Feasibility Analysis for Project 3: Treat Wastewater from the International Collector at the South Bay International Wastewater Treatment Plant

Technical Memorandum

USMCA Mitigation of Contaminated Transboundary Flows Project

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5	Final, revised	Addition of 40 and 55 MGD ITP expansion options; consolidation of ITP expansion options into sub-project 1; revisions to sub-project 2 (formerly sub-project 3)	PG	9/17/21

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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
Btu	British thermal unit
$CBOD_5$	five-day carbonaceous biological oxygen demand
CCFRPM	centrifugally cast, fiberglass-reinforced polymer mortar
CESPT	Comisión Estatal de Servicios Públicos de Tijuana
COD	chemical oxygen demand
DAF	dissolved air flotation
EID	Environmental Impact Document
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
ERG	Eastern Research Group, Inc.
FEMA	Federal Emergency Management Agency
ft^3/day	cubic feet 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
LAER	lowest achievable emission rate
lb BOD/day/1,000 ft^3	pounds of biochemical oxygen demand per day per thousand cubic feet
lb/day	pounds per day
lb/ft^3/day	pounds per cubic foot per day
lb TSS/day/ft^2	pounds of total suspended solids per day per square foot
L/s	liters per second
m^3	cubic meter
MGD	million gallons per day
mg/L	milligrams per liter
MLSS	mixed liquor suspended solids
MXN	Mexican pesos
NADB	North American Development Bank
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
PB1-A	Pump Station 1-A
PB1-B	Pump Station 1-B
PB-CILA	CILA Pump Station
PTE	potential to emit
RAS	return activated sludge
SAB	San Antonio de los Buenos
SABTP	San Antonio de los Buenos Wastewater Treatment Plant
SBOO	South Bay Ocean Outfall
SBWRP	South Bay Water Reclamation Plant
SOR	surface overflow rate
TKN	total Kjeldahl nitrogen

TSS	total suspended solids
USD	United States dollars
USMCA	United States–Mexico–Canada Agreement
VSS	volatile suspended solids
WAS	waste activated sludge

EXECUTIVE SUMMARY

PG Environmental conducted a feasibility analysis of Project 3, "Treat Wastewater from the International Collector at the South Bay International Wastewater Treatment Plant," one of 10 proposed projects identified to mitigate contaminated transboundary flows that cause impacts in the Tijuana River area and neighboring coastal areas in the U.S. under the United States–Mexico–Canada Agreement. 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 expanding the South Bay International Wastewater Treatment Plant (ITP) to handle an additional 15 to 35 MGD of wastewater from the International Collector, thus reducing impacts to the U.S. coast by capturing and treating wastewater that otherwise would be discharged to the Pacific Ocean without adequate treatment. (This project has a very similar objective to Project 9, but it uses existing or expanded facilities at the ITP rather than the South Bay Water Reclamation Plant.)

PG evaluated the feasibility of three individual sub-projects, which were proposed in reports developed by the Comisión Estatal de Servicios Públicos de Tijuana and through consultation with EPA:

1. **Expand the ITP (sub-project 1).** This sub-project consists of four options for an expanded average daily design flow rate: 40 MGD, 50 MGD, 55 MGD, and 60 MGD. Each option of sub-project 1, proposed by EPA, was found to be technically feasible. Each option will reduce the discharge of untreated or undertreated wastewater to San Antonio de los Buenos (SAB) Creek, thereby enhancing recreational opportunities for local residents and tourists and improving conditions for Navy training personnel. Disposing of the solids generated by the expanded treatment plant will be a key challenge. The estimated capital cost of the 40 MGD design option is $227 million, and the estimated 40-year life cycle cost is $510 million. The estimated capital cost of the 50 MGD option is $299 million, and the estimated 40-year life cycle cost is $700 million. The estimated capital cost of the 55 MGD option is $353 million, and the estimated 40-year life cycle cost is $860 million. The estimated capital cost of the 60 MGD option is $372 million, and the estimated 40-year life cycle cost is $940 million.

2. **Construct a pump station and force main to convey treated effluent from the expanded ITP to Mexico (sub-project 2).** This sub-project, proposed by EPA, was found to be technically feasible and is expected to reduce the volume of treated effluent discharged to the South Bay Ocean Outfall while also providing a source of reclaimed water to Mexico that could potentially be beneficially reused. The estimated capital cost of the sub-project is $12.4 million, and the estimated 40-year life cycle cost is $26.0 million.

3. **Construct a new pipeline in the U.S. to replace a portion of the International Collector (sub-project 3)**. This sub-project, proposed by EPA, was found to be technically feasible and is expected to reduce or even eliminate spills of wastewater from the International Collector to the Tijuana River and Stewart's Drain. The estimated capital cost of the sub-project is $14.1 million, and the estimated 40-year life cycle cost is $28.9 million.

PG has also explored the projected performance of Project 3 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 3.

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 contaminated transboundary flows that cause impacts in the Tijuana River area and neighboring coastal areas in the U.S. 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; an estimate of total life cycle costs; regulatory, engineering, and any possible implementation issues; and social and environmental impacts.

This feasibility analysis specifically addresses Project 3: "Treat Wastewater from the International Collector at the South Bay International Treatment 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 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 based on comments and discussions with EPA, new information presented to PG, dispersion modeling for the South Bay Ocean Outfall (SBOO), and has been updated to include information on constructing a pump station and force main to convey treated effluent from the expanded South Bay International Wastewater Treatment Plant (ITP) to Mexico. Consistent with the task order scope, PG will work with EPA to develop and analyze several infrastructure alternatives to mitigate the transboundary wastewater and stormwater flows. Each alternative will include a grouping of one or more projects evaluated in the feasibility analyses, scaled if necessary. The alternatives include groupings of one or more projects evaluated in the feasibility analyses, scaled if necessary, and will be presented to EPA in the Water Infrastructure Alternatives Analysis report.

1.1 Project Purpose

The primary purpose of Project 3 is to reduce impacts to the U.S. coast by capturing and treating wastewater from the International Collector that otherwise would be discharged to the Pacific Ocean without adequate treatment, or any treatment at all, from San Antonio de los Buenos (SAB) Creek or would be discharged to the Tijuana River. This project has a very similar objective to Project 9, but it uses new/expanded facilities at the ITP rather than existing/expanded facilities at the South Bay Water Reclamation Plant (SBWRP).

Additionally, Project 3 includes options to return treated effluent from the expanded ITP to Mexico for potential reuse (sub-project 2) and to relocate a portion of the International Collector onto the U.S. side of the border (sub-project 3). The primary purpose of sub-project 2 is to provide a source of reclaimed water to Mexico while also reducing the volume of effluent discharged at the SBOO. The primary purpose of sub-project 3 is to enable easier maintenance and prevent spillage of untreated wastewater from the International Collector, thereby protecting the Tijuana River Estuary and Pacific Ocean from transboundary flows containing untreated wastewater in the Tijuana River.

1.2 Current Conditions

This section summarizes the current conditions relevant to Project 3. Refer to the *Baseline Conditions Summary: Technical Document* for a more detailed discussion of the current conditions in the Tijuana River Watershed.

Wastewater from the International Collector is pumped to the SAB Wastewater Treatment Plant (SABTP) via Pump Station 1-B (PB1-B). Based on information provided by EPA, the aerated lagoon treatment system at the SABTP is known to be undersized and inadequately operated and maintained to provide treatment. The floating aspirating aerators in the lagoon system have been observed out of service, which greatly reduces BOD removal efficiency. 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 Station 1-A (PB1-A) and PB1-B bypasses the SABTP. Untreated or undertreated wastewater 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 wastewater from the majority of Tijuana. It is in need of rehabilitation due to 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 the International Boundary and Water Commission (IBWC), it is estimated that as much as 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). PG presumes that, to ensure the International Collector flows treated at an expanded ITP are composed of only wastewater, 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.

Based on future flow projections for the International Collector, expanding the ITP is necessary to accommodate population growth in Tijuana. Table 1-1 provides flow projections for the International Collector through the year 2040 by the North American Development Bank (NADB), EPA, and the Comisión Estatal de Servicios Públicos de Tijuana (CESPT). PG used a linear regression (R^2 = 0.99) to project flows for the years 2045 and 2050, indicated with italics.

Table 1-1. 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 et al. 2020

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 ITP, in southern San Diego County near the U.S.-Mexico border, treats raw wastewater from the International Collector and has design capacities for each stage of treatment shown in Table 1-2. The original plant, which began operation in 1997, provided advanced primary treatment only. Construction of the secondary treatment process was completed in 2011; in 2018 three new secondary sedimentation tanks were added to the 10 existing tanks to improve activated sludge process performance.

Table 1-2. Design Capacities for Each Stage of Treatment at the ITP

Type of Treatment	Average Daily Flow Rate (MGD)	Peak Daily Flow Rate (MGD)
Preliminary	50	104
Advanced primary	25	75
Secondary	25	50

The average flow rate into the ITP in 2019–2020 was about 26 MGD. Influent BOD_5, TSS, and ammoniacal nitrogen (ammonia-N) concentrations were about 350 mg/L, 350 mg/L, and 50 mg/L, respectively. The preliminary treatment process begins with three mechanically cleaned bar screens (each designed for a peak daily flow rate of 35 MGD) with three manual screens for backup. Then flow enters a horizontal flow-through grit chamber designed for a peak daily flow rate of 104 MGD. The advanced primary treatment process consists of five primary sedimentation basins (160 feet long × 20 feet wide × 15 feet deep), each designed for an average daily flow rate of 5 MGD and a peak daily flow rate of 15 MGD. Ferric chloride (at a dosage of about 20 mg/L) is added to the primary settling tank influent to promote coagulation/flocculation. When all five tanks are in use, the primary settling tanks achieve about 75% TSS removal and 60% BOD_5 removal, resulting in BOD_5 and TSS entering the secondary treatment process at about 140 mg/L and 90 mg/L, respectively.

The secondary treatment process consists of seven biological reactors; each has one pre-anoxic zone, then two anaerobic zones, then three anoxic zones, then four aerobic zones (with fine bubble diffusers). Each secondary reactor is described in Table 1-2. Thirteen secondary clarifiers (each 160 feet long × 20 feet wide × 15 feet deep) settle the biomass before the effluent is discharged to the SBOO (see Table 1-3). Each secondary clarifier has a volume of 0.36 million gallons. Secondary treatment process performance for 2019–2020 is summarized in Table 1-5. Figure 1-1 shows a treatment schematic for the liquid and solids treatment processes.

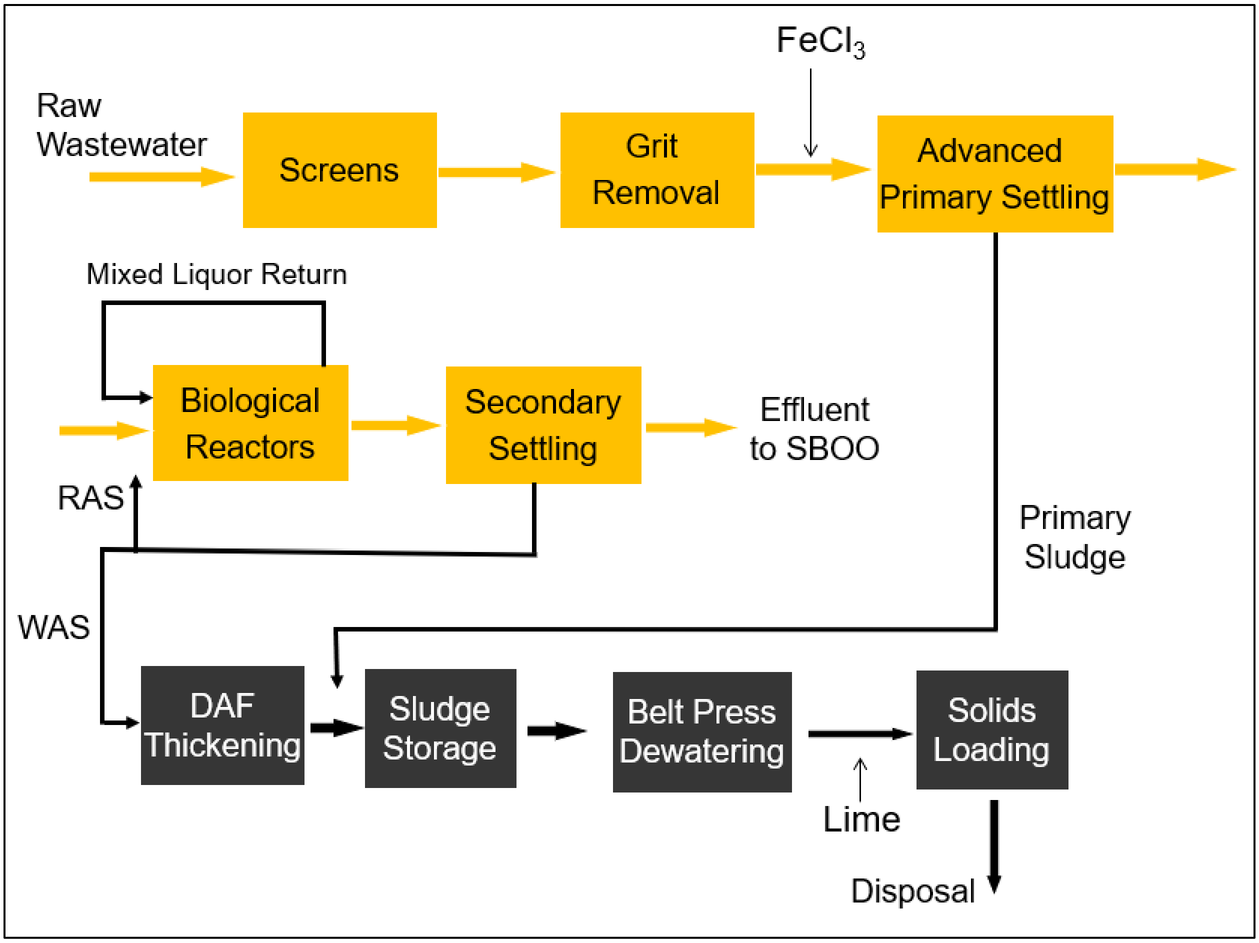

Figure 1-1. Schematic of Existing ITP Treatment Train

National Pollutant Discharge Elimination System (NPDES) effluent limits (monthly average) for the ITP for conventional parameters are 25 mg/L $CBOD_5$, 30 mg/L TSS, and 57.4 mg/L ammonia-N. Typically, the plant satisfies all its NPDES effluent limits.

Tables 1-3 and 1-4, below, describe the ITP's secondary treatment process design conditions. With information and operating data provided by IBWC, PG simulated the performance of the ITP's secondary treatment process using the Bio-Tiger model. Dr. Larry Moore developed this biokinetic model for the U.S. Department of Energy in 2017 to simulate activated sludge processes. The actual plant operating data for 2019–2020 are presented in Table 1-5 (note that the values for oxygen requirements and oxygen supplied were estimated by the model). The actual operating characteristics and model estimates were then used to inform the proposed designs for expanding the ITP.

Table 1-3. Description of Design Conditions for Each of the Seven Secondary Reactors at the ITP

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 3.57 MGD to Each Reactor
Pre-anoxic	1	0.052	0.35
Anaerobic	2	0.070	0.47
Anoxic	3	0.061	0.41
Aerobic	4	0.176	1.20
Total for one reactor	**10**	**1.08**	**7.33**

Table 1-4. Description of Each of the 13 ITP Secondary Clarifiers at Design 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	600	24	4.5
Peak daily flow rate	1,200	45	2.25

Table 1-5. Description of Secondary Process Performance in 2019–2020

Category	Item	Operating Data
Secondary influent loadings	Average flow rate (MGD)	26
	BOD_5 loading (lb/day)	30,400
	TSS loading (lb/day)	32,500
	TKN loading (lb/day)	10,800
Operating performance parameters	Solids retention time (days)	7
	MLSS concentration (mg/L)	3,700
	Total sludge production (lb/day)	44,000
	Total oxygen requirements (with denitrification) (lb/day)	42,200*
	Total oxygen supplied (lb/day)	42,200*
	RAS flow rate (MGD)	15.0
	WAS flow rate (MGD)	0.52
	Volumetric organic loading rate (lb BOD/day/1,000 ft^3)	30.0
	Blower horsepower in use	1,400
Secondary effluent quality	$CBOD_5$ (mg/L)	10
	TSS (mg/L)	13
	Ammonia-N (mg/L)	9.2

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

1.3 Major Project Elements Considered

Project 3 consists of three sub-projects, listed below:

1. Expand the ITP's advanced primary and secondary treatment processes (four design options):

   – Option 1: Expansion to 40 MGD (average daily) and 100 MGD (peak daily). This would enable the plant to treat all wastewater in the International Collector and wastewater that would be collected by the rehabilitated sewer collectors in Tijuana (see Project 5).

   – Option 2: Expansion to 50 MGD (average daily) and 100 MGD (peak daily). This would provide capacity for current and projected wastewater flows through 2030.

- Option 3: Expansion to 55 MGD (average daily) and 100 MGD (peak daily). This would provide the same treatment capabilities as Option 2 while providing capacity for current and projected wastewater flows through 2050.
- Option 4: Expansion to 60 MGD (average daily) and 100 MGD (peak daily). This would provide the same treatment capabilities as Option 3 while providing capacity for current and projected wastewater flows through 2050, plus about 5 MGD of reserve capacity.

2. Construct a pump station and force main to convey treated effluent from the expanded ITP to Mexico for beneficial reuse and/or discharge in Mexico.

3. Construct a pipeline in the U.S. to replace a portion of the International Collector.

2. DESIGN INFORMATION

Figure 2-1, on the next page, provides an overview of the proposed locations and known elevations for the three sub-projects that make up Project 3, as well as their position relative to the Federal Emergency Management Agency (FEMA) 100-year and 500-year floodplains.

Sections 2.1 through 2.4 describe the project's design features.

2.1 Sub-Project 1: Expand the ITP

2.1.1 Design Features: Overview

This sub-project involves expanding the ITP to treat one of four average daily flow rates (40 MGD, 50 MGD, 55 MGD, or 60 MGD). The plant's existing preliminary, advanced primary, and secondary treatment processes will be modified to accommodate the new average daily design flow rate. Regardless of which of the four average daily flow rates is chosen for the final design, the plant will be expanded to treat a peak daily flow rate of 100 MGD.

A treatment schematic for the expanded treatment process is shown in Figure 2-2.

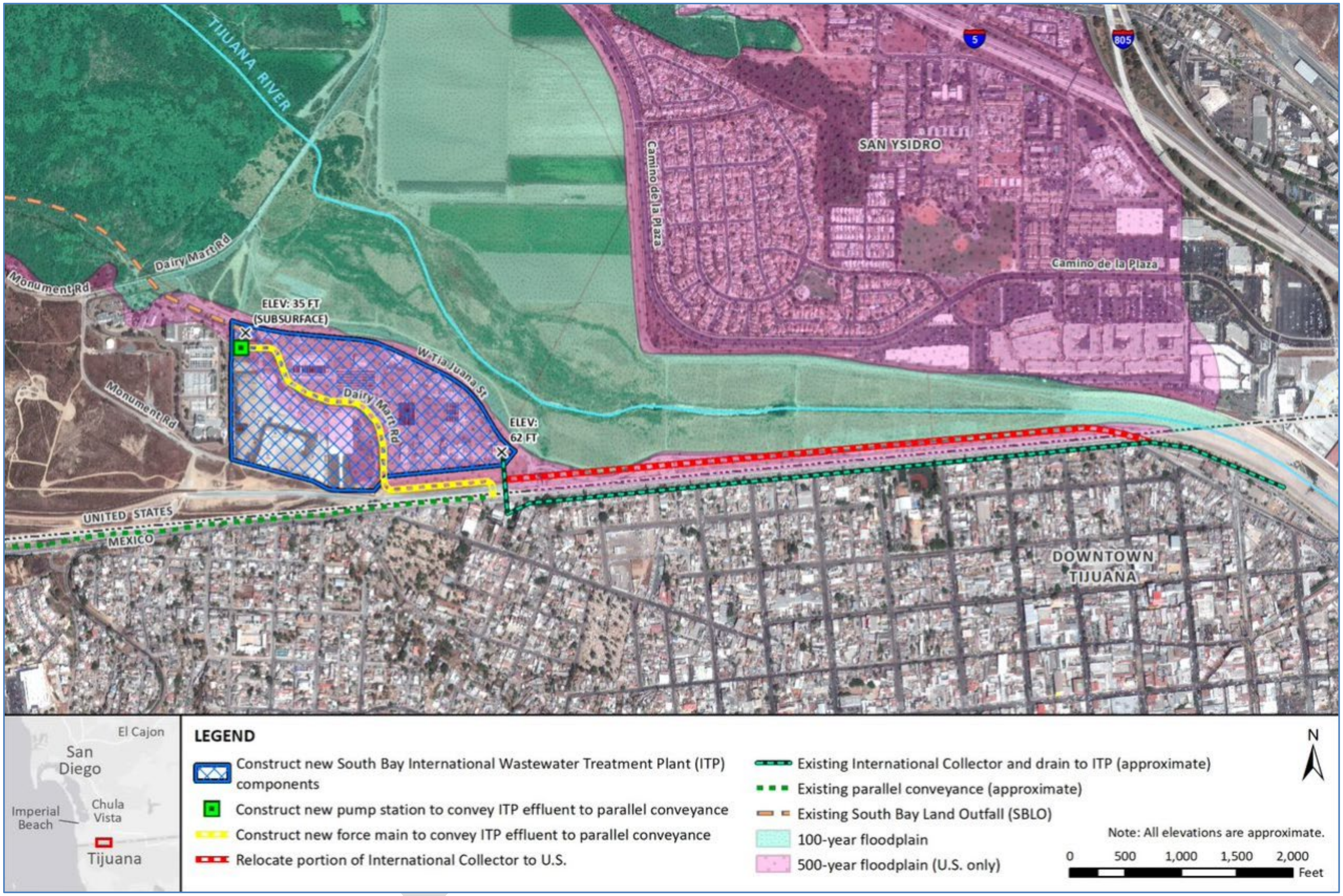

Figure 2-1. Locations of Proposed and Existing Project 3 Features Relative to FEMA Floodplains

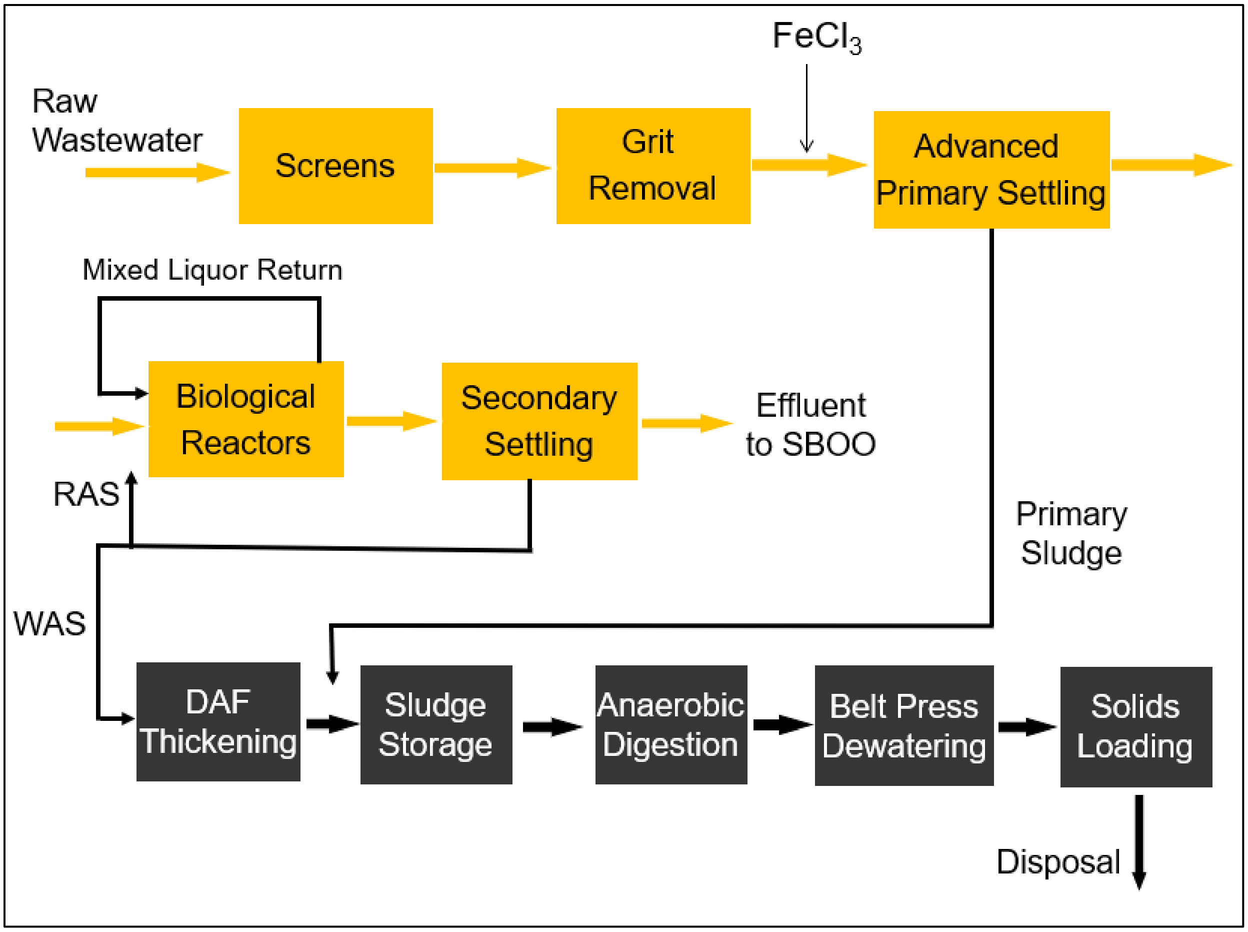

Figure 2-2. Schematic of Expanded ITP Treatment Train

2.1.2 Design Features: Preliminary Treatment

Expansion of the preliminary treatment process will not be needed because the existing bar screens and grit chambers can easily handle an average daily flow rate of 60 MGD and a peak daily flow rate of 100 MGD. However, PG has assumed that the raw wastewater pumps and screens at the ITP headworks will need to be replaced as part of plant expansion, due to ongoing maintenance issues.

2.1.3 Design Features: Primary Treatment

New primary settling tanks will be added to the advanced primary treatment process, as shown below. The new tanks will have the same dimensions and volume as the existing tanks (160 feet long × 20 feet wide × 15 feet deep; 0.36 million gallons) and will be contiguous with and west of the existing tanks (with the same south-to-north flow direction). The five existing primary settling tanks have surface overflow rates (SORs) that are slightly high for the current design conditions. In the proposed design, SORs for the settling basins generally will be within the industry standard acceptable range. Note that 13 total primary settling tanks can be operated at suitable SORs (< 1,500 gpd/ft^2) with 50, 55, and 60 MGD average daily flow rates.

40 MGD	5 new primary settling tanks (10 total)
50 MGD	8 new primary settling tanks (13 total)

55 MGD	8 new primary settling tanks (13 total)
60 MGD	8 new primary settling tanks (13 total)

2.1.4 Design Features: Secondary Treatment

New biological reactors will be added to the secondary treatment process, as shown below. The 10 zones (in sequence: one pre-anoxic, two anaerobic, three anoxic, and four aerobic) in the existing seven reactors will be replicated in the new reactors. Consistent with the ITP's current operations, mixed liquor will be returned to the first anoxic zone at two to four times the influent flow rate to achieve biological nitrogen removal. Each anoxic zone will have a three-horsepower vertical mixer. Each anaerobic zone will have a one-horsepower mixer. To accommodate the new reactor basins, Dairy Mart Road must be rerouted along the west perimeter of the ITP property.

40 MGD	5 new biological reactors (12 total)
50 MGD	7 new biological reactors (14 total)
55 MGD	9 new biological reactors (16 total)
60 MGD	10 new biological reactors (17 total)

The new reactors will be just south of the existing reactors (with the same east-to-west flow direction), so the existing blower building must be relocated to the east side of the new reactors. If the plant needs to be expanded again in the future, more reactors can be added to the south and the new blower building will be centrally located to accommodate the expansion. In the design cost estimates for sub-project 1, PG has assumed that the existing blowers will be replaced. The new blower building will house an array of new 700 horsepower centrifugal blowers, as shown below.

40 MGD	5 new 700 horsepower centrifugal blowers
50 MGD	5 new 700 horsepower centrifugal blowers
55 MGD	6 new 700 horsepower centrifugal blowers
60 MGD	6 new 700 horsepower centrifugal blowers

New sludge storage tanks (assuming anaerobic digestion is used) will be added immediately west of the two existing sludge storage tanks, as shown below. The new sludge storage tanks will have the same individual volumes as the existing tanks (0.68 million gallons). If anaerobic digestion is not used, more new sludge storage tanks will be needed for each of the future design flow rates.

40 MGD	2 new sludge storage tanks (4 total)
50 MGD	2 new sludge storage tanks (4 total)
55 MGD	2 new sludge storage tanks (4 total)
60 MGD	3 new sludge storage tanks (5 total)

New rectangular secondary sedimentation tanks will be added (160 feet long × 20 feet wide × 15 feet deep) in a cluster south of the existing cluster of secondary settling tanks. New return activated sludge (RAS), waste activated sludge (WAS), and mixed liquor return pumps will also be needed.

The expanded activated sludge process will be designed and operated as indicated in Tables 2-1, 2-2, and 2-3.

Table 2-1. Description of Biological Reactors

Number of Biological Reactors at Each Plant Design, with Average Daily Flow Rate	Treatment Zones Within Each Reactor	Number of Zones	Volume of Each Zone (Million Gallons)	Detention Time (Hours) in Each Zone at Average Daily Design Flow Rate to Each Reactor
40 MGD: 12 biological reactors	Pre-anoxic	1	0.052	0.37
	Anaerobic	2	0.070	0.50
	Anoxic	3	0.061	0.44
	Aerobic	4	0.176	1.27
	Total for one reactor	**10**	**1.08**	**7.78**
50 MGD: 14 biological reactors	Pre-anoxic	1	0.052	0.35
	Anaerobic	2	0.070	0.47
	Anoxic	3	0.061	0.41
	Aerobic	4	0.176	1.20
	Total for one reactor	**10**	**1.08**	**7.33**
55 MGD: 16 biological reactors	Pre-anoxic	1	0.052	0.37
	Anaerobic	2	0.070	0.50
	Anoxic	3	0.061	0.44
	Aerobic	4	0.176	1.27
	Total for one reactor	**10**	**1.08**	**7.78**
60 MGD: 17 biological reactors	Pre-anoxic	1	0.052	0.35
	Anaerobic	2	0.070	0.48
	Anoxic	3	0.061	0.41
	Aerobic	4	0.176	1.20
	Total for one reactor	**10**	**1.08**	7.34

Table 2-2. Description of Secondary Clarifiers at Design Loadings

Number of Clarifiers at Each Plant Design Average Daily Flow Rate*	Flow Rate Through Each Clarifier	Design Surface Overflow Rate (gpd/ft^2)	Design Solids Loading Rate (lb TSS/Day/ft^2)	Detention Time in Each Clarifier (Hours)
40 MGD: 21 secondary clarifiers (7 new)	Average daily flow rate	600	29	4.5
	Peak daily flow rate	1,200	50	2.25
50 MGD: 26 secondary clarifiers (13 new)	Average daily flow rate	600	25	4.5
	Peak daily flow rate	1,200	50	2.25
55 MGD: 26 secondary clarifiers (13 new)	Average daily flow rate	660	28	4.1
	Peak daily flow rate	1,200	50	2.25
60 MGD: 26 secondary clarifiers (13 new)	Average daily flow rate	720	28	3.75
	Peak daily flow rate	1,200	50	2.25

* Note that 26 total secondary clarifiers can be operated at suitable SORs with 50, 55, and 60 MGD average daily flow rates.

Table 2-3. Bio-Tiger Model Results for the Expanded Secondary Treatment Process Performance

Category	Item	40 MGD	50 MGD	55 MGD	60 MGD
Secondary influent loadings	BOD_5 loading (lb/day)	53,400	66,700	73,400	80,100
	TSS loading (lb/day)	41,700	52,100	57,300	70,100
	TKN loading (lb/day)	20,000	25,000	27,500	30,000
Operating performance parameters	Solids retention time (days)	7.5 days	7	7	6.5
	MLSS concentration (mg/L)	3,700 mg/L	3,400	3,500	3,300
	Total sludge production (lb/day)	69,000 lb/day	90,000	96,000	106,000
	Total oxygen requirements (with denitrification) (lb/day)	79,000 lb/day	95,000	105,000	109,000
	Total oxygen supplied (lb/day)	79,000 lb/day	95,000	105,000	110,000
	RAS flow rate (MGD)	24.2 MGD	22.0	26.3	26.0
	WAS flow rate (MGD)	0.83 MGD	0.98	1.05	1.15
	Volumetric organic loading rate (lb BOD/day/1,000 ft^3)	30.8 lb BOD/day/ 1,000 ft^3	33.0	31.7	32.6
	Blower horsepower in use	2,100 (100% output)	2,800 (85% output)	2,800 (100% output)	2,800 (100% output)
Secondary effluent quality	$CBOD_5$ (mg/L)	11 mg/L	8	11	11
	TSS (mg/L)	15 mg/L	10	15	15
	Ammonia-N (mg/L)	11 mg/L	10	10	15

2.1.5 Design Features: Solids Handling and Disposal

Currently, the plant operates without anaerobic digestion of primary/secondary sludge. To reduce the amount of waste solids that must be disposed of, PG has proposed implementing anaerobic digestion of primary and secondary sludge as part of plant expansion. The anaerobic digestion process will destroy about 46% of TSS, resulting in less solids to process and dispose of. Additionally, using anaerobic digestion will produce biogas that could be captured and used to generate electricity. The resulting dewatered sludge totals are shown in Table 2-4 for each design average daily flow rate. Note that the sludge dewatering process produces 4 wet tons of sludge for 1 dry ton.

Table 2-4. Description of Dewatered Sludge Production at Design Loadings (with Anaerobic Digestion)

Plant Design Average Daily Flow Rate (MGD)	Daily Wet Sludge Production (Tons/Day)	Dry Solids Loading to the Belt Filter Presses (Tons/Day)	Truck Trips to Mexico to Dispose Of the Solids (Trips/Day)
40	180	45	Decrease 8%
50	216	54	Increase 10%
55	230	58	Increase 18%
60	250	62	Increase 27%

To handle the increased loadings, new dissolved air flotation (DAF) thickeners for WAS will be needed, as shown below. For each of the four (design) average daily flow rates, PG has assumed that expansion of the existing dewatering building will be necessary, but the existing sludge conveyors and solids loading bay will be adequate. Note the plant currently has four belt filter presses, one of which is out of service and will be replaced as part of the plant expansion.

40 MGD	4 new DAF thickeners (6 total), 2 new belt filter presses (5 total)
50 MGD	5 new DAF thickeners (7 total), 3 new belt filter presses (6 total)
55 MGD	5 new DAF thickeners (7 total), 3 new belt filter presses (6 total)
60 MGD	6 new DAF thickeners (8 total), 4 new belt filter presses (7 total)

The new digesters will be at the southwest corner of the ITP property. PG estimated anaerobic digester design values for the expanded treatment process, provided in Table 2-5.

Table 2-5. Description of Anaerobic Digestion Process

Design Parameter	40 MGD Design Average Daily Flow Rate	50 MGD Design Average Daily Flow Rate	55 MGD Design Average Daily Flow Rate	60 MGD Design Average Daily Flow Rate
Primary sludge flow	1,440 m^3/day (0.38 MGD)	1,670 m^3/day (0.44 MGD)	1,890 m^3/day (0.50 MGD)	1,970 m^3/day (0.52 MGD)
Primary sludge solids	3%	3%	3%	3%
WAS flow	1,060 m^3/day (0.28 MGD after DAF)	1,360 m^3/day (0.36 MGD after DAF)	1,440 m^3/day (0.38 MGD after DAF)	1,590 m^3/day (0.42 MGD after DAF)
WAS solids	3% (after DAF)	3% (after DAF)	3% (after DAF)	3% (after DAF)
COD of combined sludge	43,000 mg/L	43,000 mg/L	43,000 mg/L	43,000 mg/L
VSS of combined sludge	24,000 mg/L	24,000 mg/L	24,000 mg/L	24,000 mg/L
Mass loading of COD	107,000 kg/day (237,000 lb/day)	134,000 kg/day (294,000 lb/day)	143,000 kg/day (316,000 lb/day)	158,000 kg/day (348,000 lb/day)
Mass loading of VSS	59,900 kg/day (132,000 lb/day)	72,300 kg/day (159,000 lb/day)	79,800 kg/day (176,000 lb/day)	85,400 kg/day (188,000 lb/day)
Total volume of digesters	27,700 m^3 (7.3 million gallons)	33,240 m^3 (8.8 million gallons)	35,600 m^3 (9.4 million gallons)	38,200 m^3 (10.1 million gallons)
Number of digesters	5	6	6	6
Volume of each digester	5,540 m^3 (1.46 million gallons)	5,540 m^3 (1.46 million gallons)	5,940 m^3 (1.57 million gallons)	6,360 m^3 (1.68 million gallons)
Diameter of each digester	28 meters (91.9 feet)	28 meters (91.9 feet)	29 meters (95.3 feet)	30 meters (97.4 feet)
Liquid depth of each digester	9 meters (29.5 feet)	9 meters (29.5 feet)	9 meters (29.5 feet)	9 meters (29.5 feet)
Hydraulic detention time	11.1 days	11 days	10.7 days	10.7 days
Solids retention time	11.1 days	11 days	10.7 days	10.7 days
VSS loading rate	2.24 kg/m^3/day (0.14 lb/ft^3/day)	2.24 kg/m^3/day (0.14 lb/ft^3/day)	2.24 kg/m^3/day (0.14 lb/ft^3/day)	2.24 kg/m^3/day (0.14 lb/ft^3/day)
Gas production	38,900 m^3/day (1.37 million ft^3/day)	45,100 m^3/day (1.59 million ft^3/day)	49,800 m^3/day (1.76 million ft^3/day)	53,300 m^3/day (1.88 million ft^3/day)
Estimated VSS destruction	57%	57%	57%	57%

A new power generation plant to convert anaerobic digester biogas to electricity was considered at a very cursory level. Assuming the biogas harvested from the anaerobic digesters will be 65% methane—the gas that will be combusted to generate electricity—PG estimated the scale and costs associated with a biogas electricity generation facility that the ITP could support at each proposed design average daily flow rate (assuming a methane to electricity production efficiency of 27%), shown in Table 2-6. Note, though, that the cost impact analysis in Section 4 does not consider potential cost savings from energy generation.

Table 2-6. Description of Estimated Biogas Electrical Production

Plant Design Average Daily Flow Rate (MGD)	Daily Methane Yield from Anaerobic Digesters	Methane Energy Equivalent	Biogas Energy Value (as gas)	Potential Facility Power Output	Approximate Capital Cost
40	0.89 million cubic feet	760 million Btu/day	$3,000 per day or $1,095,000 per year	2.6 megawatts	$15 million
50	1.03 million cubic feet	880 million Btu/day	$3,500 per day or $1,280,000 per year	2.9 megawatts	$17 million
55	1.14 million cubic feet	970 million Btu/day	$3,900 per day or $1,420,000 per year	3.2 megawatts	$19 million
60	1.22 million cubic feet	1,040 million Btu/day	$4,200 per day or $1,530,000 per year	3.4 megawatts	$21 million

2.1.6 Engineering Issues

For the existing ITP, PG obtained design and operating data from the IBWC and Veolia, the contract operator of the ITP. Influent and effluent data, annual operating summaries, and other information were obtained from these two entities. Influent data indicate that the raw wastewater is high-strength sewage. Nevertheless, the plant is performing well and producing good effluent quality most of the time. As mentioned above, the additional treatment units will be designed to be almost identical to the existing treatment units and will be operated in similar fashion. About 25 acres at the site are available for expansion, which appears sufficient to accommodate the new treatment components.

Industry design standards, state design requirements, and EPA design guidance have been used in the preliminary design calculations. As mentioned previously, the existing five primary settling tanks have SORs that are slightly high for current design loadings. Industry design standards call for SORs to be in the range of 600 to 1,200 gpd/ft^2 at average daily flow rate. The proposed number of primary settling tanks for each design average daily flow rate has been selected to achieve SORs within this range or slightly over this range.

The values in Tables 2-1, 2-2, and 2-3 are in desired ranges for conventional activated sludge processes designed for nitrogen and phosphorus removal. Design detention times in the anaerobic, anoxic, and aerobic zones of the bioreactors are consistent with industry design standards.

The new treatment components are readily constructible and are energy efficient. Incorporating anoxic zones in the bioreactor design provides energy savings of about 16% due to denitrification oxygen savings. Fine bubble diffusers are about 50% more efficient than coarse bubble diffusers. Additionally, high-efficiency blowers will be used in the new design. PG estimates the expanded ITP's annual energy consumption will be about 31 million kWh/year (40 MGD), 40 million kWh/year (50 MGD), 43 million kWh/year (55 MGD), or 46 million kWh/year (60 MGD).

Table 2-7 presents PG's estimates for the annual operating budget and necessary staff to successfully operate the ITP. The current staff of 25 persons is significantly short of what typically would be expected to operate a 25 MGD activated sludge process designed for biological nutrient removal.

Table 2-7. Annual O&M Costs and Staffing Requirements for the Expanded ITP

Plant Design Average Daily Flow Rate (MGD)	Annual O&M Budget	Total Staff	Grade V Certified Operators	Grade IV Certified Operators	Grade III Certified Operators
25 (current)	$14.3 million	25	4	2	2
40	$21.7 million	55 (120% increase)	4	5	5
50	$25 million	65 (160% increase)	4	6	6
55	$27.6 million	70 (180% increase)	4	6	7
60	$29 million	75 (200% increase)	4	7	7

Compatibility with existing facilities/operations at the ITP does not appear to pose significant barriers to implementation.

2.1.7 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 expanded wastewater treatment plant must satisfy State of California wastewater treatment 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.

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 on a consistent basis once the expanded treatment facility is operational. 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 was necessary to understand potential impacts to the coast. PG conducted an updated SBOO flow dispersion model concurrently with the Project 3 feasibility analysis which indicated that more stringent effluent limitations will not be necessary to protect the beneficial uses of the receiving water. However, initial informal coordination with the National Marine Fisheries Service suggests that additional plume extent modeling could be necessary to understand potential impacts to protected marine species. This will be further evaluated during preparation of the Environmental Impact Statement (EIS).

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) for regulated pollutants and can trigger burdensome regulatory requirements. Based on preliminary emissions estimates, the PTE for the plant under Project 3 has a high likelihood of being subject to additional regulatory requirements, including the following (these will be further evaluated during preparation of the EIS):

- Emissions assessments including best available control technology (BACT)/lowest achievable emission rate (LAER) determination, air impacts analysis, and emissions offset assessment, due to emissions of nitrogen oxides, volatile organic compounds, and carbon monoxide.

- Air toxics determination and health risk assessment, due to emissions of hazardous air pollutants.
- Installation of emissions reduction technologies, such as selective catalytic reduction and catalytic oxidization, based on the outcome of the BACT/LAER determination.
- Potential need for a Title V operating permit for a major modification, depending on the incorporation of emissions reduction technologies.
- Potential need for a conformity determination under the General Conformity Rule, depending on the incorporation of emissions reduction technologies.
- Potential requirements under the State of California greenhouse gas cap and trade program, if the design incorporates electricity generation and the PTE associated with onsite electricity generation exceeds 25,000 metric tons per year of carbon dioxide equivalents.

2.2 Sub-Project 2: Construct a Pump Station and Force Main to Convey Treated Effluent from the Expanded ITP to Mexico

2.2.1 Design Features

This sub-project consists of constructing a new pump station and force main to convey treated effluent from the expanded ITP to PB1-B in Mexico, where it will subsequently be pumped to SAB Creek for discharge into the Pacific Ocean. At some point in the future, Mexico could implement a project to harvest the treated effluent for beneficial water reuse. The new pump station will be in the northwest area of the ITP property and will be designed to pump an average daily flow rate of 40 MGD. The station will consist of five 75 horsepower centrifugal pumps, each capable of pumping 10 MGD. Under normal operation, four pumps will operate, with the fifth pump available as backup. Note that PB1-B cannot pump more than 40 MGD; thus, it is the bottleneck in the system. Therefore, for the four ITP design options discussed previously, daily effluent flow rates above 40 MGD will continue to go to the SBOO.

A new 42-inch centrifugally cast, fiberglass-reinforced polymer mortar (CCFRPM) force main will be constructed from the new pump station to PB1-B; it will run through the ITP property and underneath the border, as shown in Figure 2-1. The new force main will be about 2,500 feet long and will be buried at a depth of about 6 feet. On the U.S. side of the border, the pipe can be installed with open-cut trenching, but micro-tunneling (an underground tunnel construction technique) must be used to install the pipe under the border. The force main will be fitted with intermediate pressure release valves to prevent pipe collapse and to enable preventative maintenance.

2.2.2 Engineering Issues

Because the new pump station and force main will connect to PB1-B, the amount of effluent that can be returned to Mexico is limited by PB1-B's pumping capacity. Currently, PB1-B is known to have some out-of-service pumping equipment and other deferred maintenance issues. The proposed pump station and force main have been sized to match the approximate pumping capacity of a rehabilitated PB1-B. If PB1-B is not rehabilitated, the new pump station will not be able to operate at full capacity. Effluent that is not pumped to PB1-B will be discharged to the Pacific Ocean via the SBOO, as discussed above.

For the ITP effluent to be beneficially reused in Mexico, additional treatment and conveyance facilities may be necessary, depending on how the water will be reused. Until these additional facilities are constructed, the effluent must either be pumped to SAB Creek and discharged to the Pacific Ocean or be discharged at the SBOO. Therefore, if this sub-project is implemented, Mexico may need to continue to operate PB1-B and incur the energy and maintenance costs associated with doing so. There may also be limitations in the capacity of the parallel conveyance pipelines in Mexico to convey the effluent to SAB Creek.

2.2.3 Regulatory and Implementation 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 new 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 proposed infrastructure 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. Finally, since the proposed force main must cross the international border, a Presidential Permit must be obtained. If sub-project 2 is implemented, the ITP's NPDES permit must be modified accordingly to reflect the new facilities and effluent discharge point.

2.3 Sub-Project 3: Construct a New Pipeline in the U.S. to Replace a Portion of the International Collector

2.3.1 Design Features

This sub-project consists of constructing a section of new pipeline in the U.S. along the north side of the international border to replace a portion of the International Collector currently located in Tijuana. The pipeline will replace the portion of the International Collector that is parallel to the border, accounting for about two-thirds of the total existing 1.5-mile pipeline. (The rest of the International Collector runs along the Tijuana River channel heading southeast from the border and cannot be moved into the U.S. due to its location.) The main reason to partially replace the International Collector is to prevent spillage from the existing pipe, which has reached the end of its useful service life and is known to have structural defects. Additionally, relocating this portion of the International Collector will enable easier O&M due to the lack of roads, structures, and utilities on the U.S. side of the border.

For this analysis, EPA has directed PG to assume that there are no lateral connections into the portion of the International Collector that is being replaced. Therefore, the proposed project does not include extending any lateral connections from the existing pipeline under the border and into the new pipeline. The new pipeline will be connected to the existing pipeline with a single connection and will discharge directly to Junction Box 1 at the ITP headworks, as shown in Figure 2-1. It will be about 1 mile long and will be constructed out of 72-inch-diameter CCFRPM pipe. Once the new pipeline is constructed and connected to the existing International Collector, the abandoned length of pipe in Mexico must be filled with concrete to prevent sinkholes.

2.3.2 Engineering Issues

An existing access road along the north side of the border is currently used by U.S. Customs and Border Protection. Depending on the precise location of the new pipeline determined during the final design, rerouting, or modifying the access road may be necessary. The access road may also need to be taken out of service during construction. After construction is complete, an agreement should be reached with U.S. Customs and Border Protection so that the access road can be shared to allow pipeline maintenance. With the pipeline located on the U.S. side of the border rather than the Mexico side, routine O&M is expected to be easier due to the absence of nearby roads, structures, and utilities. However, because the new pipeline will be in the Tijuana River floodway, construction or maintenance during wet weather will be challenging, or even impossible during heavy rain events.

Depending on the depth and configuration of Junction Box 1, modifications to the junction box may be necessary to facilitate flow into the ITP from the new pipeline. Whether or not such modifications will be necessary must be determined during the final design process for the new pipeline. If the junction box does need to be modified, it will add to the complexity and cost associated with implementing sub-project 3.

2.3.3 Regulatory and Implementation Issues

Any infrastructure built in and adjacent to the river must be approved by the U.S. Army Corps of Engineers. The project also must be consistent with current City of San Diego and San Diego County zoning requirements. All design parameters for the new pipeline must satisfy State of California wastewater conveyance design criteria. Due to the immediate proximity to the border, the proposed pipeline 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.

Additionally, because the pipeline will be in the floodway and may need onsite O&M during storm events, safety risks may pose an additional approval obstacle, and may necessitate design modifications.

3. PROJECT IMPACT

3.1 Water Quality Impacts

Expanding the ITP to treat an additional 15 to 35 MGD of untreated wastewater from the International Collector (sub-project 1) 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. PG also estimated the total BOD_5 and TSS loads that are discharged to SAB Creek under current conditions and for all four ITP capacity designs. For this analysis, PG assumed that the 40 and 50 MGD ITP sizes would treat flows from the International Collector, and the 55 and 60 MGD sizes would treat flows from the International Collector and the Mexico side canyon pump stations.

Table 3-1 shows the estimated reduction in total flow, BOD_5, and TSS (sediment) discharged to SAB Creek resulting from ITP expansion. If sub-project 2 is implemented and ITP effluent is discharged to SAB Creek, the total annual flow to SAB Creek will not change much but improvements in BOD_5 and TSS loadings will be mostly preserved. Sub-project 3 will not impact flows to SAB Creek.

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

Parameter of Discharges to the Pacific Ocean via SAB Creek	Current Conditions*	40 MGD Expanded ITP	50 MGD Expanded ITP	55 MGD Expanded ITP	60 MGD Expanded ITP
Flow volume (million gallons/year)	13,100	9,700	9,700	7,400	7,400
Percent change	*N/A*	*-26%*	*-26%*	*-56%*	*-56%*
BOD_5 load (tons/year)	17,200	9,800	9,800	5,900	5,900
Percent change	*N/A*	*-43%*	*-43%*	*-66%*	*-66%*
Sediment load (tons/year)	17,900	10,800	10,700	6,900	6,900
Percent change	*N/A*	*-40%*	*-40%*	*-62%*	*-62%*

* "Current conditions" are based on data from January 1, 2016, through December 31, 2019, and therefore do not reflect the upgrades to PB-CILA that commenced in 2020.

Table 3-2 presents the estimated impacts of the ITP treatment scenarios on untreated wastewater discharged from SAB Creek. Expanding the ITP could reduce discharges of untreated wastewater at SAB Creek from an average of about 28 MGD (current) to as little as about 9.6 MGD, resulting in the reduction of surf contamination to U.S. beaches.

Table 3-2. Project 3 Impacts on Untreated Wastewater Discharged at SAB Creek

Scenario	Untreated Wastewater Discharged at SAB Creek (MGD)	Percent Change in Untreated Wastewater Discharged at SAB Creek
Current conditions	28.2	N/A
40 MGD ITP expansion	16.0	-43%
50 MGD ITP expansion	15.9	-44%
55 MGD ITP Expansion	9.6	-66%
60 MGD ITP expansion	9.6	-66%

Based on the Scripps modeling results, reducing wastewater discharged from SAB Creek is expected to have a substantial impact on water quality in the Pacific Ocean along the San Diego County coastline (Feddersen et al. 2020). Scripps modeled the effects of reducing the discharge of untreated wastewater from SAB Creek to 10 MGD and estimated that it could reduce the frequency at which fecal indicator bacteria concentrations exceed EPA's beach action value at Imperial Beach

Pier from 24% of the time to 9% of the time during the dry season (May 22 through September 8). It also could reduce the frequency at which fecal indicator bacteria concentrations exceed EPA's beach action value at Imperial Beach Pier from 9% of the time to 7% of the time during the wet season (October 1 through April 1). In addition to benefitting beachgoers in Southern San Diego County, implementation of sub-project 1 (ITP expansion) will improve conditions at the U.S. Navy SEALs training facility in Coronado, California.

The discharge of an additional 15 to 35 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 anticipates that if the ITP is used to treat more wastewater than it currently treats, the effluent BOD_5, TSS, and ammonia-N concentrations will 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 solids treatment and disposal), the plant will continue to be capable of producing effluent quality that consistently satisfies NPDES permit limits.

Project 3 is expected to reduce or even eliminate (if sub-project 3 is implemented) untreated wastewater that is spilled from the International Collector during dry and wet weather. Capturing and treating more wastewater from the International Collector may also reduce spills at 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 wastewater from the International Collector to the SABTP, there will be no disincentive to improving/expanding the collection system to capture more wastewater and further improve water quality in the watershed.

3.2 Sediment Impacts

Project 3 will not significantly reduce sediment loadings reaching the Tijuana River. It 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 3 is not expected to provide measurable reductions in trash quantities in the Tijuana River.

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 3), focusing on impacts in the U.S. or caused by activities in the U.S. Based on a review of existing available information, Project 3 would have the potential to result in non-water-quality environmental impacts of concern.[1] Specifically, criteria pollutant emissions from anaerobic

[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

digestion would potentially exceed Clean Air Act General Conformity Rule *de minimis* thresholds, depending on the incorporation of emissions reduction technologies. The EID, and the subsequent EIS, 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 3 (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 ITP (e.g., slight increase in truck traffic and sludge disposal). The EID, and the subsequent EIS, will include a more thorough evaluation of potential socioeconomic impacts in the U.S.

Project 3 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 reused as a soil additive. Therefore, rather than disposing of the solids, Mexico might be able to use them 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 does not threaten human health and the environment.

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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 3 to a Class V level of accuracy in accordance with AACE International's recommended practice No. 17R-97 (AACE International 2020). According to this system, Class 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.*

The sum of project construction cost plus equipment/material cost was multiplied by 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 the sum of project construction cost and equipment/material cost × 1.4 × 1.5, which is equivalent to the sum of project construction cost and equipment/material cost × 2.1. For project construction cost data, PG used the *Innovative and Alternative Technology Assessment Manual* (U.S. EPA 1980), adjustments for a 2020 *Engineering News-Record* construction cost index of 11,455, construction costs of actual treatment plants built in the last two years, and manufacturer's information.

ITP representatives have indicated that the existing headworks have some ongoing maintenance/operational issues. Therefore, PG has included capital costs for replacing the existing headworks with an expanded headworks, rather than only expanding the existing headworks.

O&M costs were estimated using existing budget information for the ITP and SBWRP. Life cycle costs were determined using an interest rate of 3% and an inflation rate of 2%.

Using anaerobic digestion will produce biogas that could be captured and used to generate electricity. The design information for sub-project 1 (Sections 2.1.4 and 2.1.5) 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 for ITP expansion do not include capital costs associated with capturing biogas for energy production or account for potential energy cost savings from biogas energy generation. Capital costs, annual O&M costs, and life cycle costs for each design option of sub-project 1 are provided in Tables 4-1 through 4-4.

The estimated capital cost, annual O&M cost, and life cycle cost to construct a pump station and force main to convey treated effluent from the expanded ITP to Mexico (sub-project 2) are provided in Table 4-5. PG has estimated that to break even with the annual O&M costs, a water reuse operation would have to generate revenue of approximately $0.21 (U.S. dollars) per 1,000 gallons of effluent pumped to Mexico. This estimate does not account for the sub-project's capital cost.

The estimated capital cost, annual O&M cost, and life cycle cost to construct a pipeline in the U.S. to replace a portion of the International Collector (sub-project 3) are provided in Table 4-6. An itemized cost breakdown for each of the three sub-projects of Project 3 is provided in Appendix A.

Table 4-1. Cost Estimate for Sub-Project 1 (40 MGD ITP Expansion)

Category	Item	Estimated Cost
Capital costs	Equipment/material	$36,300,000
	Construction costs	$72,000,000
	Indirect costs	$119,000,000
	Total capital cost	**$227,000,000**
	Total capital cost per gallon treated per day	**$15.13**
O&M	Personnel	$3,200,000
	Energy	$2,500,000
	Materials	$1,200,000
	Monitoring	$180,000
	Maintenance	$320,000
	Annual O&M costs*	**$7,400,000**
	Total annual O&M cost per 1,000 gallons treated*	**$1.35**
Major upgrade at 20 years	New pumps, blowers, screens, clarifier mechanisms, etc.	$60,000,000
Life cycle factors	Interest rate	3%
	Inflation rate	2%
	Total life cycle used	40 years
Total life cycle cost		**$510,000,000**

* The annual O&M costs shown for the plant expansions would be incurred in addition to the ITP's current annual O&M budget of $14.3 million, or about $1.57 per 1,000 gallons treated.

Table 4-2. Cost Estimate for Sub-Project 1 (50 MGD ITP Expansion)

Category	Item	Estimated Cost
Capital costs	Equipment/material	$45,600,000
	Construction costs	$96,800,000
	Indirect costs	$157,000,000
	Total capital cost	**$299,000,000**
	Total capital cost per gallon treated per day	**$11.96**
O&M	Personnel	$4,300,000
	Energy	$3,800,000
	Materials	$1,800,000
	Monitoring	$300,000
	Maintenance	$500,000
	Annual O&M costs*	**$10,700,000**
	Total annual O&M cost per 1,000 gallons treated*	**$1.17**
Major upgrade at 20 years	New pumps, blowers, screens, clarifier mechanisms, etc.	$80,000,000
Life cycle factors	Interest rate	3%
	Inflation rate	2%
	Total life cycle used	40 years
Total life cycle cost		**$700,000,000**

* The annual O&M costs shown for the plant expansions would be incurred in addition to the ITP's current annual O&M budget of $14.3 million, or about $1.57 per 1,000 gallons treated.

Table 4-3. Cost Estimate for Sub-Project 1 (55 MGD ITP Expansion)

Category	Item	Estimated Cost
Capital costs	Equipment/material	$51,900,000
	Construction costs	$116,000,000
	Indirect costs	$185,000,000
	Total capital cost	**$353,000,000**
	Total capital cost per gallon treated per day	**$11.77**
O&M	Personnel	$5,200,000
	Energy	$4,600,000
	Materials	$2,300,000
	Monitoring	$450,000
	Maintenance	$750,000
	Annual O&M costs*	**$13,300,000**
	Total annual O&M cost per 1,000 gallons treated*	**$1.22**
Major upgrade at 20 years	New pumps, blowers, screens, clarifier mechanisms, etc.	$90,000,000
Life cycle factors	Interest rate	3%
	Inflation rate	2%
	Total life cycle used	40 years
Total life cycle cost		**$860,000,000**

* The annual O&M costs shown for the plant expansions would be incurred in addition to the ITP's current annual O&M budget of $14.3 million, or about $1.57 per 1,000 gallons treated.

Table 4-4. Cost Estimate for Sub-Project 1 (60 MGD ITP Expansion)

Category	Item	Estimated Cost
Capital costs	Equipment/material	$55,000,000
	Construction costs	$122,000,000
	Indirect costs	$195,000,000
	Total capital cost	**$372,000,000**
	Total capital cost per gallon treated per day	**$10.63**
O&M	Personnel	$5,800,000
	Energy	$5,100,000
	Materials	$2,500,000
	Monitoring	$500,000
	Maintenance	$800,000
	Annual O&M costs*	**$14,700,000**
	Total annual O&M cost per 1,000 gallons treated per day*	**$1.15**
Major upgrade at 20 years	New pumps, blowers, screens, clarifier mechanisms, etc.	$100,000,000
Life cycle factors	Interest rate	3%
	Inflation rate	2%
	Total life cycle used	40 years
Total life cycle cost		**$940,000,000**

* The annual O&M costs shown for the plant expansions would be incurred in addition to the ITP's current annual O&M budget of $14.3 million, or about $1.57 per 1,000 gallons treated.

Table 4-5. Cost Estimate for Sub-Project 2: Construct a Pump Station and Force Main to Convey Treated Effluent from the Expanded ITP to Mexico

Category	Item	Estimated Cost
Capital costs	Equipment/material	$2,800,000
	Construction costs	$3,100,000
	Indirect costs (engineering, project administration, general contingency)	$6,500,000
	Total capital cost	**$12,400,000**
O&M	Personnel	$50,000
	Energy	$200,000
	Trash collection and disposal	$50,000
	Maintenance	$50,000
	Annual O&M costs	**$350,000**
Life cycle factors	Interest rate	3%
	Inflation rate	2%
	Total life cycle used	40 years
Total life cycle cost		**$26,000,000**

Table 4-6. Cost Estimate for Sub-Project 3: Construct a Pipeline in the U.S. to Replace a Portion of the International Collector

Category	Item	Estimated Cost
Capital costs	Equipment/material	$1,800,000
	Construction costs	$4,900,000
	Indirect costs (engineering, project administration, general contingency)	$7,400,000
	Total capital cost	**$14,100,000**
O&M	Personnel	$100,000
	Maintenance	$100,000
	Materials	$100,000
	Annual O&M costs	**$300,000**
Major upgrade at 20 years	Major maintenance or section replacement	$6,000,000
Life cycle factors	Interest rate	3%
	Inflation rate	2%
	Total life cycle used	40 years
Total life cycle cost		**$28,900,000**

In comparison to PG's sub-project 4 cost estimate, NADB et al. (2020) present the following preferred alternatives and capital cost estimates.

- Rehabilitation of the International Collector using a spiral PVC liner (see *Alternative 3*): $179 million Mexican pesos (MXN), about $9.1 million U.S. dollars (USD).
- U.S.-side diversion line necessary for completing the rehabilitation (see *Trazo-1*): $81 million MXN, about $4.1 million USD.[2]

[2] NADB et al. (2020) do not provide the basis for this cost estimate (pipe material, pipe diameter, pipe depth, pipe length, administrative and construction contingencies, etc.).

5. DISCUSSION

5.1 Feasibility

Currently, flows from the International Collector include Tijuana River water that is diverted at PB-CILA. PG evaluated the feasibility impacts and costs associated with Project 3 assuming that the river water will no longer flow into the International Collector because PB1-A and PB1-B would be able to handle the reduced flow rates. However, this feasibility analysis does not evaluate any infrastructure upgrades in Mexico needed to accomplish this. IBWC must coordinate with Mexican authorities to ensure that the PB-CILA discharge is not directed to the ITP. The design considerations, estimated performance, and implementation feasibility of Project 3 may be affected if river water continues to flow into the International Collector.

5.1.1 Sub-Project 1: Expand the ITP

Expanding the ITP to a design treatment capacity (average daily flow) of 40 MGD will enable the plant to treat all wastewater in the International Collector and wastewater that will be collected by the rehabilitated sewer collectors in Tijuana. However, the 40 MGD plant will have minimal if any reserve capacity for future population growth.

Expanding the ITP to treat an average daily flow of 50 MGD will enable it to treat all wastewater in the International Collector, and additional wastewater that will be collected by rehabilitating targeted sewer collectors in Tijuana. The 50 MGD plant is expected to have capacity for current and projected wastewater flows in Tijuana through 2030.

Increasing ITP capacity to treat an average daily flow of 55 MGD will enable it to treat all the wastewater in the International Collector, wastewater that will be collected by the rehabilitated collection system in Tijuana, and wastewater collected at the Mexican canyon pump stations. The 55 MGD plant is expected to have capacity for current and projected wastewater flows in Tijuana through 2050 (with no reserve capacity).

Expanding the ITP to treat an average daily flow of 60 MGD will enable it to treat all the wastewater in the International Collector, wastewater that will be collected by the repaired and improved collection system in Tijuana, and wastewater collected at the Mexican canyon pump stations. The 60 MGD plant is expected to have capacity for current and projected wastewater flows in Tijuana through 2050 (with about 5 MGD of reserve capacity).

Available land area at the ITP site appears to be sufficient to accommodate the new treatment units for each of the four design options of sub-project 1. The expanded liquid and solids treatment processes (four design options), as described in Section 2.1, are expected to be capable of consistently treating the new design flow rates to secondary treatment quality. 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 1.

Incorporating anaerobic digestion into the ITP treatment process will increase the complexity of plant operations but will significantly reduce the solids that must be dewatered and disposed of. If anaerobic digestion is implemented, air pollution control equipment such as selective catalytic reduction likely will be needed. If anaerobic digesters are not incorporated into the final design, the challenge of managing and disposing of solids from the expanded treatment process will be exacerbated. Without anaerobic digestion, the quantity of dewatered sludge will increase by approximately 65% (40 MGD design), 100% (50 MGD design), 120% (55 MGD design), or 135% (60

MGD design). 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.

5.1.2 Sub-Project 2: Construct a Pump Station and Force Main to Convey Treated Effluent from the Expanded ITP to Mexico

PG found that a new pump station and force main can be constructed to convey treated effluent from the expanded ITP to the wet well of PB1-B in Mexico, as described in Section 2.2. The new pump station and force main would allow effluent from the ITP to be reused in the future. PG's evaluation was limited to returning the effluent to PB1-B. Mexican entities would be responsible for implementing a reuse plan for the effluent once it reaches PB1-B. The primary benefits of implementing sub-project 2 are providing a source of reclaimed water to be used in Mexico and reducing the volume of effluent discharged at the SBOO.

5.1.3 Sub-Project 3: Construct a Pipeline in the U.S. to Replace a Portion of the International Collector

As shown in the cost impact analysis, PG anticipates that the new pipeline can be constructed for a similar capital cost as rehabilitating the existing International Collector, as estimated by NADB et al. (2020). Challenges with constructing, operating, and maintaining the new pipeline may be complicated by the existing configuration and depth of Junction Box 1, the existing access road along the border, and the new pipeline's location in the floodplain. Constructing the new pipeline is expected to eliminate spills of untreated wastewater from the International Collector into Stewart's Drain. Other potential benefits include more efficient transport of wastewater from Tijuana to the ITP (less spillage in Tijuana) and easier pipeline maintenance. Additionally, constructing a new pipeline in the U.S. will cause fewer traffic delays and other disruptions in Tijuana than would occur from rehabilitating the existing International Collector.

5.2 Other Stakeholder Information

On the Mexican side of the border, implementation of Project 3 will reduce cost and maintenance requirements. The project reduces maintenance burdens by eliminating the need for pumping at PB1-B (unless sub-project 2 is implemented), so the pump station can be decommissioned. The O&M burden at the SABTP will also be reduced, as the SABTP will be receiving less flow.

Based on information obtained during the technical expert consultation process, the collection system infrastructure in Mexico must be upgraded to ensure efficient transport of wastewater to the ITP 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. USMCA Project 5 also includes sewer rehabilitation projects in Tijuana. However, when the Project 3 feasibility analysis was conducted, project implementation timelines for collection system improvements in Mexico remained unclear.

6. CONCLUSION

PG has determined that all three sub-projects of Project 3 are feasible to construct as described in the proposed designs presented in this report. The available land area at the ITP will enable the plant to be expanded to any of the four proposed design daily average flow capacities. The available land area at the plant is expected to accommodate a new APTP (Project 1 or 2) in addition to the expanded ITP.

Expanding the ITP (sub-project 1) is expected to provide significant reductions in the amount of untreated wastewater discharged to the Pacific Ocean via SAB Creek. As shown by the Scripps model, this can be expected to improve water quality along the U.S. Pacific coastline and reduce the amount of time that beaches must close due to bacterial contamination. The estimated capital costs for the 40 MGD, 50 MGD, 55 MGD, and 60 MGD plant expansions are $227 million, $299 million, $353 million, and $372 million, respectively. IBWC is expected to be continue being responsible for owning and operating the ITP, which will require significantly more staff and annual budget than it currently does.

Currently, the ITP experiences challenges related to the availability of trucks and drivers for solids disposal. For this reason, implementing anaerobic digestion to reduce the volume of solids produced at the plant will be a critical component of expanding the plant. Information available to PG and ERG has indicated that state and local air regulations will not prohibit anaerobic digesters at the expanded plant. If anaerobic digesters are not included in the final design, expanding the plant may become infeasible due to the increased volumes of solids to be handled and disposed of.

Sub-projects 2 and 3, if implemented, are not expected to provide significant water quality benefits in addition to the plant expansion, but they are expected to provide other benefits. Constructing a pump station and force main to return treated effluent from the ITP to PB1-B (sub-project 2) will provide Mexico with a source of reclaimed water while also reducing the flow of effluent discharged out the SBOO. Constructing a new pipeline in the U.S. to replace a portion of the International Collector will enable easier maintenance of the pipeline and prevent spillage of untreated wastewater. The estimated capital costs for sub-projects 2 and 3 are $12.4 million and $14.1 million, respectively.

7. SUGGESTED NEXT STEPS

Four actions would improve the Project 3 feasibility analysis, reduce uncertainty, and confirm the validity of assumptions described above:

- Perform additional SBOO plume dispersion modeling (if necessary, per consultation with the National Marine Fisheries Service) to more fully characterize the potential marine impacts of discharging more effluent.
- Perform a more detailed emissions engineering assessment to identify appropriate emissions controls (e.g., selective catalytic reduction) and confirm whether a conformity determination under the General Conformity Rule is required, which could trigger the need for emissions offsets.
- Confirm the presence or absence of lateral connections into the portion of the International Collector to be replaced under sub-project 3 to determine whether the cost estimate should be revised to include extending lateral connections from the existing pipeline under the border and into the new pipeline.

8. REFERENCES

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APPENDIX A: Itemized Cost Impact Analysis

Project 3, Sub-project 1: Increase ITP Average Daily Design Flow Rate to 40 MGD - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Influent Pumping	1	each	$6,000,000	$6,000,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Screens	1	each	$1,200,000	$1,200,000	EPA cost curves, ENR adjusted, and BPJ
	Chemical Addition	1	each	$120,000	$120,000	EPA cost curves, ENR adjusted, and BPJ
	Advanced Primary Settling Tanks	1	each	$1,700,000	$1,700,000	EPA cost curves, ENR adjusted, and BPJ
	Bioreactors (includes blowers)	1	each	$5,400,000	$5,400,000	EPA cost curves, ENR adjusted, and BPJ
	Secondary Settling Tanks	1	each	$4,100,000	$4,100,000	EPA cost curves, ENR adjusted, and BPJ
	Mixed Liquor Return Pumping	1	each	$3,400,000	$3,400,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Storage	1	each	$500,000	$500,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Thickening	1	each	$460,000	$460,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Dewatering	1	each	$725,000	$725,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Processing Odor Control	1	each	$1,150,000	$1,150,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Pumping	1	each	$3,900,000	$3,900,000	EPA cost curves, ENR adjusted, and BPJ
	Anaerobic Digestors	1	each	$3,300,000	$3,300,000	EPA cost curves, ENR adjusted, and BPJ
	Allowance for Unquantified Line Items	5%			$4,368,750.00	5% of equipment/materials and construction line items
	Total Equipment/Materials Costs				**$36,300,000.00**	
Construction Costs	Influent Pumping	1	each	$4,000,000	$4,000,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Screens	1	each	$1,800,000	$1,800,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Odor Control	1	each	$850,000	$850,000	EPA cost curves, ENR adjusted, and BPJ
	Chemical Addition	1	each	$120,000	$120,000	EPA cost curves, ENR adjusted, and BPJ
	Advanced Primary Settling Tanks	1	each	$2,300,000	$2,300,000	EPA cost curves, ENR adjusted, and BPJ
	Bioreactors (includes blowers)	1	each	$9,000,000	$9,000,000	EPA cost curves, ENR adjusted, and BPJ
	Secondary Settling Tanks	1	each	$6,800,000	$6,800,000	EPA cost curves, ENR adjusted, and BPJ
	Mixed Liquor Return Pumping	1	each	$1,800,000	$1,800,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Storage	1	each	$1,200,000	$1,200,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Thickening	1	each	$680,000	$680,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Dewatering	1	each	$485,000	$485,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Processing Odor Control	1	each	$730,000	$730,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Pumping	1	each	$2,200,000	$2,200,000	EPA cost curves, ENR adjusted, and BPJ
	Anaerobic Digestors	1	each	$5,200,000	$5,200,000	EPA cost curves, ENR adjusted, and BPJ
	Site Improvements	1	each	$2,900,000	$2,900,000	EPA Manual CD-53, 1980, ENR adjusted
	Misc. Metals	1	each	$1,800,000	$1,800,000	EPA Manual CD-53, 1980, ENR adjusted
	Piping	1	each	$5,800,000	$5,800,000	EPA Manual CD-53, 1980, ENR adjusted
	Electrical	1	each	$4,600,000	$4,600,000	EPA Manual CD-53, 1980, ENR adjusted
	Controls	1	each	$1,800,000	$1,800,000	EPA Manual CD-53, 1980, ENR adjusted
	Shop & Garage Facilities	1	each	$460,000	$460,000	allowance to expand existing ITP facilities
	Laboratories	1	each	$385,000	$385,000	allowance to expand existing ITP facilities
	Controls & SCADA Building	1	each	$510,000	$510,000	allowance to expand existing ITP facilities
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$16,626,000	
	Total Construction Costs				**$72,000,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$108,300,000	
	Engineer and Administration, 40% of Subtotal	40%			$43,320,000	
	Subtotal (With Engineering)				$151,620,000	
	Contingency 50%	50%			$75,810,000	
	Total Indirect Costs				**$119,000,000**	
	Total Capital Costs				**$227,000,000**	
O&M Costs	Personnel				$3,200,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Energy				$2,500,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Materials				$1,200,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Monitoring				$180,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Maintenance				$320,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Total Annual O&M Costs (40 MGD)				**$7,400,000**	
	Total Capital Cost				$227,000,000	
	Annual O&M Costs				$7,400,000	
	Service Life				40	

	Present Value of Service Life O&M	$232,123,844	
Life Cycle Cost	Major Upgrade(s) Cost at 20 years	$60,000,000	new pumps, blowers, screens, clarifier mechanisms, etc.
	Present Value of Major Upgrade(s)	$49,172,668	
	Interest Rate	3%	
	Inflation Rate	2%	
	Location Adjustment Factor	1.0	United States
	Total Life Cycle Cost (40 MGD)	**$510,000,000**	

Project 3, Sub-project 1: Increase ITP Average Daily Design Flow Rate to 50 MGD - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Influent Pumping	1	each	$6,000,000	$6,000,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Screens	1	each	$1,200,000	$1,200,000	EPA cost curves, ENR adjusted, and BPJ
	Chemical Addition	1	each	$150,000	$150,000	EPA cost curves, ENR adjusted, and BPJ
	Advanced Primary Settling Tanks	1	each	$2,500,000	$2,500,000	EPA cost curves, ENR adjusted, and BPJ
	Bioreactors (includes blowers)	1	each	$7,000,000	$7,000,000	EPA cost curves, ENR adjusted, and BPJ
	Secondary Settling Tanks	1	each	$6,000,000	$6,000,000	EPA cost curves, ENR adjusted, and BPJ
	Mixed Liquor Return Pumping	1	each	$4,780,000	$4,780,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Storage	1	each	$500,000	$500,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Thickening	1	each	$600,000	$600,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Dewatering	1	each	$450,000	$450,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Processing Odor Control	1	each	$1,500,000	$1,500,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Pumping	1	each	$5,200,000	$5,200,000	EPA cost curves, ENR adjusted, and BPJ
	Anaerobic Digestors	1	each	$4,000,000	$4,000,000	EPA cost curves, ENR adjusted, and BPJ
	Allowance for Unquantified Line Items	5%			$5,717,500	5% of equipment/materials and construction line items
	Total Equipment/Materials Costs				**$45,600,000**	
Construction Costs	Influent Pumping	1	each	$4,000,000	$4,000,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Screens	1	each	$1,800,000	$1,800,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Odor Control	1	each	$1,000,000	$1,000,000	EPA cost curves, ENR adjusted, and BPJ
	Chemical Addition	1	each	$150,000	$150,000	EPA cost curves, ENR adjusted, and BPJ
	Advanced Primary Settling Tanks	1	each	$3,300,000	$3,300,000	EPA cost curves, ENR adjusted, and BPJ
	Bioreactors (includes blowers)	1	each	$12,000,000	$12,000,000	EPA cost curves, ENR adjusted, and BPJ
	Secondary Settling Tanks	1	each	$10,000,000	$10,000,000	EPA cost curves, ENR adjusted, and BPJ
	Mixed Liquor Return Pumping	1	each	$2,570,000	$2,570,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Storage	1	each	$1,200,000	$1,200,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Thickening	1	each	$900,000	$900,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Dewatering	1	each	$300,000	$300,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Processing Odor Control	1	each	$1,000,000	$1,000,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Pumping	1	each	$3,000,000	$3,000,000	EPA cost curves, ENR adjusted, and BPJ
	Anaerobic Digestors	1	each	$6,200,000	$6,200,000	EPA cost curves, ENR adjusted, and BPJ
	Site Improvements	1	each	$4,300,000	$4,300,000	EPA Manual CD-53, 1980, ENR adjusted
	Misc. Metals	1	each	$2,600,000	$2,600,000	EPA Manual CD-53, 1980, ENR adjusted
	Piping	1	each	$8,700,000	$8,700,000	EPA Manual CD-53, 1980, ENR adjusted
	Electrical	1	each	$6,900,000	$6,900,000	EPA Manual CD-53, 1980, ENR adjusted
	Controls	1	each	$2,700,000	$2,700,000	EPA Manual CD-53, 1980, ENR adjusted
	Shop & Garage Facilities	1	each	$675,000	$675,000	Allowance to expand existing ITP facilities
	Laboratories	1	each	$500,000	$500,000	Allowance to expand existing ITP facilities
	Controls & SCADA Building	1	each	$675,000	$675,000	Allowance to expand existing ITP facilities
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$22,341,000	
	Total Construction Costs				**$96,800,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$142,400,000	
	Engineer and Administration, 40% of Subtotal		40%		$56,960,000	
	Subtotal (With Engineering)				$199,360,000	
	Contingency 50%		50%		$99,680,000	
	Total Indirect Costs				**$157,000,000**	
	Total Capital Costs				**$299,000,000**	
O&M Costs	Personnel				$4,300,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Energy				$3,800,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Materials				$1,800,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Monitoring				$300,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Maintenance				$500,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Total Annual O&M Costs (50 MGD)				**$10,700,000**	
	Total Capital Cost				$299,000,000	

	Annual O&M Costs	$10,700,000	
	Service Life	40	
	Present Value of Service Life O&M	$335,638,531	
Life Cycle Cost	Major Upgrade(s) Cost at 20 years	$80,000,000	New pumps, blowers, screens, clarifier mechanisms, etc.
	Present Value of Major Upgrade(s)	$65,563,558	
	Interest Rate	3%	
	Inflation Rate	2%	
	Location Adjustment Factor	1.0	United States
	Total Life Cycle Cost	**$700,000,000**	

Project 3, Sub-project 1: Increase ITP Average Daily Design Flow Rate to 55 MGD - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Influent Pumping	1	each	$7,000,000	$7,000,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Screens	1	each	$1,200,000	$1,200,000	EPA cost curves, ENR adjusted, and BPJ
	Chemical Addition	1	each	$150,000	$150,000	EPA cost curves, ENR adjusted, and BPJ
	Advanced Primary Settling Tanks	1	each	$2,750,000	$2,750,000	EPA cost curves, ENR adjusted, and BPJ
	Bioreactors	1	each	$7,300,000	$7,300,000	EPA cost curves, ENR adjusted, and BPJ
	Secondary Settling Tanks	1	each	$5,600,000	$5,600,000	EPA cost curves, ENR adjusted, and BPJ
	Mixed Liquor Return Pumping	1	each	$6,500,000	$6,500,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Storage	1	each	$800,000	$800,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Thickening	1	each	$1,050,000	$1,050,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Dewatering	1	each	$1,000,000	$1,000,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Processing Odor Control	1	each	$2,000,000	$2,000,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Pumping	1	each	$6,100,000	$6,100,000	EPA cost curves, ENR adjusted, and BPJ
	Anaerobic Digestors	1	each	$3,750,000	$3,750,000	EPA cost curves, ENR adjusted, and BPJ
	Allowance for Unquantified Line Items	5%			$6,708,250.00	5% of equipment/materials and construction line items
	Total Equipment/Materials Costs				**$51,900,000.00**	
Construction Costs	Influent Pumping	1	each	$5,500,000	$5,500,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Screens	1	each	$1,800,000	$1,800,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Odor Control	1	each	$1,000,000	$1,000,000	EPA cost curves, ENR adjusted, and BPJ
	Chemical Addition	1	each	$150,000	$150,000	EPA cost curves, ENR adjusted, and BPJ
	Advanced Primary Settling Tanks	1	each	$3,950,000	$3,950,000	EPA cost curves, ENR adjusted, and BPJ
	Bioreactors	1	each	$14,900,000	$14,900,000	EPA cost curves, ENR adjusted, and BPJ
	Secondary Settling Tanks	1	each	$9,300,000	$9,300,000	EPA cost curves, ENR adjusted, and BPJ
	Mixed Liquor Return Pumping	1	each	$3,900,000	$3,900,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Storage	1	each	$1,800,000	$1,800,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Thickening	1	each	$1,700,000	$1,700,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Dewatering	1	each	$750,000	$750,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Processing Odor Control	1	each	$1,400,000	$1,400,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Pumping	1	each	$3,400,000	$3,400,000	EPA cost curves, ENR adjusted, and BPJ
	Anaerobic Digestors	1	each	$7,500,000	$7,500,000	EPA cost curves, ENR adjusted, and BPJ
	Site Improvements	1	each	$5,200,000	$5,200,000	EPA Manual CD-53, 1980, ENR adjusted
	Misc. Metals	1	each	$3,100,000	$3,100,000	EPA Manual CD-53, 1980, ENR adjusted
	Piping	1	each	$10,200,000	$10,200,000	EPA Manual CD-53, 1980, ENR adjusted
	Electrical	1	each	$8,100,000	$8,100,000	EPA Manual CD-53, 1980, ENR adjusted
	Controls	1	each	$3,300,000	$3,300,000	EPA Manual CD-53, 1980, ENR adjusted
	Shop & Garage Facilities	1	each	$700,000	$700,000	allowance to expand existing ITP facilities
	Laboratories	1	each	$565,000	$565,000	allowance to expand existing ITP facilities
	Controls & SCADA Building	1	each	$750,000	$750,000	allowance to expand existing ITP facilities
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$26,689,500	
	Total Construction Costs				**$116,000,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$167,900,000	
	Engineer and Administration, 40% of Subtotal		40%		$67,160,000	
	Subtotal (With Engineering)				$235,060,000	
	Contingency 50%		50%		$117,530,000	
	Total Indirect Costs				**$185,000,000**	
	Total Capital Costs				**$353,000,000**	
O&M Costs	Personnel				$5,200,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Energy				$4,600,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Materials				$2,300,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Monitoring				$450,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Maintenance				$750,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Total Annual O&M Costs				**$13,300,000**	
	Total Capital Cost				$353,000,000	
	Annual O&M Costs (incremental costs)				$13,300,000	

	Service Life	40	
	Present Value of Service Life O&M	$436,833,008	
Life Cycle Cost	Major Upgrade(s) Cost	$90,000,000	new pumps, blowers, screens, clarifier mechanisms
	Present Value of Major Upgrade(s)	$73,759,002	
	Interest Rate	3%	
	Inflation Rate	2%	
	Location Adjustment Factor	1.0	United States
	Total Life Cycle Cost	**$860,000,000**	

Project 3, Sub-project 1: Increase ITP Average Daily Design Flow Rate to 60 MGD - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Influent Pumping	1	each	$7,000,000	$7,000,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Screens	1	each	$1,200,000	$1,200,000	EPA cost curves, ENR adjusted, and BPJ
	Chemical Addition	1	each	$150,000	$150,000	EPA cost curves, ENR adjusted, and BPJ
	Advanced Primary Settling Tanks	1	each	$3,000,000	$3,000,000	EPA cost curves, ENR adjusted, and BPJ
	Bioreactors (includes blowers)	1	each	$8,000,000	$8,000,000	EPA cost curves, ENR adjusted, and BPJ
	Secondary Settling Tanks	1	each	$6,000,000	$6,000,000	EPA cost curves, ENR adjusted, and BPJ
	Mixed Liquor Return Pumping	1	each	$6,800,000	$6,800,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Storage	1	each	$800,000	$800,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Thickening	1	each	$1,200,000	$1,200,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Dewatering	1	each	$1,000,000	$1,000,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Processing Odor Control	1	each	$2,200,000	$2,200,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Pumping	1	each	$6,600,000	$6,600,000	EPA cost curves, ENR adjusted, and BPJ
	Anaerobic Digestors	1	each	$4,000,000	$4,000,000	EPA cost curves, ENR adjusted, and BPJ
	Allowance for Unquantified Line Items	5%			$7,097,500	5% of equipment/materials and construction line items
	Total Equipment/Materials Costs				**$55,000,000**	
Construction Costs	Influent Pumping	1	each	$5,500,000	$5,500,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Screens	1	each	$1,800,000	$1,800,000	EPA cost curves, ENR adjusted, and BPJ
	Headworks - Odor Control	1	each	$1,000,000	$1,000,000	EPA cost curves, ENR adjusted, and BPJ
	Chemical Addition	1	each	$150,000	$150,000	EPA cost curves, ENR adjusted, and BPJ
	Advanced Primary Settling Tanks	1	each	$4,200,000	$4,200,000	EPA cost curves, ENR adjusted, and BPJ
	Bioreactors (includes blowers)	1	each	$16,000,000	$16,000,000	EPA cost curves, ENR adjusted, and BPJ
	Secondary Settling Tanks	1	each	$10,000,000	$10,000,000	EPA cost curves, ENR adjusted, and BPJ
	Mixed Liquor Return Pumping	1	each	$4,100,000	$4,100,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Storage	1	each	$1,800,000	$1,800,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Thickening	1	each	$1,800,000	$1,800,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Dewatering	1	each	$750,000	$750,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Processing Odor Control	1	each	$1,500,000	$1,500,000	EPA cost curves, ENR adjusted, and BPJ
	Sludge Pumping	1	each	$3,600,000	$3,600,000	EPA cost curves, ENR adjusted, and BPJ
	Anaerobic Digestors	1	each	$8,000,000	$8,000,000	EPA cost curves, ENR adjusted, and BPJ
	Site Improvements	1	each	$5,500,000	$5,500,000	EPA Manual CD-53, 1980, ENR adjusted
	Misc. Metals	1	each	$3,250,000	$3,250,000	EPA Manual CD-53, 1980, ENR adjusted
	Piping	1	each	$10,800,000	$10,800,000	EPA Manual CD-53, 1980, ENR adjusted
	Electrical	1	each	$8,600,000	$8,600,000	EPA Manual CD-53, 1980, ENR adjusted
	Controls	1	each	$3,500,000	$3,500,000	EPA Manual CD-53, 1980, ENR adjusted
	Shop & Garage Facilities	1	each	$750,000	$750,000	Allowance to expand existing ITP facilities
	Laboratories	1	each	$600,000	$600,000	Allowance to expand existing ITP facilities
	Controls & SCADA Building	1	each	$800,000	$800,000	Allowance to expand existing ITP facilities
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$28,200,000	
	Total Construction Costs				**$122,000,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$177,000,000	
	Engineer and Administration, 40% of Subtotal		40%		$70,800,000	
	Subtotal (With Engineering)				$247,800,000	
	Contingency 50%		50%		$123,900,000	
	Total Indirect Costs				**$195,000,000**	
	Total Capital Costs				**$372,000,000**	
O&M Costs	Personnel				$5,800,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Energy				$5,100,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Materials				$2,500,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Monitoring				$500,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Maintenance				$800,000	2020 SBWRP budget information, EPA Manual CD-53, 1980
	Total Annual O&M Costs				**$14,700,000**	
	Total Capital Cost				$372,000,000	

	Annual O&M Costs	$14,700,000	
	Service Life	40	
	Present Value of Service Life O&M	$482,815,430	
Life Cycle Cost	Major Upgrade(s) Cost	$100,000,000	New pumps, blowers, screens, clarifier mechanisms
	Present Value of Major Upgrade(s)	$81,954,447	
	Interest Rate	3%	
	Inflation Rate	2%	
	Location Adjustment Factor	1.0	United States
	Total Life Cycle Cost	**$940,000,000**	

Project 3, Sub-project 2: Convey Effluent to Mexico - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Pumping Equipment				$2,000,000	Capdet; ENR adjusted
	42-inch CCFRPM force main	2,500	ft	$175	$437,500	PG Unit Price Summary
	Intermediate Pipeline Controls (pressure relief valves)	4	each	$40,000	$160,000	PG Unit Price Summary
	Allowance for Unqualified Line Items	5%			$250,125	5% of equipment/materials and construction line items
	Total Equipment/Materials Costs				**$2,800,000**	
Construction Costs	42-inch CCFRPM force main - open cut, unpaved	2,200	ft.	$200	$440,000	PG Unit Price Summary
	42-inch CCFRPM force main - microtunnel	300	ft.	$1,750	$525,000	PG Unit Price Summary
	Intermediate Pipeline Controls (pressure relief valves)	4	each	$60,000	$240,000	PG Unit Price Summary
	Pump Station Structure (eathwork, concrete work, building)				$1,200,000	Capdet; ENR adjusted
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$721,500	
	Total Construction Costs				**$3,100,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$5,900,000	
	Engineer and Administrative Contingency, 40% of subtotal	40%			$2,360,000	
	Subtotal (With Engineering)				$8,260,000	
	Contingency 50%	50%			$4,130,000	
	Total Indirect Costs				**$6,500,000**	
	Total Capital Costs				**$12,400,000**	
O&M Costs	Personnel				$50,000	Capdet; ENR adjusted
	Energy				$200,000	Capdet; ENR adjusted
	Materials				$50,000	Capdet; ENR adjusted
	Maintenance				$50,000	Capdet; ENR adjusted
	Total Annual O&M Costs				**$350,000**	
Life Cycle Cost	Total Capital Cost				$12,400,000	
	Annual O&M Costs				$350,000	
	Service Life				40	
	Present Value of Service Life O&M				$11,500,000	
	Major Upgrade(s) Cost				$2,000,000	New pumps at 20 years
	Present Value of Major Upgrade(s)				$1,639,089	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$26,000,000**	

Project 3, Sub-project 3: Partially Relocate International Collector - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs						
	CCFRPM 72-in	5,200	ft.	$ 350	1,820,000	PG Unit Price Summary
	Total Equipment/Materials Costs				**$1,800,000**	
Construction Costs	CCFRPM 72-in	5,200		$ 650	$3,380,000	PG Unit Price Summary
	Concrete Fill for Abandoned Pipe	3,630	cu. Yd.	$ 100	$362,963	PG Unit Price Summary
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$1,122,889	
	Total Construction Costs				**$4,900,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$6,700,000	
	Engineer and Administration, 40% of Subtotal	40%			$2,680,000	
	Subtotal (With Engineering)				$9,380,000	
	Contingency 50%	50%			$4,690,000	
	Total Indirect Costs				**$7,400,000**	
	Total Capital Costs				**$14,100,000**	
O&M Costs	Personnel				$100,000	Labor allowance
	Energy				$0	
	Materials				$100,000	Materials allowance
	Monitoring				$0	
	Maintenance				$100,000	Maintenance allowance
	Total Annual O&M Costs				**$300,000**	
Life Cycle Cost	Total Capital Cost				$14,100,000	
	Annual O&M Costs				$300,000	
	Service Life				40	
	Present Value of Service Life O&M				$9,900,000	
	Major Upgrade(s) Cost				$6,000,000	Major maintenance or section replacement
	Present Value of Major Upgrade(s)				$4,917,267	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$28,900,000**	