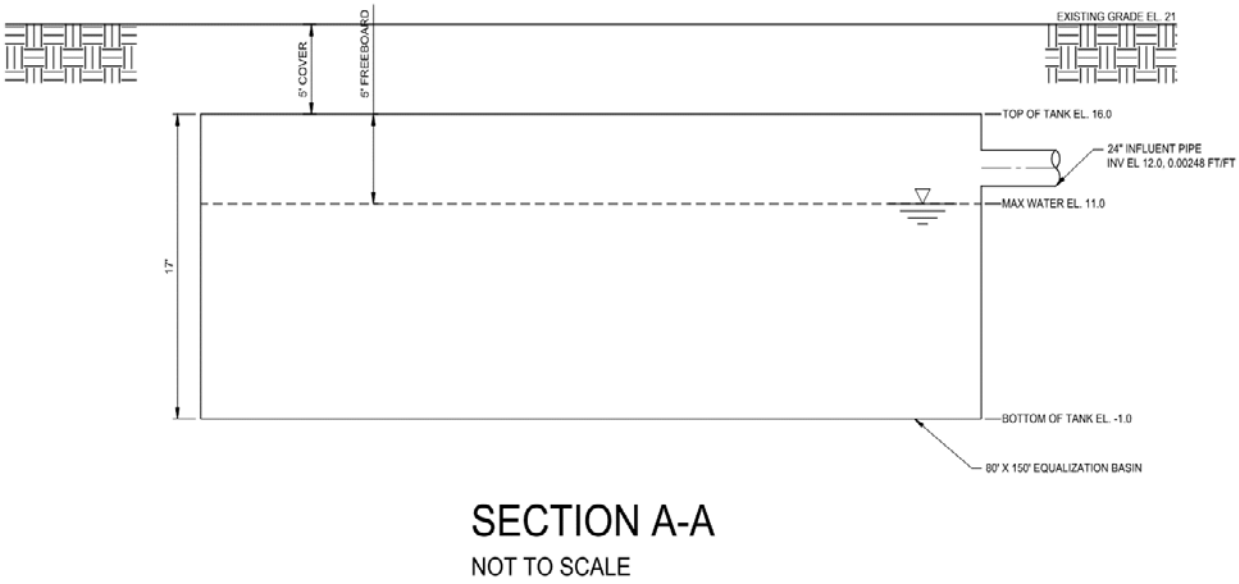


Figure 3-14: Conceptual Section View of EQ Basin

The conceptual conveyance piping between the EQ basin and the new WRRF is shown in **Figures 3-11 and 3-12**. Brine discharge piping from the WRRF to the existing Brine Discharge Outfall is also shown and generally would follow the same route of the conveyance piping to the WRRF. A conceptual layout of the connection piping from the new WRRF to the existing reuse water line for irrigation is shown highlighted in green in **Figure 3-15**. The estimated length of the new reuse water line is approximately 16,800 feet.

One alternative that may be considered in the future for potable reuse may be injection of treated water in the Carmel Valley Alluvial Aquifer. If the product water line is to be used for injection in the Carmel Valley Alluvial Aquifer, an injection well by the new WRRF could be included in the facility design. See **Figure 3-15 for a** tentative location of a new injection well. The concept of an injection well would require further development, but it is technically feasible given known hydraulic conductivity of nearby geology and therefore this concept is worth noting for future consideration/evaluation.

Figure 3-15: Conceptual Connection Piping from the WRRF to the Existing Reuse Water Line

Table 3-4 shows a summary of the pipe lengths and preliminary sizes of the conceptual conveyance and piping layout. **Appendix A** includes piping calculations and additional figures for the EQ basin and gravity sewer line.

Table 3-4 Conceptual Pipe Alignment Lengths and Sizes

Pipeline Segment	Estimated Pipe Length (feet)	Preliminary Pipe Size (inches)
Gravity Sewer Line to EQ Basin/Pump Station	3,710’	24”
Line from EQ Basin/Pump Station to WRRF	17,100’	18” pressurized line based on 2,100 gpm instantaneous flow and 3 ft/s velocity
Gravity Discharge Line from WRRF to Outfall	22,000’	24”
New Reuse Water Line to Irrigation	16,800’	24”

SECTION 4 PROPOSED NEW WRRF TREATMENT TRAIN

Relocation of the existing CAWD WWTP provides an opportunity for updating the treatment train for optimization. Currently, the existing CAWD WWTP utilizes conventional treatment to treat the wastewater which includes primary treatment, secondary treatment, tertiary treatment, and disinfection. Additional details for the existing CAWD WWTP process can be found in Section 2.2. The existing treatment train can be revised using advanced treatment technology to reduce the footprint while maintaining the required level of treatment to continue reclaimed water applications, and also include resource recovery methods to utilize the treated solids for reuse purposes.

4.1 NEW WRRF UNIT PROCESSES OVERVIEW

The proposed treatment train for the new WRRF is proposed to utilize membrane bioreactor (MBR) technology and updated solids treatment to produce Class A fertilizer. By utilizing MBR, the new WRRF would eliminate the need for the primary clarifiers and secondary clarifiers. By eliminating the need for clarifiers, the footprint of the new WRRF can be significantly reduced. A simplified conceptual process flow diagram for the proposed WRRF is shown in **Figure 4-1**.

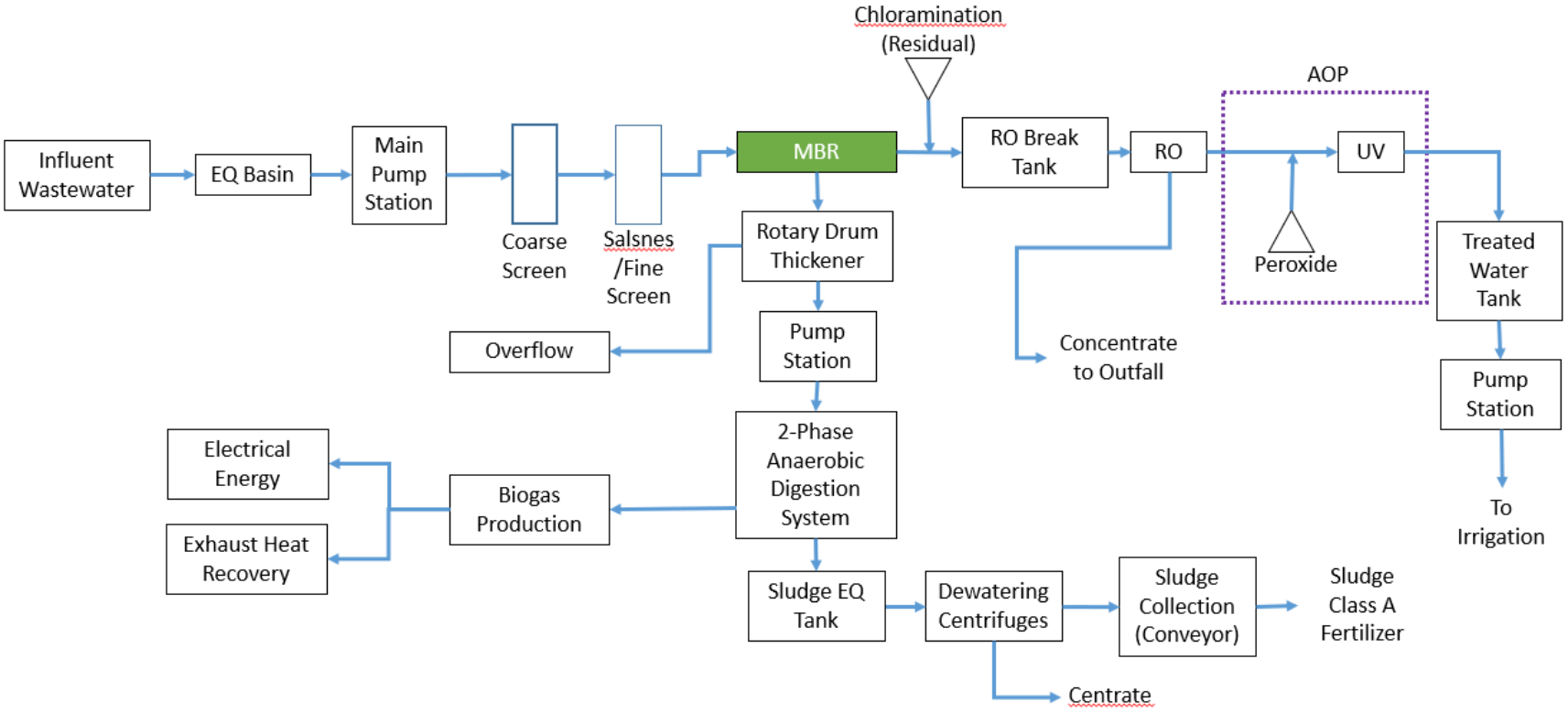


Figure 4-1: Proposed New WRRF PFD

The following sections describe the design philosophy of each unit process being proposed.

4.2 PRELIMINARY TREATMENT

Preliminary treatment focuses on the removal of large solids. The main removal mechanism is physical separation of the target constituents from the wastewater.

4.2.1 Headworks

Once the wastewater reaches the plant, it is imperative that the solids and particulates are removed from the wastewater stream at the start of the treatment process to protect the unit processes further downstream and maintain the life expectancy of the equipment at the plant. This is especially relevant to treatment trains that utilize MBR technology, where membranes experience more frequent fouling if the influent stream is not treated appropriately. For the new WRRF, a headworks facility that incorporates both coarse screening and fine screening is recommended due to the elimination of primary and secondary treatment processes to remove solids of a wide range of sizes.

4.3 ADVANCED TREATMENT

Advanced treatment focuses on the removal of dissolved and suspended solids. The purpose of advanced treatment is to treat the water to a high level to safely reuse the water.

4.3.1 Membrane Bioreactors (MBR)

MBR consists of two major components: the bioreactor and the membranes. The function of the bioreactor is to allow suspended growth of bacteria and protozoa (biomass). The biomass will consume the target constituents to be reduced. The membrane functions as a solid-liquid separation mechanism. This allows the biomass to remain in the MBR system, while the treated effluent continues to the next unit process.

There are two types of MBR: Side Stream MBR and Submerged MBR. Side Stream MBR is where the membrane modules are installed outside the reactor. Submerged MBR is where the membrane modules are installed inside the reactor. **Figure 4-2** shows the differences between the two MBR configurations.

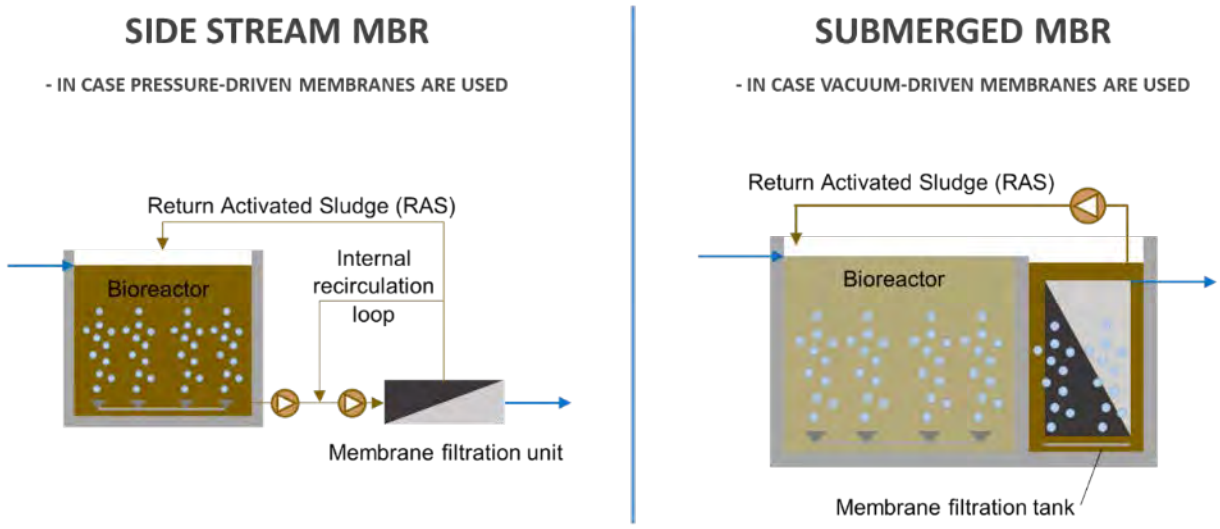


Figure 4-2: Side Stream MBR vs. Submerged MBR

4.3.2 Reverse Osmosis (RO)

The RO mechanism is pressure-driven diffusion. Pressure is applied to the influent water to force the water through a semipermeable membrane. The target constituents, typically dissolved solids, are rejected by the RO membrane, allowing only clean water to pass through. RO is capable of removing up to 98% of dissolved solids. The rejected water from the RO process, also called concentrate, will be discharged to the existing outfall. The water that passes through the RO membranes, called permeate, continues to the next unit process.

4.4 SOLIDS HANDLING

Solids handling is the treatment of the sludge and biosolids produced by the liquid treatment processes before disposal or reuse. The proposed solids handling process includes sludge equalization, sludge thickening, digestion and dewatering to treat the biosolids to a level where it can be reused for land applications.

Storage of the untreated solids is imperative to minimize changes in sludge and biosolids production rates. This will also allow uniform solids flow through the solids handling process. For these purposes, a waste activated sludge (WAS) holding tank will be included in the proposed treatment train.

The thickening process will increase the solids content of the sludge by removing some of the liquid. This will aid in reducing the volume of the sludge, as well as preparing it for stabilization via the digestor.

The digestor is important for the reduction of pathogens, odor control, and for minimizing potential of decay. This is known as “stabilization”. The mechanism for stabilization of sludge via the digestor is biological conversion. A two-step anaerobic digestion system is proposed for the treatment train.

4.5 DISINFECTION

Disinfection is the final step in the treatment process before the effluent is discharged for disposal or reuse. The methods for disinfection include application of chemical and non-ionizing radiation. The proposed disinfection process for the new WRRF includes both methods.

4.5.1 AOP: Hydrogen Peroxide with UV

Advanced oxidation processes (AOP) are used to degrade constituents through oxidation. The treated effluent will be used for water reclamation purposes. The proposed oxidant for the new WRRF is hydrogen peroxide paired with UV light. Hydrogen peroxide is a fairly stable oxidant, and typically leaves a high concentration of residual hydrogen peroxide. UV light will react with the hydrogen peroxide to produce hydroxyl radicals. The hydroxyl radicals are a strong oxidant that will completely oxidize almost all organic compounds present in the water.

4.5.2 Chloramination

Due to the distance from the new WRRF to the sites where reuse water will be utilized, chloramination is needed for providing residual chlorine in the treated effluent water. Chloramination uses a stable chemical made from chlorine and ammonia to disinfect the effluent. The chemical will be added in measured dosages to ensure microorganisms are inactivated. The stability of the chemical allows it to remain in the effluent for a longer period, therefore providing a long-lasting protection against microorganism regrowth in the distribution system before reaching the end-user. This is especially beneficial for distribution systems with large distances between the plant and the end-users. Another benefit for chloramination is that the chemical used does not produce high levels of regulated disinfection byproducts compared to other disinfection alternatives, such as free chlorine.

Chlorination at the current facility requires a Contact Time = 180 min for 2 MGD as per permit. The total CT value provided is 450 mg/l-min. Currently the existing plant at Carmel is injecting 10 mg/l chloramines achieving 7 mg/l residual chlorine. The requirement is to have a residual chlorine of 5 mg/l. For the new WRRF, UV light disinfection will take full credit on pathogen inactivation/reduction. The chlorination dose required may be in the range of only 2 mg/l, subject to confirm during the detailed design phase. Depending on the length of reuse water distribution pipe, ammonia can be added as needed to form chloramines.

SECTION 5 NEW WRRF TREATMENT TRAIN – PRELIMINARY DESIGN

This section will present the preliminary sizing of the proposed treatment train for the new WRRF. Preliminary sizing is based on the data provided by CAWD. Analysis of the provided data was discussed in Section 2.4. The proposed treatment train is shown on **Figure 4-1**.

5.1 NEW WRRF UNIT PROCESSES (LIQUID) PRELIMINARY SIZING

Preliminary sizing, budget and layout information was requested from equipment manufacturers (provided in Appendix C) and a preliminary design was developed for the liquid treatment portion of the WRRF. **Table 5-1** shows the quantities and preliminary size of the unit process components for liquid treatment at the new WRRF.

Table 5-1 New WRRF Preliminary Sizing – Liquid Process

Unit Process	Type	Quantity	Preliminary Size (2.4 or 3.6 MGD AWWF)
Preliminary Treatment			
Flow Equalization	EQ Basin	1	80’ Wide ,150’ Long, 17’ Depth
Main Pump Station	Pumps	5	3.0 MGD x 80 psi
Influent screening	Coarse Rake Screening	2	4’ Wide ,7’ Long, 6’ Height
Influent screening	Fine Drum Screening	2	4’ Wide ,7.5’ Long, 6.6’ Height
Solids Separation (optional)	Salsnes Filter System	3	8’ Wide, 9’ Long, 6’ Height
Advanced Treatment			
MBR	Membrane Train	4	20’ Wide ,40’ Long, 13’ Depth Membrane Surface Area: 430 SF
MBR	Bio Tank	4	20’ Wide ,150’ Long, 16.5’ Depth
RO Break Tank with Pumps	20,000 Gallon (20 min average flow)	2	18’ Diameter, 12’ Height
RO	RO System and Ancillary Equipment (Recovery rate = 85%)	2	1.5 MGD Skids
Brine Recovery RO (BRRO) with flipping concept	Flow Reversal RO System (Recovery rate = 75%-86%)	1	0.45 MGD Skid
Disinfection			
Advanced Oxidation Process (AOP)	4-bank Flex100 UV with 4.5 ppm peroxide	2	5’ Wide ,14’ Long, 5’ Height
Residual Disinfectant	Oxidant Skid (Chloramination)	2	5 HP Dosing pumps
Treated Water Tank	30,000 Gallon Tank (30 min Retention Time Average flow)	2	18’ Diameter, 16’-8” Height
Treated Water Pump Station			
Treated Water Pumps	Pumps (4 running and 1 spare)	5	Total 3.0 MGD x 80 psi

5.2 NEW WRRF UNIT PROCESSES (SOLIDS) PRELIMINARY SIZING

Table 5-2 shows a summary of the solids characteristics from the existing WWTP at Carmel. These values were used to estimate the sludge flow from the MBR system. Preliminary performance requirements for the solids handling processes (thickening, digestion, and dewatering) were estimated, as well as preliminary energy production and Class A biosolids production. **Table 5-3** to **Table 5-9** summarize the preliminary performance requirements and resource production estimates.

Table 5-2 Existing WWTP Sludge Characteristics

Process Step	Sludge Flow [gallons/day]	% Solids	% VS/TS	Lbs. of Solids
Primary Clarification	8,000	4.1%	88%	2,735 lbs.
Secondary Clarification	15,000	1.2%	80%	1,501 lbs.
TOTAL				4,236 lbs.

Table 5-3 Sludge Characteristics from Membrane Bioreactor

Sludge Characteristics from MBR
23,000 gpd
4,236 lbs/day Total Solids
3,607 lbs/day Volatile Solids
2.2 % Solids

Table 5-4 Preliminary Thickening Performance Requirements

Thickening Performance
Increase from 2.2% to 5% Solids
95% Capture
4,024 lbs/day Total Solids
3,427 lbs/day Volatile Solids
9,649 gpd

Table 5-5 Preliminary Digestion Performance Requirements

Digestion Performance
60% Volatile Solids Destruction
2,056 lbs Volatile Solids Destroyed
1,371 lbs Volatile Solids Remaining

Digestion Performance
1,968 lbs Total Solids Remaining
9,649 gallons Remaining
2.45 % Solids Remaining

Table 5-6 Preliminary Dewatering Performance Requirements

Dewatering Performance
9,649 gpd Feed
6.7 gpm Feed
1,968 lbs/day Feed
1.37 lbs/min Feed
28% Solids Discharge
95% Solids Capture
1,870 lbs/day Discharged

Table 5-7 Preliminary Gas Production Estimates

Gas Production
2,056 Volatile Solids Destroyed
15 Cubic Feet (CF) of Gas per Lb Destroyed
30,840 CF of Gas/Day
18,504,000 BTU/Day

Table 5-8 Preliminary Energy Production Estimates

Energy Production	
40% Efficiency For Electricity Production	7,401,600 BTU of Electrical Energy
	90 KW/hr of Electrical Energy
OR	
40% Efficiency For Exhaust Heat Recovery	7,401,600 BTU of Heat Energy

Table 5-9 Preliminary Class A Biosolids Production

Solids Available for Fertilizer Production
1,870 lbs/day
28% Solids Concentration
70% Volatile Solids Fraction

With the estimates shown in the previous tables, information was requested from equipment manufacturers (provided in Appendix C) and a preliminary design was developed for the solids handling portion of the WRRF. **Table 5-10** shows quantities and preliminary sizing of the solids handling unit process from the preliminary design.

Table 5-10 New WRRF Preliminary Sizing – Solids Process

Unit Process	Type	Quantity	Preliminary Size
Sludge Pump Station	Sludge Pumps	3	23,000 GPD x 40 psi
Thickening	Rotary Drum Thickener	2	23,000 GPD Capacity 5' Wide ,17' Long, 7.5' Height
Digestion	2-Phase Anaerobic Digestion System	2	One (1) Feed Sequencing Tank (8' Diameter, 24' Depth) One (1) Thermophilic Digester (20' Diameter, 24' Depth) Thermophilic SRT = 2.28 days Oner (1) Mesophilic Digester (46' Diameter, 24' Depth) Mesophilic SRT = 11.85 days
Dewatering	Centrifuges	2	10,000 GPD feed Solids 2,000 lbs/day feed 4' Wide ,13' Long, 6' Height

Figure 5-1 shows a plan view of the conceptual WRRF. The area occupied by the preliminary layout is about 2 acres. The majority of the equipment components for the liquid and solids handling unit processes would be enclosed in barn-style buildings (highlighted in blue in Figure 5-1), and the required tanks (digester tanks, storage tanks and biological tanks for the MBR system) would be underground. This approach will allow blending of the WRRF with the surroundings. **Figure 5-2** shows conceptual section views across the WRRF. **Figure 5-3** shows a conceptual aerial view of the new WRRF at the Roach Canyon location. The new WWRF facility land area would be approximately 3 acres; much less than the existing WWTP site which occupies 8 acres.

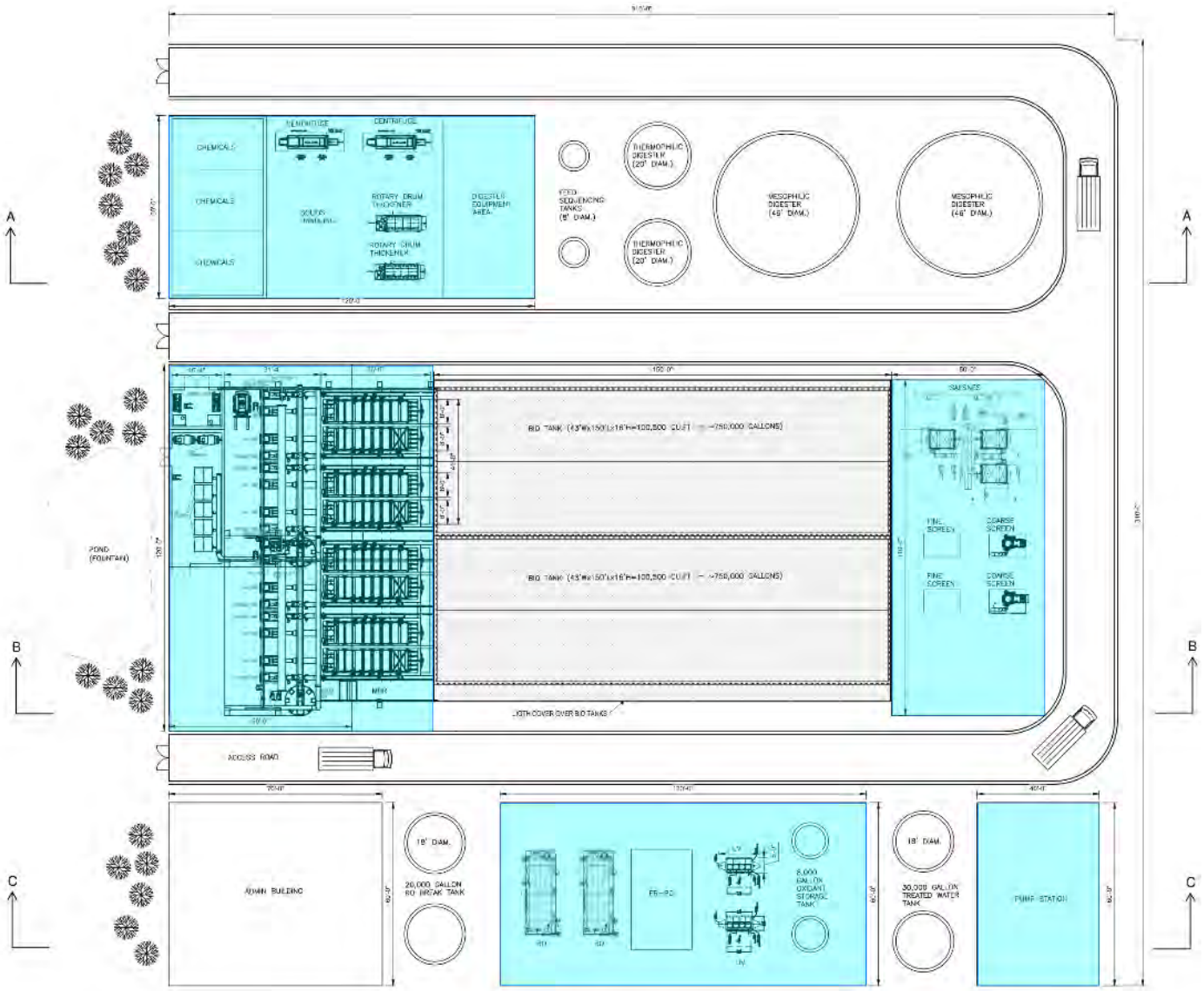


Figure 5-1: New Conceptual WRRF Plan View

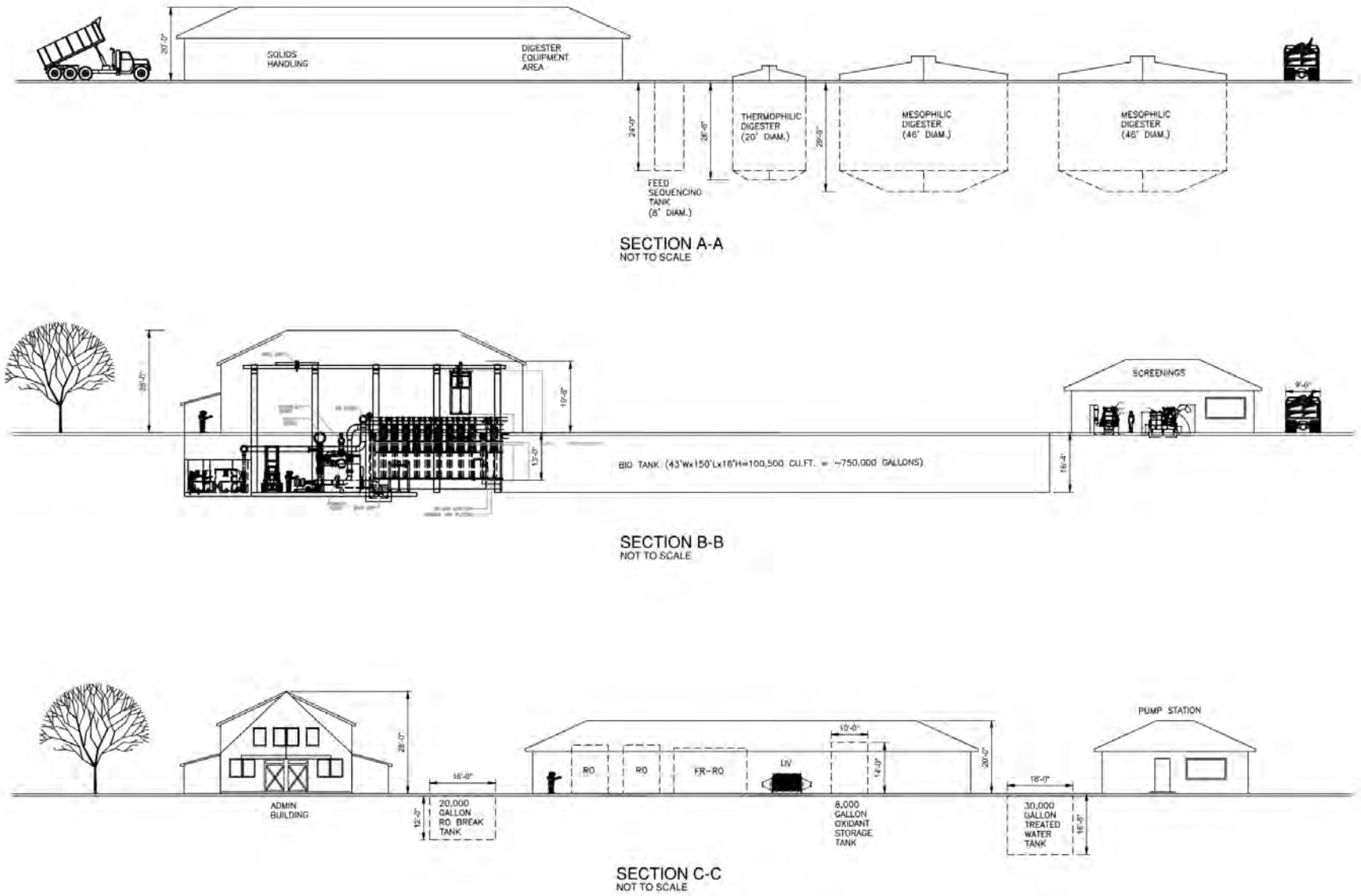


Figure 5-2: New Conceptual WRRF Section Views

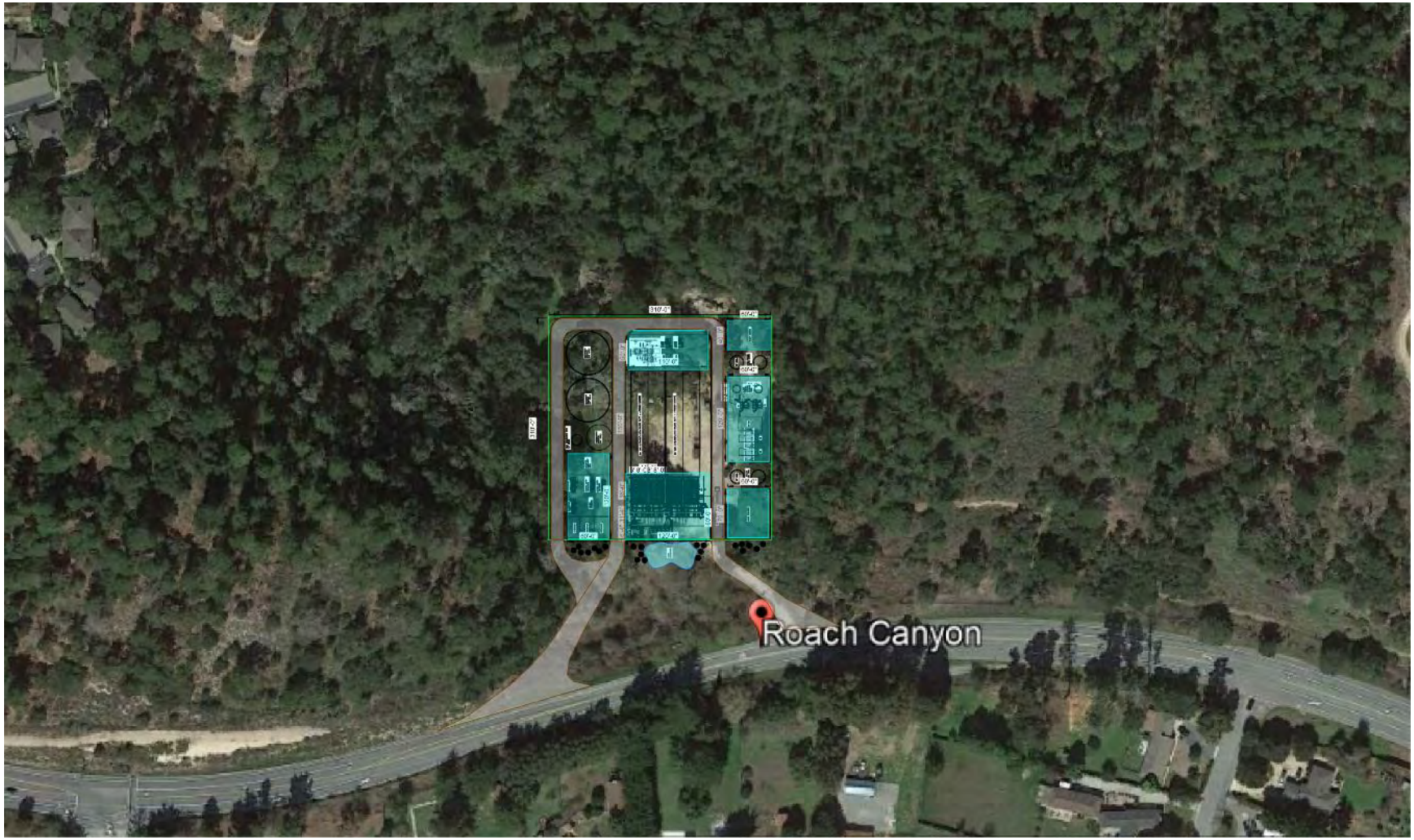


Figure 5-3: New Conceptual WRRF Aerial View

5.3 NEW WRRF EQUIPMENT ELECTRICAL REQUIREMENTS

Table 5-11 shows the electrical requirements of the major components on the new WRRF.

Table 5-11 WRRF Electrical Component Requirements

Unit Processes	Type	Electrical Requirements
Flow Equalization	EQ Basin	Mixers - 20 HP total
Raw Sewage Main Pump Station	Pumps	3.6 MGD x 80 psi (200 HP total)
Influent screening	Coarse Rake Screening	• Wash press electric drive motor 5.0 HP TEFC 1760 rpm suitable for 460/3/60 supply
	Fine Drum Screening	• Drive unit with 1.5 HP TEFC motor suitable for 460/3/60 electrical supply.
Solids Separation	Salsnes Filter System	15.7 kVA, 11.8 kW 480 Volts 60 Hz 3 phase + ground
MBR	MBR Train	9300 kWh-day (this includes the major equipment – mixers, process blowers, membrane permeate pumps, membrane blowers, compressors, and RAS pumps)
RO Break Tank with Pumps	20,000 Gallon (20 min average flow)	3.0 MGD x 40 psi
RO	2 x 1.5 MGD RO System and Ancillary Equipment, including Start-up Services	• RO High Pressure Pumps 2 x 1.5 MGD x 120 psi •2 CIP Pumps – Motor 40 HP, 1800 RPM, 460 V, premium efficiency, TEFC • 1 CIP Tank Mixer – Motor 2 HP, 1800 RPM, 460 V • Flush pumps; Static Mixers; Feed Pumps. • VFDs and Starters. • Air supply system for pneumatic valves. • Flush Tank and all related equipment for the flushing system.
Brine Recovery RO (BRRO) with flipping concept	0.45 MGD Flow Reversal RO System (recovery rate = 75%-86%)	0.45 MGD x 350 psi
Thickening	Rotary Drum Thickener	• Main Unit Drive -2.0 HP. The controller shall be a variable frequency drive (VFD) built for 460 Volts/3 Phase/60 Hertz input power. • Floc Tank Drive: Eurodrive 0.5 HP, The controller shall be a variable frequency drive (VFD) built for 460 Volts/3 Phase/60 Hertz input power. • High Pressure Booster Pump: pump will be driven by a fixed speed, 460 Volts/3 Phase/60 Hertz/3500 RPM direct coupled to a 3 HP TEFC motor.
Sludge Pump Station	Sludge Pumps	23,000 GPD x 40 psi
Dewatering	Centrifuges	• Main-drive motor: 30 HP • Back-drive motor: 7.5 HP • The selected main-drive motor and the back-drive motor are both VFD control, 460 Volt,

Unit Processes	Type	Electrical Requirements
		60 Hz, 3 phase power supply.
Sludge Collection	Conveyor	20 HP
Advanced Oxidation Process (AOP)	4-bank Flex100 UV with 4.5 ppm peroxide	64 kW of power each reactor (128 kW for 2 reactors)
Residual Disinfectant	Oxidant Skid (Chloramination)	5 HP (Dosing Pumps)
Treated Water Pump Station (3.0 MGD)	Pumps	Total = 3.0 MGD x 80 psi

The electrical service and distribution conceptual design requirements were developed based on the conceptual layout and associated process component requirements. Subsequent tables describe the preliminary conceptual electrical service distribution configuration(s) reflected in associated budget, as well as pertinent electrical options for further evaluation during detailed design phase.

Table 5-12 identifies the electrical configuration requirements recommended and included in preliminary conceptual budget.

Table 5-12 WRRF Electrical Redundancy Configurations Requirements

Configuration Item	Requirement
Service	Two Separate Services
Distribution Equipment Type	Main-Tie-Main Motor Control Center
Backup Power Supply	Diesel Generator

A redundancy scheme and configuration requirements can have significant impact to the electrical cost component to a new WRRF. These requirements, as shown in **Table 5-12**, have been selected as it coincides with similar facilities and associated operational requirements. It is recommended for both WRRF and Pump Station to be configured to accept two separate electrical services from electrical utility provided by PG&E. Intermediate distribution within each Unit Process area will be served via dedicated Main-Tie-Main configured Motor Control Center, and associated Diesel Generator connected where back-power supply is required. Deployment of these configuration requirements are subject to varying design approaches and will further be defined during the detailed design phase.

Table 5-13 shows the preliminary electrical service size for the New WRRF and EQ Basin & Main Pump Station.

Table 5-13 WRRF Electrical Service Size

Facility	Size
New WRRF	3500kVA
New EQ Basin and MPS	300kVA

Preliminary load calculation of both facilities was determined by Unit Process requirements defined in **Table 5-11.** To support loads identified within **Table 5-11** with some adjustment to support anticipation of typical building and process loads not defined, the recommended redundant size of electrical services at both facilities are defined within **Table 5-13.** These preliminary service sizes are to be finalized subsequent selection of site, corresponding layout, and final equipment list during detailed design phase.

Table 5-14 shows a breakdown of what unit processes will require an on-site redundant source of power during a service(s) outage.

Table 5-14 Backup Diesel Generators Requirements

Unit Processes	Backup Required
Administration Building	Yes
Preliminary Treatment - EQ Basin and MPS	Yes
Preliminary Treatment - Screening	Yes
Advanced Treatment - MBR	Yes
Advanced Treatment - RO	Yes
Solids Handling	Yes
Disinfection	Yes

As it corresponds to the criticality of each Unit Process, provisions for where on-site Backup Diesel Generators are required were selected as indicated in **Table 5-14**. The arrangement of how this can be accomplished is subject to varying design approaches and will further be defined during the detailed design phase.

Table 5-15 identifies to intermediate distribution options to further be considered during detailed design of the New WRRF.

Table 5-15 WRRF Electrical Intermediate Distribution Configuration Options

Advantages	Disadvantages
Medium Voltage *	
Reduced Size/Quantity of Conductors	Additional Transformers Required
Minimal Underground Distribution Required	Increase Quantity Point of Failure
Accommodates Future Expansion	Additional Maintenance Required
480 Volt	
Reduced Equipment Cost	Conductor Size/Qty Increased (Factor x8 – x25)
Less Points of Failure	Increase Risk Single Point of Failure (Large Transformers)
Less Equipment Maintenance	Minimal Distribution Expansion

*Included in Preliminary Conceptual Budget

Intermediate distribution configurations vary among WRRF's, and specifically depend on operational, site, and future requirements. **Table 5-15** is defined to support preliminary discussion and evaluation of this electrical infrastructure feature of the electrical design with CAWD Operation and Engineering team(s). Continued discussion and coordination to support design determination of intermediate distribution will further be defined during the detailed design phase.

Table 5-16 captures the potential for a Solar Photovoltaic (PV) power supply at the new WRRF.

Table 5-16 WRRF Solar PV

Unit Process Canopy	Area (Sqft)	Size (kWdc)	Production (kWh/Year)
Preliminary Treatment - Screening	5,500	69	114,311
Advanced Treatment - MBR	10,040	127	208,670
Advanced Treatment – RO & Disinfection	7,200	91	149,644
Solids Handling	7,200	91	149,644
Total	**29,940**	**378**	**622,269**

Solar PV is an opportunity that should be considered given the life cycle of the intended facility to support offset some of the electrical utility cost during operation. A fixed Solar PV installation on top of proposed Unit Process canopies as shown in **Figure 5-1** would yield approximately 622,269 kWh per year of production. Utilizing nominal energy rate of 0.12 cents per kWh, the new WRRF would see annual offsetting electric utility savings of approximately $74,600.

SECTION 6 OPINION OF PROBABLE CONSTRUCTION COST

Table 6-1 shows the unit price of the major components of the new WRRF. The preliminary Conceptual level OPCC developed is shown in **Appendix B,** and the summary with the overall estimated project construction cost is included in **Table 6-2.** The quotes and information obtained from equipment manufacturers are included in **Appendix C.**

Costs are provided for two different capacity scenarios. One scenario is for facilities' design capacity of 3.6 MGD AWWF to match existing flows. The second scenario is for facilities' design capacity of 2.4 MGD AWWF assuming PBCSD flows are not included in the project.

The OPCC included in Appendix B is a conceptual level OPCC developed at a Class 4 level for system rehabilitation per the Association for the Advancement of Cost Engineering (AACE) International standard. This class represents a "study or feasibility" maturity level and has an expected accuracy range of - -30% to +50%.

Table 6-1 WRRF Preliminary Equipment Cost

Unit Processes	Type	Quantity for 3.6 MGD WWF	Budget Pricing (Total for 3.6 MGD WWF)	Quantity for 2.4 MGD WWF	Budget Pricing (Total for 2.4 MGD WWF)
Flow Equalization	EQ Basin Mixers	4	$12,000	4	$12,000
Raw Sewage Main Pump Station	Pumps	5	$50,000	4	$40,000
Influent screening	Coarse Rake Screening	2	$750,000	2	$500,000
	Fine Drum Screening	2	$320,500	2	$260,000
Solids Separation	Salsnes Filter System	3	$954,713	3	$957,713
MBR	MBR Train	4	$3,500,000	4	$2,625,000
RO Break Tank with Pumps	20,000 Gallon (20 min average flow)	2	$160,000	2	$105,000
RO	2 x 1.5 MGD RO System and Ancillary Equipment	2	$1,750,000	2	$1,200,000
Brine Recovery RO (BRRO) with flipping concept	0.45 MGD FR RO System (recovery rate = 75%-86%)	1	$1,000,000	1	$650,000
Thickening	Rotary Drum Thickener	2	$480,000	2	$340,000
Sludge Pump Station	Sludge Pumps	3	$15,000	3	$15,000
Digestion	2-Phase Anaerobic Digestion System	1 (Redundant)	$3,510,000	1 (Redundant)	$2,500,000
Dewatering	Centrifuges	2	$504,750	2	$504,750
Sludge Collection	Conveyor	2	$300,000	2	$300,000

Unit Processes	Type	Quantity for 3.6 MGD WWF	Budget Pricing (Total for 3.6 MGD WWF)	Quantity for 2.4 MGD WWF	Budget Pricing (Total for 2.4 MGD WWF)
Advanced Oxidation Process (AOP)	4-bank Flex100 UV with 4.5 ppm peroxide	2	$1,600,000	2	$1,600,000
Residual Disinfectant	Oxidant Skid (Chloramination)	2	$500,000	2	$500,000
Treated Water Tank	30,000 Gallon Tank (30 min Retention Time Average flow)	2 (30,000 Gallon Tank)	$240,000	2 (20,000 Gallon Tank)	$160,000
Treated Water Pump Station	Pumps	5 (3.0 MGD Total Capacity)	$25,000	4 (2.0 MGD Total Capacity)	$20,000

Table 6-2 WRRF Preliminary Construction Cost

CAWD WWTP Relocation
Carmel Area Wastewater District
Project Construction Costs - ENR CCI = 11,620
Project Summary
New Centralized Water Resource Recovery Facility (WRRF)

AACE Class Number 4
Contingency: 25%

Element No.	Program Element Description	Project Cost (December 2020.75 ENR CCI = 11,620) $ (3.6 MGD)	$ (2.4 MGD)
1	New WRRF	37,690,900	33,496,600
2	New Equalization Basin	5,020,000	5,020,000
3	New Pump Station	1,496,300	1,496,300
4	Land Acquisition	6,118,200	6,118,200
5	New WRRF Electrical Supply	2,896,600	2,896,600
6	Conveyance Piping	29,430,700	23,434,900
	Construction Subtotal	82,652,700	72,462,600
	Bonds and Insurance (at 3%)	2,479,600	2,173,900
	Engineering (at 7%)	5,785,700	5,072,400
	Construction Management (at 5%)	4,132,600	3,623,200
	Permitting (at 2%)	1,653,100	1,449,300
	Commissioning (at 2%)	1,653,100	1,449,300
	Mobilization / Demobilization (at 5%)	4,132,600	3,623,200
	Contingency (at 25%)	20,663,200	18,115,700
	Contractor Overhead and Profit (at 15%)	12,397,900	10,869,400
	Sales Tax (at 9.5%)	7,852,000	6,884,000
	Construction Total	143,402,500	125,723,000

	-30% Estimate	Estimated	+50% Estimate
Construction Total Estimate Range of Accuracy (3.6 MGD AWWF Facility)	$100,381,750	$143,402,500	$215,103,750
Construction Total Estimate Range of Accuracy (2.4 MGD AWWF Facility)	$88,006,100	$125,723,000	$163,439,900

SECTION 7 SUMMARY

CAWD is preparing a WWTP long-term coastal hazards planning roadmap, which includes alternatives analysis of relocating the WWTP to address sea level rise for the next 40 years.

In this Technical Memorandum plant relocation concepts were developed for the CAWD WWTP in response to climate change and resulting sea level rise. The concepts developed for the new CAWD plant considered upgrading the system to a new Water Resource Recovery Facility (WRRF), taking into consideration available treatment technologies, and incorporating resource recovery to further serve the local community.

The following key infrastructures were considered in the analysis:

- New WRRF located at Roach Canyon
- New Equalization (EQ) Basin and Pump Station at Hatton Canyon Park
- Reuse of the existing 24" Outfall
- Extension of the existing Reclaimed Water pipeline to the new facility

The conceptual conveyance piping between the EQ basin and the new WRRF was shown in Figures 3-11 and 3-12. Brine discharge piping from the WRRF to the existing Brine Discharge Outfall was also shown and generally would follow the same route of the conveyance piping to the WRRF. A conceptual layout of the connection piping from the new WRRF to the existing Reclaimed Water line for irrigation was shown in Figure 3-15. The estimated length of the new Reclaimed Water line was approximately 16,800 feet. If the product water line is to be used for injection in the Carmel Valley Alluvial Aquifer, an injection well by the new WRRF would be required. The tentative location of a new injection well is highlighted in Figure 3-15.

The conceptual new treatment process included coarse and fine screening, followed by MBR, reverse osmosis, advanced oxidation process using hydrogen peroxide and UV light, and finally residual chloramination prior to distribution for irrigation. On the solids treatment, the sludge generated from the MBR process would be thickened with rotary drum thickeners and sent to a 2-Phae Anaerobic Digestion System. The digested sludge would be dewatered with centrifuges and finally Class A biosolids would be produced. The biogas generated as part of the anaerobic digestion process would be used for electrical energy generation and exhaust heat recovery. The conceptual centralized WRRF would occupy about 3 acres at Roach Canyon and conceptual layouts were shown in Figures 5-1 to 5-3.

Solar PV is an opportunity that should be considered given the life cycle of the intended facility to support offset some of the electrical utility cost during operation. A fixed Solar PV installation on top of proposed Unit Process canopies as shown in Figure 5-1 would yield approximately 622,269 kWh per year of production.

APPENDIX A: DESIGN CALCULATIONS

Carmel Area Wastewater District
CAWD Relocation Alternatives

Elevations and EQ Tank Depth Summary
New Gravity Line to Proposed Hatton Canyon Park EQ Tank

Greeley and Hansen
Calculations by: MT
9/30/2022

Option 1: 27" Diameter Pipe, S = 0.00248

Parameter	Symbol	Units	Value	Notes
12% Full - Flow	Q_{12}	[MGD]	0.397602	
12% Full - Velocity	V_{12}	[fps]	2.273283	
75% Full - Flow	Q_{75}	[MGD]	11.84491	
75% Full - Velocity	V_{75}	[fps]	5.726185	
Top of EQ Tank Elevation	El_{top}	[ft]	16	NAVD88
Bottom of EQ Tank Elevation	El_{bot}	[ft]	-1	NAVD88
Total Depth of Excavation	$d_{excavation}$	[ft]	22	Includes 5' cover and 5' freeboard

Option 2: 24" Diameter Pipe, S = 0.00248

Parameter	Symbol	Units	Value	Notes
12% Full - Flow	Q_{12}	[MGD]	0.290418	
12% Full - Velocity	V_{12}	[fps]	2.101517	
75% Full - Flow	Q_{75}	[MGD]	8.651797	
75% Full - Velocity	V_{75}	[fps]	5.293523	
Top of EQ Tank Elevation	El_{top}	[ft]	16	NAVD88
Bottom of EQ Tank Elevation	El_{bot}	[ft]	-1	NAVD88
Total Depth of Excavation	$d_{excavation}$	[ft]	22	Includes 5' cover and 5' freeboard

MH639 to New MH/Tie-In (Assumes Option 2 Alternative)

Parameter	Symbol	Units	Value	Notes
Min. Pipe Diameter	D	[in]	18	
Slope	S	[ft/ft]	0.014992	
12% Full - Flow	Q_{12}	[MGD]	0.331569	
12% Full - Velocity	V_{12}	[fps]	4.265413	
75% Full - Flow	Q_{75}	[MGD]	9.877728	
75% Full - Velocity	V_{75}	[fps]	10.74417	

Carmel Area Wastewater District
CAWD Relocation Alternatives

Required Elevations and EQ Tank Depth (Assuming Pipe Dia. and Slope)
New Gravity Line to Proposed Hatton Canyon Park EQ Tank

Greeley and Hansen
Calculations by: MT
9/26/2022

Pipe Conditions

Parameter	Symbol	Units	Value	Notes
Diameter	D	[in]	27	Adjust until velocity is within range (see calculations below)
		[ft]	2.25	
Manning's Coeffiecient	n	[--]	0.01	Assuming constant n
Design Slope	S	[ft/ft]	0.00248	Assumption
Required Depth to Diameter Ratio	d/D	[--]	0.12	12% full
Partial Flow to Full Flow Ratio	Q/Q_{full}	[--]	0.0306	From Hydraulic Elements Table for Circular Sewers
Partial Velocity to Full Velocity Ratio	V/V_{full}	[--]	0.4496	From Hydraulic Elements Table for Circular Sewers
Start Elevation	El_0	[ft]	21.2	Invert el. of new gravity line (Set at Inv. El. of MH R641)
Pipe Length	L	[ft]	3710	Routing shown on right; measured using Google Earth Pro

EQ Tank Assumptions

Length	L_{tank}	[ft]	150	
Width	W_{tank}	[ft]	80	
Design Capacity	~~V~~	[MG]	1	
		[ft^3]	133690	
Hatton Canyon Park Grade El.	El_{Hatton}	[ft]	21	NAVD88
Min. Depth of Cover	d_{cover}	[ft]	5	
Freeboard	d_{free}	[ft]	5	
Height b/w Influent Invert and Max. Water Surface Lvl.	h	[ft]	1	

Calculations - Pipe Capacity and Velocity

Full Flow	Q_{full}	[cfs]	20.10398	
		[gpm]	9026.687	
		[MGD]	12.99354	
Partial Flow	Q	[cfs]	0.615182	12% full
		[gpm]	276.2166	
		[MGD]	0.397602	
Velocity @ Full Flow	V_{full}	[fps]	5.056234	Velocity must be within 2 fps to 10 fps range to prevent settling of solids and damage to pipeline
Velocity @ Partial Flow	V	[fps]	2.273283	12% full
Area for Full Flow	A	[ft^2]	3.976078	
Perimeter for Full Flow	P	[ft]	7.068583	
Hydraulic Radius for Full Flow	R_h	[ft]	0.5625	
Required End Elevation	**El_f**	**[ft]**	**11.9992**	NAVD 88

Calculations - EQ Tank Depth

El. of Influent Invert	El_{invert}	[ft]	12	NAVD88; Rounded up
El. of Max. Water Surface Lvl.	El_{water}	[ft]	11	NAVD88
EQ Tank Top El.	**$El_{tank, top}$**	**[ft]**	**16**	NAVD88
Actual Depth of Cover	$d_{cover, actual}$	[ft]	5	
Operating Tank Depth	d_{op}	[ft]	12	Rounded up
EQ Tank Bottom El.	**$El_{tank, bot}$**	**[ft]**	**-1**	NAVD88
Total Depth of Excavation	**$d_{excavation}$**	**[ft]**	**22**	

Carmel Area Wastewater District
CAWD Relocation Alternatives

Required Elevations and EQ Tank Depth (Assuming Pipe Dia. and Slope)
New Gravity Line to Proposed Hatton Canyon Park EQ Tank

Greeley and Hansen
Calculations by: MT
9/30/2022

Pipe Conditions

Parameter	Symbol	Units	Value	Notes
Diameter	D	[in]	27	Adjust until velocity is within range (see calculations below)
		[ft]	2.25	
Manning's Coeffiecient	n	[--]	0.01	Assuming constant n
Design Slope	S	[ft/ft]	0.00248	Assumption
Required Depth to Diameter Ratio	d/D	[--]	0.75	75% full
Partial Flow to Full Flow Ratio	Q/Q_{full}	[--]	0.9116	From Hydraulic Elements Table for Circular Sewers
Partial Velocity to Full Velocity Ratio	V/V_{full}	[--]	1.1325	From Hydraulic Elements Table for Circular Sewers
Start Elevation	El_0	[ft]	21.2	Invert el. of new gravity line (Set at Inv. El. of MH R641)
Pipe Length	L	[ft]	3710	Routing shown on right; measured using Google Earth Pro

EQ Tank Assumptions

Length	L_{tank}	[ft]	150	
Width	W_{tank}	[ft]	80	
Design Capacity	~~V~~	[MG]	1	
		[ft^3]	133690	
Hatton Canyon Park Grade El.	El_{Hatton}	[ft]	21	NAVD88
Min. Depth of Cover	d_{cover}	[ft]	5	
Freeboard	d_{free}	[ft]	5	
Height b/w Influent Invert and Max. Water Surface Lvl.	h	[ft]	1	

Calculations - Pipe Capacity and Velocity

Full Flow	Q_{full}	[cfs]	20.10398	
		[gpm]	9026.687	
		[MGD]	12.99354	
Partial Flow	Q	[cfs]	18.32679	75% full
		[gpm]	8228.728	
		[MGD]	11.84491	
Velocity @ Full Flow	V_{full}	[fps]	5.056234	Velocity must be within 2 fps to 10 fps range to prevent settling of solids and damage to pipeline
Velocity @ Partial Flow	V	[fps]	5.726185	75% full
Area for Full Flow	A	[ft^2]	3.976078	
Perimeter for Full Flow	P	[ft]	7.068583	
Hydraulic Radius for Full Flow	R_h	[ft]	0.5625	
Required End Elevation	**El_f**	**[ft]**	**11.9992**	NAVD 88

Calculations - EQ Tank Depth

El. of Influent Invert	El_{invert}	[ft]	12	NAVD88; Rounded up
El. of Max. Water Surface Lvl.	El_{water}	[ft]	11	NAVD88
EQ Tank Top El.	**$El_{tank, top}$**	**[ft]**	**16**	NAVD88
Actual Depth of Cover	$d_{cover, actual}$	[ft]	5	
Operating Tank Depth	d_{op}	[ft]	12	Rounded up
EQ Tank Bottom El.	**$El_{tank, bot}$**	**[ft]**	**-1**	NAVD88
Total Depth of Excavation	**$d_{excavation}$**	**[ft]**	**22**	

Carmel Area Wastewater District
CAWD Relocation Alternatives

Required Elevations and EQ Tank Depth (Assuming Pipe Dia. and Slope)
New Gravity Line to Proposed Hatton Canyon Park EQ Tank

Greeley and Hansen
Calculations by: MT
9/30/2022

Pipe Conditions				
Parameter	**Symbol**	**Units**	**Value**	**Notes**
Manning's Coeffiecient	n	[--]	0.01	Assuming constant n
Design Flow	Q	[MGD]	8	Max. design flow; should occur @ 75% full
		[cfs]	12.37783	
		[gpm]	5557.644	
Design Depth to Diameter Ratio	d/D	[--]	0.75	75% full; Design
Design Partial Flow to Full Flow Ratio	Q/Q_{full}	[--]	0.9116	From Hydraulic Elements Table for Circular Sewers; 75% full
Design Partial Velocity to Full Velocity Ratio	V/V_{full}	[--]	1.1325	From Hydraulic Elements Table for Circular Sewers; 75% full
Minimum Depth to Diameter Ratio	$[d/D]_{min}$	[--]	0.12	Minimum; used for velocity check
Minimum Partial Flow to Full Flow Ratio	$[Q/Q_{full}]_{min}$	[--]	0.0306	From Hydraulic Elements Table for Circular Sewers; 12% full
Minimum Partial Velocity to Full Velocity Ratio	$[V/V_{full}]_{min}$	[--]	0.4496	From Hydraulic Elements Table for Circular Sewers; 12% full
Start Elevation	El_0	[ft]	21.2	Invert el. of new gravity line (Set at Inv. El. of MH R641)
Pipe Length	L	[ft]	3710	Routing shown on right; measured using Google Earth Pro
EQ Tank Conditions and Assumptions				
Length	L_{tank}	[ft]	150	
Width	W_{tank}	[ft]	80	
Design Capacity	₮	[MG]	1	
		[ft^3]	133690	
Hatton Canyon Park Grade El.	El_{Hatton}	[ft]	21	NAVD88
Min. Depth of Cover	d_{cover}	[ft]	5	
Freeboard	d_{free}	[ft]	5	
Height b/w Influent Invert and Max. Water Surface Lvl.	h	[ft]	1	Dictates minimum invert elevation of influent pipe
Calculations - Pipe Sizing and Velocity				
Minimum Pipe Invert @ EQ Tank	$El_{inv,EQ}$	[ft]	12	NAVD88; Based on minimum requirements for EQ Tank, rounded up
Minimum Pipe Slope	S	[ft/ft]	0.00248	Based on minimum EQ Tank cover, freeboard, and influent invert height above max. water surface level
Full Flow	Q_{full}	[MGD]	8.775779	
		[cfs]	13.57813	
		[gpm]	6096.582	
Minimum Diameter	**D_{min}**	**[ft]**	**1.94211**	
		[in]	**23.30532**	
Closest Commercially Available Diameter	**D**	**[ft]**	**2**	
		[in]	**24**	**From Logan Clay Products catalogue**
Area for Full Flow (Actual)	A_{full}	[ft^2]	3.141593	
Perimeter for Full Flow (Actual)	P_{full}	[ft]	6.283185	
Hydraulic Radius for Full Flow (Actual)	R_{full}	[ft]	0.5	
Actual Full Flow	$Q_{full,actual}$	[MGD]	9.490782	
		[cfs]	14.68441	
		[gpm]	6593.299	
Actual Partial Flow (75% full)	**$Q_{75,\ actual}$**	**[MGD]**	**8.651797**	
		[cfs]	**13.38631**	
		[gpm]	**6010.451**	
Actual Pipe Slope	**S_{actual}**	**[ft/ft]**	**0.00248**	
Actual Velocity @ Full Flow	V_{full}	[fps]	4.674192	Velocity must be within 2 fps to 10 fps range to prevent settling of solids and damage to pipeline
Actual Velocity @ Partial Flow (75%)	**V_{75}**	**[fps]**	**5.293523**	**75% full**
Calculations - Velocity Check @ 12% Full				
Velocity @ Partial Flow (12% full)	V_{12}	[fps]	2.101517	Velocity must be within 2 fps to 10 fps range to prevent settling of solids and damage to pipeline
Flow @ Partial Flow (12% full)	Q_{12}	[MGD]	0.290418	
		[cfs]	0.449343	
		[gpm]	201.755	
Calculations - EQ Tank Depth				
El. of Influent Invert	El_{invert}	[ft]	12	NAVD88; Based on minimum requirements for EQ Tank, rounded up

El. of Max. Water Surface Lvl.	El_{water}	[ft]	11	NAVD88
EQ Tank Top El.	**$El_{tank, top}$**	**[ft]**	**16**	NAVD88
Actual Depth of Cover	$d_{cover, actual}$	[ft]	5	
Operating Tank Depth	d_{op}	[ft]	12	Rounded up
EQ Tank Bottom El.	**$El_{tank, bot}$**	**[ft]**	**-1**	NAVD88
Total Depth of Excavation	**$d_{excavation}$**	**[ft]**	**22**	

Carmel Area Wastewater District
CAWD Relocation Alternatives

Required Pipe Diameter and Slope (Pipe Section MHR639 to New MH [Tie-in])
New Gravity Line to Proposed Hatton Canyon Park EQ Tank

Greeley and Hansen
Calculations by: MT
9/30/2022

Pipe Conditions

Parameter	Symbol	Units	Value	Notes
Manning's Coeffiecient	n	[--]	0.01	Assuming constant n
Design Flow	Q	[MGD]	8	Max. design flow; should occur @ 75% full
		[cfs]	12.37783	
		[gpm]	5557.644	
Design Depth to Diameter Ratio	d/D	[--]	0.75	75% full; Design
Design Partial Flow to Full Flow Ratio	Q/Q_{full}	[--]	0.9116	From Hydraulic Elements Table for Circular Sewers; 75% full
Design Partial Velocity to Full Velocity Ratio	V/V_{full}	[--]	1.1325	From Hydraulic Elements Table for Circular Sewers; 75% full
Minimum Depth to Diameter Ratio	$[d/D]_{min}$	[--]	0.12	Minimum; used for velocity check
Minimum Partial Flow to Full Flow Ratio	$[Q/Q_{full}]_{min}$	[--]	0.0306	From Hydraulic Elements Table for Circular Sewers; 12% full
Minimum Partial Velocity to Full Velocity Ratio	$[V/V_{full}]_{min}$	[--]	0.4496	From Hydraulic Elements Table for Circular Sewers; 12% full
Start Elevation	El_0	[ft]	34.5	Invert el. of new gravity line (Set at Inv. El. of MH R639)
Pipe Length	L	[ft]	1082	Routing shown on right; measured using Google Earth Pro

Pipe Segment MH R641 to EQ Tank Conditions

Length	L_1	[ft]	1178	MHR641 to New MH (tie-in)
Slope	S_1	[ft/ft]	0.00248	
MH R641 Inv El	El_{R641}	[ft]	21.2	

New MH (Tie-In) Conditions

Grade (Rim) Elevation	$Elt_{ie\text{-}in}$	[ft]	21.44767	Avg. rim elevations of MHs in approximate location of tie-in (MHs R709, R708, and R707)

Calculations - Pipe Sizing and Velocity

Minimum Pipe Invert @ New MH	$El_{inv,new\ MH}$	[ft]	18.27881	NAVD88; Based on minimum requirements for EQ Tank, rounded up
Minimum Pipe Slope	$S_{R639\text{-}NewMH}$	[ft/ft]	0.014992	
Full Flow	Q_{full}	[MGD]	8.775779	
		[cfs]	13.57813	
		[gpm]	6096.582	
Minimum Diameter	**D_{min}**	**[ft]**	**1.385969**	
		[in]	**16.63163**	
Closest Commercially Available Diameter	**D**	**[ft]**	**1.5**	
		[in]	**18**	**From Logan Clay Products catalogue**
Area for Full Flow (Actual)	A_{full}	[ft^2]	1.767146	
Perimeter for Full Flow (Actual)	P_{full}	[ft]	4.712389	
Hydraulic Radius for Full Flow (Actual)	R_{full}	[ft]	0.375	
Actual Full Flow	$Q_{full,actual}$	[MGD]	10.83559	
		[cfs]	16.76514	
		[gpm]	7527.548	
Actual Partial Flow (75% full)	**$Q_{75,\ actual}$**	**[MGD]**	**9.877728**	
		[cfs]	**15.2831**	
		[gpm]	**6862.113**	
Actual Pipe Slope	**S_{actual}**	**[ft/ft]**	**0.014992**	
Actual Velocity @ Full Flow	V_{full}	[fps]	9.487129	Velocity must be within 2 fps to 10 fps range to prevent settling of solids and damage to pipeline
Actual Velocity @ Partial Flow (75%)	**V_{75}**	**[fps]**	**10.74417**	**75% full**

Calculations - Velocity Check @ 12% Full

Velocity @ Partial Flow (12% full)	V_{12}	[fps]	4.265413	Velocity must be within 2 fps to 10 fps range to prevent settling of solids and damage to pipeline
Flow @ Partial Flow (12% full)	Q_{12}	[MGD]	0.331569	
		[cfs]	0.513013	
		[gpm]	230.343	

FIGURE 1

GREELEY AND HANSEN

NOTES:
1. PIPE ROUTING IS AN ESTIMATION. ACTUAL PIPE LENGTH TO BE CONFIRMED.

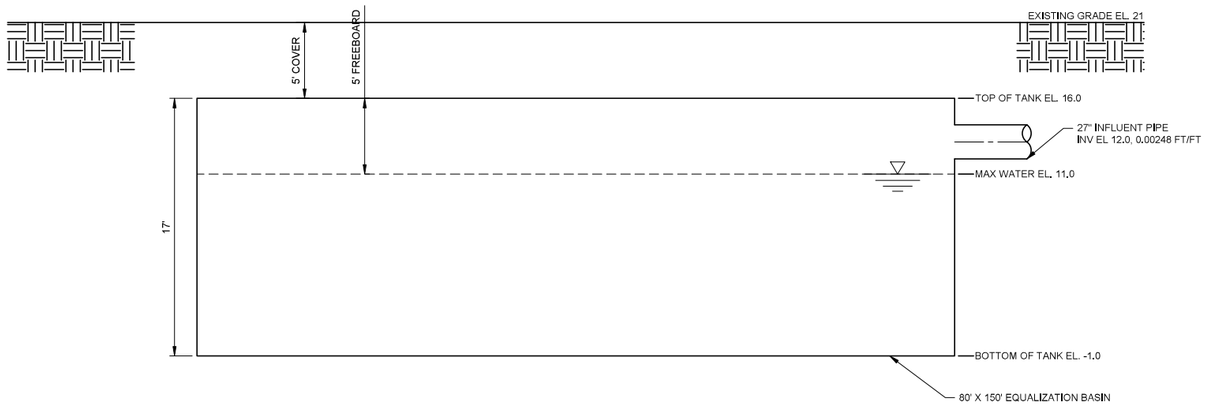
PIPE ROUTING

1:110

CARMEL AREA WASTEWATER DISTRICT
CAWD WWTP RELOCATION
CARMEL-BY-THE-SEA, CA

SITE LAYOUT

1:40



SECTION A-A

NOT TO SCALE

GREELEY AND HANSEN

CARMEL AREA WASTEWATER DISTRICT
CAWD WWTP RELOCATION
CARMEL-BY-THE-SEA, CA

FIGURE 3

GREELEY AND HANSEN

NOTES:
1. PIPE ROUTING IS AN ESTIMATION. ACTUAL PIPE LENGTH TO BE CONFIRMED.

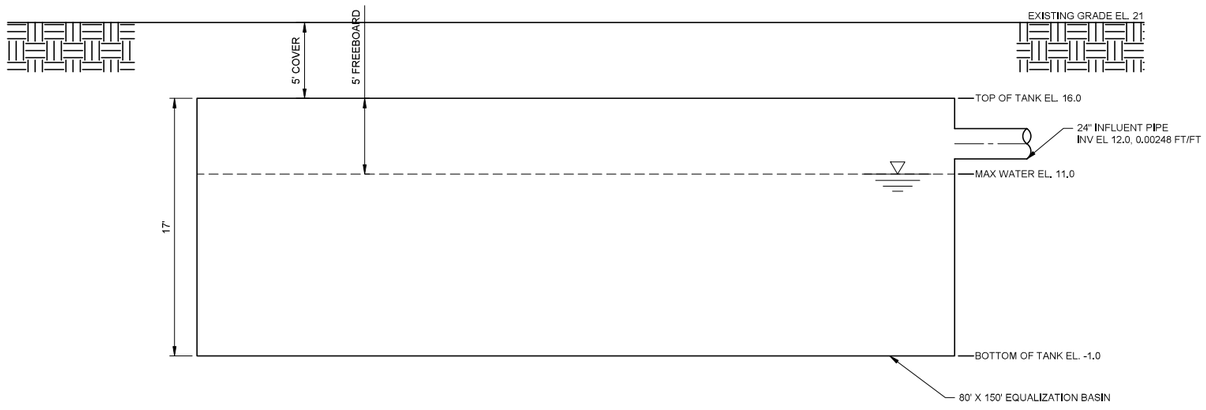
PIPE ROUTING

1:110

CARMEL AREA WASTEWATER DISTRICT
CAWD WWTP RELOCATION
CARMEL-BY-THE-SEA, CA

SITE LAYOUT

1:40



SECTION A-A

NOT TO SCALE

GREELEY AND HANSEN

CARMEL AREA WASTEWATER DISTRICT
CAWD WWTP RELOCATION
CARMEL-BY-THE-SEA, CA

APPENDIX B: OPINION OF PROBABLE CONSTRUCTION COSTS

Project Construction Cost
Project: CAWD WWTP Relocation
Client: Carmel Area Wastewater District
Title: Element No. 1
Date: 1/12/2023
Items Included: New WRRF

CSI No.		Item Name	Takeoff Quantity		Rate: Material	Rate: Labor	Rate: Equipment	Rate: Subcontract	Total Unit Cost	Escalation ENR CCI = 11,396		Unit Cost in Year 2020.75 ENR CCI = 11,620	Total Amount	Source Notes
			Quantity	unit	($/unit)	($/unit)	($/unit)	($/unit)		Year	Escalation Factor			
	PRELIMINARY TREATMENT													
		Coarse Screening	2	EA	$ -	$ -	$ 375,000.00	$ -	$ 375,000.00	2020.75	1.020	$ 382,386	$ 764,800	Saveco Quote - FSM Filter Screen Model FRSIII-T 1000 x 60/6 mounted in stainless steel tank with integral FSM Model SPW 300-1300 Screenings Wash Press
		Fine Screening	2	EA	$ -	$ -	$ 160,250.00	$ -	$ 160,250.00	2020.75	1.020	$ 163,455	$ 326,900	
		Salsnes Filter System	3	EA	$ -	$ -	$ 318,237.00	$ -	$ 318,237.00	2020.75	1.020	$ 324,602	$ 973,800	Salsnes Filter Quote - Model SF6000
												Subtotal	**$ 2,065,500**	
	ADVANCED TREATMENT													
		Membrane Bioreactor + Bio	1	LS	$ -	$ -	$ 3,500,000	$ -	$ 3,500,000.00	2020.75	1.020	$ 3,568,940	$ 3,568,900	Suez Quote - ZeeWeed MBR System; includes all equipment & services
		RO Break Tank	2	EA	$ -	$ -	$ 80,000.00	$ -	$ 80,000.00	2020.75	1.020	$ 81,576	$ 163,200	
		1.5 MGD RO Skids	2	EA	$ -	$ -	$ 875,000	$ -	$ 875,000.00	2020.75	1.020	$ 892,235	$ 1,784,500	NorCal Quote; includes RO system, ancillary equipment, and start-up services
		0.45 MGD FR RO	1	EA	$ -	$ -	$ 1,000,000	$ -	$ 1,000,000.00	2020.75	1.020	$ 1,019,697	$ 1,019,700	NorCal Quote; includes RO system, ancillary equipment, and start-up services
												Subtotal	**$ 6,536,300**	
	SOLIDS HANDLING													
		Rotary Drum Thickener	2	EA		$ -	$ 240,000.00	$ -	$ 240,000.00	2020.75	1.020	$ 244,727	$ 489,500	Parkson Corporation Quote - Model RDT200
		Sludge Pumps	3	EA	$ -	$ -	$ 5,000.00	$ -	$ 5,000.00	2020.75	1.020	$ 5,098	$ 15,300	Engineers Estimate
		Two Phase Anaerobic Digestion System	1	LS	$ -	$ -	$ 3,510,000.00	$ -	$ 3,510,000.00	2020.75	1.020	$ 3,579,137	$ 3,579,100	SUEZ
		Sludge Equalization Tank	1	EA	$ -	$ -	$ 20,000.00	$ -	$ 20,000.00	2020.75	1.020	$ 20,394	$ 20,400	Engineers Estimate
		Dewatering Centrifuges	2	EA	$ -	$ -	$ 252,375.00	$ -	$ 252,375.00	2020.75	1.020	$ 257,346	$ 514,700	Alfa Laval Quote - Model Aldec 45; includes set of controls, set of ancillaries, and commissioning
		Conveyor	2	LS	$ -	$ -	$ 150,000.00	$ -	$ 150,000.00	2020.75	1.020	$ 152,955	$ 305,900	Engineers Estimate
												Subtotal	**$ 4,924,900**	
	DISINFECTION													
		Advanced Oxidation Process - Hydrogen Peroxide with UV	1	LS	$ -	$ -	$ 1,600,000.00	$ -	$ 1,600,000.00	2020.75	1.020	$ 1,631,516	$ 1,631,500	Trojan Technologies Quote - TrojanUVFlex AOP 100 (add $250K for oxidant dosing pumps and HDPE tank) Lump sum price is for two (2) UV reactors
		Residual Disinfectant - Chloramination	2	EA	$ -	$ -	$ 250,000.00	$ -	$ 250,000.00	2020.75	1.020	$ 254,924	$ 509,800	Trojan UV Quote
		Treated Water Tank	2	EA	$ -	$ -	$ 120,000.00	$ -	$ 120,000.00	2020.75	1.020	$ 122,364	$ 244,700	Engineers Estimate
		Reuse Water Pumps	5	EA	$ -	$ -	$ 5,000.00	$ -	$ 5,000.00	2020.75	1.020	$ 5,098	$ 25,500	Engineers Estimate
												Subtotal	**$ 2,411,500**	
	BUILDINGS													
		Barn-style Building for Equipment	6	EA	$ -	$ -	$ 200,000.00	$ -	$ 200,000.00	2020.75	1.020	$ 203,939	$ 1,223,600	
		Concrete - Base Slab	960	CY	$ 515.48	$ 419.99	$ 21.16	$ -	$ 956.63	2020.75	1.020	$ 975	$ 936,500	RSMeans 033053401900 - Elevated slab (4000 psi), flat slab with drops, 125 psf sup. Load, 20' span
		Light Cover Over Bio Tanks	2	EA	$ -	$ -	$ 100,000.00	$ -	$ 100,000.00	2021.75	1.020	$ 101,970	$ 203,900	
												Subtotal	**$ 2,364,000**	
	EXCAVATION													
		MBR+BIO Tanks	16,207	CY	$ -	$ 260.00	$ 0.83	$ -	$ 260.83	2020.75	1.020	$ 266	$ 4,310,400	
		Digesters	5,616	CY	$ -	$ 260.00	$ 0.83	$ -	$ 260.83	2020.75	1.020	$ 266	$ 1,493,700	RSMeans 033053401900 - Elevated slab (4000 psi), flat slab with drops, 125 psf sup. Load, 20' span
		RO Break Tanks and Treated Water Tanks	859	CY	$ -	$ 260.00	$ 0.83	$ -	$ 260.83	2020.75	1.020	$ 266	$ 228,500	
												Subtotal	**$ 6,032,600**	
												Element No. 1 Direct Cost	**$ 24,334,800**	
												Electrical (includes Installation)	$ 7,272,400	
											10%	I&C	$ 2,433,480	
											15%	Installation	$ 3,650,220	
												Element No. 1 Total	**$ 37,690,900**	

Project Construction Cost

Project: CAWD WWTP Relocation
Client: Carmel Area Wastewater District
Title: Element No. 1
Date: 1/12/2023

Items Included: New WRRF

CSI No.		Item Name	Takeoff Quantity		Rate					Escalation ENR CCI = 11,396		Unit Cost in Year 2020.75 ENR CCI = 11,620	Total Amount	Source Notes
			Quantity	unit	Material ($/unit)	Labor ($/unit)	Equipment ($/unit)	Subcontract ($/unit)	Total Unit Cost	Year	Escalation Factor			
	PRELIMINARY TREATMENT													
		Coarse Screening	2	EA	$ -	$ -	$ 250,000.00	$ -	$ 250,000.00	2020.75	1.020	$ 254,924	$ 509,800	Engineers Estimate
		Fine Screening	2	EA	$ -	$ -	$ 130,000.00	$ -	$ 130,000.00	2020.75	1.020	$ 132,600	$ 265,200	Engineers Estimate
		Salsnes Filter System	3	EA	$ -	$ -	$ 318,237.00	$ -	$ 318,237.00	2020.75	1.020	$ 324,602	$ 973,800	Salsnes Filter Quote - Model SF6000
												Subtotal	**$ 1,748,800**	
	ADVANCED TREATMENT													
		Membrane Bioreactor + Bio	1	LS	$ -	$ -	$ 2,625,000	$ -	$ 2,625,000.00	2020.75	1.020	$ 2,676,705	$ 2,676,700	Engineers Estimate
		RO Break Tank	2	EA	$ -	$ -	$ 52,500.00	$ -	$ 52,500.00	2020.75	1.020	$ 53,534	$ 107,100	Engineers Estimate
		1.5 MGD RO Skids	2	EA	$ -	$ -	$ 600,000	$ -	$ 600,000.00	2020.75	1.020	$ 611,818	$ 1,223,600	Engineers Estimate
		0.45 MGD FR RO	1	EA	$ -	$ -	$ 650,000	$ -	$ 650,000.00	2020.75	1.020	$ 662,803	$ 662,800	Engineers Estimate
												Subtotal	**$ 4,670,200**	
	SOLIDS HANDLING													
		Rotary Drum Thickener	2	EA		$ -	$ 170,000.00	$ -	$ 170,000.00	2020.75	1.020	$ 173,349	$ 346,700	Engineers Estimate
		Sludge Pumps	3	EA	$ -	$ -	$ 5,000.00	$ -	$ 5,000.00	2020.75	1.020	$ 5,098	$ 15,300	Engineers Estimate
		Two Phase Anaerobic Digestion System	1	LS	$ -	$ -	$ 2,500,000.00	$ -	$ 2,500,000.00	2020.75	1.020	$ 2,549,243	$ 2,549,200	Engineers Estimate
		Sludge Equalization Tank	1	EA	$ -	$ -	$ 20,000.00	$ -	$ 20,000.00	2020.75	1.020	$ 20,394	$ 20,400	Engineers Estimate
		Dewatering Centrifuges	2	EA	$ -	$ -	$ 252,375.00	$ -	$ 252,375.00	2020.75	1.020	$ 257,346	$ 514,700	Alfa Laval Quote - Model Aldec 45; includes set of controls, set of ancillaries, and commissioning
		Conveyor	2	LS	$ -	$ -	$ 150,000.00	$ -	$ 150,000.00	2020.75	1.020	$ 152,955	$ 305,900	Engineers Estimate
												Subtotal	**$ 3,752,200**	
	DISINFECTION													
		Advanced Oxidation Process - Hydrogen Peroxide with UV	1	LS	$ -	$ -	$ 1,600,000.00	$ -	$ 1,600,000.00	2020.75	1.020	$ 1,631,516	$ 1,631,500	Trojan Technologies Quote - TrojanUVFlex AOP 100 (add $250K for oxidant dosing pumps and HDPE tank) Lump sum price is for two (2) UV reactors
		Residual Disinfectant - Chloramination	2	EA	$ -	$ -	$ 250,000.00	$ -	$ 250,000.00	2020.75	1.020	$ 254,924	$ 509,800	Trojan UV Quote
		Treated Water Tank	2	EA	$ -	$ -	$ 120,000.00	$ -	$ 120,000.00	2020.75	1.020	$ 122,364	$ 244,700	Engineers Estimate
		Reuse Water Pumps	5	EA	$ -	$ -	$ 5,000.00	$ -	$ 5,000.00	2020.75	1.020	$ 5,098	$ 25,500	Engineers Estimate
												Subtotal	**$ 2,411,500**	
	BUILDINGS													
		Barn-style Building for Equipment	6	EA	$ -	$ -	$ 200,000.00	$ -	$ 200,000.00	2020.75	1.020	$ 203,939	$ 1,223,600	
		Concrete - Base Slab	960	CY	$ 515.48	$ 419.99	$ 21.16	$ -	$ 956.63	2020.75	1.020	$ 975	$ 936,500	RSMeans 033053401900 - Elevated slab (4000 psi), flat slab with drops, 125 psf sup. Load, 20' span
		Light Cover Over Bio Tanks	2	EA	$ -	$ -	$ 100,000.00	$ -	$ 100,000.00	2021.75	1.020	$ 101,970	$ 203,900	
												Subtotal	**$ 2,364,000**	
	EXCAVATION													
		MBR+BIO Tanks	16,207	CY	$ -	$ 260.00	$ 0.83	$ -	$ 260.83	2020.75	1.020	$ 266	$ 4,310,400	
		Digesters	5,616	CY	$ -	$ 260.00	$ 0.83	$ -	$ 260.83	2020.75	1.020	$ 266	$ 1,493,700	RSMeans 033053401900 - Elevated slab (4000 psi), flat slab with drops, 125 psf sup. Load, 20' span
		RO Break Tanks and Treated Water Tanks	859	CY	$ -	$ 260.00	$ 0.83	$ -	$ 260.83	2020.75	1.020	$ 266	$ 228,500	
												Subtotal	**$ 6,032,600**	
												Element No. 1 Direct Cost	**$ 20,979,300**	
												Electrical (includes Installation)	$ 7,272,400	
											10%	I&C	$ 2,097,930	
											15%	Installation	$ 3,146,895	
												Element No. 1 Total	**$ 33,496,600**	

Project Construction Cost

Project: CAWD WWTP Relocation
Client: Carmel Area Wastewater District
Title: Element No. 2
Date: 1/12/2023

Items Included: New Equalization Basin

CSI No.		Item Name	Takeoff Quantity		Rate: Material	Rate: Labor	Rate: Equipment	Rate: Subcontract	Total Unit Cost	Escalation ENR CCI = 11,396		Unit Cost in Year 2020.75 ENR CCI = 11,620	Total Amount	Source Notes
			Quantity	unit	($/unit)	($/unit)	($/unit)	($/unit)		Year	Escalation Factor			
	SITE WORK													
		Clearing and Grubbing		ACRE	$ -	$ 2,300.00	$ 4,489.20	$ -	$ 6,789.20	2020.75	1.020	$ 6,923	$ -	RSMeans 311110100160 - Clear & Grub brush including stumps
		Rough Grading	1	EA	$ -	$ 467.18	$ 443.76	$ -	$ 910.94	2020.75	1.020	$ 929	$ 900	RSMeans 312213200200 - Rough grade open sites, 10,000-20,000 SF
												Subtotal	**$ 900**	
	EARTHWORK													
		Excavation	11,733	BCY	$ -	$ 260.00	$ 0.83	$ -	$ 260.83	2020.75	1.020	$ 266	$ 3,120,700	RSMeans 312316425500 - Excavating, bulk bank measure, sandy clay & loam piled; excavator 3-1/2 CY cap = 350 CY/hr
												Subtotal	**$ 3,120,700**	
	CONCRETE													
		Concrete - Base Slab	889	BCY	$ 515.48	$ 419.99	$ 21.16	$ -	$ 956.63	2020.75	1.020	$ 975	$ 867,100	RSMeans 033053401900 - Elevated slab (4000 psi), flat slab with drops, 125 psf sup. Load, 20' span
		Concrete - Walls	290	BCY	$ 314.51	$ 315.33	$ 16.51	$ -	$ 646.35	2020.75	1.020	$ 659	$ 190,900	RSMeans 033053404500 - Wall, free-standing (3000 psi), 15" thick, 18' high
												Subtotal	**$ 1,058,000**	
	WASTEWATER EQUIPMENT													
		Mixers	4	EA	$ -	$ -	$ 3,000.00	$ -	$ 3,000.00	2020.75	1.020	**$ 3,059.09**	$ 12,200	
												Subtotal	**$ 12,200**	
	ELECTRICAL													
		Site lighting and general power to support basin, site poles and misc power requirement	1	LS	$ -	$ -	$ 85,000.00	$ -	$ 85,000.00	2021.75	1.020	$ 86,674	$ 86,700	
												Subtotal	**$ 86,700**	
	INSTRUMENTATION AND CONTROLS													
		Process Integration	1	LS	$ -	$ -	$ 85,000.00	$ -	$ 85,000.00	2020.75	1.020	$ 86,674	$ 86,700	
												Subtotal	**$ 86,700**	
												Element No. 2 Direct Cost	**$ 4,365,200**	
											15%	Installation	$ 654,780	
												Element No. 2 Total	**$ 5,020,000**	

Project Construction Cost

Project: CAWD WWTP Relocation
Client: Carmel Area Wastewater District
Title: Element No. 3
Date: 1/12/2023

Items Included: New Pump Station

CSI No.		Item Name	Takeoff Quantity		Rate					Escalation ENR CCI = 11,396		Unit Cost in Year 2020.75 ENR CCI = 11,620	Total Amount	Source Notes
			Quantity	unit	Material ($/unit)	Labor ($/unit)	Equipment ($/unit)	Subcontract ($/unit)	Total Unit Cost	Year	Escalation Factor			
	SITE WORK													
		Clearing and Grubbing	1	ACRE	$ -	$ 2,300.00	$ 4,489.20	$ -	$ 6,789.20	2020.75	1.020	$ 6,923	$ 6,900	RSMeans 311110100160 - Clear & Grub brush including stumps
		Rough Grading	1	EA	$ -	$ 467.18	$ 443.76	$ -	$ 910.94	2020.75	1.020	$ 929	$ 900	RSMeans 312213200200 - Rough grade open sites, 10,000-20,000 SF
												Subtotal	**$ 7,800**	
	EQUIPMENT													
		Pumps	5	EA	$ -	$ -	$ 10,000.00	$ -	$ 10,000.00	2020.75	1.020	$ 10,197	$ 51,000	
		Pump Station Building	1	LS	$ -	$ -	$ -	$ -	$ 500,000.00	2020.75	1.020	$ 509,849	$ 509,800	
		Bollards	4	EA	$ 763.20	$ 137.81	$ 28.38	$ -	$ 929.39	2020.75	1.020	$ 948	$ 3,800	RSMeans 321713131500 - Metal parking bumpers, pipe bollards, concrete filled/painted, 8' L x 4' D hole, 12" diam.
												Subtotal	**$ 564,600**	
	ELECTRICAL													
		Service and Distribution	1	LS	$ -	$ -	$ 594,600.00	$ -	$ 594,600.00	2020.75	1.020	$ 606,312	$ 606,300	
												Subtotal	**$ 606,300**	
	INSTRUMENTATION & CONTROLS													
		Process Integration	1	LS	$ -	$ 120,000.00	$ -	$ -	$ 120,000	2020.75	1.020	$ 122,364	$ 122,400	
												Subtotal	**$ 122,400**	
												Element No. 3 Direct Cost	**$ 1,301,100**	
											15%	Installation	$ 195,165	
												Element No. 3 Total	**$ 1,496,300**	

Project Construction Cost

Project: CAWD WWTP Relocation
Client: Carmel Area Wastewater District
Title: Element No. 4
Date: 1/12/2023

Items Included: Land Acquisition

CSI No.		Item Name	Takeoff Quantity		Rate					Escalation ENR CCI = 11,396		Unit Cost in Year 2020.75 ENR CCI = 11,620	Total Amount	Source Notes
			Quantity	unit	Material ($/unit)	Labor ($/unit)	Equipment ($/unit)	Subcontract ($/unit)	Total Unit Cost	Year	Escalation Factor			
	LAND ACQUISITION													
		Roach Canyon	2.5	ACRE	$ -	$ -	$ -	$ -	$ 2,000,000.00	2020.75	1.020	$ 2,039,394	$ 5,098,500	Engineers estimate
		Hatton Canyon Park	0.5	ACRE	$ -	$ -	$ -	$ -	$ 2,000,000.00	2020.75	1.020	$ 2,039,394	$ 1,019,700	Engineers estimate
		Rio Park Dolores		ACRE	$ -	$ -	$ -	$ -	$ 2,000,000.00	2020.75	1.020	$ 2,039,394	$ -	Engineers estimate
												Subtotal	**$ 6,118,200**	
												Element No. 4 Direct Cost	**$ 6,118,200**	
												Element No. 4 Total	**$ 6,118,200**	

Project Construction Cost
Project: CAWD WWTP Relocation
Client: Carmel Area Wastewater District
Title: Element No. 5
Date: 1/12/2023
Items Included: New WRRF Electrical Supply

CSI No.		Item Name	Takeoff Quantity		Rate: Material	Rate: Labor	Rate: Equipment	Rate: Subcontract	Rate: Total Unit Cost	Escalation ENR CCI = 11,396		Unit Cost in Year 2020.75 ENR CCI = 11,620	Total Amount	Source Notes
			Quantity	unit	($/unit)	($/unit)	($/unit)	($/unit)		Year	Escalation Factor			
	ELECTRICAL SUPPLY													
		PG&E	1	LS	$ -	$ -	$ -	$ 1,860,000.00	$ 1,860,000.00	2020.75	1.020	$ 1,896,637	$ 1,896,600	Per PG&E Unit Price Guide Dated April, 2021. Includes Primary Service Entrance Switchgear (QTY-2) and Underground Line from Nearest Pole(s) (QTY-1,000' Per Service).
		Electrical Routing and Connections		LS	$ -	$ -	$ -	$ -	$ -	2020.75	1.020	$ -	$ -	
												Subtotal	**$ 1,896,600**	
												Subtotal	**$ -**	
												Element No. 5 Direct Cost	**$ 1,896,600**	
												Allowance Diesel Generators	$ 1,000,000	
												Element No. 5 Total	**$ 2,896,600**	

Project Construction Cost

Project: CAWD WWTP Relocation
Client: Carmel Area Wastewater District
Title: Element No. 6
Date: 1/12/2023

Items Included: Conveyance Piping

CSI No.		Item Name	Takeoff Quantity		Rate: Material	Rate: Labor	Rate: Equipment	Rate: Subcontract	Rate: Total Unit Cost	Escalation ENR CCI = 11,396		Unit Cost in Year 2020.75 ENR CCI = 11,620	Total Amount	Source Notes
			Quantity	unit	($/unit)	($/unit)	($/unit)	($/unit)		Year	Escalation Factor			
	CONVEYANCE PIPING													
		Gravity Sewer Line to EQ Basin/Pump Station	3,710	FT	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 1,324,100	Engineers estimate
		Line from EQ Basin/Pump Station to WRRF	17,100	FT	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 6,102,900	Engineers estimate
		Gravity Discharge Line from WRRF to Outfall	22,000	FT	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 7,851,700	Engineers estimate
		New Reuse Water Line to Irrigation	16,800	FT	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 5,995,800	Engineers estimate
		Trench excavation and backfill for 6-30 inch sewer pipe (4 to 12 foot depth)	22,853	CY	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 8,156,200	Engineers estimate
												Subtotal	**$ 29,430,700**	
												Element No. 6 Direct Cost	**$ 29,430,700**	
												Element No. 4 Total	**$ 29,430,700**	

APPENDIX C: EQUIPMENT DATA AND INFORMATION

Budget Proposal

Project:
Carmel WWTP

Equipment:
FSM In-tank Filter Screen Model FRSIII-T 1000 x 60/6 with integral FSM Screenings Wash Press Model SPW 300-1300

Represented By:
Coombs Hopkins.
Brad Leidecker
Phone: 925.76.0646
Email: brad@chcwater.com

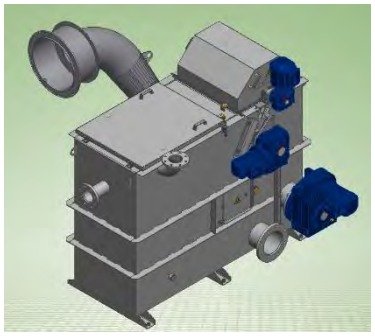
Regional Sales Manager:
SAVÉCO North America, Inc.
Formerly Enviro-Care
Alan Spratt
Phone: 224.302.0316
Email: alan.spratt@savecowaterna.com

Project No.: WEC222312
September 1, 2022

ITEM: "A" - Two (2) FSM Filter Screen Model FRSIII-T 1000 x 60/6 Mounted in Stainless Steel Tank with integral FSM Model SPW 300-1300 Screenings Wash Press.

BASIS OF DESIGN (EACH)

Application:	Municipal Wastewater
Peak Flow:	3.0MGD
Screen Perforated Opening:	6 mm
Angle of Screen:	60 degrees from horizontal
Tank Width:	3.95 feet
Tank Depth:	5.9 feet
Tank Length:	6.9 feet
Tank Total Height:	6.9 feet
Influent Flange:	18 inch
Effluent Flange:	18 inch
Wash Water:	26 gpm at 40 – 60 psi
SCR (Screenings Capture Ratio):	85%



PERFORATED PANEL TRAVELING BELT SCREEN (EACH)

- Fully automatic self-cleaning FSM screen complete with all appurtenances – 316 stainless steel.
- Screen support rails from UHMW-PE provided front and back on each side of frame.
- Replaceable UHMW-PE seals mounted to each side of frame.
- Replaceable bottom seals – Buna-N rubber and triple layer polyester brush with 316 stainless steel adjustable holder.
- Perforated filter screen elements from 3 mm thick (12 gauge) type 316 stainless steel, bolted to drive chain with 316 stainless steel bolt ny-lock nuts and washers.
- Screen drive chain from 316 stainless steel with specially hardened bushings, and pins from stainless steel.
- Stainless steel chain and screen elements driven by two (2) drive shaft mounted stainless steel sprockets with minimum thickness of 0.75 inches.
- Lower rotating guide sprockets from type 304 stainless steel, wear areas hardened, with life seal bushings, and a stub shaft from type 316 stainless steel.
- Drive tensioners – 316 stainless steel.
- Drive system to include 1.0 HP 1760 rpm TEFC geardrive motor suitable for 460/3/60 electrical supply.

- Nylon screen cleaning brush, automatic self-adjusting, with stainless steel drive shaft and 2.0 HP 1760 rpm TEFC geared motor suitable for 460/3/60 electrical.
- Rotary Deflector on back side of screen auxiliary driven by screen drive.
- Internal spray system to clean internal surfaces of screen panel from stainless steel with PVDF nozzles, complete with manual ball valve and NEMA 4X 120 vac solenoid valve.
- Screenings discharge chute with hinged hood – 316 stainless steel.
- Anchor bolts – 316 stainless steel.
- Fasteners – 316 stainless steel.
- Shop surface preparation, stainless steel full dip passivation process.

BASIS OF DESIGN – SCREENINGS WASH PRESS (EACH)

Screenings Capacity:	177 ft3/hr
Inlet Opening:	1300 mm (51.2 inches)
Screw Diameter:	300 mm (11.81 inches)
Discharged Material Dry Solids:	>40%
Volume Reduction:	60 – 85%
Weight Reduction:	60 – 85%
Fecal Reduction:	95% or <20 mg/g BOD5)
Wash Water:	11 gpm @ 20-40 psi

SCREENINGS WASH PRESS (EACH)

- Screenings wash press from type 316 stainless steel.
- Inlet hopper and spray header from type 316 stainless steel.
- Screw auger with torque tube and nylon brushes fitted to screw flights to clean drainage trough perforations – shaft from high tensile steel with flights from Hardox 400.
- Tapered roller bearing with stainless steel body.
- Wear bars from Hardox® 400 alloy steel.
- 6 mm perforated curved drainage section from type 316 stainless steel.
- Washwater piping from type 316 stainless steel.
- Discharge piping with 45 degree elbows from type 316 stainless steel.
- Discharge piping to have a manually controlled back pressure device from type 316 stainless steel with integral access box and bolted hatch.
- Wash press electric drive motor 5.0 HP TEFC 1760 rpm suitable for 460/3/60 supply with gear reducer mounted directly onto auger drive shaft.

STAINLESS STEEL TANK (EACH)

- Screen tank from type 316 stainless steel.
- Flanged inlet and outlet.
- Overflow flanged outlet.
- Removable covers.

- Connection for pressure level sensor.

CONTROL PANEL AND INSTRUMENTATION (EACH)

- One (1) NEMA 4X type 316 stainless steel wall mount main control panel suitable for 480/3/60 electrical supply. Control panel shall contain the following control devices for operation of the filter screen and wash press.
    1. Main disconnect with through door interlock handle.
    2. Control transformer 480/120.
    3. Branch circuit protection.
    4. Screen and brush motor starters (IEC) with overloads.
    5. Brush motor starter (IEC) with overloads.
    6. Wash press motor starter (IEC), reversing with overloads
    7. Load monitor for screen motor overtorque/overload protection.
    8. Load monitor for wash press motor overtorque/overload protection
    9. Emergency stop pushbutton.
    10. HOA switches for each motor.
    11. HOA switches for each wash water solenoid valve.
    12. Hour meter for each motor.
    13. Run indicating lights.
    14. Alarm lights indicating overcurrent and starter overload.
    15. Alarm reset pushbutton.
    16. Programmable control relay for screen and wash press control logic functions.
    17. Run and alarm auxiliary contacts.
    18. Barrier Relay for Pressure Sensor.
    19. UL Label.

- One (1) NEMA 4X Emergency Stop pushbutton station.
- One (1) safety microswitch suitable for the area classification, mounted to the screen hinged hood.
- Two (2) NEMA 4X 120 VAC, brass body wash water solenoid valves for screen and wash press wash water.
- One (1) Pressure sensor to detect water level upstream of screen.

SPARE PARTS (TOTAL)

- None.

FIELD SERVICE (TOTAL)

- Site service of one (1) trip for a total of two (2) days for installation inspection, startup and operator training.

CLARIFICATIONS/COMMENTS

- None.

OPTIONAL ITEMS

- None.

NOTE: ANY ITEM NOT LISTED ABOVE TO BE FURNISHED BY OTHERS

EXCLUSIONS

Taxes, electrical wiring, conduit or electrical equipment, piping, valves, or fittings, shimming material, lubricating oil or grease, shop or field painting, field welding, erection, hoist or lifting apparatus, detail shop fabrication drawings, performance testing, unloading, storage, concrete work, civil design, grating, platforms, stairs, hand railing, dumpster (except as specifically noted).

This proposal section has been reviewed for accuracy and is approved for issue:
By: Todd Campbell Date: September 1, 2022

BUDGET

Item	Equipment	Budget Price
A	Two (2) FSM Filter Screen Model FRSIII-T 1000 x 60/6 Mounted in Stainless Steel Tank with integral FSM Model SPW 300-1300 Screenings Wash Press.	$ 748,000

Validity:
Prices are valid for a period of 30 days from the date of this proposal. Beyond 30 days, delivery is subject to prior sales.

Warranty Statement and Term:
SAVÉCO North America, Inc. warrants the supplied equipment to the original end user against defects in workmanship or material under normal use and service in compliance with the original design specifications and the maintenance requirements and instructions as found in the Operations & Maintenance Manual. All SAVÉCO North America supplied equipment is warranted for 12 months from date of start-up or 18 months from date of shipment, whichever occurs first.

Warranty Exclusions:
This warranty does not cover costs for standard and/or scheduled maintenance performed, nor does it cover consumables and SAVÉCO North America parts that, by virtue of their operation, require replacement through normal wear (aka: Wear Parts), unless a defect in material or workmanship can be determined by SAVÉCO North America. Wear parts are defined as brushes, rollers, spray nozzles, drum seals and other items specifically identified in the Operations & Maintenance Manual.

Warranty Coverage:
SAVÉCO North America's liability is limited to the supply or repair of defective parts returned, freight prepaid by buyer to a location specified by SAVÉCO North America. Repaired or replacement parts will be shipped to buyer prepaid via standard ground freight. Express or expedited shipments will be at the expense of the buyer.

Exclusions and Exceptions:
This Warranty excludes damage or wear to equipment caused by misapplication of product, improper maintenance, accident, abuse, unauthorized alteration or repair, Acts of God, or installation or operation that is non-compliant with SAVÉCO North America installation and operations instructions.

Limited Liability:
SAVÉCO North America shall not under any circumstances be liable for any incidental or consequential damages arising from loss, damage to property, personal injury or other damage or losses owing to the failure of SAVÉCO North America's equipment. The liability of SAVÉCO North America, Inc. is limited as set forth above within the time period set forth above.

Term: 15% with Submittal Approval
80% Net 30 Days after Shipment
5% Net 30 days after Startup. Startup not to exceed 180 days from equipment delivery.

Taxes: No sales or use taxes have been included in our pricing.

Freight: Prices quoted are F.O. B. shipping point with freight allowed to a readily accessible location nearest jobsite. Any claims for damage or loss in shipment to be initiated by purchaser.

Submittals: Full submittals will be supplied approximately 4 to 6 weeks after receipt and acceptance of purchase order at the SAVÉCO North America offices.

Shipment: Shipment time is approximately 20 to 22 weeks after receipt of approved submittal is received at the SAVÉCO North America offices. Under no circumstances will verbal approval be accepted.

Additional Field Service: This service may be scheduled at $1,250.00 per day plus expenses or is available through a yearly service contract.

Material of Construction: SAVÉCO North America is providing the equipment from the type of material specified for this project. If from 316L stainless steel the concentration of chloride and hydrogen sulfide (H2S) in the equipment operating environment shall be kept below the following values:

- Chloride <200 mg/L
- Hydrogen Sulfide (H2S) <6ppm

If not already done so, SAVÉCO North America can provide the equipment from 316L stainless steel for a price adder for environments that exceed the values noted above.

Please issue Purchase Orders to:
SAVÉCO® North America, Inc.
1570 St Paul Avenue
Gurnee, IL 60031

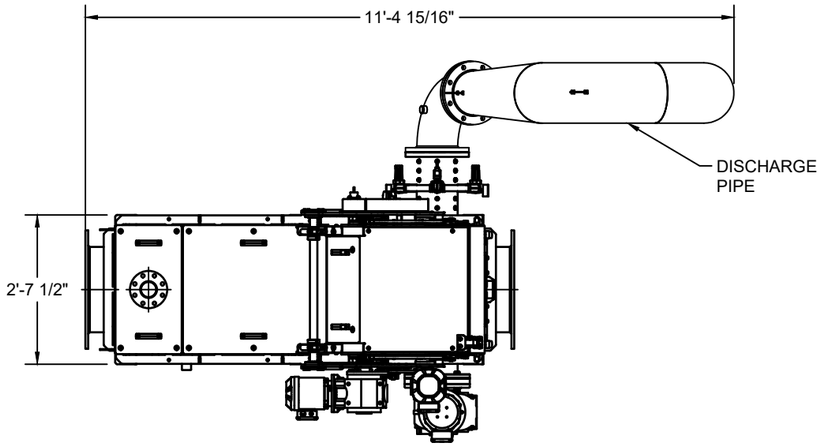
Attn: Matt Bodwell
Phone: 224-302-0326
Email: matt.bodwell@savecowaterna.com

PROCESS DESIGN INFORMATION (SCREEN):

APPLICATION:	MUNICIPAL WASTEWATER
PEAK FLOW:	3.0MGD
SCREEN PERFORATED OPENING:	6 MM
ANGLE OF SCREEN:	60 DEGREES FROM HORIZONTAL
TANK WIDTH:	3.95 FEET
TANK DEPTH:	5.9 FEET
TANK LENGTH:	6.9 FEET
TANK TOTAL HEIGHT:	6.9 FEET
INFLUENT FLANGE:	18 INCH
EFFLUENT FLANGE:	18 INCH
WASH WATER:	26 GPM AT 40 - 60 PSI
SCR (SCREENINGS CAPTURE RATIO):	85%

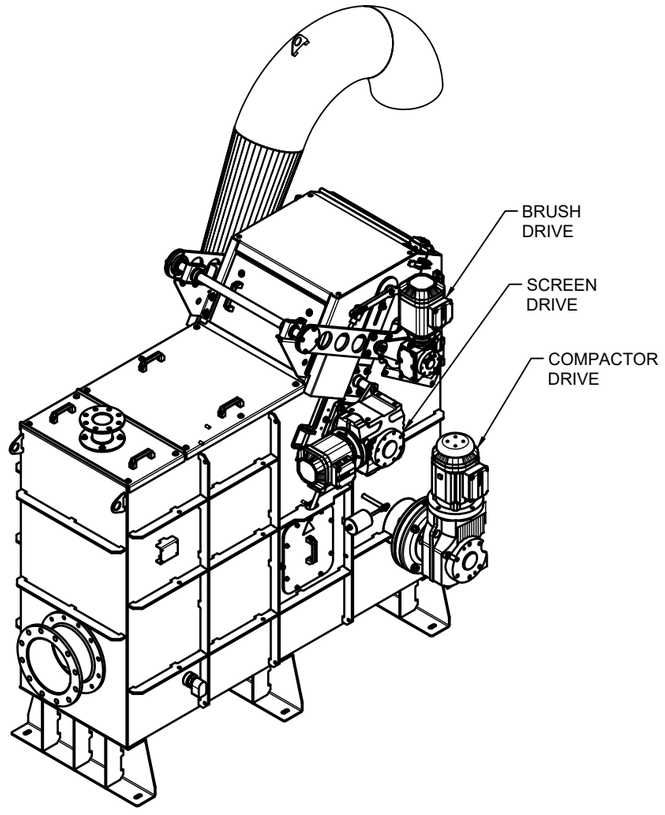
PROCESS DESIGN INFORMATION (WASH PRESS):

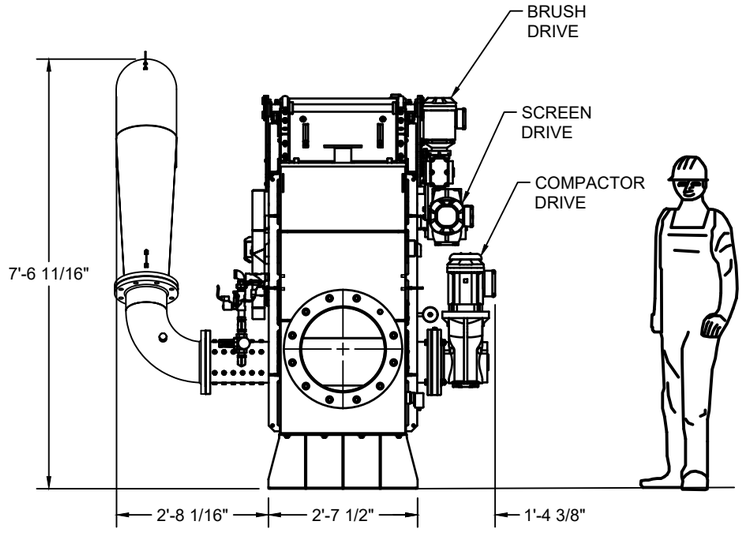
SCREENINGS CAPACITY:	177 FT3/HR
INLET OPENING:	1300 MM (51.2 INCHES)
SCREW DIAMETER:	300 MM (11.81 INCHES)
DISCHARGED MATERIAL DRY SOLIDS:	>40%
VOLUME REDUCTION:	60 - 85%
WEIGHT REDUCTION:	60 - 85%
FECAL REDUCTION:	95% OR <20 MG/G BOD5)
WASH WATER:	11 GPM @ 20-40 PSI



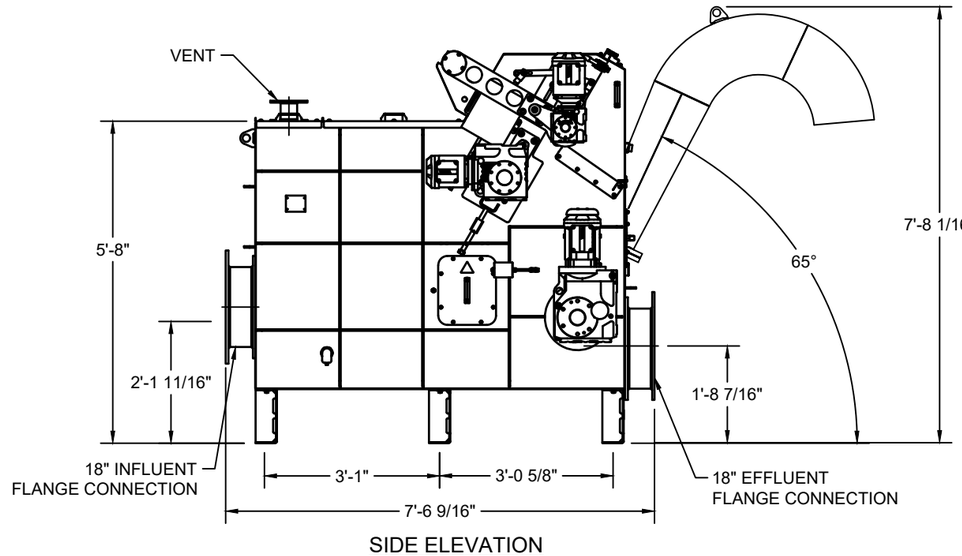
PLAN

NOTES:
1. CONCRETE, GROUT, INTERCONNECTING PIPING NOT BY SAVECO
2. ALL INTERCONNECTING PIPING TO BE SELF SUPPORTING
3. DRAWING NOT FOR CONSTRUCTION





FRONT ELEVATION



SIDE ELEVATION

SAVECO®
Member of WAMGROUP®
Formerly Enviro-Care®

Project Information
PROJECT NAME: CARMEL WWTP

Third Angle Projection

Status: SALES DRAWING

Title: FRSIII-T1000x60-T1 FSM IN-TANK FILTER SCREEN W/ INTEGRAL SPW300-1300 FSM SCREENINGS WASH PRESS

Designer	Checker	Date	Sheet
MB29	TC01	09-01-2022	1 OF 1

Scale	Drawing Number	Revision
3/8"=1'-0"	WEC222312-A	-

Budget Proposal

Project:
Carmel WWTP

Equipment:
SAVI Flo-Drum Tank Mounted Rotating Drum Screen Model VSA 1000/6-T

Represented By:
Coombs Hopkins.
Brad Leidecker
Phone: 925.76.0646
Email: brad@chcwater.com

Regional Sales Manager:
SAVÉCO North America, Inc.
Formerly Enviro-Care
Alan Spratt
Phone: 224.302.0316
Email: alan.spratt@savecowaterna.com

Project No.: WEC222312
September 1, 2022

ITEM: "A" – Two (1) SAVI Flo-Drum Tank Mounted Rotating Drum Screen Model VSA 1000/2-T

BASIS OF DESIGN (EACH)

Application:	Municipal Wastewater
Peak Design Flow:	3.2 MGD
Tank Length:	7.5 feet
Tank Width:	3.6 feet
Tank Height:	6.6 feet
Screen Opening:	6 mm
Opening Type:	Perforated
Angle of Inclination:	35 degrees
Influent Flange Size:	20 inch
Effluent Flange Size:	20 inch
Discharge Height:	5.9 feet from mounting floor
Wash Water Flow & Pressure:	48 gpm at 58 psi
Screenings Capture Ratio Value (SCR):	66% independently tested at UKWIR testing facility

FINE SCREEN (EACH)

- Integral screen tank from type 316L stainless steel. Tank supplied with influent and effluent flanges, mounting flange for level sensor and removable access panels.
- Fully automatic, self-cleaning, perforated plate, rotating drum fine screen with integral screenings washing, conveying, and dewatering.
- Cylindrical drum screen basket constructed of perforated plate media from type 316L stainless steel with perforations around the entire basket.
- Proprietary triple face seal with polyurethane designed for maximum capture of fine solids including hair and to prevent material bypass.
- Cleaning brush and spray bar on the outside of the screen drum to thoroughly clean the drum and to prevent small solids from passing through the screen.

- Drum screen supported by reinforced type 316L stainless steel support arm on drive end and rollers on the opposite end. Rollers with stainless steel shafts mounted to upper support plate and shall require no lubrication. A brush is clamped to the upper support plate sealing the gap between the rotating screen basket and the fixed upper support plate.
- One piece type 316L stainless steel seal plate on the influent end of the drum screen, directs flow into the screen basket and creates a seal with the tank sides preventing flow bypass.
- Drum screen and screw conveyor are driven by a common drive unit.
- The shafted screenings screw conveyor to be constructed of an epoxy coated high strength alloy steel for maximum torsion resistance.
- Shafted screw supported by a lower sealed, self-lubricating bronze bushing.
- The screenings screw conveyor shall have a brush mounted on it for the length of the screenings inlet hopper.
- Screenings spray wash system with multiple injection points located in transport zone prior to dewatering zone with manual ball valves.
- Dual chambered dewatering and discharge zone from type 316L stainless steel with hinged access door.
- Dewatering zone drain flush spray system from type 316L stainless steel with manual ball valve.
- Plastic hose for drain connection to direct pressate back into the tank.
- Drive unit with 1.5 HP TEFC motor suitable for 460/3/60 electrical supply.
- Fasteners and anchors from type 316 stainless steel.

FINE SCREEN SUPPORTS

- A stand from type 316 stainless steel is supplied to support the fine screen unit. Support shall allow unit to be rotated.

CONTROL PANEL AND INSTRUMENTATION (EACH)

- One (1) NEMA 4X type 316 stainless steel wall mount main control panel suitable for 480/3/60 electrical supply. Control panel shall contain the following control devices for operation of the screen.
    1. Main disconnect with through door interlock handle.
    2. Control transformer 480/120.
    3. Branch circuit protection.
    4. Screen drive motor starter w/ soft start and overload.
    5. Emergency stop pushbutton.
    6. HOA switch for each motor.
    7. HOA switch for each solenoid valve.
    8. Hour meter for each motor.
    9. Run indicating lights.

10. Alarm lights indicating overcurrent and starter overload.
11. Alarm reset pushbutton.
12. Programmable control relay for screen logic control.
13. Universal transmitter for level relay.
14. Run and alarm auxiliary dry contacts.
15. Intrinsically safe barrier relay for level sensor.
16. UL Label.

- One (1) NEMA 4X emergency stop pushbutton station.
- Three (3) safety microswitches suitable for the area classification, mounted to the hinged tank and dewatering/discharge access doors.
- One (1) NEMA 4X 120V brass body solenoid valve to control compaction zone water spray functions.
- One (1) NEMA 4X 120V stainless steel body electrically actuated ball valve to control drum spray wash functions.
- One (1) non-contacting radar transmitter to detect start and high level.

SPARE PARTS (TOTAL)

- None.

FIELD SERVICE (TOTAL)

- Site service of one (1) trip for a total of two (2) days for installation inspection, startup and operator training.

CLARIFICATIONS/COMMENTS

- None.

OPTIONAL ITEMS (EACH)

- None.

NOTE: ANY ITEM NOT LISTED ABOVE TO BE FURNISHED BY OTHERS.

EXCLUSIONS

Taxes, electrical wiring, conduit or electrical equipment, piping, valves, or fittings, shimming material, lubricating oil or grease, shop or field painting, field welding, erection, hoist or lifting apparatus, detail shop fabrication drawings, performance testing, unloading, storage, concrete work, civil design, grating, platforms, stairs, hand railing, dumpster (except as specifically noted).

This proposal section has been reviewed for accuracy and is approved for issue:
By: Todd Campbell Date: September 1, 2022

BUDGET

Item	Equipment	Budget Price
A	Two (2) SAVI Flo-Drum Tank Mounted Rotating Drum Screen Model VSA 1000/6-T and Manual Bypass	$320,500

Validity:
Prices are valid for a period of 30 days from the date of this proposal. Beyond 30 days, delivery is subject to prior sales.

Warranty Statement and Term:
SAVÉCO North America, Inc. warrants the supplied equipment to the original end user against defects in workmanship or material under normal use and service in compliance with the original design specifications and the maintenance requirements and instructions as found in the Operations & Maintenance Manual. All SAVÉCO North America supplied equipment is warranted for 12 months from date of start-up or 18 months from date of shipment, whichever occurs first.

Warranty Exclusions:
This warranty does not cover costs for standard and/or scheduled maintenance performed, nor does it cover consumables and SAVÉCO North America parts that, by virtue of their operation, require replacement through normal wear (aka: Wear Parts), unless a defect in material or workmanship can be determined by SAVÉCO North America. Wear parts are defined as brushes, rollers, spray nozzles, drum seals and other items specifically identified in the Operations & Maintenance Manual.

Warranty Coverage:
SAVÉCO North America's liability is limited to the supply or repair of defective parts returned, freight prepaid by buyer to a location specified by SAVÉCO North America. Repaired or replacement parts will be shipped to buyer prepaid via standard ground freight. Express or expedited shipments will be at the expense of the buyer.

Exclusions and Exceptions:
This Warranty excludes damage or wear to equipment caused by misapplication of product, improper maintenance, accident, abuse, unauthorized alteration or repair, Acts of God, or installation or operation that is non-compliant with SAVÉCO North America installation and operations instructions.

Limited Liability:
SAVÉCO North America shall not under any circumstances be liable for any incidental or consequential damages arising from loss, damage to property, personal injury or other damage or losses owing to the failure of SAVÉCO North America's equipment. The liability of SAVÉCO North America, Inc. is limited as set forth above within the time period set forth above.

Term: 15% with Submittal Approval
80% Net 30 Days after Shipment
5% Net 30 days after Startup. Startup not to exceed 180 days from equipment delivery.

Taxes: No sales or use taxes have been included in our pricing.

Freight: Prices quoted are F.O. B. shipping point with freight allowed to a readily accessible location nearest jobsite. Any claims for damage or loss in shipment to be initiated by purchaser.

Submittals: Full submittals will be supplied approximately 4 to 6 weeks after receipt and acceptance of purchase order at the SAVÉCO North America offices.

Shipment: Shipment time is approximately 20 to 22 weeks after approved submittal is received at the SAVÉCO North America offices. Under no circumstances will verbal approval be accepted.

Additional Field Service: This service may be scheduled at $1,250.00 per day plus expenses or is available through a yearly service contract.

Material of Construction: SAVÉCO North America is providing the equipment from the type of material specified for this project. If from 316L stainless steel the concentration of chloride and hydrogen sulfide (H2S) in the equipment operating environment shall be kept below the following values:

- Chloride <200 mg/L
- Hydrogen Sulfide (H2S) <6ppm

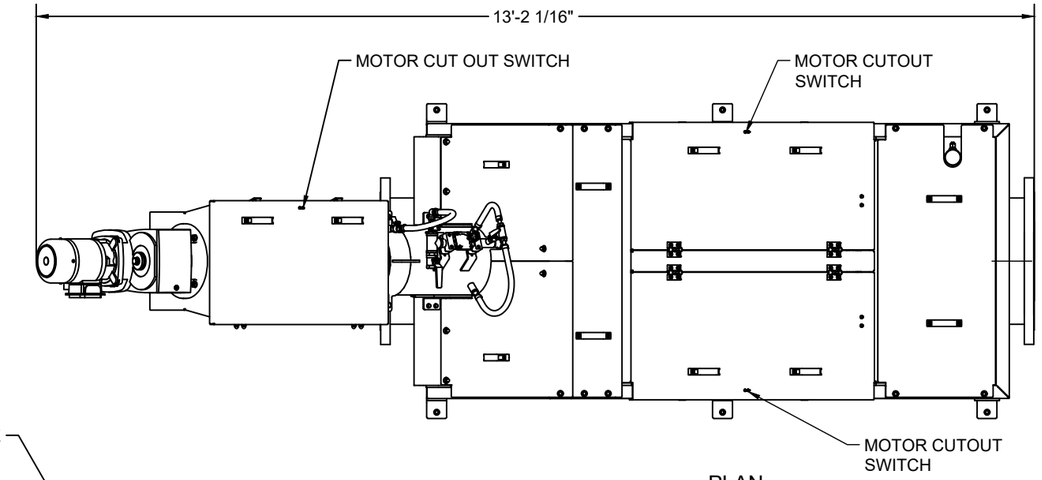
If not already done so, SAVÉCO North America can provide the equipment from 316L stainless steel for a price adder for environments that exceed the values noted above.

Please issue Purchase Orders to:
SAVÉCO® North America, Inc.
1570 St Paul Avenue
Gurnee, IL 60031

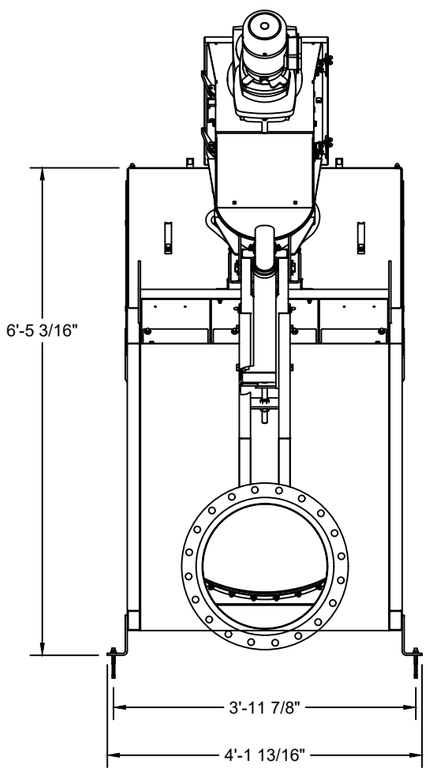
Attn: Matt Bodwell
Phone: 224-302-0326
Email: matt.bodwell@savecowaterna.com

PROCESS DESIGN INFORMATION (EACH SCREEN):

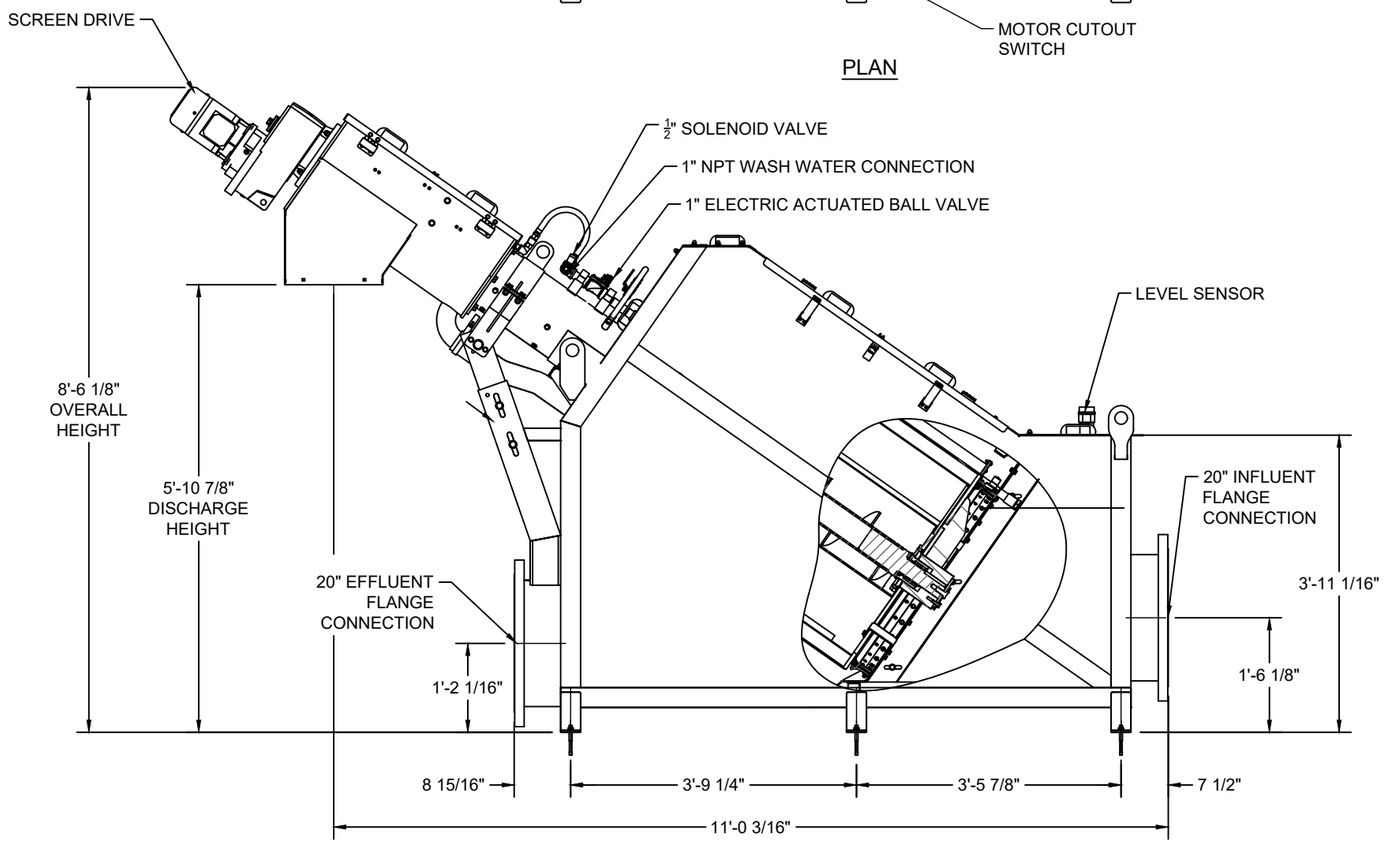
APPLICATION:	MUNICIPAL WASTEWATER
PEAK DESIGN FLOW:	3.2 MGD
TANK LENGTH:	7.5 FEET
TANK WIDTH:	3.6 FEET
TANK HEIGHT:	6.6 FEET
SCREEN OPENING:	6 MM
OPENING TYPE:	PERFORATED
ANGLE OF INCLINATION:	35 DEGREES
INFLUENT FLANGE SIZE:	20 INCH
EFFLUENT FLANGE SIZE:	20 INCH
DISCHARGE HEIGHT:	5.9 FEET FROM MOUNTING FLOOR
WASH WATER FLOW & PRESSURE:	48 GPM AT 58 PSI
SCREENINGS CAPTURE RATIO VALUE (SCR):	66% INDEPENDENTLY TESTED AT UKWIR TESTING FACILITY



PLAN



REAR ELEVATION



SIDE ELEVATION

NOTES:

1. CONCRETE, GROUT, INTERCONNECTING PIPING NOT BY SAVECO
2. ALL INTERCONNECTING PIPING TO BE SELF SUPPORTING
3. DRAWING NOT FOR CONSTRUCTION

SAVECO®
Member of WAMGROUP®
Formerly Enviro-Care®

Project Information
PROJECT NAME: CARMEL WWTP

Third Angle Projection

Status: SALES DRAWING

Title: VSA1000 - T SAVI FLO-DRUM TANK MOUNTED ROTATING DRUM SCREEN

Designer	Checker	Date	Sheet
MB29	TC01	09-01-2022	1 OF 1

Scale	Drawing Number	Revision
½"=1'-0"	WEC222312-B	-

September 15, 2022

Greeley and Hansen
9020 Stony Point Parkway, Suite 275
Richmond, VA 23235
USA

Attention: Bernardo Vazquez Bravo

We are pleased to provide the following Salsnes Filter proposal for the **Carmel District WWT Reclamation Plant - Salsnes, California** project.

The Salsnes Filter system provides compact, flexible and cost-effective solids separation for primary wastewater, stormwater and industrial applications. Three critical processes – solids separation, primary sludge thickening and dewatering – are performed in one compact unit that can replace conventional primary treatment and does so in a fraction of the footprint – saving costs and valuable land space.

Our patented Air Knife automatic cleaning system uses air to clean the filter mesh, which has many benefits compared to scrapers, brushes or water-based cleaning systems. Air is gentler on both the mesh (elongating its life) and on particles (so they don't just break into smaller pieces). Air cleaning also keeps sludge drier for more effective and less costly dewatering.

The Salsnes Filter system defines eco-efficient. This cost-effective, high-performing, chemical-free solids separation technology has demonstrated itself in hundreds of installations around the world – including some of the most challenging industrial process applications.

In 2012, Salsnes Filter became a Trojan Technologies company. The Salsnes Filter technology aligns closely with Trojan's municipal business and corporate goal of providing sustainable technologies and smaller footprint solutions – to ensure greater water confidence and environmental stewardship for industries and municipalities around the world.

Please do not hesitate to call us if you have any questions regarding this proposal. Thank you for the opportunity to quote the Salsnes Filter system and we look forward to working with you on this project.

Rep Company: Coombs Hopkins
Contact: Brad Leidecker

Ph: 925 876 0646

This proposal has been respectfully submitted by,

Andrew J. Daley
Business Development AOP & Salsnes NA
Salsnes / Trojan Technologies

DESIGN CRITERIA

Peak Daily Flow:	3 MGD(US)
Average Flow:	1.50 MGD(US)
Average TSS, influent:	600 mg/l
TSS removal:	Typically 35%-45% (average). Dependent on type and size of particles, can be higher depending on process water makeup.
Average BOD, influent:	300 mg/l
BOD removal:	Typically 10 - 20% (average). Dependent on soluble to insoluble BOD ratio.
Maximum TSS, influent:	The system can handle almost limitless TSS concentrations, but higher TSS levels lower the hydraulic capacity of a given design.
Influent characteristics:	Domestic municipal wastewater
Pre-treatment (by others):	Bar screen. De-gritting & de-greasing recommended, but not always necessary. Please ask for further clarification if these are not present.
Additional Information:	TSS and BOD removal can vary depending on mesh size selection.

DESIGN SUMMARY

Based on the above design criteria and a review of your application, we are recommending the following Salsnes Filter system configuration:

SALSNES FILTER SYSTEM	
Quantity of Filter Unit(s)	**3 Total, 2+1 as design option**
Model Number	**SF6000**
Air Blower(s)	**3 – Included**
Integrated Dewatering	**Included (can be replaced with spool for wetter material if desired)**
Additional Information	**Medium Pressure (inframe) Filtermesh Cleaning System**
PROCESS EQUIPMENT DESCRIPTIONS	
Filtration: SF6000 ***High levels of TSS and BOD removal are accomplished, without chemicals, and in a very compact footprint***	• Each Unit contains a filter mesh mounted on a removable cartridge • Patented cogwheel design holds mesh in place, enables rotation and maintains high mesh strength • Wastewater fills inlet well to a set level at which time belt begins to rotate • Filtration process occurs through the filter mat (graded layer of particles) that accumulates on the mesh. • The slower the belt speed, the thicker the filter mat becomes and higher degrees of TSS and BOD removal are accomplished
Integrated Sludge Thickening and Dewatering ***A smaller volume of drier solids is produced, reducing disposal costs***	• As the belt with filter mat rotates, the thickening process occurs, producing sludge with ~ 3-8% dry matter typical • Sludge is collected and conveyed in a screw where it is pressed and dewatered to achieve 20-30% dry matter typical. As option the dewatering press can be replaced with a spool if dry content isn't needed.

Air Knife – Filter Mesh Particle Removal System ***Reduces maintenance by keeping filter mesh clean and sludge drier***	• A patented cleaning system literally blows sludge off the filter mesh into the sludge collector for dewatering • Using compressed air to clean mesh is proven more effective (longer mesh life and drier sludge) than water-based or mechanical brush/scraping methods
Control Power Panel ***Automated operation – ideal for remote/small facilities***	• A common control system is provided with Modbus for central communication • A level sensor in each Unit senses influent water level and controls the filter mesh (belt) speed accordingly • The Air Knife filter mesh cleaning and sludge dewatering processes operate while the belt is rotating – ensuring optimum cleaning and dewatering under changing influent conditions • PLC and HMI to be Allen Bradley Compact Logix L16 and Beijer 7"
UTILITY REQUIREMENTS	
Power Supply	15.7 kVA, 11.8 kW 480 Volts 60 Hz 3 phase + ground
Water Supply	Cold Water is used for periodic flushing of filtered water basin Water Requirements: Max 317 Gal, Normal 95 Gal (31Gal / filter) Hot Water Requirements: Max 221 Gal, Normal 174 Gal (58Gal / filter) 4-6 bar pressure (58-88 psi) Hot Water Minimum - 70°C (160°F) Recommended - 80°C (176°F)

COMMERCIAL INFORMATION

Total Capital Cost: $ 954 713 (USD) or $318 237 per filter
Pricing includes the following: • Equipment as described • Start up and Operator training • Standard warranty terms (12 months from installation or 18 months from delivery) • Freight from factory to jobsite (in North America) • Inlet/outlet ports • Outlet port for odor control • 812um filter mesh has been selected based on TSS and removal objectives. • Dewatering box can we replaced with spool if wetter material is required • Type 4 painted panel with A/C
Pricing excludes the following: • Odor control equipment, if required • Any applicable taxes, duties • Civil works (e.g. concrete pads, inlet/outlet piping) • Equipment Installation • Crane for equipment unloading or maintenance • Hot/cold water and air supply, electrical cabling and disconnects required per local code

This price excludes any taxes that may be applicable and is valid for 30 days from the date of this letter.
As per Trojans Standard Terms and Conditons
Payment Terms- 10% Award of PO, 40% up to submittal, 45% up to delivery, 5% owner approval

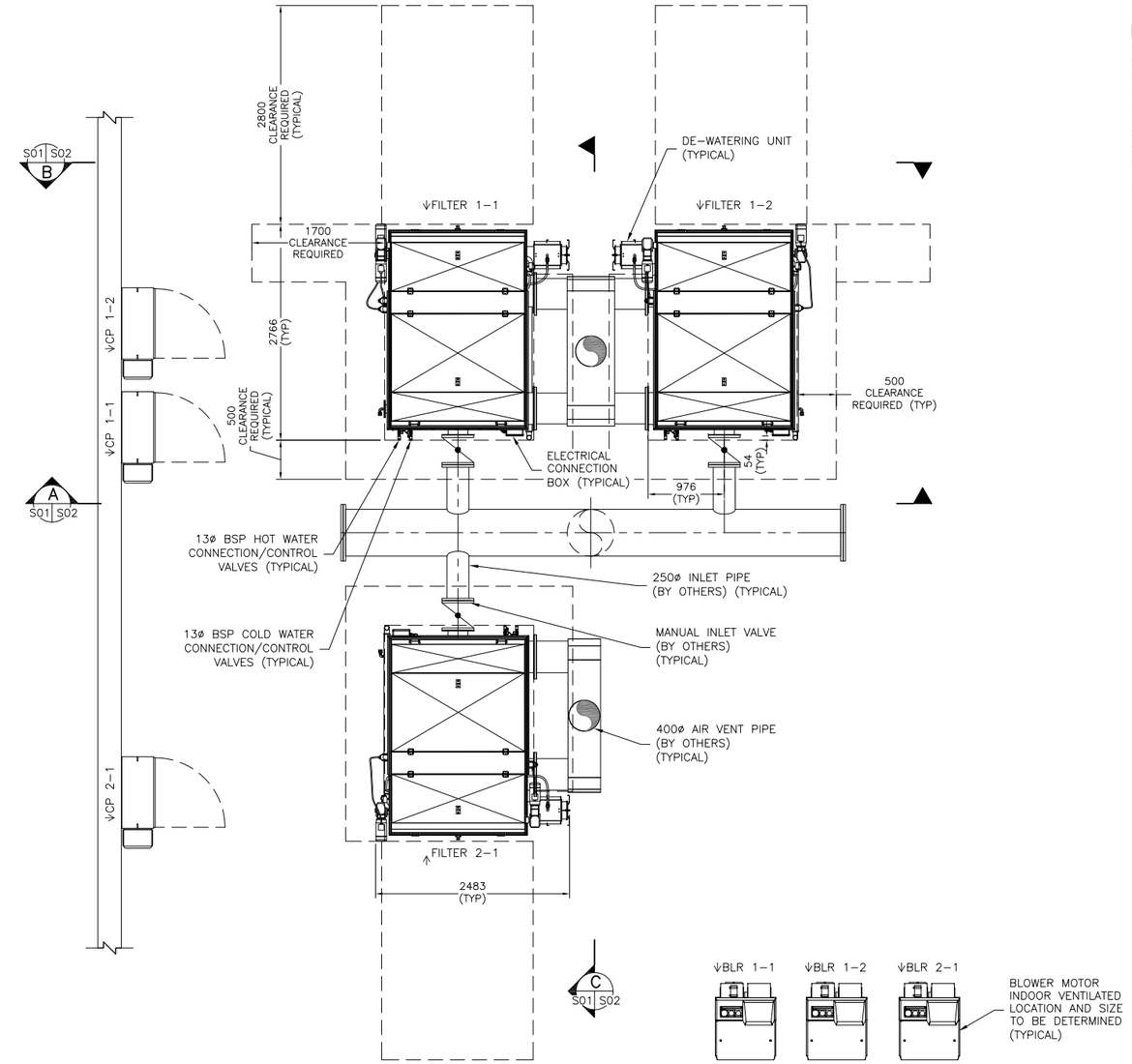
SAMPLE INSTALLATIONS

Riviera Utilities WWTP, AL, USA
3 MGD (131 l/s)
Primary wastewater treatment
A Salsnes SF6000 Filter system replaced a microscreen system to remove three times more solids (increasing plant capacity from 2 to 3 MGD) and reduce the load entering their oxidation ditch. They have also saved 33-50% in electrical costs amounting to $60,000/ year.

Agua Prieta WWTP, Guadalajara, Mexico
350 MGD (1325 MLD)
Primary wastewater treatment
The Agua Prieta WWTP in Guadalajara, Mexico will treat 350 MGD (1325 MLD) of wastewater with SFK600s and using only10,550 ft^2 (980 m^2) of land. Primary settling tanks would have needed 215,000 ft^2 (20,000 m^2) of land.

Enderby WWTP, BC, Canada
365 gpm (23 l/s)
Primary wastewater treatment
A Salsnes SF4000 Filter system installed upstream of their oxidation ditch solved a sludge overload problem. Total sludge volume and disposal costs were significantly reduced.

Tomasjord / Tromso WWTP, Norway
10.5 MGD (40 MLD)
Primary wastewater treatment
The Tromso WWTP would have needed 21,530 f^2 (2000 m^2) of land to install clarifiers. Instead, they used only 1,600 f^2 (150 m^2) of land and installed Salsnes Filter systems – model SF6000.



PLAN VIEW

SCALE:AS SHOWN

NOTES:

: ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE NOTED.
: FILTER ENCLOSURE MATERIAL TO BE 316L STAINLESS STEEL.
: ANCHOR BOLTS ARE NOT SUPPLIED BY SALSNES FILTER.
: SYSTEM CONDUIT, WIRING, DISTRIBUTION PANELS & INTERCONNECTIONS BY OTHERS.
: FILTER UNIT TO BE POSITIONED ON A FOUNDATION (CONCRETE, STEEL OR ALUMINUM) WITH A MINIMUM LOAD CAPACITY OF 2000 kgs.
: FOUNDATION FLOOR MUST BE FIRM AND LEVEL.
: MAXIMUM CABLE DISTANCE TO CONTROL PANEL (CP) IS 10m.
: ELECTRICAL REQUIREMENTS SHOWN ARE TO SUPPLY SALSNES FILTER EQUIPMENT ONLY. ELECTRICAL INRUSH FACTOR TO BE ADDED AS PER LOCAL CODE.
: CONTRACTOR TO REVIEW ALL SALSNES FILTER INSTALLATION INSTRUCTIONS PRIOR TO EQUIPMENT INSTALLATION.

PRELIMINARY, NOT FOR CONSTRUCTION

VERIFY DIMENSIONS BEFORE COMMENCING CIVIL OR DESIGN WORK

DESIGN CRITERIA		
	PEAK FLOW	39000 m3/DAY
	SUSPENDED SOLIDS	300 mg/L
	SOLIDS REMOVAL	50%

DESCRIPTION: LAYOUT, SALSNES FILTER SF6000

DRAWN BY : MVW	DATE : 13MY23
CHECKED BY : SAH	DATE : 13MY31
APPROVED BY : LSL	DATE : 13MY31
SCALE (11x17) : 1:75	LOG NUMBER : N/A

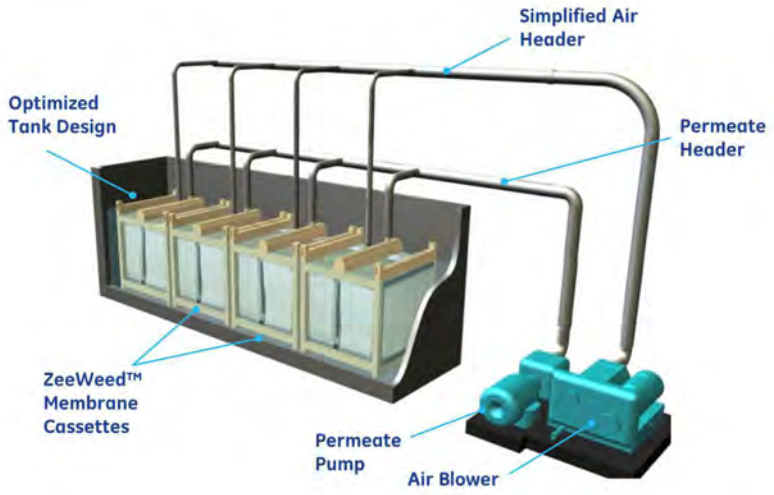
QUOTE NO.	
204191	
PROJECT NO.	
N/A	
DWG NO.	REV.
S01	A

Qualifier Proposal: ZeeWeed® Membrane Bioreactor System

Project Name: Unnamed
Location: California
Submitted To: Greeley-Hansen
Date: August 18, 2022
SUEZ Contact: Chris Allen, P.E. – Regional Manager

The ZeeWeed® Membrane Bioreactor Process

The ZeeWeed® Membrane Bioreactor (MBR) process is technology that consists of a suspended growth biological reactor integrated with an ultrafiltration membrane system, using the ZeeWeed® hollow fiber membrane. Essentially, the ultrafiltration system replaces the solids separation function of secondary clarifiers and sand filters in a conventional activated sludge system.



ZeeWeed® ultrafiltration membranes are immersed in an aeration tank, in direct contact with mixed liquor. Through the use of a permeate pump, a vacuum is applied to a header connected to the membranes. The vacuum draws the treated water through the hollow fiber ultrafiltration membranes. Permeate is then directed to disinfection or discharge facilities. Intermittent airflow is introduced to the bottom of the membrane module, producing turbulence that scours the external surface of the hollow fibers. This scouring action transfers rejected solids away from the membrane surface.

Influent Flow Data

Hydraulic Condition	Flow	Units
Average dry weather flow (ADWF)	1.2	MGD
Average wet weather flow (AWWF)	3.5	MGD
Maximum month flow (MMF)	2.4	MGD
Peak day flow (PDF)	4.9	MGD
Peak hour flow (PHF)	8.0	MGD
Maximum flow with one train offline for maintenance or cleaning (≤ 30 days)	3.4	MGD

Influent Quality

Design Parameter	Value	Units
Membrane pre-screen	≤2	mm

Raw sewage FOG	<150	mg/L
MLSS minimum temperature	20	ºC
Soluble BOD_5	≤5	mg/L
Colloidal TOC (cTOC)	≤1	mg/L
NH_3-N	≤1	mg/L
MLSS in bioreactor	8,000	mg/L
Coagulant addition	N/A	

Effluent Quality

Design Parameter	Value	Units
TSS	≤1	mg/L
NH_3-N	≤ 1	mg/L
Turbidity	≤0.2 (95% of time) ≤0.5 (100% of time)	mg/L

Preliminary Membrane Design

Parameter	Value
Membrane type	ZeeWeed 500
Membrane surface area	430sf
Total number of membrane trains	3
Total number of cassette spaces per train	5
Type of cassette	52-module
Number of cassettes installed per train	4 (3x52 + 1x48 + 1x0)
Modules installed per train	204
Module spaces available per train	260
Total membrane surface area installed	263,160sf
Percentage spare space	21.5%
Membrane tank internal dimensions (L x W x H) (ft)[1]	46.3 x 9 x 13

note 1: Tank dimensions and volumes are preliminary only and may change slightly once final detail design commences.

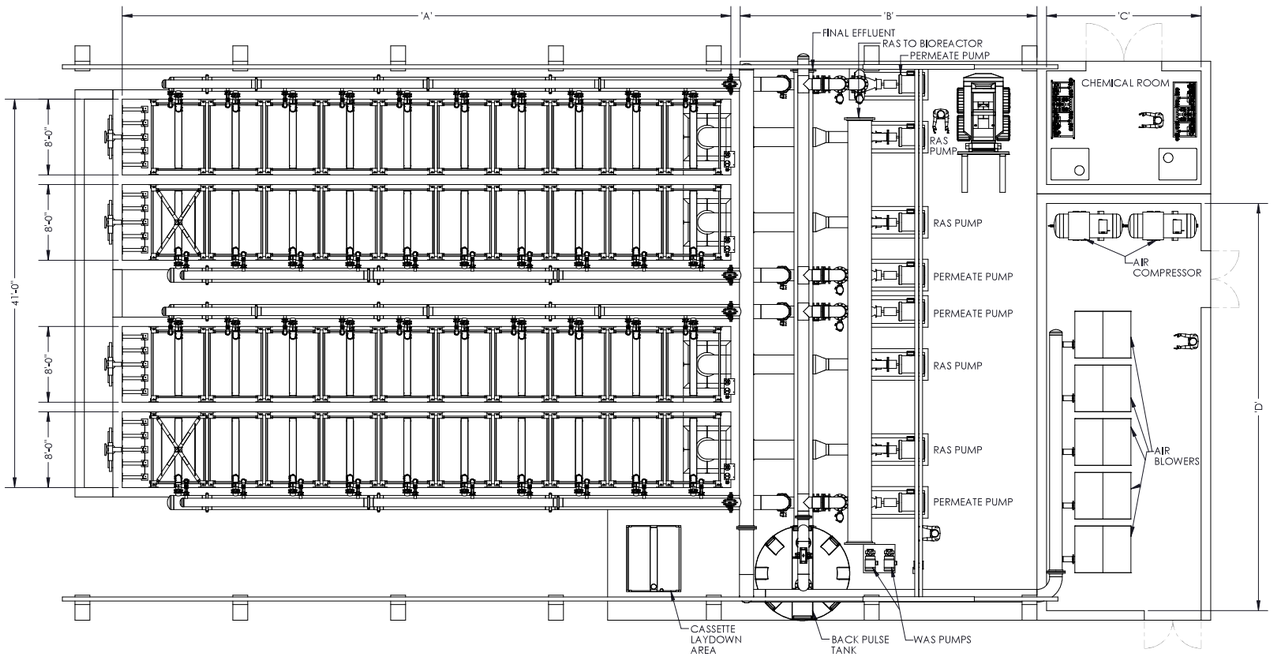
Scope of Supply by SUEZ

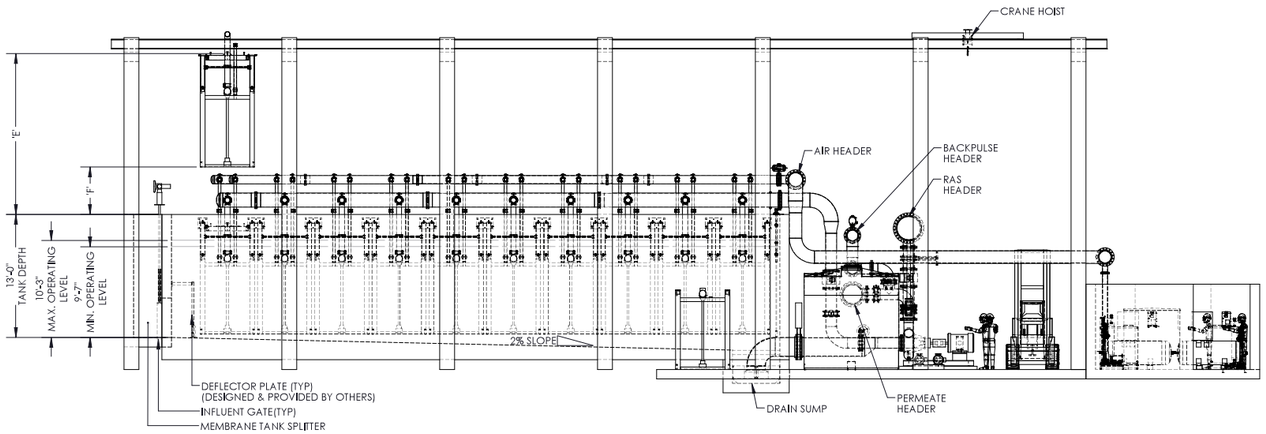
- ZeeWeed® Permeate pumps
- ZeeWeed® Cassettes and Modules
- Membrane Air Scour Blowers
- Electrical and Control Equipment
- Air Compressor and Dryer System
- Membrane Cleaning Systems
- Permeate and aeration headers within the footprint of the membrane basins
- Operation & Maintenance Manuals
- Installation, Commissioning and Start-up Assistance
- Operator Training
- InSight Pro – Process Consulting Service (one year)
- Membrane Warranty – 2 Yrs Full + 8 Yrs Prorated

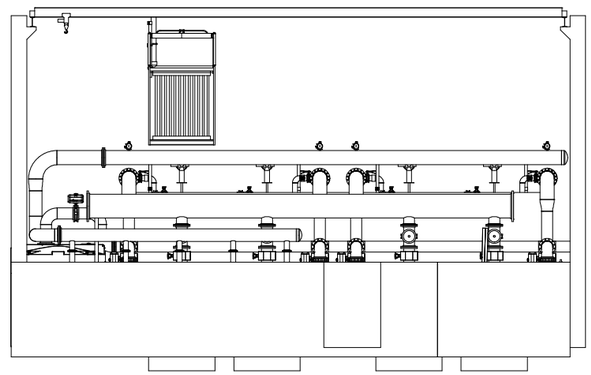
Pricing

All pricing is based on the design operating conditions and influent characteristics detailed in herein. The pricing herein is for budgetary purposes only and does not constitute an offer of sale. No sales, consumer use or other similar taxes or duties are included in the pricing below.

price: all equipment & service	
ZeeWeed membrane bioreactor system	$ 2,600,000 USD (+/- 15%)







NOTES:
1. FOR SCOPE OF SUEZ SUPPLIED EQUIPMENT AND TECHNICAL DATA REFER TO THE P&ID DRAWINGS.
2. SIZE AND LOCATION OF LISTED ROOMS ARE PRESENTED FOR REFERENCE ONLY. OVERALL SYSTEM ENGINEER TO DETERMINE SIZE AND LOCATION OF AMENITIES.
3. OVERALL SYSTEM ENGINEER TO SIZE AND DESIGN GRAVITY MEMBRANE TANK SPLITTER, EMERGENCY OVERFLOW, WALKWAYS/HANDRAILS ON TOP OF THE WALLS (IF REQWUIRED); THESE ARE NOT SHOWN IN THIS DRAWING FOR CLARITY.
4. MEMBRANE TANK BOTTOM TO BE SLOPED MINIMUM 2% TOWARD DRAIN SUMP.
5. OVERALL SYSTEM ENGINEER TO CONSIDER PROVISION FOR FOAM/SLUDGE SURFACE WASTING AT THE DETAILED ENGINEERING STAGE.
6. MEMBRANE TANK COATING TO BE SUITABLE FOR APPROPRIATE CHEMICAL CONTACT; PAINT SPECS TO BE PROVIDED UPON REQUEST.
7. DESIGN FOR SUPPORTS FOR PERMEATE AND AIR HEADERS, GRATING OR THE COVER PLATES IS BY OTHERS. OVERALL SYSTEM ENGINEER TO DETERMINE DESIGN, NUMBER AND LOCATION OF SUPPORTS.
8. BIOLOGICAL PROCESS AERATION BLOWERS ARE NOT INCLUDED IN THE BLOWER ROOM. THEY CAN BE FOUND IN THE BIOREACTOR LAYOUT DRAWING. BOTH GROUPS OF BLOWERS CAN BE PLACED IN THE SAME ROOM.
9. BLOWER MONORAIL IS ONLY REQUIRED FOR PLANTS WITH CENTRIFUGAL BLOWERS. FOR THE SYSTEMS WITH PD BLOWERS, ADEQUATE SPACE HAS BEEN INCLUDED IN DESIGN TO ALLOW REMOVAL WITH FORKLIFT.

MAJOR TANK & BUILDING DIMENSIONS

CASSETTES 'N' PER TRAIN	'A'	'B'	'C'	'D'	'E'	'F'
2	15'-0"	15'-6"	12'-0"	32'-0"	17'-0"	5'-0"
3	21'-8"	15'-6"	13'-0"	32'-0"	17'-0"	5'-0"
4	28'-4"	18'-10"	15'-0"	32'-0"	17'-0"	5'-0"
5	35'-0"	18'-10"	15'-0"	32'-0"	17'-0"	5'-0"
6	41'-8"	22'-6"	18'-0"	35'-0"	17'-0"	5'-0"
7	48'-4"	31'-4"	18'-0"	35'-0"	17'-0"	5'-0"
8	55'-0"	31'-4"	18'-0"	35'-0"	17'-0"	5'-0"
9	61'-8"	31'-4"	18'-6"	35'-0"	17'-0"	5'-0"
10	68'-4"	31'-4"	21'-0"	39'-0"	17'-0"	5'-0"
11	75'-0"	31'-4"	21'-0"	39'-0"	17'-0"	5'-0"
12	81'-8"	31'-4"	21'-0"	39'-0"	17'-0"	5'-0"

REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE

TOLERANCES UNLESS NOTED
DECIMALS .X .XX .XXX
ANGLES °
FRAC

CUSTOMER INFORMATION: LAYOUT PREPARATION

LAYOUT: BEAMLESS-8FT-FLG-PF-ZW500D-4 TRAINS-10 CASSETTE

DRAWING NUMBER: 2830000-AG-01
REVISION: A
REF.:
DOC. OWNER:
PROJECT NO.: ITO-NUMBER
PART/MATERIAL NO.:
SCALE: 1:96
SIZE: D
SHEET: 1 OF 2

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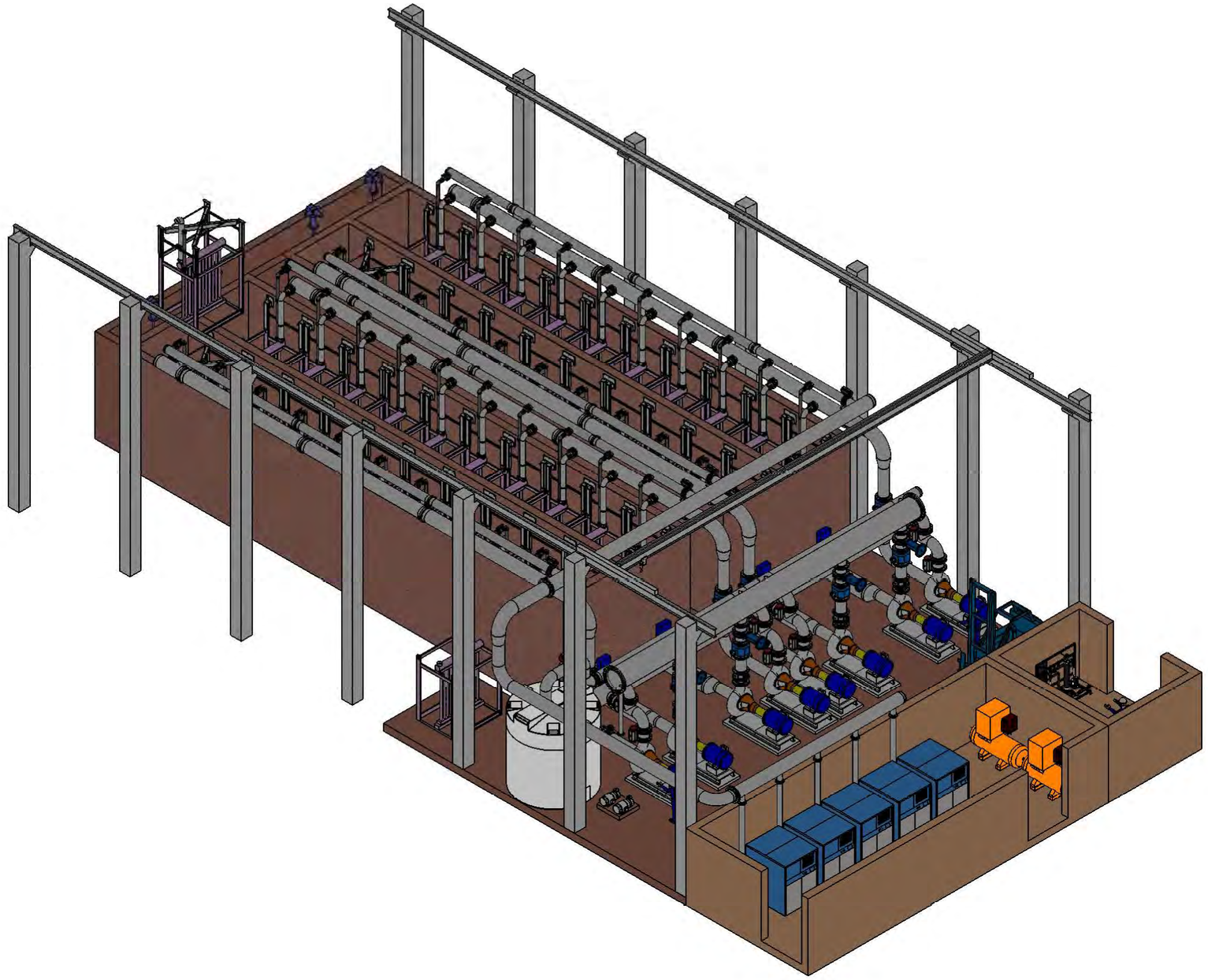

REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE

TOLERANCES UNLESS NOTED
DECIMALS .X .XX .XXX
ANGLES °
FRAC

suez

CUSTOMER INFORMATION
LAYOUT PREPARATION

LAYOUT
BEAMLESS-8FT-FLG-PF-ZW500D-4 TRAINS-10 CASSETTE

DRAWING NUMBER: 2830000-AG-01
REVISION: A
REF.:
DOC. OWNER:
PROJECT NO.: ITO-NUMBER
PART/MATERIAL NO.:
SCALE: 1:76
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SHEET: 2 OF 2

FILE LOCATION: C:\SWP\DMS\MAHITO\ITO=NUMBER - LAYOUT PREPARATION\2. Mechanical Drawings

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WIGEN Since 1965 WATER TECHNOLOGIES

Water.
Process.
Solutions.

3 MGD REVERSE OSMOSIS SYSTEM
BUDGET PROPOSAL
PREPARED FOR: GREELEY HANSEN

Submitted by:
Michael Bourke
VP Business Development
(303) 350-3086
michael.bourke@wigen.com

Represented by:
Tarn Victor
JBI Water
(949) 859-2333
tarnvictor@jbiwater.com

Issue Date:
August 26, 2022

Budget Proposal No:
082622-200A

TABLE OF CONTENTS

1.0 SCOPE OF SUPPLY

REVERSE OSMOSIS SYSTEM

Table 1: RO System Design Basis

Design Basis – Reverse Osmosis System	
Parameter	**Value**
Number of Trains	2
Feed Flow (each train)	1.765 MGD
Permeate Flow (each train)	1.5 MGD
Concentrate Flow (each train)	0.265 MGD
System Array	26:13:6, 7-long
Membrane Element Diameter	8-inch
Membrane Element Area	400 square feet
Design Recovery	85%
Average System Flux	11.9 gfd

RO EQUIPMENT SCOPE OF SUPPLY

Membrane Elements	
Membrane Quantity	315 per RO Skid (630 total)
Manufacturer/Model	Hydranautics ESPA2-LD
Type	Polyamide, Thin Film Composite
Membrane Element Warranty	A Five (5) Year Limited Pro-Rated Warranty will be provided.
Membrane Pressure Vessels	
Vessel Quantity	45 per RO Skid (90 total)
Manufacturer/Model	Protec Model PRO-8-300-MSP-7, ASME Code, 7 Long 8”
Vessel Construction	FRP, 300 psi

1.0 SCOPE OF SUPPLY

Valves	
RO Inlet from Pressure Pumps	One (1) per RO skid, 10" Bray Series 41 w/ Modulating Electric Actuator
RO Flush Inlet	One (1) per RO skid, 6" Bray Series 41 w/ Modulating Electric Acutator
CIP Inlet	One (1) per RO skid, 10" Bray Series 41 w/ Geared Handwheel
1st Stage Feed Isolation	One (1) per RO skid, 10" Bray Series 41 w/ Geared Handwheel
1st Stage Cleaning Feed/Return Isolation	One (1) per RO skid, 8" Bray Series 43 w/ Geared Handwheel
1st Stage Concentrate Isolation	One (1) per RO skid, 6" Bray Series 41 w/ Geared Handwheel
2nd Stage Feed Isolation	One (1) per RO skid, 6" Bray Series 41 w/ Geared Handwheel
2nd Stage Cleaning Feed/Return Isolation	One (1) per RO skid, 6" Bray Series 41 w/ Geared Handwheel
2nd Stage Concentrate Isolation	One (1) per RO skid, 4" Bray Series 41 w/ Lever Operator
3rd Stage Feed Isolation	One (1) per RO skid, 4" Bray Series 41 w/Lever Operator
3rd Stage Cleaning Feed/Return Isolation	One (1) per RO skid, 4" Bray Series 41 w/Lever Operator
1st Stage Permeate Backpressure	One (1) per RO skid, 8" V-Port Ball Valve w/ Modulating Electric Actuator
Combined Permeate	One (1) 10" Bray Series 41 w/ Geared Handwheel
Combined Concentrate	One (1) 4" Bray Bray Series 41 w/ Lever Operator
Concentrate Control Valve	One (1) 4" V-Port Ball Valve with Modulating Electric Actuator
Concentrate Flush Valve	One (1) per RO skid, 4" Bray Series 41 w/ Electric Acutator
Combined Concentrate Check Valve	Two (2) per RO skid, 4" 316SS
Permeate Check Valves	One (1) per RO skid, 10" 316SS
Sampling Valves/Trough	Feed, Housing Permeate, 1st, 2nd, & 3rd stage Permeate, Total Permeate – ¼" PVC Labcock Valves w/1/4" tubing Interstage 1 & 2 and Concentrate – ¼" SS Plug valves w/tubing SS Sample Trough as Specified
Pressure Relief Valve	Two (2) per RO Train, 8"
Pressure Vessel Permeate	One (1) per pressure vessel – 1/4" PVC ball valves

1.0 SCOPE OF SUPPLY

RO System Instruments

Combined RO System Feed Free Chlorine Analyzer	
Quantity	(1) Per RO System – Combined Feed
Manufacturer/Model	Rosemount 499ACL
Combined RO System Feed TOC Analyzer	
Quantity	(1) Per RO System – Combined Feed
Manufacturer/Model	GE Sievers M5310C
Combined Feed pH Meter	
Quantity	(2) Per RO System – Combined Feed
Manufacturer/Model	Rosemount 389VP w/ 1056 Transmitter
Combined RO System Feed Conductivity/Temperature Meter	
Quantity	(2) Per RO System – Pre / Post Chemical Dosing
Manufacturer/Model	Rosemount 400VP; (1) 0.50 Cell, (1) 0.05 Cell
Combined Feed ORP Meter	
Quantity	(1) Per RO System – Combined Feed
Manufacturer/Model	Rosemount 389VP w/ 1056 Transmitter
Permeate Conductivity Meters	
Quantity	(4) Per RO Train – 1st, 2nd, 3rd, Final Permeate
Manufacturer/Model	Rosemount 400VP; 0.05 Cell
Concentrate Conductivity Meter	
Quantity	(1) Per RO Train – Final Concentrate
Manufacturer/Model	Rosemount 400VP; 0.50 Cell
Second Stage and Concentrate pH Meter	
Quantity	(2) Per RO Train – Stage 2 and Final Concentrate
Manufacturer/Model	Rosemount 389VP w/ 1056 Transmitter
First Stage Permeate Flow Meter	
Quantity	(1) Per RO Train
Manufacturer/Model	8” Krohne, Waterflux
Second Stage Permeate Flow Meter	
Quantity	(1) Per RO Train
Manufacturer/Model	4” Krohne, Waterflux
Third Stage Permeate Flow Meter	
Quantity	(1) Per RO Train
Manufacturer/Model	3” Krohne, Waterflux
Final Concentrate Flow Meter	
Quantity	(1) Per RO Train
Manufacturer/Model	4” Krohne, Waterflux

1.0 SCOPE OF SUPPLY

RO System Instruments Cont'd

RO System Combined Concentrate Flow Meter	
Quantity	(1) Per RO System
Manufacturer/Model	8" Krohne, Waterflux
Pressure Transmitters	
Quantity	(6) Per RO Train, (1) Combined RO System Concentrate
Manufacturer/Model	Rosemount 2051
Pressure Gauges	
Quantity	(1) Per RO Train
Manufacturer/Model	Ashcroft 1279 Duragauge
Pressure Switches	
Quantity	(2) Per RO Train, (2) Combined RO System Concentrate
Manufacturer/Model	Ashcroft B-Series NEMA 4
Combined RO System pH Meter	
Quantity	(2) Per RO System – Combined Concentrate, Combined Permeate
Manufacturer/Model	Rosemount 389VP w/ 1056 Transmitter
Combined RO System Conductivity/Temperature Meter	
Quantity	(2) Per RO System – Combined Concentrate, Combined Permeate
Manufacturer/Model	Rosemount 400VP; (1) 0.50 Cell, (1) 0.05 Cell
Combined RO System Permeate Free Chlorine Analyzer	
Quantity	(1) Per RO System – Combined Permeate
Manufacturer/Model	Rosemount 499ACL
Combined RO System Permeate TOC Analyzer	
Quantity	(1) Per RO System – Combined Permeate
Manufacturer/Model	GE Sievers M5310C

Controls/Electrical	
Master PLC Panel	Allen Bradley CompactLogix PLC and 15" PVP7 HMI in Floor Mounted NEMA 4X Stainless Steel Enclosure.
Remote I/O Panels	(3) Allen-Bradley CompactLogix Remote I/O Panels (one per RO skid and one for CIP system)
Enclosure	Hoffman Concept, Stainless Steel, NEMA-4X.
Conduit	Liquid-Tight Flexible Conduit and PVC Rigid Conduit
Location	Remote I/O Panels installed on each RO skid, Skid Panels installed and wired to components on skids.

1.0 SCOPE OF SUPPLY

Piping Materials	
RO Skid Inlet	Schedule 10S 316 Stainless Steel, Passivated
RO Skid High Pressure	Schedule 10S 316 Stainless Steel, Passivated
RO Skid Permeate	Schedule 10S 316 Stainless Steel, Passivated
RO Skid CIP	Schedule 80 CPVC
RO Skid Concentrate	10S 316 Stainless Steel from header to skid boundary, Passivated
NOTE	*Piping, valves, and fittings to and from skids by Others*
RO Skids	
Skid Quantity	(3)
Construction	Powder coated carbon steel per specifications.
Dimensions (W x L x H) – approx. each skid	120”x276”x120” (Approx. Overall Dimensions). Each RO train consist of 2 skids with Stage 1 housings on the one skid and Stage 2 and 3 housings on another skid. These skids are connected onsite by the contractor.

1.0 SCOPE OF SUPPLY

CIP Equipment (All loose Components)

CIP Pumps	
Quantity	(2) One duty and one Shelf Spare
Manufacturer/Model	Goulds,
Type/ Performance	Centrifugal, 1,100 GPM @ 40 PSI
Materials of Construction	316 SS housing and impeller
Motor	40 HP, 1800 RPM, 460 V, premium efficiency, TEFC
VFD/Starter	Provided by Others
CIP Tank Heater	
Quantity	(1) *to be installed by others*
Manufacturer/Model	Chromalox
Size/Type	100 KW, insertion, 8.0" flanged connection, with local control panel, wired to PLC by others.
CIP Tank Mixer	
Quantity	(1) One duty
Manufacturer/Model	Lightnin
Type/ Performance	Mechanical Mixer
Materials of Construction	316 SS wetted parts
Motor	2 HP, 1800 RPM, 460 V
Starter	Provided by Others
CIP Cartridge Filter	
Housing Quantity	(1)
Manufacturer	Parker, 6-MP-86H-4-10-FK2
Housing Construction	316L Stainless Steel, Rated for Minimum 100 psi Working Pressure, ASME Stamp
Cartridge Quantity	(86) 2.5" Dia x 40" Length
Cartridge Construction	Single Open End, Spun Polypropylene, 5 Micron
Differential Pressure Indicator	Ashcroft 1128 Differential Pressure Gauge
Controls	
Remote I/O Panel	(1) Allen-Bradley CompactLogix Remote I/O
CIP/Flush Tank	
Quantity	(1)
Volume	3,900 gallons
Materials	FRP

1.0 SCOPE OF SUPPLY

RO System Instrument Panels

Instrument Panels	
RO Pretreatment Sample Instrument Panels	(1) Per Specifications
Total Permeate and Concentrate Instrument/Sample Panel	(1) Per Specifications
RO Primary Skid Instrument and Sample Panel	(2) Per Specifications

Flush Pumps

Flush Pumps (Loose)	
Quantity	(2)
Manufacturer/Model	Goulds,
VFDs/Starters	By Others

Provided by Others

- Static Mixers
- Feed Pumps.
- All VFDs and Starters.
- Air supply system for pneumatic valves.
- Flush Tank and all related equipment for the flushing system.
- Installation of Membranes (under supervision of Wigen Technician).
- Unloading and storage of equipment.
- All items not described in this scope of supply.

1.0 SCOPE OF SUPPLY

Start-up Services

Service	No. Trips	No. Days Onsite
Pre-Startup Inspection	2	4
48-hour Performance Testing	1	2
7-day Performance Testing	1	7
Training	1-2	4
Assistance with first RO CIP and Refresher Training around 6-months after start-up.	1	2

The start-up and training services listed above have been included in the equipment price in this proposal. If additional services are required than those listed above, the service rates are outlined below.

In addition to the start-up and training services, WWT engineers shall also provide data analysis and additional assistance and advice for process performance optimization. Telephone support is available 24/7 via toll free number as outlined below.

2.0 BUDGET PRICING

Budget Pricing

The budget pricing for the equipment and services as outlined in the scope of supply is as follows:

Item	Budget Price
2 x 1.5 MGD RO System and Ancillary Equipment, including Start-up Services and Shipping to California	$1,750,000.00

Budget Price is in US dollars Job Site CA not including any applicable taxes.

Customer understands that this proposal has been issued based upon the information provided by customer, and currently available to WWT at the time of issuing this proposal. Any changes or discrepancies in site conditions, including but not limited to system influent water characteristics, changes in environmental health and safety conditions, Customer financial standing, Customer requirements, or any other relevant change, or discrepancy in, the factual basis upon which this proposal was created, may lead to changes in the offering, including but not limited to changes in pricing, warranties, quoted specifications, or terms and conditions.

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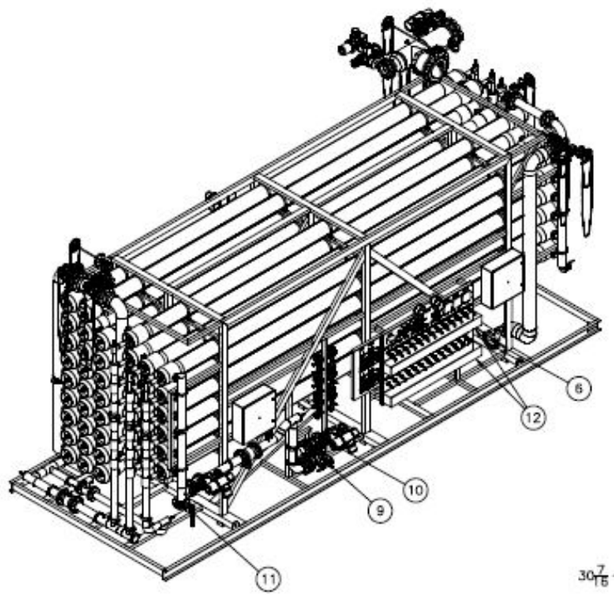
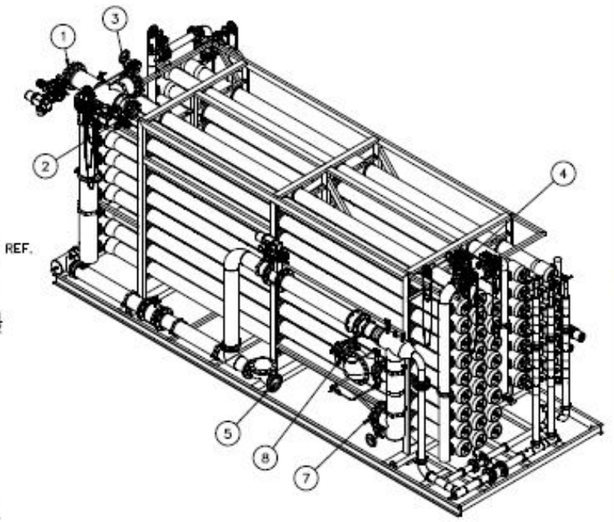
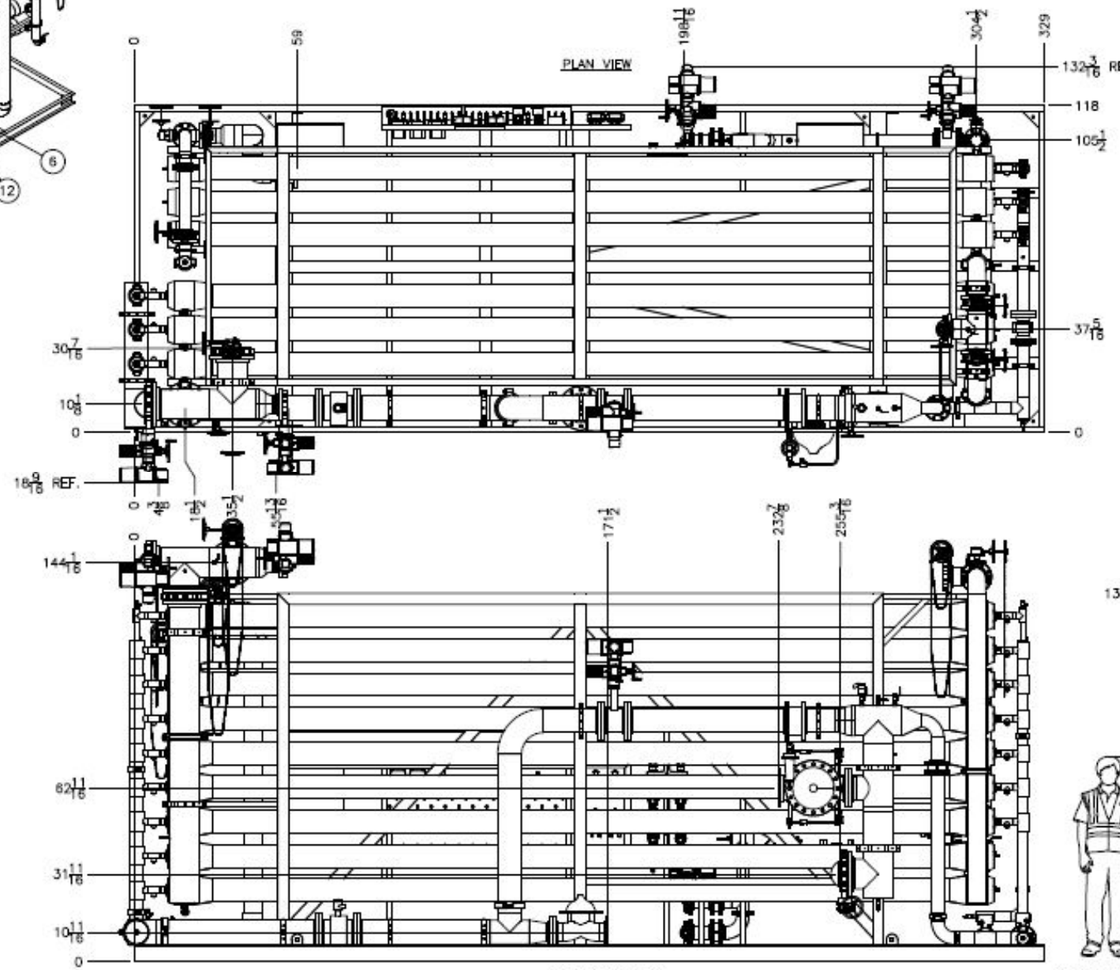
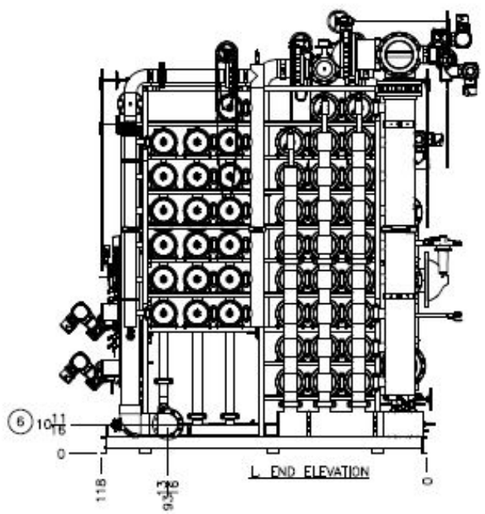
CONNECTION SCHEDULE							
#	DESCRIPTION	TYPE	SIZE	#	DESCRIPTION	TYPE	SIZE
1	PRIMARY RO FEED	150# FLG	10.00	6	STAGE 3 AND 2 CIP FEED/RETURN	150# FLG	6.00
2	FROM RO FLUSH PUMPS	150# FLG	6.00	7	RO PERMEATE TO POST TREATMENT	150# FLG	10.00
3	FROM RO CIP PUMPS	150# FLG	10.00	8	RO PERMEATE TO WASTE	150# FLG	8.00
4	STAGE 2/1 CIP FEED/RETURN	150# FLG	6.00	9	STAGE 3 RO CONCENTRATE TO WASTE	150# FLG	4.00
5	RO PERMEATE TO WASTE	150# FLG	6.00	10	RO FLUSH TO DISPOSAL	150# FLG	4.00
				11	STAGE 3 CIP RETURN	150# FLG	4.00
				12	WET PANEL DRAIN	FNPT	1.50





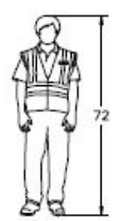
PLAN VIEW





L. END ELEVATION

FRONT ELEVATION



6' PERSON REF.

R. END ELEVATION

UNCONTROLLED IF PRINTED (UNLESS STAMPED OTHERWISE)	B	4/15/20	MMS	BCC	REVISED PER COMMENTS RECEIVED ON 4/9/20
NOTE 1, EST. SHIPPING WEIGHT: 19,200 LB	C	5/28/20	MMS	BCC	REVISED PER COMMENTS RECEIVED ON 5/7/20
NOTE 2, EST. OPERATING WEIGHT: 29,700 LB	D	7/30/20	MMS	BCC	RELEASED FOR PRODUCTION
NOTE 3, FRAME COLOR: SKY BLUE	E	3/2/21	MMS	BCC	AS-BUILT CHANGES
NOTE 4, PIPING ON TOP OF FRAME TO BE REMOVED FOR SHIPPING					
NOTE 5,					
NOTE 6,					
DRAWING NOTES	REV	DATE	DWN	APVD	DESCRIPTION

FRAC ± 1/2" DECIMALS .X ± .XX ± .XXX ± ANGLES ±

TOLERANCES UNLESS NOTED

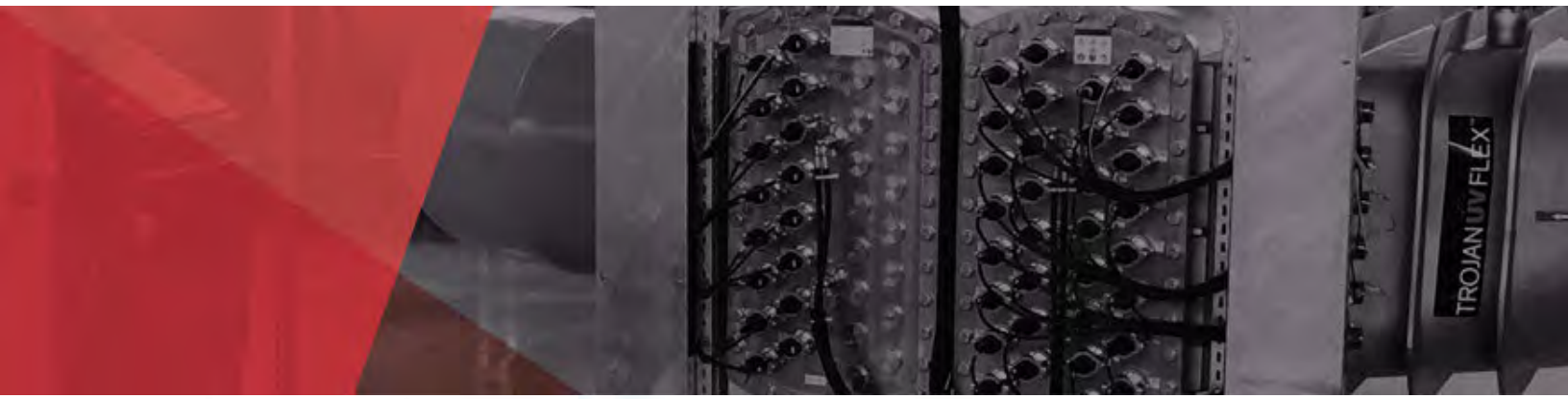
DRAWN BY	MMS
DATE	3/20/20
CHK'D BY	
DATE	
SIZE	D
SCALE	NONE
FILE TYPE	ACAD

TITLE: GENERAL ARRANGEMENT
RO SKID (TYP. 3)
PURE WATER OCEANSIDE AWPF

CLIENT NAME: CITY OF OCEANSIDE
ENGINEERING DEPARTMENT
OCEANSIDE, CA

PROJECT NUMBER	DRAWING NUMBER	SHEET	REV
C-3509-0120	C-3509-107-1	1 OF 1	E

WIGEN WATER TECHNOLOGIES
302 LAKE HAZELTINE DRIVE
CHASKA, MN 55318 USA
952-448-6884
WWW.WIGEN.COM



TROJAN UV FLEX™ AOP

PROPOSAL FOR CAWD GREEN FIELD SITE, CALIFORNIA
QUOTE: 236418

Andrew J. Daley, Trojan Technologies
3020 Gore Road
London, Ontario N5V 4T7
(519) 457-3400, adaley@trojantechnologies.com
www.trojanuv.com

August 30, 2022

We are pleased to submit this conceptual design for the CAWD Green Field Site H_2O_2 Project. This quotation is based on the TrojanUVFlex™ AOP 100 system with TrojanUV Solo Lamps™ to deliver highly efficient treatment with minimum maintenance.

TROJANUVFLEX: Equipped with TrojanUV Solo Lamp technology, the TrojanUVFlex provides state-of-the-art UV-oxidation with the most compact footprint **and** with the fewest number of high efficiency lamps. Solo Lamps combine the benefits of both low and medium pressure lamps. At 500 Watts each, they are the most powerful high-efficiency amalgam lamps in the industry.

The unique TrojanUVFlex reactor offers the highest treatment capacity in a reduced number of trains – reducing total space requirements for chambers and panels, saving overall construction costs. The low lamp count, low power consumption and long lamp life (15,000 hours guaranteed) offer both maintenance and operating cost benefits. The TrojanUVFlex is also the only large-scale high-efficiency LPHO UV system available **with automatic sleeve cleaning** (optional upon request) to remove sleeve fouling which can be a potential issue with ozone/carbon-treated effluent.

SERVICE PROGRAMS: Service is an integral part of Trojan's UV-oxidation solutions. We have a global network of certified Trojan service technicians that provide local service & support for routine and emergency responses. Our Technical Assistance Center provides 24/7 telephone and remote trouble-shooting support. Lastly, a number of our customers have pursued long-term service contracts with us – for complete peace of mind.

OUR UV-OXIDATION EXPERIENCE: Trojan's involvement in treating trace contaminants, such as began nearly 20 years ago. Since then, we've installed dozens of successful UV-oxidation systems around the world treating water from surface water sources for municipal drinking water distribution, as well as other applications treating various contaminants. For example, Trojan introduced high efficiency UV for the treatment of *N*-nitrosodimethylamine (NDMA) and 1,4-dioxane to convert treated wastewater to potable drinking water (an application known as indirect potable reuse). The largest such installation in the world, and a project that includes a Trojan UV-oxidation system, is the Orange County Water District's Groundwater Replenishment System in Southern California.

SYSTEM DESIGN AND OPERATING DESCRIPTION: Trojan relies on our advanced understanding of both the fundamental photochemistry of UV-oxidation and the hydraulic and optical performance of TrojanUV chambers, as well as extensive full-scale experience to evaluate the UV energy and oxidant concentration required to carry out the desired treatment using the UV-oxidation process. Our operational strategy calculates an instantaneous real-time chemical contaminant log reduction while simultaneously determining the operating configuration that results in a minimized operating cost. This cost optimization algorithm includes inputs such as $/kWh and $/Gal of oxidant and ensures that adjustments made to either lamp power or oxidant dose are done in an effort to minimize operational cost while meeting the desired contaminant(s) log reduction(s) at all times.

We look forward to working with you on this exciting project. We hope that our experience and expertise in UV-oxidation along with the TrojanUVFlex solution enable you to provide Water Confidence™ to your customers and their community.

DESIGN CRITERIA

CAWD Green Field Site H_2O_2, California

APPLICATION REQUIREMENTS	
Peak Design Flow:	4 MGD(US)
UV Transmittance:	96% (minimum)
Targeted Treatment #1:	1.4 LRV of N-Nitrosodimethylamine
Targeted Treatment #2:	0.5 LRV of Dioxane, 1,4-

DESIGN SUMMARY*

QUOTE: 236418

UV CHAMBER	
Model:	TrojanUVFlex™AOP 100
Number of chambers:	1
Operating Lamps per Chamber:	128
Oxidant Dose:	4.5 ppm Hydrogen Peroxide
Lamp Technology:	TrojanUV Solo Lamp (500 Watts amalgam)
Sleeve Cleaning:	None
Chamber Material:	Type 2205 Duplex Stainless Steel
Estimated Pressure Drop at Peak Flow:	8.5 inches H_2O
Maximum Power Draw (Duty Chamber):	76.30 kW
Chamber Pressure Rating:	60 psi (4 bar)
EQUIPMENT LAYOUT & DIMENSIONS	
Flange Type:	12" AWWA Class B
Clearance Requirements:	5 ft. 3 in. (1.6 m) of space required for lamp removal and equipment maintenance
Cable Length (CPP to Chamber):	Maximum of 69 ft (20 m); other length available upon request
CONTROL POWER PANEL	
Control Power Panel (CPP) Quantity:	1
CPP(s) Enclosure Material and Rating:	Painted Mild Steel (Type 4, IP66)
Total Double-Door CPP(s):	1 CPP(s) Per Chamber
Double-Door CPP Dimensions (W x H x D):	76” x 80” x 30” (1,921 mm x 2,029 mm x 739 mm)
Controller (located in CPP):	Trojan Controller
HMI (located in CPP):	Trojan OIT 7” Display

Network Connection:	AB Ethernet/IP
Hydraulic System Center (HSC) Quantity:	One (1) HSC Panel per Chamber
HSC Enclosure Material and Rating:	304 Stainless Steel (Type 4X, IP66)
HSC Dimensions (width x height x depth):	25” x 47” x 21” (683 mm x 1,172 mm x 513 mm)
ADDITIONAL EQUIPMENT	
Safety Equipment:	1 Operators Kit Included
UVT Monitor:	1 Trojan OptiView™ On-line UVT monitor Included
ELECTRICAL REQUIREMENTS	

1. One (1) 480V, 3 phase, 4 wire + GND, 60 Hz electrical supply for 1 double-door CPP per chamber with a 83 kVA power supply connected
2. The Optiview UVT Monitor requires one (1) 120V, 1 Phase, 2 Wire + GND, 250VA
3. Electrical disconnects are not included in this proposal. Refer to local electrical codes.

COMMERCIAL INFORMATION

CAPITAL COST ESTIMATE
Total Capital Cost: $ 798 000 USD

Optional Oxidant Dosing Equipment, Capital Cost Estimate: $ 250 000 USD	
Oxidant Storage Tank:	7,800-gallon double-contained HDPE storage tank
Dosing/Pump Equipment:	Skid-mounted duty and standby metering pumps, interconnecting piping.
Signals / Instrumentation Required But Not Included	
pH, Total Chlorine – we suggest Hach CL17 instrument	

Notes:
This price excludes any taxes that may be applicable and is valid for 30 days from the date of this letter.

WARRANTIES

Component	Warranted Life
Lamps	15,000 Hours
Ballasts	10 Years
Sleeves	10 Year
Sensors	5 Years

1. Trojan Technologies warrants all components of the system (excluding UV lamps) against faulty workmanship and materials for a period of 12 months from start-up or 18 months after shipment, whichever occurs first.

2. UV lamps purchased are warranted for 15,000 hours of operation or 3 years from shipment, whichever comes first. The warranty is pro-rated after 9,000 hours of operation. This means that if a lamp fails prior to 9,000 hours of use, a new lamp is provided at no charge.

3. Trojan offers an unparalleled Lifetime Performance Guarantee. The spirit of this guarantee is simple: the Trojan equipment, as sized for the project, will meet the treatment requirements for the life of the system.

Terms and Conditions of Sale

This document sets forth the Terms & Conditions of Sale for goods manufactured and/or supplied, and services provided, by the seller entity identified on the purchase order ("SELLER") and sold to the original purchaser thereof ("BUYER"). The term "SELLER" includes only SELLER, and none of its affiliates. Unless otherwise specifically stated in a previously-executed written purchase agreement signed by authorized representatives of SELLER and BUYER, these Terms & Conditions of Sale establish the rights, obligations and remedies of SELLER and BUYER which apply to this offer and any resulting order or contract for the sale of SELLER's goods and/or services ("Products").

1. APPLICABLE TERMS & CONDITIONS: These Terms & Conditions of Sale are contained directly and/or by reference in SELLER's proposal, offer, order acknowledgment, packing slip, and/or invoice documents. The first of the following acts constitutes an acceptance of SELLER's offer and not a counteroffer and creates a contract of sale ("Contract") in accordance with these Terms & Conditions of Sale: (i) BUYER's issuance of a purchase order document against SELLER's offer; (ii) acknowledgement of BUYER's order by SELLER; or (iii) commencement of any performance by SELLER pursuant to BUYER's order. Provisions contained in BUYER's purchase documents (including electronic commerce interfaces) that materially alter, add to, or subtract from the provisions of these Terms & Conditions of Sale are not a part of the Contract.

2. CANCELLATION AND RETURN: The whole or any part of this order may be cancelled only with the prior written consent of SELLER. If SELLER does consent to a cancellation, such consent will be given only upon payment of reasonable cancellation charges in an amount determined by SELLER. In addition, with respect to any Products returned on cancellation, BUYER will pay SELLER's cost of placing the returned Products in a saleable condition, sales expenses incurred by SELLER in connection with such returned Products, a reasonable restocking charge and freight costs incurred in connection with the original shipment and in connection with returning such Products to SELLER, all in such amounts as are advised to the BUYER by SELLER.

3. DELIVERY: Delivery will be accomplished EXW or CIP at the point of shipment (Incoterms 2020), unless otherwise expressly agreed between the parties. Legal title and risk of loss or damage pass to BUYER upon transfer to the first carrier, regardless of final destination and mode of transit. SELLER will use commercially reasonable efforts to deliver the Products ordered herein within SELLER's normal lead-time necessary for SELLER to deliver the Products sold hereunder. Products will be boxed or crated as determined appropriate by SELLER for protection against normal handling and there will be an extra charge to the BUYER for additional packaging required by the BUYER with respect to waterproofing or other added protection. BUYER has sole responsibility for off-loading, storage and handling of the Products at the site. Where Buyer is responsible for any delay in the delivery date or installation date, the earlier of the date of delivery or the date on which the Products are ready for shipment by SELLER may be treated as the delivery date for purposes of determining the time of payment of the purchase price. Moreover, BUYER will be responsible for reasonable storage and insurance expenses with respect to such Products. Should BUYER fail to effect pick-up of Product as previously agreed in a timely manner, SELLER may, at its discretion, assess reasonable storage charges to the account of BUYER.

4. INSPECTION: BUYER will promptly inspect and accept any Products delivered pursuant to this Contract after receipt of such Products. In the event the Products do not conform to any applicable specifications, BUYER will promptly notify SELLER of such nonconformance in writing. SELLER will have a reasonable opportunity to repair or replace the nonconforming Product at its option. BUYER will be deemed to have accepted any Products delivered hereunder and to have waived any such nonconformance for such Products unless a written notification pursuant to this paragraph is received by SELLER within thirty (30) days of delivery to BUYER destination on order.

5. PRICES & ORDER SIZES: Prices do not include any charges for services such as insurance; brokerage fees; sales, use, inventory, or excise taxes; import or export duties; special financing fees; value added tax, income, or royalty taxes imposed outside the U.S. or Canada; consular fees; special permits or licenses; or other charges imposed upon the production, sale, distribution, or delivery of Products. BUYER will either pay any and all such charges or provide SELLER with acceptable exemption certificates, which obligation survives performance under this Contract. Installation, maintenance and any other services which relate to the Products are not included unless specifically set forth in the quotation. SELLER reserves the right to establish minimum order sizes and will advise BUYER accordingly. Any orders below the minimum order size are subject to a fee as set out by SELLER. If SELLER's delivery of Products surpasses one (1) year in length, then at least on an annual basis, or if changes to the Products are requested or needed, the parties shall conduct good faith discussions regarding changes to the prices for the Products, to reflect SELLER's increased costs for which SELLER shall be entitled to additional fair and appropriate compensation.

6. PAYMENTS: All payments must be made in agreed-to currency, normally Canadian or U.S. Dollars. Unless other payment terms are expressly set forth in the purchase order or otherwise required by the Seller, invoices are due and payable NET 30 DAYS from date of the invoice, without regard to delays for inspection or transportation, with payments to be made by check to SELLER at the address listed in the purchase order or by bank transfer to the account obtainable from SELLER's Accounts Receivable Manager. In the event payments are not made or not made in a timely manner, SELLER may, in addition to all other remedies provided at law, either: (a) declare BUYER's performance in breach and terminate this Contract for default; (b) withhold future shipments until delinquent payments are made; (c) deliver future shipments on a cash-with-order or cash-in-advance basis even after the delinquency is cured; (d) charge interest on the outstanding balance at a rate of 1.5% per month or the maximum rate permitted by law, if lower, for each month or part thereof that there is an outstanding balance plus applicable storage charges and/or inventory carrying charges; (e) repossess the Products for which payment has not been made; (f) pursue other collection efforts and recover all associated costs including reasonable attorney's fees; or (g) combine any of the above rights and remedies as is practicable and permitted by law. BUYER is prohibited from setting off any and all monies owed under this Contract from any other sums, whether liquidated or not, that are or may be due to the BUYER, which arise out of a different transaction with SELLER or any of its affiliates. Should BUYER's financial condition become unsatisfactory to SELLER in its discretion, SELLER may require payment in advance or other security. If BUYER fails to meet these requirements, SELLER may treat such failure as reasonable grounds for repudiation of this Contract, in which case reasonable cancellation charges shall be due to SELLER. BUYER hereby grants SELLER a security interest in the Products, wherever located, and whether now existing or hereafter arising or acquired from time to time, and in all accessions thereto and replacements or modifications thereof, as well as all proceeds of the foregoing, to secure payment in full of all amounts to Seller, which payment releases the security interest but only if such payment could not be considered an avoidable transfer under applicable laws. The security interest granted hereby constitutes a purchase money security interest under the applicable Uniform Commercial Code or Personal Property Security Act or other applicable law, and SELLER is authorized to make whatever registration or notification or take such other action as SELLER deems necessary or desirable to perfect such security interest. BUYER's insolvency, bankruptcy, assignment for the benefit of creditors, or dissolution or termination of the existence of BUYER, constitutes a default under this Contract and affords SELLER all of the remedies of a secured creditor under applicable law, as well as the remedies stated above for late payment or non-payment.

7. LIMITED WARRANTY: Unless specifically provided otherwise in SELLER's quotation, SELLER provides the following Limited Warranty. SELLER warrants that Products sold hereunder will be free from defects in material and workmanship and will, when used in accordance with the manufacturer's operating and maintenance instructions, conform to any express written warranty pertaining to the specific goods purchased, which for Products is for a period of twelve (12) months from delivery. SELLER warrants that services furnished hereunder will be free from defects in workmanship for a period of ninety (90) days from the completion of the services. Products repaired or replaced are not covered by any warranty except to the extent repaired or replaced by SELLER, an authorized representative of SELLER, or under specific instructions by SELLER, in which cases, the Products will be covered under warranty up to the end of the warranty period applicable to the original Products. The above warranties do not include the cost of shipping and handling of returned items. Parts provided by SELLER in the performance of services may be new or refurbished parts functioning equivalent to new parts. Any non-functioning parts that are repaired by SELLER shall become the property of SELLER. No warranties are extended to consumable items such as, without limitation, light bulbs, and for normal wear and tear. All other guarantees, warranties, conditions and representations, either express or implied, whether arising under any statute, law, commercial usage or otherwise, including implied warranties of merchantability and fitness for a particular purpose, are hereby excluded. The sole remedy for Products not meeting this Limited Warranty is replacement, credit or refund of the purchase price, as determined by SELLER in its sole discretion. This remedy will not be deemed to have failed of its essential purpose so long as SELLER is willing to provide such replacement, credit or refund. To make a warranty claim, BUYER must notify SELLER in writing within 5 days of discovery of the defect in question. This notification must include a description of the problem, a copy of the applicable operator's log, a copy of BUYER's maintenance record and any analytical results detailing the problem. Any warranty hereunder or performance guarantees shall only be enforceable if (a) all equipment is properly installed, inspected regularly, and is in good working order, (b) all operations are consistent with SELLER recommendations, (c) operating conditions at the installation site have not materially changed and remain within anticipated specifications, and (d) no reasonably unforeseeable circumstances exist or arise.

8. INDEMNIFICATION: Indemnification applies to a party and to such party's successors-in-interest, assignees, affiliates, directors, officers, and employees ("Indemnified Parties"). SELLER is responsible for and will defend, indemnify and hold harmless the BUYER Indemnified Parties against all losses, claims, expenses or damages which may result from accident, injury, damage, or death due to SELLER's breach of the Limited Warranty. BUYER is responsible for and will defend, indemnify and hold harmless SELLER Indemnified Parties against all losses, claims, expenses, or damages which may result from accident, injury, damage, or death due to the negligence or misuse or misapplication of any Products or the breach of any provision of this Contract by the BUYER or any third party affiliated or in privity with BUYER.

9. PATENT PROTECTION: Subject to all limitations of liability provided herein, SELLER will, with respect to any Products of SELLER's design or manufacture, indemnify BUYER from any and all damages and costs as finally determined by a court of competent jurisdiction in any suit for infringement of any U.S. or Canadian patent (or European patent for Products that SELLER sells to BUYER for end use in a member state of the E.U.) that has issued as of the delivery date, solely by reason of the sale or normal use of any Products sold to BUYER hereunder and from reasonable expenses incurred by BUYER in defense of such suit if SELLER does not undertake the defense thereof, provided that BUYER promptly notifies SELLER of such suit and offers SELLER either (i) full and exclusive control of the defense of such suit when Products of SELLER only are involved, or (ii) the right to participate in the defense of such suit when products other than those of SELLER are also involved. SELLER's warranty as to use patents only applies to infringement arising solely out of the inherent operation of the Products according to their applications as envisioned by SELLER's specifications. In case the Products are in such suit held to constitute infringement and the use of the Products is enjoined, SELLER will, at its own expense and at its option, either procure for BUYER the right to continue using such Products or replace them with non-infringing products, or modify them so they become non-infringing, or remove the Products and refund the purchase price (prorated for depreciation) and the transportation costs thereof. The foregoing states the entire liability of SELLER for patent

infringement by the Products. Further, to the same extent as set forth in SELLER's above obligation to BUYER, BUYER agrees to defend, indemnify and hold harmless SELLER for patent infringement related to (x) any goods manufactured to the BUYER's design, (y) services provided in accordance with the BUYER's instructions, or (z) SELLER's Products when used in combination with any other devices, parts or software not provided by SELLER hereunder.

10. TRADEMARKS AND OTHER LABELS: BUYER agrees not to remove or alter any indicia of manufacturing origin or patent numbers contained on or within the Products, including without limitation the serial numbers or trademarks on nameplates or cast, molded or machined components.

11. SOFTWARE AND INTELLECTUAL PROPERTY: All licenses to SELLER's separately provided software products are subject to the separate software license agreement(s) accompanying the software media. In the absence of such express licenses and for all other software, SELLER grants BUYER only a personal, non-exclusive license to access and use the software provided by SELLER with Products purchased hereunder solely as necessary for BUYER to enjoy the benefit of the Products. A portion of the software may contain or consist of open source software, which BUYER may use under the terms and conditions of the specific license under which the open source software is distributed. BUYER agrees that it will be bound by all such license agreements. Title to software remains with the applicable licensor(s). All SELLER contributions to the Products, the results of the services, and any other work designed or provided by SELLER hereunder may contain or result in statutory and non-statutory Intellectual Property, including but not limited to patentable subject matter or trade secrets; and all such Intellectual Property remains the sole property of SELLER; and BUYER shall not disclose (except to the extent inherently necessary during any resale of Product sold hereunder), disassemble, decompile, or any results of the Services, or any Products, or otherwise attempt to learn the underlying processes, source code, structure, algorithms, or ideas.

12. PROPRIETARY INFORMATION AND PRIVACY: "Proprietary Information" means any information, technical data, or know-how in whatever form, whether documented, contained in machine readable or physical components, mask works or artwork, or otherwise, which SELLER considers proprietary, including but not limited to service and maintenance manuals. BUYER and its customers, employees, and agents will keep confidential all such Proprietary Information obtained directly or indirectly from SELLER and will not transfer or disclose it without SELLER's prior written consent, or use it for the manufacture, procurement, servicing, or calibration of Products or any similar products, or cause such products to be manufactured, serviced, or calibrated by or procured from any other source, or reproduce or otherwise appropriate it. All such Proprietary Information remains SELLER's property. No right or license is granted to BUYER or its customers, employees or agents, expressly or by implication, with respect to the Proprietary Information or any patent right or other proprietary right of SELLER, except for the limited use licenses implied by law. In respect of personal data supplied by BUYER to SELLER, BUYER warrants that is duly authorized to submit and disclose these data, including but not limited to obtaining data subjects´ informed consent. SELLER will manage BUYER's information and personal data in accordance with its Privacy Policy, a copy of which is available to Buyer upon request. In respect of other data and information that SELLER may receive in connection with BUYER´s use of the Products including without limitation data that are captured by the Products and transmitted to SELLER, BUYER hereby grants SELLER a non-exclusive, worldwide, royalty-free, perpetual, non-revocable license to use, compile, distribute, display, store, process, reproduce, or create derivative works of such data as needed for Product operation and maintenance, and to aggregate such data for use in an anonymous manner, solely to facilitate marketing, sales and R&D activities of SELLER and its affiliates.

13. SPECIAL TOOLS, DIES, JIGS, FIXTURES AND PATTERNS: Any tools, dies, jigs, fixtures, patterns and similar items which are included or required in connection with the manufacture and/or supply of the Products will remain the property of SELLER without credit to the BUYER. SELLER assumes the cost for maintenance and replacement of such items and shall have the right to discard and scrap any such item after it has been inactive for a minimum of one year, without credit to the BUYER.

14. CHANGES AND ADDITIONAL CHARGES: SELLER reserves the right to make design changes or improvements to any products of the same general class as Products being delivered hereunder without liability or obligation to incorporate such changes or improvements to Products ordered by BUYER unless agreed upon in writing before the Products' delivery date.

15. SITE ACCESS / PREPARATION / WORKER SAFETY / ENVIRONMENTAL COMPLIANCE: In connection with services provided by SELLER, BUYER agrees to permit prompt access to equipment. BUYER assumes full responsibility to back-up or otherwise protect its data against loss, damage or destruction before services are performed. BUYER is the operator and in full control of its premises, including those areas where SELLER employees or contractors are performing service, repair, and maintenance activities. BUYER will ensure that all necessary measures are taken for safety and security of working conditions, sites, and installations during the performance of any services. BUYER is the generator of any resulting wastes, including without limitation hazardous wastes. BUYER is solely responsible to arrange for the disposal of any wastes at its own expense. BUYER will, at its own expense, provide SELLER employees and contractors working on BUYER's premises with all information and training required under applicable safety compliance regulations and BUYER's policies. SELLER has no responsibility for the supervision or actions of BUYER's employees or contractors or for non-SELLER items (e.g., chemicals, equipment) and disclaims all liability and responsibility for any loss or damage that may be suffered as a result of such actions or items, or any other actions or items not under SELLER's control.

16. LIMITATIONS ON USE: BUYER will not use any Products for any purpose other than those identified in SELLER's catalogs and literature as intended uses. Unless SELLER has advised the BUYER in writing, in no event will BUYER use any Products in drugs, food additives, food, or cosmetics, or medical applications for humans or animals. In no event will BUYER use in any application any Product that requires FDA 510(k) clearance unless and only to the extent the Product has such clearance. BUYER will not sell, transfer, export, or re-export any SELLER Products or technology for use in activities which involve the design, development, production, use, or stockpiling of nuclear, chemical, or biological weapons or missiles, nor use SELLER Products or technology in any facility which engages in activities relating to such weapons. Unless the "ship-to" address is in California, U.S.A., the Products are not intended for sale in California and may lack markings required by California Proposition 65; accordingly, unless BUYER has ordered Products specifying a California ship-to address, BUYER will not sell or deliver any SELLER Products for use in California. Any warranty granted by SELLER is void if any goods covered by such warranty are used for any purpose not permitted hereunder.

17. EXPORT AND IMPORT LICENSES AND COMPLIANCE WITH LAWS: Unless otherwise expressly agreed, BUYER is responsible for obtaining any required export or import licenses necessary for Product delivery. BUYER will comply with all laws and regulations applicable to the installation or use of all Product, including applicable import and export control laws and regulations of the U.S., E.U., and any other country having proper jurisdiction, and will obtain all necessary export or import licenses in connection with any subsequent export, re-export, transfer, and use of all Product and technology delivered hereunder. BUYER will not sell, transfer, export, or re-export any SELLER Product or technology for use in activities which involve the design, development, production, use or stockpiling of nuclear, chemical, or biological weapons or missiles, nor use SELLER Product or technology in any facility which engages in activities relating to such weapons. BUYER will comply with all local, national, and other laws of all jurisdictions globally relating to anti-corruption, bribery, extortion, kickbacks, or similar matters which are applicable to BUYER's business activities in connection with this Contract, including but not limited to the U.S. Foreign Corrupt Practices Act of 1977, as amended (the "FCPA"). BUYER agrees that no payment of money or provision of anything of value will be offered, promised, paid, or transferred, directly or indirectly, by any person or entity, to any government official, government employee, or employee of any company owned in part by a government, political party, political party official, or candidate for any government office or political party office to induce such organizations or persons to use their authority or influence to obtain or retain an improper business advantage for BUYER or for SELLER, or which otherwise constitute or have the purpose or effect of public or commercial bribery, acceptance of or acquiescence in extortion, kickbacks, or other unlawful or improper means of

obtaining business or any improper advantage, with respect to any of BUYER's activities related to this Contract. SELLER asks BUYER to "Speak Up!" if aware of any violation of law, regulation, or our Code of Conduct ("CoC") in relation to this Contract. See www.danaherintegrity.com and www.danaher.com/how-we-work/integrity-and-compliance for a copy of the CoC and for access to our Helpline portal.

18. RELATIONSHIP OF PARTIES: BUYER is not an agent or representative of SELLER and will not present itself as such under any circumstances, unless and to the extent it has been formally screened by SELLER's compliance department and received a separate duly-authorized letter from SELLER setting forth the scope and limitations of such authorization.

19. FORCE MAJEURE: SELLER is excused from performance of its obligations under this Contract to the extent caused by acts or omissions that are beyond its control, including but not limited to Government embargoes, blockages, seizures or freezing of assets, delays, or refusals to grant an export or import license, or the suspension or revocation thereof, or any other acts of any Government; fires, floods, severe weather conditions, or any other acts of God; quarantines; labor strikes or lockouts; riots; strife; insurrections; civil disobedience or acts of criminals or terrorists; war; material shortages or delays in deliveries to SELLER by third parties. In the event of the existence of any force majeure circumstances, the period of time for delivery, payment terms, and payments under any letters of credit will be extended for a period of time equal to the period of delay. If the force majeure circumstances extend for six months, SELLER may, at its option, terminate this Contract without penalty and without being deemed in default or in breach thereof.

20. NON-ASSIGNMENT AND WAIVER: BUYER will not transfer or assign this Contract or any rights or interests hereunder without SELLER's prior written consent. Failure of either party to insist upon strict performance of any provision of this Contract, or to exercise any right or privilege contained herein, or the waiver of any breach of the terms or conditions of this Contract, will not be construed as thereafter waiving any such terms, conditions, rights, or privileges, and the same will continue and remain in force and effect as if no waiver had occurred.

21. FUNDS TRANSFERS: BUYER and SELLER both recognize that there is a risk of banking fraud when individuals impersonating a business demand payment under new mailing or banking transfer instructions. To avoid this risk, BUYER must verbally confirm any new or changed mailing or banking transfer instructions by calling SELLER and speaking with SELLER's Accounts Receivable Manager before transferring any monies using the new instructions. Both parties agree that they will not institute mailing or banking transfer instruction changes and require immediate payment under the new instructions, but will instead provide a ten (10) day grace period to verify any mailing or banking transfer instruction changes before any new or outstanding payments are due using the new instructions.

22. LIMITATION OF LIABILITY: None of SELLER, its successors-in-interest, assignees, affiliates, directors, officers, and employees will be liable to BUYER under any circumstances for any special, treble, incidental, or consequential damages, including without limitation, damage to or loss of property other than for the Products purchased hereunder; damages incurred in installation, repair, or replacement; lost profits, revenue, or opportunity; loss of use; losses resulting from or related to downtime of the Products or inaccurate measurements or reporting; the cost of substitute products; or claims of BUYER's customers for such damages, howsoever caused, and whether based on warranty, contract, and/or tort (including negligence, strict liability or otherwise). The total liability of SELLER, its successors-in-interest, assignees, affiliates, directors, officers, and employees arising out of the performance or nonperformance hereunder, or SELLER's obligations in connection with the design, manufacture, sale, delivery, and/or use of Products, will in no circumstance exceed the amount actually paid to SELLER for Products delivered hereunder.

23. APPLICABLE LAW AND DISPUTE RESOLUTION: All issues relating to the construction, validity, interpretation, enforcement, and performance of this agreement and the rights and obligations of SELLER and the BUYER hereunder shall be governed by the laws of the Province of Ontario and the federal laws of Canada applicable therein. Any provisions of the International Sale of Goods Act or any convention on contracts for the international sale of goods shall not be applicable to this agreement. The parties submit to and consent to the non-exclusive jurisdiction of courts located in the Province of Ontario.

24. ENTIRE AGREEMENT & MODIFICATION: These Terms & Conditions of Sale constitute the entire agreement between the parties and supersede any prior agreements or representations, whether oral or written. No change to or modification of these Terms & Conditions shall be binding upon SELLER unless in a written instrument specifically referencing that it is amending these Terms & Conditions of Sale and signed by an authorized representative of SELLER. SELLER rejects any additional or inconsistent Terms & Conditions of Sale offered by BUYER at any time, whether or not such terms or conditions materially alter the Terms & Conditions herein and irrespective of SELLER's acceptance of BUYER's order for the described goods and services.

Terms and Conditions Covering Sales of Configured-to-Order Projects and Systems

In addition to all terms and conditions above, the following sections apply to sales of Configured-to-Order Projects, Systems, and the like:

101. PAYMENT.

101.1 Payments will be made per the schedule of payment events set forth in Seller's Quotation; provided that if the Start-Up Date (as defined below) is less than 30 days after the Acceptance Date, 90% of the purchase price is due on or before the Start-Up Date.

101.2. In the event that achievement of a scheduled payment event is delayed or suspended due to the Buyer's convenience or other reasons for which the Buyer or its representatives is responsible, such payment event will be deemed to have occurred and Seller shall be entitled to invoice Buyer as if achievement of such payment event had been achieved. In such circumstances, Buyer must notify Seller in writing of the reasons for the delay and anticipated duration of the delay. Seller will mark the Products (or parts thereof) as the Buyer's property and shall store the Products (or parts thereof) in a segregated area until actual delivery.

102. DELIVERY

102.1 SELLER will request the BUYER to provide a firm date for delivery of the Products to the project site (the "Delivery Date") which SELLER will then use to establish the production schedule for the Products. The Delivery Date will then be binding on the BUYER except for any changes made in accordance with the provisions below.

102.2 The BUYER can request a rescheduling of the Delivery Date on one occasion only by notifying SELLER in writing not less than four weeks prior to the scheduled Delivery Date. The BUYER may request that the Delivery Date be extended by a period up to six weeks, without penalty, but may not request that the Delivery Date be moved forward. The BUYER may also request that the Delivery Date be extended beyond a six-week period but, SELLER may not agree to such extension, beyond the maximum six-week extension period

102.3 SELLER may, in its sole discretion, agree to change the Delivery Date on more than one occasion or if less than four weeks' prior notice is provided of a requested change, but is under no obligation to do so.

102.4 SELLER reserves the right to reschedule the Delivery Date to a date prior to or subsequent to the scheduled Delivery Date in order to accommodate its shipping, production or other requirements. This right to reschedule will be applicable unless otherwise agreed in writing by an authorized officer of SELLER. SELLER will provide the BUYER or its representative with a minimum of 24 hours' notice of any such rescheduling.

102.5 Where any change to the Delivery Date is made at BUYER's request, for all purposes with respect to the warranty and payment provided by SELLER in connection with the Products, the initial Delivery Date will be considered to be the Delivery Date regardless of any change later made to the Delivery Date.

103. ACCEPTANCE

103.1 During the period between the Delivery Date and the Start-up Date, the BUYER shall prepare the Products and the project site for installation and start-up and, unless otherwise agreed in writing by an authorized representative of SELLER, shall complete acceptance testing with respect to the Products. The Products shall be deemed to be accepted on the earliest to occur of the following dates (the "Acceptance Date"): (a) that date on which the Products can function in either manual or automatic operation and provide disinfection in accordance with criteria specified in the Quotation, or (b) 60 days after the Delivery Date.

103.2 All amounts which remain owing by the BUYER for the Products, including any amount which is specified to be payable on the Acceptance Date, will be paid by the BUYER to SELLER within 30 days after the Acceptance Date, unless otherwise agreed in writing by an authorized representative of SELLER.

103.3 Written notification must be given by the BUYER to SELLER within seven days after the Acceptance Date listing any outstanding deficiencies with respect to the Products and SELLER will use all reasonable efforts to correct such deficiencies promptly.

104. START-UP

104.1 SELLER will request a firm date for start-up of the Equipment (the "Start-Up Date"). Trojan will then schedule its technician to be on-site for the Start-up Date. The Start-up Date is binding except for any changes made in accordance with the provisions below.

104.2 On the Start-up Date, BUYER must have the Equipment and site ready as provided in the Installation Preparation Checklist contained in the Contractor Installation Package sent to BUYER and must have paid all amounts then due and payable to SELLER.

104.3 BUYER can request a rescheduling of the Start-up Date by notifying SELLER in writing not less than three weeks prior to the Start-up Date. BUYER may request that the Start-up Date be extended but may not request that the Start-up Date be moved forward. SELLER requires a minimum extension period of two weeks between the existing Start-up Date and the requested new Start-up Date in order to reschedule its technician.

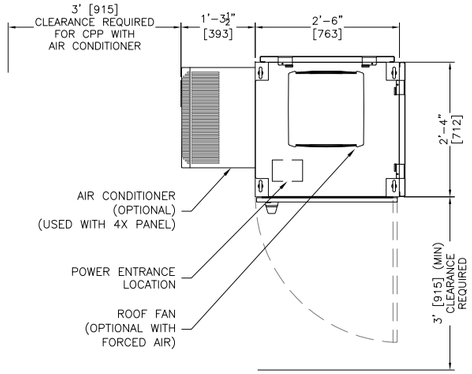
104.4 SELLER may, in its sole discretion, agree to reschedule the Start-up Date where a BUYER requests less than a two-week extension but is under no obligation to do so. In the event that SELLER does agree to less than a two-week extension or that BUYER requests more than two changes to the Start-up Date, BUYER will be charged an administration fee in an amount determined by SELLER.

104.5 SELLER reserves the right to reschedule the Start-up Date to a date which is prior to or subsequent to the scheduled Start-up Date in order to accommodate its resource availability. This right to reschedule will be applicable unless otherwise agreed in writing by an authorized officer of SELLER. SELLER will provide BUYER or its representative with a minimum of 72 hours' notice of any such change to the Start-up Date.

104.6 In the event that SELLER'S technician arrives at the project site and finds that the Equipment or the project site is not ready for start-up as defined in the Contractor Installation Package, or any amounts then due and payable to SELLER remain unpaid, BUYER may either:

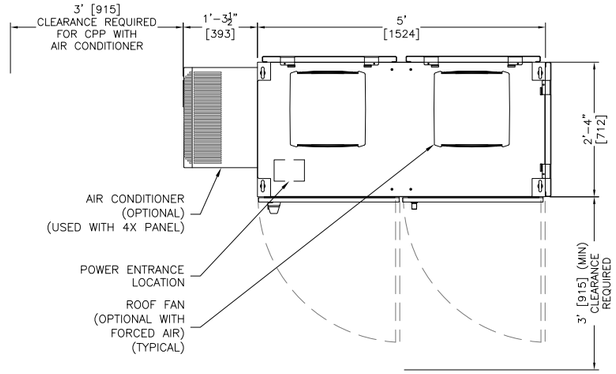
(a) provided all amounts then due and payable to SELLER have been paid, issue a purchase order for all costs involved in having SELLER correct the deficiencies, or

(b) have SELLER'S technician leave the site and then reschedule the Start-up Date to a date when all deficiencies will be corrected, and the Equipment will be ready for start-up as defined in the Contractor Installation Package. If BUYER selects this option, the cost of rescheduling will be not less than a minimum amount specified by SELLER, with the final cost being determined by SELLER based on its costs and expenses incurred in connection with the rescheduling.



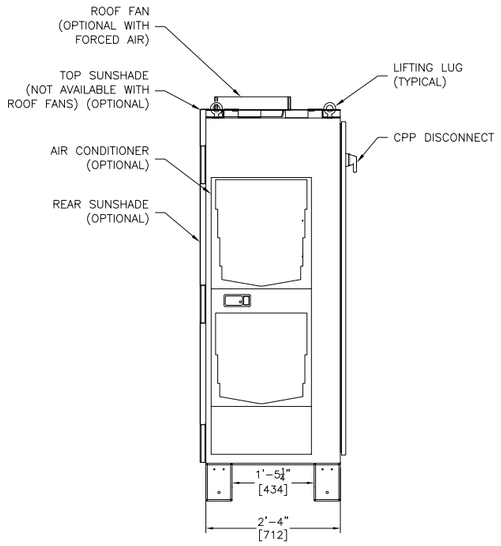
PLAN VIEW

SCALE:AS SHOWN
NOTE: DIMENSIONS SHOWN DO NOT INCLUDE SUNSHADE (OPTIONAL).



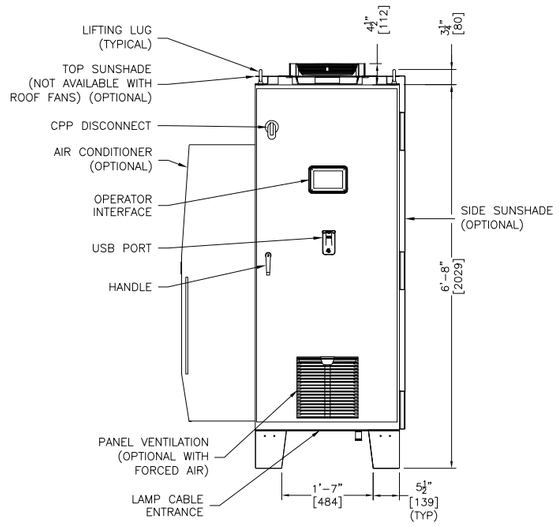
PLAN VIEW

SCALE:NOT TO SCALE
NOTE: DIMENSIONS SHOWN DO NOT INCLUDE SUNSHADE (OPTIONAL).



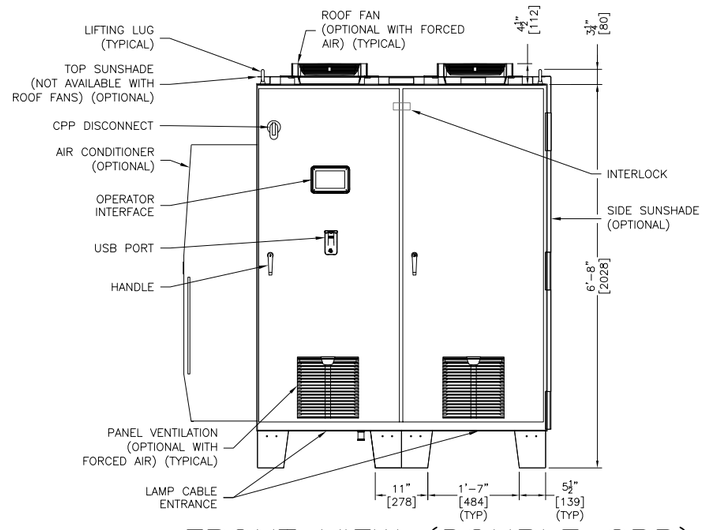
LEFT SIDE VIEW

SCALE:AS SHOWN



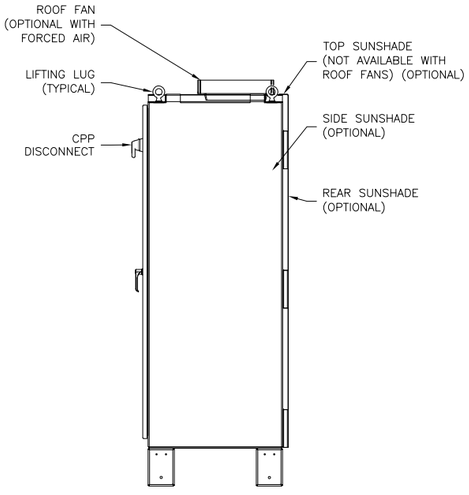
FRONT VIEW (SINGLE CPP)

SCALE:AS SHOWN
NOTE: MAXIMUM 64 UV LAMPS PER CPP



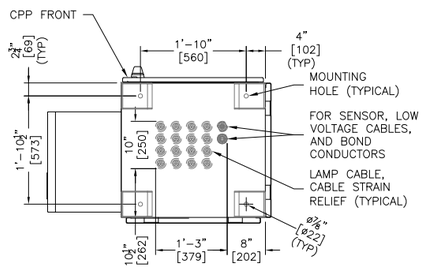
FRONT VIEW (DOUBLE CPP)

SCALE:AS SHOWN
NOTE: MAXIMUM 128 UV LAMPS PER CPP



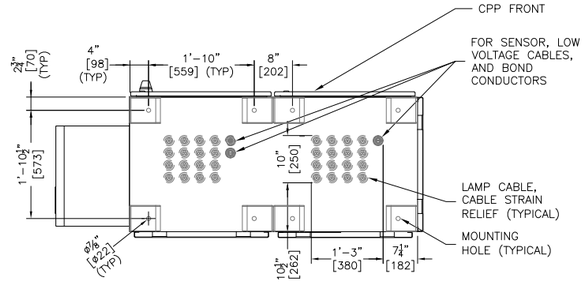
RIGHT SIDE VIEW

SCALE:AS SHOWN



BOTTOM VIEW CONDUIT ENTRANCE)

SCALE:AS SHOWN



BOTTOM VIEW (CONDUIT ENTRANCE)

SCALE:AS SHOWN

NOTES:
: [ ] INDICATES DIMENSIONS IN mm UNLESS OTHERWISE SPECIFIED.
: METRIC DIMENSIONS SHOWN ARE DCONVERSIONS FROM IMPERIAL.
: PAINTED MILD STEEL, TYPE 12 [IP54] (WITH FORCED AIR – INSTALLED IN ENVIRONMENTALLY CONTROLLED ROOM (MAXIMUM AMBIENT TEMPERATURE OF 82'F [30'C]) STANDARD DESIGN. 304 SST & 316 SST, TYPE 4 [IP66] & 4X [IP66] OPTIONS AVAILABLE (WITH OPTIONAL A/C).
: AIR CONDITIONER (OPTIONAL) CAN BE MOUNTED ON RIGHT SIDE OR LEFT SIDE OF ENCLOSURE. LEFT-SIDED AIR CONDITIONER IS SHOWN.
: CPP TO BE FLOOR MOUNTED.
: APPROXIMATE SINGLE PANEL WEIGHT = 1000 lbs. [454 kg]
: APPROXIMATE DOUBLE PANEL WEIGHT = 1600 lbs. [726 kg]
: CONDUIT CUT OUTS ARE SHOWN IN APPROXIMATE LOCATIONS ONLY AND WILL VARY SLIGHTLY DUE TO SITE SPECIFIC PANEL REQUIREMENTS.

TROJANUV™
A TROJAN TECHNOLOGIES BUSINESS

DESCRIPTION: TROJANUVFLEX100, CONTROL POWER PANEL (CPP)

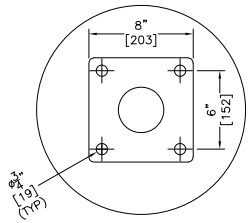
STD. DRAWING NO. 932830G

DRAWN BY : SPM	DATE : 20MY11
CHECKED BY : RLM	DATE : 20MY11
APPROVED BY : SPM	DATE : 20MY11
SCALE (8.5x11) : 3/8" = 1'-0"	LOG NUMBER : N/A

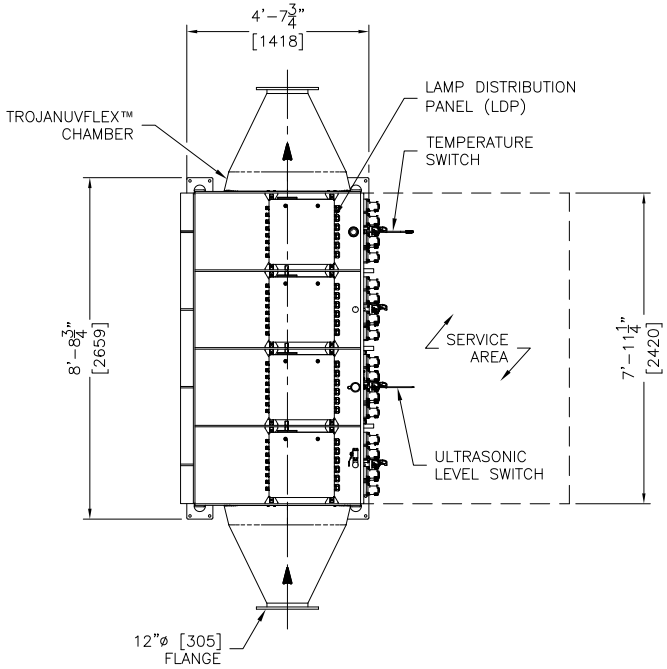
REFERENCE NO. FX0004

DWG NO. D01 | REV. A

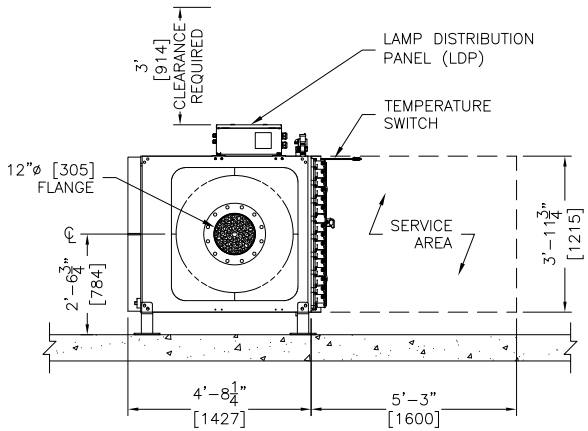
NOTES:
: UV CHAMBER MATERIAL TO BE TYPE 2205 DUPLEX.
: STANDARD OPERATING PRESSURE TO BE 60 PSI [4 BAR]. OPTIONAL RATINGS OF 125 PSI [8.6 BAR] AVAILABLE.
: TROJAN RECOMMENDS THAT VALVES ARE USED TO ISOLATE THE UV CHAMBER FROM PLANT FLOW FOR SERVICING. (NOTE: LAMP CHANGE OUT CAN BE DONE ON-LINE).
: OPTIONAL FLANGE RATINGS AVAILABLE, AWWA CLASS B (SHOWN), AWWA CLASS D, PN6, PN10.
: RIGHT SIDE LAMP REMOVAL AND LEFT SIDE LAMP ORIENTATIONS AVAILABLE.
: FLOW DIRECTION CAN BE EITHER DIRECTION. LEFT TO RIGHT SHOWN.
: CHAMBER WEIGHT DRY 6697 LBS [3160 KGS] / WET 14802 LBS [6714 KGS].
: FACTORY INSTALLED LAMP CABLES BETWEEN LDP AND CHAMBER NOT SHOWN.
: MINIMUM OF FIVE STRAIGHT PIPE DIAMETERS OF PIPING REQUIRED UPSTREAM AND THREE REQUIRED DOWNSTREAM.



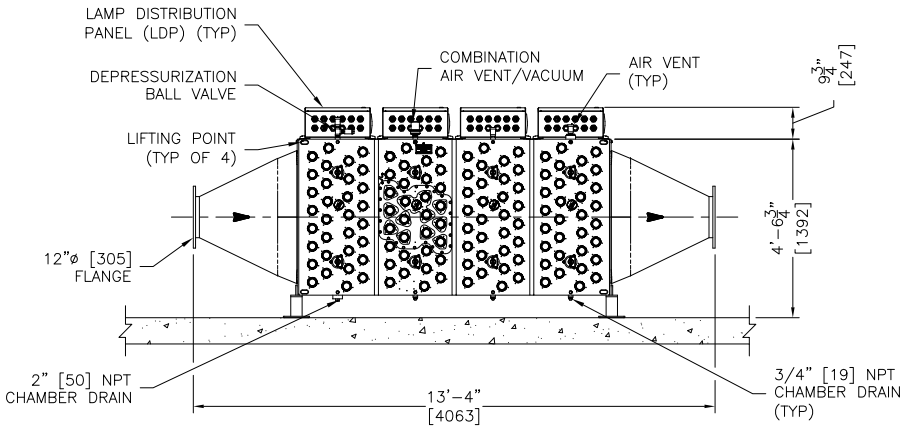
FOOT DETAIL
SCALE: NOT TO SCALE



PLAN VIEW
SCALE: NOT TO SCALE

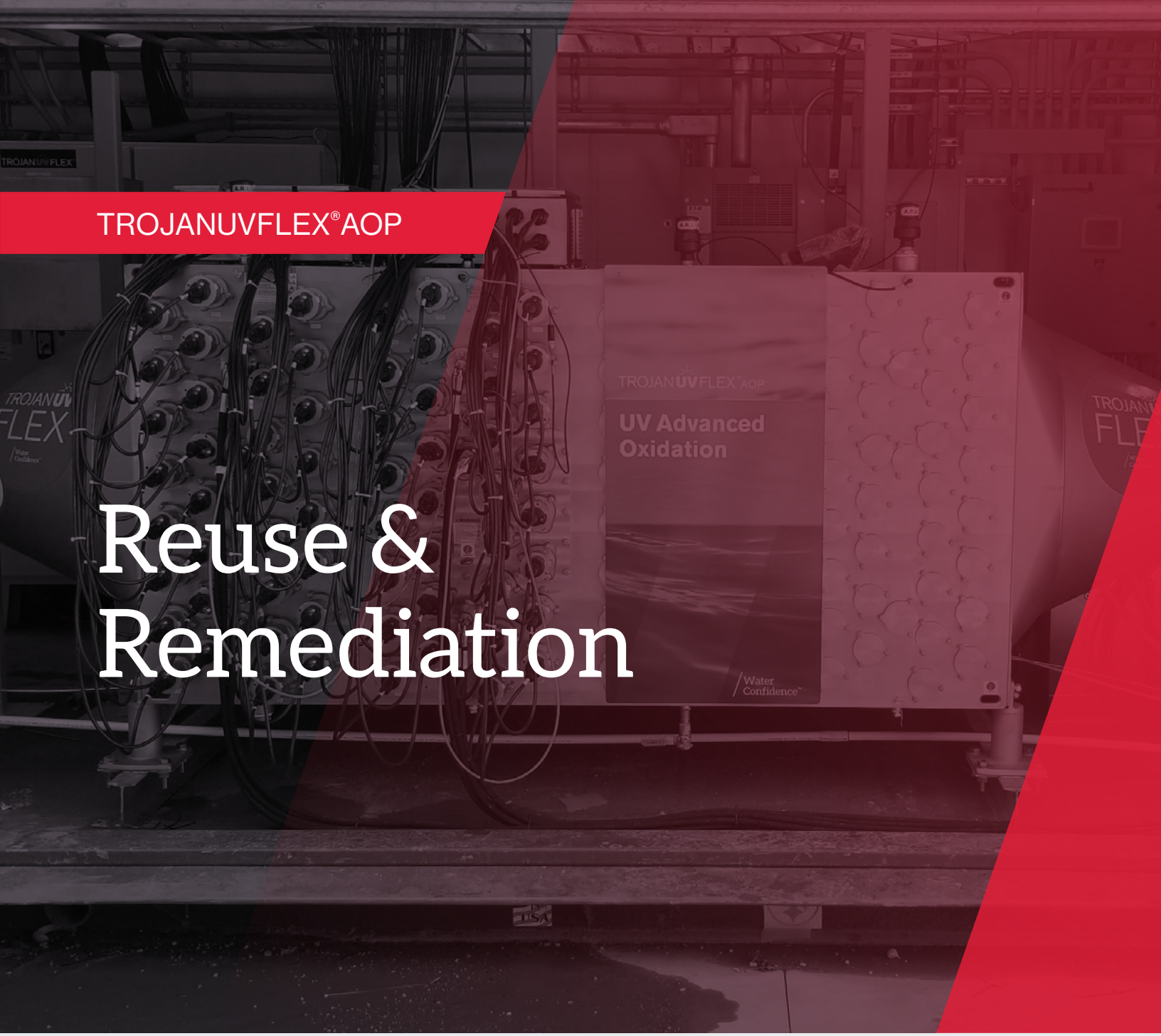


INLET VIEW
SCALE: NOT TO SCALE



SIDE VIEW
SCALE: NOT TO SCALE

DESCRIPTION: STD, TROJANUVFLEX100 4 BANK, HORIZONTAL LAMP, 12" [305] FLANGE		STD. DRAWING NO.	FL100H1204
DRAWN BY : AMM	DATE : 30MR31	REFERENCE NO.	822620G
CHECKED BY : RLM	DATE : 20MR05		
APPROVED BY : SPM	DATE : 20MR05	DWG NO. D01	REV. A
SCALE (8.5x11) : NOT TO SCALE	LOG NUMBER : N/A		



TROJANUVFLEX®AOP

Reuse & Remediation

TROJANUV®

TROJAN UV®

Reuse & Remediation

Producing High-quality Drinking Water with UV Advanced Oxidation

Meeting the demand for clean water has never been more challenging. Communities around the world are facing a growing water stress – in terms of water quality or water quantity – and often both. Many are relying on more advanced treatment methods such as UV Advanced Oxidation Processes for drinking water remediation and potable wastewater reuse in order to overcome these challenges and meet demand.

The UV Advanced Oxidation Process (also known as UV AOP) can help municipalities relying on lower quality water sources to continue producing high-quality drinking water for their communities. UV AOP does this by breaking down environmental contaminants 1,4-dioxane, NDMA, MIB and Geosmin, while simultaneously treating microorganisms *Cryptosporidium* and *Giardia*.

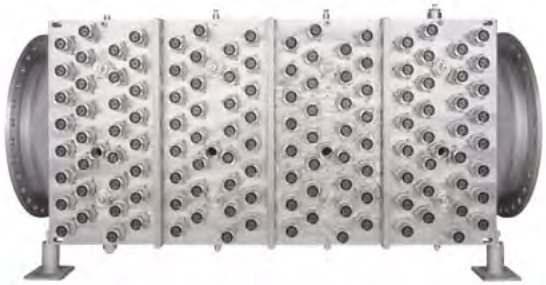
With decades of experience in the design of UV AOP systems and dozens of full-scale installations around the world, Trojan is a global leader in the application of UV AOP technology.

TROJAN UV FLEX® AOP

Compact, Eco-efficient UV Advanced Oxidation

The TrojanUVFlex® AOP is our latest innovation for UV AOP treatment and is designed with features to make installation and operation simpler, faster, and more cost-effective than ever before. Built on our proven Solo Lamp® Technology platform, TrojanUVFlexAOP allows for energy-efficient high-intensity delivery of UV light in an extremely compact footprint.

TrojanUVFlexAOP 200 Series



TrojanUVFlexAOP 100 Series

Cost-Saving Cross-Flow Lamp Orientation. TrojanUV Solo Lamps are arranged in arrays engineered to minimize cost. Perpendicular cross-flow lamp orientation reduces operating costs by allowing independently operated sections of lamps to be turned on/off in response to changing treatment conditions and also ensures water continues to be treated by downstream lamps in the event an upstream lamp needs to be replaced.

Future Expansion Made Easy. Chambers can be manufactured with additional banks to accommodate future treatment capacity. This ensures the system meets your current requirements while also planning for future needs.

Advanced Sleeve Cleaning. Automatic mechanical sleeve wiping system maintains maximum UV output and is available for even our largest UV chambers. Replacing worn wiper seals is quickly and easily accomplished from outside the UV chamber.

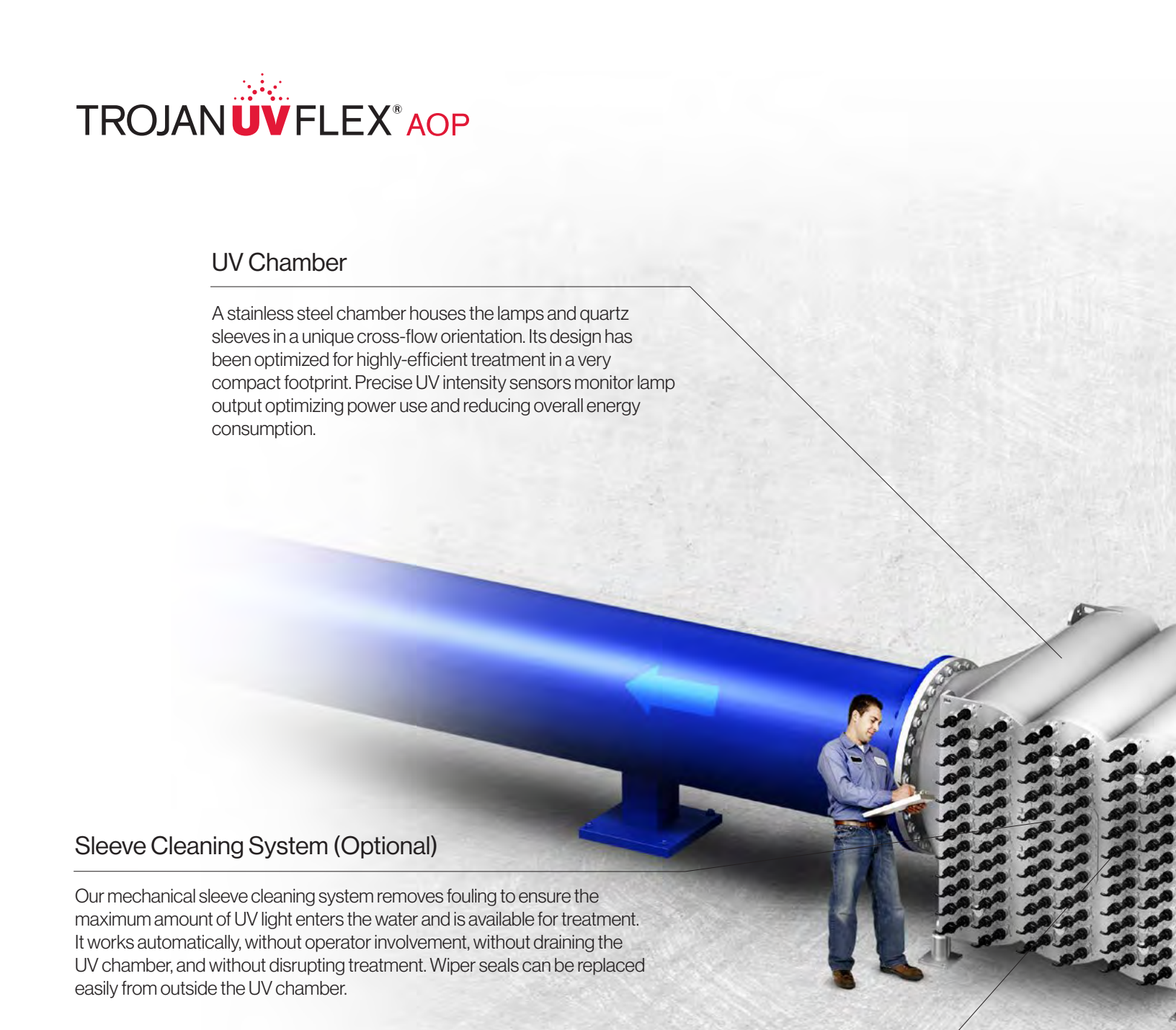
Low Footprint with Flexible Installation Options. With up to 1,000 Watts of available power per lamp, the lamp count and chamber size is greatly reduced for UV AOP applications. The option to install chambers vertically or horizontally makes integration into existing piping straightforward and allows service access from any direction.

Advanced Validation. The TrojanUVFlexAOP has been validated through microbial testing. Through this testing, performance data has been generated for UV dose delivery to inactivate *Cryptosporidium, Giardia*, and Adenovirus.

TROJAN UVFLEX® AOP

UV Chamber

A stainless steel chamber houses the lamps and quartz sleeves in a unique cross-flow orientation. Its design has been optimized for highly-efficient treatment in a very compact footprint. Precise UV intensity sensors monitor lamp output optimizing power use and reducing overall energy consumption.



Sleeve Cleaning System (Optional)

Our mechanical sleeve cleaning system removes fouling to ensure the maximum amount of UV light enters the water and is available for treatment. It works automatically, without operator involvement, without draining the UV chamber, and without disrupting treatment. Wiper seals can be replaced easily from outside the UV chamber.

TrojanUV Solo Lamps

The TrojanUV Solo Lamp combines the benefits of low- and medium-pressure lamps, providing high UV output, low power consumption, low lamp count, long lamp life (>15,000 hours), and reduced maintenance. Lamps are located within protective quartz sleeves and are easily accessible for change-outs.

SOLO LAMP® TECHNOLOGY

Power Distribution

The compact power distribution panels house rack mounted Solo Lamp drivers to power and control the UV lamps. To reduce power consumption and save costs, drivers control lamp sections which turn on/off based on real-time treatment conditions and can dim lamps from 100 to 30% power. They feature built-in diagnostic capability for easy troubleshooting and take only minutes to replace.

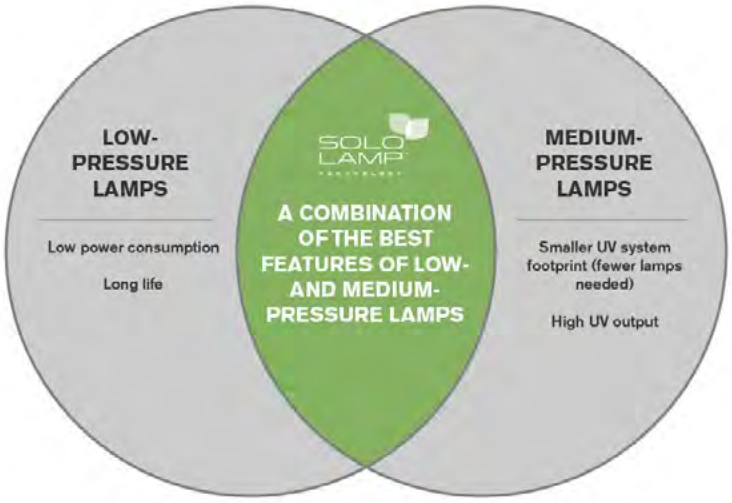
Local Control

A local control panel houses the UV controller which maintains the customer desired contaminant treatment through real-time input signals for flow, UVT, and UV intensity. Performance is carefully monitored with return signals being sent to lamp drivers and oxidant injection pumps which adjust both UV output and oxidant dose to maintain cost effective operation.

Revolutionary Lamp and Driver Technology

The best features of both low- and medium-pressure lamps

- High UV output and high electrical efficiency
- Low total lamp count (and associated components like drivers and sleeves) reduces maintenance costs
- Long lamp life (15,000 hours guaranteed)
- Solo Lamp driver has a high power factor and low total harmonic distortion
- Lamp drivers are rack mounted in panels for compact footprint and easy replacement

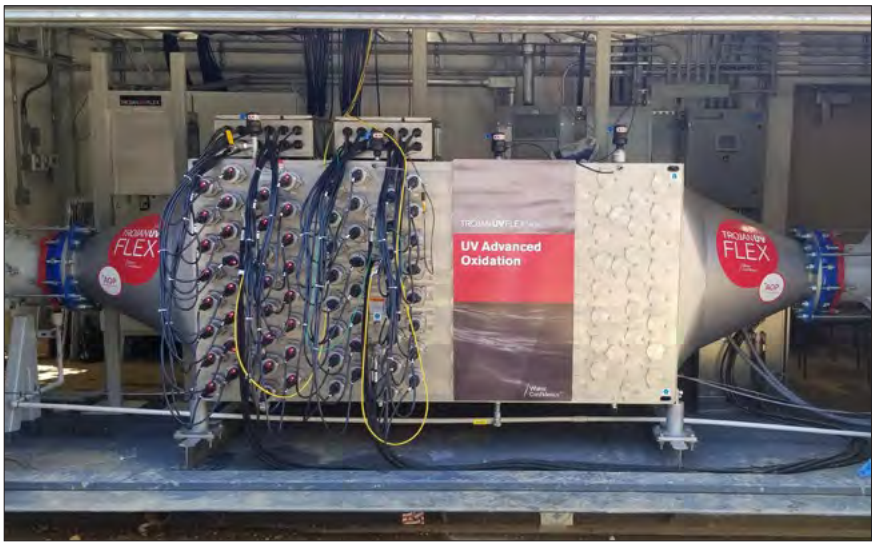


TrojanUV Solo Lamp systems combine the benefits of other lamp technologies – the low lamp count of medium-pressure systems with the high electrical efficiency of low-pressure high-output (LPHO) systems. The result is a compact, cost-effective installation that is easy and quick to maintain.

Compact, Modular UV Chamber

Significantly reduces footprint and installation cost

- Staggered, cross-flow lamp arrays maximize UV output and reduce chamber size
- Compact footprint simplifies indoor retrofit installations and reduces construction costs
- Horizontal or vertical installation allows service access from any direction
- Modular lamp sections enable expandability, redundancy, and low power consumption
- Low headloss design reduces or eliminates pumping

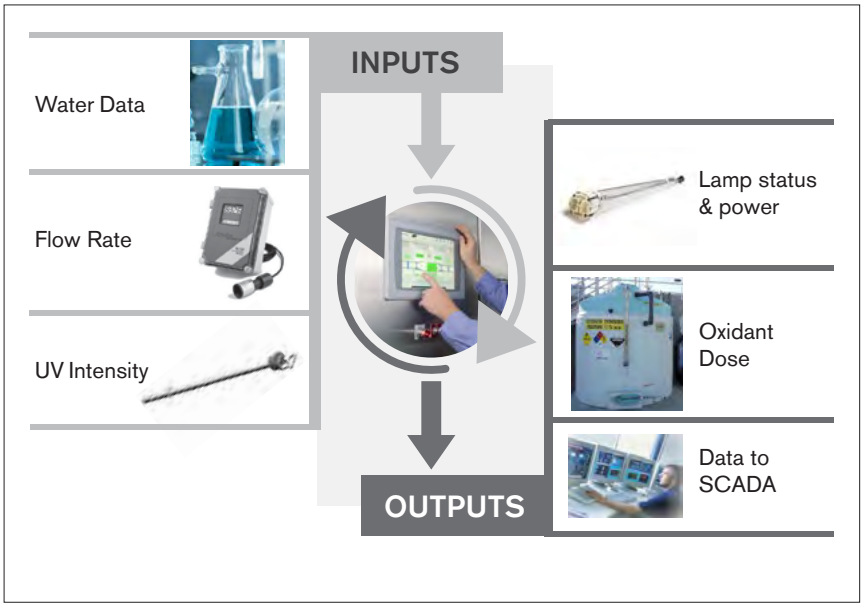


The chamber has been designed for high intensity delivery of UV light in an extremely compact footprint.

State-of-the-Art AOP Control System

Confidently achieve treatment objectives while minimizing operational costs

- The advanced UV AOP controller processes multiple real-time inputs including flow rate and UV transmission
- Critical water characteristics including scavenging demand and alkalinity as well as other system parameters such as lamp data are all computed together to evaluate real-time performance
- Computes delivered contaminant reductions with either hydrogen peroxide or free chlorine oxidants and compares performance against desired treatment requirements
- Optimizes energy use by modulating UV output and oxidant delivery to match treatment conditions
- Displays Critical Control Points through SCADA and local and/or remote HMIs



Real-time inputs are utilized in the computation of the break down of contaminants. The system dynamically adjusts lamp power and oxidant dose to minimize operation and maintenance costs.

User-Friendly Experience

Designed to make the operator's job easier

- Access lamps, UV sensors, and quartz sleeves all from the outside of the chamber
- "Lamp on" LED indicator on lamp plug provides easy visual determination of lamp status
- Optional mechanical sleeve cleaning system prevents quartz sleeve fouling
- Wiper seals are quickly replaced from outside the UV chamber
- Integrated chamber hatches provide easy access for internal inspection or maintenance
- Graphic screens and icons make system operation intuitive for operators

All UV systems require periodic maintenance; but TrojanUVFlexAOP allows fast access to all routine maintenance components (including wiper components) from outside the UV chamber. This minimizes maintenance time and increases efficiency.

Building Water Confidence

The TrojanUV line of products include open-channel and closed-vessel UV treatment and UV advanced oxidation systems for municipal wastewater, drinking water, remediation and reuse applications. We have the largest municipal UV installation base in the world and are proud to play an important role in continually advancing UV technology and helping to build Water Confidence for communities and municipalities.

Experience. Over 10,000 municipal UV installations; treating 60 billion gallons of water every day (225 million m^3/day).

Global Support. Local Service. Our comprehensive network of certified service providers offer rapid response and personalized attention for service, replacement parts and system optimization.

Guaranteed Performance and Comprehensive Warranty. TrojanUV systems include a Lifetime Performance Guarantee* and comprehensive warranties for systems and parts.

System Specifications

System Characteristics	TrojanUVFlexAOP 200 Series	TrojanUVFlexAOP 100 Series
Lamp Type	TrojanUV Solo Lamp - Low Pressure High Output	
Lamp Power	1000 Watts	500 Watts
Lamp Driver	Electronic, variable power (30% to 100%)	
Chamber Material	2205 duplex stainless steel	
Flange Size	48 inch AWWA C207, DN1200 24 inch AWWA C207, DN600	36-inch AWWA C207, DN900 12-inch AWWA C207, DN300
Maximum Pressure	87 psi (6 bar)	150 psi (10 bar)
Sleeve Cleaning	Mechanical cleaning (Optional)	
Network Connection	AB Ethernet I/P, ProfiNet, Profibus, Modbus TCP/IP, Modbus RTU RS485	
Panel Material	Painted mild steel, 304 stainless steel, 316 stainless steel	
Available Oxidants	Hydrogen Peroxide (H_2O_2) and Sodium Hypochlorite (NaOCl)	
Validation	USEPA and NWRI	

* When you use TrojanUV parts, we guarantee that your system will meet the treatment requirement specified at purchase, provided that the system's original design parameters haven't changed (e.g., flow rate, UV Transmittance) and maintenance is completed per the UV System O&M manual. Should you experience an issue, our Service Technicians will work with you to resolve it as fast as possible.

To learn more about the brands and affiliates of Trojan Technologies, please visit www.trojantechnologies.com

TROJAN technologies*

1401 West Cypress Creek Road
Suite 100
Fort Lauderdale FL 33309-1969

Phone 1.888.PARKSON
Fax 954.974.6182

ThickTech™ Rotary Drum Thickener (RDT) Budget

September 14, 2022

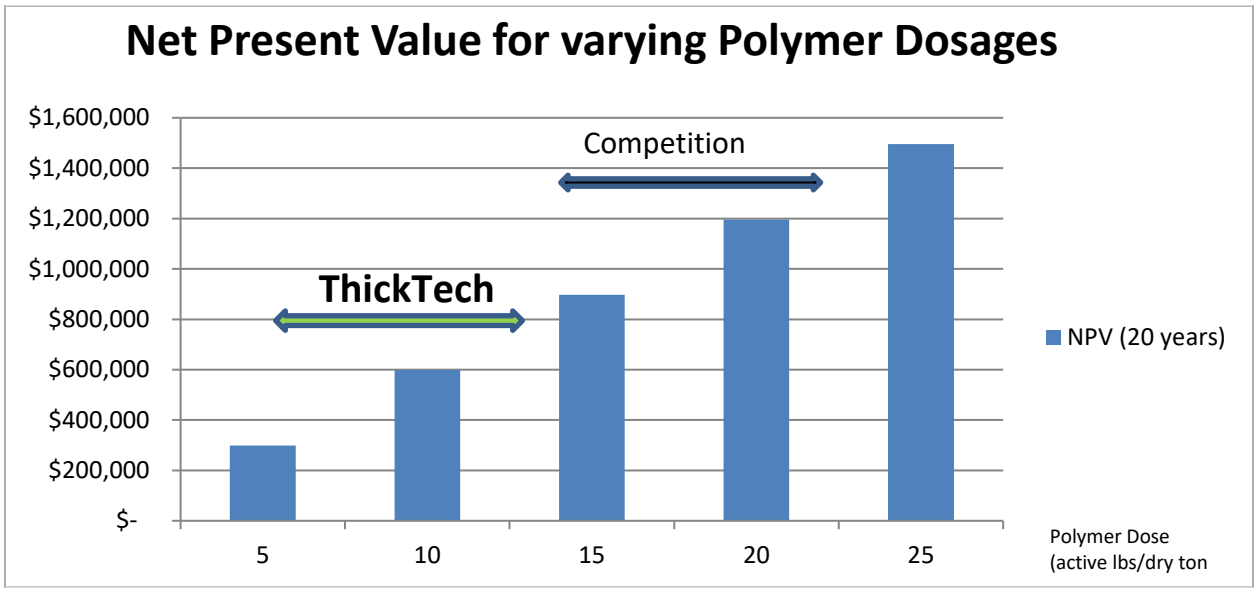
Greeley & Hansen
Attn: Bernardo Vazquez Bravo

Re: Carmel, CA Sludge Thickening

Parkson Corporation is pleased to provide a budget for our ThickTech™ rotary drum thickener (RDT) for your project. Your requested information is included with this letter, along with other items which detail our offering for this project.

Basis of Design	
Parameter	**Values**
Thickening Application	WAS
Influent Flow	120-170 GPM
Influent solids (%)	0.86%
Capture Efficiency (%)	98%
Thickened Solids	4%-5%
Polymer Usage	7 to 10 active lbs / dry ton sludge

The ThickTech RDT offers many advantages over other thickeners on the market. In addition to having the most installations (over 250 units), the longest history (over 20 years) and robust, high quality manufacturing made in America, the Parkson ThickTech™ uses less polymer than any other RDT on the market. For an RDT, more money is spent on polymer than for anything else in the system. Polymer costs more than electricity, supporting equipment, and can be up to 10 times the cost of the RDT itself! Although this is by far the highest cost item, it is regularly overlooked when selecting an RDT while focus is made on the comparative capital cost, which is a small fraction of the overall lifecycle costs.



Calculation Basis:
Flow: 200 GPM @ 1.5% solids
Polymer cost: $2.5/lb (active)
Operation: 5 days/week, 8 hrs/day
Discount Rate: 3%

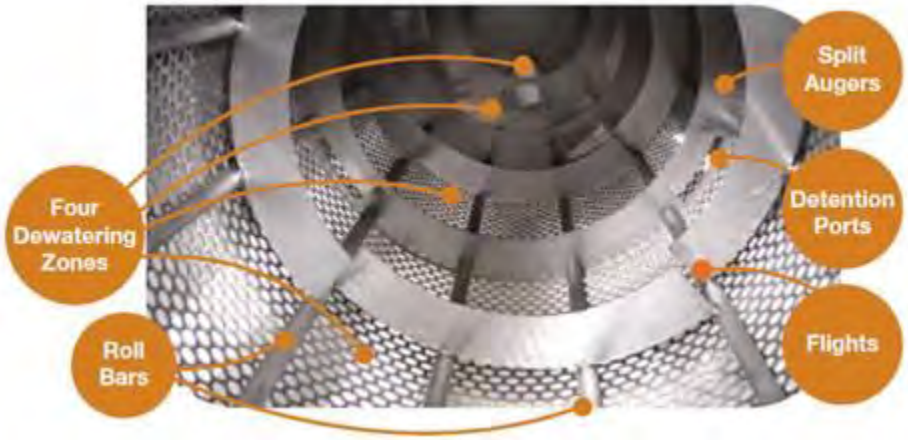
As displayed in the 20 years Net Present Value (NPV) chart, the lifecycle polymer cost for given influent flow and solids could be as high as 2X for the competition. So, it is crucially important to pick the best performing unit for the lowest life cycle cost.

Why the Parkson ThickTech uses so less polymer is pretty elementary. It comes down to three things:

1. Flocculation tank design: The tangential inlet and outlet creates a swirling upward flow pattern with negligible shear promoting enhanced floc development.
2. Screening material: Woven wire mesh has the smallest opening size leading to high capture rates and most open area allowing for most efficient release of water.
3. Internal drum components: The drum is divided into four zones with split augers and detention ports to fine tune the sludge residence time and also prevents breaking down of floc. The roll bars allow for gentle flipping and turning of the sludge for efficient water removal.

So, although woven wire mesh screens can be a little more expensive up front, they save a lot of money down the line. Below is a picture of the Parkson drum showing the internal drum features compared to our two leading competitors (a wedge wire and perforated sheet drum).

Parkson



Scope:

- 304 SS unit
- Basic Controls
- End Enclosure
- Booster Pump
- Vortex Mixer with polymer injection ring

Based on the design parameters and above scope, the budget price for one (1) RDT200 including startup service is……**$240,000**

Thank you for considering the comments I have provided above. Should you have any questions at all I would appreciate the opportunity to discuss with you and provide answers.

Regards,

Dave Mitchell
RDT Product Manager

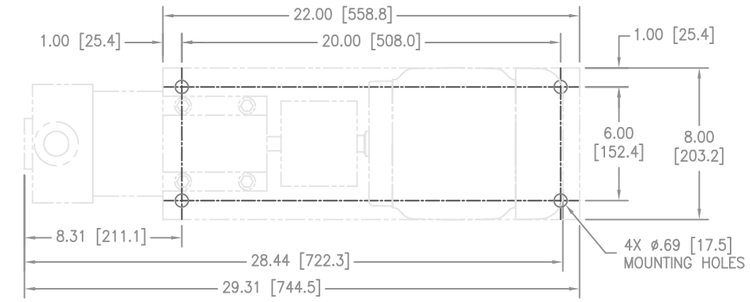
NOTE:

1. ALL 304 STAINLESS STEEL CONSTRUCTION EXCEPT FOR TRUNNION WHEELS, DRIVE MOTORS, DRIVE CHAIN, SPROCKETS, HANDLES, CABLE PULL SAFETY SWITCH, BEARING BLOCK AND MANUAL CLEANING SPRAY BRUSH.
2. DRIVE SPECIFICATIONS:

   DRUM GEARMOTOR: 1 HP [.75 kW], 1800 RPM, 230/460 V, 3 PH, 60 HZ, TEFC, SEVERE DUTY.

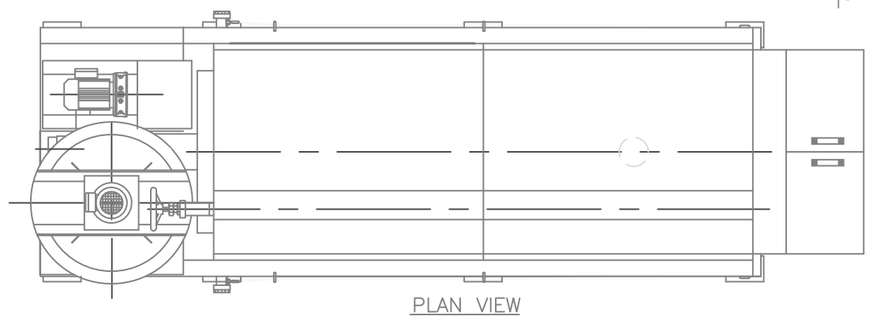
   FLOC GEARMOTOR: 1/2 HP [.37 kW], 1800 RPM, 230/460 V, 3 PH, 60 HZ, TEFC, SEVERE DUTY.

   BOOSTER PUMP MOTOR: 2 HP, [1.5 kW], 3500 RPM, 230/460 V, 3 PH, 60 HZ, TEFC.
3. DRUM SPEED: 10 RPM MAXIMUM
4. RECOMMENDED MINIMUM CLEARANCE TO BE 36.00 [914.4] AROUND UNIT AND 36.00 [914.4] ABOVE UNIT.
5. ALL EXTERNAL PIPING TO BE SUPPORTED INDEPENDENTLY OF THICKTECH UNIT.
6. EST. DRY WEIGHT: 2,675 LB [1214 kg]; OPERATING WEIGHT: 7,675 [3482 kg]
7. TOTAL SPRAY USAGE WITH BOOSTER PUMP AT 100 PSI [6.9 BAR]: 10.50 GPM [.6 L/s]
8. DIMENSIONS WRITTEN IN INCHES [mm] UNLESS OTHERWISE SPECIFIED.
9. CONSULT THE HYCOR® PRODUCTS GROUP OR YOUR LOCAL HYCOR PRODUCTS REPRESENTATIVE FOR AVAILABLE OPTIONS.

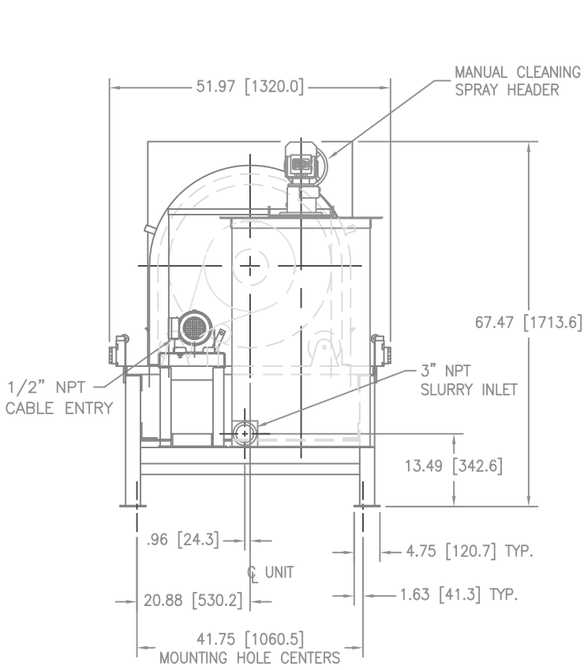


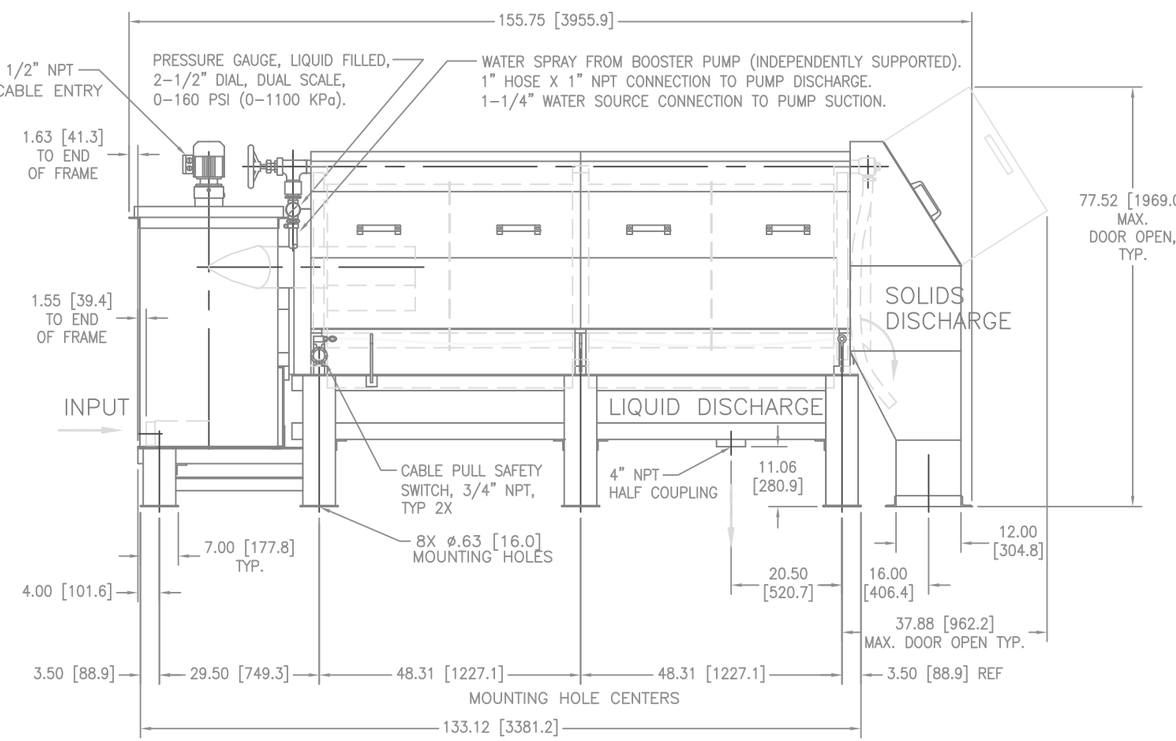
BOOSTER PUMP MOUNTING HOLE LOCATIONS

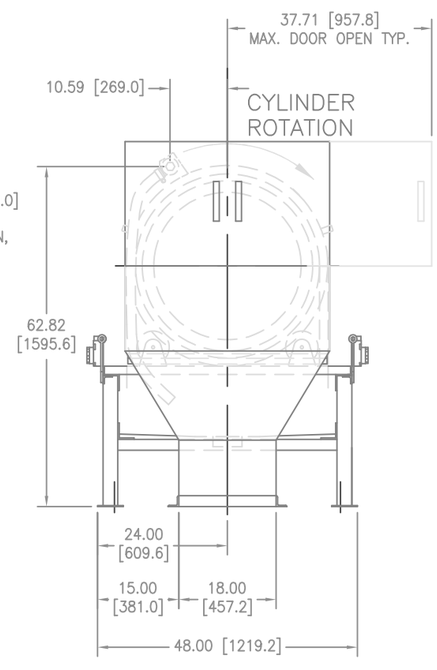
SCALE: 1/8"= 1"



PLAN VIEW







PARKSON CORPORATION

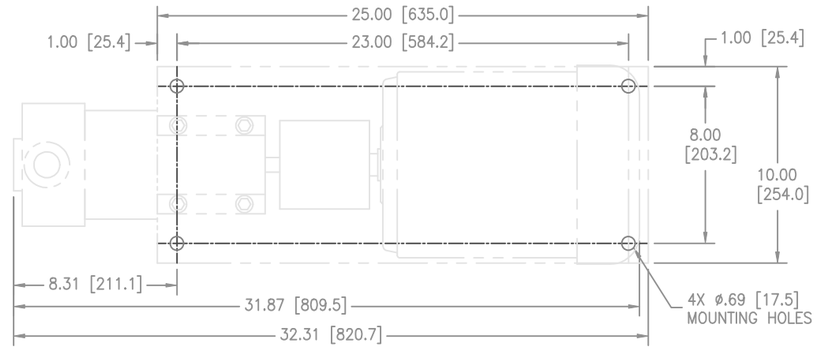
The Owner, Project Engineer, and all others involved with the project design must implement and follow all safety standards required by local, state and federal laws when incorporating Parkson Corporation equipment into the overall project design. Parkson Corporation will not be responsible for location and/or placement of equipment in the plant design, nor is Parkson Corporation responsible for plant safety design and for the failure to follow appropriate safety precautions in the operation and maintenance of Parkson Corporation equipment.

REV	DESCRIPTION	DATE	BY

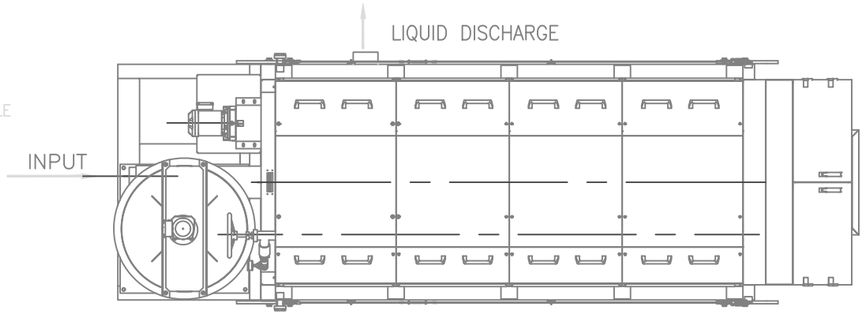
DRAWN BY: DFT — DATE: MM/DD/YY
CHECKED BY: ENG — DATE: MM/DD/YY
SCALE: 1/28" = 1"
REFERENCE INFORMATION: REV DATE: 03/31/05
INFORMATION ONLY
PROJECT NAME: PROJECT NUMBER
TITLE: RDT100 HYCOR® THICKTECH™ ROTARY DRUM THICKENER
DRAWING NO
REV
SHEET 1 OF

NOTES:

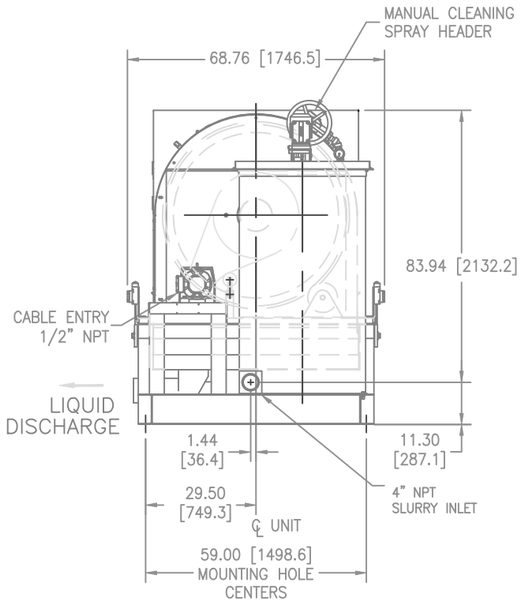
1. ALL 304 STAINLESS STEEL CONSTRUCTION EXCEPT FOR TRUNNION WHEELS, DRIVE MOTORS, DRIVE CHAIN, SPROCKETS, HANDLES, CABLE PULL SAFETY SWITCH, BEARING BLOCK AND MANUAL CLEANING SPRAY BRUSH.
2. DRIVE SPECIFICATIONS:
   - DRUM GEARMOTOR: 2 HP [1.49 kW], 1800 RPM, 230/460 V, 3 PH, 60 HZ, TEFC, SEVERE DUTY.
   - FLOC GEARMOTOR: 1/2 HP [.37 kW], 1800 RPM, 230/460 V, 3 PH, 60 HZ, TEFC, SEVERE DUTY.
   - BOOSTER PUMP MOTOR: 3 HP, [2.24 kW], 3500 RPM, 230/460 V, 3 PH, 60 HZ, TEFC, SEVERE DUTY.
3. DRUM SPEED: 10 RPM MAXIMUM
4. RECOMMENDED MINIMUM CLEARANCE TO BE 36.00 [914.4] AROUND UNIT AND 36.00 [914.4] ABOVE UNIT.
5. ALL EXTERNAL PIPING TO BE SUPPORTED INDEPENDENTLY OF THICKTECH UNIT.
6. EST. DRY WEIGHT: 5851 LB [2,660 kg]; OPERATING WEIGHT: 13,616 LB [6,189 kg]
7. TOTAL SPRAY USAGE WITH BOOSTER PUMP AT 100 PSI [6.9 BAR]: 13.00 GPM [.8 L/s]
8. THE SPRAY HEADER ASSEMBLY MAY BE ROTATED SLIGHTLY TO OPTIMIZE THE SPRAY ANGLE FOR CLEANING THE DRUM SCREEN. PROVIDE APPROXIMATELY 2 FEET OF SLACK IN THE HOSE TO ALLOW FOR POSSIBLE SPRAY HEADER ROTATION.
9. DIMENSIONS WRITTEN IN INCHES [mm] UNLESS OTHERWISE SPECIFIED.
10. CONSULT THE HYCOR® PRODUCTS GROUP OR YOUR LOCAL HYCOR PRODUCTS REPRESENTATIVE FOR AVAILABLE OPTIONS.
11. ONE (1) UNIT SUPPLIED

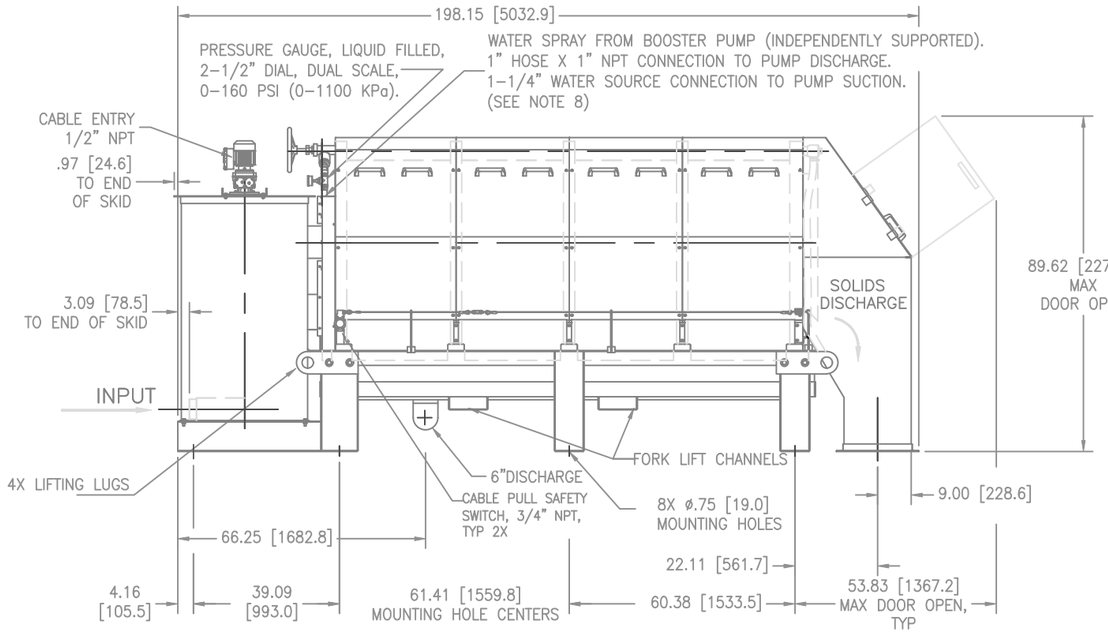


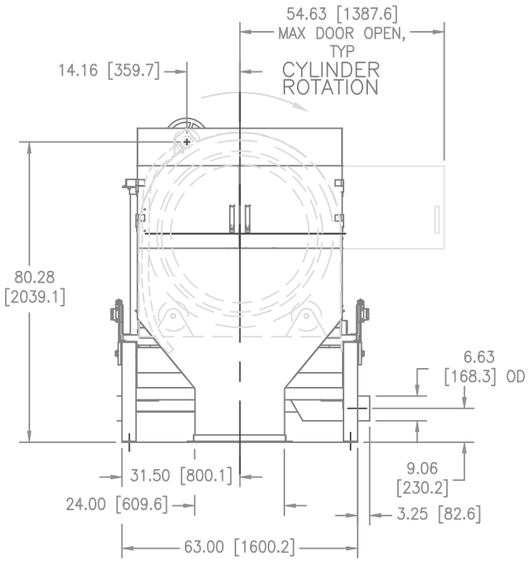
BOOSTER PUMP MOUNTING HOLE LOCATIONS
SCALE: 1/8" = 1"



PLAN VIEW







REV	DESCRIPTION	DATE	BY

__ PRELIMINARY __ APPROVAL
X INFORMATION __ CERTIFIED

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DRAWN BY	DATE
IMP	MM/DD/YY
CHECKED BY	DATE
MBK	MM/DD/YY
SCALE	SIZE
1/42"=1"	B

Parkson™

PROJECT NAME
PROJECT NUMBER
PROJECT NAME
PROJECT LOCATION

REFERENCE INFORMATION
SPECIFICATION SECTION
XX

TITLE
RDT200
HYCOR® THICKTECH™
ROTARY DRUM THICKENER

DRAWING NO.
RDT200L

REV

SHEET 1 OF 1

Parkson™
Treating Water Right

ThickTech™

Rotary Drum Thickener

- Highest performance
- Lowest cost of ownership
- Adjustable to changing sludges
- Designed to build floc
- Sludges: waste activated, primary, blends, recuperative

Why Thicken Sludge?

- **Increase digester capacity**
- **Reduce hauling costs**
- **Pre-thicken before other dewatering equipment**

Sludge thickening, for example, can reduce 192,000 gallons of sludge per day down to 13,400 gallons by thickening 0.5% feed to 7%. The higher concentration of solids equates to more pounds of solids stored in the same volume area.

The industry leading Parkson ThickTech™ Rotary Drum Thickener (RDT), with over 300 installations, consumes the lowest amount of expensive polymer while offering the highest capture rate of 98% and therefore, the lowest cost of re-treatment. Units are compact, require little operator attention and are pre-engineered for easy installation.

Why Rotary Drum Thickeners

- Fully enclosed – clean
- Odor control capability
- Smaller footprint
- Indoor/outdoor installation
- Ease of operation
- Low polymer usage
- Replace centrifuges
- Lower power costs
- Replace DAFs

Why Choose the Parkson ThickTech™

- Industry leading performance
- Quality of design
- Over 300 installations
- Designed to build floc
- Lowest polymer consumed
- Adjustable performance for changing sludges

Mobile on-site pilot testing

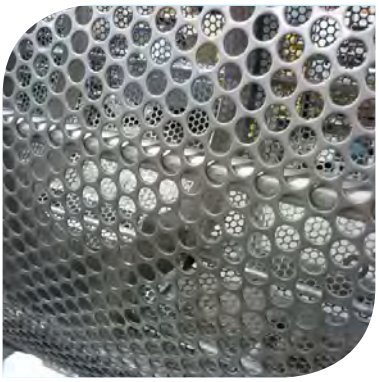
Cost Savings Through Superior Design

A 400 GPM ThickTech™ RDT can save users ~$860,000 or more in reduced polymer consumption over a 15-year period vs. a leading competitor. Savings are based on a side-by-side pilot test conducted by an independent third party.

Summary of Comparison Report
(ThickTech vs. Leading Competitor)

	Parkson	Competitor
Inlet Sludge	400 GPM @ 0.95-1.37% Solids	400 GPM @ 0.95-1.37% Solids
Thickened Sludge	6.6%	6.6%
Polymer Use	72 lbs/day	168 lbs/day
Polymer Cost (@ $2/lb)	$52,458/year $645,028/15 years*	$122,402/year $1,505,065/15 years*
	$860,037 savings	

* 3% net discount rate



How the ThickTech Outperforms Other RDTs

Superior Drum Design Controls Sludge Advancement

Staged Screens:

– Dewatering occurs in four distinct dewatering stages divided by split augers

– Woven wire mesh size can be changed between stages to maximize dewatering

Roll Bars:

– Flip sludge over for additional water removal

Woven Wire Mesh Filtration Media:

– Provides significantly more open area than wedge wire or perforated plate

– Easily removable and replaceable to match sludge

Other Special Features:

– Perforated stainless steel support media

– Split augers

– Detention rings with ports to adjust sludge detention time

– Self-cleaning spray header with booster pump

Low Shear Flocculation Tank

Tangential Inlet and Outlet: All polymer mixing occurs prior to the sludge entering the flocculation tank. The tank is where the sludge and polymer grow into a popcorn floc before entering the drum. Tangential feed and outlets promise low shear and maximize floc size.

General Performance Specifications

Capacity	50 GPM – 400 GPM (50, 100, 150, 200, 300 and 400)
Inlet	0.5% - 1.5% solids
Outlet	5% - 8% solids
Typical Polymer Usage	5-10 lbs (100% active) / ton of sludge (dry wt.)
Solids Capture	98%+ for low retreatment costs

Polymer Cost by Dose

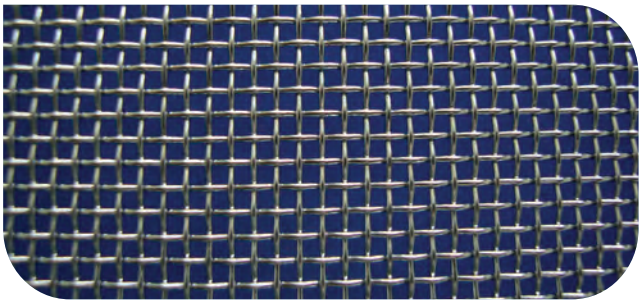
Polymer Use	Cost Over 10 Years	10-Year Difference from Base Case	
5 lbs/Dry-Ton	$520,416	$0	**Parkson ThickTech™ Dose Range**
10 lbs/Dry-Ton	$1,040,832	$520,416	
15 lbs/Dry-Ton	$1,561,260	$1,040,844	
20 lbs/Dry-Ton	$2,081,680	$1,561,264	**Polymer Dose of Competitors**
25 lbs/Dry-Ton	$2,602,100	$2,081,684	
30 lbs/Dry-Ton	$3,122,520	$2,602,104	
35 lbs/Dry-Ton	$3,642,940	$3,122,524	

* This table is based on 1,000 GPM @ 1.0% solids inlet sludge concentration

Screening Material

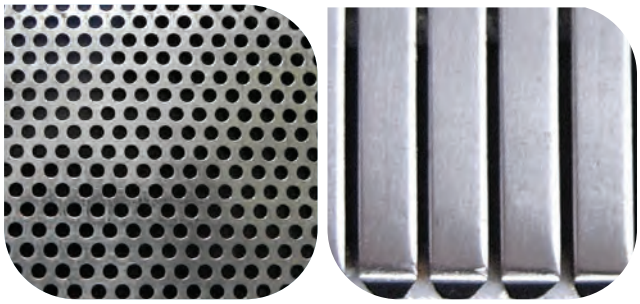
The ThickTech Way

Woven wire mesh with perpendicular openings has more open area and better water release for more efficient thickening.



The Competition

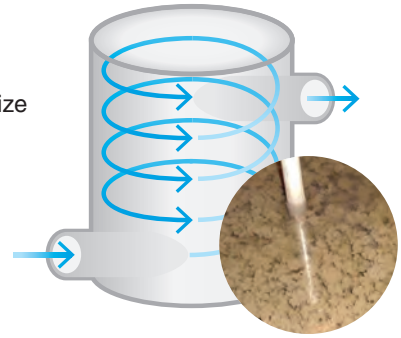
Perforated sheet and wedge wire drums have significantly less open area and lower solids capture. Multi-layered poly cloths can be hard to clean.



Flocculation Tank Design Builds a Popcorn Floc

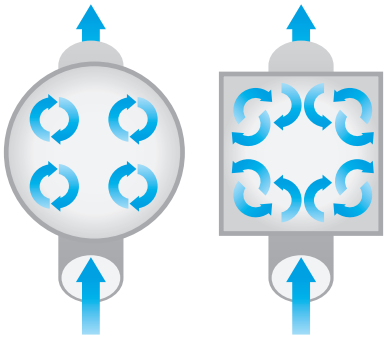
The ThickTech Way

Tangential inlet and outlet openings maximize detention time and flocculation, reducing shear from turbulence.



The Competition

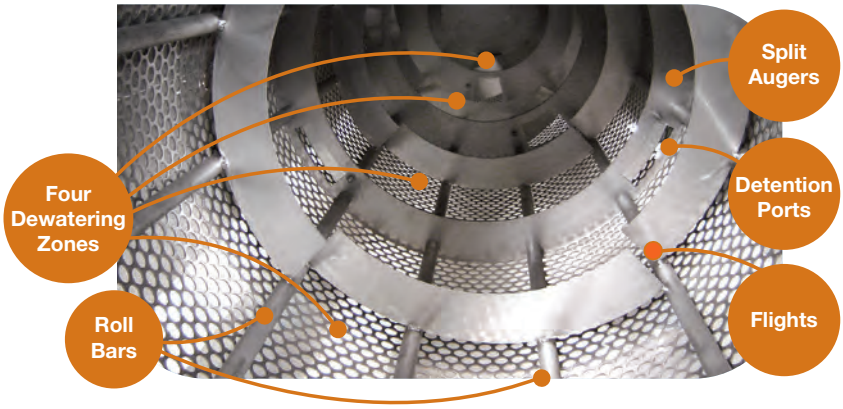
Direct inlet and outlets creates turbulence and fluid shear that break up and reduce floc development.



Internal Drum Components

The ThickTech Way

Internal drum components such as roll bars, split augers, flights and detention ports roll, flip and control sludge movement through the drum and detain sludge for maximum water release.



Parkson™
Treating Water Right

Fort Lauderdale
Chicago
Kansas City
Denver

1.888.PARKSON
technology@parkson.com
www.parkson.com

RDT

ROTARY DRUM THICKENER
INSTALLATION LIST

562 Bunker Court
Vernon Hills, IL 60061
Phone 847-816-3700
Fax 847-816-3707

PLANT/LOCATION	CITY	ST	START-UP	APPLICATION	MODEL	# Units	RDT 25	RDT 50	RDT 100	RDT 150	RDT 200	RDT 300	RDT 400
					Totals	0	0	0	0	0	0	0	0
Lincoln WWTP, AL	Lincoln	AL	2002	Thicken waste activated sludge.	RDT300	1						1	
Gold Canyon WRF, AZ	Gold Canyon	AZ	2005	Thicken waste activated sludge.	RDT150	1				1			
Penticton, BC	Penticon	BC		Thicken waste activated sludge.	RDT150	1				1			
Eastern Municipal Water District-Temecula Valley,	Temecula	CA	2007	Thicken waste activated sludge.	RDT400	1							1
Fallbrook, CA WWTP #1, CA	Fallbrook	CA	2007	Thicken waste activated sludge.	RDT150	1				1			
Holtville, CA	Holtville	CA	2017	Thicken waste activated sludge.	RDT 200L	1					1		
Salida WWTF, CA	Salida	CA	1999	Thicken primary sludge.	RDT300	1						1	
Santa Rosa	Santa Rosa	CA	2021	Thickened waste activated sludge.	RDT 300	2						2	
West County	Richmond	CA	Ordered 2021	Thicken waste activated sludge.	RDT200L	2					2		
Eastern Municipal Water District/Moreno Valley, CA	Moreno	CA	2007	Thicken waste activated sludge.	RDT400	3							3
Eastern Municipal Water District/Perris Valley, CA	Perris Valley	CA	2008	Thicken waste activated sludge.	RDT400	3							3
Eastern Municipal Water District/San Jacinto, CA	San Jacinto	CA	2011	Thicken waste activated sludge.	RDT400	3							3
Selma-Kingsburg-Fowler CSD, CA	Kingsburg	CA	2018	Thickened waste activated sludge.	RDT400	3							3
South Dundas Township/Iroquois-	Ontario	CAN	2012	Thicken waste activated sludge.	RDT100	1			1				
Barrie, City of	Barrie, Ontario	CAN	2000	Thicken waste activated sludge.	RDT400	3							3
Halifax Regional Water Commission/Eastern	Halifax, NS	CAN-NS	2012	Thicken waste activated sludge.	RDT150	2				2			
Chemical Separation Tech, Inc.	Summitville	CO	1992	Thicken mineral sludge.	RDT150	1				1			
Eagle, CO-RDT	Eagle	CO	2008	Thicken waste activated sludge.	RDT200	1					1		
Louisville WWTP, CO	Louisville	CO	2000	Thicken waste activated sludge.	RDT200	1					1		
Rocky Flats Solar Pond-Golden, CO	Golden	CO	1992	Thicken waste activated sludge.	RDT100	1			1				
US Solar Pondcrete	Rocky Flats	CO	1992	Thicken waste activated sludge,	RDT100	1			1				

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Edwards WWTP, Edwards, CO	Edwards	CO	2007	Thicken waste activated sludge.	RDT200	2					2		
Loveland, CO	Loveland	CO	2011	Thicken waste activated sludge.	RDT300	2						2	
Parker	Parker	CO	2021	Blended waste activated sludge and primary sludge	RDT200L	2					2		
South Fort Collins	South Fort Collins	CO	2020	Thicken waste activated sludge.	RDT400	2						2	
Squaw Creek WWTP, CO	Edwards	CO	1999	Thicken waste activated sludge.	RDT100	2			2				
Widefield WWTP, CO	Widefield	CO	2006	Thicken waste activated sludge.	RDT200	2					2		
Denver Metro. CO	Denver	CO	2013	Thickening biological sludge.	RDT400	3							3
Montville WWTP, CT	Montville	CT	1996	Thicken waste activated sludge.	RDT400	1							1
Plainville, CT	Plainville	CT	2019	Thicken primary, waste activated, and combined sludge.	RDT400	1							1
Windham WPCF, CT	Willimantic	CT	1997	Thicken waste activated sludge.	RDT300	1						1	
Southington, CT	Southington	CT	2016	Thicken waste activated sludge use PAC in the facility and they run two operations summer and	RDT300	2						2	
Vernon	Vernon	CT	2020	Thicken waste activated sludge and scum and primary sludge.	RDT300	2						2	
Perdue Farms, Inc.	Georgetown	DE	1994	Thicken waste activated poultry sludge.	RDT200	1					1		
Pasteurizadora Rica	Dominican Republic	DR	2004	Thicken waste activated sludge.	RDT50	1		1					
Beverage MFG	Dunedin	FL	2020	Thicken waste activated sludge.	RDT100	1			1				
Coral Springs, FL-RDT	Coral Springs	FL	2007	Thickening waste activated sludge	RDT150	1				1			
Delta Pioneer, Inc.	Sarasota	FL	1993	Thicken waste activated sludge, mobile unit.	RDT100	1			1				
Dunedin WWTP, FL	Dunedin	FL	1999	Thicken waste activated sludge.	RDT100	1			1				
Dunedin WWTP, FL	Dunedin	FL	2014	Thicken waste activated sludge.	RDT100	1			1				
Escambia County Utilities, FL Bayou Marcus WRF	Pensacola	FL	1998	Thicken waste activated sludge.	RDT300	1						1	
Florida Keys Aquaduct Authority-Little Venice	Marathon	FL	2004	Thicken SBR waste activated sludge.	RDT50	1		1					
Indian River Central	Vero Beach	FL	Ordered 2021	Thicken waste activated sludge.	RDT300L	1						1	
Indian River County, FL Central WWTP	Vero Beach	FL	1998	Thicken waste activated sludge.	RDT150	1				1			
Indian River County, FL North Regional WWTP	Vero Beach	FL	1998	Thicken waste activated sludge.	RDT150	1				1			

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Indian River County, FL-South Regional WWTP	Vero Beach	FL	1998	Thicken waste activated sludge.	RDT150	1				1			
Indian River County, FL-West Regional WWTP	Vero Beach	FL	2003	Thickening wast activated sludge.	RDT150	1				1			
Indian River County, FL-West Regional WWTP	Vero Beach	FL	2008	Thicken waste activated sludge.	RDT300	1						1	
Indian River County, FL-West Regional WWTP	Vero Beach	FL	2008	Thicken waste activated sludge.	RDT150	1				1			
Indian River South	Vero Beach	FL	Ordered 2020	Thicken waste activated sludge.	RDT150	1							
Killearn Lakes WWTP, FL	Tallahassee	FL	1998	Thicken waste activated sludge.	RDT150	1				1			
Mulberry, FL	Mulberry	FL	2011	Thicken waste activated sludge.	RDT100	1			1				
North Port WWTP, FL	North Port	FL	2003	Thicken waste activated sludge prior	RDT150	1				1			
Okaloosa County, FL/Arbennie Pritchett WRF	Pritchett	FL	2008	Thicken waste activated sludge.	RDT400	1							1
Palm Beach Co Western Regional	Palm Beach County	FL	2019	Thicken waste activated sludge.	RDT150	1				1			
Palm Beach County, FL Western Regional	Palm Beach County	FL	2014	Thicken waste activated sludge.	RDT150	1				1			
Palm Beach County, FL Western Regional #2	Palm Beach County	FL	2019	Thicken waste activated sludge.	RDT150	1				1			
Pinellas County, FL William E. Dunn WWTP	Harbor	FL	2003	Thicken waste activated sludge prior	RDT200	1					1		
Polk County, fK Southwest Regional	Winter Haven	FL	2001	Thicken waste activated sludge.	RDT150	1				1			
Polk County, FL-Central WWTP	Winter Haven	FL	2000	Thicken waste activated sludge.	RDT300	1						1	
Polk County, FL-Northeast Regional WWTF	Davenport	FL	2001	Thicken waste activated sludge.	RDT150	1				1			
Southern Garden Citrus Processing, FL	Clewiston	FL	1996	Thicken primary/secondary citrus processing sludge.	RDT300	1						1	
Tindall Hammock, FL	Tindall Hammock	FL	2013	Thicken waste activated sludge.	RDT100	1			1				
Apopka, FL East	Apopka	FL	2018	Thicken waste activated sludge.	RDT300	2						2	
Southern Garden Citrus Processing, FL #2	Clewiston	FL	1997	Thicken primary/secondary citrus processing sludge.	RDT300	2						2	
Cherokee County WSA, GA	Woodstock	GA	2005	Thickening biological sludge.	RDT100	1			1				

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Henry County, GA WSA/Walnut Creek WWTP	Henry County	GA	2009	Thicken waste activated sludge.	RDT400	1							1
Rubes Creek WRF, GA	Woodstock	GA	2004	Thicken waste activated sludge prior	RDT100	1			1				
Tyson Foods, Inc.	Cumming	GA	2000	Thicken waste activated poultry sludge	RDT100	1			1				
Villa Rica GA/West	Villa Rica	GA	2009	Thicken waste activated sludge.	RDT300	1						1	
Athens-Clarke County, GA/North Oconee- RDT	Athens	Ga	2009	Waste activated sludge	RDT400	2							2
Canton WPCP	Canton	GA	order 2021	Thicken waste activated sludge.	RDT400	2							2
Clayton County, GA Northeast WWTP	Morrow	GA	2006	Thickening waste activated sludge	RDT200	2					2		
Dekalb County, GA Pole Bridge Creek WWTP	Lithonia	GA	2002	1) Thicken waste activated sludge. 2) Thicken digested sludge.	RDT400	3							3
Gwinnett County, GA-Fort Wayne Hill WWTP	Gwinnett	GA	2014	Thicken WAS and Primary	RDT400	6							6
Hawaii Kai WWTP, HI	Honolulu	HI	1994	Thicken waste activated sludge.	RDT100	1			1				
Clinton, IA-RDT	Clinton	IA	2011	Thickening waste activated sludge	RDT400	2							2
Dubuque, IA-RDT	Dubuque	IA	2011	Thicken waste activated sludge.	RDT400	2							2
Fort Madison, IA	Fort Madison	IA	2018	Thickened waste activated sludge.	RDT200	2					2		
Des Moines WRF, IA	Des Moines	IA	2005	Thicken waste activated sludge prior	RDT400	3							3
Grafton WWTP, IL	Grafton	IL	2000	Thicken waste activated sludge.	RDT25	1	1						
Plano, IL	Plano	IL	2018	Thicken waste activated sludge.	RDT300	1						1	
Sycamore, IL -RDT	Sycamore	Il	2009	Thicken waste activated sludge	RDT400	1							1
CID Landfill, IL	Calumet City	IL	2006	Thicken waste activated sludge from landfill and waste process.	RDT150	2				2			
Itasca, IL	Itasca	Il	2010	Thicken waste activated sludge.	RDT400	2							2
Decatur, IL	Decatur city of	IL	2016	Thicken waste activated sludge.	RDT400L	3							3
Ferdinand WWTF, IN	Ferdinand	IN	1999	Thicken waste activated sludge.	RDT100	1			1				
Frankfort	Frankfort	IN	TBD 2022	Thicken waste activated sludge.	RDT400	1							1
Greensburg WWTP, IN	Greensburg	IN	2008	Thicken waste activated sludge.	RDT300	1						1	
Huntington, IN	Huntington	IN	2012	Thicken waste activated sludge.	RDT300	1						1	
Muncie WWTP, IN	Muncie	IN	2002	Thicken waste activated sludge.	RDT300	1						1	

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Richmond, IN William E Ross WWTP	Richmond	IN	2019	Thicken waste activated sludge.	RDT200	1					1		
Richmond, IN William E Ross WWTP	Richmond	IN	2019	Thicken waste activated sludge.	RDT 200L	1					1		
Westfield WWTP, IN	Westfield	IN	2005	Thicken waste activated sludge.	RDT200	1					1		
Indianola	Indianola	IN	TBD 2022	Thicken waste activated sludge.	RDT 200L	2					2		
Mooresville WWTF, IN	Mooresville	IN	2006	Secondary clarifier WAS thickened by	RDT200	2					2		
Terre Haute, IN-RDT		IN	2013	Thicken waste activated sludge.	RDT400	4							4
Tomoe Engineering Company, Ltd.	Tokyo	Japan	1998	Thicken waste activated sludge, demonstration unit.	RDT100	1			1				
Johnson County, KS/Blue River WWTP	Johnson Co	Ks	2007	Thicken waste activated sludge.	RDT400	1							1
Osawatomie, KS WWTF	Osawatomie	KS	1999	Thicken waste activated sludge.	RDT50	1		1					
Swindell Dressler, KS	Pittsburg	KS		Thicken waste activated sludge.	RDT150	1				1			
Wichita, KS Four Mile Creek	Wichita	KS	2019	Thicken waste activated sludge and recuperative thickening.	RDT400	1							1
Perdue Farms, Inc.	Cromwell	KY	1995	Thicken waste activated poultry sludge.	RDT100	1			1				
Exxon Company-Baton Rouge, LA	Baton Rouge	LA	1997	Thicken biological sludge from refinery.	RDT150	1				1			
Exxon Mobil Refinging-Chalmette, LA	Chalmette	LA	2004	Thicken biological sludge from refinery.	RDT150	1				1			
East Bridgewater, MA	East Bridgewater	MA	2000	Thicken waste activated sludge.	RDT300	1						1	
Hull WWTP, MA	Hull	MA	1995	Thicken waste activated sludge.	RDT150	1				1			
North Attleborough WWTF,	North	MA	2000	Thicken waste activated	RDT300	1						1	
North Attleborough, WWTF, MA	North Attleborough	MA	2009	Thicken waste activated sludge.	RDT300	1						1	
Freedom WTP, MD	Carroll County	MD	2004	Thicken alum sludge containing diatomaceous earth prior to	RDT200	1					1		
Hanover-Sykesville, MD	Sykesville	MD	2004	Thicken waste activated sludge.	RDT200	1					1		
Indian Head WWTP, MD	Indian Head	Md	2007	Thicken waste activated sludge.	RDT100	1			1				
Tyson Foods, Inc.	Berlin	MD	1997	Thicken waste activated poultry sludge.	RDT300	1						1	
Havre de Grace, MD-RDT	Harve de Grace	MD	2009	Sludge thickening – biological	RDT400	2							2
Genoa-Oceola WWTF, MI	Howell	MI	2002	Thicken waste activated	RDT100	1			1				
Howell WWTP Expansion. MI	Howell	MI	2001	Thicken waste activated sludge.	RDT150	1				1			
Lowell WWTP, MI	Lowell	MI	1998	Thicken waste activated sludge.	RDT150	1				1			

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Marshall WWTP, MI	Marshall	MI	2000	Thicken waste activated sludge.	RDT150	1				1			
Reed City, MI	Reed City	MI	1999	Thicken waste activated sludge.	RDT200	1					1		
Three Rivers WWTP, MI	Three Rivers	MI	2002	Thicken waste activated sludge.	RDT200	1					1		
Union Township, MI	Mt. Pleasant	MI	2001	Thicken waste activated sludge.	RDT150	1				1			
South Huron Valley, MI Utility	Rockwood	MI	1999	Thicken waste activated sludge.	RDT150	2				2			
South Lyon WWTP, MI	South Lyon	MI	2004	Thicken waste activated sludge.	RDT150	2				2			
Aitkin WWTF. MN	Aitkin	MN	2004	Thicken waste activated sludge prior	RDT50	1		1					
Fairmont WWTF, MN	Fairmont	MN	2006	Thicken waste activated sludge.	RDT100	1			1				
Hector, MN	Hector	MN	2017	Thicken waste activated sludge.	RDT100	1			1				
Jasper Products	Joplin	MO	2017	Thicken waste activated sludge from manufacturing soy milk, rice milk,	RDT400	1							1
Simmonds Poultry, MO	Southwest City	MO	2000	Thicken waste activated sludge.	RDT300	1						1	
Triumph Foods, LLC	St. Joseph	MO	2010	Thicken sludge	RDT300	1						1	
Jasper Products	Joplin	MO	2005	Thicken waste activated sludge from	RDT400	2							2
Jasper Products	Joplin	MO	2017	Thicken waste activated sludge from	RDT400	2							2
O'Fallon, MO	O'Fallon	MO	2019	Thicken waste activated sludge.	RDT300	2						2	
Republic Services Landfill Bridgeton, MO	Bridgetown	MO	2013	Leechate process sludge	RDT400	2							2
St. Louis, MO MSD/Missouri River	St. Louis MSD	MO	2012	Thicken waste activated sludge.	RDT400	4							4
East Helena WWTP, MT	East Helena	MT	2008	Thicken waste activated sludge.	RDT100	1			1				
Laurel, MT	Laurel	MT	2014	was	RDT150	1				1			
Lewistown WWTP, MT	Lewistown	MT	2005	Thicken waste activated sludge.	RDT100	1			1				
Apex, NC/Middle Creek-RDT	Apex	NC	2011	Waste activated sludge	RDT400	1							1
Dunn, NC	Dunn	NC	2011	Thicken waste activated sludge.	RDT150	1				1			
Graham WWTF, NC	Graham	NC	2001	Thicken waste activated sludge.	RDT300	1						1	
High Point, NC/Westside WWTP	High Point	NC	2010	Thicken waste activated sludge.	RDT300	1						1	

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John Umstead WWTP-Butner, NC	Butner	NC	2001	Thicken waste activated sludge.	RDT400	1							1
Little Creek WRF, MC	Clayton	NC	2007	Thicken waste activated sludge.	RDT300	1						1	
Mebane	Mebane	NC	Ordered 2021	Thicken waste activated sludge.	RDT200L	1					1		
Orange Water & Sewer Mason Farm	Orange	NC	2021	Thicken WAS and fermented primary sludge	RDT300	2						2	
Reidsville, NC	Reidsville	NC	2015	Thicken waste activated sludge.	RDT400	2							2
West Point WWTP, NE	West Point	NE	2005	Thicken waste activated sludge.	RDT100	1			1				
Northeast WWTP, NE	Lincoln	NE	2003	Thicken waste activated sludge.	RDT400	2							2
Caldwell WWTP, NJ	Caldwell	NJ	2003	Thicken combined primary and waste	RDT150	1				1			
Caldwell WWTP, NJ RDT #2	Caldwell	NJ	2010	Thicken combined primary and waste	RDT150	1				1			
East Windsor, NJ RDT	East Winsor	NJ	2010	Thicken waste activated sludge.	RDT300	1						1	
Ferro Corporation, NJ	Swedesboro	NJ	2011	510336	RDT100	1			1				
Givaudan Flavors Corporation, NJ	East Hanover	NJ	2004	Thicken waste activated sludge prior to hauling to further treatment.	RDT150	1				1			
Greenwich Twsp, Gibbstown, NJ	Gibbstown	NJ	2007	Thicken waste activated sludge.	RDT200	1					1		
Logan Township, NJ	Bridgeport	NJ	2006	Thicken waste activated sludge.	RDT300	1						1	
Monsanto	Bridgeport	NJ	1998	Thicken waste activated and thermophilic sludge.	RDT100	1			1				
United Water-Plainsboro, NJ	Plainsboro	NJ	1992		RDT150	1				1			
United Water-Plainsboro, NJ	Plainsboro	NJ	1994		RDT150	1				1			
Woodstown Sewerage Authority	Woodstown	NJ	1996	Thicken waste activated sludge.	RDT100	1			1				
Princeton Meadows WWTP, NJ	Plainsboro	NJ	1992	Thicken waste activated sludge.	RDT50	2		2					
Princeton Meadows WWTP, NJ	Princeton Meadows	NJ	Ordered 2020	Primary and Waste Activated Sludge	RDT 200L	2					2		
Rahway Valley WWTP, NJ	Rahway	NJ	2008	Thicken waste activated sludge.	RDT400	3							3
Farmington, NM	Farmington	NM	2018	Thicken waste activated sludge.	RDT400	1							1
Las Vegas, NV	Las Vegas	NM	2016	Thicken waste activated sludge.	RDT 400L	1							1
Albuquerque-Bernalillo	Alburqurque	NM	2021	Thicken waste activated sludge.	RDT 400L	4							4
Washoe, NV WWTP	Washoe, NV WWTP	NV	2015	Thicken aerobically digested sludge.	RDT150	1				1			

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North Castle, NY	North Castle	NY	2007	Thicken waste activated sludge.	RDT50	1		1					
Onadaga County, NY-Meadowbrook Limestone	Manilus	NY	1994	Thicken waste activated sludge.	RDT400	1							1
Onongaga County, NY Brewerton WWTP	Brewerton	NY	2001	Thicken aerobically digested sludge	RDT300	1						1	
Watchtower, NY	Patterson	NY	1992	Thicken primary and secondary sludge prior to	RDT50	1		1					
Fox River Paper, OH (Formerly Howard Paper	Urbana	OH	1995	Thicken paper mill sludge.	RDT150	1				1			
Oberon, OH	Trenton	OH	2014	Secondary clarifier sludge	RDT400	1							1
Piqua	Piqua	OH	2020	Thicken waste activated sludge.	RDT400	1							1
Professional Services Group,	Jones	OK	1995	Thicken waste activated sludge.	RDT100	1			1				
Midwest City, OK	Midwest City	OK	2011	Thicken waste activated sludge.	RDT100	2			2				
Tulsa, OK/Haikey	Haikey	Ok	2010	Thicken waste activated	RDT400	2							2
Tulsa, OK SSWWTP	Tulsa	OK	2007	Thicken waste activated sludge.	RDT400	3							3
Cornwall, ON Canad	Cornwall	ON	2013	Thickening waste activated sludge	RDT400	1							1
Stayton, OR-RDT	Stayton	Or	2010	Thicken waste activated	RDT400	1							1
Salem or Willow Lake	Willow Lake	OR	2020	Thicken waste activated sludge.	RDT300	2						2	
Chemical Separation Tech, Inc.	McMurray	PA	1992	Thicken mineral sludge.	RDT300	1						1	
Cherokee WWTP, Danville, PA	Danville	PA	1995	Thickening waste activated sludge.	RDT300	1						1	
Hatfield Quality Meats, PA	Hatfield	PA	2003	Sludge thickening – biological	RDT150	1				1			
Hollidaysburg, PA	Hollidaysburg	PA	2012	Thicken waste activated sludge.	RDT300	1						1	
Merck & Company, Inc.	Riverside	PA	1995	Thicken biological pharmaceutical sludge.	RDT300	1						1	
South Middleton, PA Township	South Middleton	PA	2014	Thicken waste activated sludge.	RDT100	1			1				
Towanda, PA	Towanda	PA	2008	Thicken waste activated sludge.	RDT150	1				1			
Elizabethtown WWTP, PA	Elizabethtown	PA	2002	Thicken waste activated sludge.	RDT150	2				2			
Ephrata WWTF #2, PA	Ephrata	PA	1998	Thicken waste activated sludge.	RDT100	2			2				
Scranton WWTP, PA	Scranton	PA	2002 2003	Thicken combined primary and waste activated sludge prior to	RDT50	3		3					
Cavendish Farms, PEI Canada	New Annan	PEI	2016	Thickens industrial waste sludge	RDT400	1							1
Corozal WWTP, Puerto Rico		PR	1996	Thicken waste activated sludge.	RDT50	1		1					

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Valleyfield, QC		QC	2013	Thicken waste activated sludge.	RDT300	2						2	
Vaufreuil-Dorion, QC,		QC	2016	Thicken waste activated sludge.	RDT400	2							2
Toray Plastics (America), Inc.	North Kingstown	RI	1997	Thicken biological sludge.	RDT150	1				1			
Warwick WWTP, RI	Warwick	RI	2002	Thicken aerobically digested primary	RDT300	1						1	
Warwick WWTP, RI	Warwick	RI	2014	Thicken aerobically digested primary and waste activated sludge prior	RDT300	1						1	
Grand Strand WSA, SC-Vereen WWTP	Conway	SC	2003	Thicken waste activated, primary or	RDT400	1							1
Keowee Key Utilities DBC, SC	Sales	SC	2002	Thicken waste activated sludge prior	RDT50	1		1					
Mt. Pleasant Waterworks & Sewer Commission Rifle	Mt. Pleasant	SC	1994	Thicken waste activated sludge.	RDT300	1						1	
Mt. Pleasant, SC	Mt. Pleasant	SC	1992	Water Sludge	RDT200	1					1		
Camden, SC	Camden	SC	2014	Thicken SBR waste activated sludge.	RDT300	2						2	
Gilder Creek WWTP, SC	Greenville	SC	2005	1) Thicken primary and waste activated sludge prior to	RDT400	4							4
Southwest Suburban SD/Salmon Creek, SD	Salmon Creek	SD	2008	Thicken waste activated sludge.	RDT50	1		1					
Sioux Falls	Sioux Falls	SD	Ordered 2021	Thicken waste activated sludge.	RDT400L	3							3
Cookville	Cookville	Tn	2022	Thicken waste activated sludge.	RDT400	1							1
Hallsdale-Powell County, TN-Beaver Creek WWTP	Powell	TN	2016	Sludge thickening – biological	RDT200	1					1		
Harriman, TN	Harriman	TN	2004	Thicken waste activated sludge.	RDT200	1					1		
Knob Creek WWTP-Johnson City,TN	Johnson City	TN	2003	Thicken waste activated sludge prior	RDT150	1				1			
Lebanon WWTP, TN	Lebanon	TN	1999	Thicken waste activated sludge.	RDT200	1					1		
Oak Ridge, TN	Oak Ridge	TN	2009	Thicken waste activated sludge.	RDT150	1				1			
Pigeon Forge, TN	Pigeon Forge	TN	2008	Thicken waste activated sludge.	RDT400	1							1
Smyrna WWTP, TN	Smyrna	TN	2001	Thicken waste activated sludge.	RDT400	1							1
Smyrna WWTP, TN	Smryrna	TN	Order 2019	Thicken waste activated sludge.	RDT400	1							1
All Waste, Inc. (Formerly Enviroganics, Inc.)	Stafford	TX	1986	Thicken waste activated sludge.	RDT200	1					1		

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All Waste, Inc. (Formerly Enviroganics, Inc.)	Stafford	TX	1992	Thicken waste activated sludge.	RDT50	1		1					
Alvin WWTP, TX	Alvin	TX	1996	Thicken waste activated sludge.	RDT150	1				1			
Jackrabbit Road PUD-Houston, TX	Houston	TX	2002	Thicken waste activated sludge.	RDT400	1							1
Remington Road MUD #1-Houston, TX	Houston	TX	2005	Thicken waste activated sludge.	RDT150	1				1			
Rosenberg, TX	Rosenberg	TX	2008	Thicken waste activated sludge.	RDT400	1							1
South WWTP, TX	Tomball	TX	2002	Thicken waste activated sludge.	RDT100	1			1				
Sugarland, TX	Sugarland	TX	1999	Thicken waste activated sludge.	RDT100	1			1				
Carters Creek WWTP, TX	College Station	TX	1995	Thicken waste activated sludge.	RDT100	2			2				
Cibolo Creek WWTP, TX	Shertz	TX	2006	Thickening waste activated sludge	RDT150	2				2			
Salt Lake City, UT	Salt Lake City	UT	2016	Thicken waste activated sludge.	RDT400	4							4
Frederick County, VA/Crooked		VA	2005	Thicken waste activated sludge.	RDT150	1				1			
Front Royal, VA	Front Royal, VA	VA	2017	Thicken waste activated sludge.	RDT200L	1					1		
Rapidan Service Authority-Orange County, VA	Charlottesville e	VA	2010	Thicken waste activated sludge.	RDT200	1					1		
Morningstar Foods (Dean Foods), VA	Mount Crawford	VA	2006	Thicken waste activated sludge from	RDT400	2							2
Burlington WWTP,WA Upgrade	Burlington	WA	2000	Thicken waste activated sludge.	RDT300	1						1	
Lynden WWTP, WA	Lynden	WA	2003	Thicken waste activated sludge.	RDT200	1					1		
Snoqualmie, WA	Snoqualmie	WA	2019	Thicken waste activated sludge and aerobically digested sludge.	RDT150	1				1			
Twisp WWTP, WA	Twisp	WA	2001	Thicken waste activated sludge.	RDT50	1		1					
Zillah WWTP, WA	Zillah	WA	1994	Thicken waste activated sludge.	RDT50	1		1					
Foremost Farms, WI	Plover	WI	2013	Waste Activated Sludge from Cheese	RDT200	1					1		
Procorp	Wauwatosa	WI	2005	Mobile RDT thickening; various sludge.	RDT100	1			1				
Richland Center, WI	Richland Center	WI	2016	Thicken waste activated sludge.	RDT100	1			1				
Stevens Point WWTF, WI	Stevens Point	WI	2000	Thicken waste activated sludge.	RDT150	1				1			
Wrightstown WWTP, WI	Wrightstown	WI	1998	Thicken waste activated sludge.	RDT50	1		1					
Wisconsin Rapids, WI	Wisconsin	WI	2009	WAS and Primary	RDT400	2							2
Teton Village WWTP, WY	Teton Village	WY	2006	Thicken waste activated sludge.	RDT100	1			1				
Cheyenne, WY BOPU-Dry Creek WWTP	Cheyenne	WY	2004	Thickening waste activated sludge.	RDT200	2					2		

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E. I. DuPont-Singapore	Singapore		1993	Thicken chemical plant sludge, location in Singapore.	RDT100	1			1				
Tecnoagua/Productos Sosua	Dominican Republic		2001	Thicken waste activated sludge.	RDT25	1	1						
						338	2	18	42	56	43	57	119
						%	1%	5%	12%	17%	13%	17%	35%

Water Technologies & Solutions

Proposal for the
Carmel WWTP
2PAD

submitted to:
Greeley-Hansen

December 19, 2022

proposal number: 522553 Rev.1

submitted by:
Chris Allen, P.E. - Regional Manager
Cell: (503) 307-2238
Email: chris.allen@veolia.com

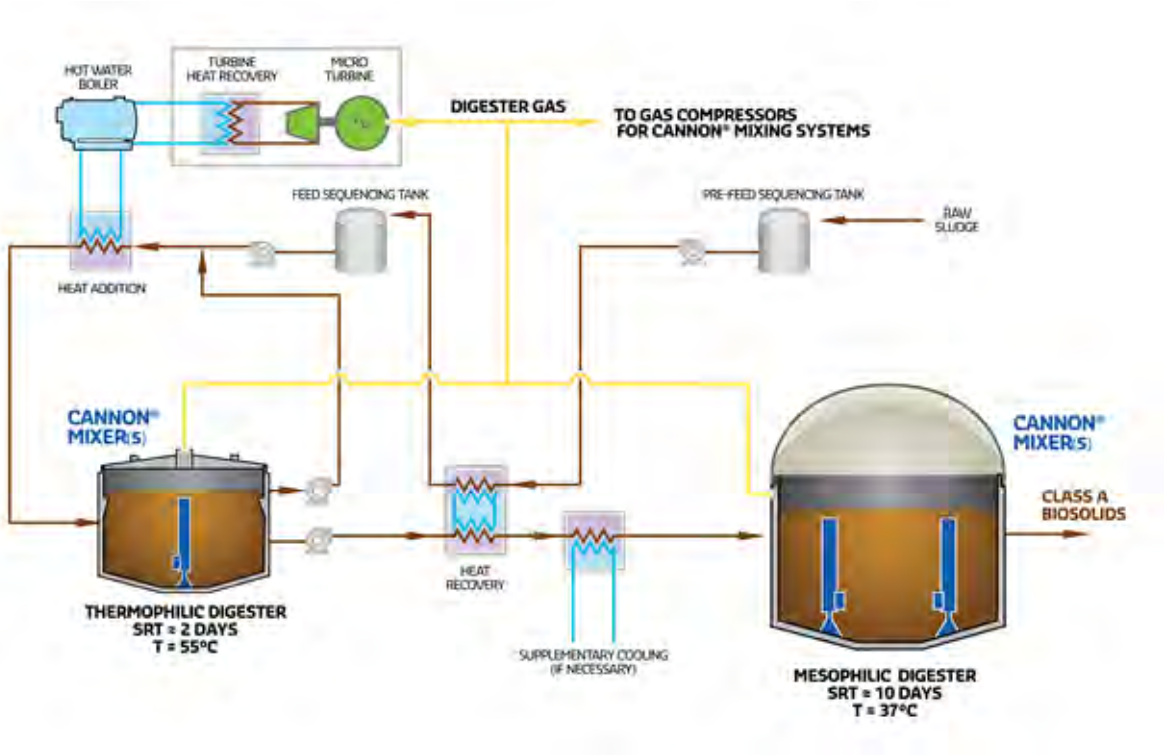
local representation by:
Coombs Hopkins

Table of Contents

1 Process Description

2PAD

The SUEZ 2PAD System is a two-phase anaerobic digestion system designed to enhance the digestion process and to satisfy Class A biosolids requirements in accordance with the EPA's 40 CFR Part 503 regulations. The 2PAD System was granted a National PFRP (Processes to Further Reduce Pathogens) Equivalency by the EPA in September 2002. This means that all of our installations will have **automatic site-specific approval for Class A biosolids**. No other two-phase anaerobic digestion process has achieved this certification.



2PAD System Process Flow Diagram

Basically, two key sequential phases take place in anaerobic digestion, the acidogenesis and methanogenesis phases (the acid forming and methane forming phases). In conventional anaerobic digestion, these two separate phases occur in the same tank, so there is a sacrifice in process efficiency. The acid forming bacteria do develop much faster than the methane forming bacteria and are much less sensitive to process changes. In the 2PAD System, these two phases occur in separate digester tanks in series, with the first phase carried out at a thermophilic temperature of 132°F (55°C). Thermophilic temperatures maximize pathogen destruction, as well as lower detention times due to the increased rate of biological reactions. The second phase digesters (**typically existing**) are operated at mesophilic temperature of 98°F (35°C).

Conventional low rate anaerobic digestion system operates at a volatile solids loading rate of 0.04 to 0.1 lbs./ft3.d, while a high rate system is known to operate at loading rates of 0.1 to 0.2 lbs/ft3.d. The 2PAD process is considered an **advanced high rate** anaerobic digestion system, a typical 2PAD system operates at up to 8% total solids (TS) concentration sludge, with volatile solids (VS) loading rate greater than **0.75 lbs/ft3.d** (12 kg/m3.d) in **thermophilic** acid phase and greater than **0.125 lbs/ft3.d** (2 kg/m3.d)

in **mesophilic** gas phase. The typical sludge retention times (SRT) of 2 days for thermophilic acid phase and a little over 10 days for the mesophilic gas phase for a combined 13 days SRT is sufficient for the process to achieve Class A biosolids.

The 2PAD process converts greater than 55% volatile solids (VS) into biogas, with feedstock of at least 70% VS, the process yields about two times as much of biogas than conventional mesophilic anaerobic digester. See table below for details:

Example gas production assuming sludge feed / day of 25,000 GPD @ 4.5% TS and 70% VS				
	Biogas Conversion (Ft^3 /Lbs. VSR)	VSR (%)	Estimated Gas Production (Cu. Ft./Hour)	Delta (%)
2PAD	19	>55	3,064	**+ 88%**
Conventional Mesophilic	15	>37	1,627	

The 2PAD process is semi-batch with **two**, **three** or four **sludge feedings per day** to the system. The process is operated in a draw and fill mode and relies on SUEZ's Cannon Mixer ® System for its mixing, which ensures the calculated active digestion volume shall be greater than 90% of the total digester volume. Also, the process optimized for minimum energy consumption as the digester with a low detention time is operated in the thermophilic range.

KEY BENEFITS:

1. The digested biosolids will meet Class A requirements according to the EPA's 40 CFR Part 503 regulations. As already indicated, the EPA has granted the 2PAD System a Conditional National PFRP Equivalency, with automatic site-specific Class A approval for our installations.
2. Gas production from the mesophilic digester will be significantly higher than conventional anaerobic digestion.
3. The total hydraulic retention time is reduced compared to conventional anaerobic digestion. This means that total digester volumes can be reduced and/or sludge loading rates can be increased.
4. Foaming associated with mixed primary and waste activated sludge is virtually eliminated. Nocardia bacteria, which can be present in waste activated sludge and is the cause of most digester foaming, is a mesophilic organism and the thermophilic first stage destroys this bacteria.
5. Both phases will be completely mixed by the Cannon® Mixing System. This will ensure (SUEZ will guarantee) an active volume of greater than 90%, as required for Class A digestion processes.
6. Aeration is not required in either stage, so the energy requirements are low.
7. Optional optimization of biogas and use of micro turbine to generate electricity may offset the power requirement for the entire 2PAD system making it self reliant and possibly a net producer of electricity (qualify for green credits) with zero (0) carbon footprint.

SUMMARY:

- Optimizes digestion process by splitting acid and gas phases
- Designed to produce Class A biosolids (fertilizer)
- Optimized for maximum biogas production (cogeneration)
- Certified National PFRP Equivalency Automatic "Site-Specific" Approval
- Designed to use existing infrastructure to minimize new construction

2 Design Basis

The following is the summary of design, sizing and scope of supply for the 2PAD System:

General Information	
Type of Screening	PLEASE ADVISE
Type of Grit Removal	PLEASE ADVISE
Total Flow to Digesters	23,000 gpd
Type of Sludge	Combined Primary and WAS
Sludge % Solids	2.2%
Sludge % Volatile Solids	75%
Estimated Viscosity of Sludge	300 cps at shear rate of 6 seconds^{-1}
Minimum Raw Sludge Temperature	45°F*
Maximum Raw Sludge Temperature	65°F*
Number of Sludge Feeding Cycles per Day	3

*Assumed value.

Design of Feed Sequencing Tank	
Number of Digesters	1 (new)
Diameter	8 ft
Sidewater Depth	24 ft

Design of Thermophilic Digester	
Number of Digesters	1 (new)
Diameter	20 ft
Sidewater Depth	24 ft
Depth of Cone	2.5 ft
Type of Cover	Fixed
Detention Time, Actual	2.28 days
Digester Temperature	55°C

Design of Mesophilic Digester	
Number of Digesters	1 (new)
Diameter	46 ft
Maximum Sidewater Depth	24 ft
Minimum Sidewater Depth	20 ft

Depth of Cone	5.75 ft
Detention Time, Actual	11.85 days
Digester Temperature	37°C

3 Scope of Supply

3.1 Scope of Supply - SUEZ

SUEZ proposes to furnish the following equipment and services for the 2PAD System:

QTY	ITEM
1	24" Cannon® Mixers for thermophilic digester, each consisting of a non-clog piston bubble generator, draft tube, floor support bracket and fittings. Each mixer will be fabricated of mild steel, 1/4" minimum thickness, except the bubble generator which is fabricated of Type 304 stainless steel, 1/8" thickness. Carbon steel will be prepared by sandblasting followed by two shop coats of epoxy paint.
3	24" Cannon® Mixers for mesophilic digester, each consisting of a non-clog piston bubble generator, draft tube, floor support bracket and fittings. Each mixer will be fabricated of mild steel, 1/4" minimum thickness, except the bubble generator which is fabricated of Type 304 stainless steel, 1/8" thickness. Carbon steel will be prepared by sandblasting followed by two shop coats of epoxy paint.
2	Compressor assembly to be located in a digester building. Compressor assembly will include the following components shipped loose for field assembly by others: liquid ring rotary compressor with explosion proof motor, guard, baseplate, discharge moisture separator, inlet flame arrester, inlet sediment trap seal water line accessories, discharge check valve, inlet and outlet pressure gauges and high/low pressure safety controls.
2	Gas flow balancing system consisting of one gas flow meter, one pressure gauge, one balancing valve and isolation valves for each mixer. The components for the gas flow balancing system will be shipped loose for field assembly and piping by others.
LOT	Pumps: Raw Sludge Feed to Feed Sequencing Tank, Sludge Feed from Feed Sequencing Tank, Sludge Transfer to Mesophilic Digesters, Recirculation Pump for Heat Recovery Exchanger, Hot water pump for Mesophilic Heating Jackets (sludge pumps will be progressive cavity type and water pumps will be centrifugal)
LOT	Inline Grinder/Macerators: Raw Sludge Line before the heat recovery system, Thermophilic Digester discharge line before the heat recovery system
LOT	Hot Water Boiler & Accessories: Constructed in accordance with ASME Boiler Code requirements. Boiler will include the following accessories and is factory assembled, tested, and shipped to jobsite as one assembly (except the gas train): operating control and low water cutoff, pressure and temperature gauges, ASME relief valve, drain valve, natural gas train, burner with automatic fuel changeover, burner control panel NEMA 12 enclosure. The following auxiliaries will be provided but shipped separately: boiler air-troll fitting, air separator, bladder expansion tank assembly, pressure reducing anti-siphon check valve, and chemical feeder tank (for boiler make-up water).
3	Tube-in-shell external heat exchangers. One (1) Heat Recovery Heat Exchanger to cool down the thermophilic sluge and to heat the raw sludge prior to the thermophilic phase. The heat recovery train will consist of a pair of sludge-to-water heat exchangers transferring the heat by means of an intermediate water loop. One (1)

	Thermophilic Digester Heat Exchanger for the Thermophilic Digester to maintain the digester temperature at 55^{O}C. One (1) Supplementary Cooling Heat Exchanger for the cooling of the hot thermophilic sludge when required (summer months).
LOT	Internal Heating System for Mesophilic Digester – each mesophilic digester will be provided with 3-way blending valve, temperature regulator, balancing valves, hot water heating jacket for each mixer, balancing and flow set valves, and circuit setters.
LOT	Automatic knife gate valves suitable for wastewater sludge: outlet feed sequencing tank, inlet sludge mesophilic digesters.
LOT	Local Instrumentation: Level transmitter for each digester and Feed Sequencing Tank, Temperature transmitters for thermophilic digester (top and bottom), including thermowells, each mesophilic digester, including thermowell, inlet feed sequencing tank, additional temperature transmitters as required, local temperature and pressure indicators as required.
LOT	Control Panel: NEMA 12, 72” W x 12” D x 72” H, Allen Bradley SLC-500 PLC, PC running In Touch Wonderware software, graphic overview of equipment, equipment failure status, alarm screen, alarm setpoints, process timers and counters setpoints, process indicating and recording as required, ControlNet communication card to enable communication with the customer’s SCADA system (if required), terminal blocks in the control panel for hard-wiring connections to field mounted devices, phone modem to enable dial-up remote communication to PLC, and UPS to power the PLC through momentary power interruption.
LOT	Detailed engineering design for 2PAD system only
LOT	Freight to the jobsite
LOT	Electronic O&M Manuals
30	Field Service Days of a SUEZ field service representative for installation inspection, commissioning and training in no more than five (5) trips. Additional days of field service are available on a per diem basis at $1,500/Day, plus travel expenses

3.2 Scope of Supply – By Others

The following items, but not limited to, shall be provided by Others:

- Installation of any kind and unloading & placement of equipment.
- All concrete and civil works of any kind.
- All civil, mechanical, electrical and plumbing works.
- Digester building
- Tanks
- All anchor bolts and mounting hardware not specified herein.
- All piping, piping supports and manual valves.
- Gas safety not listed in proposal.
- Biogas treatment, storage, or CHP system.
- Sludge pumps, water/hot water pumps not listed in the proposal.
- Pressurized air pump for pneumatics.
- Temporary sludge treatment/hauling

- Wiring and motor starters.
- Instruments not listed in the proposal.
- Spare parts
- Utility tie-in
- All other necessary equipment and services not otherwise listed as specifically supplied by SUEZ.

4 Commercial

4.1 Pricing

Equipment and service pricing

Purchase Price	
SUEZ Scope of Supply	$1,755,000 USD

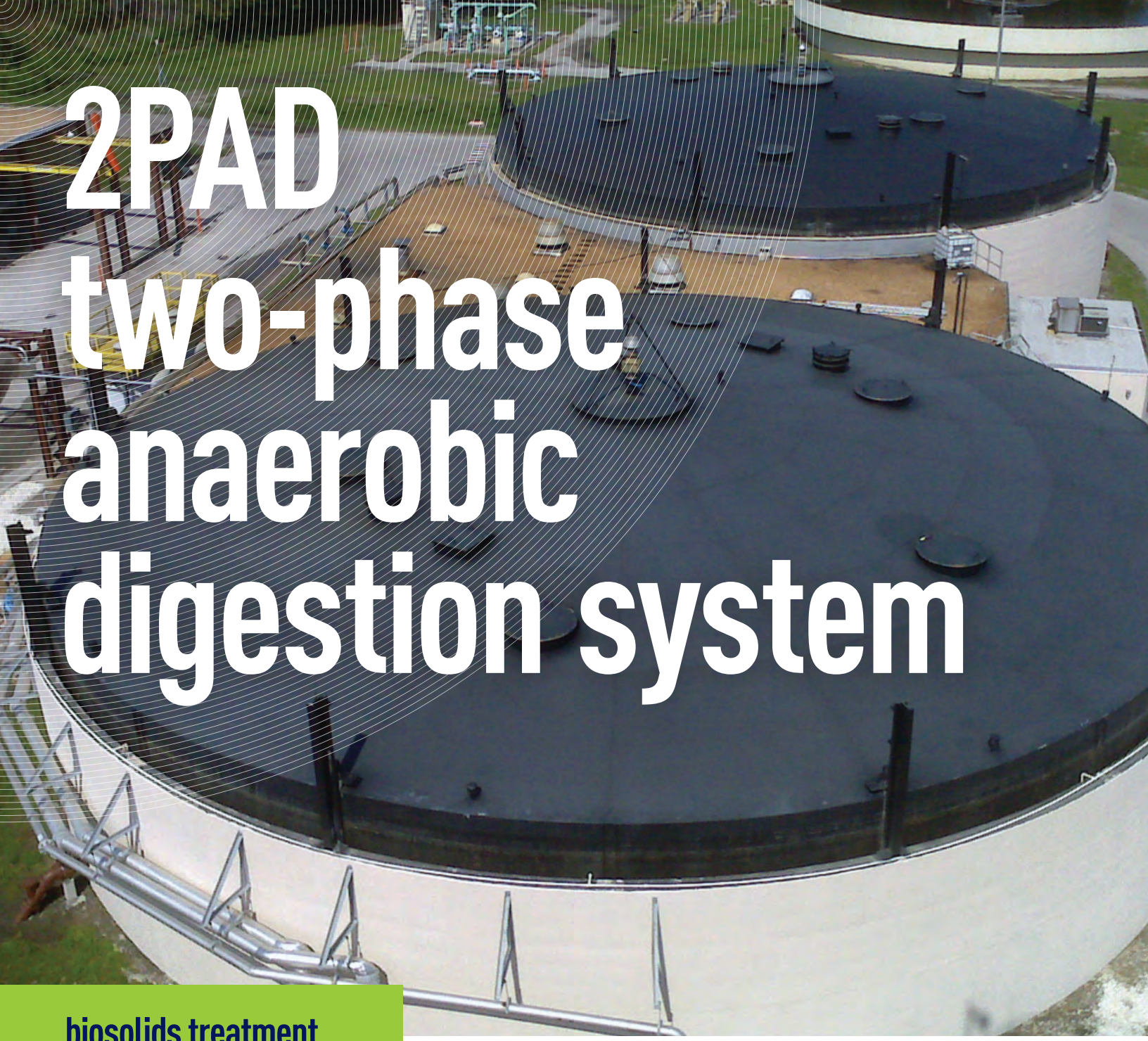
Payment Terms	
10%	Net Cash, Payable in thirty (30) days from date of submittal of initial drawings for approval
85%	Net Cash, Payable in progress payments thirty (30) days from dates of respective shipments of the Products
5%	Net Cash, Payable in thirty (30) days from Product installation and acceptance or sixty (60) days after date of final Product delivery, whichever occurs first

4.2 Freight Terms

The following freight terms used are as defined by INCOTERMS 2010.

All pricing is DDP to project site.

Appendix A. Brochure



2PAD two-phase anaerobic digestion system

biosolids treatment

APPLICATIONS
- municipal sludge treatment
- industrial sludge treatment

MAIN CHARACTERISTICS
- produces Class A biosolids
- makes digestion process more efficient

a unique two-phase anaerobic digestion system that produces Class A Biosolids, which can be land-applied without restrictions

ready for the resource revolution

suez

biosolids technology: 2PAD

Whether you are retrofitting an existing plant or building a new one, the 2PAD System is ready to take your sludge to a new class - Class A Biosolids.

This unique two-phase anaerobic digestion system produces Class A Biosolids, which can be land - applied without restrictions in accordance with the EPA's 40 CFR Part 503 regulations.

Our innovative process separates the acid - and methane - forming digestion phases (acidogenesis and methanogenesis), increasing the efficiency of both and, combined with the high temperature, destroys the pathogens to below detectable limits. A two - year pilot study confirmed the effectiveness of the 2PAD System to meet EPA requirements for Class A Biosolids. In fact, the 2PAD System has been granted "PFRP Conditional National Equivalency" by the Environmental Protection Agency, as recommended by the Pathogen Equivalency Committee.

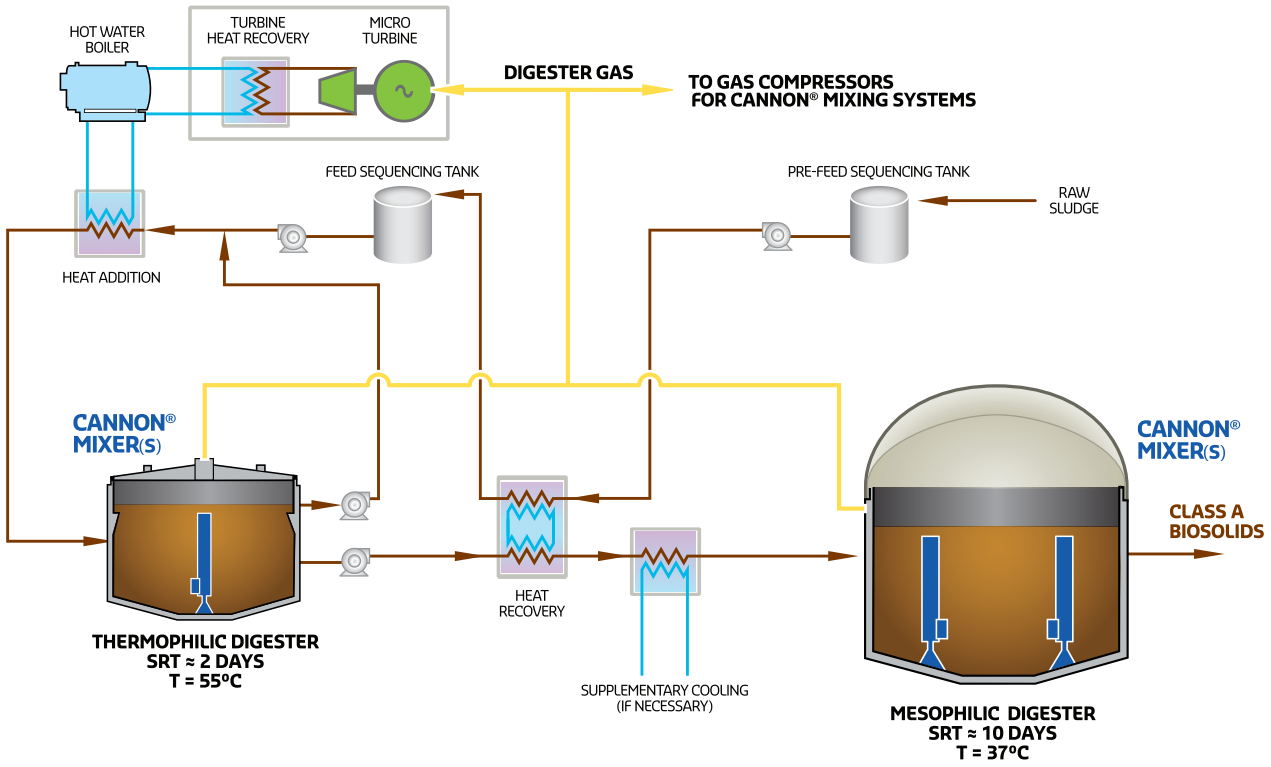
main features

- **produces class A biosolids, which are bio-safe and can be land-applied without restrictions**
- **Separating the acid- and methane-forming phases makes the digestion process more efficient and more effective**
- **Aeration is not required, so energy costs are low**
- **Total hydraulic retention time is greatly reduced, which means smaller digesters can be used and associated costs are lower**
- **Foaming is virtually eliminated because nocardia bacteria, the typical cause of digester foaming, is destroyed in the thermophilic stage**

process

- Raw sludge is heated as it passes through a heat recovery exchanger and then enters a thermophilic digester where it is held for two days and reaches a temperature of 55°C, maximizing pathogen destruction.
- The discharge goes through the heat recovery exchanger to cool the sludge, recover the heat, and partially heat the raw sludge.
- The cooled sludge is pumped into a mesophilic digester for ten days, where volatile solids are destroyed and gas is produced.
- The result is Class A Biosolids, which can be land - applied without restrictions.

2PAD process



equipment list

- Cannon Mixing System for each digester tank (complete mixing is critical for Class A approval)
- Heating equipment, including boiler, heat recovery exchanger, and other heat exchangers as required
- Gas safety and handling equipment
- Transfer pumps
- Digester covers
- PLC control system

2PAD

two-phase anaerobic digestion system

integrated treatment solutions

As a full treatment line specialist, SUEZ draws upon a broad portfolio of proven technologies to assist industries and municipalities meet their water and waste water treatment challenges. We provide integrated equipment solutions and services for a wide range of applications:

- **industrial water and wastewater**
- **municipal drinking water**
- **municipal wastewater**
- **biosolids management**

We also offer global expertise in the design, build, operation and maintenance of water treatment plants and systems, all delivered to your specific demands.

piloting

SUEZ in North America offers pilot systems and services for this and many other of our product offerings. Pilot studies are a practical means of optimizing physical-chemical and biological process designs and offer the client several benefits, such as:

- **proof of system reliability**
- **optimal design conditions for the full-scale system**
- **raw water lab analysis**
- **regulatory approval**

Please contact us if you would like to learn more about pilot studies for this system.

services

Aftermarket

SUEZ in North America sells parts and components for most SUEZ brand equipment as well as parts for demineralizers, thickeners, nozzles, pressure filters, and valves. We offer reliable spare parts at competitive prices. We maintain records of previous installations to quickly identify your requirements. Many items are shipped directly from stock for quick delivery.

Rebuilds, Retrofits and Upgrades

SUEZ in North America offers cost-effective rebuilds and upgrades for SUEZ provided systems, no matter what year they were built. If you are interested in an economical alternative to installing a whole new system, contact us for a proposal.

If interested in this product, check out some of our complementary products:

- **ABW® Automatic Backwash Filter**
- **AquaDAF® Clarifier**
- **Cleargreen®**
- **Densadeg® Clarifier/Thickener**
- **Ferazur®/Mangazur®**
- **Meteor® IFAS/MBBR**
- **Ultragreen™**
- **Climber Screen®**
- **Vortex®**
- **2PAD**
- **Thermylis® HTFB**

contact

SUEZ
8007 Discovery Drive
Richmond, VA 23229 USA
Tel. : +1 804 756 7600
Fax : +1 804 756 7643
sales.usa@suez-na.com

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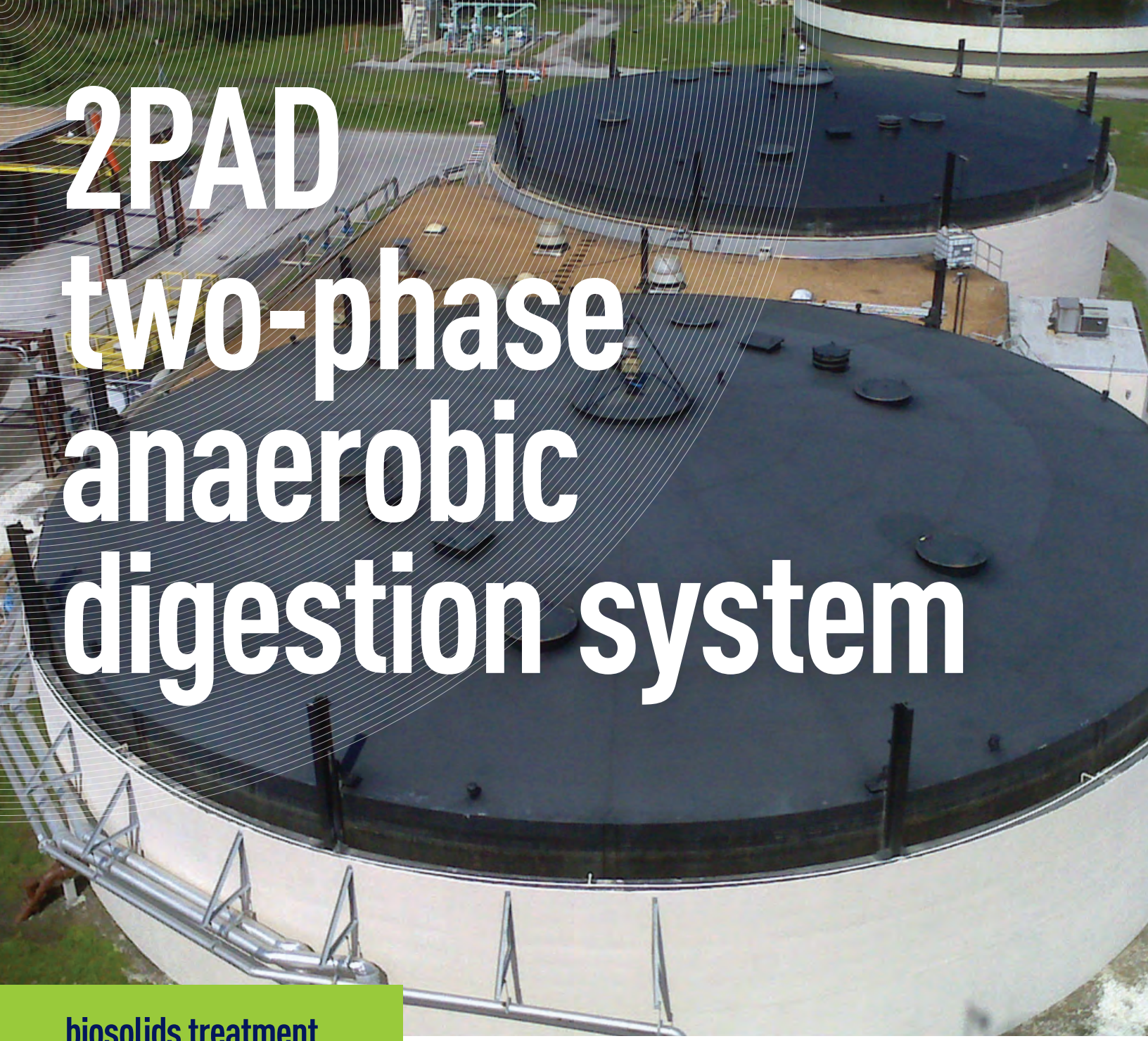

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Whether you are retrofitting an existing plant or building a new one, the 2PAD System is ready to take your sludge to a new class - Class A Biosolids.

This unique two-phase anaerobic digestion system produces Class A Biosolids, which can be land - applied without restrictions in accordance with the EPA's 40 CFR Part 503 regulations.

Our innovative process separates the acid - and methane - forming digestion phases (acidogenesis and methanogenesis), increasing the efficiency of both and, combined with the high temperature, destroys the pathogens to below detectable limits. A two - year pilot study confirmed the effectiveness of the 2PAD System to meet EPA requirements for Class A Biosolids. In fact, the 2PAD System has been granted "PFRP Conditional National Equivalency" by the Environmental Protection Agency, as recommended by the Pathogen Equivalency Committee.

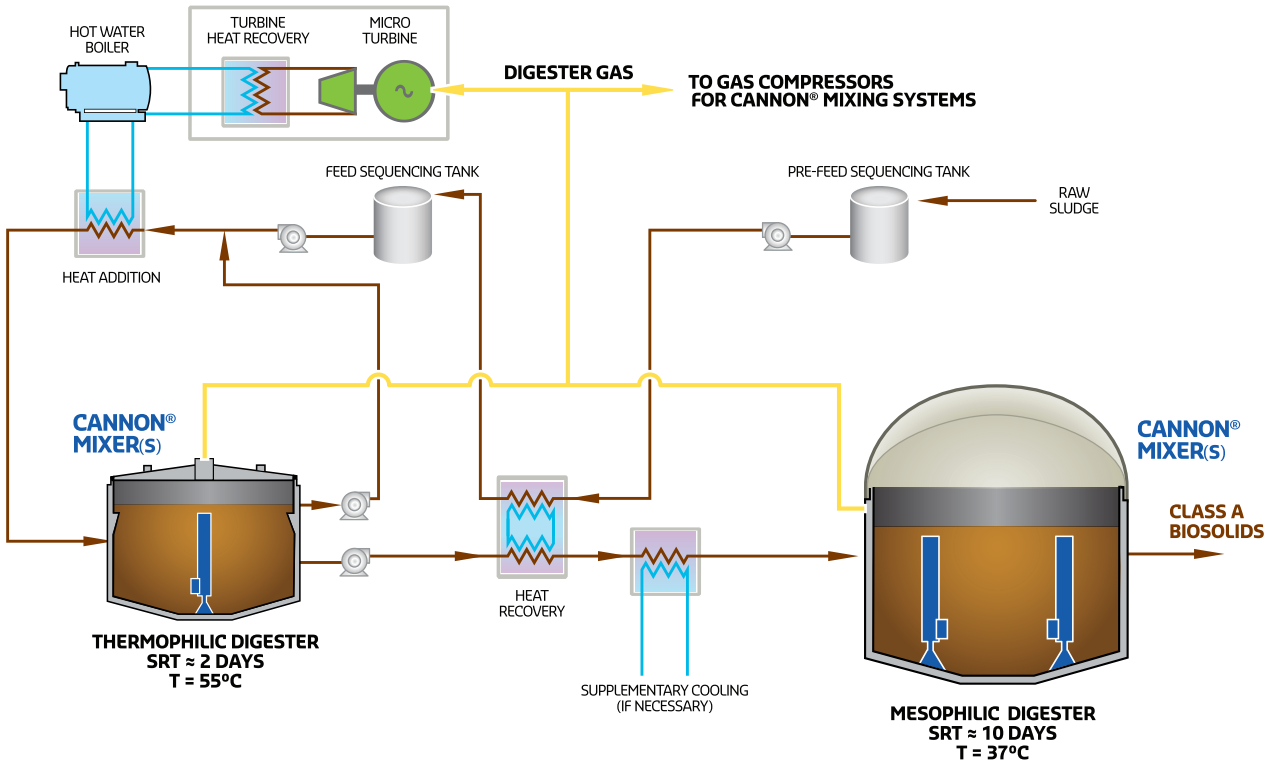
main features

- **produces class A biosolids, which are bio-safe and can be land-applied without restrictions**
- **Separating the acid- and methane-forming phases makes the digestion process more efficient and more effective**
- **Aeration is not required, so energy costs are low**
- **Total hydraulic retention time is greatly reduced, which means smaller digesters can be used and associated costs are lower**
- **Foaming is virtually eliminated because nocardia bacteria, the typical cause of digester foaming, is destroyed in the thermophilic stage**

process

- Raw sludge is heated as it passes through a heat recovery exchanger and then enters a thermophilic digester where it is held for two days and reaches a temperature of 55°C, maximizing pathogen destruction.
- The discharge goes through the heat recovery exchanger to cool the sludge, recover the heat, and partially heat the raw sludge.
- The cooled sludge is pumped into a mesophilic digester for ten days, where volatile solids are destroyed and gas is produced.
- The result is Class A Biosolids, which can be land - applied without restrictions.

2PAD process



equipment list

- Cannon Mixing System for each digester tank (complete mixing is critical for Class A approval)
- Heating equipment, including boiler, heat recovery exchanger, and other heat exchangers as required
- Gas safety and handling equipment
- Transfer pumps
- Digester covers
- PLC control system

2PAD

two-phase anaerobic digestion system

integrated treatment solutions

As a full treatment line specialist, SUEZ draws upon a broad portfolio of proven technologies to assist industries and municipalities meet their water and waste water treatment challenges. We provide integrated equipment solutions and services for a wide range of applications:

- **industrial water and wastewater**
- **municipal drinking water**
- **municipal wastewater**
- **biosolids management**

We also offer global expertise in the design, build, operation and maintenance of water treatment plants and systems, all delivered to your specific demands.

piloting

SUEZ in North America offers pilot systems and services for this and many other of our product offerings. Pilot studies are a practical means of optimizing physical-chemical and biological process designs and offer the client several benefits, such as:

- **proof of system reliability**
- **optimal design conditions for the full-scale system**
- **raw water lab analysis**
- **regulatory approval**

Please contact us if you would like to learn more about pilot studies for this system.

services

Aftermarket

SUEZ in North America sells parts and components for most SUEZ brand equipment as well as parts for demineralizers, thickeners, nozzles, pressure filters, and valves. We offer reliable spare parts at competitive prices. We maintain records of previous installations to quickly identify your requirements. Many items are shipped directly from stock for quick delivery.

Rebuilds, Retrofits and Upgrades

SUEZ in North America offers cost-effective rebuilds and upgrades for SUEZ provided systems, no matter what year they were built. If you are interested in an economical alternative to installing a whole new system, contact us for a proposal.

If interested in this product, check out some of our complementary products:

- **ABW® Automatic Backwash Filter**
- **AquaDAF® Clarifier**
- **Cleargreen®**
- **Densadeg® Clarifier/Thickener**
- **Ferazur®/Mangazur®**
- **Meteor® IFAS/MBBR**
- **Ultragreen™**
- **Climber Screen®**
- **Vortex®**
- **2PAD**
- **Thermylis® HTFB**

contact

SUEZ
8007 Discovery Drive
Richmond, VA 23229 USA
Tel. : +1 804 756 7600
Fax : +1 804 756 7643
sales.usa@suez-na.com

042016

Project Name: Carmel Area Wastewater District Dewatering

ALDEC 45 Decanter Centrifuge for Sludge Dewatering

Alfa Laval Reference No. 0255008
September 16, 2022
Quote Validity: 30 Days

Prepared by:

Patrick Tung
Application Engineer
Patrick.tung@alfalaval.com

Alfa Laval, Inc.
804-222-5300
5400 International Trade Drive
Richmond, VA 23231

Prepared for:

Val Frenkel and Bernardo Vazquez-Bravo

Greeley and Hansen

Date: September 16, 2022

PROJECT NAME **Carmel Area Wastewater District**

OUR REFERENCE **0255008**

Dear Mr. Frenkel and Mr. Vazquez Bravo,

Thank you for your enquiry. We are pleased to enclose our non-binding Budget Quotation for **Two (2) ALDEC 45 Decanter Centrifuges** for the **Carmel Area Wastewater District Dewatering** project.

As part of Alfa Laval's dedication to continuous innovation, the ALDEC Decanter Centrifuge is the industry benchmark for dewatering and thickening in wastewater treatment. In summary…

- **ALDEC decanters deliver greater operational efficiency,** allowing for increased sludge treating capacity or dryer sludge cake for reducing sludge disposal costs.
- **Lowest energy consumption,** with optimized motors & drives, delivering the lowest installed power and energy consumption.
- **Low maintenance costs,** with reduced planned maintenance and easily replaceable wear parts.

Alfa Laval offers unrivalled **24-hour service agreements**, placing your needs as close as a phone call away! Our certified field service engineers are available for installation, commissioning, maintenance, repairs, and process optimization. Additionally, Alfa Laval provides original equipment manufacturer (OEM) parts direct from our US Distribution Center in Indianapolis.

As requested, we have included the scope of supply and applicable process guarantees based on the defined influent sludge parameters. Technical details along with dimensional drawing for the proposed centrifuge including weights, bowl diameter, speed, installed power, power consumption and G-Force are enclosed in the proposal.

Alfa Laval recommends the described equipment per the outlined technical specifications, and additional clarifications for greater understanding of the offer. We trust that we have interpreted your requirements correctly and shall be pleased to provide any additional information which may be required in support of our proposal.

Note: Kindly indicate our Quotation Reference in your Purchase Order/ Letter of Acceptance/ Sales Contract and all our correspondences if the order is confirmed to us.

Best Regards,
Marc Perratore

Marc Perratore
Regional Sales Manager – Water Separation Sales
Alfa Laval Food & Water Division

Cc: Brad Leidecker / Coombs – Hopkins <Brad@chcwater.com>

CONTENTS

1. ALFA LAVAL

1.1. About us

Alfa Laval is a leading global provider of separation, heat transfer, and fluid handling technology. Founded in 1883 and for more than 130 years, we have built a global presence with service centers and partners in nearly 100 countries. This offers local expertise, supported by the global breadth and depth of Alfa Laval. With these as its base, Alfa Laval aims to help enhance the productivity and competitiveness of its customers in various industries all over the world. Alfa Laval – Our Company.

1.2. Wastewater Separation Technologies

Alfa Laval has been manufacturing Municipal Water and Wastewater decanters centrifuges for over 50 years. There are 50,000+ units operating worldwide, with 5,000+ in the US. We remain committed to being the technology leader in design innovations, delivering reduced power & polymer consumption, increased cake dryness, and increased capacity within the same footprint. Alfa Laval - Municipal wastewater treatment

- Decanter Centrifuge
- Belt Filter Press
- Gravity Belt Thickener
- Rotary Drum Thickener
- Plate & Frame Press
- Tertiary Water Filtration
- SBR / MBR / Pkg. Plants

1.3. Lab & Pilot Testing

Alfa Laval's DNA is to continuously bring value to our customers. Our state-of-the-art wastewater laboratory, located in the Houston, TX service center; allows Alfa Laval to analyze the optimal technology for your specific separation requirements. Additionally, Alfa Laval provides separation equipment available for on-site field testing and demonstration. These include decanter centrifuge, rotary drum filter, and belt press.

1.4. Always at Your Service:

- 24/7 Support
- 75+ Authorized Service Providers
- 4 - USA Service Centers -
- Indianapolis US Parts Distribution Center
- OEM Parts – 450,000+ Spare Parts in Stock
- 50+ Field Technicians
  Alfa Laval - Service and support in the USA

1.5. Spare Parts

A smart choice

Boost productivity and maximize uptime with quality genuine parts from Alfa Laval. With easy access to a broad range of long-lasting high-quality parts, you can lower your total cost of ownership and preserves the value of your equipment throughout its entire life cycle.

Available everywhere

Through our global service network, you have easy access to our extensive genuine spare parts inventory through 11 major Alfa Laval distribution centers.

Alfa Laval maintains an extensive inventory of spare parts that supports our current product range as well as some legacy parts, which are up to 100 years old. Our parts inventory system contains specific information, such as technical details and availability, for more than 450,000 parts, and we have more than 50,000 unique items in stock.

The Americas are conveniently served through the American Distribution Center (AMDC), which is centrally located in Greenwood, IN, USA.

Alfa Laval AMDC
200 South Park Blvd
Greenwood, IN 46143

Unmatched quality

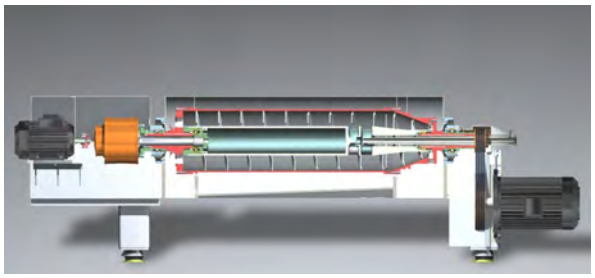
Designed for durability, reliability and productivity, our parts deliver outstanding performance time and time again. Manufactured to precise specifications, Alfa Laval parts have proven performance in our material and test laboratories as well as in process lines around the world.

Traceability and certification

Parts are continuously improved to meet the highest standards and comply with various certification requirements and regulations, such as REACH.
Alfa Laval - Spare parts

2. ALDEC CENTRIFUGE GENERAL DESCRIPTION

See how it work in less than 2 minDecanter Animation Dewatering

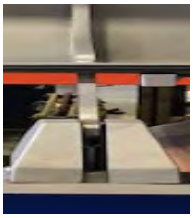


The ALDEC Decanter Centrifuge is an open, non-pressured horizontal decanter centrifuge. It features a solid horizontal bowl and scroll type conveyor, with counter current flow design. The centrifuge is designed and built to operate continuously at a maximum g-force. All parts of the centrifuge in contact with the process material are made of type Duplex stainless steel or AISI 316 stainless steel except O-rings, seals, feed tube and abrasion resistant materials. Process seals and other O-rings and seals are made of nitrile rubber, unless otherwise specified. The feed tube is fabricated from AISI 316 stainless steel. Alfa Laval - ALDEC

Frame and Casing Assembly

- The frame and casing are a box beam profile type with integral casing with or without hinges.
- The material of the casing and cover is AISI 316 stainless steel.
- The inside surface of the casing consists of stainless-steel liners in the discharge areas and a painted surface in the neutral compartment.
- Casing gaskets are of nitrile rubber. The material of the frame is painted mild steel.
- The cover is bolted in place

OPTIONAL: Hinged Cover



- Spring loaded hinges for ease of opening during maintenance or inspection (spring loading prevents cover from closing on its own).
- These can be located on the left or right side.
- The hinged cover provides the operator easy access **without the requirement of overhead crane and additional manpower** for routine inspections and maintenance.

Bowl Assembly

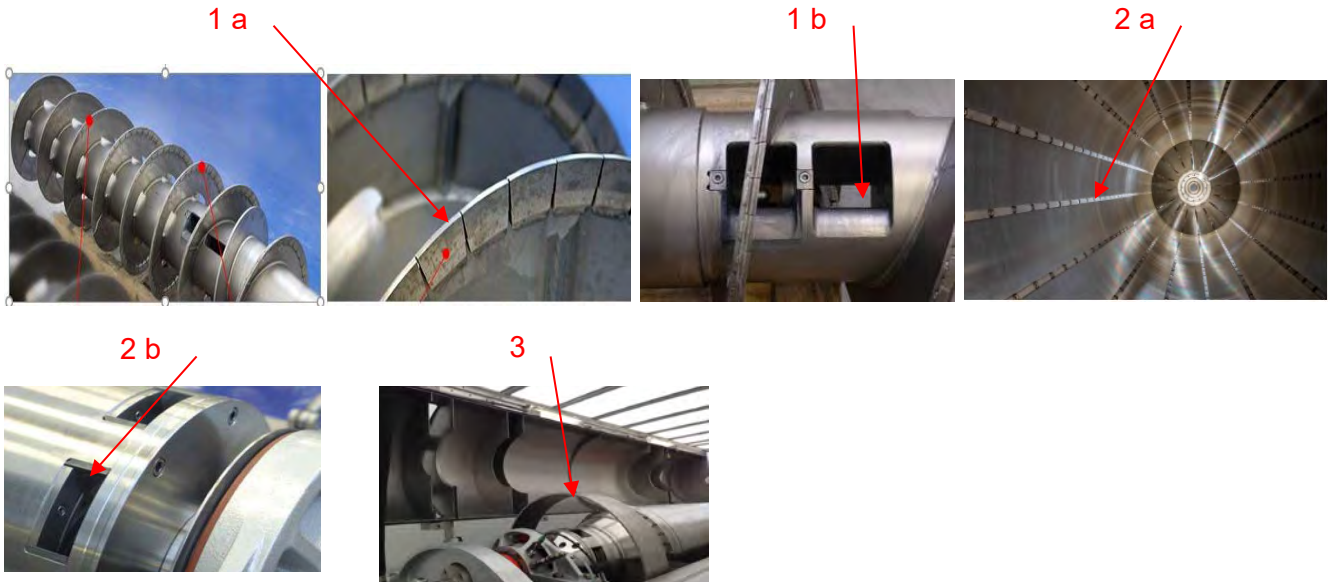
- Material: centrifugally cast duplex stainless steel, AISI 304 or AISI 316.
- End-hubs: centrifugally cast duplex stainless steel.
- All surfaces are examined for cracks, shrinkage, porosity, or other defects.
- The pool depth adjustable using plate dams at the large diameter end of the bowl.

Conveyor Assembly

- Material: AISI 316 stainless steel.
- Feed zone of a high-capacity design.
- Flights:
  - Windowed quasi-axial.
  - Material
    - Tiles-length: duplex stainless steel.
    - Remaining section: AISI 316.

Wear Protection

1. Conveyor
    a. Flights: With a series of welded-on sintered tungsten carbide (TC) tile assemblies and from two wraps beyond the feed zone through the solids discharge end, and with flame sprayed tungsten carbide (TC) for the remaining section.
    b. Feed zone wear liner
2. Bowl:
    a. Stainless steel strips to secure against abrasion.
    b. Solids discharge ports: field replaceable (TC) wear saddles, with 360º solids discharge to avoid blocking.
3. Replaceable stainless steel or urethane insert is available on certain decanters to protect the solids discharge casing.



Gearbox

- The gearbox is an Alfa Laval proprietary multi-stage planetary gear reducer unit.
- Controls the maximum differential speed between the centrifuge bowl and conveyor.
- Torque capacity: 2.5 kNm with a gear ratio of 1:159.5

Bearings

- Alfa Laval decanters have standardized grease lubricated bearings.
- These highly reliable bearings provide easier maintenance, greater reliability and lower power consumption.

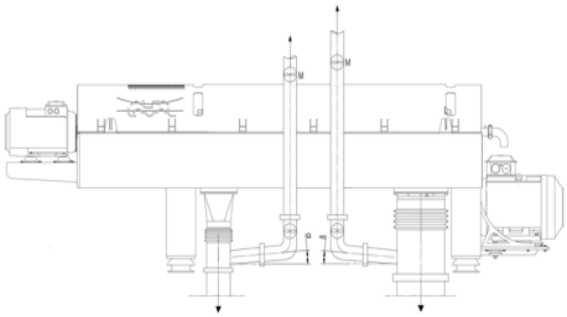
Centrifuge Electrical Equipment

- Vibration Sensors
- Bearing Temperature
- Speed Sensors
- Main and Back motors' thermistors/thermostats/RDT

Other Requirements

Venting

- Venting of outlets reduces the pressure impact created by air suction from the bowl rotation. Alleviating this small pressure inside the casing reduces the possibility of bearing contamination, as well as excess bowl wear.



Other Features

Bowl configuration

- Baffle disc provides higher processing capacity and drier cake solids.

Cone configuration

- Steep or shallow cone configuration for optimum separation of any type of slurry.

Figure 1. Steep cone configuration

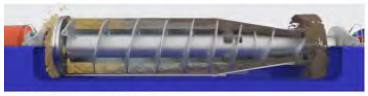


Figure 2. Shallow cone configuration

Safety Features

- Cover Switch: Cover switch protection, to prevent the operation or shut down of the system if the cover switch is activated.
- E-Stop: Emergency Stop button to shut the system down.

3. Ancillaries

3.1. Feed Flexible Connector
150# ANSI flange with suction discharge hose and 24” long.

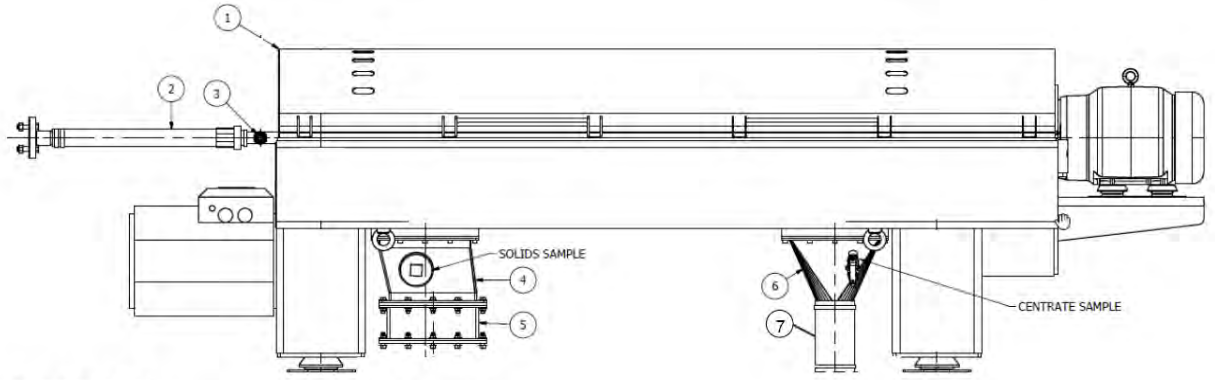
3.2. Polymer Flexible Connector
PTFE Lined SS braided, 24” long with crimped fittings.

3.3. Solids Discharge Flexible Connector
8" Tall rubber boot, flanged top & bottom, including 2 sets of Backer bar frames, and 304SS fasteners.

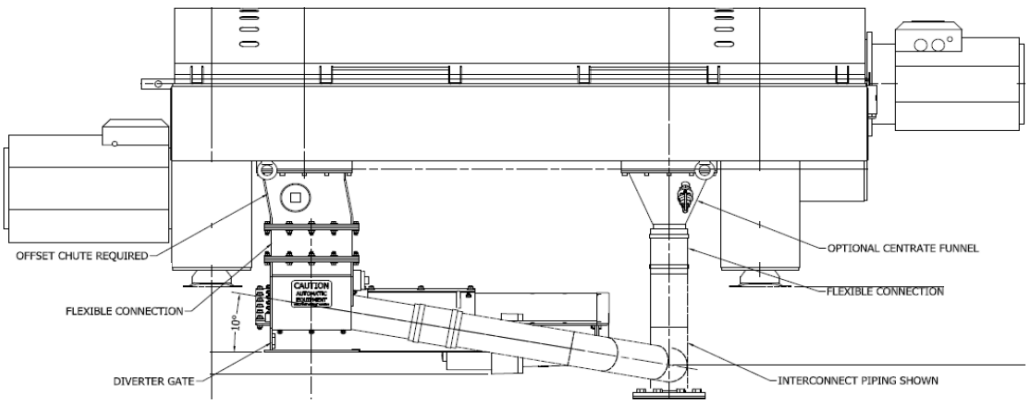
3.4. Solids Discharge Chute
Flange gasket, 3" sample port with plug, and 304SS fastener. Flanged chute top & bottom.

3.5. Centrate Discharge Funnel
Flange gasket, top flange to match centrifuge outlet, transition to 6" OD for hose connection. 1" Valved sample port, 6" 125# plate flange with a 12” long discharge hose and 304SS fastener.

3.6. Diverter Gate (Optional)
The diverter/slide gate is of the knife/gate type with an electric actuator, limit switches and position feedback relays specifically designed for diverting liquid flow, as specified and/or wastewater sludge. 110V Linear actuator, 3" inspection port, 24VDC position sensors, 6" pipe coupling, 1/2" flush nozzle, 316SS nameplate and caution labels. Diverter piping: 6" Sch10 welded piping, 4" 125# plate flange.



1 - ALDEC Centrifuge
2 - Feed flexible connector
3 - Connection to the polymer flexible con
4 - Solids discharge chute with sample pc
5 - Solids discharge flexible connector
6 - Funnel centrate chute with sample por
7 - Centrate flexible connector



3.7. ALSYS – Centrifuge Skid System (Optional)

The ALSYS module is a compact, reliable and efficient solution for reducing the liquid content of sludge. It is specially configured for dewatering many of the sludge types normally encountered in industry and in smaller-scale municipal and potable water treatment plants.

It is a self-contained system that includes all the equipment required for on-site dewatering. This includes a progressing cavity feed pump, flow meters, polymer dosing pump and all the necessary piping and valves, along with a screw conveyor for the dewatered sludge.

- Plug-and-play" design that ensures rapid, easy installation on site
- Compact layout reduces floor space requirements and ensures easy maintenance
- Automatic operation does away with the need for continuous attendance
- Factory-tested modular construction paves the way for rapid commissioning by Alfa Laval field service personnel.

The ALSYS module is based on the ALDEC / ALDEC G3 decanter centrifuge and is available with Alfa Laval Decanter Connect System (DCS) technology, designed to make both installation and operation more efficient, simple and cheap. The very efficient DCS ensures trouble-free operation, with excellent levels of safety built in.

4. Electrical Assembly and Controls

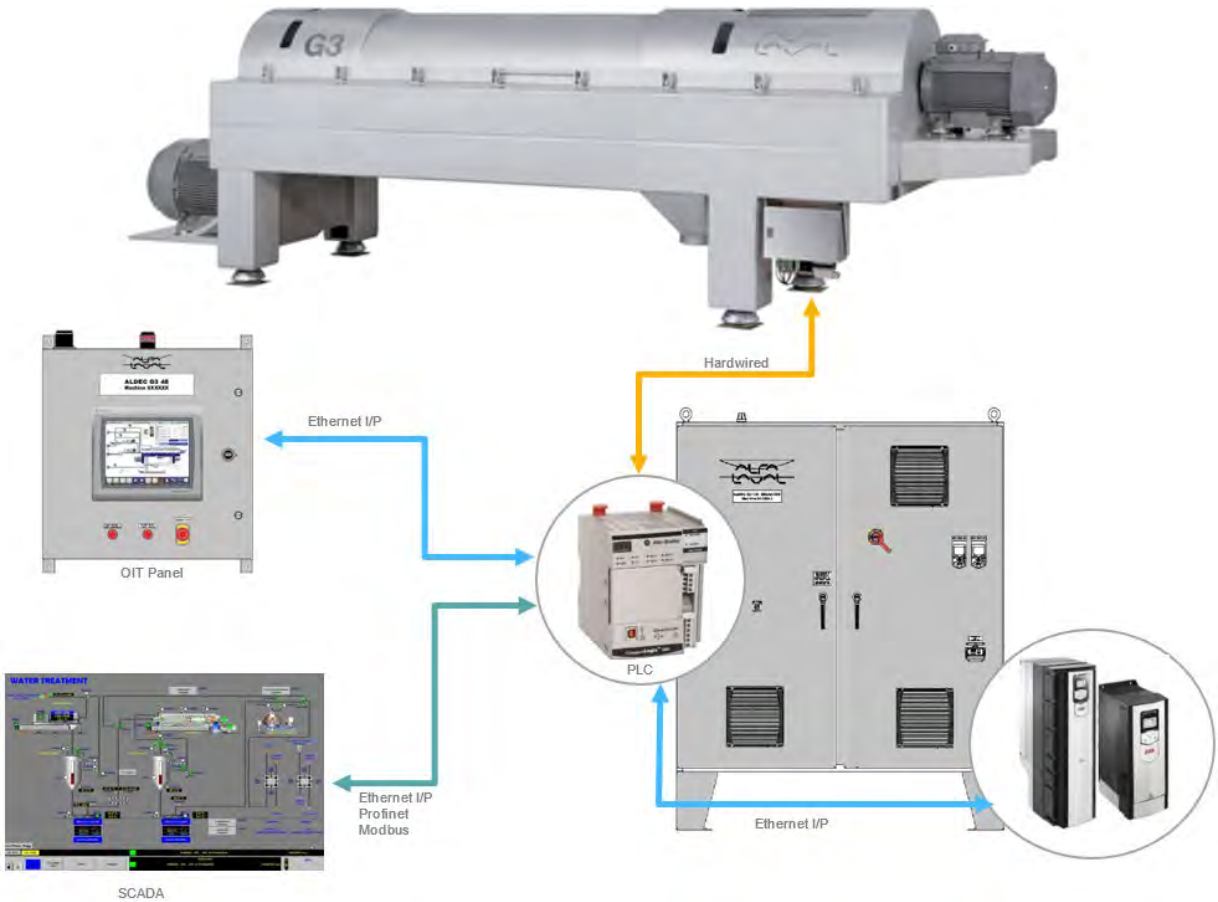
4.1. Electrical Assembly

- Main-drive motor: 30 HP
- Back-drive motor:7.5 HP
- The selected main-drive motor and the back-drive motor are both VFD control, 460 Volt, 60 Hz, 3 phase power supply.

4.2. Controls

- Alfa Laval's standard design: **Alfa Laval's Decanter Connect Control Package**
  - Regulation of the conveying torque or differential speed between the conveyor and the bowl via the VFD-controlled back-drive motor
  - Control of associated equipment (e.g. sludge macerator, sludge feed pump, diverter-gate, cake-conveyor, flushing valve, etc., starter-panels of these to be provided by others).
- Centrifuge vibration sensor control and PT 100 for main bearings temperature control are incorporated for added safety of the machine.

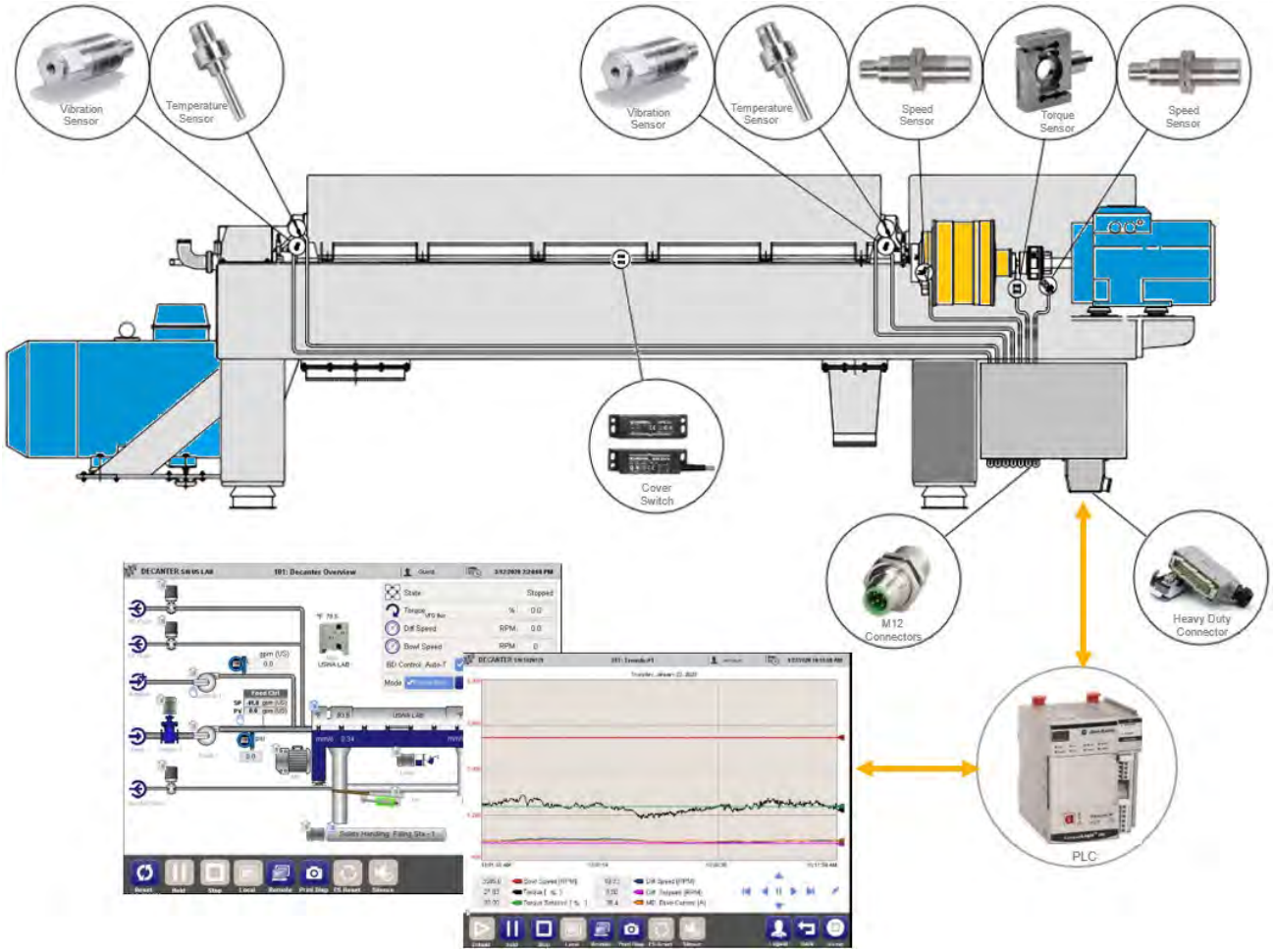
Alfa Laval Decanter-Connect Controls



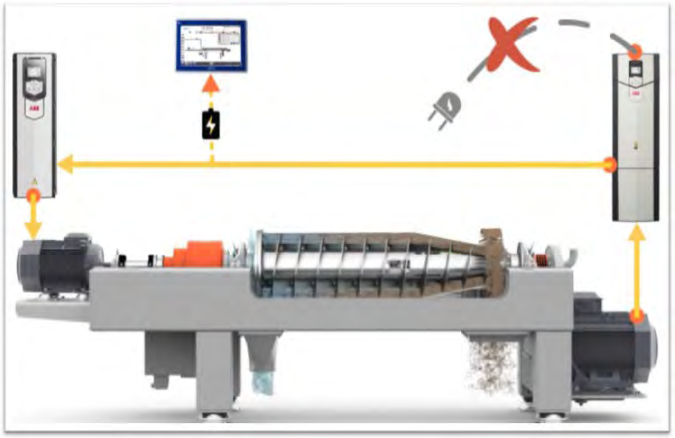
4.3. Alfa Laval Connect Control System

Key Features

a) Allen Bradley CompactLogix or ControlLogix PLC
b) Ability to use either ABB ACS 880 series or AB PF755 series VFDs
c) PanelView 7 Performance HMI – 10” (or optional 15”)
d) SCADA Communication to Allen Bradley, Delta V, ProfiNet, or Modbus TCP protocols
e) Fully assembled & wired to centrifuge instrumentation
f) Pre-wired and tested with all core centrifuge instrumentation: Speed sensors, backdrive torque sensor, main bearing vibration sensors, and main bearing PT-100 temperature sensors
g) Touch-screen 10” HMI-Display (or optional 15”)
   - o Easy Navigation
   - o Machine animated overview screen
   - o Analog, Digital and Multi centrifuges data display
   - o Alarms
   - o Trend curves



h. **POWER LOSS-** The control of centrifuge during power loss or outage will allow the centrifuge to run through a short duration power blip, generally defined as 3-5 seconds. If the power outage extends past the 3-5 seconds the system will shut down the feed and polymer pumps and put the centrifuge into the production standby mode for a programmed set time. If power is restored during this time the feed pump and polymer pump will automatically restart and production will resume. Should the power not be restored, the control system will allow the centrifuge to be brought to a stop in a normal shutdown mode (as if it had power) maintaining the differential speed during the coast down period. This system will allow the centrifuge to scroll the solids out and be available for an immediate restart once power is restored. Click on the image to see how it works



i. Control Panel Optional Configurations
   - Different configurations for Local and Starter panels
   - NEMA 12 or NEMA 4X
   - VFD ABB Type ACS800 for Main Motor
   - VFD ABB Type ACS800 for Back-drive Motor
   - Power supply Source: 460 V / 60 Hz / 3 Ph
   - For locating within “safe” non-hazardous area,

5. ALFA LAVAL SERVICE

5.1. 360º Service Portfolio

Alfa Laval partners with you for the entire life cycle of your equipment – from start-up, through operation, monitoring and maintenance, all the way to reconditioning and eventual redesign. Our goal is to ensure that our equipment continuously gives you optimized process performance.

5.2. Alfa Laval Service Centers:

You can trust Alfa Laval service technicians to maintain your decanter centrifuges in peak performance and minimize the risk of unscheduled production stops. Our local service centers are equipped with the tools and expertise to improve the performance of your decanters. Join us on a virtual tour of our state-of-the-art facilities.

Learn more about Alfa Laval Decanter Service

Alfa Laval - Decanter centrifuge service

Alfa Laval - Chesapeake service center

Alfa Laval - Greenwood service center

Alfa Laval - Houston service center

Alfa Laval - Fresno service center

5.3. Commissioning

Services consist of:

- installation review,
- performance checks,
- process optimization,
- operator training.

The commissioning process ends with a handover or acceptance certificate and is often the first day of warranty.

The commissioning:

- Enables trouble-free start-up and process fine-tuning.
- Advice on optimizing process conditions.
- Checks on surrounding components, systems and controls and optimization recommendations.
- Help to reduce maintenance costs with a customized proposal to optimize maintenance.

5.4. Preventive Maintenance

- Highly experienced Alfa Laval specialists can formulate and implement an optimal maintenance plan for your equipment.
- Service intervals are determined by various factors, including type of application as well as the usage and condition of the equipment.
- The service can be performed on site or in one of the local Alfa Laval Service Centers located near you.

The preventive maintenance:

- Delivers peace of mind and operational reliability
- Secures maximum throughput
- Increases overall equipment lifetime and provides good cost control
- Maintains safe equipment operation

5.5. Repair

Alfa Laval specialists repair the equipment according to your needs, replacing unsafe or worn parts as required, and then reassemble the equipment.

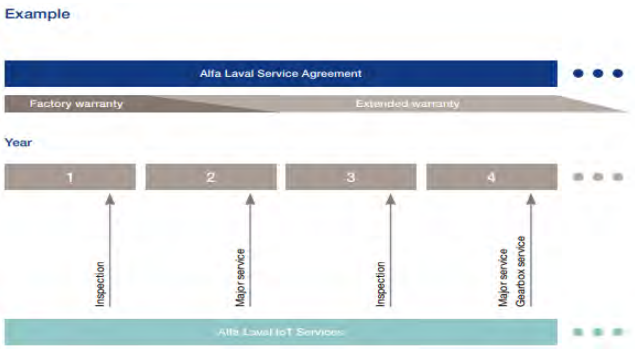
- Minimizes downtime
- Maximizes production performance
- Extends the lifetime of equipment
- Prevents equipment from consequential damage and accidents

5.6. Equipment Upgrades

- There is a wide range of upgrade solutions available to ensure your Alfa Laval equipment features the latest technical developments.
- As operating conditions change over time, new challenges can call for a review of the current installations.
- Equipment Upgrades can also include control upgrades that improve equipment automation.

6. ALFA LAVAL SUPPORT

6.1. Service Performance Agreements



With an Alfa Laval Service Agreement, you ensure outstanding performance from your Alfa Laval decanter and minimal total cost of ownership. Tailored to your priorities and requirements, a service agreement is the ideal maintenance solution from the original manufacturer of your equipment. Alfa Laval offers Service Performance Agreements which include premium customer discount levels on parts, preferential scheduling for field service and free unlimited access to Alfa Laval's Technical Helpdesk.

A quotation for a Service Agreement tailored to your requirements can be provided upon request. For more information on Service Performance Agreements, and our local service organization which includes 11 service centers, over 50 factory-trained field technicians, a centrally located parts distribution center, and our 24/7 365 Days Technical Helpdesk, visit our website link below
Alfa Laval - Performance Agreements

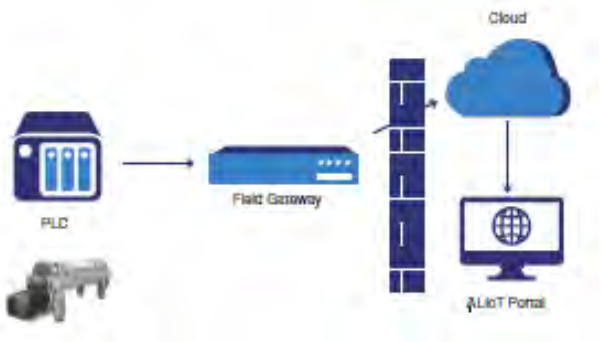
6.2. Connected Services

Imagine the possibilities if you could have an eagle eye's view of your equipment. At Alfa Laval, our top priority is ensuring that customers get outstanding and reliable performance from their equipment throughout its long lifetime. That's why we're investing heavily in R&D for IoT (internet of things) services to interconnect your production and control systems. You'll have vital information at your fingertips to truly get the most from your equipment – each and every day!

Alfa Laval IoT Services add new possibilities to your Alfa Laval wastewater decanter such as remote support and monitoring, condition monitoring, predictive maintenance and process optimization. The results are lower service costs, maximum operating reliability, higher process efficiency and more uptime. Learn more about Alfa Laval's IoT Services for decanters in wastewater plants in the sections below or contact us for a discussion on the best combination for your plant.
Alfa Laval - IoT Connected Services

6.2.1. Remote Monitoring & Support

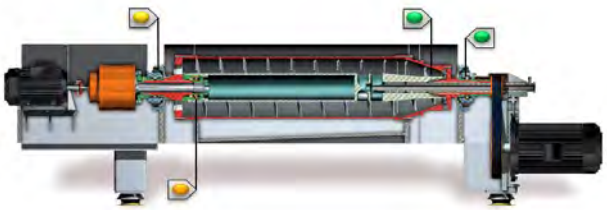
Remote Monitoring helps assure you that your decanter is running as expected. Access data like bowl speed and torque in the Alfa Laval IoT portal via your laptop, tablet or phone. Alarm notifications can be sent by e-mail or SMS/text message to let you know about anomalies.



Remote Support allows our experts insight to live and historic data to identify the problem more quickly and accurately when you call for support.

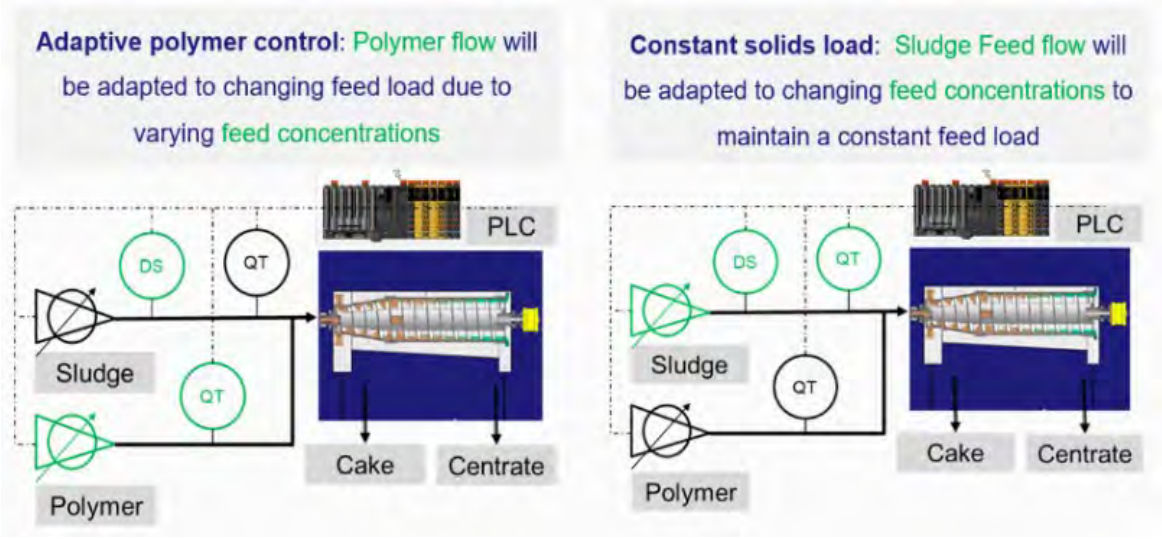
6.2.2. Predictive Maintenance

The Predictive Maintenance area of Connected Services develops services that help our customers improve reliability and avoid risk. The long-term objective is to develop a predictive maintenance solution that predicts failures before they ever happen. The first service in this area, is ConditionAlert™; based on vibration measurements and frequency analyses which can identify the source of abnormal vibration levels and suggest remedies. The customer is notified by Alfa Laval with a plan for service.



6.2.3. Process Optimization

The Process Optimization area of Connected Services develops services that help our customers optimize their decanter process, thereby reducing cost and increasing savings. Focused on the Wastewater Treatment industry, we offer Constant Solids Load & Adaptive Polymer Control, with the long-term objective of developing a self-optimizing decanter.



7. PROCESS DETAILS AND SIZING

7.1. General Data

Sludge Origin:	Wastewater Treatment Plant
Sludge Type:	Anaerobically digested sludge
Duty:	Dewatering

7.2. Sizing Data

Operating Times

Days per Week:	5
Hours per Days:	8

Capacity per Machine

Hydraulic (gpm):	35
Solids (lbs./hr.)	345

Number of units

Operating:	1
Standby:	1

Feed Solids

Range (%):	2
Design (%):	2

Polymer Consumption:

Design Dosage (lbs./dT):	To be determined after lab sample test
Expected Dosage (lbs./dT):	To be determined after lab sample test

Centrifuge Performance

Cake Solids (%):	To be determined after lab sample test
Expected Recovery (%)	95

Bowl Diameter (in)	14.17

Maximum Bowl Speed (rpm)	4200

Installed Power (HP)	37.5

G-Force (x g)	3556

8. SCOPE OF SUPPLY

Two (2) ALDEC 45 Centrifuges, each will come complete and include the following scope of supply:

- Modular frame with process contact areas in 316 SS
- Vibration isolators
- Singular cover in 316 SS (covers belts, rotating assembly and gearbox)
- Abrasion protection (Tungsten Carbide on wear surfaces)
- Rotating assembly complete with 2.5 kNm Planetary gearbox and pillow block bearings
- All bearings grease lubricated
- Vibration and temperature sensors in main bearing housings
- Main drive Motor: 30 Hp AC VFD
- Back drive Motor: 7.5 Hp AC VFD
- Starter Panel: NEMA 12 Free-Standing
- Local Control Panel: NEMA 4 X (304 SS) Wall mounted
- PLC: Allen Bradley CompactLogix
- HMI: Allen Bradley – 10 inch
- Main Drive VFD: ABB ACS880
- Back drive VFD: ABB ACS880
- Control of centrifuge during power loss or outage
- Flexible connectors
- Solids discharge chute
- Centrate discharge chute
- Factory Paint System
- One (1) set required lubricants
- One (1) set of required spares

Also included with pricing:

- Required Tools including bowl lifter and conveyor lifter
- Electronic Submittal and O&M Manual

8.1. **DIMENSIONED DRAWING** ALDEC 45 Dimension Drawing No. 4099899039. (See Appendix A)

8.2. **NOTES OF CLARIFICATION**

Scope of supply is per Alfa Laval standard centrifuge configuration, and in accordance with typical specifications and drawings. Any additional items not explicitly stated in this proposal or standard to Alfa Laval's typical specifications are not included in this quotation. The specified equipment is intended for installation within a **non-hazardous** safe area.

Equipment to be supplied by Alfa Laval (and /or sub-supplier), as specified in this quotation, are standard machines. Any modifications / additions other than those expressly specified in the quotation shall incur extra engineering cost, material cost and delivery time.

Technical submittal documentation shall be per Alfa Laval's (and /or sub-supplier) standards, delivered electronically, in English language. Additional documentation requirements shall incur extra engineering cost, material cost and delivery time.

The enclosed quotation is a non-binding budgetary quotation. Therefore, price, scope and other terms contained within this budgetary quotation are subject to considerable variations when preparing our binding quotation. **All scope of supply modifications / additions requires prior agreement by both parties and written acknowledgement by Alfa Laval.**

Escalation Charges:

- In the event that delivery of equipment cannot be made on the scheduled delivery date agreed upon between Alfa Laval and Purchaser and as evidenced by the terms of the contract, due to Purchaser delay, Alfa Laval reserves the right to assess reasonable escalation charges to the project at the rate of 1% per month of the contract value for material price escalation for each month that the project is delayed.

- Given the current volatility in steel prices over the past twelve months, Alfa Laval has made this offer based upon shipment of the offered products contained herein within the schedule dictated above. Should the projected shipment schedule fall outside this period for any reason, pricing shall be subject to review and revision.

8.3. Exclusions from this quotation:

- All mechanical & electrical Installation, including but not limited to:
- Equipment offloading and placement
- Field wiring, conduit and electrical flexible connections...etc.; contractor shall remain responsible for meeting all relevant electrical codes
- Pipes, valves, and fittings...etc.
- Anchor bolts are supplied by others.
- Associated equipment, i.e., sludge macerators, feed pumps, polymer preparation & dosing unit, cake conveyors, centrate tanks and pumps…etc.
- Measuring instruments between centrifuges and associated equipment
- Noise abatement enclosures
- Odor control equipment
- Inspection and access platforms or ladders
- Utilities and consumables (polymer, power, water and other consumables required during testing, start-up and commissioning
- Detailed or project specific related engineering
- Duties, taxes, bonds…etc.
- Freight to job site. We are offering this FCA (Pune, India) Incoterms 2020

8.4. Service time is included in the quoted price based on the following: (1) x Field Service Engineer, - up to ten (10) days, @ 10 hr./day, with up to two (2) round trips, per unit for start-up, commissioning, and training. Any additional service time resulting from non- Alfa Laval -warranty delays, will be charged at the rate in effect at the time of service.

8.5. Warranty: Per the enclosed Alfa Laval's Standard Terms & Condition of Sale. Alfa Laval reserves the right to review operating and maintenance records to ensure compliance.

8.6. Process performance achieved by the centrifuge (cake solids, loading, hydraulic throughput, etc.) is verified through onsite analysis of representative sampling during equipment commissioning.

9. COMMERCIAL TERMS

9.1. Pricing

Item	Description	Qty.	Unit Price	Extended Price
1	ALDEC 45	2	Included	Included
2	Set of Controls	2	Included	Included
3	Set of Ancillaries	2	Included	Included
4	Commissioning	2	Included	Included
Total Budget Price				**$504,750.00**

9.2. Payment Terms

10% with PO, N10 days
10% upon Alfa Laval Submittal Delivery, N30 days
75% upon delivery or availability to deliver should owner encounter delays, N30 days
5% upon acceptance or beneficial use, whichever comes first, N30 days, but not later than 180 days after shipment.

9.3. Estimated Delivery Time

Submittals: 8 -12 weeks from fully executed PO
Centrifuge: 34 – 38 weeks from release to manufacturing

9.4. TERMS AND CONDITIONS OF SALES

These Terms and Conditions of Sale (“Terms and Conditions”) apply to all quotations, orders, and contracts for Alfa Laval Inc. products (hereafter "Equipment") and associated services (“Services”) as used in these Terms and Conditions, the word "Equipment" includes all hardware, parts, components, software, and options.

1. **ACCEPTANCE**: Our sale to you is limited to and expressly made conditional on your assent to these Terms and Conditions and, if applicable, on the attendant quotation, both of which form a part of the contract between us and which supersede and reject all prior agreements, representations, discussions, or negotiations, whether written or oral, with respect to this sale and any conflicting terms and conditions of yours, whether signed by you. Any terms and conditions contained in your purchase order or request for quotation or other form which are different from, in addition to, or vary from these Terms and Conditions are expressly rejected, shall not be binding upon us, and are void and of no force or effect. These Terms and Conditions may not be changed except by the written agreement of both parties.

2. **PRICES**: Unless otherwise specified in writing, all quoted prices are in U.S. Dollars and are firm for thirty (30) days from the date of offer. Prices quoted are exclusive of taxes, freight and insurance, and you agree to pay any and all sales, revenue, excise or other taxes (exclusive of taxes based on our net income) applicable to the purchase of Equipment. If you claim an exemption from any such taxes, you shall provide us with a tax exemption certificate acceptable to the taxing authorities.

3. **DELIVERY; FORCE MAJEURE**: Dates for the furnishing of Services and/or delivery or shipment of Equipment are approximate only and are subject to change. Quoted lead times are figured from the date of receipt of complete technical data and approved drawings as such may be necessary. We shall not be liable, directly, or indirectly, for any delay in delivery or failure to deliver caused by carriers or by labor difficulties, shortages, strikes or stoppages of any sort, or difficulties in obtaining materials from ordinary sources and suppliers. In addition, we shall not be liable for any such delays or for any failure to perform our obligations under an order or contract due to any one or more of the following events, whether foreseeable or not: war, hostilities, military operations, terrorism, riots, disorder, accidents, floods, storms, natural disasters, fires, acts of God, epidemics and/or pandemics (and specifically in relation hereto and notwithstanding anything else stated herein, whether or not outbreak of such epidemic or pandemic has occurred prior to acceptance of this order or execution of a contract for the Services), governmental, judicial or administrative decisions, decrees or orders, embargoes or blockades, or any causes beyond our reasonable control. Unless otherwise specifically agreed in writing by us, in no event shall we be liable for any damages or penalties whatsoever, or however designated, resulting from our failure to perform or delay in performing due to any of the causes specified in this paragraph 3.

4. **SHIPMENT, RISK OF LOSS, TITLE**: All sales are made F.O.B. Alfa Laval shipping point, unless otherwise noted. Duty, brokerage fees, insurance, packing and handling as applicable are not included unless otherwise noted. Our liability for delivery ceases upon making delivery of Equipment to the carrier at the shipping point in good condition. The carrier shall be your agent. Risk of loss shall pass to you upon such delivery. Regardless of the delivery term specified, we shall retain title to the Equipment until final payment thereof has been made.

5. **CREDIT AND PAYMENT**: Payment terms are (30) days net, unless agreed otherwise by us in writing. *Pro rata* payments shall become due with partial shipments. Any discount period which may be granted by us begins on the invoice date and all payments are due 30 days after the invoice date. All payments shall be made without deduction, deferment, set-off, lien or counterclaim of any nature.

All amounts due not paid within 30 days after the date such amounts are due and payable shall bear interest at the lesser of 1.5 percent per month or the maximum rate of interest allowed by law. We reserve the right at any time to suspend credit or to change credit terms provided herein, when, in our sole opinion, your financial condition so warrants. Failure to pay invoices when such invoices are due and payable, at our election, shall make all subsequent invoices immediately due and payable irrespective of terms, and we may withhold all subsequent deliveries until the full account is settled. We shall not, in such event, be liable for delay of performance or nonperformance of contract in whole or in part subsequent to such event.

6. **SECURITY AGREEMENT:** You hereby grant us a security interest in the Equipment, including a purchase money security interest, and in such materials, proceeds and accessories thereof, to secure payment of the purchase price of the Equipment. You authorize us to file or record a purchase order or copy thereof or any UCC financing statement
showing our interest in the Equipment in all jurisdictions where we may determine filing to be appropriate, and you agree to sign all such documents reasonably related thereto promptly following our request. You will not encumber the Equipment with any mortgage, lien, pledge or other attachment prior to payment in full of the price therefor.

7. **CANCELLATIONS AND CHANGES**: Orders which have been accepted by us are not subject to cancellation or changes in specification except upon prior written agreement by us and upon terms that will indemnify us against all losses resulting from or arising out of such cancellation or change in specifications. In the absence of such indemnification, we shall be entitled to recover all damages and costs of whatever nature permitted by the Uniform Commercial Code.

8. **DEFERRED SHIPMENT**: If shipment is deferred at your request, payment of the contract price shall become due when you are notified that the Equipment is ready for shipment. If you fail to make payment or furnish shipping instructions, we may either extend the time for so doing or cancel the contract. In case of deferred shipment at your request, storage and other reasonable expenses attributable to such delay shall be payable by you.

9. **EQUIPMENT WARRANTY AND REMEDY**:
(a) For new Equipment only, we warrant to you that the Equipment that is the subject of this sale is free from defects in design (provided that we have design responsibility), material and workmanship. The duration of this warranty is twelve (12) months from start-up or eighteen (18) months from delivery to you, whichever occurs first (the "Warranty Period"). If you discover within the Warranty Period a defect in design, material, or workmanship, you must promptly notify us in writing. Within a reasonable time after such notification, we shall repair, replace, or, at our option, refund you the price of the defective Equipment or part thereof.
(b) For repairs, parts and Services provided by us, we warrant to you that the repairs, parts and Services we provide to you will be free from defects in material and workmanship. The duration of this warranty is ninety (90) days from as applicable (i) the date the Equipment which required the repairs, parts or Services is returned to you by us, (ii) the date of your receipt of the part, or (iii) the date of completion of the repair or other Services, if performed at your facility. If during this ninety-day period you discover a defect in the repairs, parts or Services you must promptly notify us in writing, and we shall correct such defect with either new or used replacement parts or reperform the Services as applicable. If we are unable to correct the defect after a reasonable number of attempts, we will provide a refund of the price paid for the defective repair, parts or Services.
(c) All warranty service is subject to our prior examination and approval and will be performed by us at your facility or at service centers designated by us. All transportation to and from the designated service center will be at our expense. The remedies set forth above are your exclusive remedies for breach of

warranty. Unless otherwise agreed in writing by us, our warranty extends only to you and is not assignable to or assumable by any subsequent purchaser, in whole or in part, and any such attempted transfer shall render all warranties provided hereunder null and void and of no further force or effect.
(d) The warranties set forth above are inapplicable to and exclude any product, components or parts not manufactured by us or covered by the warranty of another manufacturer. We shall have no responsibility for defects, loss or damage to the extent caused by (i) normal wear and tear, (ii) your failure to follow all installation and operation instructions or manuals or to provide normal maintenance, (iii) repairs or modifications by you or by others not under our direct supervision, or (iv) a product or component part which we did not design, manufacture, supply, or repair.
(e) **DISCLAIMER OF IMPLIED WARRANTIES**. THE WARRANTIES SET FORTH ABOVE AND IN SECTION 12 BELOW ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

10. **LIMITATION OF LIABILITY**: In no event shall we be liable, and you hereby waive any claims against us and release us from liability to you, for any indirect, special, punitive, incidental, or consequential damages whatsoever based upon breach of warranty, breach of contract, negligence, strict tort, or any other legal theory. In no circumstance, shall we be liable for, however such damages are characterized, loss of profits, loss of savings or revenue, loss of use of the Equipment or any associated equipment, cost of capital, cost of any substitute Equipment, facilities or services, downtime, or loss of prospective economic advantage. **OUR AGGREGATE LIABILITY FOR FAILURE TO PERFORM, BREACH OF WARRANTY OR BREACH OF OTHER CONTRACTUAL OBLIGATIONS SHALL NOT EXCEED THE TOTAL PRICE PAID TO US FOR THE EQUIPMENT AND SERVICES THAT ARE THE SUBJECT OF ANY CLAIM BY YOU.**

11. **OWNERSHIP:** All drawings, designs, specifications, data and other proprietary rights supplied by us (including without limitation in connection with the Equipment) have been prepared or assembled by us and are (and shall remain) exclusively our property, and upon our request you agree to execute any additional documents needed to give effect to the foregoing. Such drawings, designs and specifications have been furnished in order to provide full documentation and on the condition that they shall not be disclosed, reproduced or copied in any manner whatsoever, in whole or in part, except for your internal use as necessary, and upon the further condition that, as our sole property, they shall not be used for furnishing information and/or disclosed, in whole or in part, to others or otherwise for any purpose not specifically authorized in a writing signed by one of our corporate officers.

12. **PATENT INFRINGEMENT**
(a) We make no express or implied warranties of non-infringement with respect to the Equipment. We will, however, defend, indemnify and hold you harmless from any third party apparatus claims based upon an issued U.S. patent to the extent such claim relates to the Equipment supplied and sold to you; provided, however, that we undertake no indemnification in respect of third-party rights (i) where the alleged patent infringement is based upon or related to any method, process or design claims in third-party U.S. patents, any combination of the Equipment with other equipment not supplied by us, or any modifications of the Equipment made by you and not approved by us, or (ii) to the extent the alleged infringement is directly attributable to the negligence or intentional misconduct of you or otherwise for which you are obligated to indemnify us for under paragraph 12(c).

(b) We shall assume defense of a claim at our expense in accordance with these Terms and Conditions, provided you shall notify us within 30 days of your receipt of notice of an alleged third-party claim that you believe would entitle you to patent infringement indemnification pursuant to paragraph 12(a). You acknowledge and agree that we shall have the sole right to settle or otherwise compromise such a third-

party claim, including but not limited to the right to either (i) modify the Equipment to avoid infringement if you are agreeable to the modification, (ii) repurchase the Equipment from you at a price equal to the then-current fair market value of the Equipment, or (iii) secure rights by assignment or license to permit continued use of the Equipment.

(c) If a third-party charges us with patent infringement relating to Equipment sold by us to you, we shall have the right to either (i) modify the Equipment to avoid infringement if you are agreeable to the modification, (ii) repurchase the Equipment from you at a price equal to the then-current fair market value of the Equipment, or (iii) secure rights by assignment or license to permit continued use of the Equipment. If a third party charges us with patent infringement on the bases set forth in paragraph 12(a)(i) or (ii), you shall indemnify and hold us harmless for all expenses as well as any awards of damage assessed against us, and, without limiting any of our other rights and remedies available at law or in equity, we shall also have the right to modify or repurchase the Equipment or to secure rights for continued use by way of assignment or license as set forth in this paragraph.

13. **INSPECTION**: Upon prior written notice, you may make reasonable inspections of Equipment at our facility. We reserve the right to determine the reasonableness of the request and to select an appropriate time and location for such inspection. You agree to execute appropriate confidentiality provisions upon our request prior to visiting our facility. All costs of inspection shall be solely determined by us and shall be payable by you. No inspection or expediting by you at the facilities of our suppliers is authorized.

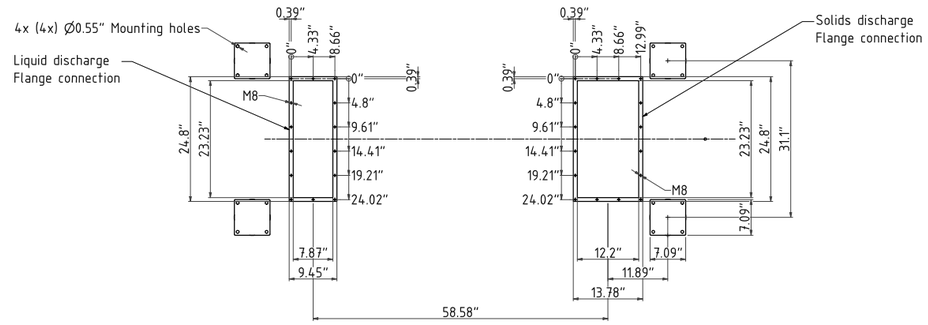
14. **SOFTWARE PROVISIONS**: If software is provided hereunder (whether such is integrated into the Equipment or otherwise operates alongside the same), you are hereby granted a non-exclusive, non-sublicensable, non-transferable, royalty free license to access and use such software as provided and as intended with our Equipment. Without limiting the foregoing, under the foregoing license you may specifically: (i) use our software in machine readable object code only and only with the Equipment provided; (ii) copy our software into any machine-readable object code form solely for back up purposes in support of your use of our software on the Equipment provided in accordance with these Terms and Conditions; and (iii) create one additional copy of the software for archival purposes only. This license may only be assigned, sublicensed, or otherwise transferred by you with our prior written consent. You hereby recognize and acknowledge that the software provided to you hereunder comprises valuable trade secret and/or copyright property of Alfa Laval (or its licensors) and you covenant that you will take adequate precautions against access to the software by, or disclosure of the software to, anyone not authorized hereunder to use or have access to the software as contemplated herein. The software is subject to the confidentiality obligations set forth below in paragraph 15.

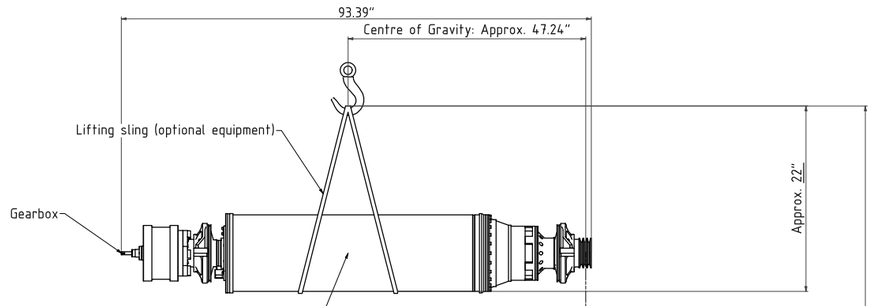
15. **CONFIDENTIALITY:** Subject to any non-disclosure or confidentiality agreement already in effect between us, any drawings, data, software or other information exchanged between us is proprietary or confidential to us and shall not be used or disclosed by you without our prior written consent. Confidential information shall not be any information that (i) is known previously to you under no obligation of secrecy; (ii) becomes known to the public through no breach of an obligation of secrecy by you; or (iii) is independently developed by you without use or reference to any of the confidential information or materials provided to you by us.

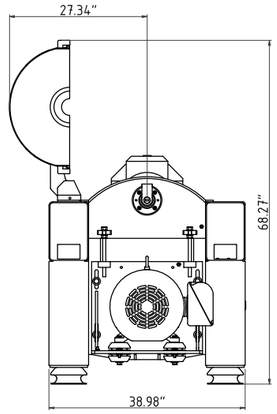
16. **INAPPLICABILITY OF CISG:** The parties specifically agree that the United Nations Convention on Contracts for the International Sale of Goods shall not apply to any sale or order or the contract between us.

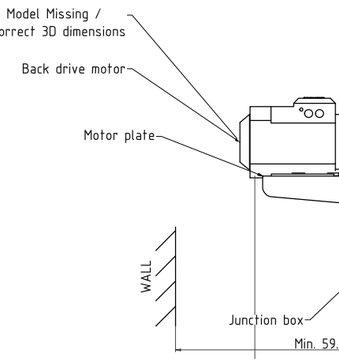
17. **GOVERNING LAW & VENUE**: These Terms and Conditions and any dispute or claim arising out of or related to an order or the contract between us shall be finally decided in accordance with the laws of the Commonwealth of Virginia, without giving effect to the provisions thereof relating to conflict of laws. You agree that the venue for any such dispute shall lie in the United States District Court for the Eastern District of Virginia, Richmond Division. In the event that federal jurisdiction cannot be established pursuant to 28 U.S.C. §§ 1331 or 1332, the venue for any such dispute shall lie in the Circuit Court of Henrico County, Virginia. You expressly submit and waive any objection to the sole and exclusive jurisdiction of such courts.

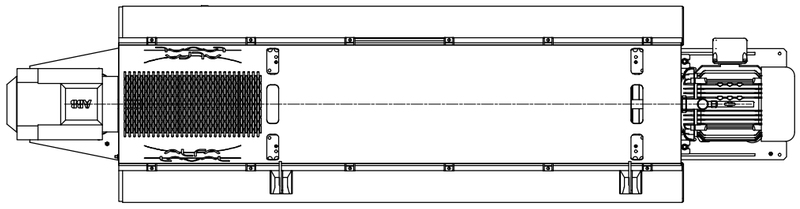
18. **GENERAL:** All previous agreements or understandings between us, either oral or written, with regard to the subject order, with the exception of a pre-existing non-disclosure agreement between us, are void and these Terms and Conditions constitute the entire agreement between us with respect to the matters addressed herein. Neither of us shall assign an order or contract to which these Terms and Conditions apply without the prior written consent of the other party, which consent shall not be unreasonably withheld. If any provision of these Terms and Conditions is held to be invalid or unenforceable, such holding shall not affect the validity or enforceability of any other provision herein. No waiver by either of us of any default or breach by the other party will operate as or be deemed a waiver of any subsequent default or breach.

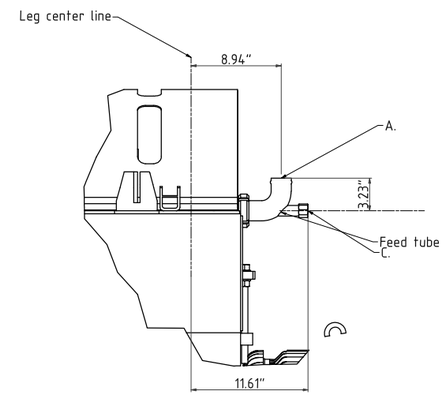












Detail A (1 : 5)

All dimensions in inches (inch)

www.alfalaval.com

ALDEC 45-2 phase-2.5kNm

First angle projection

Sales configuration id: 4099899039

Date: 04-02-2020

Revision: 0 Scale[A0]: 1:10

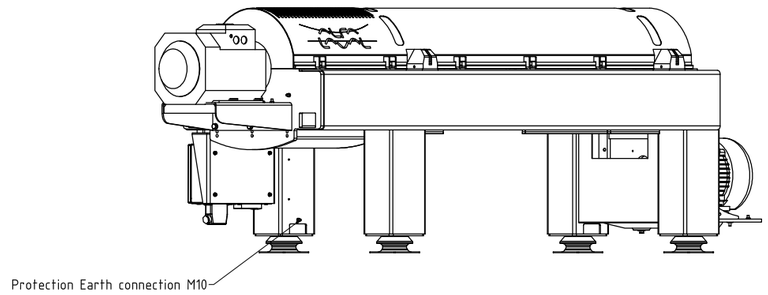
Approximate weights:	**Value:**
Total weight of empty decanter	5622 lbs
Rotating assembly	1235 lbs
Cover	218 lbs
Gear box	161 lbs
Main motor	531 lbs
Crane lifting capacity for rotating assembly (Lifting weight with blocked bowl)	1323 lbs

Foundation loads:

Max. static load	
Vertical	5845 lbf
Horizontal	0 lbf
Max. dynamic load at run-down	
Vertical	±1798 lbf
Horizontal	±899 lbf
Max. dynamic load at operating speed	
Vertical	±47 lbf
Horizontal	±47 lbf

All loads are evenly distributed on the four decanter legs

Connections:	**Dimensions/Value:**
A. Feed tube Feed connection	Diameter 51 (2") Hose connection
B. Feed tube Internal polymer connection	
C. Feed tube External polymer connection	ISO 228-G 3/4" Connection
D. Feed tube CIP connection	
E. Cover CIP connection	
F. Liquid discharge connection	
G. Solids discharge connection	
H. Paring disc liquid discharge connection	
I. Paring disc drain discharge	
J. Paring disc liquid/vent discharge	



Notes:

Alfa Laval cannot be held responsible for any failures or damages of the decanter, if the decanter isn't installed according to the instructions and guide lines in the Installation Manual

All dimensions in inches (inch)

www.alfalaval.com

ALDEC 45-2 phase-2.5kNm

First angle projection

Sales configuration id: 4099899039
Date: 04-02-2020
Revision: 0 Scale[A0]: 1 : 10

50 California Street, Suite 1500
San Francisco, CA 94111

Appendix B:

Technical Report – No. 2
Proposed Conceptual Design Decentralized Water Resource Recovery Facility and Treated Water Conveyance (Greeley and Hansen)

Carmel-by-the-Sea, California
Carmel Area Wastewater District

WRRF Relocation Alternatives Planning

TECHNICAL REPORT – N0. 2

Proposed Conceptual Design
Decentralized Water Resource Recovery Facility and Treated Water Conveyance

January 2023

GREELEY AND HANSEN

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SECTION 1 SATELLITE PLANT SERVICE AREAS AND CONVEYANCE

The goal of this project is to develop plant relocation concepts for the CAWD WWTP in response to climate change and sea level rise. Technical Report No. 1 describes a relocated Centralized Water Resource Recovery Facility (WRRF). This Report (No. 2) describes the conceptual Decentralized alterative with four (4) satellite WRRF distributed throughout the Carmel area instead of a Centralized facility.

With coordination between Greeley and Hansen and CAWD, the Carmel area was reviewed to determine conceptual service areas for the new satellite facilities. From this coordination, and for the purposes of the conceptual design development, the Carmel service area was divided into four areas with a 0.25 MGD ADWF maximum capacity each. In this Decentralized concept the Pebble Beach Community Services District flows would not be treated by CAWD. The Carmel area was subdivided into the following areas:

- Area 1: Carmel Woods and Downtown (0.25 MGD ADWF)
- Area 2: Mission Canyon and Carmel Point (0.25 MGD ADWF)
- Area 3: Highway 1 South of Carmel (0.25 MGD ADWF)
- Area 4: Carmel Valley Phase 1 (0.25 MGD ADWF)

Figure 1-1 shows the division of the four (4) CAWD service areas. A satellite WRRF with a 0.25 MGD treatment capacity was considered for each of the service areas for liquid treatment. Each of the four (4) 0.25 MGD ADWF facilities would be equipped with liquid stream treatment similar to the Centralized WRRF; which includes: Screening, Membrane Bioreactor (MBR), Reverse Osmosis (RO), and Ultraviolet Advanced Oxidation Process (UVAOP). Only one (1) of the Decentralized facilities (the facility in Area 4, Carmel Valley Phase 1) would be equipped with solids handling equipment (1.0 MGD sludge treatment capacity), and this solids treatment process would serve all four (4) satellite facilities with solids treatment. The sludge from the other three (3) facilities without solids handling/digestion (Areas 1, 2, and 3) would be collected and brought to the facility in Area 4 for treatment and production of Class A biosolids.

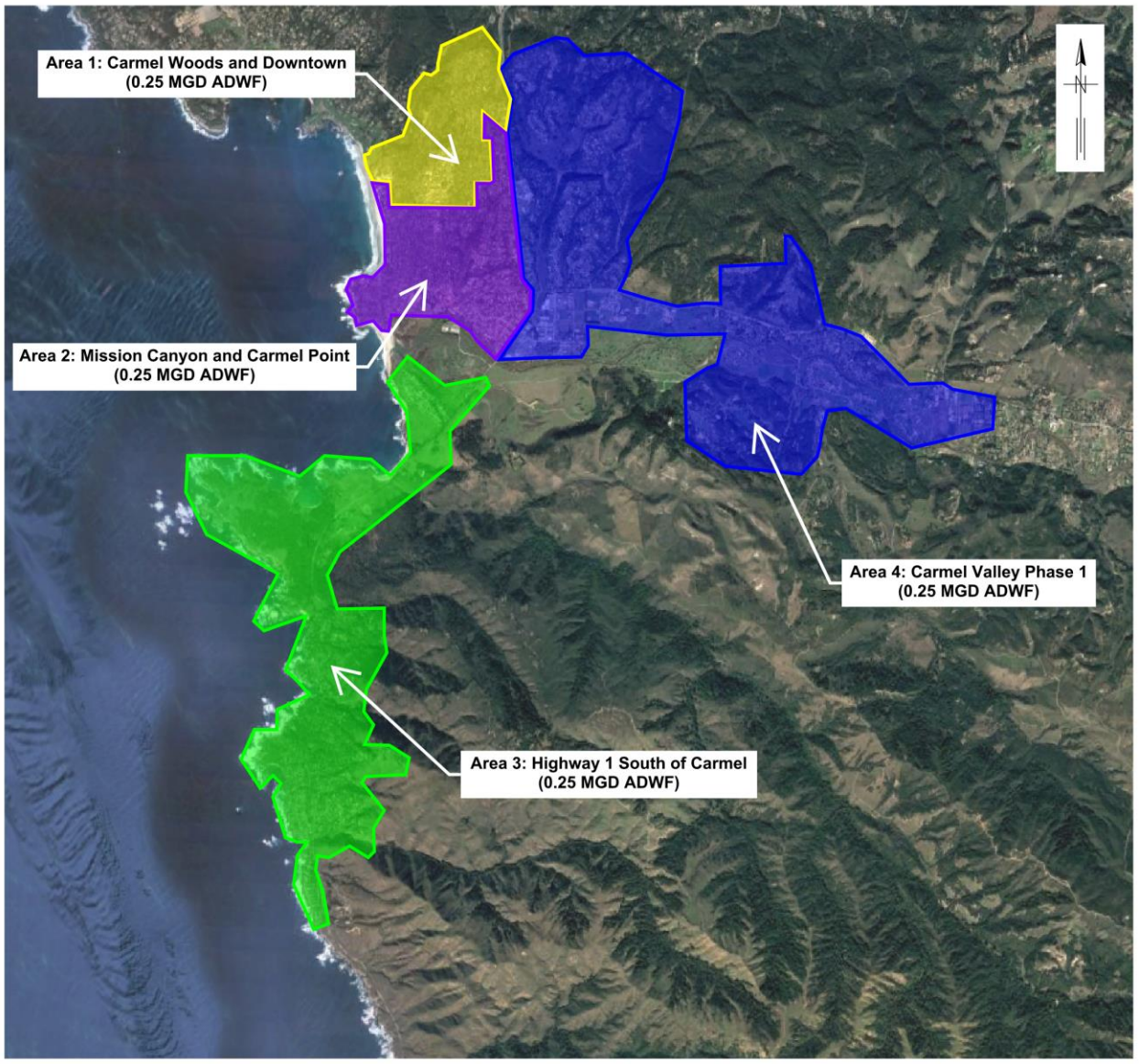


Figure 1-1: Carmel Service Area Division

1.1 CONVEYANCE BETWEEN SATELLITE PLANTS AND EXISTING REUSE WATER LINE

The conceptual conveyance piping between the satellite facilities is shown in **Figure 1-2**. Each satellite facility will collect and treat wastewater from their respective service area. Then, the treated effluent will be forwarded to the existing reclaimed water line, and the concentrated brine waste would be piped to the existing CAWD ocean outfall. The collected solids will be trucked out of the plants for treatment at the WRRF located in Area 4.

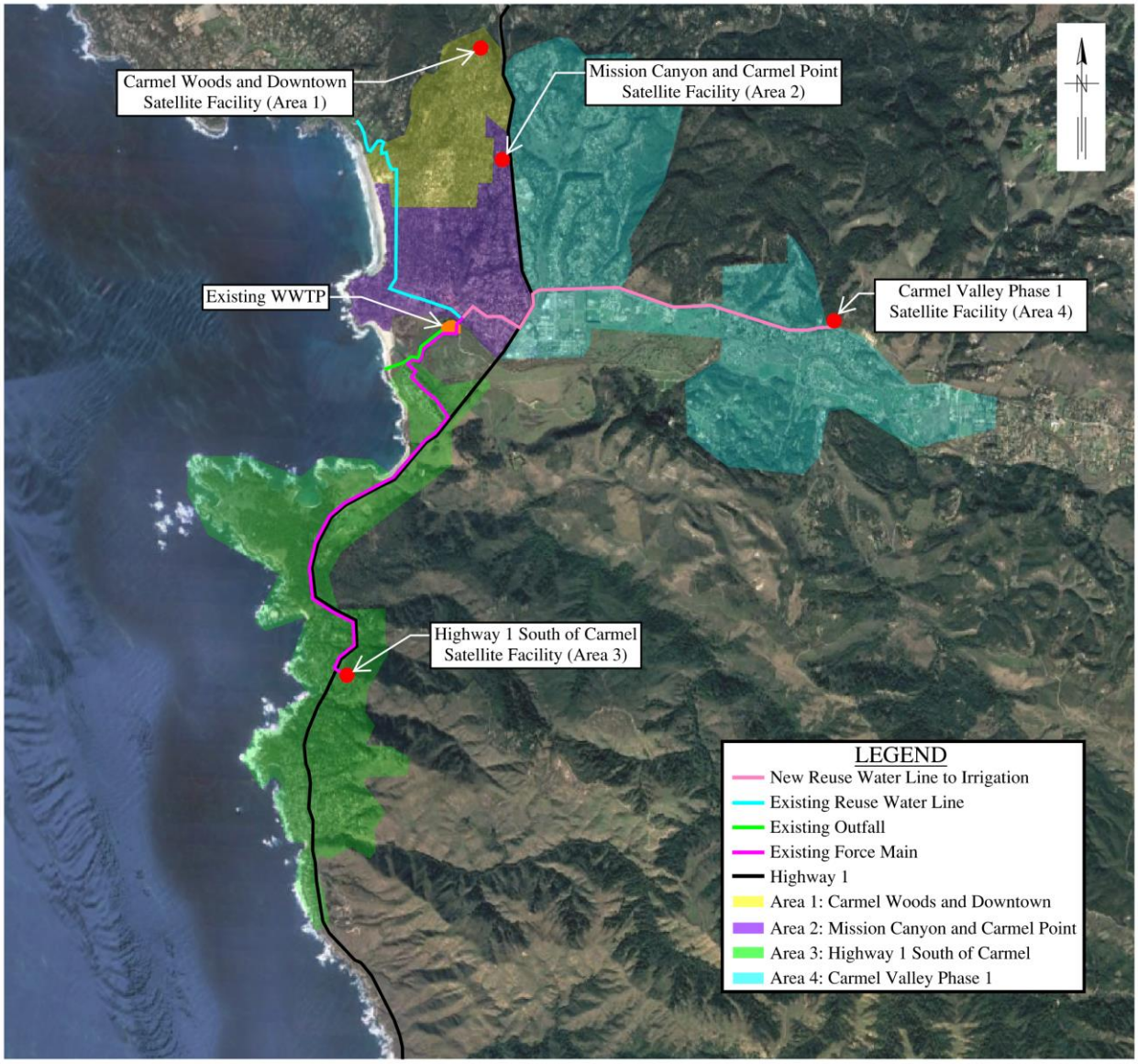


Figure 1-2: Conceptual Conveyance Piping for Satellite Facilities

Each service area would include an equalization (EQ) basin. The EQ basin sizing assumes a 0.25 MG maximum storage capacity with an additional 5-ft freeboard. The dimensions of the EQ basin were determined to be approximately 70’ length, 40’ width, and 17’ depth.

Figure 1-3 shows a section view sketch of the EQ basin.

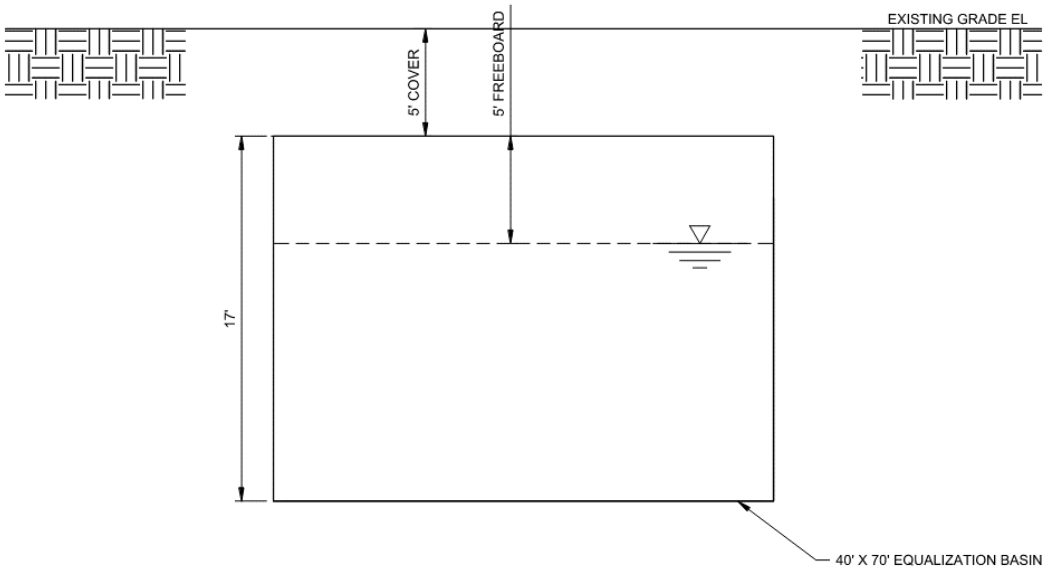


Figure 1-3 Decentralized EQ Basin Section

SECTION 2 PROPOSED NEW SATELLITE WRRF TREATMENT TRAIN

Each satellite facility is proposed to follow the treatment train layout as described in this section. The facility in Area 4 is proposed to have the capacity to handle the solids produced in all four (4) satellite facilities. Two treatment train scenarios are considered as follows:

- Maximum liquid treatment capacity of 0.25 MGD without sludge treatment (Areas 1, 2, and 3)
- Maximum liquid treatment capacity of 0.25 MGD with sludge treatment for all four (4) satellite facilities (Area 4)

The proposed treatment train for the liquid portion in each of the four new satellite facilities would be the same; incorporating preliminary treatment, membrane bioreactor (MBR) technology, reverse osmosis, disinfection with advanced oxidation process that utilizes hydrogen peroxide and UV light, and finally chloramination for residual disinfection. By utilizing MBR, the new WRRF would eliminate the need for primary clarifiers and secondary clarifiers. By eliminating the need for clarifiers, the footprint of the new WRRF can be significantly reduced.

The footprint of the liquid only treatment satellite facilities serving Areas 1, 2, and 3 could be built on a one (1) acre site. The footprint of the larger facility in Area 4 that includes solids treatment could be built on a (2) acre site.

The facility in Area 4 will utilize solids treatment to produce Class A fertilizer. A simplified conceptual process flow diagram for the proposed treatment train for Areas 1, 2, and 3 is shown in **Figure 2-1**. The conceptual process flow diagram for the proposed treatment train for Area 4 is shown in **Figure 2-3.** A conceptual layout for the WRRF Areas is shown in **Figure 2-3.**

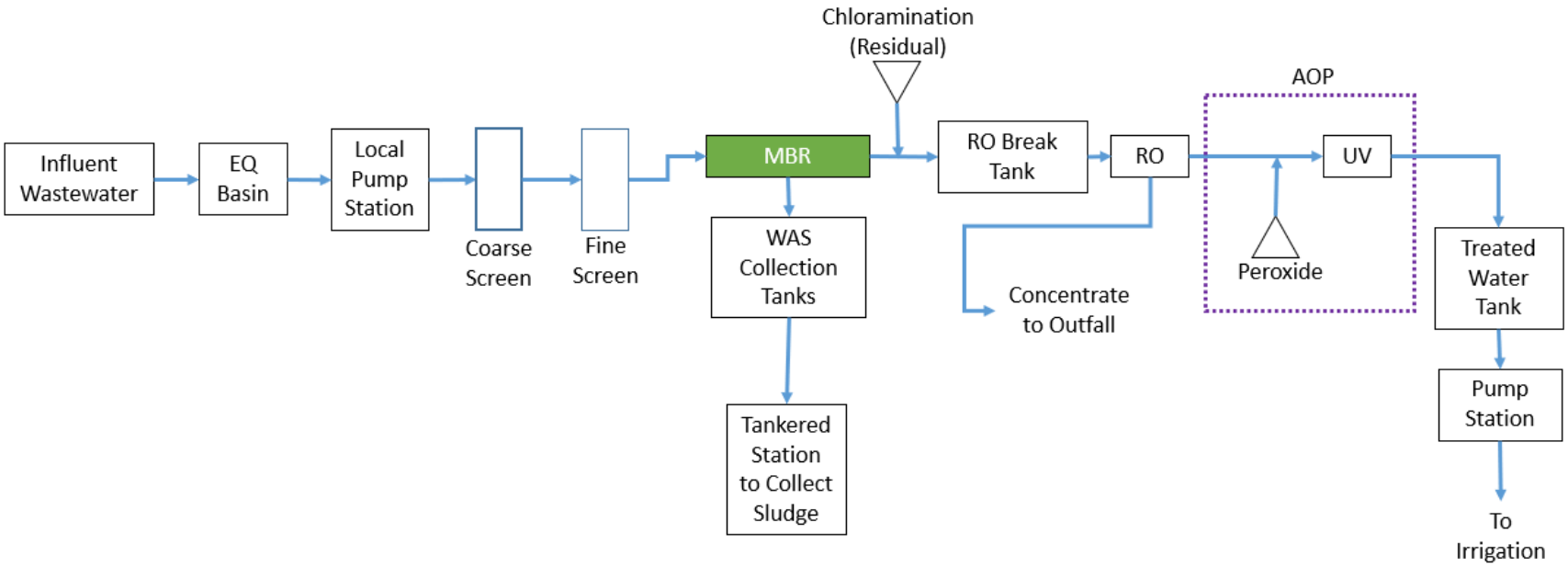


Figure 2-1: New Satellite WRRF Process Flow Diagram (PFD) for Areas 1, 2 and 3

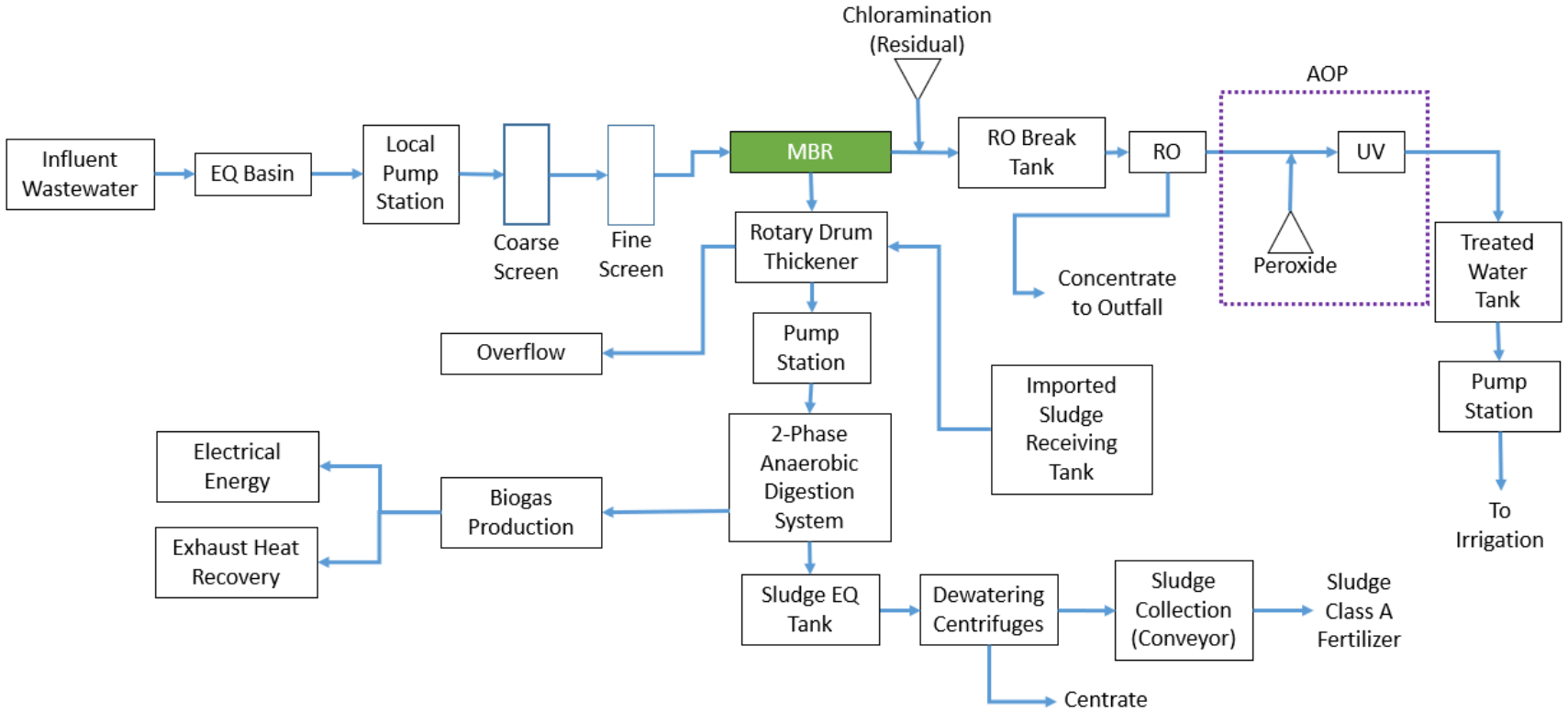
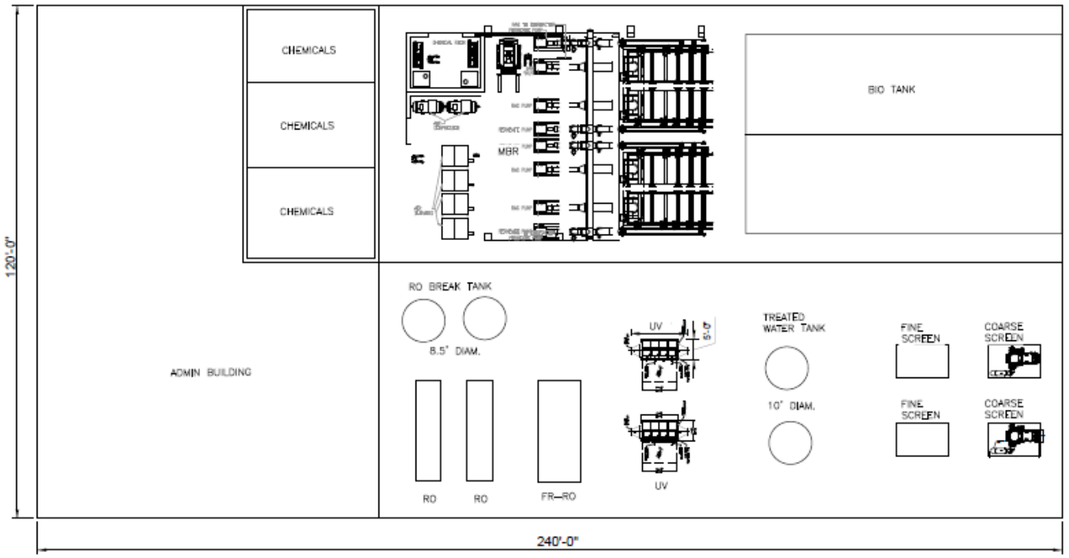
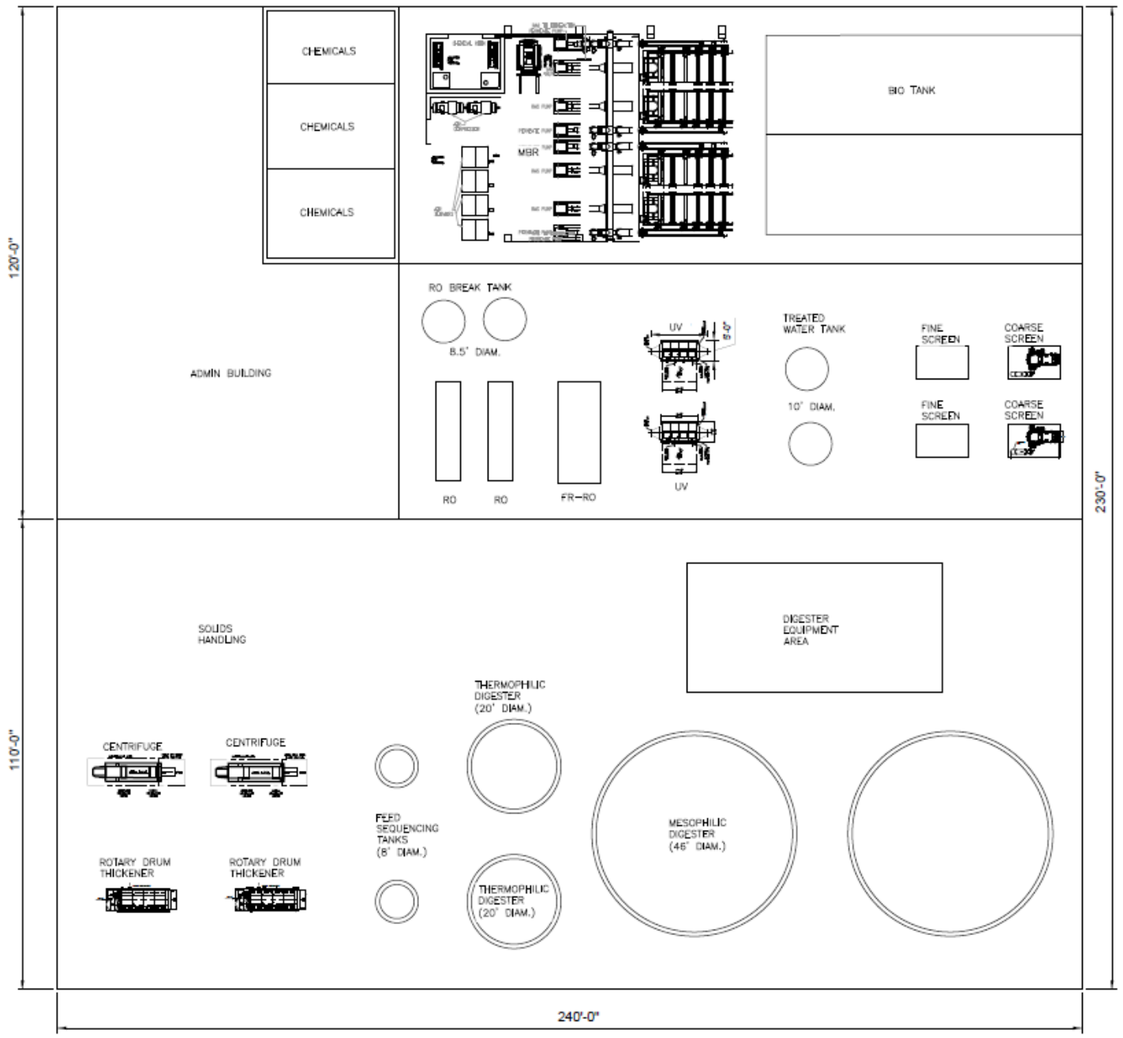


Figure 2-2: New Satellite WRRF Process Flow Diagram (PFD) - Area 4



DECENTRALIZED WRRF PLAN – AREAS 1, 2, AND 3



DECENTRALIZED WRRF PLAN – AREA 4

Figure 2-3: Conceptual Decentralized WWRF Layout Plans

SECTION 3 NEW SATELLITE PLANT TREATMENT TRAIN – PRELIMINARY DESIGN

This section presents the preliminary sizing of the proposed treatment train for the new satellite plants. Preliminary sizing is based on the data provided by CAWD.

3.1 NEW SATELLITE PLANTS UNIT PROCESSES (LIQUID) PRELIMINARY SIZING

Preliminary sizing, budget and layout information was requested from equipment manufacturers (provided in Appendix B) and a conceptual preliminary design was developed for the liquid treatment portion of the WRRF. **Table 3-1** shows the quantities and preliminary size of the unit process components for liquid treatment in all four (4) of the satellite facilities.

Table 3-1 Satellite WRRF Preliminary Sizing – Liquid Process in Areas 1, 2, 3, and 4

Unit Process	Type	Quantity	Preliminary Size
Preliminary Treatment			
Flow Equalization	EQ Basin 0.25 MG Working Capacity	1	70' length, 40' width, and 17' depth
Raw Sewage Pump Station	Pumps	3	0.75 MGD x 80 psi
Influent screening	Coarse Rake Screening	2	4' Wide ,7' Long, 6' Height
Influent screening	Fine Drum Screening	2	4' Wide ,7.5' Long, 6.6' Height
Advanced Treatment			
MBR Zee Weed 500D	Membrane Train	2	9' Wide, 15' Long, 13' Depth
RO Break Tank with Pumps	5,000 Gallon (20 min average flow)	2	8.5' Diameter, 12.5' Height
RO	174 gpm RO System	2	RO skid with 5:3:1, 6-long housing array.
Brine Recovery RO (BRRO) with flipping concept	FR RO System (Recovery rate = 75%-86%)	1	0.25 MGD Skid
Disinfection			
Advanced Oxidation Process (AOP)	TrojanUVPHOX™ - 18AL50	2	5' Wide, 7' Long, 5' Height
Residual Disinfectant	Oxidant Skid (Chloramination)	2	5 HP Dosing pumps
Treated Water Tank	8,000 Gallon Tank (30 min Retention Time Average flow)	2	10' Diameter, 15' Height
Treated Water Pump Station			
Treated Water Pumps	Pumps (2 running and 1 spare)	3	Total 0.75 MGD x 80 psi

3.2 NEW SATELLITE PLANTS UNIT PROCESSES (SOLIDS) PRELIMINARY SIZING FOR AREA 4 ONLY

A summary of the solids characteristics from the existing WWTP at Carmel, the estimated performance requirements for the solids handling processes, and estimated energy production and Class A biosolids production can be found in the 2023 Technical Report No. 1 "Proposed Conceptual Design Centralized Water Resource Recovery Facility and Treated Water Conveyance" prepared by Greeley and Hansen. Based on these estimates, information was requested from equipment manufacturers (provided in Appendix B) and a conceptual preliminary design was developed for the solids handling portion of the satellite plants proposed. As previously noted, only the facility in Area 4 would have the solids handling equipment with the capacity to treat the solids produced in all 4 satellites facilities. Solids from Areas 1, 2 and 3 will be hauled to the solids processing facility located at the facility in the Area 4. **Table 3-3** shows proposed quantities and preliminary sizing of the solids handling unit process from the preliminary design.

Table 3-2 Satellite WRRF Preliminary Sizing – Solids Process (Area 4 Only)

Unit Process	Type	Quantity	Preliminary Size
Sludge Pump Station	Sludge Pumps	3	23,000 GPD x 40 psi
Thickening	Rotary Drum Thickener	2	23,000 GPD Capacity 5' Wide ,17' Long, 7.5' Height
Digestion	2-Phase Anaerobic Digestion System	2	One (1) Feed Sequencing Tank (8' Diameter, 24' Depth) One (1) Thermophilic Digester (20' Diameter, 24' Depth) Thermophilic SRT = 2.28 days Oner (1) Mesophilic Digester (46' Diameter, 24' Depth) Mesophilic SRT = 11.85 days
Dewatering	Centrifuges	2	10,000 GPD feed Solids 2,000 lbs/day feed 4' Wide ,13' Long, 6' Height

Similar to the approach described for the centralized facility alternative, the majority of the equipment components for the liquid and solids handling unit processes in the satellite facilities could be enclosed in barn-style buildings, and the required tanks (digester tanks, storage tanks and biological tanks for the MBR system) would be underground. This approach will allow blending view of the WRRF with the surroundings.

3.3 NEW SATELLITE WRRF EQUIPMENT ELECTRICAL REQUIREMENTS

Table 3-4 shows the electrical requirements of the major components on the new WRRF. The electrical components pertaining to solids handling equipment would only apply to the facility for Area 4.

Table 3-3 WRRF Electrical Component Requirements for Each Satellite Plant

Unit Processes	Type	Electrical Requirements
Flow Equalization	EQ Basin	Mixers – 5 HP each
Raw Sewage Main Pump Station	Pumps	0.75 MGD x 80 psi (50 HP total)
Influent screening	Coarse Rake Screening	• Wash press electric drive motor 5.0 HP TEFC 1760 rpm suitable for 460/3/60 supply
	Fine Drum Screening	• Drive unit with 1.5 HP TEFC motor suitable for 460/3/60 electrical supply.
MBR	MBR Train	2,400 kWh-day (this includes the major equipment – mixers, process blowers, membrane permeate pumps, membrane blowers, compressors, and RAS pumps)
RO Break Tank with Pumps	5,000 Gallon (20 min average flow)	0.75 MGD x 40 psi
RO	2 x 0.4 MGD RO System and Ancillary Equipment, including Start-up Services	• RO High Pressure Pumps 2 x 0.4 MGD x 120 psi •2 CIP Pumps – Motor 10 HP, 1800 RPM, 460 V, premium efficiency, TEFC • 1 CIP Tank Mixer – Motor 1 HP, 1800 RPM, 460 V • Flush pumps; Static Mixers; Feed Pumps. • VFDs and Starters. • Air supply system for pneumatic valves. • Flush Tank and all related equipment for the flushing system.
Brine Recovery RO (BRRO) with flipping concept	0.15 MGD Flow Reversal RO System (recovery rate = 75%-86%)	0.15 MGD x 350 psi
Thickening	Rotary Drum Thickener	• Main Unit Drive – 1.0 HP. The controller shall be a variable frequency drive (VFD) built for 460 Volts/3 Phase/60 Hertz input power. • Floc Tank Drive: Eurodrive 0.5 HP, The controller shall be a variable frequency drive (VFD) built for 460 Volts/3 Phase/60 Hertz input power. • High Pressure Booster Pump: pump will be driven by a fixed speed, 460 Volts/3 Phase/60 Hertz/3500 RPM direct coupled to a 3 HP TEFC motor.
Sludge Pump Station	Sludge Pumps	6,000 GPD x 40 psi
Dewatering	Centrifuges	• Main-drive motor: 10 HP • Back-drive motor: 2.0 HP

Unit Processes	Type	Electrical Requirements
		• The selected main-drive motor and the back-drive motor are both VFD control, 460 Volt, 60 Hz, 3 phase power supply.
Sludge Collection	Conveyor	10 HP
Advanced Oxidation Process (AOP)	TrojanUVPHOX™ - 18AL50	Single phase, 2 wire + gnd, 50/60 Hz L-L, 4.62kW Two (2) Supplies of 120 V single phase, 2 wire plus ground, 60 Hz, 1.2 kVA
Residual Disinfectant	Oxidant Skid (Chloramination)	2 HP (Dosing Pumps)
Treated Water Pump Station (0.75 MGD)	Pumps	Total = 0.75 MGD x 80 psi

The electrical service and distribution conceptual design requirements were developed based on the conceptual layout and associated process component requirements. Subsequent tables describe the preliminary conceptual electrical service distribution configuration(s) reflected in associated budget, as well as pertinent electrical options for further evaluation during detailed design phase.

Table 3-5 identifies the electrical configuration requirements recommended and included in preliminary conceptual budget.

Table 3-4 WRRF Electrical Redundancy Configurations Requirements

Configuration Item	Requirement
Service	Two Separate Services
Distribution Equipment Type	Main-Tie-Main Motor Control Center
Backup Power Supply	Diesel Generator

A redundancy scheme and configuration requirements can have significant impact to the electrical cost component to a new WRRF. These requirements, as shown in **Table 3-5**, have been selected as it coincides with similar facilities and associated operational requirements. It is recommended for both WRRF and Pump Station to be configured to accept two separate electrical services from electrical utility provided by PG&E. Intermediate distribution within each Unit Process area will be served via dedicated Main-Tie-Main configured Motor Control Center, and associated Diesel Generator connected where back-power supply is required. Deployment of these configuration requirements are subject to varying design approaches and will further be defined during the detailed design phase.

Table 3-6 shows the preliminary electrical service size for the New WRRF and EQ Basin & Main Pump Station at each Area.

Table 3-5 WRRF Electrical Service Size

Facility	Size Areas 1, 2, and 3	Size Area 4
New WRRF	800kVA each	1,100kVA
New EQ Basin and MPS	75kVA each	75kVA

Preliminary load calculation of both facilities was determined by Unit Process requirements defined in **Table 3-4.** To support loads identified within **Table 3-4** with some adjustment to support anticipation of typical building and process loads not defined, the recommended redundant size of electrical services at the satellite facilities are defined within **Table 3-6.** These preliminary service sizes are to be finalized subsequent selection of site, corresponding layout, and final equipment list during detailed design phase.

Table 3-7 shows a breakdown of what unit processes will require an on-site redundant source of power during a service(s) outage.

Table 3-6 Backup Diesel Generators Requirements

Unit Processes	Backup Required
Administration Building	Yes
Preliminary Treatment - EQ Basin and MPS	Yes
Preliminary Treatment - Screening	Yes
Advanced Treatment - MBR	Yes
Advanced Treatment - RO	Yes
Solids Handling	Yes (Area 4 only)
Disinfection	Yes

As it corresponds to the criticality of each Unit Process, provisions for where on-site Backup Diesel Generators are required were selected as indicated in **Table 3-7**. The arrangement of how this can be accomplished is subject to varying design approaches and will further be defined during the detailed design phase.

Table 3-8 identifies to intermediate distribution options to further be considered during detailed design of the new satellite WRRF.

Table 3-7 WRRF Electrical Intermediate Distribution Configuration Options

Advantages	Disadvantages
Medium Voltage *	
Reduced Size/Quantity of Conductors	Additional Transformers Required
Minimal Underground Distribution Required	Increase Quantity Point of Failure
Accommodates Future Expansion	Additional Maintenance Required

Advantages	Disadvantages
480 Volt	
Reduced Equipment Cost	Conductor Size/Qty Increased (Factor x8 – x25)
Less Points of Failure	Increase Risk Single Point of Failure (Large Transformers)
Less Equipment Maintenance	Minimal Distribution Expansion

*Included in Preliminary Conceptual Budget

Intermediate distribution configurations vary among WRRF's, and specifically depend on operational, site, and future requirements. **Table 3-8** is defined to support preliminary discussion and evaluation of this electrical infrastructure feature of the electrical design with CAWD Operation and Engineering team(s). Continued discussion and coordination to support design determination of intermediate distribution will further be defined during the detailed design phase.

Table 3-9 captures the potential for a Solar Photovoltaic (PV) power supply at the new satellite WRRF at Areas 1, 2 and 3. **Table 3-10** shows the values for the satellite facilities in Area 4.

Table 3-8 WRRF Solar PV for Areas 1, 2 and 3

Unit Process Canopy	Area (Sqft)	Size (kWdc)	Production (kWh/Year)
Preliminary Treatment - Screening	2,500	32	52,000
Advanced Treatment - MBR	3,000	38	62,000
Advanced Treatment – RO & Disinfection	3,000	38	62,000
Total Each Area	**8,500**	**108**	**176,000**

Table 3-9 WRRF Solar PV Area 4

Unit Process Canopy	Area (Sqft)	Size (kWdc)	Production (kWh/Year)
Preliminary Treatment - Screening	2,500	32	52,000
Advanced Treatment - MBR	3,000	38	62,000
Advanced Treatment – RO & Disinfection	3,000	38	62,000
Solids Handling	7,200	91	149,644
Total	**15,700**	**199**	**325,644**

Solar PV is an opportunity that should be considered given the life cycle of the intended facility to support offset some of the electrical utility cost during operation. A fixed Solar PV installation on top of proposed Unit Process canopies would yield approximately 176,000 kWh per year of production for each of the facilities in Areas 1, 2, and 3, and approximately 325,644 kWh per year of production for Area 4. Utilizing nominal energy rate of 0.12 cents per kWh, the new WRRF in Areas 1, 2 and 3 would each see annual offsetting electric utility savings of approximately $21,000, and Area 4 would see annual offsetting electric utility savings of approximately $39,000.

SECTION 4 OPINION OF PROBABLE CONSTRUCTION COST

Table 4-1 shows the unit price of the major components of the new satellite WRRF. The preliminary Conceptual level OPCC developed is shown in **Appendix A,** and the summary with the overall estimated project construction cost is included in **Table 4-2.** The quotes and information obtained from equipment manufacturers are included in **Appendix B.** Costs are provided for two scenarios. One scenario is for each of the three facilities in Areas 1, 2, and 3 with a liquid treatment design capacity of 0.25 MGD ADWF and no solids handling. The second scenario is for the WRRF in Area 4 that has a liquid treatment capacity of 0.25 MGD ADWF and a solids handling capacity of 1.0 MGD.

The OPCC included in Appendix B is a conceptual level OPCC developed at a Class 4 level per the Association for the Advancement of Cost Engineering (AACE) International standard. This class represents a "study or feasibility" maturity level and has an expected accuracy range of -30% to +50%.

Table 4-1 WRRF Preliminary Equipment Cost

Unit Processes	Type	Quantity for Areas 1, 2, and 3 (Each Area)	Budget Pricing (Total for Each Area)	Quantity for Facility in Area 4	Budget Pricing (Total)
Flow Equalization	EQ Basin Mixers	2	$12,000	2	$12,000
Raw Sewage Main Pump Station	Pumps	3	$30,000	3	$30,000
Influent screening	Coarse Rake Screening	2	$300,000	2	$300,000
	Fine Drum Screening	2	$240,000	2	$240,000
MBR	MBR Train	2	$2,500,000	2	$2,500,000
RO Break Tank with Pumps	5,000 Gallon (20 min average flow)	2	$60,000	2	$60,000
RO	2 x 174 gpm RO System + Ancillary Equipment	2	$840,000	2	$840,000
Brine Recovery RO (BRRO) with flipping concept	0.15 MGD FR RO System (recovery rate = 75%-86%)	1	$350,000	1	$350,000
Thickening	Rotary Drum Thickener	N/A	N/A	2	$380,000
Sludge Pump Station	Sludge Pumps	N/A	N/A	3	$15,000
Digestion	2-Phase Anaerobic Digestion System	N/A	N/A	1 (Redundant)	$3,510,000
Dewatering	Centrifuges	N/A	N/A	2	$504,750
Sludge Collection	Conveyor	N/A	N/A	2	$300,000

Unit Processes	Type	Quantity for Areas 1, 2, and 3 (Each Area)	Budget Pricing (Total for Each Area)	Quantity for Facility in Area 4	Budget Pricing (Total)
Advanced Oxidation Process (AOP)	TrojanUVPHOX™ - 18AL50 + 5 ppm peroxide	2	$960,244	2	$960,244
Residual Disinfectant	Oxidant Skid (Chloramination)	2	$500,000	2	$500,000
Treated Water Tank	8,000 Gallon Tank	2 (8,000 Gallon Tank)	$40,000	2 (8,000 Gallon Tank)	$40,000
Treated Water Pump Station	Pumps	3 (0.75 MGD Total Capacity)	$30,000	3 (0.75 MGD Total Capacity)	$30,000

Table 4-2 WRRF Preliminary Construction Cost

CAWD WWTP Relocation
Carmel Area Wastewater District
Project Construction Costs - ENR CCI = 11,620
Project Summary
New Centralized Water Resource Recovery Facility (WRRF)

AACE Class Number 4
Contingency: 25%

Project Cost (December 2020.75 ENR CCI = 11,620)			
Element No.	Program Element Description	$ WRRF Areas 1, 2, and 3 (EACH)	$ WRRF Area 4
1	New WRRF	12,435,600	20,331,400
2	New Equalization Basin	1,542,100	1,542,100
3	New Pump Station	609,900	609,900
4	Land Acquisition	2,549,200	4,078,800
5	New WRRF Electrical Supply	974,200	1,069,100
6	Conveyance Piping (Average)	16,258,475	23,396,475
	Construction Subtotal	**34,369,475**	**51,027,775**
	Bonds and Insurance (at 3%)	1,031,100	1,530,800
	Engineering (at 7%)	2,405,900	3,571,900
	Construction Management (at 5%)	1,718,500	2,551,400
	Permitting (at 2%)	687,400	1,020,600
	Commissioning (at 2%)	687,400	1,020,600
	Mobilization / Demobilization (at 5%)	1,718,500	2,551,400
	Contingency (at 25%)	8,592,400	12,756,900
	Contractor Overhead and Profit (at 15%)	5,155,400	7,654,200
	Sales Tax (at 9.5%)	3,265,100	4,847,600
	Construction Total	**59,631,175**	**88,533,175**

Construction Total for Areas 1, 2, and 3	**$178,893,525**	
Construction Total for Area 4		**$88,533,175**

	-30% Estimate	Estimated	+50% Estimate
Construction Total Estimate Range of Accuracy (Total for Areas 1, 2, 3, and 4)	**$187,198,690**	**$267,426,700**	**$401,140,050**

SECTION 5 SUMMARY

CAWD is preparing a WWTP long-term coastal hazards planning roadmap, which includes alternatives analysis of relocating the WWTP to address sea level rise for the next 40 years.

In this Report (No. 2) concepts for satellite facilities were developed for the CAWD WWTP in response to climate change and sea level rise. The concepts developed for the new satellite facilities considered upgrading the system to a new Water Resource Recovery Facility (WRRF), taking into consideration available treatment technologies, and incorporating resource recovery to further serve the local community.

The following key infrastructures were considered in the analysis:

- Four (4) New Satellite WRRF to serve four (4) areas accordingly
- New Equalization (EQ) Basin and Pump Station for each of the four (4) satellite facilities
- Reuse of the existing 24” Outfall
- Extension of the existing Reclaimed Water pipeline to the new facilities

The conceptual new treatment process included advanced state-of-the-art treatment technologies, which include coarse and fine screening, followed by MBR, reverse osmosis, advanced oxidation process using hydrogen peroxide and UV light, and finally residual chloramination prior to distribution for beneficial use of the treated water. On the solids treatment, the sludge generated from the MBR process would be thickened with rotary drum thickeners and sent to a 2-Phase Anaerobic Digestion System that includes Thermophilic and Mesophilic Processes. The digested sludge would be dewatered with centrifuges and finally Class A biosolids would be produced, which is considered as a natural fertilizer for beneficial use. The biogas generated as part of the anaerobic digestion process would be used for electrical energy generation and exhaust heat recovery. Solar PV is an opportunity that should be considered given the life cycle of the intended facility to support offset some of the electrical utility cost during facility operation.

APPENDIX A: OPINION OF PROBABLE CONSTRUCTION COST

CAWD WWTP Relocation
Carmel Area Wastewater District
Project Construction Costs - ENR CCI = 11,620
Project Summary
1/26/2023
New Centralized Water Resource Recovery Facility (WRRF)
AACE Class Number 4
Contingency: 25%

GREELEY AND HANSEN

Project Cost (December 2020.75 ENR CCI = 11,620)			
Element No.	Program Element Description	$ WRRF Areas 1, 2, and 3 (Each)	$ WRRF Area 4
1	New WRRF	12,435,600	20,331,400
2	New Equalization Basin	1,542,100	1,542,100
3	New Pump Station	609,900	609,900
4	Land Acquisition	2,549,200	4,078,800
5	New WRRF Electrical Supply	974,200	1,069,100
6	Conveyance Piping (Average)	16,258,475	23,396,475
	Construction Subtotal	**34,369,475**	**51,027,775**
	Bonds and Insurance (at 3%)	1,031,100	1,530,800
	Engineering (at 7%)	2,405,900	3,571,900
	Construction Management (at 5%)	1,718,500	2,551,400
	Permitting (at 2%)	687,400	1,020,600
	Commissioning (at 2%)	687,400	1,020,600
	Mobilization / Demobilization (at 5%)	1,718,500	2,551,400
	Contingency (at 25%)	8,592,400	12,756,900
	Contractor Overhead and Profit (at 15%)	5,155,400	7,654,200
	Sales Tax (at 9.5%)	3,265,100	4,847,600
	Construction Total	**59,631,175**	**88,533,175**

Construction Total for Areas 1, 2, and 3 ($59,631,175 x 3) **$178,893,525**

Construction Total for Area 4 **$88,533,175**

Construction Total Estimate Range of Accuracy for Areas 1, 2, 3 and 4

-30% Estimate	Estimated	+50% Estimate
$187,198,690	$267,426,700	$401,140,050

Project Construction Cost
Project: CAWD WWTP Relocation
Client: Carmel Area Wastewater District
Title: Element No. 1
Date: 1/25/2023
Items Included: New WRRF

CSI No.		Item Name	Takeoff Quantity		Rate: Material	Rate: Labor	Rate: Equipment	Rate: Subcontract	Total Unit Cost	Escalation ENR CCI = 11,396		Unit Cost in Year 2020.75 ENR CCI = 11,620	Total Amount	Source Notes
			Quantity	unit	($/unit)	($/unit)	($/unit)	($/unit)		Year	Escalation Factor			
	PRELIMINARY TREATMENT													
		Coarse Screening	2	EA	$ -	$ -	$ 150,000.00	$ -	$ 150,000.00	2020.75	1.020	$ 152,955	$ 305,900	Saveco Quote - FSM Filter Screen Model FRSIII-T 1000 x 60/6 mounted in stainless steel tank with integral FSM Model SPW 300-1300 Screenings Wash Press
		Fine Screening	2	EA	$ -	$ -	$ 120,000.00	$ -	$ 120,000.00	2020.75	1.020	$ 122,400	$ 244,800	
		Salsnes Filter System	0	EA	$ -	$ -	$ 318,237.00	$ -	$ 318,237.00	2020.75	1.020	$ 324,602	$ -	Salsnes Filter Quote - Model SF6000
												Subtotal	**$ 550,700**	
	ADVANCED TREATMENT													
		Membrane Bioreactor + Bio	1	LS	$ -	$ -	$ 2,500,000	$ -	$ 2,500,000.00	2020.75	1.020	$ 2,549,243	$ 2,549,200	Suez Quote - ZeeWeed MBR System; includes all equipment & services
		RO Break Tank	2	EA	$ -	$ -	$ 60,000.00	$ -	$ 60,000.00	2020.75	1.020	$ 61,182	$ 122,400	
		0.25 MGD RO Skids	2	EA	$ -	$ -	$ 420,000	$ -	$ 420,000.00	2020.75	1.020	$ 428,273	$ 856,500	NorCal Quote; includes RO system, ancillary equipment, and start-up services
		0.15 MGD FR RO	1	EA	$ -	$ -	$ 350,000	$ -	$ 350,000.00	2020.75	1.020	$ 356,894	$ 356,900	NorCal Quote; includes RO system, ancillary equipment, and start-up services
												Subtotal	**$ 3,885,000**	
	SOLIDS HANDLING													
		Rotary Drum Thickener	0	EA		$ -	$ 190,000.00	$ -	$ 190,000.00	2020.75	1.020	$ 193,742	$ -	Parkson Corporation Quote - Model RDT200
		Sludge Pumps	0	EA	$ -	$ -	$ 5,000.00	$ -	$ 5,000.00	2020.75	1.020	$ 5,098	$ -	Engineers Estimate
		Two Phase Anaerobic Digestion System	0	LS	$ -	$ -	$ 3,510,000.00	$ -	$ 3,510,000.00	2020.75	1.020	$ 3,579,137	$ -	SUEZ
		Sludge Equalization Tank	0	EA	$ -	$ -	$ 20,000.00	$ -	$ 20,000.00	2020.75	1.020	$ 20,394	$ -	Engineers Estimate
		Dewatering Centrifuges	0	EA	$ -	$ -	$ 252,375.00	$ -	$ 252,375.00	2020.75	1.020	$ 257,346	$ -	Alfa Laval Quote - Model Aldec 45; includes set of controls, set of ancillaries, and commissioning
		Conveyor	0	LS	$ -	$ -	$ 150,000.00	$ -	$ 150,000.00	2020.75	1.020	$ 152,955	$ -	Engineers Estimate
												Subtotal	**$ -**	
	DISINFECTION													
		Advanced Oxidation Process - Hydrogen Peroxide with UV	1	LS	$ -	$ -	$ 1,000,000.00	$ -	$ 1,000,000.00	2020.75	1.020	$ 1,019,697	$ 1,019,700	Trojan Technologies Quote - TrojanUVFlex AOP 100 (add $250K for oxidant dosing pumps and HDPE tank) Lump sum price is for two (2) UV reactors
		Residual Disinfectant - Chloramination	2	EA	$ -	$ -	$ 250,000.00	$ -	$ 250,000.00	2020.75	1.020	$ 254,924	$ 509,800	Trojan UV Quote
		Treated Water Tank	2	EA	$ -	$ -	$ 20,000.00	$ -	$ 20,000.00	2020.75	1.020	$ 20,394	$ 40,800	Engineers Estimate
		Reuse Water Pumps	3	EA	$ -	$ -	$ 5,000.00	$ -	$ 5,000.00	2020.75	1.020	$ 5,098	$ 15,300	Engineers Estimate
												Subtotal	**$ 1,585,600**	
	BUILDINGS													
		Barn-style Building for Equipment	6	EA	$ -	$ -	$ 100,000.00	$ -	$ 100,000.00	2020.75	1.020	$ 101,970	$ 611,800	
		Concrete - Base Slab	240	CY	$ 515.48	$ 419.99	$ 21.16	$ -	$ 956.63	2020.75	1.020	$ 975	$ 234,100	RSMeans 033053401900 - Elevated slab (4000 psi), flat slab with drops, 125 psf sup. Load, 20' span
		Light Cover Over Bio Tanks	2	EA	$ -	$ -	$ 100,000.00	$ -	$ 100,000.00	2021.75	1.020	$ 101,970	$ 203,900	
												Subtotal	**$ 1,049,800**	
	EXCAVATION													
		MBR Tanks	4,052	CY	$ -	$ 260.00	$ 0.83	$ -	$ 260.83	2020.75	1.020	$ 266	$ 1,077,600	
		Digesters	0	CY	$ -	$ 260.00	$ 0.83	$ -	$ 260.83	2020.75	1.020	$ 266	$ -	RSMeans 033053401900 - Elevated slab (4000 psi), flat slab with drops, 125 psf sup. Load, 20' span
		RO Break Tanks and Treated Water Tanks	204	CY	$ -	$ 260.00	$ 0.83	$ -	$ 260.83	2020.75	1.020	$ 266	$ 54,400	
												Subtotal	**$ 1,132,000**	
												Element No. 1 Direct Cost	**$ 8,203,100**	
												Electrical (includes Installation)	$ 2,181,720	
											10%	I&C	$ 820,310	
											15%	Installation	$ 1,230,465	
												Element No. 1 Total	**$ 12,435,600**	

Project Construction Cost
Project: CAWD WWTP Relocation
Client: Carmel Area Wastewater District
Title: Element No. 1
Date: 1/25/2023
Items Included: New WRRF

CSI No.		Item Name	Takeoff Quantity		Rate: Material	Rate: Labor	Rate: Equipment	Rate: Subcontract	Total Unit Cost	Escalation ENR CCI = 11,396		Unit Cost in Year 2020.75 ENR CCI = 11,620	Total Amount	Source Notes
			Quantity	unit	($/unit)	($/unit)	($/unit)	($/unit)		Year	Escalation Factor			
	PRELIMINARY TREATMENT													
		Coarse Screening	2	EA	$ -	$ -	$ 150,000.00	$ -	$ 150,000.00	2020.75	1.020	$ 152,955	$ 305,900	Saveco Quote - FSM Filter Screen Model FRSIII-T 1000 x 60/6 mounted in stainless steel tank with integral FSM Model SPW 300-1300 Screenings Wash Press
		Fine Screening	2	EA	$ -	$ -	$ 120,000.00	$ -	$ 120,000.00	2020.75	1.020	$ 122,400	$ 244,800	
		Salsnes Filter System	0	EA	$ -	$ -	$ 318,237.00	$ -	$ 318,237.00	2020.75	1.020	$ 324,602	$ -	Salsnes Filter Quote - Model SF6000
												Subtotal	**$ 550,700**	
	ADVANCED TREATMENT													
		Membrane Bioreactor + Bio	1	LS	$ -	$ -	$ 2,500,000	$ -	$ 2,500,000.00	2020.75	1.020	$ 2,549,243	$ 2,549,200	Suez Quote - ZeeWeed MBR System; includes all equipment & services
		RO Break Tank	2	EA	$ -	$ -	$ 60,000.00	$ -	$ 60,000.00	2020.75	1.020	$ 61,182	$ 122,400	
		0.25 MGD RO Skids	2	EA	$ -	$ -	$ 420,000	$ -	$ 420,000.00	2020.75	1.020	$ 428,273	$ 856,500	NorCal Quote; includes RO system, ancillary equipment, and start-up services
		0.15 MGD FR RO	1	EA	$ -	$ -	$ 350,000	$ -	$ 350,000.00	2020.75	1.020	$ 356,894	$ 356,900	NorCal Quote; includes RO system, ancillary equipment, and start-up services
												Subtotal	**$ 3,885,000**	
	SOLIDS HANDLING													
		Rotary Drum Thickener	2	EA		$ -	$ 190,000.00	$ -	$ 190,000.00	2020.75	1.020	$ 193,742	$ 387,500	Parkson Corporation Quote - Model RDT200
		Sludge Pumps	3	EA	$ -	$ -	$ 5,000.00	$ -	$ 5,000.00	2020.75	1.020	$ 5,098	$ 15,300	Engineers Estimate
		Two Phase Anaerobic Digestion System	1	LS	$ -	$ -	$ 3,510,000.00	$ -	$ 3,510,000.00	2020.75	1.020	$ 3,579,137	$ 3,579,100	SUEZ
		Sludge Equalization Tank	1	EA	$ -	$ -	$ 20,000.00	$ -	$ 20,000.00	2020.75	1.020	$ 20,394	$ 20,400	Engineers Estimate
		Dewatering Centrifuges	2	EA	$ -	$ -	$ 252,375.00	$ -	$ 252,375.00	2020.75	1.020	$ 257,346	$ 514,700	Alfa Laval Quote - Model Aldec 45; includes set of controls, set of ancillaries, and commissioning
		Conveyor	2	LS	$ -	$ -	$ 150,000.00	$ -	$ 150,000.00	2020.75	1.020	$ 152,955	$ 305,900	Engineers Estimate
												Subtotal	**$ 4,822,900**	
	DISINFECTION													
		Advanced Oxidation Process - Hydrogen Peroxide with UV	1	LS	$ -	$ -	$ 1,000,000.00	$ -	$ 1,000,000.00	2020.75	1.020	$ 1,019,697	$ 1,019,700	Trojan Technologies Quote - TrojanUVFlex AOP 100 (add $250K for oxidant dosing pumps and HDPE tank) Lump sum price is for two (2) UV reactors
		Residual Disinfectant - Chloramination	2	EA	$ -	$ -	$ 250,000.00	$ -	$ 250,000.00	2020.75	1.020	$ 254,924	$ 509,800	Trojan UV Quote
		Treated Water Tank	2	EA	$ -	$ -	$ 20,000.00	$ -	$ 20,000.00	2020.75	1.020	$ 20,394	$ 40,800	Engineers Estimate
		Reuse Water Pumps	3	EA	$ -	$ -	$ 5,000.00	$ -	$ 5,000.00	2020.75	1.020	$ 5,098	$ 15,300	Engineers Estimate
												Subtotal	**$ 1,585,600**	
	BUILDINGS													
		Barn-style Building for Equipment	6	EA	$ -	$ -	$ 100,000.00	$ -	$ 100,000.00	2020.75	1.020	$ 101,970	$ 611,800	
		Concrete - Base Slab	240	CY	$ 515.48	$ 419.99	$ 21.16	$ -	$ 956.63	2020.75	1.020	$ 975	$ 234,100	RSMeans 033053401900 - Elevated slab (4000 psi), flat slab with drops, 125 psf sup. Load, 20' span
		Light Cover Over Bio Tanks	2	EA	$ -	$ -	$ 100,000.00	$ -	$ 100,000.00	2021.75	1.020	$ 101,970	$ 203,900	
												Subtotal	**$ 1,049,800**	
	EXCAVATION													
		MBR Tanks	4,052	CY	$ -	$ 260.00	$ 0.83	$ -	$ 260.83	2020.75	1.020	$ 266	$ 1,077,600	
		Digesters	5,616	CY	$ -	$ 260.00	$ 0.83	$ -	$ 260.83	2020.75	1.020	$ 266	$ 1,493,700	RSMeans 033053401900 - Elevated slab (4000 psi), flat slab with drops, 125 psf sup. Load, 20' span
		RO Break Tanks and Treated Water Tanks	204	CY	$ -	$ 260.00	$ 0.83	$ -	$ 260.83	2020.75	1.020	$ 266	$ 54,400	
												Subtotal	**$ 2,625,700**	
												Element No. 1 Direct Cost	**$ 14,519,700**	
												Electrical (includes Installation)	$ 2,181,720	
											10%	I&C	$ 1,451,970	
											15%	Installation	$ 2,177,955	
												Element No. 1 Total	**$ 20,331,400**	

Project Construction Cost

Project: CAWD WWTP Relocation
Client: Carmel Area Wastewater District
Title: Element No. 2
Date: 1/25/2023

Items Included: New Equalization Basin

CSI No.		Item Name	Takeoff Quantity		Rate: Material	Rate: Labor	Rate: Equipment	Rate: Subcontract	Total Unit Cost	Escalation ENR CCI = 11,396		Unit Cost in Year 2020.75 ENR CCI = 11,620	Total Amount	Source Notes
			Quantity	unit	($/unit)	($/unit)	($/unit)	($/unit)		Year	Escalation Factor			
	SITE WORK													
		Clearing and Grubbing		ACRE	$ -	$ 2,300.00	$ 4,489.20	$ -	$ 6,789.20	2020.75	1.020	$ 6,923	$ -	RSMeans 311110100160 - Clear & Grub brush including stumps
		Rough Grading	1	EA	$ -	$ 467.18	$ 443.76	$ -	$ 910.94	2020.75	1.020	$ 929	$ 900	RSMeans 312213200200 - Rough grade open sites, 10,000-20,000 SF
												Subtotal	**$ 900**	
	EARTHWORK													
		Excavation	3,259	BCY	$ -	$ 260.00	$ 0.83	$ -	$ 260.83	2020.75	1.020	$ 266	$ 866,900	RSMeans 312316425500 - Excavating, bulk bank measure, sandy clay & loam piled; excavator 3-1/2 CY cap = 350 CY/hr
												Subtotal	**$ 866,900**	
	CONCRETE													
		Concrete - Base Slab	207	BCY	$ 515.48	$ 419.99	$ 21.16	$ -	$ 956.63	2020.75	1.020	$ 975	$ 202,300	RSMeans 033053401900 - Elevated slab (4000 psi), flat slab with drops, 125 psf sup. Load, 20' span
		Concrete - Walls	139	BCY	$ 314.51	$ 315.33	$ 16.51	$ -	$ 646.35	2020.75	1.020	$ 659	$ 91,300	RSMeans 033053404500 - Wall, free-standing (3000 psi), 15" thick, 18' high
												Subtotal	**$ 293,600**	
	WASTEWATER EQUIPMENT													
		Mixers	2	EA	$ -	$ -	$ 3,000.00	$ -	$ 3,000.00	2020.75	1.020	**$ 3,059.09**	$ 6,100	
												Subtotal	**$ 6,100**	
	ELECTRICAL													
		Site lighting and general power to support basin, site poles and misc power requirement	1	LS	$ -	$ -	$ 85,000.00	$ -	$ 85,000.00	2021.75	1.020	$ 86,674	$ 86,700	
												Subtotal	**$ 86,700**	
	INSTRUMENTATION AND CONTROLS													
		Process Integration	1	LS	$ -	$ -	$ 85,000.00	$ -	$ 85,000.00	2020.75	1.020	$ 86,674	$ 86,700	
												Subtotal	**$ 86,700**	
												Element No. 2 Direct Cost	**$ 1,340,900**	
											15%	Installation	$ 201,135	
												Element No. 2 Total	**$ 1,542,100**	

Project Construction Cost

Project: CAWD WWTP Relocation
Client: Carmel Area Wastewater District
Title: Element No. 3
Date: 1/25/2023

Items Included: New Pump Station

CSI No.		Item Name	Takeoff Quantity		Rate					Escalation ENR CCI = 11,396		Unit Cost in Year 2020.75 ENR CCI = 11,620	Total Amount	Source Notes
			Quantity	unit	Material ($/unit)	Labor ($/unit)	Equipment ($/unit)	Subcontract ($/unit)	Total Unit Cost	Year	Escalation Factor			
	SITE WORK													
		Clearing and Grubbing	1	ACRE	$ -	$ 2,300.00	$ 4,489.20	$ -	$ 6,789.20	2020.75	1.020	$ 6,923	$ 6,900	RSMeans 311110100160 - Clear & Grub brush including stumps
		Rough Grading	1	EA	$ -	$ 467.18	$ 443.76	$ -	$ 910.94	2020.75	1.020	$ 929	$ 900	RSMeans 312213200200 - Rough grade open sites, 10,000-20,000 SF
												Subtotal	**$ 7,800**	
	EQUIPMENT													
		Pumps	3	EA	$ -	$ -	$ 10,000.00	$ -	$ 10,000.00	2020.75	1.020	$ 10,197	$ 30,600	
		Pump Station Building	1	LS	$ -	$ -	$ -	$ -	$ 300,000.00	2020.75	1.020	$ 305,909	$ 305,900	
		Bollards	4	EA	$ 763.20	$ 137.81	$ 28.38	$ -	$ 929.39	2020.75	1.020	$ 948	$ 3,800	RSMeans 321713131500 - Metal parking bumpers, pipe bollards, concrete filled/painted, 8' L x 4' D hole, 12" diam.
												Subtotal	**$ 340,300**	
	ELECTRICAL													
		Service and Distribution	1	LS	$ -	$ -	$ 148,650.00	$ -	$ 148,650.00	2020.75	1.020	$ 151,578	$ 151,600	
												Subtotal	**$ 151,600**	
	INSTRUMENTATION & CONTROLS													
		Process Integration	1	LS	$ -	$ 30,000.00	$ -	$ -	$ 30,000	2020.75	1.020	$ 30,591	$ 30,600	
												Subtotal	**$ 30,600**	
												Element No. 3 Direct Cost	**$ 530,300**	
											15%	Installation	$ 79,545	
												Element No. 3 Total	**$ 609,900**	

Project Construction Cost

Project: CAWD WWTP Relocation
Client: Carmel Area Wastewater District
Title: Element No. 4
Date: 1/25/2023

Items Included: Land Acquisition

CSI No.		Item Name	Takeoff Quantity		Rate					Escalation ENR CCI = 11,396		Unit Cost in Year 2020.75 ENR CCI = 11,620	Total Amount	Source Notes
			Quantity	unit	Material ($/unit)	Labor ($/unit)	Equipment ($/unit)	Subcontract ($/unit)	Total Unit Cost	Year	Escalation Factor			
	LAND ACQUISITION													
		Area 1	1.3	ACRE	$ -	$ -	$ -	$ -	$ 2,000,000.00	2020.75	1.020	$ 2,039,394	$ 2,549,200	Engineers estimate
		Area 2	1.3	ACRE	$ -	$ -	$ -	$ -	$ 2,000,000.00	2020.75	1.020	$ 2,039,394	$ 2,549,200	Engineers estimate
		Area 3	1.3	ACRE	$ -	$ -	$ -	$ -	$ 2,000,000.00	2020.75	1.020	$ 2,039,394	$ 2,549,200	Engineers estimate
		Area 4	2.0	ACRE	$ -	$ -	$ -	$ -	$ 2,000,000.00	2020.75	1.020	$ 2,039,394	$ 4,078,800	Engineers estimate
												Subtotal	**$ 11,726,400**	
												Element No. 4 Direct Cost	**$ 11,726,400**	
												Element No. 4 Total	**$ 11,726,400**	

Project Construction Cost

Project: CAWD WWTP Relocation
Client: Carmel Area Wastewater District
Title: Element No. 5
Date: 1/25/2023

Items Included: New WRRF Electrical Supply

CSI No.		Item Name	Takeoff Quantity		Rate					Escalation ENR CCI = 11,396		Unit Cost in Year 2020.75 ENR CCI = 11,620	Total Amount	Source Notes
			Quantity	unit	Material ($/unit)	Labor ($/unit)	Equipment ($/unit)	Subcontract ($/unit)	Total Unit Cost	Year	Escalation Factor			
	ELECTRICAL SUPPLY													
		PG&E	1	LS	$ -	$ -	$ -	$ 465,000.00	$ 465,000.00	2020.75	1.020	$ 474,159	$ 474,200	Per PG&E Unit Price Guide Dated April, 2021. Includes Primary Service Entrance Switchgear (QTY-2) and Underground Line from Nearest Pole(s) (QTY-1,000' Per Service).
		Electrical Routing and Connections		LS	$ -	$ -	$ -	$ -	$ -	2020.75	1.020	$ -	$ -	
												Subtotal	**$ 474,200**	
												Subtotal	**$ -**	
												Element No. 5 Direct Cost	**$ 474,200**	
												Additional 20% for Area 4	**$ 569,040**	
												Allowance Diesel Generators	$ 500,000	
												Element No. 5 Total Areas 1, 2, 3 each	**$ 974,200**	
												Elemnt No. 5 Total Area 4	**$ 1,069,100**	

Project Construction Cost

Project: CAWD WWTP Relocation
Client: Carmel Area Wastewater District
Title: Element No. 6
Date: 1/25/2023

Items Included: Conveyance Piping

CSI No.		Item Name	Takeoff Quantity		Rate					Escalation ENR CCI = 11,396		Unit Cost in Year 2020.75 ENR CCI = 11,620	Total Amount	Source Notes
					Material	Labor	Equipment	Subcontract	Total Unit Cost					
			Quantity	unit	($/unit)	($/unit)	($/unit)	($/unit)		Year	Escalation Factor			
	CONVEYANCE PIPING													
		Area 1 Gravity Discharge to Outfall	15,000	FT	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 5,353,400	Engineers estimate
		Line from EQ Basin/Pump Station to WRRF Area 1	15,000	FT	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 5,353,400	Engineers estimate
		Area 2 Gravity Discharge to Outfall	10,000	FT	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 3,568,900	Engineers estimate
		Line from EQ Basin/Pump Station to WRRF Area 2	10,000	FT	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 3,568,900	Engineers estimate
		Area 3 Gravity Discharge to Outfall	20,000	FT	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 7,137,900	Engineers estimate
		Line from EQ Basin/Pump Station to WRRF Area 3	20,000	FT	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 7,137,900	Engineers estimate
		Area 4 Gravity Discharge from WRRF to Outfall	25,000	FT	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 8,922,400	Engineers estimate
		Line from EQ Basin/Pump Station to WRRF Area 4	25,000	FT	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 8,922,400	Engineers estimate
		Trench excavation and backfill for 6-30 inch sewer pipe (4 to 12 foot depth)	62,222	CY	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 22,206,700	Engineers estimate
		New Reuse Water Line to Irrigation	16,800	FT	$ -	$ -	$ -	$ -	$ 350.00	2020.75	1.020	$ 357	$ 5,995,800	Engineers estimate
												Subtotal	**$ 78,167,700**	
												Element No. 6 Direct Cost	**$ 78,167,700**	
												Average Each Facility Area 1, 2, 3	**$ 16,258,475**	
												Area 4	**$ 23,396,475**	
												Element No. 4 Total	**$ 78,167,700**	

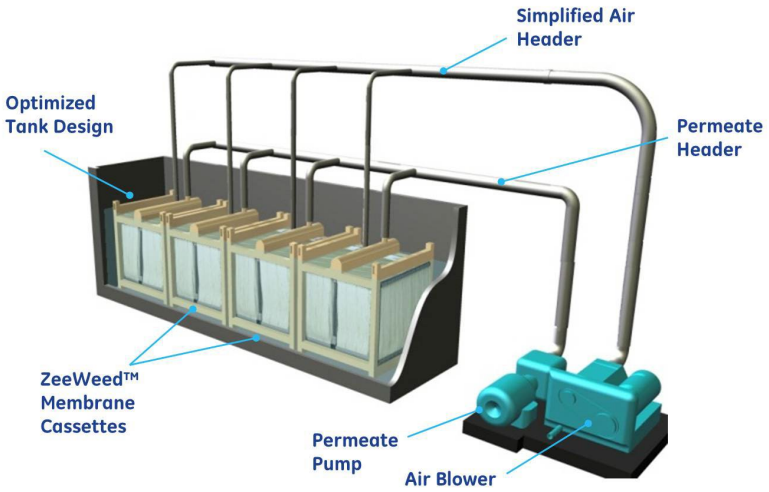
APPENDIX B: EQUIPMENT DATA AND INFORMATION

Qualifier Proposal: ZeeWeed® Membrane Bioreactor System

Project Name: Carmel Area WWTP
Location: Carmel, CA
Submitted To: Greely-Hansen
Date: November 7, 2022
SUEZ Contact: Chris Allen, P.E. – Regional Manager

The ZeeWeed® Membrane Bioreactor Process

The ZeeWeed® Membrane Bioreactor (MBR) process is technology that consists of a suspended growth biological reactor integrated with an ultrafiltration membrane system, using the ZeeWeed® hollow fiber membrane. Essentially, the ultrafiltration system replaces the solids separation function of secondary clarifiers and sand filters in a conventional activated sludge system.



ZeeWeed® ultrafiltration membranes are immersed in an aeration tank, in direct contact with mixed liquor. Through the use of a permeate pump, a vacuum is applied to a header connected to the membranes. The vacuum draws the treated water through the hollow fiber ultrafiltration membranes. Permeate is then directed to disinfection or discharge facilities. Intermittent airflow is introduced to the bottom of the membrane module, producing turbulence that scours the external surface of the hollow fibers. This scouring action transfers rejected solids away from the membrane surface.

Influent Flow Data

Hydraulic Condition	Flow	Units
Average dry weather flow (ADWF)	0.25	MGD
Maximum month flow (MMF)	0.50	MGD
Peak day flow (PDF)	1.00	MGD
Peak hour flow (PHF)	1.67	MGD
Maximum flow with one train offline for maintenance or cleaning (≤ 30 days)	0.50	MGD

Influent Quality (at MMF)

Design Parameter	Value	Units
Membrane pre-screen	≤2	mm
Raw sewage FOG	<150	mg/L

MLSS minimum temperature	20	°C
BOD_5	658	mg/L
TSS	1241	mg/L
NH_3-N	40	mg/L
TKN	Not provided	mg/L
TP	Not provided	mg/L
Alkalinity	392	mg/L

Anticipated Effluent Quality

TSS	≤ 1	mg/L
NH_3-N	≤ 1	mg/L
Turbidity	≤ 0.2 (95% of time) ≤ 0.5 (100% of time)	

Preliminary Biological Design

The biological system for this project consists of a pre-anoxic and aerobic zone. The design detail is listed in the table below.

Flow basis for biological design	0.5	MGD
Design wastewater temperature	20	°C
Total pre-anoxic volume	23,000	gal
Total aerobic volume (excluding membranes)	371,000	gal
Total design HRT	19.8	hours
Aerobic design SRT	12	days
Design MLSS concentration in aerobic zone	8,000	mg/L
Design MLSS concentration in membrane zone	10,000	mg/L

note 1: Tank volumes are preliminary only.

Preliminary Membrane Design

Membrane type	ZeeWeed 500D (430 ft^2)
Number of membrane trains	2
Number of cassette spaces per train	2
Type of cassette	52-module
Module design per train	2 x 32
Total number of modules installed per train	64
Total number of modules installed per plant	128

Total number of cassettes installed per plant	4
Percentage spare space	38.5%
Membrane tank internal dimensions (L x W x H) (ft)	15 x 9 x 13

note 1: Tank dimensions and volumes are preliminary only and may change slightly once final detail design commences.

note 2: The ultrafiltration system is designed for installation within steel tanks provided by SUEZ.

Scope of Supply by SUEZ

- ZeeWeed® Permeate pumps
- ZeeWeed® Cassettes and Modules
- Membrane Air Scour Blowers
- CIP Tank
- Electrical and Control Equipment
- Air Compressor and Dryer System
- Membrane Cleaning Systems
- Biological equipment (blowers, diffusers, sensors, RAS pumps)
- Operation & Maintenance Manuals
- Installation, Commissioning and Start-up Assistance
- Operator Training
- InSight Pro – Process Consulting Service (one year)
- Membrane Warranty – 2 Yrs Full + 8 Yrs Prorated

Pricing

All pricing is based on the design operating conditions and influent characteristics detailed in herein. The pricing herein is for budgetary purposes only and does not constitute an offer of sale. No sales, consumer use or other similar taxes or duties are included in the pricing below.

price: all equipment & service	
ZeeWeed membrane bioreactor system	$ 1,250,000 USD (+/- 15%)

Water.
Process.
Solutions.

Corporate Headquarters

302 Lake Hazeltine Drive
Chaska, MN 55318 USA

Phone 800-240-3330
Phone 952-448-4884
Fax 952-448-4886
Web WIGEN.COM

PROJECT:

NOR CAL REUSE AWTP

EQUIPMENT:

0.25 MGD REVERSE OSMOSIS SYSTEMS

PREPARED FOR:

GREELEY HANSEN

BUDGET PROPOSAL No. 112122-200A

DATE: 11/21/22

Prepared By:
Michael Bourke
Wigen Water Technologies
Tel: (303) 350 3086
Email: Michael.Bourke@wigen.com

Local Representative:
Mike Brunelle
JBI Water
Tel: (916) 939 0728
Email: mikebrunelle@jbiwater.com

TABLE OF CONTENTS

1.0 BASIS OF DESIGN

This RO system is designed as one (1) 174 gpm train (0.25 MGD) with CIP system. Pricing is provided for the initial RO system and then additional RO systems of identical design.

A summary of the proposed system flow balance is as follows:

Process	Flow	Notes
RO Feed per Train	205 gpm	Assumes 85% recovery.
RO Permeate per Train	174 gpm	
RO Concentrate Flow per Train	31 gpm	

Other Design Parameters are as follows:

Reverse Osmosis System

- Array: 5:3:1, 6L per train.
- Average Flux: 11.55 gfd
- Recovery: 85%
- Design Temperature: 70 deg F

2.0 EQUIPMENT SCOPE OF SUPPLY

REVERSE OSMOSIS SYSTEM

RO Train

- (1) RO skid with 5:3:1, 6-long housing array. Skid to include the following:
    - (1) 19 Round 316 SS Cartridge Filter Housing with 5 micron Cartridge Filters.
    - (1) 40 HP High Pressure Feed Pump. Powerflex 400 VFD in Air Conditioned NEMA 4/12 Painted Carbon Steel Panel on Skid.
    - (54) Toray TMG20D-400 membranes.
    - (5) Air actuated valves with limit switches.
    - (1) Temperature Transmitter (feed).
    - (2) Conductivity Sensors (feed and permeate).
    - (1) ORP sensor (feed).
    - (2) Flow Meters (feed and concentrate).
    - (2) Pressure sensors.
    - (7) Pressure Transmitters.
    - (1) CompactLogix PLC, PVP7 10” HMI in NEMA 4/12 Painted Carbon Steel Enclosure on RO skid.
    - Schedule 80 PVC low pressure piping.
    - Schedule 10 316SS high pressure piping.
    - Powder coated carbon steel skid. RO train will be shipped as fully assembled skid.

CIP/Flush System

- (1) CIP/Flush Pump Skid including the following:
    - (1) 20 HP 200 gpm @ 60 psi CIP/Flush pump.
    - Schedule 80 PVC Piping.
    - Local NEMA 4/12 Panel to be wired to Master PLC Panel.
    - Powder coated carbon steel skid.

- CIP/Flush System loose components for contractor installation, including the following:
  - (1) 1,000 gallon CIP/Flush tank. HDPE cone bottom with stand.
  - (1) 30 kW CIP heater.
  - (1) Level transmitter.

Chemical Dosing Feed System

- Skid Mounted Antiscalant Feed Skid:
  - (2) Grundfos DDA metering pumps.
  - Calibration column and all valves and accessories for each pump to provide fully assembled chemical metering systems.
- CIP Chemical Feed manual process via eductor system on CIP Pump Skid.

Start-up Services

- Start-up Services, including 8-days onsite over 3 trips plus travel expenses and per diem.

EXCLUSIONS

The following would be required **by others:**

- Installation of skids and loose components.
- All interconnecting piping between skids and tanks.
- Power drops to control panels and Ethernet connections between RO skid PLC panel. Hard wiring from CIP and chemical pump skids to Master PLC panels.
- Loading of RO membranes and cartridge filters (under Wigen supervision).
- Air supply for pneumatic valves (can be included if desired).
- All chemicals and chemical storages.
- Disinfection of equipment prior to start-up.

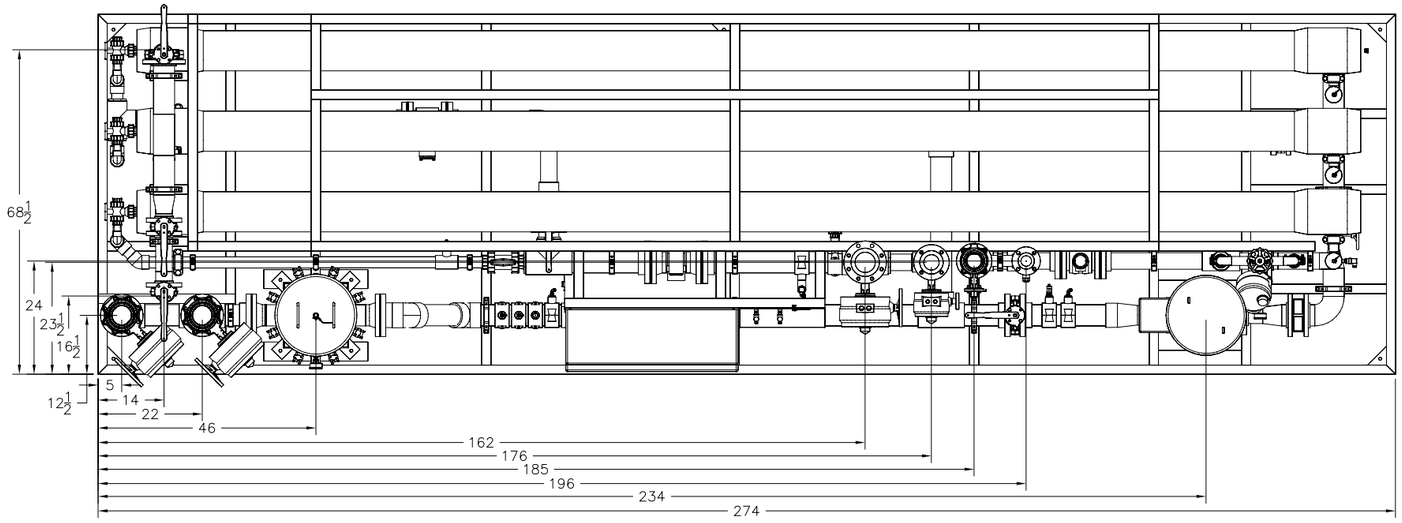
3.0 BUDGET PRICING

The budget price for the equipment and services outlined above is as follows:

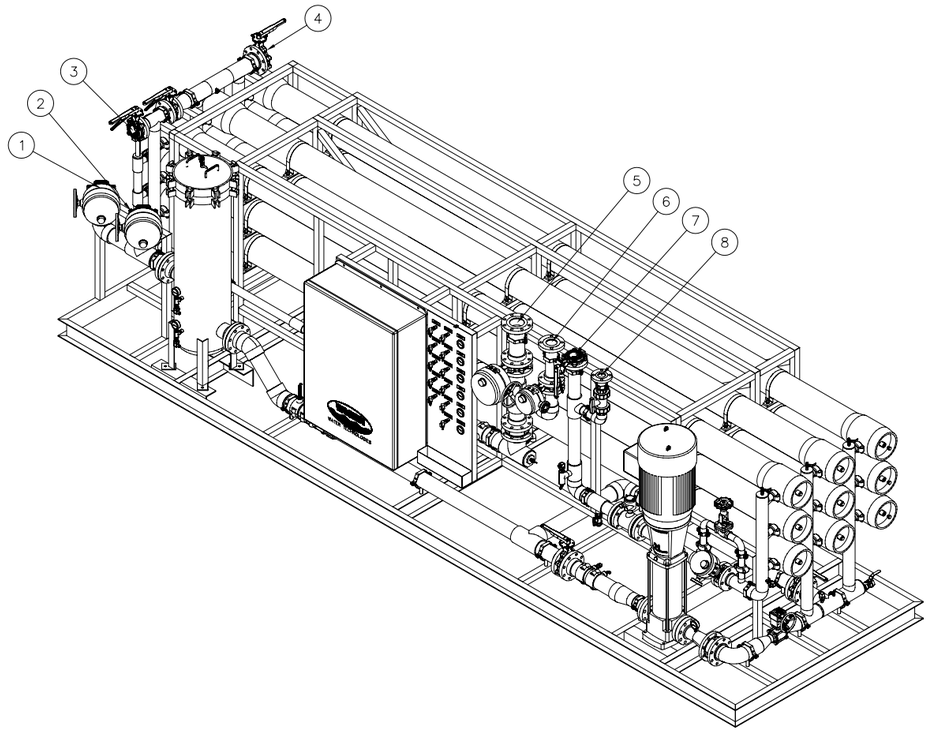
Item	Budget Price
174 gpm RO System and Startup Services as described in the above scope of supply.	**$420,000.00**
Each additional 174 gpm RO System and Startup Services as described in the above scope of supply.	**$330,000.00**

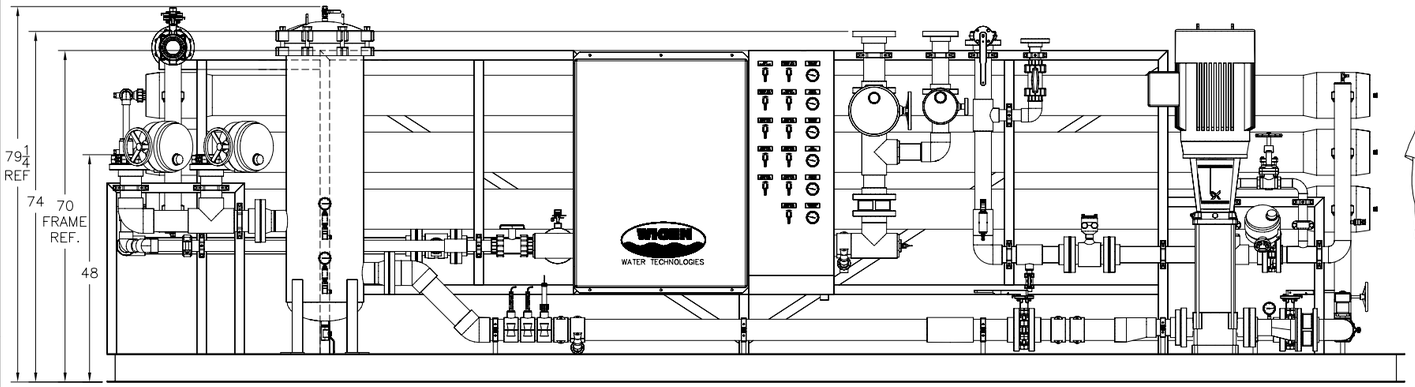
Budget Price is in US dollars FOB Northern CA, exclusive of any applicable taxes.

Customer understands that this budget proposal has been issued based upon the information provided by customer, and currently available to WWT at the time of issuing this proposal. Any changes or discrepancies in site conditions, including but not limited to system influent water characteristics, changes in environmental health and safety conditions, Customer financial standing, Customer requirements, or any other relevant change, or discrepancy in, the factual basis upon which this proposal was created, may lead to changes in the offering, including but not limited to changes in pricing, warranties, quoted specifications, or terms and conditions.

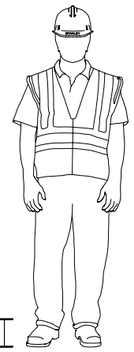


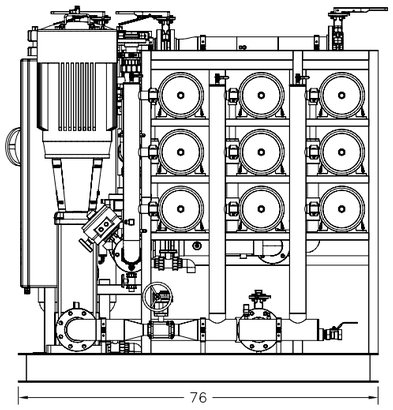
PLAN VIEW





FRONT ELEVATION





R.SIDE ELEVATION

CONNECTION SCHEDULE			
#	DESCRIPTION	TYPE	SIZE
1	RO INLET	150# FLG.	4.00
2	CIP BANK #1/FLUSH INLET	150# FLG.	4.00
3	BANK #2 CIP FEED	150# FLG.	3.00
4	BANK #1 CIP OUTLET	150# FLG.	4.00
5	PERMEATE OUTLET	150# FLG.	4.00
6	PERMEATE CIP/FLUSH OUTLET	150# FLG.	3.00
7	BANK #2 CONC. CIP OUTLET	150# FLG.	3.00
8	CONCENTRATE OUTLET	150# FLG.	2.00

UL

#

UL NUMBER

NOTE 1.
NOTE 2.
NOTE 3.
NOTE 4.
NOTE 5.
NOTE 6.

DRAWING NOTES

REV	DATE	DWN	APVD	DESCRIPTION

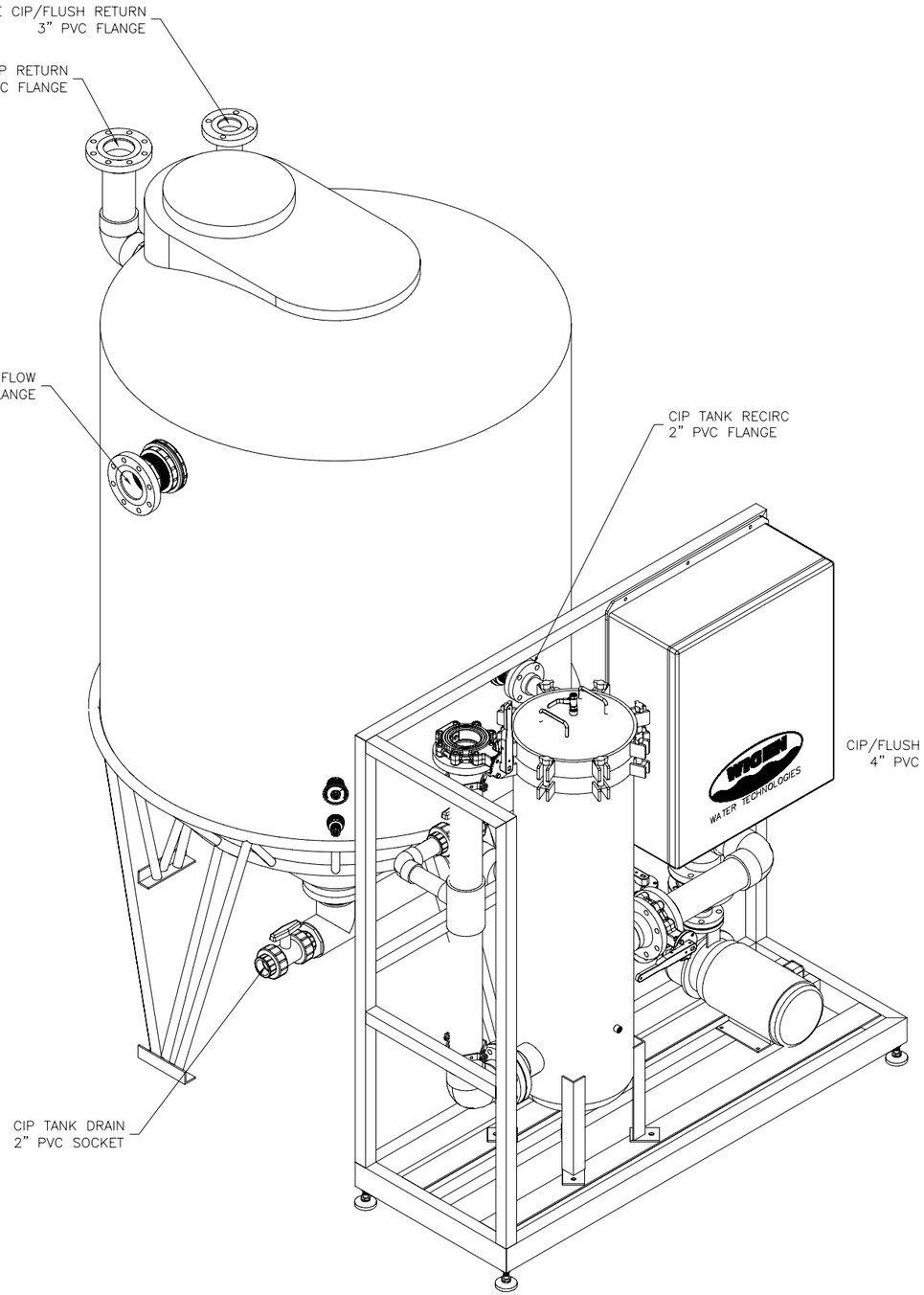
DRAWN BY	TJC	DATE	1/31/12
CHK'D BY	SAB	DATE	1/31/12
SIZE	D	SCALE	NONE
FILE TYPE	ACAD		

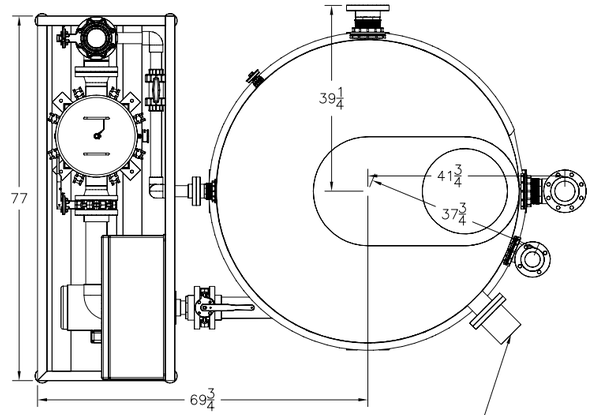
TITLE: GENERAL ARRANGEMENT
REVERSE OSMOSIS SYSTEM – 210 GPM

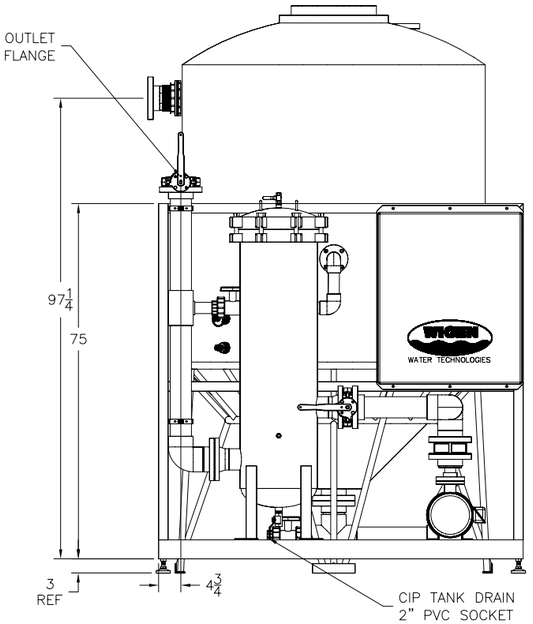
CLIENT NAME: PANORA WTP IMPROVEMENTS PROJECT
PANORA, IA
PROJECT NO. 110.0421

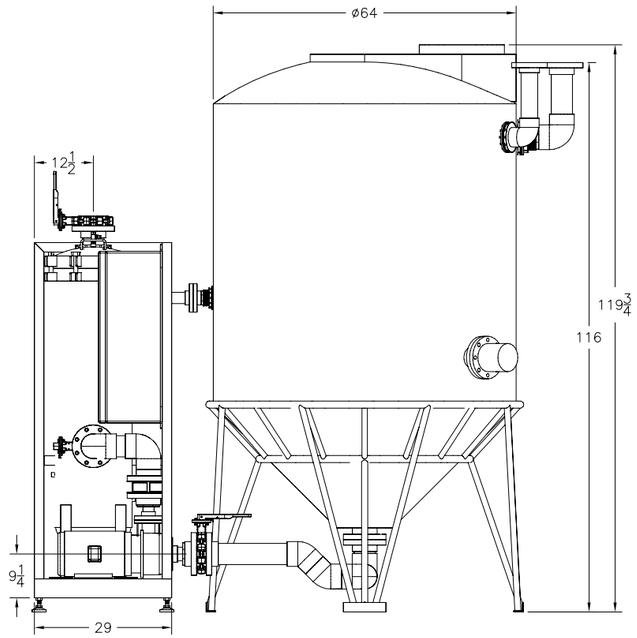
PROJECT NUMBER	DRAWING NUMBER	SHEET	REV
C-3224-1211	C-3224-100	1 OF 1	A

WIGEN
SINCE 1965
WATER TECHNOLOGIES
302 LAKE HAZELTINE DRIVE
CHASKA, MN 55318 USA
952-448-4884
WWW.WIGEN.COM









UL NUMBER	DRAWING NOTES	REV	DATE	DWN	APVD	DESCRIPTION
#						

DRAWN BY: TJC	DATE: 1/31/12	TITLE: GENERAL ARRANGEMENT CIP/ PERMEATE FLUSH SYSTEM 240 GPM	
CHK'D BY: SAB	DATE: 1/31/12	CLIENT NAME: PANORA WTP IMPROVEMENTS PROJECT PANORA, IA PROJECT NO. 110.0421	
SIZE: D	SCALE: NONE		
FILE TYPE: ACAD		PROJECT NUMBER: C-3224-1211	DRAWING NUMBER: C-3224-102 / SHEET: 1 OF 1 / REV: A

WIGEN SINCE 1965
WATER TECHNOLOGIES
302 LAKE HAZELTINE DRIVE
CHASKA, MN 55318 USA
952-448-4884
WWW.WIGEN.COM

October 24, 2022

Brad Leidecker, P.E. | Coombs-Hopkins Company
2855 Mitchell Drive, Suite 215 | Walnut Creek, CA 94598
M: 925.876.0646 | brad@chcwater.com

Reference: Carmel Advanced Water District (CAWD) IPR/DPR Monterey Project_0.25 mgd
Quote Number: 118779

Trojan Technologies is pleased to submit this preliminary quotation for the supply of a TrojanUVPhox™ UV-oxidation treatment system for the **Carmel Advanced Water District (CAWD) IPR/DPR Monterey Project Project**. Our current understanding is that the contaminants targeted for treatment are primarily N-Nitrosodimethylamine and 1,4-dioxane. Therefore, the UV-oxidation system has been sized to provide the necessary treatment of these two contaminants. In order to estimate the equipment needed for this project Trojan assumed a Hydroxyl Radical Scavenging term and a UV Transmittance of 96%.

The TrojanUVPhox™ UV-oxidation system will cost-effectively destroy N-Nitrosodimethylamine and 1,4-dioxane along with other trace contaminants that may be present in the source water. The recommended Trojan UV-oxidation equipment, hydrogen peroxide concentrations, and capital equipment price are listed below.

As with all UV-oxidation projects, this estimate is conditional upon the receipt of a water sample by Trojan for testing to verify UV system sizing. The sizing provided is based on propriety sizing models developed by Trojan and may not be shared or made public without Trojan's consent.

Should you have any comments or questions please feel free to contact me anytime at 519-457-3400.

Sincerely,

Andrew J Daley, Trojan Technologies
3020 Gore Road
London, Ontario N5V 4T7
(519) 457-3400, adaley@trojantechnologies.com
www.trojanuv.com

DESIGN CRITERIA

Flowrate:	**0.25 mgd (US)**
UV Transmittance:	**96%** (minimum, estimated)
Target Contaminant Removal:	**1.4-log removal of NDMA**
Target Contaminant Removal:	**>0.5-log removal of 1,4-dioxane**
Hydrogen Peroxide Dose:	**5 mg/l**

DESIGN SUMMARY

UV REACTOR	
Reactor Model	**TrojanUVPHOX™ - 18AL50**
Number of SS316L Reactor Chambers	**1** * includes support structures
Number of Lamps per Reactor Chamber	**18**
Lamp Technology	**Low Pressure High Output**
SYSTEM CONTROL CENTER	
System Control Center (SCC) Quantity	1
SCC Enclosure Rating	**Mild Painted Steel (Type 12)**
CONTROL AND POWER PANELS	
Power Distribution Center (PDC) Quantity	1 per reactor
PDC Enclosure Rating	**Mild Painted Steel (Type 12)**
EQUIPMENT LAYOUT & DIMENSIONS	
Reactor Flange Size	**4 in ANSI 150 lb** (8" available)
Approximate Reactor Length (+ clearance)	**82 in. + 66 in. clearance at reactor endcap**
PDC Dimensions (WxHxD)	**39 in. x 48 in. x 12 in.**
Cable Length Between PDC and Reactor	**12 ft. – other options available**
ELECTRICAL REQUIREMENTS	
Each Power Distribution Center	**Single phase, 2 wire + gnd, 50/60 Hz L-L, 4.62kW**
Each System Control Center	**Two (2) Supplies of 120 V single phase, 2 wire plus ground, 60 Hz, 1.2 kVA**

COMMERCIAL INFORMATION

Total Capital Cost : $480,122 (USD)

Notes: Includes one online UVT – Opti-view
This price excludes any taxes that may be applicable and is valid for 90 days from the date of this letter.
Electrical disconnects required per local code are not included in this proposal.

HYDROGEN PEROXIDE DOSING EQUIPMENT	

Dosing/Pump Equipment	**Skid-mounted metering pump, interconnecting piping, injection quill.**
Hydrogen Peroxide Storage	**Not included**

Note: A hydrogen peroxide storage tank is not included in the quote. Due to the small annual volume of peroxide consumed, a locally sourced drum or tote tank would be sufficient.

EQUIPMENT WARRANTEES

1. Trojan Technologies warrants all components of the system (excluding UV lamps) against faulty workmanship and materials for a period of 12 months from date of start-up or 18 months after shipment, which ever comes first.

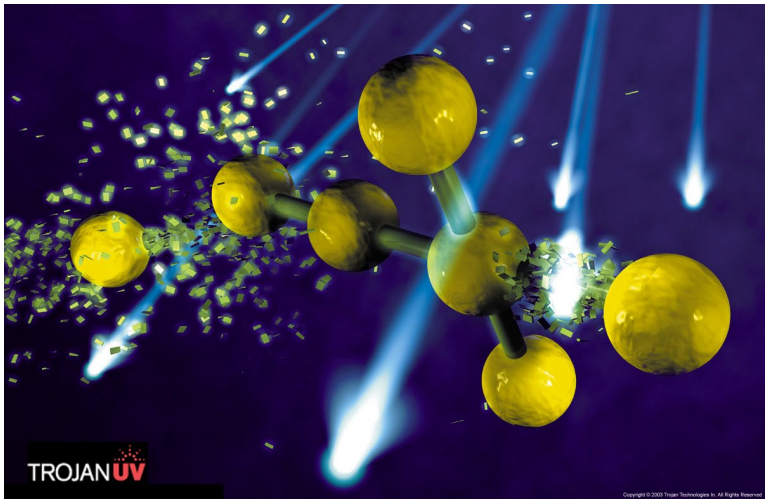
2. UV lamps purchased are warranted for 12,000 hours of operation or 3 years from shipment, whichever comes first. The warranty is pro-rated after 9,000 hours of operation. This means that if a lamp fails prior to 9,000 hours of use, a new lamp is provided at no charge.

3. Electronic ballasts are warranted for 5 years, pro-rated after 1 year.

ABOUT UV-OXIDATION

UV-oxidation is a photochemical process that breaks down chemical constituents into their harmless component parts. Trojan has revolutionized UV-oxidation, making it an efficient and cost-effective approach to treating and destroying many contaminants.

Trojan UV-oxidation involves the addition of hydrogen peroxide to the influent, and a photochemical reaction that occurs almost instantly within the UV reactor. UV light incident on hydrogen peroxide breaks hydrogen peroxide (through the UV-photolysis reaction illustrated at right) into two hydroxyl radicals. These highly reactive radicals break down toxic contaminants into their physiologically-inert component parts.



BENEFITS OF UV-OXIDATION

- Efficient destruction of organic compounds
- Cost-effective - Trojan's optimized reactor technology makes UV-oxidation cost-effective for a wide range of applications
- Eliminates difficult to treat contaminants - Ideal for treatment of nitrosamines (e.g. NDMA), 1,4-dioxane, and currently unmonitored and unregulated contaminants
- No bromate formation
- Compact design reduces capital costs
- Easy and safe to operate - Designed for minimal operator involvement and maximum safety

THE TROJANUVPhox™

The patent-pending TrojanUVPhox™ (UV-**Ph**otolysis and UV-**Ox**idation) solution is a groundbreaking, pressurized ultraviolet (UV) light reactor that utilizes Trojan's low energy, high output, monochromatic UV lamps.

Key Benefits of the TrojanUVPhox™:

- Vertically stackable, modular design allows for system expansion without increasing footprint
- Scalable system is available in multiple configurations various lamps per reactor to handle virtually any flow rate
- Reactor designed using computational fluid dynamics (CFD) modeling and other advanced computer simulation tools providing optimum lamp spacing, uniform flow field and significant efficiency advantages
- Chambers constructed of electropolished 316L stainless steel for a smooth interior and exterior finish for long life and durability
- Lamps are performance guaranteed to 12,000 hours for reduced maintenance requirements
- UV controls are integrated with hydrogen peroxide system to ensure smooth operation with minimal operator involvement
- Optional sleeve wiping system ensures lamps deliver maximum UV energy for disinfection and UV-oxidation of contaminants

Terms and Conditions of Sale

This document sets forth the Terms & Conditions of Sale for goods manufactured and/or supplied, and services provided, by the seller entity identified on the purchase order ("SELLER") and sold to the original purchaser thereof ("BUYER"). The term "SELLER" includes only SELLER, and none of its affiliates. Unless otherwise specifically stated in a previously-executed written purchase agreement signed by authorized representatives of SELLER and BUYER, these Terms & Conditions of Sale establish the rights, obligations and remedies of SELLER and BUYER which apply to this offer and any resulting order or contract for the sale of SELLER's goods and/or services ("Products").

1. APPLICABLE TERMS & CONDITIONS: These Terms & Conditions of Sale are contained directly and/or by reference in SELLER's proposal, offer, order acknowledgment, packing slip, and/or invoice documents. The first of the following acts constitutes an acceptance of SELLER's offer and not a counteroffer and creates a contract of sale ("Contract") in accordance with these Terms & Conditions of Sale: (i) BUYER's issuance of a purchase order document against SELLER's offer; (ii) acknowledgement of BUYER's order by SELLER; or (iii) commencement of any performance by SELLER pursuant to BUYER's order. Provisions contained in BUYER's purchase documents (including electronic commerce interfaces) that materially alter, add to, or subtract from the provisions of these Terms & Conditions of Sale are not a part of the Contract.

2. CANCELLATION AND RETURN: The whole or any part of this order may be cancelled only with the prior written consent of SELLER. If SELLER does consent to a cancellation, such consent will be given only upon payment of reasonable cancellation charges in an amount determined by SELLER. In addition, with respect to any Products returned on cancellation, BUYER will pay SELLER's cost of placing the returned Products in a saleable condition, sales expenses incurred by SELLER in connection with such returned Products, a reasonable restocking charge and freight costs incurred in connection with the original shipment and in connection with returning such Products to SELLER, all in such amounts as are advised to the BUYER by SELLER.

3. DELIVERY: Delivery will be accomplished EXW or CIP at the point of shipment (Incoterms 2020), unless otherwise expressly agreed between the parties. Legal title and risk of loss or damage pass to BUYER upon transfer to the first carrier, regardless of final destination and mode of transit. SELLER will use commercially reasonable efforts to deliver the Products ordered herein within SELLER's normal lead-time necessary for SELLER to deliver the Products sold hereunder. Products will be boxed or crated as determined appropriate by SELLER for protection against normal handling and there will be an extra charge to the BUYER for additional packaging required by the BUYER with respect to waterproofing or other added protection. BUYER has sole responsibility for off-loading, storage and handling of the Products at the site. Where Buyer is responsible for any delay in the delivery date or installation date, the earlier of the date of delivery or the date on which the Products are ready for shipment by SELLER may be treated as the delivery date for purposes of determining the time of payment of the purchase price. Moreover, BUYER will be responsible for reasonable storage and insurance expenses with respect to such Products. Should BUYER fail to effect pick-up of Product as previously agreed in a timely manner, SELLER may, at its discretion, assess reasonable storage charges to the account of BUYER.

4. INSPECTION: BUYER will promptly inspect and accept any Products delivered pursuant to this Contract after receipt of such Products. In the event the Products do not conform to any applicable specifications, BUYER will promptly notify SELLER of such nonconformance in writing. SELLER will have a reasonable opportunity to repair or replace the nonconforming Product at its option. BUYER will be deemed to have accepted any Products delivered hereunder and to have waived any such nonconformance for such Products unless a written notification pursuant to this paragraph is received by SELLER within thirty (30) days of delivery to BUYER destination on order.

5. PRICES & ORDER SIZES: Prices do not include any charges for services such as insurance; brokerage fees; sales, use, inventory, or excise taxes; import or export duties; special financing fees; value added tax, income, or royalty taxes imposed outside the U.S. or Canada; consular fees; special permits or licenses; or other charges imposed upon the production, sale, distribution, or delivery of Products. BUYER will either pay any and all such charges or provide SELLER with acceptable exemption certificates, which obligation survives performance under this Contract. Installation, maintenance and any other services which relate to the Products are not included unless specifically set forth in the quotation. SELLER reserves the right to establish minimum order sizes and will advise BUYER accordingly. Any orders below the minimum order size are subject to a fee as set out by SELLER. If SELLER's delivery of Products surpasses one (1) year in length, then at least on an annual basis, or if changes to the Products are requested or needed, the parties shall conduct good faith discussions regarding changes to the prices for the Products, to reflect SELLER's increased costs for which SELLER shall be entitled to additional fair and appropriate compensation.

6. PAYMENTS: All payments must be made in agreed-to currency, normally Canadian or U.S. Dollars. Unless other payment terms are expressly set forth in the purchase order or otherwise required by the Seller, invoices are due and payable NET 30 DAYS from date of the invoice, without regard to delays for inspection or transportation, with payments to be made by check to SELLER at the address listed in the purchase order or by bank transfer to the account obtainable from SELLER's Accounts Receivable Manager. In the event payments are not made or not made in a timely manner, SELLER may, in addition to all other remedies provided at law, either: (a) declare BUYER's performance in breach and terminate this Contract for default; (b) withhold future shipments until delinquent payments are made; (c) deliver future shipments on a cash-with-order or cash-in-advance basis even after the delinquency is cured; (d) charge interest on the outstanding balance at a rate of 1.5% per month or the maximum rate permitted by law, if lower, for each month or part thereof that there is an outstanding balance plus applicable storage charges and/or inventory carrying charges; (e) repossess the Products for which payment has not been made; (f) pursue other collection efforts and recover all associated costs including reasonable attorney's fees; or (g) combine any of the above rights and remedies as is practicable and permitted by law. BUYER is prohibited from setting off any and all monies owed under this Contract from any other sums, whether liquidated or not, that are or may be due to the BUYER, which arise out of a different transaction with SELLER or any of its affiliates. Should BUYER's financial condition become unsatisfactory to SELLER in its discretion, SELLER may require payment in advance or other security. If BUYER fails to meet these requirements, SELLER may treat such failure as reasonable grounds for repudiation of this Contract, in which case reasonable cancellation charges shall be due to SELLER. BUYER hereby grants SELLER a security interest in the Products, wherever located, and whether now existing or hereafter arising or acquired from time to time, and in all accessions thereto and replacements or modifications thereof, as well as all proceeds of the foregoing, to secure payment in full of all amounts to Seller, which payment releases the security interest but only if such payment could not be considered an avoidable transfer under applicable laws. The security interest granted hereby constitutes a purchase money security interest under the applicable Uniform Commercial Code or Personal Property Security Act or other applicable law, and SELLER is authorized to make whatever registration or notification or take such other action as SELLER deems necessary or desirable to perfect such security interest. BUYER's insolvency, bankruptcy, assignment for the benefit of creditors, or dissolution or termination of the existence of BUYER, constitutes a default under this Contract and affords SELLER all of the remedies of a secured creditor under applicable law, as well as the remedies stated above for late payment or non-payment.

7. LIMITED WARRANTY: Unless specifically provided otherwise in SELLER's quotation, SELLER provides the following Limited Warranty. SELLER warrants that Products sold hereunder will be free from defects in material and workmanship and will, when used in accordance with the manufacturer's operating and maintenance instructions, conform to any express written warranty pertaining to the specific goods purchased, which for Products is for a period of twelve (12) months from delivery. SELLER warrants that services furnished hereunder will be free from defects in workmanship for a period of ninety (90) days from the completion of the services. Products repaired or replaced are not covered by any warranty except to the extent repaired or replaced by SELLER, an authorized representative of SELLER, or under specific instructions by SELLER, in which cases, the Products will be covered under warranty up to the end of the warranty period applicable to the original Products. The above warranties do not include the cost of shipping and handling of returned items. Parts provided by SELLER in the performance of services may be new or refurbished parts functioning equivalent to new parts. Any non-functioning parts that are repaired by SELLER shall become the property of SELLER. No warranties are extended to consumable items such as, without limitation, light bulbs, and for normal wear and tear. All other guarantees, warranties, conditions and representations, either express or implied, whether arising under any statute, law, commercial usage or otherwise, including implied warranties of merchantability and fitness for a particular purpose, are hereby excluded. The sole remedy for Products not meeting this Limited Warranty is replacement, credit or refund of the purchase price, as determined by SELLER in its sole discretion. This remedy will not be deemed to have failed of its essential purpose so long as SELLER is willing to provide such replacement, credit or refund. To make a warranty claim, BUYER must notify SELLER in writing within 5 days of discovery of the defect in question. This notification must include a description of the problem, a copy of the applicable operator's log, a copy of BUYER's maintenance record and any analytical results detailing the problem. Any warranty hereunder or performance guarantees shall only be enforceable if (a) all equipment is properly installed, inspected regularly, and is in good working order, (b) all operations are consistent with SELLER recommendations, (c) operating conditions at the installation site have not materially changed and remain within anticipated specifications, and (d) no reasonably unforeseeable circumstances exist or arise.

8. INDEMNIFICATION: Indemnification applies to a party and to such party's successors-in-interest, assignees, affiliates, directors, officers, and employees ("Indemnified Parties"). SELLER is responsible for and will defend, indemnify and hold harmless the BUYER Indemnified Parties against all losses, claims, expenses or damages which may result from accident, injury, damage, or death due to SELLER's breach of the Limited Warranty. BUYER is responsible for and will defend, indemnify and hold harmless SELLER Indemnified Parties against all losses, claims, expenses, or damages which may result from accident, injury, damage, or death due to the negligence or misuse or misapplication of any Products or the breach of any provision of this Contract by the BUYER or any third party affiliated or in privity with BUYER.

9. PATENT PROTECTION: Subject to all limitations of liability provided herein, SELLER will, with respect to any Products of SELLER's design or manufacture, indemnify BUYER from any and all damages and costs as finally determined by a court of competent jurisdiction in any suit for infringement of any U.S. or Canadian patent (or European patent for Products that SELLER sells to BUYER for end use in a member state of the E.U. or the U.K.) that has issuedas of the delivery date, solely by reason of the sale or normal use of any Products sold to BUYER hereunder and from reasonable expenses incurred by BUYER in defense of such suit if SELLER does not undertake the defense thereof, provided that BUYER promptly notifies SELLER of such suit and offers SELLER either (i) full and exclusive control of the defense of such suit when Products of SELLER only are involved, or (ii) the right to participate in the defense of such suit when products other than those of SELLER are also involved. SELLER's warranty as to use patents only applies to infringement arising solely out of the inherent operation of the Products according to their applications as envisioned by SELLER's specifications. In case the Products are in such suit held to constitute infringement and the use of the Products is enjoined, SELLER will, at its own expense and at its option, either procure for BUYER the right to continue using such Products or replace them with non-infringing products, or modify them so they become non-infringing, or remove the Products and refund the purchase price (prorated for depreciation) and the transportation costs thereof. The foregoing states the entire liability of SELLER for patent

infringement by the Products. Further, to the same extent as set forth in SELLER's above obligation to BUYER, BUYER agrees to defend, indemnify and hold harmless SELLER for patent infringement related to (x) any goods manufactured to the BUYER's design, (y) services provided in accordance with the BUYER's instructions, or (z) SELLER's Products when used in combination with any other devices, parts or software not provided by SELLER hereunder.

10. TRADEMARKS AND OTHER LABELS: BUYER agrees not to remove or alter any indicia of manufacturing origin or patent numbers contained on or within the Products, including without limitation the serial numbers or trademarks on nameplates or cast, molded or machined components.

11. SOFTWARE AND INTELLECTUAL PROPERTY: All licenses to SELLER's separately provided software products are subject to the separate software license agreement(s) accompanying the software media. In the absence of such express licenses and for all other software, SELLER grants BUYER only a personal, non-exclusive license to access and use the software provided by SELLER with Products purchased hereunder solely as necessary for BUYER to enjoy the benefit of the Products. A portion of the software may contain or consist of open source software, which BUYER may use under the terms and conditions of the specific license under which the open source software is distributed. BUYER agrees that it will be bound by all such license agreements. Title to software remains with the applicable licensor(s). All SELLER contributions to the Products, the results of the services, and any other work designed or provided by SELLER hereunder may contain or result in statutory and non-statutory Intellectual Property, including but not limited to patentable subject matter or trade secrets; and all such Intellectual Property remains the sole property of SELLER; and BUYER shall not disclose (except to the extent inherently necessary during any resale of Product sold hereunder), disassemble, decompile, or any results of the Services, or any Products, or otherwise attempt to learn the underlying processes, source code, structure, algorithms, or ideas.

12. PROPRIETARY INFORMATION AND PRIVACY: "Proprietary Information" means any information, technical data, or know-how in whatever form, whether documented, contained in machine readable or physical components, mask works or artwork, or otherwise, which SELLER considers proprietary, including but not limited to service and maintenance manuals. BUYER and its customers, employees, and agents will keep confidential all such Proprietary Information obtained directly or indirectly from SELLER and will not transfer or disclose it without SELLER's prior written consent, or use it for the manufacture, procurement, servicing, or calibration of Products or any similar products, or cause such products to be manufactured, serviced, or calibrated by or procured from any other source, or reproduce or otherwise appropriate it. All such Proprietary Information remains SELLER's property. No right or license is granted to BUYER or its customers, employees or agents, expressly or by implication, with respect to the Proprietary Information or any patent right or other proprietary right of SELLER, except for the limited use licenses implied by law. In respect of personal data supplied by BUYER to SELLER, BUYER warrants that is duly authorized to submit and disclose these data, including but not limited to obtaining data subjects´ informed consent. SELLER will manage BUYER's information and personal data in accordance with its Privacy Policy, a copy of which is available to Buyer upon request. In respect of other data and information that SELLER may receive in connection with BUYER´s use of the Products including without limitation data that are captured by the Products and transmitted to SELLER, BUYER hereby grants SELLER a non-exclusive, worldwide, royalty-free, perpetual, non-revocable license to use, compile, distribute, display, store, process, reproduce, or create derivative works of such data as needed for Product operation and maintenance, and to aggregate such data for use in an anonymous manner, solely to facilitate marketing, sales and R&D activities of SELLER and its affiliates.

13. SPECIAL TOOLS, DIES, JIGS, FIXTURES AND PATTERNS: Any tools, dies, jigs, fixtures, patterns and similar items which are included or required in connection with the manufacture and/or supply of the Products will remain the property of SELLER without credit to the BUYER. SELLER assumes the cost for maintenance and replacement of such items and shall have the right to discard and scrap any such item after it has been inactive for a minimum of one year, without credit to the BUYER.

14. CHANGES AND ADDITIONAL CHARGES: SELLER reserves the right to make design changes or improvements to any products of the same general class as Products being delivered hereunder without liability or obligation to incorporate such changes or improvements to Products ordered by BUYER unless agreed upon in writing before the Products' delivery date.

15. SITE ACCESS / PREPARATION / WORKER SAFETY / ENVIRONMENTAL COMPLIANCE: In connection with services provided by SELLER, BUYER agrees to permit prompt access to equipment. BUYER assumes full responsibility to back-up or otherwise protect its data against loss, damage or destruction before services are performed. BUYER is the operator and in full control of its premises, including those areas where SELLER employees or contractors are performing service, repair, and maintenance activities. BUYER will ensure that all necessary measures are taken for safety and security of working conditions, sites, and installations during the performance of any services. BUYER is the generator of any resulting wastes, including without limitation hazardous wastes. BUYER is solely responsible to arrange for the disposal of any wastes at its own expense. BUYER will, at its own expense, provide SELLER employees and contractors working on BUYER's premises with all information and training required under applicable safety compliance regulations and BUYER's policies. SELLER has no responsibility for the supervision or actions of BUYER's employees or contractors or for non-SELLER items (e.g., chemicals, equipment) and disclaims all liability and responsibility for any loss or damage that may be suffered as a result of such actions or items, or any other actions or items not under SELLER's control.

16. LIMITATIONS ON USE: BUYER will not use any Products for any purpose other than those identified in SELLER's catalogs and literature as intended uses. Unless SELLER has advised the BUYER in writing, in no event will BUYER use any Products in drugs, food additives, food, or cosmetics, or medical applications for humans or animals. In no event will BUYER use in any application any Product that requires FDA 510(k) clearance unless and only to the extent the Product has such clearance. BUYER will not sell, transfer, export, or re-export any SELLER Products or technology for use in activities which involve the design, development, production, use, or stockpiling of nuclear, chemical, or biological weapons or missiles, nor use SELLER Products or technology in any facility which engages in activities relating to such weapons. Unless the "ship-to" address is in California, U.S.A., the Products are not intended for sale in California and may lack markings required by California Proposition 65; accordingly, unless BUYER has ordered Products specifying a California ship-to address, BUYER will not sell or deliver any SELLER Products for use in California. Any warranty granted by SELLER is void if any goods covered by such warranty are used for any purpose not permitted hereunder.

17. EXPORT AND IMPORT LICENSES AND COMPLIANCE WITH LAWS: Unless otherwise expressly agreed, BUYER is responsible for obtaining any required export or import licenses necessary for Product delivery. BUYER will comply with all laws and regulations applicable to the installation or use of all Product, including applicable import and export control laws and regulations of the U.S., E.U., and any other country having proper jurisdiction, and will obtain all necessary export or import licenses in connection with any subsequent export, re-export, transfer, and use of all Product and technology delivered hereunder. BUYER will not sell, transfer, export, or re-export any SELLER Product or technology for use in activities which involve the design, development, production, use or stockpiling of nuclear, chemical, or biological weapons or missiles, nor use SELLER Product or technology in any facility which engages in activities relating to such weapons. BUYER will comply with all local, national, and other laws of all jurisdictions globally relating to anti-corruption, bribery, extortion, kickbacks, or similar matters which are applicable to BUYER's business activities in connection with this Contract, including but not limited to the U.S. Foreign Corrupt Practices Act of 1977, as amended (the "FCPA"). BUYER agrees that no payment of money or provision of anything of value will be offered, promised, paid, or transferred, directly or indirectly, by any person or entity, to any government official, government employee, or employee of any company owned in part by a government, political party, political party official, or candidate for any government office or political party office to induce such organizations or persons to use their authority or influence to obtain or retain an improper business advantage for BUYER or for SELLER, or which otherwise constitute or have the purpose or effect of public or commercial bribery, acceptance of or acquiescence in extortion, kickbacks, or other unlawful or improper means of

obtaining business or any improper advantage, with respect to any of BUYER's activities related to this Contract. SELLER asks BUYER to "Speak Up!" if aware of any violation of law, regulation, or our Code of Conduct ("CoC") in relation to this Contract. See www.danaherintegrity.com and www.danaher.com/how-we-work/integrity-and-compliance for a copy of the CoC and for access to our Helpline portal.

18. RELATIONSHIP OF PARTIES: BUYER is not an agent or representative of SELLER and will not present itself as such under any circumstances, unless and to the extent it has been formally screened by SELLER's compliance department and received a separate duly-authorized letter from SELLER setting forth the scope and limitations of such authorization.

19. FORCE MAJEURE: SELLER is excused from performance of its obligations under this Contract to the extent caused by acts or omissions that are beyond its control, including but not limited to Government embargoes, blockages, seizures or freezing of assets, delays, or refusals to grant an export or import license, or the suspension or revocation thereof, or any other acts of any Government; fires, floods, severe weather conditions, or any other acts of God; quarantines; epidemics and pandemics; labor strikes or lockouts; riots; strife; insurrections; civil disobedience or acts of criminalsor terrorists; war; material shortages or delays in deliveries to SELLER by third parties. In the event of the existenceof any force majeure circumstances, the period of time for delivery, payment terms, and payments under any letters of credit will be extended for a period of time equal to the period of delay. If the force majeure circumstances extend for six months, SELLER may, at its option, terminate this Contract without penalty and without being deemed in default or in breach thereof.

20. NON-ASSIGNMENT AND WAIVER: BUYER will not transfer or assign this Contract or any rights or interests hereunder without SELLER's prior written consent. Failure of either party to insist upon strict performance of any provision of this Contract, or to exercise any right or privilege contained herein, or the waiver of any breach of the terms or conditions of this Contract, will not be construed as thereafter waiving any such terms, conditions, rights, or privileges, and the same will continue and remain in force and effect as if no waiver had occurred.

21. FUNDS TRANSFERS: BUYER and SELLER both recognize that there is a risk of banking fraud when individuals impersonating a business demand payment under new mailing or banking transfer instructions. To avoid this risk, BUYER must verbally confirm any new or changed mailing or banking transfer instructions by calling SELLER and speaking with SELLER's Accounts Receivable Manager before transferring any monies using the new instructions. Both parties agree that they will not institute mailing or banking transfer instruction changes and require immediate payment under the new instructions, but will instead provide a ten (10) day grace period to verify any mailing or banking transfer instruction changes before any new or outstanding payments are due using the new instructions.

22. LIMITATION OF LIABILITY: None of SELLER, its successors-in-interest, assignees, affiliates, directors, officers, and employees will be liable to any BUYER Indemnified Parties under any circumstances for any special, treble, incidental, or consequentialdamages, including without limitation, damage to or loss of property other than for the Products purchased hereunder; damages incurred in installation, repair, or replacement; lost profits, revenue, or opportunity; loss of use; losses resulting from or related to downtime of the Products or inaccurate measurements or reporting; the cost of substitute products; or claims of any BUYER's Indemnified Parties' customers for such damages, howsoever caused, and whether based on warranty, contract, and/or tort (including negligence, strict liability or otherwise). The total liability of SELLER, its successors-in-interest, assignees, affiliates, directors, officers, and employees arising out of the performance or nonperformance hereunder, or SELLER's obligations in connection with the design, manufacture, sale, delivery, and/or use of Products, will in no circumstance exceed the amount actually paid to SELLER for Products delivered hereunder.

23. APPLICABLE LAW AND DISPUTE RESOLUTION: All issues relating to the construction, validity, interpretation, enforcement, and performance of this agreement and the rights and obligations of SELLER and the BUYER hereunder shall be governed by the laws of the Province of Ontario and the federal laws of Canada applicable therein. Any provisions of the International Sale of Goods Act or any convention on contracts for the international sale of goods shall not be applicable to this agreement. The parties submit to and consent to the non-exclusive jurisdiction of courts located in the Province of Ontario.

24. ENTIRE AGREEMENT, TERM & MODIFICATION: These Terms & Conditions of Sale constitute the entire agreement between the parties and supersede any prior agreements or representations, whether oral or written. Upon thirty (30) days prior written notice, SELLER may, in its sole discretion, elect to terminate any order for the sale of Products and provide a pro-rated refund for any pre-payment of undelivered Products. No changeto or modification of these Terms & Conditions shall be binding upon SELLER unless in a written instrument specifically referencing that it is amending these Terms & Conditions of Sale and signed by an authorized representative of SELLER. SELLER rejects any additional or inconsistent Terms & Conditions of Sale offered by BUYER at any time, whether or not such terms or conditions materially alter the Terms & Conditions herein and irrespective of SELLER's acceptance of BUYER's order for the described goods and services.

Terms and Conditions Covering Sales of Configured-to-Order Projects and Systems

In addition to all terms and conditions above, the following sections apply to sales of Configured-to-Order Projects, Systems, and the like:

101. PAYMENT.

101.1 Payments will be made per the schedule of payment events set forth in Seller's Quotation; provided that if the Start-Up Date (as defined below) is less than 30 days after the Acceptance Date, 90% of the purchase price is due on or before the Start-Up Date.

101.2. In the event that achievement of a scheduled payment event is delayed or suspended due to the Buyer's convenience or other reasons for which the Buyer or its representatives is responsible, such payment event will be deemed to have occurred and Seller shall be entitled to invoice Buyer as if achievement of such payment event had been achieved. In such circumstances, Buyer must notify Seller in writing of the reasons for the delay and anticipated duration of the delay. Seller will mark the Products (or parts thereof) as the Buyer's property and shall store the Products (or parts thereof) in a segregated area until actual delivery.

102. DELIVERY

102.1 SELLER will request the BUYER to provide a firm date for delivery of the Products to the project site (the "Delivery Date") which SELLER will then use to establish the production schedule for the Products. The Delivery Date will then be binding on the BUYER except for any changes made in accordance with the provisions below.

102.2 The BUYER can request a rescheduling of the Delivery Date on one occasion only by notifying SELLER in writing not less than four weeks prior to the scheduled Delivery Date. The BUYER may request that the Delivery Date be extended by a period up to six weeks, without penalty, but may not request that the Delivery Date be moved forward. The BUYER may also request that the Delivery Date be extended beyond a six-week period but, SELLER may not agree to such extension, beyond the maximum six-week extension period

102.3 SELLER may, in its sole discretion, agree to change the Delivery Date on more than one occasion or if less than four weeks' prior notice is provided of a requested change, but is under no obligation to do so.

102.4 SELLER reserves the right to reschedule the Delivery Date to a date prior to or subsequent to the scheduled Delivery Date in order to accommodate its shipping, production or other requirements. This right to reschedule will be applicable unless otherwise agreed in writing by an authorized officer of SELLER. SELLER will provide the BUYER or its representative with a minimum of 24 hours' notice of any such rescheduling.

102.5 Where any change to the Delivery Date is made at BUYER's request, for all purposes with respect to the warranty and payment provided by SELLER in connection with the Products, the initial Delivery Date will be considered to be the Delivery Date regardless of any change later made to the Delivery Date.

103. ACCEPTANCE

103.1 During the period between the Delivery Date and the Start-up Date, the BUYER shall prepare the Products and the project site for installation and start-up and, unless otherwise agreed in writing by an authorized representative of SELLER, shall complete acceptance testing with respect to the Products. The Products shall be deemed to be accepted on the earliest to occur of the following dates (the "Acceptance Date"): (a) that date on which the Products can function in either manual or automatic operation and provide disinfection in accordance with criteria specified in the Quotation, or (b) 60 days after the Delivery Date.

103.2 All amounts which remain owing by the BUYER for the Products, including any amount which is specified to be payable on the Acceptance Date, will be paid by the BUYER to SELLER within 30 days after the Acceptance Date, unless otherwise agreed in writing by an authorized representative of SELLER.

103.3 Written notification must be given by the BUYER to SELLER within seven days after the Acceptance Date listing any outstanding deficiencies with respect to the Products and SELLER will use all reasonable efforts to correct such deficiencies promptly.

104. START-UP

104.1 SELLER will request a firm date for start-up of the Equipment (the "Start-Up Date"). Trojan will then schedule its technician to be on-site for the Start-up Date. The Start-up Date is binding except for any changes made in accordance with the provisions below.

104.2 On the Start-up Date, BUYER must have the Equipment and site ready as provided in the Installation Preparation Checklist contained in the Contractor Installation Package sent to BUYER and must have paid all amounts then due and payable to SELLER.

104.3 BUYER can request a rescheduling of the Start-up Date by notifying SELLER in writing not less than three weeks prior to the Start-up Date. BUYER may request that the Start-up Date be extended but may not request that the Start-up Date be moved forward. SELLER requires a minimum extension period of two weeks between the existing Start-up Date and the requested new Start-up Date in order to reschedule its technician.

104.4 SELLER may, in its sole discretion, agree to reschedule the Start-up Date where a BUYER requests less than a two-week extension but is under no obligation to do so. In the event that SELLER does agree to less than a two-week extension or that BUYER requests more than two changes to the Start-up Date, BUYER will be charged an administration fee in an amount determined by SELLER.

104.5 SELLER reserves the right to reschedule the Start-up Date to a date which is prior to or subsequent to the scheduled Start-up Date in order to accommodate its resource availability. This right to reschedule will be applicable unless otherwise agreed in writing by an authorized officer of SELLER. SELLER will provide BUYER or its representative with a minimum of 72 hours' notice of any such change to the Start-up Date.

104.6 In the event that SELLER'S technician arrives at the project site and finds that the Equipment or the project site is not ready for start-up as defined in the Contractor Installation Package, or any amounts then due and payable to SELLER remain unpaid, BUYER may either:

(a) provided all amounts then due and payable to SELLER have been paid, issue a purchase order for all costs involved in having SELLER correct the deficiencies, or

(b) have SELLER'S technician leave the site and then reschedule the Start-up Date to a date when all deficiencies will be corrected, and the Equipment will be ready for start-up as defined in the Contractor Installation Package. If BUYER selects this option, the cost of rescheduling will be not less than a minimum amount specified by SELLER, with the final cost being determined by SELLER based on its costs and expenses incurred in connection with the rescheduling.

Water Technologies & Solutions

Proposal for the
Carmel WWTP
2PAD

submitted to:
Greeley-Hansen

December 19, 2022

proposal number: 522553 Rev.1

submitted by:
Chris Allen, P.E. - Regional Manager
Cell: (503) 307-2238
Email: chris.allen@veolia.com

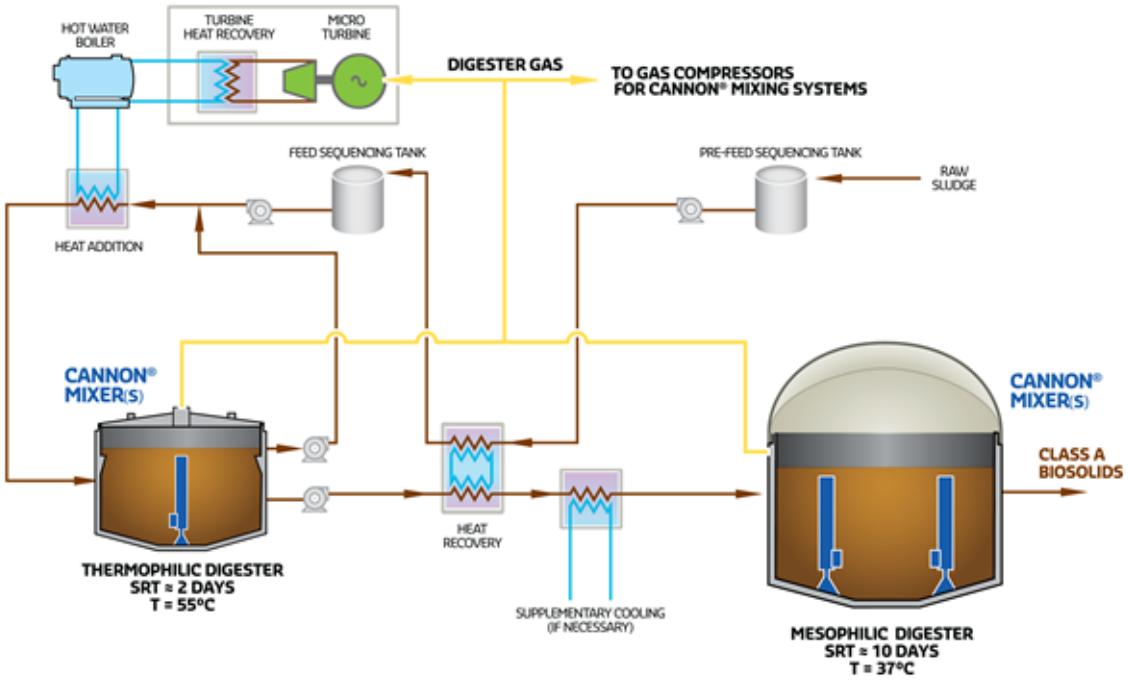
local representation by:
Coombs Hopkins

Table of Contents

1 Process Description

2PAD

The SUEZ 2PAD System is a two-phase anaerobic digestion system designed to enhance the digestion process and to satisfy Class A biosolids requirements in accordance with the EPA's 40 CFR Part 503 regulations. The 2PAD System was granted a National PFRP (Processes to Further Reduce Pathogens) Equivalency by the EPA in September 2002. This means that all of our installations will have **automatic site-specific approval for Class A biosolids**. No other two-phase anaerobic digestion process has achieved this certification.



2PAD System Process Flow Diagram

Basically, two key sequential phases take place in anaerobic digestion, the acidogenesis and methanogenesis phases (the acid forming and methane forming phases). In conventional anaerobic digestion, these two separate phases occur in the same tank, so there is a sacrifice in process efficiency. The acid forming bacteria do develop much faster than the methane forming bacteria and are much less sensitive to process changes. In the 2PAD System, these two phases occur in separate digester tanks in series, with the first phase carried out at a thermophilic temperature of 132°F (55°C). Thermophilic temperatures maximize pathogen destruction, as well as lower detention times due to the increased rate of biological reactions. The second phase digesters (**typically existing**) are operated at mesophilic temperature of 98°F (35°C).

Conventional low rate anaerobic digestion system operates at a volatile solids loading rate of 0.04 to 0.1 lbs./ft3.d, while a high rate system is known to operate at loading rates of 0.1 to 0.2 lbs/ft3.d. The 2PAD process is considered an **advanced high rate** anaerobic digestion system, a typical 2PAD system operates at up to 8% total solids (TS) concentration sludge, with volatile solids (VS) loading rate greater than **0.75 lbs/ft3.d** (12 kg/m3.d) in **thermophilic** acid phase and greater than **0.125 lbs/ft3.d** (2 kg/m3.d)

in **mesophilic** gas phase. The typical sludge retention times (SRT) of 2 days for thermophilic acid phase and a little over 10 days for the mesophilic gas phase for a combined 13 days SRT is sufficient for the process to achieve Class A biosolids.

The 2PAD process converts greater than 55% volatile solids (VS) into biogas, with feedstock of at least 70% VS, the process yields about two times as much of biogas than conventional mesophilic anaerobic digester. See table below for details:

Example gas production assuming sludge feed / day of 25,000 GPD @ 4.5% TS and 70% VS				
	Biogas Conversion (Ft^3 /Lbs. VSR)	VSR (%)	Estimated Gas Production (Cu. Ft./Hour)	Delta (%)
2PAD	19	>55	3,064	**+ 88%**
Conventional Mesophilic	15	>37	1,627	

The 2PAD process is semi-batch with **two**, **three** or four **sludge feedings per day** to the system. The process is operated in a draw and fill mode and relies on SUEZ's Cannon Mixer ® System for its mixing, which ensures the calculated active digestion volume shall be greater than 90% of the total digester volume. Also, the process optimized for minimum energy consumption as the digester with a low detention time is operated in the thermophilic range.

KEY BENEFITS:

1. The digested biosolids will meet Class A requirements according to the EPA's 40 CFR Part 503 regulations. As already indicated, the EPA has granted the 2PAD System a Conditional National PFRP Equivalency, with automatic site-specific Class A approval for our installations.
2. Gas production from the mesophilic digester will be significantly higher than conventional anaerobic digestion.
3. The total hydraulic retention time is reduced compared to conventional anaerobic digestion. This means that total digester volumes can be reduced and/or sludge loading rates can be increased.
4. Foaming associated with mixed primary and waste activated sludge is virtually eliminated. Nocardia bacteria, which can be present in waste activated sludge and is the cause of most digester foaming, is a mesophilic organism and the thermophilic first stage destroys this bacteria.
5. Both phases will be completely mixed by the Cannon® Mixing System. This will ensure (SUEZ will guarantee) an active volume of greater than 90%, as required for Class A digestion processes.
6. Aeration is not required in either stage, so the energy requirements are low.
7. Optional optimization of biogas and use of micro turbine to generate electricity may offset the power requirement for the entire 2PAD system making it self reliant and possibly a net producer of electricity (qualify for green credits) with zero (0) carbon footprint.

SUMMARY:

- Optimizes digestion process by splitting acid and gas phases
- Designed to produce Class A biosolids (fertilizer)
- Optimized for maximum biogas production (cogeneration)
- Certified National PFRP Equivalency Automatic "Site-Specific" Approval
- Designed to use existing infrastructure to minimize new construction

2 Design Basis

The following is the summary of design, sizing and scope of supply for the 2PAD System:

General Information	
Type of Screening	PLEASE ADVISE
Type of Grit Removal	PLEASE ADVISE
Total Flow to Digesters	23,000 gpd
Type of Sludge	Combined Primary and WAS
Sludge % Solids	2.2%
Sludge % Volatile Solids	75%
Estimated Viscosity of Sludge	300 cps at shear rate of 6 seconds^{-1}
Minimum Raw Sludge Temperature	45°F*
Maximum Raw Sludge Temperature	65°F*
Number of Sludge Feeding Cycles per Day	3

*Assumed value.

Design of Feed Sequencing Tank	
Number of Digesters	1 (new)
Diameter	8 ft
Sidewater Depth	24 ft

Design of Thermophilic Digester	
Number of Digesters	1 (new)
Diameter	20 ft
Sidewater Depth	24 ft
Depth of Cone	2.5 ft
Type of Cover	Fixed
Detention Time, Actual	2.28 days
Digester Temperature	55°C

Design of Mesophilic Digester	
Number of Digesters	1 (new)
Diameter	46 ft
Maximum Sidewater Depth	24 ft
Minimum Sidewater Depth	20 ft

Depth of Cone	5.75 ft
Detention Time, Actual	11.85 days
Digester Temperature	37°C

3 Scope of Supply

3.1 Scope of Supply - SUEZ

SUEZ proposes to furnish the following equipment and services for the 2PAD System:

QTY	ITEM
1	24" Cannon® Mixers for thermophilic digester, each consisting of a non-clog piston bubble generator, draft tube, floor support bracket and fittings. Each mixer will be fabricated of mild steel, 1/4" minimum thickness, except the bubble generator which is fabricated of Type 304 stainless steel, 1/8" thickness. Carbon steel will be prepared by sandblasting followed by two shop coats of epoxy paint.
3	24" Cannon® Mixers for mesophilic digester, each consisting of a non-clog piston bubble generator, draft tube, floor support bracket and fittings. Each mixer will be fabricated of mild steel, 1/4" minimum thickness, except the bubble generator which is fabricated of Type 304 stainless steel, 1/8" thickness. Carbon steel will be prepared by sandblasting followed by two shop coats of epoxy paint.
2	Compressor assembly to be located in a digester building. Compressor assembly will include the following components shipped loose for field assembly by others: liquid ring rotary compressor with explosion proof motor, guard, baseplate, discharge moisture separator, inlet flame arrester, inlet sediment trap seal water line accessories, discharge check valve, inlet and outlet pressure gauges and high/low pressure safety controls.
2	Gas flow balancing system consisting of one gas flow meter, one pressure gauge, one balancing valve and isolation valves for each mixer. The components for the gas flow balancing system will be shipped loose for field assembly and piping by others.
LOT	Pumps: Raw Sludge Feed to Feed Sequencing Tank, Sludge Feed from Feed Sequencing Tank, Sludge Transfer to Mesophilic Digesters, Recirculation Pump for Heat Recovery Exchanger, Hot water pump for Mesophilic Heating Jackets (sludge pumps will be progressive cavity type and water pumps will be centrifugal)
LOT	Inline Grinder/Macerators: Raw Sludge Line before the heat recovery system, Thermophilic Digester discharge line before the heat recovery system
LOT	Hot Water Boiler & Accessories: Constructed in accordance with ASME Boiler Code requirements. Boiler will include the following accessories and is factory assembled, tested, and shipped to jobsite as one assembly (except the gas train): operating control and low water cutoff, pressure and temperature gauges, ASME relief valve, drain valve, natural gas train, burner with automatic fuel changeover, burner control panel NEMA 12 enclosure. The following auxiliaries will be provided but shipped separately: boiler air-troll fitting, air separator, bladder expansion tank assembly, pressure reducing anti-siphon check valve, and chemical feeder tank (for boiler make-up water).
3	Tube-in-shell external heat exchangers. One (1) Heat Recovery Heat Exchanger to cool down the thermophilic sluge and to heat the raw sludge prior to the thermophilic phase. The heat recovery train will consist of a pair of sludge-to-water heat exchangers transferring the heat by means of an intermediate water loop. One (1)

	Thermophilic Digester Heat Exchanger for the Thermophilic Digester to maintain the digester temperature at 55^{O}C. One (1) Supplementary Cooling Heat Exchanger for the cooling of the hot thermophilic sludge when required (summer months).
LOT	Internal Heating System for Mesophilic Digester – each mesophilic digester will be provided with 3-way blending valve, temperature regulator, balancing valves, hot water heating jacket for each mixer, balancing and flow set valves, and circuit setters.
LOT	Automatic knife gate valves suitable for wastewater sludge: outlet feed sequencing tank, inlet sludge mesophilic digesters.
LOT	Local Instrumentation: Level transmitter for each digester and Feed Sequencing Tank, Temperature transmitters for thermophilic digester (top and bottom), including thermowells, each mesophilic digester, including thermowell, inlet feed sequencing tank, additional temperature transmitters as required, local temperature and pressure indicators as required.
LOT	Control Panel: NEMA 12, 72” W x 12” D x 72” H, Allen Bradley SLC-500 PLC, PC running In Touch Wonderware software, graphic overview of equipment, equipment failure status, alarm screen, alarm setpoints, process timers and counters setpoints, process indicating and recording as required, ControlNet communication card to enable communication with the customer’s SCADA system (if required), terminal blocks in the control panel for hard-wiring connections to field mounted devices, phone modem to enable dial-up remote communication to PLC, and UPS to power the PLC through momentary power interruption.
LOT	Detailed engineering design for 2PAD system only
LOT	Freight to the jobsite
LOT	Electronic O&M Manuals
30	Field Service Days of a SUEZ field service representative for installation inspection, commissioning and training in no more than five (5) trips. Additional days of field service are available on a per diem basis at $1,500/Day, plus travel expenses

3.2 Scope of Supply – By Others

The following items, but not limited to, shall be provided by Others:

- Installation of any kind and unloading & placement of equipment.
- All concrete and civil works of any kind.
- All civil, mechanical, electrical and plumbing works.
- Digester building
- Tanks
- All anchor bolts and mounting hardware not specified herein.
- All piping, piping supports and manual valves.
- Gas safety not listed in proposal.
- Biogas treatment, storage, or CHP system.
- Sludge pumps, water/hot water pumps not listed in the proposal.
- Pressurized air pump for pneumatics.
- Temporary sludge treatment/hauling

- Wiring and motor starters.
- Instruments not listed in the proposal.
- Spare parts
- Utility tie-in
- All other necessary equipment and services not otherwise listed as specifically supplied by SUEZ.

4 Commercial

4.1 Pricing

Equipment and service pricing

Purchase Price	
SUEZ Scope of Supply	$1,755,000 USD

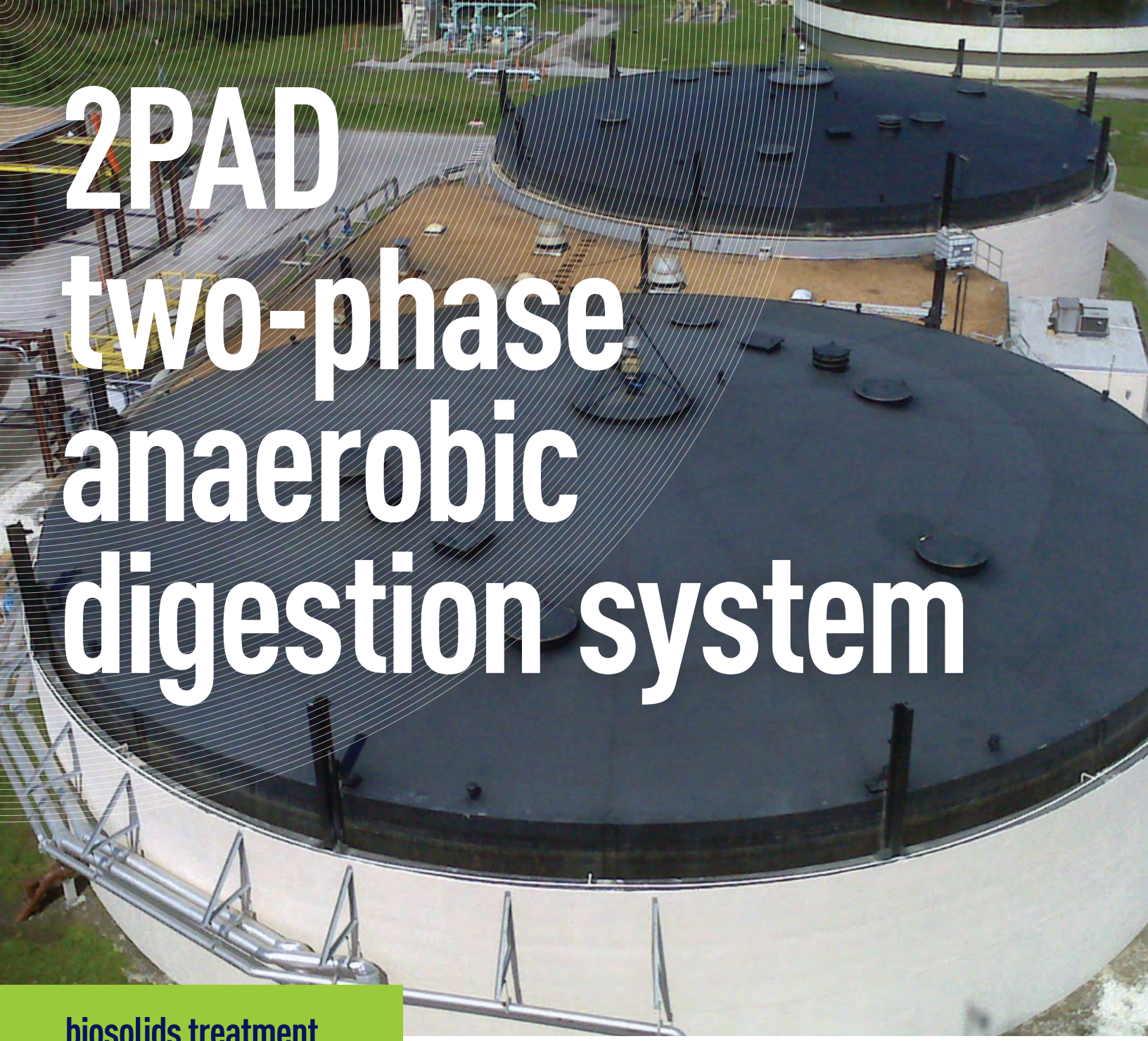
Payment Terms	
10%	Net Cash, Payable in thirty (30) days from date of submittal of initial drawings for approval
85%	Net Cash, Payable in progress payments thirty (30) days from dates of respective shipments of the Products
5%	Net Cash, Payable in thirty (30) days from Product installation and acceptance or sixty (60) days after date of final Product delivery, whichever occurs first

4.2 Freight Terms

The following freight terms used are as defined by INCOTERMS 2010.

All pricing is DDP to project site.

Appendix A. Brochure



2PAD two-phase anaerobic digestion system

biosolids treatment

APPLICATIONS
- municipal sludge treatment
- industrial sludge treatment

MAIN CHARACTERISTICS
- produces Class A biosolids
- makes digestion process more efficient

a unique two-phase anaerobic digestion system that produces Class A Biosolids, which can be land-applied without restrictions

ready for the resource revolution

suez

biosolids technology: 2PAD

Whether you are retrofitting an existing plant or building a new one, the 2PAD System is ready to take your sludge to a new class - Class A Biosolids.

This unique two-phase anaerobic digestion system produces Class A Biosolids, which can be land - applied without restrictions in accordance with the EPA's 40 CFR Part 503 regulations.

Our innovative process separates the acid - and methane - forming digestion phases (acidogenesis and methanogenesis), increasing the efficiency of both and, combined with the high temperature, destroys the pathogens to below detectable limits. A two - year pilot study confirmed the effectiveness of the 2PAD System to meet EPA requirements for Class A Biosolids. In fact, the 2PAD System has been granted "PFRP Conditional National Equivalency" by the Environmental Protection Agency, as recommended by the Pathogen Equivalency Committee.

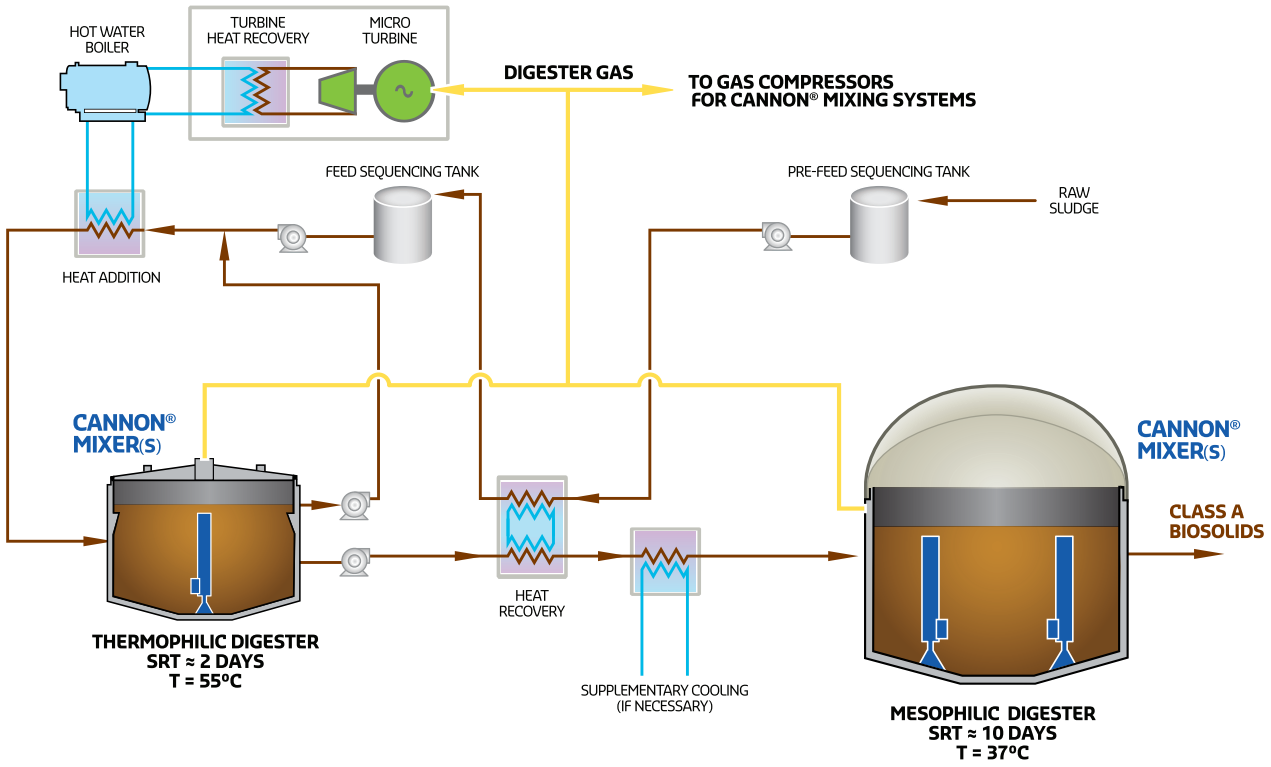
main features

- **produces class A biosolids, which are bio-safe and can be land-applied without restrictions**
- **Separating the acid- and methane-forming phases makes the digestion process more efficient and more effective**
- **Aeration is not required, so energy costs are low**
- **Total hydraulic retention time is greatly reduced, which means smaller digesters can be used and associated costs are lower**
- **Foaming is virtually eliminated because nocardia bacteria, the typical cause of digester foaming, is destroyed in the thermophilic stage**

process

- Raw sludge is heated as it passes through a heat recovery exchanger and then enters a thermophilic digester where it is held for two days and reaches a temperature of 55°C, maximizing pathogen destruction.
- The discharge goes through the heat recovery exchanger to cool the sludge, recover the heat, and partially heat the raw sludge.
- The cooled sludge is pumped into a mesophilic digester for ten days, where volatile solids are destroyed and gas is produced.
- The result is Class A Biosolids, which can be land - applied without restrictions.

2PAD process



equipment list

- Cannon Mixing System for each digester tank (complete mixing is critical for Class A approval)
- Heating equipment, including boiler, heat recovery exchanger, and other heat exchangers as required
- Gas safety and handling equipment
- Transfer pumps
- Digester covers
- PLC control system

2PAD

two-phase anaerobic digestion system

integrated treatment solutions

As a full treatment line specialist, SUEZ draws upon a broad portfolio of proven technologies to assist industries and municipalities meet their water and waste water treatment challenges. We provide integrated equipment solutions and services for a wide range of applications:

- **industrial water and wastewater**
- **municipal drinking water**
- **municipal wastewater**
- **biosolids management**

We also offer global expertise in the design, build, operation and maintenance of water treatment plants and systems, all delivered to your specific demands.

piloting

SUEZ in North America offers pilot systems and services for this and many other of our product offerings. Pilot studies are a practical means of optimizing physical-chemical and biological process designs and offer the client several benefits, such as:

- **proof of system reliability**
- **optimal design conditions for the full-scale system**
- **raw water lab analysis**
- **regulatory approval**

Please contact us if you would like to learn more about pilot studies for this system.

services

Aftermarket

SUEZ in North America sells parts and components for most SUEZ brand equipment as well as parts for demineralizers, thickeners, nozzles, pressure filters, and valves. We offer reliable spare parts at competitive prices. We maintain records of previous installations to quickly identify your requirements. Many items are shipped directly from stock for quick delivery.

Rebuilds, Retrofits and Upgrades

SUEZ in North America offers cost-effective rebuilds and upgrades for SUEZ provided systems, no matter what year they were built. If you are interested in an economical alternative to installing a whole new system, contact us for a proposal.

If interested in this product, check out some of our complementary products:

- **ABW® Automatic Backwash Filter**
- **AquaDAF® Clarifier**
- **Cleargreen®**
- **Densadeg® Clarifier/Thickener**
- **Ferazur®/Mangazur®**
- **Meteor® IFAS/MBBR**
- **Ultragreen™**
- **Climber Screen®**
- **Vortex®**
- **2PAD**
- **Thermylis® HTFB**

contact

SUEZ
8007 Discovery Drive
Richmond, VA 23229 USA
Tel. : +1 804 756 7600
Fax : +1 804 756 7643
sales.usa@suez-na.com

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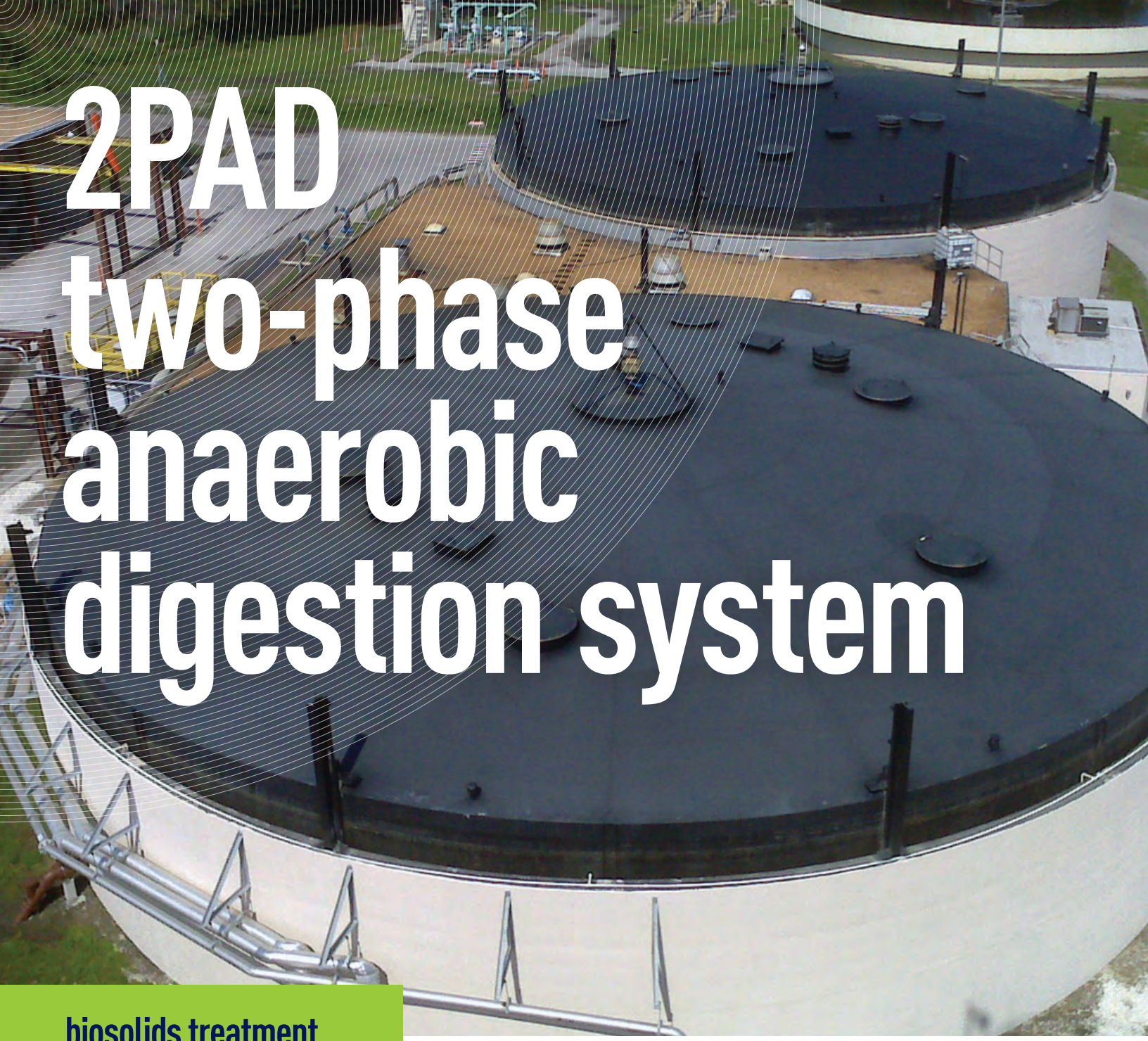

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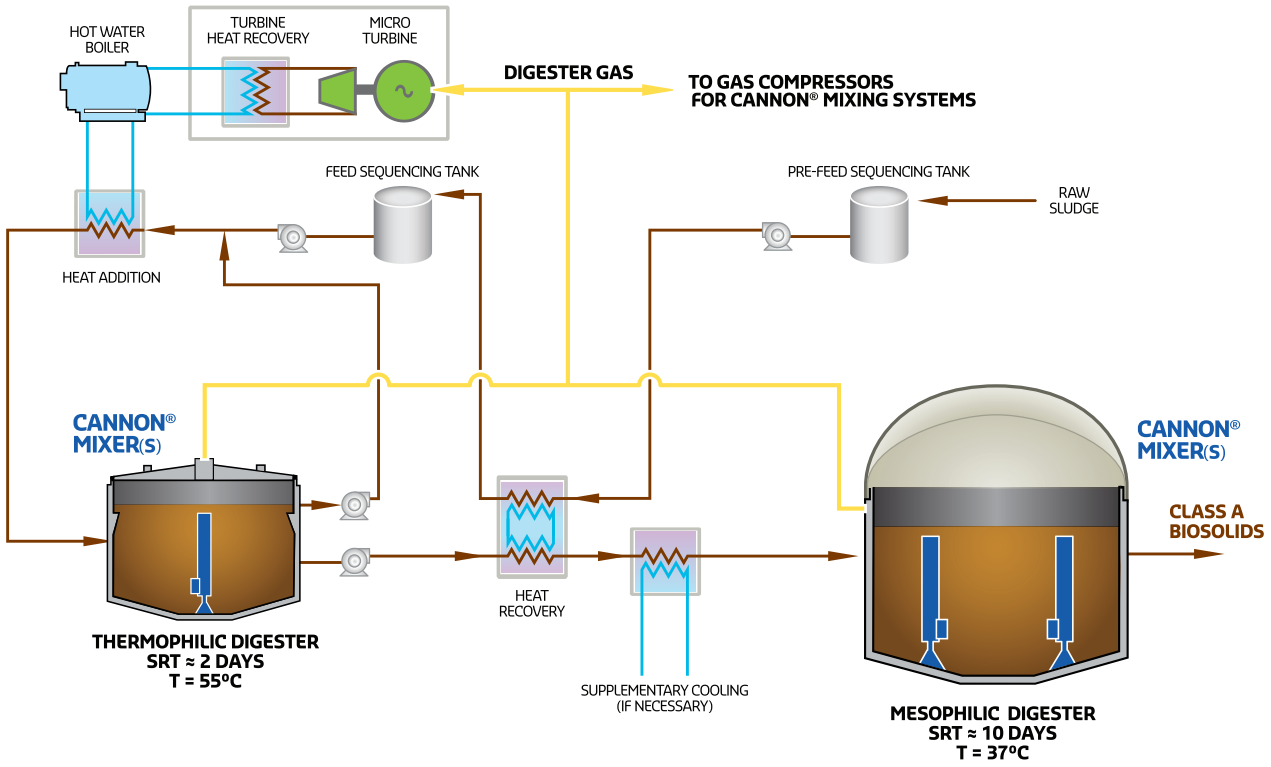

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SUEZ
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sales.usa@suez-na.com

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50 California Street, Suite 1500
San Francisco, CA 94111