Feasibility Analysis for Project 9: Treat Wastewater from the International Collector at the South Bay Water Reclamation Plant

Technical Memorandum

USMCA Mitigation of Contaminated Tijuana Transboundary Flows Project

Prepared for:

EPA

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

ammonia-N	ammoniacal nitrogen
BACT	best available control technology
BOD	biochemical oxygen demand
BOD_5	amount of oxygen consumed by microorganisms within five days
COD	chemical oxygen demand
EID	Environmental Impact Document
EPA	United States Environmental Protection Agency
ERG	Eastern Research Group, Inc.
ft^2	square foot
ft^3/day	cubic feet per day
gpd	gallons per day
gpd/ft^2	gallons per day per square foot
IBWC	International Boundary and Water Commission
ITP	South Bay International Wastewater Treatment Plant
kg/day	kilograms per day
kg/m^3/day	kilograms per cubic meter per day
lb BOD/day/1,000 ft^3	pounds of BOD per day per one thousand cubic feet
lb/day	pounds per day
lb/ft^3/day	pounds per cubic foot per day
m^3	cubic meter
MGD	million gallons per day
mg/L	milligrams per liter
MLSS	mixed liquor suspended solids
nitrate-N	nitrate nitrogen
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
PB1-A	Pump Station 1A
PB1-B	Pump Station 1B
PB-CILA	CILA Pump Station
RAS	return activated sludge
SAB	San Antonio de los Buenos
SBOO	South Bay Ocean Outfall
SBWRP	South Bay Water Reclamation Plant
TKN	total Kjeldahl nitrogen
TSS	total suspended solids
USMCA	United States–Mexico–Canada Agreement
UV	ultraviolet
VSS	volatile suspended solids
WAS	waste activated sludge
WEF	Water Environment Federation

EXECUTIVE SUMMARY

PG Environmental conducted a feasibility analysis of Project 9, "Treat Wastewater from the International Collector at the South Bay Water Reclamation Plant," one of 10 proposed projects identified to mitigate transboundary wastewater flows in the Tijuana River watershed under the United States–Mexico–Canada Agreement (USMCA). This feasibility analysis report includes an analysis of the technical, economic, and environmental feasibility of the project and builds on past studies and consultation with engaged stakeholders using available data.

The project involves the purchase and possible expansion of the South Bay Water Reclamation Plant (SBWRP) to handle 15 to 30 MGD of raw sewage from the International Collector to reduce impacts to the U.S. coast by capturing and treating sewage from the International Collector that otherwise would be discharged to the Pacific Ocean without adequate treatment. The project requires the federal government to purchase the SBWRP and the South Bay Ocean Outfall from the City of San Diego and for both facilities to be owned and operated by the U.S. International Boundary and Water Commission. PG evaluated the feasibility of using the SBWRP to treat sewage from the International Collector in three sub-projects:

1. **Use the SBWRP at its current design capacity of 15 MGD and pump solids to Point Loma for processing.** This sub-project, proposed by PG, was found to be technically feasible with limitations and will enable all raw sewage from the International Collector to be treated in the U.S. (if the ITP continues to treat 25 MGD) until at least 2030. This will reduce the discharge of untreated or undertreated sewage to San Antonio de los Buenos (SAB) Creek, thereby enhancing recreational opportunities for local residents and tourists and improving conditions for Navy training personnel. However, implementation of sub-project 1 requires the City of San Diego to continue to process solids from the SBWRP, which may not be acceptable to the City. The estimated capital cost of the sub-project is $51.6 million, and the estimated 40-year life cycle cost is $681 million.

2. **Use the SBWRP at its current design capacity of 15 MGD and construct new onsite solids processing facilities.** This sub-project, proposed by PG, was found to be technically feasible with limitations and will accomplish the same objective as sub-project 1 but will take longer to implement. Disposing of the solids generated by the treatment plant will be a key challenge. This challenge will be further exacerbated if anaerobic digestion is not permitted by local air regulations, as the amount of solids to be disposed of will approximately double. The estimated capital cost of the sub-project is $105 million, and the estimated 40-year life cycle cost is $759 million. The estimated operation and maintenance (O&M) costs for solids processing and disposal are substantial, as PG has assumed that sludge will be transported to Mexico for disposal consistent with disposal practices implemented at the ITP.

3. **Expand the SBWRP to an average daily design flow rate of 30 MGD with onsite solids processing facilities.** This sub-project, proposed by PG, was found to be technically feasible with limitations and will enable all raw sewage from the International Collector, as well as flows from the canyon collectors, to be treated in the U.S. until at least 2045. To accommodate these future flow rates, the SBWRP will be essentially doubled in size with corresponding increases in sludge production and disposal, energy consumption, and manpower. As with sub-project 2, disposing of the solids generated by the expanded treatment plant will be a key challenge. This challenge will be further exacerbated if anaerobic digestion is not permitted by local air regulations, as the amount of solids to be

disposed of will approximately double. The estimated capital cost of the sub-project is $274 million, and the estimated 40-year life cycle cost is $1.2 billion. The estimated O&M costs for solids processing and disposal are substantial, as PG has assumed that sludge will be transported to Mexico for disposal consistent with disposal practices implemented at the ITP.

PG has also explored the projected performance of Project 9 to mitigate effects from discharges from SAB Creek, including some high-level environmental and social impacts. ERG is preparing an Environmental Impact Document with a more thorough evaluation of potential environmental and social impacts in the U.S. associated with Project 9.

Note that more information on background data analyzed and referenced in this document can be found in PG's *Baseline Conditions Summary: Technical Document,* available from EPA.

1. INTRODUCTION

Under EPA Contract No. 68HERH19D0033, Task Order No. 53, PG Environmental conducted a detailed feasibility analysis of 10 proposed projects to mitigate transboundary wastewater flows in the Tijuana River watershed. Each feasibility analysis considered an estimate of capital costs; an estimate of design, project, and construction management costs; an estimate of operation and maintenance (O&M) costs; project implementation schedule; regulatory, engineering, and any possible implementation issues; and social and environmental impacts.

This feasibility analysis specifically addresses Project 9: "Treat Wastewater from the International Collector at the South Bay Water Reclamation Plant." During the analysis, PG consulted with stakeholders and reviewed previous work including the following:

- *Tijuana River Valley Needs and Opportunities Assessment* (HDR 2020).
- *Modeling Impacts of Various Wastewater and Stormwater Flow Scenarios on San Diego South Bay and Tijuana Beaches* (Feddersen et al. 2020).
- *Tijuana River Diversion Study: Flow Analysis, Infrastructure Diagnostic and Alternatives Development* (Arcadis 2019).

The PG document *Baseline Conditions Summary: Technical Document,* prepared for EPA under the United States–Mexico–Canada Agreement (USMCA) Mitigation of Contaminated Tijuana Transboundary Flows Project, contains more information on background data analyzed, U.S. and Mexico entities, infrastructure and its operating conditions, water bodies, affected areas, other studies and reports, and dry- and wet-weather flow conditions referenced in this document.

This report has been revised and finalized from the draft version based on comments and discussions with EPA and new information available for dispersion modeling for the South Bay Ocean Outfall (SBOO).

Consistent with the task order scope, PG will work with EPA to develop and analyze several infrastructure alternatives, including a preferred alternative, to mitigate the transboundary wastewater and stormwater flows. The alternatives will include groupings of one or more projects evaluated in the feasibility analyses, scaled if necessary, and will be presented to EPA in the Alternatives Document. Where applicable, the Alternatives Document will also include any changes to the estimated costs or feasibility of this project based on evaluation of the additional information described above.

1.1 Project Purpose

The primary purpose of Project 9 is to reduce impacts to the U.S. coast by capturing and treating sewage from the International Collector that otherwise would be discharged to the Pacific Ocean without adequate treatment, or any treatment at all, from SAB Creek. This project has a very similar objective to that of Project 3 but uses existing or expanded facilities at the South Bay Water Reclamation Plant (SBWRP) rather than the South Bay International Wastewater Treatment Plant (ITP). The project requires the federal government to purchase the SBWRP and the SBOO from the City of San Diego and for both facilities to be owned and operated by the U.S. International Boundary and Water Commission (IBWC).

1.2 Current Conditions

Sewage from the International Collector is pumped to the SAB wastewater treatment plant via Pump Station 1B (PB1-B). Based on information provided by EPA, the aerated lagoon treatment system at the SAB plant is known to be undersized and inadequately operated and maintained to provide adequate treatment. The floating aspirating aerators in the lagoon system have been observed out of service, which greatly reduces BOD removal efficiency. Also, in the absence of aeration, solids accumulation at the lagoon bottom is accelerated. In addition, some portion of wastewater and diverted river water from pump stations PB1-A and PB1-B bypasses the SAB plant. Untreated or undertreated sewage is thereby discharged into the Pacific Ocean via SAB Creek where, depending on ocean currents, it can migrate northward along the coast and across the maritime boundary (Feddersen et al. 2020).

The International Collector was originally constructed in the 1990s to intercept and convey sewage from the majority of Tijuana. It needs rehabilitation to prevent spillage of sewage into the Tijuana River because of significant crown corrosion of the concrete interceptor sewer, attributable to hydrogen sulfide. It is also affected by high flows caused by inflow during large storms. Based on data provided by IBWC, it is estimated that about half the dry-weather flow in the Tijuana River is composed of untreated wastewater. Refer to the *Baseline Conditions Summary: Technical Document* for further discussion of the International Collector.

Currently, flows from the International Collector include Tijuana River water that is diverted by the CILA Pump Station (PB-CILA). So that the International Collector flows treated at an expanded SBWRP will be composed of only sewage, it is presumed that the connection between the International Collector and PB-CILA in Mexico must be severed. However, PG did not evaluate any infrastructure upgrades needed in Mexico to accomplish this. PG anticipates that IBWC will operate the SBWRP in any of the three proposed scenarios.

Stewart's Drain is a concrete structure immediately southeast of the ITP where surface flow from Tijuana flows into the U.S. and is directed to the ITP headworks. Flows at Stewart's Drain typically occur during wet weather and are composed of sanitary sewer overflows from the International Collector and other sources (Arcadis 2019).

The existing SBWRP is designed to treat an average daily flow rate of 15 MGD and a peak daily flow rate of 35 MGD. The existing treatment process consists of preliminary treatment (screening and grit removal), primary treatment, secondary treatment (activated sludge with an anoxic selector ahead of aerobic zones), tertiary treatment (deep bed mono-media filtration), and disinfection (UV light using high-intensity, medium-pressure lamps). Secondary treated wastewater is discharged to the SBOO; effluent intended for reuse undergoes tertiary treatment. The City of San Diego pumps primary and secondary sludge from the treatment process through a dedicated force main that discharges into a major sewer interceptor in the Point Loma collection system. The sludge then mixes with sewage and receives treatment at the Point Loma wastewater treatment plant. The SBWRP is located on a 22.3-acre site, with an adjacent area of about 29 acres to the southwest for future expansion or new facilities. Figure 1-1 shows a schematic of the treatment process.

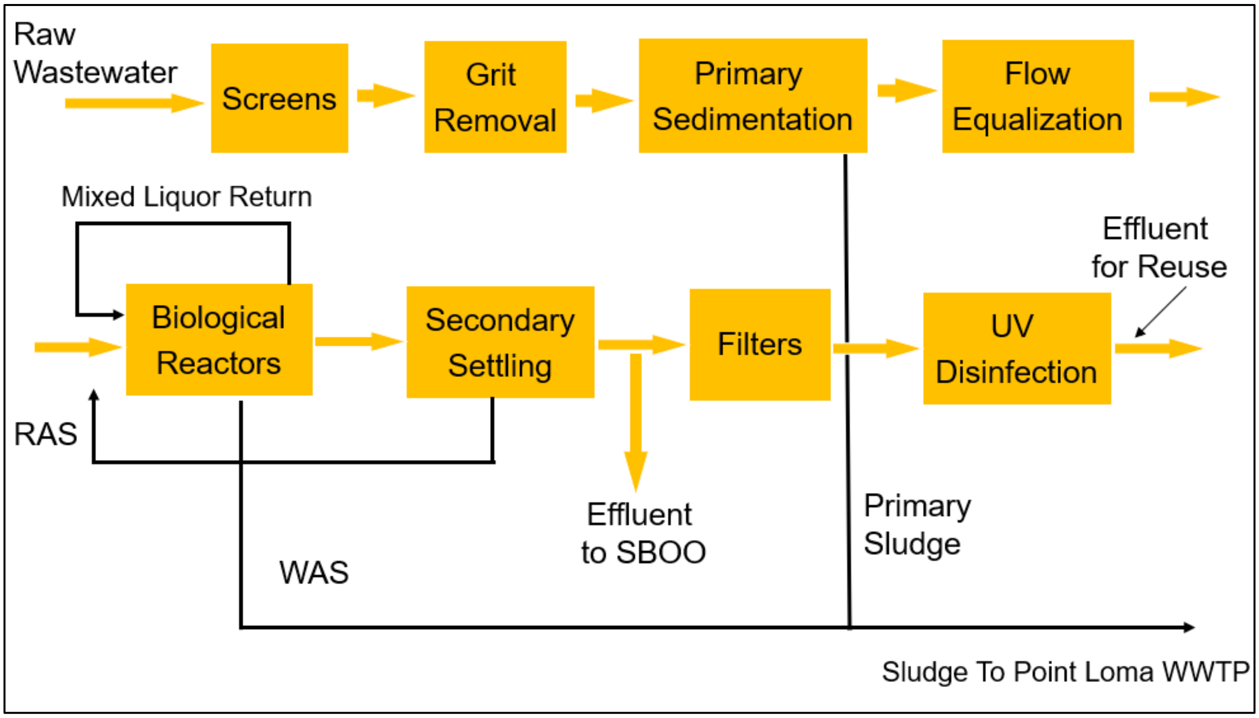

Figure 1-1. Schematic of the Existing SBWRP Wastewater Treatment Process

The average flow rate into the SBWRP in 2020 was about 6.5 MGD. Influent BOD_5, TSS, and ammonia-N concentrations were about 370 mg/L, 320 mg/L, and 35 mg/L, respectively. The preliminary treatment process consists of two mechanically cleaned bar screens (each designed for a peak daily flow rate of 18 MGD) and two aerated grit chambers, each designed for a peak daily flow rate of 18 MGD. Grit removed from the wastewater is pumped into grit cyclones where residual organic matter is removed. The classified grit drops into a grit hopper located over a truck loading area.

The SBWRP's primary treatment process consists of five primary sedimentation basins, each designed for an average daily flow rate of 3 MGD and a peak daily flow rate of 7 MGD. Currently, only two of the primary settling tanks are in use. Primary settling achieves about 42% BOD_5 removal and 50% TSS removal. Thus, BOD_5 and TSS entering the secondary treatment process are about 220 mg/L and 165 mg/L, respectively. Downstream of the primary sedimentation basins are two 0.75-million-gallon equalization basins, which are designed to smooth out organic and solids loadings to the activated sludge process.

The secondary treatment process consists of eight biological reactors, each with an anoxic zone followed by four aerobic zones, which are equipped with fine bubble diffusers. Four 400-horsepower centrifugal blowers are available for aeration and a fifth blower is out of service. At current loadings, only five bioreactors and one blower are typically used. Average dissolved oxygen concentration in each aerobic reactor is about 3 mg/L. Chemical addition, deep bed mono-media filters, and UV disinfection follow the secondary treatment process to provide effluent suitable for reclamation. Nine rectangular secondary clarifiers (20 feet wide × 130 feet long × 15 feet deep) are available, but only five are used at current loads.

Each biological reactor is described in Table 1-1. Each secondary clarifier is described in Table 1-2. The secondary treatment process performance for 2020 is summarized in Table 1-3. The data presented in Tables 1-1, 1-2, and 1-3 are based on information provided by SBWRP personnel, with the exception of the oxygen requirement and oxygen supplied values in Table 1-3, which were supplied by the Bio-Tiger model. Dr. Larry Moore developed the Bio-Tiger model for the U.S. Department of Energy in 2017 to simulate activated sludge processes.

Table 1-1. Description of Each of the Eight SBWRP Secondary Reactors at Current Loadings

Type of Zone	Number of Zones	Volume of Each Zone (Million Gallons)	Detention Time (Hours) in Each Zone at Average Daily Design Flow Rate of 1.88 MGD to Each Reactor
Anoxic	1	0.17	2.17
Aerobic	4	0.118	1.51
Total for one reactor	**5**	**0.64**	**8.2**

Table 1-2. Description of Each of the Nine SBWRP Secondary Clarifiers at Current Loadings

Type of Zone	Design Surface Overflow Rate (gpd/ft^2)	Design Solids Loading Rate (lb TSS/day/ft^2)	Detention Time in Each Clarifier (Hours)
Average daily flow rate	641	21	4.2
Peak daily flow rate	1,500	49	1.8

Table 1-3. Description of SBWRP Secondary Process Performance in 2020

Category	Item	Operating Data
Secondary influent loadings	Average flow rate (MGD)	6.5
	BOD_5 loading (lb/day)	11,900
	TSS loading (lb/day)	8,900
	TKN loading (lb/day)	2,700
Operating performance parameters	Solids retention time (days)	10
	MLSS concentration (mg/L)	2,800
	Total sludge production (lb/day)	8,900
	Total oxygen requirements (with denitrification) (lb/day)	17,500*
	Total oxygen supplied (lb/day)	17,500*
	RAS flow rate (MGD)	3.1
	WAS flow rate (MGD)—from mixed liquor	0.37
	Volumetric organic loading rate (lb BOD/day/1,000 ft^3)	27.9
	Blower horsepower in use	400
Secondary effluent quality	BOD_5 (mg/L)	10
	TSS (mg/L)	12
	Ammonia-N (mg/L)	1.5
	Nitrate-N (mg/L)	7.0

*Bio-Tiger model results for 2019–2020 operating conditions.

1.3 Major Project Elements Considered

Project 9 involves the federal government purchasing the SBWRP to treat raw sewage from the International Collector to help solve water quality problems in the Tijuana River watershed and the Pacific Ocean. The plant will be used exclusively to treat sewage from the International Collector and will no longer treat sewage from San Diego. At the time of this feasibility analysis, negotiations between EPA and the City of San Diego concerning the sale of the SBWRP and SBOO were in a preliminary stage. The likelihood of an agreement being reached remains unclear, as does the exact cost at which the facility would sell. Assuming the sale can be executed, PG has evaluated the feasibility of using the SBWRP to treat sewage from the International Collector in three distinct scenarios (sub-projects):

1. Use the SBWRP at its current design capacity of 15 MGD and pump solids to Point Loma for processing.
2. Use the SBWRP at its current design capacity of 15 MGD and construct new onsite solids processing facilities.
3. Expand the SBWRP to an average daily design flow rate of 30 MGD with onsite solids processing facilities.

2. DESIGN INFORMATION

Sections 2.2 and 2.3 describe the design features of Project 9. Figure 2-1, on the next page, provides an overview of the proposed locations and known elevations for the three sub-projects. Figure 2-2, on the following page, shows their proposed locations relative to the FEMA 100-year and 500-year floodplains.

2.1 Sub-Project 1: Use the SBWRP at Its Current Design Capacity of 15 MGD and Pump Solids to Point Loma for Processing

2.1.1 *Design Features*

Based on future flow projections for the International Collector, utilizing the WRP to treat an average daily flow rate of 15 MGD of sewage from the International Collector will accommodate population increase in Tijuana through at least 2030 (if the ITP continues to treat 25 MGD). Table 2-1 provides flow projections for the International Collector through the year 2040 from the NADB-EPA-CESPT study. PG used a linear regression (R2 = 0.99) to project flows for the years 2045 and 2050, indicated with italics.

Table 2-1. Future Flow Projections for the International Collector

Year	Projected International Collector Flow	
2015	1,371 l/s	31.3 MGD
2020	1,524 l/s	34.8 MGD
2025	1,625 l/s	37.1 MGD
2030	1,726 l/s	39.4 MGD
2035	1,825 l/s	41.7 MGD
2040	1,922 l/s	43.9 MGD
2045	*2,020 l/s*	*46.1 MGD*
2050	*2,151 l/s*	*49.1 MGD*

Source: NADB-EPA-CESPT 2020

The only new infrastructure that will be constructed for sub-project 1 is a new pump station and force main to convey sewage from the International Collector to the SBWRP. The International Collector currently terminates into Junction Box 1 immediately upstream from the ITP headworks. The new force main will be built from Junction Box 1, the headworks of the ITP, or just upstream from the headworks, to the headworks of the SBWRP. The pump station will be designed to convey 30 MGD (average daily flow rate) to 70 MGD (peak daily flow rate) of sewage. This pumping capacity will accommodate a future plant expansion to an average daily flow rate of 30 MGD, consistent with the plant expansion proposed in sub-project 3. The pump station will feature four 35-MGD grinder pumps preceded by bar screens. The force main will be constructed from 48-inch ductile iron pipe and will be about 1,700 feet long.

Based on conversations with SBWRP personnel, the facility is in reasonably good condition, and major upgrades of the existing plant equipment are not expected to be necessary for five to 10 years. However, the COVID-19 pandemic has prevented PG from visiting the SBWRP, so the precise condition of plant equipment must be determined with a future site visit in order to understand whether any major repairs or replacement of equipment will be necessary for the plant to reliably operate at the design average daily flow capacity of 15 MGD.

Figure 2-1. Locations of Proposed and Existing Project 9 Features

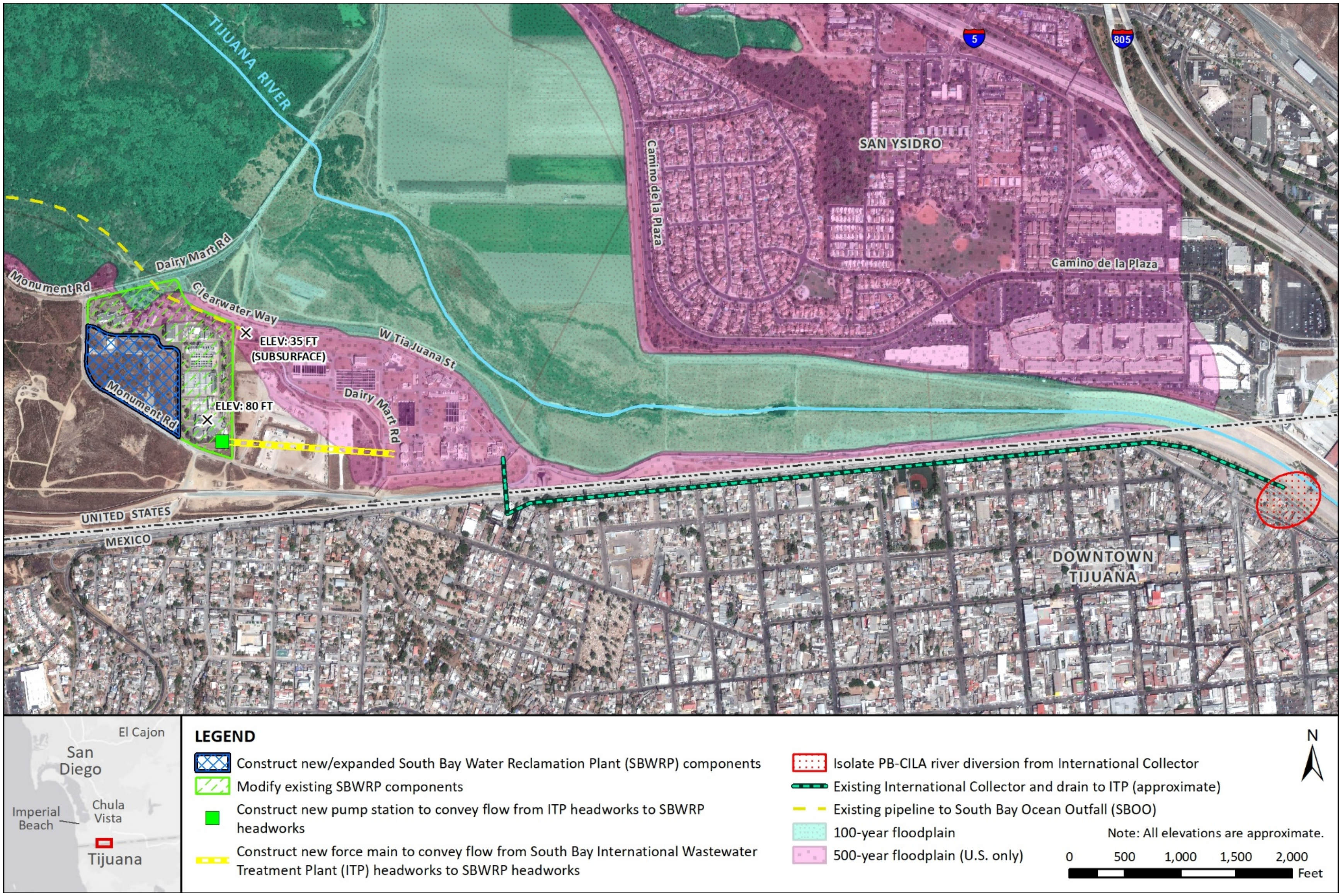

Figure 2-2. Locations of Proposed and Existing Project 9 Features Relative to FEMA Floodplains

In this scenario, PG has assumed that sludge can continue to be pumped to Point Loma for processing after the SBWRP has changed ownership. PG also has assumed that the existing sludge conveyance to Point Loma can handle sludge quantities associated with the SBWRP's design average daily flow capacity of 15 MGD. The existing tertiary treatment and disinfection facilities will be decommissioned since the effluent will no longer undergo beneficial reuse; the treated effluent will be discharged to the SBOO at secondary treatment quality.

With information and operating data provided by the City of San Diego, PG used the same Bio-Tiger model described in Section 1.2 to model the characteristics and performance of the SBWRP's secondary treatment process when operating at the design average daily flow rate of 15 MGD. Table 2-2 presents the estimated performance. At the design peak daily flow rate of 35 MGD, wastewater mass loadings are expected to change very little; influent pollutant concentrations will decrease proportionally because of the influx of stormwater and the hydraulic loading on various treatment units will remain in acceptable ranges.

Table 2-2. Description of Secondary Process Performance (Design Flow Rate = 15 MGD)

Category	Item	Design Operating Data
Secondary influent loadings	Average flow rate (MGD)	15
	BOD_5 loading (lb/day)	25,000
	TSS loading (lb/day)	22,000
	TKN loading (lb/day)	7,500
Operating performance parameters	Solids retention time (days)	9
	MLSS concentration (mg/L)	3,200
	Total sludge production (lb/day)	18,000
	Total oxygen requirements (with denitrification) (lb/day)	39,000
	Total oxygen supplied (lb/day)	39,000
	RAS flow rate (MGD)	7.1
	WAS flow rate (MGD)—from clarifier bottom	0.20
	Volumetric organic loading rate (lb BOD/day/1,000 ft^3)	36.6
	Blower horsepower in use	1,200
Secondary effluent quality	BOD_5 (mg/L)	10
	TSS (mg/L)	12
	Ammonia-N (mg/L)	2.5
	Nitrate-N (mg/L)	9

2.1.2 Engineering Issues

For the existing SBWRP, design and operating data were obtained from the City of San Diego, which owns and operates the SBWRP. Influent and effluent data, monthly operating reports, and other information were obtained from the Chief Operator. Influent data indicate that the raw wastewater is high strength. Nevertheless, the plant is performing well and producing good effluent quality at the current average daily flow rate of 6.5 MGD. Based on modeled performance data shown in Table 2-1, the plant will continue to perform well at an average daily flow rate of 15 MGD.

The new pump station and force main will increase O&M demands on the SBWRP staff because efficient and continuous operation is critical to keeping raw sewage from escaping the pump station and polluting the Tijuana River. Overall SBWRP O&M costs are expected to increase by about 70% because of the new pump station and force main and the increased average daily flow rate. PG used EPA and Water Environment Federation (WEF) guidance to estimate manpower requirements for providing O&M associated with sub-project 1. The current staff of 25 people will need to be expanded to about 40 people (an increase of about 60%). The plant currently has one Grade V operator, one Grade IV operator, and three Grade III operators. If sub-project 1 is implemented, PG estimates two new Grade III operators will need to be added as part of the staff expansion.

If chemical addition were incorporated in the primary treatment process, it might be possible to treat an average daily flow of up to 20 MGD at the existing plant. However, this scenario would necessitate additional analysis, including a site visit and interviews with the plant operators.

2.1.3 Implementation and Regulatory Issues

The final project will need to be consistent with current City of San Diego and San Diego County zoning requirements. All design parameters for the influent pump station and force main must satisfy State of California wastewater pumping and conveyance design criteria. Due to the immediate proximity to the border, the plant expansion will likely need review and approval from U.S. Customs and Border Protection. Border security concerns will also need to be accounted for during construction.

The SBWRP will be subject to a National Pollutant Discharge Elimination System (NPDES) permit modification to reflect the International Collector as the new wastewater source, the SBOO as the new effluent discharge point, and IBWC as the new owner and operator. The effluent limitations, monitoring requirements, and other conditions established by the Regional Water Quality Control Board must be achieved consistently once the treatment facility is treating sewage from the International Collector. The new pump station may also be subject to permitting by the California Air Resources Board. Otherwise, sub-project 1 is not expected to require any burdensome environmental regulatory approvals by U.S. federal, state, or local agencies

2.2 Sub-Project 2: Use the SBWRP at Its Current Design Capacity of 15 MGD and Construct New Onsite Solids Processing Facilities

2.2.1 Design Features

Sub-project 2 is identical to sub-project 1, except that new sludge processing facilities will be built onsite at the SBWRP, rather than pumping sludge to Point Loma for processing and disposal. Therefore, the same design features and performance estimates discussed in Section 2.1.1 apply to sub-project 2 in addition to the following discussion about new onsite sludge processing facilities. Processed solids will be trucked to Mexico or another location for ultimate disposal. For this feasibility assessment, PG has assumed that sludge will be transported to Mexico for disposal consistent with disposal practices implemented at the ITP.

With the SBWRP operating at the design average daily capacity of 15 MGD, the production of primary sludge solids (dry) will increase from the current total of about 9,000 lb/day to approximately 22,000 lb/day. Assuming the activated sludge process will be operated at a solids retention time of about nine days, waste activated sludge (WAS) solids (dry) will increase to about 18,000 lb/day. WAS will be thickened in two gravity-belt thickeners before being combined with primary sludge. Based on operating data provided by SBWRP personnel, PG has estimated the performance of the activated sludge process for sub-project 2 in Table 2-3. Compared to the values presented in Table 2-2, note that the secondary BOD, TSS, and TKN loadings will increase slightly because of recycle flows from the new sludge processing operations.

Table 2-3. Description of Secondary Process Performance with Sludge Processing Recycle Flows (Design Flow Rate = 15 MGD)

Category	Item	Design Operating Data
Secondary influent loadings	Average flow rate (MGD)	15
	BOD_5 loading (lb/day)	25,600
	TSS loading (lb/day)	22,500
	TKN loading (lb/day)	8,000
Operating performance parameters	Solids retention time (days)	9
	MLSS concentration (mg/L)	3,200
	Total sludge production (lb/day)	18,000
	Total O_2 requirements (with denitrification) (lb/day)	40,600
	Total O_2 supplied (lb/day)	40,600
	RAS flow rate (MGD)	7.2
	WAS flow rate (MGD)	0.20
	Volumetric organic loading rate (lb BOD/day/1,000 ft^3)	37.5
	Blower horsepower in use (HP)	1,200
Secondary effluent quality	BOD_5 (mg/L)	10
	TSS (mg/L)	12
	Ammonia-N (mg/L)	3
	Nitrate-N (mg/L)	9

At the design loading of 15 MGD, the plant will generate a total of 40,000 lb/day (dry) of waste primary and secondary sludge solids. PG has proposed implementing anaerobic digestion of primary/secondary sludge as part of the plant expansion. The anaerobic digestion process will destroy about 46% of TSS, resulting in less solids to process and dispose of than if anaerobic digestion was not used. Additionally, using anaerobic digestion will produce biogas that can potentially be captured and used to generate electricity. The resulting sludge will total about 44 wet tons per day, or 11 dry tons per day after dewatering to 25% solids. To handle these loadings, PG has proposed two 2-meter belt filter presses (one primary, one standby), each designed to handle 1,200 pounds of dry solids per hour or about 14.5 tons/day (assuming 24 hours/day operation). PG has proposed two sludge conveyors (one primary, one standby), each designed to handle 60 wet tons per day of dewatered sludge. The solids loading bay will be designed to handle 120 wet tons per day. All sludge processing units (except the anaerobic digestors) will be enclosed in a solids handling building with an odor control system.

PG estimated anaerobic digester design values for the 15 MGD treatment process, provided in Table 2-3. The proposed digestion process is single-stage high-rate mesophilic anaerobic digestion. Auxiliary mixing, uniform feeding, and thickening of the feed stream will be provided. The proposed digesters for the SBWRP are cylindrical units equipped with gasholder covers. Occasionally, cleaning will be required to remove grit and scum, which may require the digester to be taken out of service temporarily. The sludge will be mixed by gas recirculation, pumping, or draft-tube mixers. Sludge will be pumped to the digester continuously or on a 30-minute to two-hour time cycle to facilitate constant conditions in the digester. Digested sludge will be withdrawn from the digester before adding the feed sludge. VSS destruction and TSS destruction are estimated to be 57% and 46%, respectively.

The respiration and oxidation end products of anaerobic digestion are methane gas and carbon dioxide. Biogas production will be about 19 cubic feet per pound of VSS destroyed. As shown in

Table 2-4, approximately 0.35 million cubic feet per day of biogas will be produced, yielding about 0.23 million cubic feet per day of methane (assuming the biogas is 65% methane). The energy equivalent of this methane will be 230 million Btu per day. At $4 per million Btu, the energy value of the biogas will be about $920 per day or $336,000 per year. Note, though, that the cost impact analysis in Section 4 does not consider potential cost savings from energy generation.

Table 2-4. Description of SBWRP Anaerobic Digestion Process (Design Flow Rate = 15 MGD)

Design Parameter	Design Value
Primary sludge flow	333 m^3/day (0.088 MGD)
Primary sludge solids	3%
WAS flow	151 m^3/day (0.04 MGD after thickening)
WAS solids	5% (after gravity belt thickening)
COD of combined sludge	52,000 mg/L
VSS of combined sludge	29,000 mg/L
Mass loading of COD	28,000 kg/day (62,000 lb/day)
Mass loading of VSS	15,600 kg/day (32,000 lb/day)
Total volume of digesters	9,860 m^3 (4.67 million gallons)
Number of digesters	2
Volume of each digester	4,930 m^3 (1.30 million gallons)
Diameter of each digester	28 meters (92 feet)
Liquid depth of each digester	8 meters (26.2 feet)
Hydraulic detention time	20 days
Solids retention time	20 days
VSS loading rate	1.6 kg/m^3/day (0.10 lb/ft^3/day)
Gas production	9,800 m^3/day (0.35 million ft^3/day)
Estimated VSS destruction	57%

A new power generation plant to convert anaerobic digester biogas to electricity was considered at a very cursory level. It is estimated that the total biogas production of proposed anaerobic digesters will be about 0.35 million cubic feet per day at full design capacity of 15 MGD (average daily flow rate). This biogas production rate could support a 1-megawatt power generation plant. A very rough estimate is that the power generation plant (including rigorous cleanup of the biogas before it enters the electrical production plant) would have a capital cost of about $7 million. Note, though, that the cost impact analysis in Section 4 does not include construction of the power generation plant.

2.2.2 Engineering Issues

PG has used industry design standards, state design requirements, and EPA design guidance in the preliminary design calculations. If properly operated and maintained, the plant is expected to perform well and to produce good effluent quality operating at 15 MGD. The values in Table 2-1 are in desired ranges for conventional activated sludge processes designed for nitrogen removal. Design detention times in the anoxic and aerobic zones of the bioreactors are consistent with industry design standards.

With anaerobic digestion of primary/secondary sludge added to the liquid treatment process, the facility will be more complex and more challenging to operate and maintain. Overall SBWRP O&M costs are expected to increase by about 120% because of the new pump station and force main, new sludge processing facilities, and increased average daily flow rate. PG used EPA and WEF guidance to estimate manpower requirements for providing O&M associated with sub-project 2. The current staff of 25 people will need to be expanded to about 45 people (an increase of about 80%). The plant currently has one Grade V operator, one Grade IV operator, and three Grade III operators. If sub-project 2 is implemented, PG estimates one new Grade V operator, one new Grade IV operator, and two new Grade III operators will need to be added as part of the staff expansion.

2.2.3 Implementation and Regulatory Issues

The final project needs to be consistent with current City of San Diego and San Diego County zoning requirements. All design parameters for the expanded wastewater treatment plant must satisfy State of California wastewater treatment design criteria. Due to the immediate proximity to the border, all proposed intake and treatment infrastructure likely will also need review and approval from U.S. Customs and Border Protection. Border security concerns will also need to be accounted for during construction.

Since the expanded treatment facility will be subject to NPDES permit modification, anticipated effluent limitations, monitoring requirements, and other conditions established by the Regional Water Quality Control Board must be achieved consistently once the treatment facility is treating sewage from the International Collector. The NPDES permit must be modified to reflect the new influent waste stream and sludge processing facilities, as well as the federal government as the new owner and IBWC as the new operator.

Incorporation of anaerobic digestion, and the associated requirement to combust the generated biogas (e.g., via flare, engine, or turbine), drastically increases the plant's potential-to-emit (PTE) of regulated pollutants and can trigger burdensome regulatory requirements. Based on preliminary emissions estimates, the PTE for the plant under Project 9 has a high likelihood of being subject to additional regulatory requirements, including the following:

- Emissions assessments including Best Available Control Technology (BACT) determination and air impacts analysis, due to emissions of nitrogen oxides and volatile organic compounds.
- Air toxics determination and health risk assessment, due to emissions of hazardous air pollutants.
- Installation of emissions reduction technologies, such as selective catalytic reduction, based on the outcome of the BACT determination.

2.3 Sub-Project 3: 3. Expand the SBWRP to an Average Daily Design Flow Rate of 30 MGD with Onsite Solids Processing Facilities

2.3.1 Design Features

Based on the future flow projections for the International Collector provided in Table 2-1, expanding the WRP to treat an average daily flow rate of 30 MGD of sewage from the International Collector will accommodate population increase in Tijuana through at least 2050 (if the ITP continues to treat 25 MGD)

The design and layout of the SBWRP appear to be conducive to plant expansion in order to increase capacity to treat flows from the International Collector. To accommodate a future average daily design flow rate of 30 MGD and a peak daily flow rate of 70 MGD, the SBWRP will be essentially doubled in size. A new pump station and force main will be built to convey flow from the International Collector to the SBWRP, as described in Section 2.1.1. A mirror image of the existing headworks, primary treatment, and secondary treatment will be built west of the existing treatment system. The proposed plant expansion does not include new equalization basins. Figure 2-3 shows a flow schematic of the renovated treatment plant. PG anticipates that the existing tertiary treatment and disinfection facilities would no longer be used, since treated effluent would be discharged to the SBOO at secondary treatment quality. Additionally, because the SBWRP does not currently have sludge processing facilities, new sludge processing facilities will need to be constructed on site, and processed solids will need to be trucked to Mexico or another location for ultimate disposal. For this feasibility assessment, PG has assumed that sludge will be transported to Mexico for disposal consistent with disposal practices implemented at the ITP.

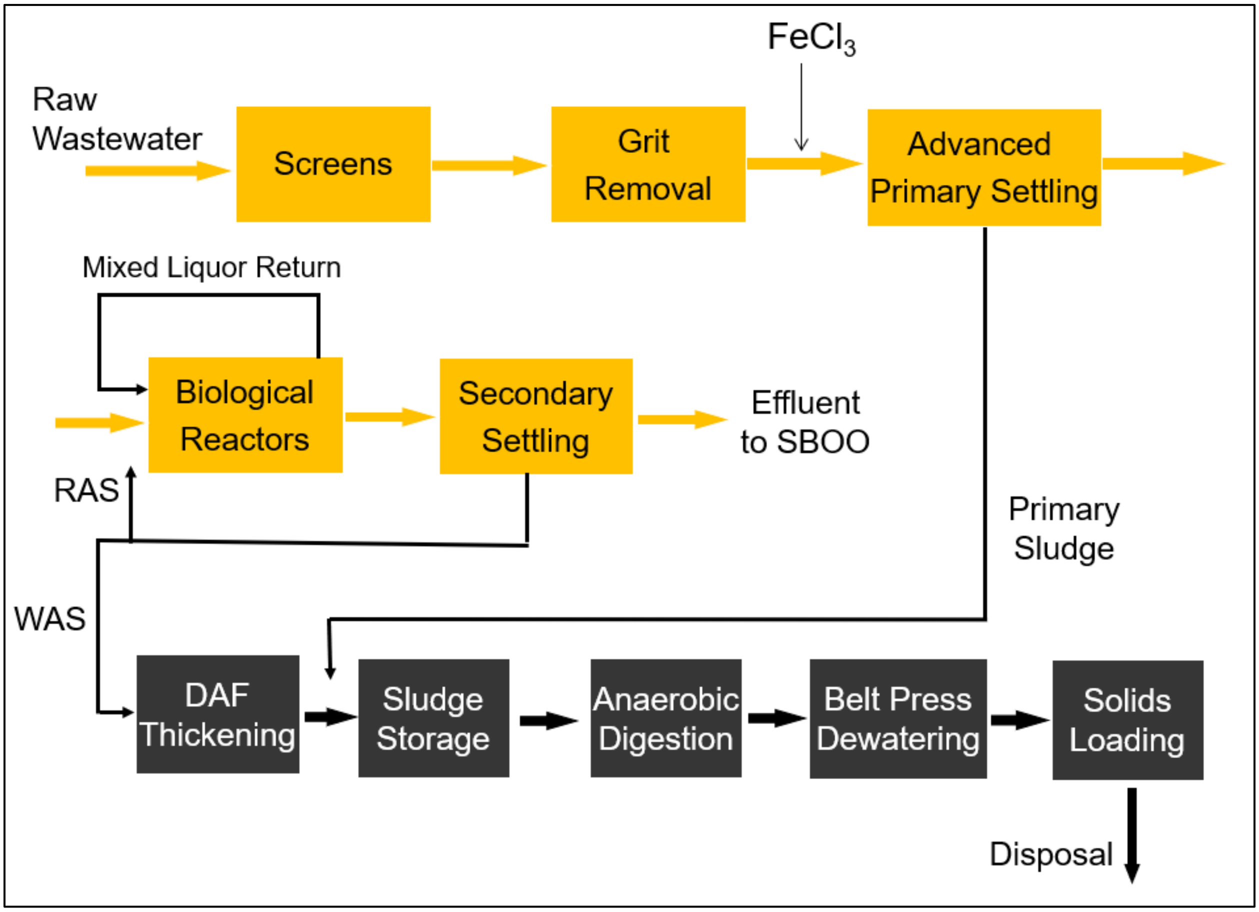

Figure 2-3. Schematic of the Proposed SBWRP Expansion to 30 MGD

The existing headworks (screens, pumps, and grit chambers) will be doubled in size and expanded to the west. The preliminary treatment process will consist of four new mechanically cleaned bar screens (18 MGD each) and four new aerated grit removal basins (18 MGD each).

The existing primary treatment process will be expanded with a cluster of five new primary settling basins about 200 feet due west of the existing primary settling basins. The new basins will have the same dimensions as the existing tanks (about 20 feet by 100 feet by 12 feet) and the same south-to-north flow direction. They will have design surface overflow rates (average daily) of 1,500 gpd/ft^2.

The secondary treatment process will be modified with eight new biological reactors, identical to the existing reactors. The five zones of each existing reactor (one anoxic and four aerobic, as described in Table 1-1) will be replicated in the new reactors. The new reactors will be about 100 feet due west of the existing reactors (with the same south-to-north flow direction). Four new 400-horsepower centrifugal blowers will supply air to the new aerobic zones, using fine-bubble, flexible-membrane diffusers.

Nine new secondary sedimentation tanks (about 20 feet by 130 feet by 15 feet) will be added in a cluster about 200 feet due west of the existing cluster of secondary settling tanks. They will have a south-to-north flow direction and a design surface overflow rate (average daily) of 640 gpd/ft^2. New return activated sludge (RAS) and WAS pumps will be needed, but their proposed location must be determined with a site visit.

The production of primary sludge solids (dry) will increase to about 45,000 lb/day. Assuming the activated sludge process will be operated at a solids retention time of about nine days, WAS solids (dry) will increase from about 17,000 lb/day to about 34,000 lb/day. WAS will be thickened in two gravity-belt thickeners before being combined with primary sludge. Based on PG's simulation of the expanded plant using the Bio-Tiger model, the expanded activated sludge process will perform as indicated in Table 2-5.

Table 2-5. Description of Secondary Process Performance (Design Flow Rate = 30 MGD)

Category	Item	Design Operating Data
Secondary influent loadings	Average flow rate (MGD)	30
	BOD_5 loading (lb/day)	50,000
	TSS loading (lb/day)	44,000
	TKN loading (lb/day)	15,000
Operating performance parameters	Solids retention time (days)	9
	MLSS concentration (mg/L)	3,200
	Total sludge production (lb/day)	34,000
	Total oxygen requirements (with denitrification) (lb/day)	78,000
	Total oxygen supplied (lb/day)	78,000
	RAS flow rate (MGD)	14.1
	WAS flow rate (MGD)	0.40
	Volumetric organic loading rate (lb BOD/day/1,000 ft^3)	36.6
	Blower horsepower in use	2,400
Secondary effluent quality	BOD_5 (mg/L)	10
	TSS (mg/L)	12
	Ammonia-N (mg/L)	3
	Nitrate-N (mg/L)	10

The 30 MGD plant will generate a total of 79,000 lb/day (dry) of waste primary and secondary sludge solids at design loadings. PG has proposed implementing anaerobic digestion of primary/secondary sludge as part of the plant expansion. The anaerobic digestion process will destroy about 46% of TSS, resulting in less solids to process and dispose of than if anaerobic digestion were not used. Additionally, using anaerobic digestion will produce biogas that can be captured and potentially used to generate electricity. The resulting sludge will total about 21.5 dry tons per day, or 86 wet tons per day (4 wet tons is approximately equivalent to 1 dry ton). To handle these loadings, PG has proposed three 2-meter belt filter presses (two primary, one standby), each designed to handle 1,200 pounds of dry solids per hour or about 14.5 tons/day (assuming 24 hours/day operation). PG has proposed two sludge conveyors, each designed to handle 70 wet tons per day of dewatered sludge. The solids loading bay will be designed to handle 140 wet tons per day. If Project 3 is implemented along with Project 9, the anaerobic digestors could be sized to treat solids from both plants.

PG estimated anaerobic digester design values for the 30 MGD treatment process, provided in Table 2-6. The proposed digestion process is single-stage high-rate mesophilic anaerobic digestion. It will provide auxiliary mixing, uniform feeding, and thickening of the feed stream. The proposed digesters for the SBWRP are cylindrical units with gasholder covers. Occasionally, cleaning will be needed to remove grit and scum, which may require the digester to be taken out of service temporarily.

Table 2-6. Description of SBWRP Anaerobic Digestion Process (Design Flow Rate = 30 MGD)

Design Parameter	Design Value
Primary sludge flow	681 m^3/day (0.18 MGD)
Primary sludge solids	3%
WAS flow	303 m^3/day (0.08 MGD after thickening)
WAS solids	5% (after gravity belt thickening)
COD of combined sludge	52,000 mg/L
VSS of combined sludge	29,000 mg/L
Mass loading of COD	51,000 kg/day (112,000 lb/day)
Mass loading of VSS	28,600 kg/day (63,000 lb/day)
Total volume of digesters	17,700 m^3 (4.67 million gallons)
Number of digesters	4
Volume of each digester	4,420 m^3 (1.17 million gallons)
Diameter of each digester	25 m (82 ft)
Liquid depth of each digester	9 m (29.5 ft)
Hydraulic detention time	18 days
Solids retention time	18 days
VSS loading rate	1.6 kg/m^3/day (0.10 lb/ft^3/day)
Gas production	17,900 m^3/day (0.63 million ft^3/day)
Estimated VSS destruction	57%

The sludge will be mixed by gas recirculation, pumping, or draft-tube mixers. Sludge will be pumped to the digester continuously or on a 30-minute to 2-hour time cycle to facilitate constant conditions in the digester. Digested sludge will be withdrawn from the digester before adding the feed sludge. VSS and TSS destruction are estimated to be 57% and 46%, respectively.

The respiration and oxidation end products of anaerobic digestion are methane gas and carbon dioxide. Biogas production will be about 19 cubic feet per pound of VSS destroyed. As shown in Table 2-6, about 0.63 million cubic feet per day of biogas will be produced, yielding about 0.41 million cubic feet per day of methane (assuming the biogas is 65% methane). The energy equivalent of this methane will be 410 million Btu per day. At $4 per million Btu, the energy value of the biogas will be about $1,640 per day or $599,000 per year. Note, however, that the cost impact analysis in Section 4 does not consider potential cost savings from energy generation.

A new power generation plant to convert anaerobic digester biogas to electricity was considered at a very cursory level. It is estimated that the total biogas production of proposed anaerobic digesters will be about 0.63 million cubic feet per day at full design capacity of 30 MGD (average daily flow rate). This biogas production rate could support a 2-megawatt power generation plant. A very rough estimate is that the power generation plant (including rigorous cleanup of the biogas before it enters the electrical production plant) would have a capital cost of about $10 million. Note, though, that the cost impact analysis in Section 4 does not include construction of the power generation plant.

2.3.2 Engineering Issues

As mentioned above, the additional treatment units for plant expansion will be designed to be almost identical to the existing treatment units and will be operated similarly. About 29 acres at the site are available for expansion, and the new treatment components is expected to fit into the existing footprint.

PG has used industry design standards, state design requirements, and EPA design guidance in the preliminary design calculations. If properly operated and maintained, the dual-train liquid treatment process is expected to perform well and to produce good effluent quality. The values in Table 2-5 are in desired ranges for conventional activated sludge processes designed for nitrogen removal. Design detention times in the anoxic and aerobic zones of the bioreactors are consistent with industry design standards.

The expanded treatment plant with anaerobic digestion of primary/secondary sludge will be significantly more complex and more challenging to operate and maintain. Overall SBWRP O&M costs are expected to increase by about 195% because of the new pump station and force main, new sludge processing facilities, and expanded treatment process. PG used EPA and WEF guidance to estimate manpower requirements for providing O&M associated with sub-project 3. The current staff of 25 people will need to be expanded to about 65 people (an increase of about 160%). The plant currently has one Grade V operator, one Grade IV operator, and three Grade III operators. If sub-project 3 is implemented, PG estimates one new Grade V operator, two new Grade IV operators, and five new Grade III operators will need to be added as part of the staff expansion.

The new treatment components are readily constructible and are energy efficient. The Bio-Tiger model shows that incorporating anoxic zones in the bioreactor design provides energy savings of about 18% due to denitrification oxygen savings. Moreover, fine bubble diffusers are about 50% more efficient than coarse bubble diffusers. New tertiary filters and effluent disinfection will not be provided, and the existing filters and UV disinfection system will not be used, resulting in additional energy conservation.

The discussion in Section 2.1.1 about constructing a new force main to convey sewage from the International Collector to the SBWRP applies for this sub-project as well.

2.3.3 Implementation and Regulatory Issues

The implementation and regulatory issues described for sub-project 2 (Section 2.2.3) also apply to sub-project 3. In addition, the NPDES permit modification would need to reflect the plant modifications to expand treatment capacity to 30 MGD. PG noted during the feasibility analysis that the most recent effluent dispersion model for the SBOO was conducted using data from 2002 to 2005 at a discharge rate of 40 MGD. Due to the additional volumes of flow that Project 3 proposes to discharge through the SBOO, an updated flow dispersion model is necessary to understand potential impacts to the coast. PG was in the process of conducting an updated SBOO flow dispersion model at the time of the Project 3 feasibility analysis and preliminary results suggest that more stringent effluent limitations will not be necessary in order to protect the beneficial uses of the receiving water.

3. PROJECT IMPACT

3.1 Water Quality Impacts

Treating sewage from the International Collector at SBWRP will reduce the untreated and undertreated wastewater discharged to the Pacific Ocean via SAB Creek, thereby reducing surf contamination at Southern San Diego County beaches. PG estimated the discharges to SAB Creek using flow data from the major pump stations from January 1, 2016, through December 31, 2019, and flow balances. PG also estimated the total BOD_5 and TSS loads that are discharged to SAB Creek under current conditions and with both treatment designs. The discharges for both scenarios were estimated using mass balances and the flow rates calculated for the total discharge estimates.

Table 3-1 shows the estimated reduction in total flows to SAB Creek, as well as the reduction in BOD_5 and TSS loads discharged to the creek, for the SBWRP providing 15 MGD of treatment (sub-projects 1 and 2) and 30 MGD of treatment (sub-project 3).

Table 3-1. Project 9 Impacts on Flows to SAB Creek

Parameter	Existing Conditions	SBWRP Providing 15 MGD of Treatment	SBWRP Providing 30 MGD of Treatment
Total annual flow to SAB Creek (million gallons)	13,100	9,670	7,360
Percent change in total flow to SAB Creek	N/a	26%	56%
Annual BOD_5 load conveyed to SAB Creek (tons)	17,200	9,770	5,900
Percent change in BOD_5 load conveyed to SAB Creek	N/a	43%	66%
Annual TSS load conveyed to SAB Creek (tons)	17,900	10,720	6,850
Percent change in TSS load conveyed to SAB Creek	N/a	40%	62%

Table 3-2 shows the estimated impacts of the SBWRP treatment scenarios on raw sewage discharged from SAB Creek. Using the SBWRP to treat 15 or 30 MGD of sewage from the International Collector could reduce discharges of raw sewage at SAB Creek from an average of about 28.2 MGD (current) to as little as about 9.69 MGD, resulting in the reduction of surf contamination to U.S. beaches.

Table 3-2. Project 9 Impacts on Raw Sewage Discharged at SAB Creek

Scenario	Raw Sewage Discharged at SAB Creek (MGD)	Percent Change in Raw Sewage Discharged at SAB Creek
Current conditions	28.2	N/A
SBWRP Providing 15 MGD of Treatment	16.0	-43%
SBWRP Providing 30 MGD of Treatment	9.69	-66%

The estimated impacts presented in Tables 3-1 and 3-2 are identical for Projects 3 and 9. This is because, for both projects, PG has assumed that the smaller plant (the 50 MGD ITP in Project 3 and the 15 MGD SBWRP in Project 9) will only treat flows from the International Collector and the larger plant (the 60 MGD ITP in Project 3 and the 30 MGD SBWRP in Project 9) will treat flows from the International Collector plus flows from the canyon collectors. Under these assumptions, either project has sufficient capacity to treat the current flows from those sources, so the estimated impacts to SAB Creek are the same.

Based on the Scripps modeling results, reducing sewage discharged from SAB Creek is expected to have a substantial impact on water quality in the Pacific Ocean along the San Diego County coastline. The Scripps modeling report (Feddersen et al. 2020) estimated that reducing the discharge from SAB to 10 MGD of treated wastewater (with discharges of untreated wastewater eliminated) could reduce dry-weather beach closure days at Imperial Beach Pier from 24% of the time to about 9% of the time, and could reduce wet-weather beach closure days from 9% of the time to about 7% of the time. This expected reduction in impacts will improve conditions at the U.S. Navy SEALs training facility in Coronado, California.

The discharge of an additional 8 to 22 MGD of secondary-level treated wastewater via the SBOO (which currently discharges an average of 35 MGD of secondary-level treated wastewater), in compliance with NPDES effluent limits, is not expected to substantially affect marine water quality near the outfall. PG was in the process of conducting an updated SBOO flow dispersion model at the time of the Project 9 feasibility analysis and preliminary results suggest that more stringent effluent limitations will not be necessary in order to protect the beneficial uses of the receiving water.

PG anticipates that if the SBWRP is used to treat more sewage than it currently treats, the effluent BOD_5, TSS, and ammonia-N concentrations can remain consistent with current levels, but mass loadings of these constituents will increase proportionally with the increase in flow. If properly operated and maintained (including adequate sludge treatment and disposal), the plant will still be capable of producing effluent quality that consistently satisfies NPDES permit limits.

Project 9 is expected to reduce the amount of sewage that is spilled from the International Collector into Stewart's Drain during wet weather. Capturing and treating more sewage from the International Collector may also reduce sewage spilled into the Tijuana River from other points in the Tijuana collection system, providing environmental benefits in the river and estuary with respect to organic loading, nutrient loading, pathogen content, dissolved oxygen levels, etc. Additionally, because Mexico will no longer have to spend money to pump sewage to SAB, there will be no disincentive to improving/expanding the collection system to capture more sewage and further improve water quality in the watershed.

3.2 Sediment Impacts

Project 9 will not significantly reduce sediment loadings reaching the Tijuana River. Project 9 is expected to reduce annual sediment loadings to the Pacific Ocean via SAB Creek by up to 71% (see Table 3-1).

3.3 Trash Impacts

Project 9 will provide minor reductions in trash quantities reaching the Tijuana River. This is because the sewage that Project 9 will prevent from reaching the river is assumed to have some trash in it and can convey trash to the river during overflow events.

3.4 Non-Water-Quality Environmental Impacts

In conjunction with the feasibility assessment, ERG is currently preparing an Environmental Impact Document (EID) that will describe the potential environmental impacts of the 10 proposed projects (including Project 9), focusing on impacts in the U.S. or caused by activities in the U.S. Based on a review of existing available information, Project 9 is not expected to trigger any non-water-quality environmental impacts of concern in the U.S.[1] The EID will include a more thorough evaluation of potential non-water-quality impacts in the U.S.

3.5 Social Impacts

The long-term positive socioeconomic impacts to affected populations associated with Project 9 (e.g., reduced public health risk and increased economic activity in coastal areas) are expected to outweigh the negative, localized impacts during construction (e.g., temporary increase in noise, equipment/dust emissions, and traffic) and long-term operation of the SBWRP (e.g., increase in truck traffic and sludge disposal). The EID will include a more thorough evaluation of potential socioeconomic related impacts in the U.S.

Project 9 would reduce contaminated transboundary flows near border infrastructure where the Tijuana River crosses into the U.S. However, it would not resolve existing impacts to U.S. Customs and Border Protection operations and workforce resulting from exposure to contaminated transboundary flows near border infrastructure in Goat Canyon or Smuggler's Gulch.

Solids produced by the anaerobic digestion process are higher quality than normal biosolids in terms of their ability to be beneficially re-used as a soil additive. Therefore, rather than disposing of the solids, Mexico could potentially utilize the solids to enhance agricultural operations, leading to increased economic opportunity for farmers by increasing agricultural output. Pathogen reduction and vector attraction reduction must be ensured so that land application of biosolids poses little to no threat to human health and the environment.

[1] ERG considered the following "impacts of concern" to be indicators of potentially significant environmental impacts that warrant detailed review during preparation of the EID, the subsequent National Environmental Policy Act process, and related consultations and resource-specific studies: disproportionate, adverse effects on minority and/or low-income communities; potential for adverse effects on federally listed threatened or endangered species or their critical habitat; adverse effects on tribal/cultural resources; adverse effects on important natural resource areas such as wetlands, floodplains, coastal zones, and significant fish or wildlife habitat; modification, diversion, and/or alteration of the main course of the Tijuana River; criteria pollutant emissions that exceed Clean Air Act General Conformity Rule *de minimis* thresholds; and significant public controversy about a potential environmental impact.

4. COST IMPACT ANALYSIS

PG developed comparative project construction cost estimates for Project 9 to a Grade V level of accuracy in accordance with AACE International's recommended practice No. 17R-97 (AACE International 2020). According to this system, Grade V estimate accuracy can range from +40%/-20% to as high as +200%/-100%. Based on the information that was reviewed, the estimated accuracy goal for construction in the U.S. is +50%/-25%, meaning actual construction costs may range from 50% higher than the estimated cost to 25% lower. Because there are fewer sources of cost data for construction in Mexico, the estimated accuracy goal for construction in Mexico was +100%/-50%, meaning actual construction costs may range from 100% higher than the estimated cost to 50% lower. More details on this methodology can be found in the *Baseline Conditions Summary: Technical Document.*

PG estimated construction costs using the *Innovative and Alternative Technology Assessment Manual* (U.S. EPA 1980), adjustments for a 2020 *Engineering News-Report* value of 11455, construction costs of actual treatment plants built in the last two years, and manufacturer information. Project capital costs were based on project construction cost multiplied by a factor of 1.4 to account for project engineering and owner administration costs. That total was multiplied by a general contingency factor of 1.5 to account for unanticipated construction, unknown subsoils, and other factors. Therefore, project capital cost equals project construction cost × 1.4 × 1.5, which is equivalent to project construction cost × 2.1. O&M costs were developed using the 2020 annual budget for the SBWRP (operating at a flow rate of 6.5 MGD [average daily]) extrapolated to the design flow rates of 15 MGD and 30 MGD (with and without sludge processing facilities). Life cycle costs were determined using an interest rate of 3% and an inflation rate of 2%.

PG has estimated the value of the existing 15 MGD facility to be $30,000,000. This estimate accounts for the fact that EPA paid 33% of the capital cost of the original plant when it was built in 2002, as well as depreciation of plant assets over the last 19 years. It has been assumed that the City of San Diego's SBOO discharge capacity would be included in the sale.

Using anaerobic digestion will produce biogas that can be potentially captured and used to generate electricity. The design information for sub-projects 2 and 3 (Sections 2.2.1 and 2.3.1, respectively) provides estimates of the energy potential of the biogas produced under those scenarios, as well as capital cost estimates to build power generation plants to convert the biogas into electricity. The cost estimates below do not include capital costs associated with capturing biogas for energy production or account for potential energy cost savings from biogas energy generation.

The estimated capital cost to purchase and operate the existing plant at its design capacity (15 MGD), construct a new force main to convey sewage from the International Collector to the plant, and continue to transport solids to Point Loma (sub-project 1) is $51.6 million, or $3.44 per gallon treated per day. PG has estimated the annual O&M cost for sub-project 1 will be $17.8 million, or about $3.25 per 1,000 gallons treated. This includes an estimated $4.6 million per year paid to the City of San Diego for treating sludge from the SBWRP at Point Loma. The estimated total 40-year life cycle cost for sub-project 1 is $681 million.

The estimated capital cost to purchase and operate the existing plant at its design capacity (15 MGD), construct a new force main to convey sewage from the International Collector to the plant, and construct new onsite solids processing facilities (sub-project 2) is $105 million, or about $7.00 per gallon treated per day. PG has estimated the annual O&M cost for sub-project 2 will be $18.1

million, or $3.31 per 1,000 gallons treated. The estimated total life cycle cost for sub-project 2 is $759 million.

The estimated capital cost to purchase the SBWRP, expand it to treat an average daily flow of 30 MGD (including solids processing), and construct a new influent pump station and force main (sub-project 3) is $274 million, or about $9.13 per gallon treated per day. PG has estimated the annual O&M cost associated with sub-project 3 will be $25.1 million, or $2.29 per 1,000 gallons treated. The estimated total life cycle cost for sub-project 3 is $1.2 billion.

Tables 4-1 through 4-3 summarize the capital, O&M, and life cycle costs PG estimated for each of the three sub-projects. An itemized cost impact analysis is provided in Appendix A.

Table 4-1. Cost Estimate for Sub-Project 1: Use the SBWRP at Its Current Design Capacity of 15 MGD and Pump Solids to Point Loma for Processing

Category	Item	Estimated Cost
Capital costs	Equipment/material	$3,100,000
	Construction costs	$7,200,000
	Indirect costs	$11,300,000
	Capital cost—pump station and force main	**$21,500,000**
	Capital cost—purchase of SBWRP	**$30,000,000**
	Total capital cost	**$51,600,000**
	Total capital cost per gallon treated per day	**$3.44**
O&M	Personnel	$5,000,000
	Energy	$4,200,000
	Materials	$2,200,000
	Maintenance	$1,400,000
	Monitoring	$400,000
	Sludge treatment at Point Loma	$4,600,000
	Total O&M costs	**$17,800,000**
	Total O&M costs per 1,000 gallons treated	**$3.25**
Major upgrades after 20 years	New pumps, blowers, screens, clarifier mechanisms, etc.	$54,000,000
Life cycle factors	Interest rate	3%
	Inflation rate	2%
	Total life cycle used	40 years
Total life cycle cost		**$681,000,000**

Table 4-2. Cost Estimate for Sub-Project 2: Use the SBWRP at Its Current Design Capacity of 15 MGD and Construct New Onsite Solids Processing Facilities

Category	Item	Estimated Cost
Capital costs	Equipment/material	$9,500,000
	Construction costs	$26,000,000
	Indirect costs	$39,000,000
	Capital cost—solids processing facilities, pump station, and force main	**$74,000,000**
	Capital cost—purchase of SBWRP	**$30,000,000**
	Total capital cost	**$105,000,000**
	Total capital cost per gallon treated per day	**$7.00**
O&M	Personnel	$6,400,000
	Energy	$5,300,000
	Materials	$2,700,000
	Maintenance	$1,600,000
	Monitoring	$500,000
	Sludge disposal	$1,600,000
	Total O&M costs	**$18,100,000**
	Total O&M costs per 1,000 gallons treated	**$3.31**
Major upgrades after 20 years	Blowers, pumps, clarifiers, sludge process, etc.	$72,000,000
Life cycle factors	Interest rate	3%
	Inflation rate	2%
	Total life cycle used	40 years
Total life cycle cost		**$759,000,000**

Table 4-3. Cost Estimate for Sub-Project 3: Expand the SBWRP to an Average Daily Design Flow Rate of 30 MGD with Onsite Solids Processing Facilities

Category	Item	Estimated Cost
Capital costs	Equipment/material	$34,000,000
	Construction costs	$82,000,000
	Indirect costs	$128,000,000
	Capital cost—plant expansion (with solids processing facilities), pump station, and force main	**$244,000,000**
	Capital cost—purchase of SBWRP	**$30,000,000**
	Total capital cost	**$274,000,000**
	Total capital cost per gallon treated per day	**$9.13**
O&M	Personnel	$8,600,000
	Energy	$6,900,000
	Materials	$3,600,000
	Maintenance	$2,200,000
	Monitoring	$600,000
	Sludge disposal	$3,200,000
	Total O&M costs	**$25,100,000**
	Total O&M costs per 1,000 gallons treated	**$2.29**
Major upgrades after 20 years	Blowers, pumps, clarifiers, sludge process, etc.	$125,000,000
Life cycle factors	Interest rate	3%
	Inflation rate	2%
	Total life cycle used	40 years
Total life cycle cost		**$1,200,000,000**

5. DISCUSSION

5.1 Feasibility

Currently, flows from the International Collector include Tijuana River water that is diverted at PB-CILA. PG presumes that, to ensure that International Collector flows treated the SBWRP are composed of only sewage, the connection between the International Collector and PB-CILA in Mexico must be severed. However, this feasibility analysis does not evaluate any infrastructure upgrades in Mexico needed to accomplish this. IBWC must coordinate with Mexican authorities in order to ensure that PB-CILA effluent is not directed to the SBWRP. If the connection between PB-CILA and the International Collector is not severed, the design considerations, estimated performance, and implementation feasibility of Project 9 may be affected.

5.1.1 Sub-Project 1: Use the SBWRP at Its Current Design Capacity of 15 MGD and pump solids to Point Loma for Processing

Based on information reviewed by PG, the SBWRP can be used to treat 15 MGD (existing average daily design capacity) of sewage from the International Collector without expanding the plant. This will enable all raw sewage from the International Collector to be treated in the U.S. (if the ITP continues to treat 25 MGD) until at least 2030. The only major modification needed would be the new pump station and force main to convey sewage from the International Collector to the facility. Based on available information from the City of San Diego, the facility is in reasonably good condition, and major upgrades of plant equipment should not be necessary for five to 10 years. The precise condition of plant equipment must be determined with a site visit.

In preliminary negotiations for the purchase of the SBWRP, the City of San Diego has indicated that continuing to treat solids from the plant at Point Loma is not favorable. Therefore, the primary challenge to implementing sub-project 1 lies in reaching an agreement with the City of San Diego to continue accepting SBWRP solids for treatment at Point Loma.

5.1.2 Sub-Project 2: Use the SBWRP at Its Current Design Capacity of 15 MGD and Construct New Onsite Solids Processing Facilities

Based on information reviewed by PG, new onsite sludge processing facilities could be built at the SBWRP, and the facility could be used to treat 15 MGD (existing average daily design capacity) of sewage from the International Collector without having to rely on the City of San Diego for solids processing. Like sub-project 1, this will enable all raw sewage from the International Collector to be treated in the U.S. (if the ITP continues to treat 25 MGD) until at least 2030. Based on available information from the City of San Diego, the facility is in reasonably good condition, and major upgrades of plant equipment (other than construction of sludge treatment facilities) should not be necessary for five to 10 years. The precise condition of plant equipment must be determined with a site visit. As stated above, PG has also concluded that a new pump station and force main can be constructed to convey flow from the International Collector to the SBWRP.

Incorporating anaerobic digestion into the treatment process will increase the complexity of plant operations but will significantly reduce the solids that must be dewatered and disposed of. However, it is possible that local air pollution regulations may not permit construction of anaerobic digesters for sludge stabilization at the ITP. If anaerobic digestors are not permissible as part of the final design, managing and disposing of solids from the treatment process may pose a significant operational challenge. One of the challenges currently facing the ITP is securing enough trucks and drivers to transport the dewatered sludge to the disposal site in Mexico.

5.1.3 Sub-Project 3: Expand the SBWRP to an Average Daily Design Flow Rate of 30 MGD with Onsite Solids Processing Facilities

Based on information reviewed by PG, the SBWRP can be expanded to treat 30 MGD (average daily design flow rate) including new onsite sludge process facilities and a new influent pump station and force main. This will enable all raw sewage from the International Collector, as well as flows from the canyon collectors, to be treated in the U.S. until at least 2045. The new treatment facilities will essentially be a mirror image of the existing preliminary, primary, and secondary treatment processes, and will readily fit into the available space to the west of the existing plant. Expansion of the treatment processes as described in Section 2.3.1 is expected to result in a system capable of consistently treating the design flow rates to secondary treatment quality. The design values are consistent with regulatory guidance and engineering design standards. The design process may be cumbersome because of local, state, and federal approval steps as well as input from stakeholders, but this is not expected to affect the overall feasibility of implementing sub-project 3.

The discussion in Section 5.1.2 about anaerobic digestion and solids disposal applies for sub-project 3 as well.

5.2 Other Stakeholder Information

A major benefit to Mexican interests is the reduction in cost and maintenance requirements that this project provides. Maintenance burdens are reduced because Project 9 eliminates the need for pumping at PB1-B, so the pump station can be decommissioned. The O&M burden at SAB will also be reduced, as SAB will be treating less sewage.

Based on information obtained during the technical expert consultation process, the collection system infrastructure in Mexico must be upgraded to ensure efficient transport of sewage to the SBWRP and to minimize spillage into the Tijuana River. In a separate project to be carried out by Mexico, about 1.5 miles of the primary International Collector will be rehabilitated at a cost of about $15 million. However, when the Project 9 feasibility analysis was conducted, project implementation timelines for collection system improvements in Mexico remained unclear.

6. CONCLUSION

The primary purpose of Project 9 is to reduce impacts at southern San Diego County beaches from untreated or undertreated sewage discharged to the Pacific Ocean via SAB Creek. Project 9 will accomplish this by using the SBWRP to treat sewage from the International Collector that would otherwise be discharged to SAB Creek.

PG evaluated the technical feasibility, impacts, and cost of the three sub-projects and reached the following conclusions:

1. Sub-project 1 represents the smallest capital investment of the three sub-projects and is the simplest from a design and construction perspective. It also offers the shortest timeline for beginning to treat sewage from the International Collector at the SBWRP. The influent pump station and force main could likely be designed and built in about one year. However, implementation of sub-project 1 relies on City of San Diego to continue accepting sludge from the SBWRP for treatment at Point Loma. In this scenario, the SBWRP could begin treating sewage from the International Collector much sooner than if taking on a full plant expansion or needing to construct new onsite sludge processing facilities.

2. Sub-project 2 falls between sub-projects 1 and 3 in terms of capital costs, complexity of design, and timeline for the SBWRP to begin treating sewage from the International Collector. It is notable that the estimated annual O&M cost for sub-project 2 is slightly higher than that of sub-project 1, indicating that onsite sludge treatment may be less economical than paying the City of San Diego to treat the sludge at Point Loma (with the SBWRP treating 15 MGD). Constructing the onsite sludge processing facilities is expected to take about two years.

3. The capital cost and annual O&M cost of sub-project 3 are high, and the federal government will have to make a substantial financial commitment to bring it to fruition. The expanded SBWRP will be operated by the IBWC, and significantly more operating personnel will be needed than currently used by the City of San Diego. Even still, the estimated O&M cost per 1,000 gallons treated for sub-project 3 is significantly less than sub-projects 1 and 2 due to an economy of scale when treating more wastewater. The project implementation time frame is estimated to be two to four years.

4. If anaerobic digestion is prohibited from being implemented at the SBWRP by local air regulations, solids generated by sub-projects 2 and 3 will approximately double compared to if anaerobic digestion is implemented. One of the challenges currently facing the ITP is securing enough trucks and drivers to transport solids to the disposal site in Mexico. If anaerobic digestion is permitted at the SBWRP, total solids requiring disposal will be more manageable. Additionally, if anaerobic digestion is implemented, biogas conversion to electricity may be feasible and will produce economic benefits.

5. Successful implementation of Project 9 is expected to enhance recreational opportunities for local residents and tourists, and to improve human health among Navy personnel who train along the beachfront near the U.S. Navy Base in San Diego.

7. SUGGESTED NEXT STEPS

Four activities would improve the feasibility analysis and reduce any uncertainty and assumptions described above, facilitating implementation of Project 9:

- Visit the SBWRP to determine the condition of existing plant equipment and identify appropriate locations for the RAS and WAS pumps for the sub-project 3 plant expansion.
- Evaluate the potential for chemical addition in the primary treatment process to increase the treatment capacity of the existing plant.
- Work with the California Air Resources Board to determine whether local air pollution regulations preclude construction of anaerobic digesters at the SBWRP.
- Finalize the updated dispersion model for the SBOO in order to fully understand the environmental impact of discharging additional effluent.

8. REFERENCES

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APPENDIX A: Itemized Cost Impact Analysis

Project 9, Sub-project 1: Existing SBWRP (15 MGD) with No Solids Processing - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Pumping & Force Main from International Collector				$2,700,000	EPA cost curves, ENR adjusted, and BPJ
	Allowance for Unquantified Line Items	5%			$410,000	
	Total Equipment/Materials Costs				**$3,100,000**	
Construction Costs	Pumping & Force Main from International Collector				$5,500,000	EPA cost curves, ENR adjusted, and BPJ
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin,	30%			$1,650,000	
	Total Construction Costs				**$7,200,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$10,300,000	
	Engineer and Administrative Contingency, 40% of subtota	40%			$4,120,000	
	Contingency 50%	50%			$7,210,000	
	Total Indirect Costs				**$11,300,000**	
	Purchase of SBWRP				**$30,000,000**	
	Total Capital Costs				**$51,600,000**	
O&M Costs	Personnel				$5,000,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Energy				$4,200,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Materials				$2,200,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Monitoring				$400,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Maintenance				$1,400,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Sludge treatment at Point Loma				$4,600,000	BPJ
	Total Annual O&M Costs				**$17,800,000**	
Life Cycle Cost	Total Capital Cost				$51,600,000	
	Annual O&M Costs				$17,800,000	
	Service Life				40	
	Present Value of Service Life O&M				$584,633,650	
	Major Upgrade(s) Cost at 20 years				$54,000,000	new pumps, blowers, screens, clarifier mechanisms
	Present Value of Major Upgrade(s)				$44,280,000	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$681,000,000**	

Project 9, Sub-project 2: Existing SBWRP (15 MGD) with Solids Processing - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Pumping & Force Main from International Collector				$2,700,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Storage				$400,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Thickening				$670,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Dewatering				$600,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Conveyor				$600,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Loading Facilities				$200,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Processing Odor Control				$1,000,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Pumping				$300,000	EPA cost curves, ENR adjusted, and BPJ
	Anaerobic Digestors				$1,600,000	EPA cost curves, ENR adjusted, and BPJ
	Allowance for Unquantified Line Items	5%			$1,400,200	
	Total Equipment/Materials Costs				**$9,500,000**	
Construction Costs	Pumping & Force Main from International Collector				$5,500,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Storage				$670,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Thickening				$502,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Dewatering				$402,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Processing Odor Control				$670,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Pumping				$250,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Processing Building				$400,000	EPA cost curves, ENR adjusted, and BPJ
	Anaerobic Digestors				$3,200,000	EPA cost curves, ENR adjusted, and BPJ
	Site Improvements				$1,050,000	EPA Manual CD-53, 1980, ENR adjusted
	Misc. Metals				$450,000	EPA Manual CD-53, 1980, ENR adjusted
	Piping				$2,300,000	EPA Manual CD-53, 1980, ENR adjusted
	Electrical				$1,800,000	EPA Manual CD-53, 1980, ENR adjusted
	Controls				$1,200,000	EPA Manual CD-53, 1980, ENR adjusted
	Shop & Garage Facilities				$560,000	EPA Manual CD-53, 1980, ENR adjusted
	Laboratories				$420,000	EPA Manual CD-53, 1980, ENR adjusted
	Controls & SCADA Building				$560,000	EPA Manual CD-53, 1980, ENR adjusted
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$5,980,200	
	Total Construction Costs				**$26,000,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$35,500,000	
	Engineer and Administrative Contingency, 40% of subtotal	40%			$14,200,000	
	Contingency 50%	50%			$24,850,000	
	Total Indirect Costs				**$39,000,000**	
	Purchase Price of the SBWRP from San Diego				**$30,000,000**	
	Total Capital Costs				**$105,000,000**	
O&M Costs	Labor				$6,400,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Energy				$5,300,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Materials				$2,700,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Monitoring				$500,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Maintenance				$1,600,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Sludge Disposal				$1,600,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Total Annual O&M Costs				**$18,100,000**	
Life Cycle Cost	Total Capital Cost				$105,000,000	
	Annual O&M Costs				$18,100,000	
	Service Life				40	
	Present Value of Service Life O&M				$594,487,027	
	Major Upgrade(s) Cost at 20 years				$72,000,000	New pumps, blowers, screens, clarifier mechanisms
	Present Value of Major Upgrade(s)				$59,040,000	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$759,000,000**	

Project 9, Sub-project 3: Existing SBWRP (30 MGD) with Solids Processing - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Pumping & Force Main from International Collector				$2,700,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Screens & Grit Chambers				$1,200,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Odor Control				$1,200,000	EPA cost curves, ENR adjusted, and BPJ
	Advanced Primary Settling Tanks				$2,600,000	EPA cost curves, ENR adjusted, and BPJ
	Bioreactors				$4,500,000	EPA cost curves, ENR adjusted, and BPJ
	Secondary Settling Tanks				$4,000,000	EPA cost curves, ENR adjusted, and BPJ
	Mixed Liquor Return Pumping				$3,100,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Storage				$600,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Thickening				$1,000,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Dewatering				$900,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Conveyor				$900,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Loading Facilities				$300,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Processing Odor Control				$1,500,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Pumping				$2,100,000	EPA cost curves, ENR adjusted, and BPJ
	Anaerobic Digestors				$2,700,000	EPA cost curves, ENR adjusted, and BPJ
	Allowance for Unquantified Line Items	5%			$4,621,500	
	Total Equipment/Materials Costs				**$34,000,000**	
Construction Costs	Pumping & Force Main from International Collector				$5,500,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Screens & Grit Chambers				$1,800,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Odor Control				$800,000	EPA cost curves, ENR adjusted, and BPJ
	Advanced Primary Settling Tanks				$3,500,000	EPA cost curves, ENR adjusted, and BPJ
	Bioreactors				$8,000,000	EPA cost curves, ENR adjusted, and BPJ
	Secondary Settling Tanks				$6,500,000	EPA cost curves, ENR adjusted, and BPJ
	Mixed Liquor Return Pumping				$2,200,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Storage				$1,000,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Thickening				$750,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Dewatering				$600,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Processing Odor Control				$1,000,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Pumping				$1,800,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Processing Building				$3,700,000	EPA cost curves, ENR adjusted, and BPJ
	Anaerobic Digestors				$4,500,000	EPA cost curves, ENR adjusted, and BPJ
	Site Improvements				$3,500,000	EPA Manual CD-53, 1980, ENR adjusted
	Misc. Metals				$1,780,000	EPA Manual CD-53, 1980, ENR adjusted
	Piping				$7,100,000	EPA Manual CD-53, 1980, ENR adjusted
	Electrical				$6,000,000	EPA Manual CD-53, 1980, ENR adjusted
	Controls				$1,600,000	EPA Manual CD-53, 1980, ENR adjusted
	Shop & Garage Facilities				$500,000	EPA Manual CD-53, 1980, ENR adjusted
	Laboratories				$500,000	EPA Manual CD-53, 1980, ENR adjusted
	Controls & SCADA Building				$500,000	EPA Manual CD-53, 1980, ENR adjusted
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$18,939,000	
	Total Construction Costs				**$82,000,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$116,000,000	
	Engineer and Administrative Contingency, 40% of subtotal	40%			$46,400,000	
	Contingency 50%	50%			$81,200,000	
	Total Indirect Costs				**$128,000,000**	
	Purchase Price of the SBWRP from San Diego				**$30,000,000**	
	Total Capital Costs				**$274,000,000**	
O&M Costs	Personnel				$8,600,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Energy				$6,900,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Materials				$3,600,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Monitoring				$600,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Maintenance				$2,200,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Sludge Disposal				$3,200,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Total Annual O&M Costs				**$25,100,000**	
Life Cycle Cost	Total Capital Cost				$274,000,000	
	Annual O&M Costs				$25,100,000	
	Service Life				40	
	Present Value of Service Life O&M				$824,399,136	
	Major Upgrade(s) Cost				$125,000,000	New pumps, blowers, screens, clarifier mechanisms
	Present Value of Major Upgrade(s)				$102,500,000	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$1,200,000,000**	