Feasibility Analysis for Project 4: Shift Wastewater Treatment of Canyon Flows to U.S. (via Expanded ITP or SBWRP) to Reduce Flows to SAB

Technical Memorandum

USMCA Mitigation of Contaminated Tijuana Transboundary Flows Project

Prepared for:

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

BOD_5	amount of oxygen consumed by microorganisms within five days
CESPT	Comisión Estatal de Servicios Públicos de Tijuana
EID	Environmental Impact Document
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
HDPE	high-density polyethylene
IBWC	International Boundary and Water Commission
ITP	South Bay International Wastewater Treatment Plant
MGD	million gallons per day
mg/L	milligrams per liter
NADB	North American Development Bank
PB1-A	Pump Station 1-A
PB1-B	Pump Station 1-B
PB-CILA	CILA Pump Station
PVC	polyvinyl chloride
SAB	San Antonio de los Buenos
SABTP	San Antonio de los Buenos Wastewater Treatment Plant
SBWRP	South Bay Water Reclamation Plant
TSS	total suspended solids
USMCA	United States–Mexico–Canada Agreement

EXECUTIVE SUMMARY

PG Environmental conducted a feasibility analysis of Project 4, "Shift Wastewater Treatment of Canyon Flows to U.S. (via Expanded ITP or SBWRP) to Reduce Flows to SAB," one of 10 proposed projects identified to mitigate transboundary wastewater flows in the Tijuana River watershed under the United States–Mexico–Canada Agreement (USMCA). This feasibility analysis report includes an analysis of the technical, economic, and environmental feasibility of the project and builds on past studies and consultation with engaged stakeholders using available data.

The project involves decommissioning the Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations in Mexico and constructing a new gravity pipeline system to convey wastewater collected at the current pump stations to the U.S. for treatment at the ITP (South Bay International Wastewater Treatment Plant) or SBWRP (South Bay Water Reclamation Plant) to reduce the load on the San Antonio de los Buenos Wastewater Treatment Plant (SABTP). The purpose of this project is to protect coastal communities and reduce impacts in the U.S. due to untreated or undertreated sewage discharged from the SABTP that originates in Matadero Canyon (Smuggler's Gulch on the U.S. side of the border) and Los Laureles Canyon (the upper reach of Goat Canyon on the U.S. side of the border). The secondary purpose of this project is to reduce the pooling of untreated wastewater that escapes from the wastewater collection system in Mexico and flows overland to capture facilities in the U.S. to reduce potential health threats to U.S. Customs and Border Protection agents. PG evaluated two individual sub-projects, both developed by PG:

1. **Decommissioning the Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations in Mexico and constructing a new conveyance system** to transport the wastewater flows collected at the current pump stations to the ITP or SBWRP. Building the new conveyance system and decommissioning the existing pump stations was found to be technically feasible and is expected to reduce BOD_5 discharges from SAB Creek to the Pacific Ocean by 25%. The estimated capital cost of the sub-project is $30.8million, and the estimated 40-year life cycle cost is $35.9 million. Decommissioning the pump stations is estimated to save $133,000 in annual O&M and save $5.1 million over the 40-year life cycle. The analysis could be refined with additional flow data for the existing pump stations to better characterize the flow rates.

2. **Upgrading the U.S.-side wastewater collection structures at Smuggler's Gulch and Goat Canyon** to decrease pooling during dry weather. Improving the intake pipes and regrading the U.S.-side collectors to reduce untreated wastewater pooling would reduce the exposure of U.S. Customs and Border Protection agents to untreated sewage that currently pools at the collectors. The estimated capital cost of the sub-project is $435,000, and the estimated 40-year life cycle cost is $600,000.

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

1. INTRODUCTION

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

This feasibility analysis specifically addresses Project 4: "Shift Wastewater Treatment of Canyon Flows to U.S. (via Expanded ITP or SBWRP) to Reduce Flows to SAB." During the analysis, PG consulted with stakeholders and reviewed previous work including the following:

- *Binational Water Quality Study of the Tijuana River and Adjacent Canyons and Drains* (IBWC 2020).
- *Modeling Impacts of Various Wastewater and Stormwater Flow Scenarios on San Diego South Bay and Tijuana Beaches* (Fedderson et al. 2020).
- Pump station flow data collected by the Comisión Estatal de Servicios Públicos de Tijuana (CESPT) and provided to PG by the North American Development Bank (NADB).

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

This report has been revised and finalized from the draft version based on comments and discussions with EPA, and on new information presented to PG. PG is working with EPA to acquire additional information that would enhance this feasibility analysis:

- Additional flow data from the Los Laureles 1 and Los Laureles 2 Pump Stations.
- Water quality data from the canyon collectors.

This information might affect both project feasibility and project costs. (The costs in this report are best estimates, based on information available at the time the report was finalized.)

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

1.1 Project Purpose

The purpose of this project is to protect coastal communities and reduce beach impacts in the U.S. due to untreated or undertreated sewage discharged from the SABTP that originates in Matadero Canyon (Smuggler's Gulch on the U.S. side of the border) and Los Laureles Canyon (the upper reach of Goat Canyon on the U.S. side of the border). This project will also reduce the pooling of untreated wastewater that escapes from the wastewater collection system in Mexico and flows overland to capture facilities in the U.S. to reduce potential health threats to U.S. Customs and Border Protection agents.

1.2 Current Conditions

Matadero Canyon and Los Laureles Canyon are on the west side of the Tijuana metropolitan area. These canyons are natural stormwater drainageways that flow into the U.S. from Mexico. Wastewater from the majority of development across the land area tributary to these canyons is collected and pumped to the SABTP via the Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations. Currently, the SABTP is overloaded and cannot reliably achieve its targeted pollutant reductions. It discharges to the Pacific Ocean via SAB Creek. According to modeling by the Scripps Institute of Oceanography, undertreated or untreated wastewater discharges from SAB Creek are the cause of all beach closures during the dry season (May 22 through September 8) and about one-third of beach closures during the wet season (Fedderson et al. 2020).

Some untreated wastewater also escapes from the existing sanitary sewer systems in Mexico. This wastewater drains to the canyons and flows northward along the canyon thalweg[1] into the U.S. Facilities for collecting the untreated wastewater flowing from the canyons have been constructed in the U.S. However, these structures' current configurations allow wastewater to pool on ground surfaces before entering the conveyance systems that transport it to the South Bay International Wastewater Treatment Plant (ITP) for treatment.

Figure 1-1 provides an overview of the current dry weather flow paths in Mexico.

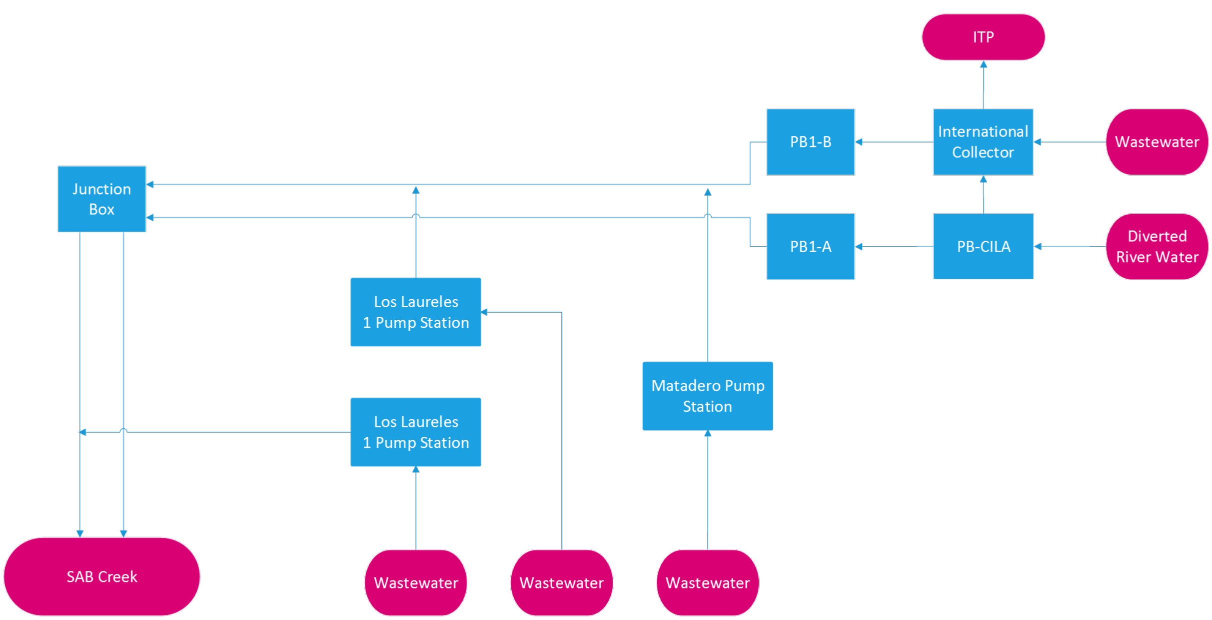

Figure 1-1. Current Flow Diagram of the Canyon Pump Stations

[1] A thalweg is a line connecting the lowest points along the entire length of a valley or river in its downward slope, defining its deepest channel.

Wastewater flows generated in the land area tributary to Matadero Canyon are currently collected at the Matadero Pump Station. This pump station is about 1,700 feet south of the International Highway, as shown in Figure 2-1. The station is designed to convey a peak flow rate of 8.0 MGD. It has a series of five pairs of pumps. The pairs of pumps work in parallel; the station requires two pairs actively working to operate effectively. As of March 2020, two pairs of pumps were operational, two backup pairs were undergoing construction, and one backup pair was being repaired. Flow data obtained from CESPT from January 1, 2016, through December 31, 2019, indicate the average daily flow rate pumped by the El Matadero Pump Station is about 4.5 MGD (Avila 2020).

Wastewater flows generated in the land area tributary to Los Laureles Canyon are collected by the Los Laureles 1 and Los Laureles 2 Pump Stations and are conveyed to the SABTP, as shown in Figure 1-1. Los Laureles 1 is the northernmost pump station and is about 400 feet south of the border, as shown in Figure 2-1. This pump station was designed to convey a peak flow rate of 2.0 MGD. It has three 1.0 MGD pumps. One of these appears to be intended to serve as a redundant standby unit, but that pump was not in service as of March 2020 (Avila 2020). Data for September to November 2020 (provided to PG from CESPT via NADB) indicate that Los Laureles 1 discharged an average of 1.0 MGD over the three-month timespan. Flow data from Los Laureles 1 are limited, and more data are needed for a more accurate estimate of the average flow rate (Avila 2020).

The Los Laureles 2 Pump Station is farther south, about 5,000 feet upstream in the canyon from Los Laureles 1, as shown in Figure 2-1. This second station was designed to convey a peak wastewater flow rate of 2.7 MGD. Los Laureles 2 has four pairs of pumps, each pair apparently designed to handle 0.9 MGD. As of March 2020, three pairs of pumps were operational; no information was available on the operational status of the fourth pair. Data for September to November 2020 (provided to PG from CESPT via NADB) indicated that Los Laureles 2 discharged an average of 0.9 MGD over the three-month timespan. Flow data from Los Laureles 2 Pump Station are limited, and more data are needed for a more accurate estimate of the average flow rate (Avila 2020).

1.3 Major Project Elements Considered

This project involves decommissioning the Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations in Mexico and constructing a new gravity pipeline system to convey wastewater collected at the current pump stations to the U.S. for treatment at the ITP or South Bay Water Reclamation Plant (SBWRP) to reduce the load on the SABTP. The existing pump stations appear to have adequate reserve capacity for future growth, based on a comparison of actual wastewater pumping rates and pump station capacity. Further, recent aerial photography suggests that there is little vacant land for future development in the three stations' service areas. Therefore, for the purposes of this feasibility analysis, PG has assumed that no additional conveyance capacity (beyond the canyon pump stations' current capacities) is needed to accommodate future growth. This project also involves modifying the structures on the U.S. side of the border at Goat Canyon and Smuggler's Gulch to improve collection of wastewater that escapes the canyon sanitary sewer systems. Figure 1-2 illustrates canyon flows upon completion of the proposed project.

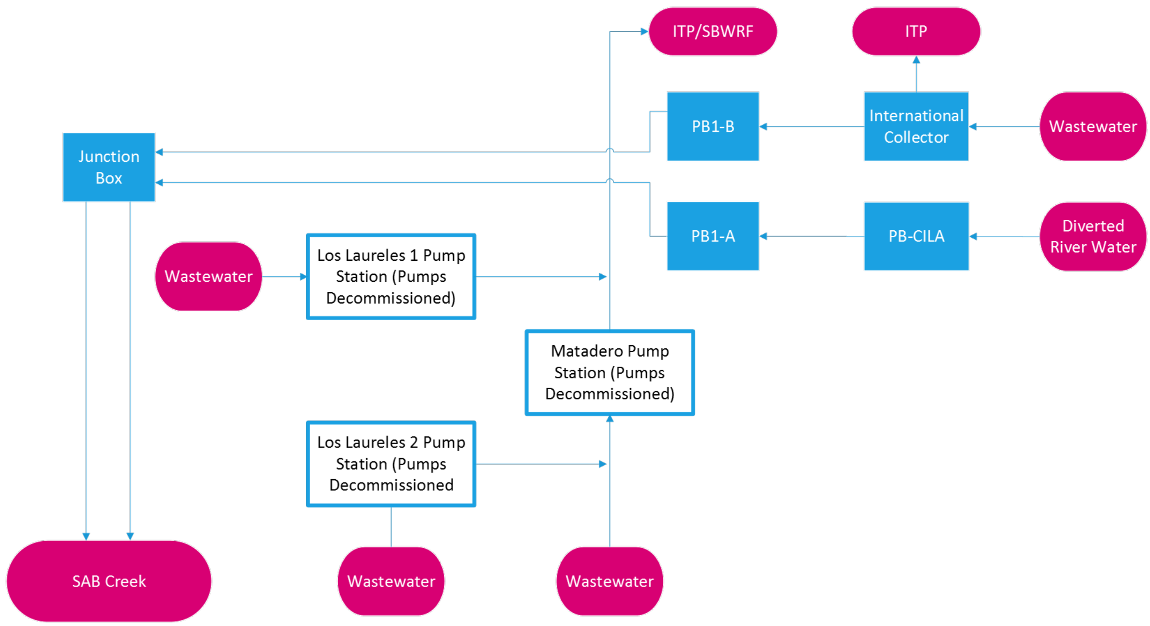

Figure 1-2. Flow Diagram of the Canyon Flows upon Completion of Project 4

PG evaluated the elements of two separate sub-projects:

1. Decommissioning the Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations in Mexico and constructing a new conveyance system (sub-project 1). The new conveyance would transport sanitary wastewater flows via gravity sewers or via new pump stations, force mains, and gravity sewers if required by area topography and/or other site constraints directly to the SBWRP or ITP.

2. Upgrading the U.S.-side wastewater collection structures at Smuggler's Gulch and Goat Canyon to decrease pooling during dry weather (sub-project 2).

As noted above, the new conveyance system conceived under sub-project 1 would transport the sanitary wastewater flows from the sites of the existing pump stations directly to either the ITP or the SBWRP. This project does not include expansion of those facilities to treat these additional flows, since expansion of those facilities is addressed in Projects 3 (for the ITP) and 9 (for the SBWRP).

2. DESIGN INFORMATION

Sections 2.1 and 2.2 describe the design features, engineering issues, and regulatory issues associated with the two sub-projects evaluated. Figure 2-1, on the next page, shows the locations of the Project 4 sub-projects and elements, including relative elevations, their U.S. locations relative to the FEMA 500-year floodplain map, and Mexico locations relative to the 100-year flood map.

2.1 Sub-Project 1: Pump Station Decommissioning and Construction of a New Conveyance System

2.1.1 Design Features

The new conveyance system would transport the wastewater flows from the sites of the existing pump stations to either the ITP or the SBWRP. PG reviewed several possible conveyance system routing alternatives and determined that the system shown in Figure 2-1 is the most practicable because it minimizes environmental disturbance, operational costs, and capital costs. Key to this alternative is building the conveyance pipelines from the Los Laureles 1 and 2 sites to the main conveyance pipeline from the El Matadero site by directional drilling. This approach eliminates the need to build an independent conveyance pipeline from Los Laureles 1 and 2 to either the SBWRP or the ITP. The proposed system is designed to convey current and future flows from the pump stations to either the ITP or the SBWRP using only gravity. Therefore, the pumps at Matadero, Los Laureles 1, and Los Laureles 2 will no longer be needed and can be decommissioned. The proposed system consists of five reaches of pipe, as shown in Figure 2-1:

1. A 15-inch nominal diameter gravity sewer that would flow directly east from the Los Laureles 2 site until it intersects with the sewer running north from the Matadero site. This sewer would be about 2,000 feet long and would pass underneath the high ground between the two canyons. It would be installed by directional drilling.
2. A 15-inch nominal diameter gravity sewer that would flow generally north from the eastern end of the sewer from the Los Laureles 2 site to the Matadero site. This sewer would be about 1,700 feet long, installed using conventional open-cut construction methods.
3. A 21-inch nominal diameter gravity sewer that would flow generally north along Matadero Canyon from the Matadero Pump site until it intersects with the sewer flowing east from the Los Laureles 1 site about 300 feet south of the border. This sewer would be about 3,500 feet long and would carry flows from the Matadero and Los Laureles 2 sites. It would be installed using conventional open-cut construction methods except for about 700 feet passing beneath the International Highway, which would be installed by micro-tunneling.
4. A 15-inch nominal diameter gravity sewer that would flow generally east from the Los Laureles 1 site until it intersects with the sewer carrying flows from the Matadero and Los Laureles 2 sites. This sewer would be about 4,000 feet long and would pass beneath the high ground between the canyons. It would be installed by directional drilling.
5. A 24-inch nominal diameter gravity sewer that would run from 300 feet south of the border in Matadero Canyon to the headworks of either the ITP or the SBWRP. This sewer would run north beneath the border and continue generally north along Smuggler's Gulch for about 2,400 feet until it reaches Monument Road. The sewer would then follow Monument Road generally east for up to 12,500 feet until it reaches the headworks of the selected treatment plant. This sewer would be installed using conventional open-cut construction methods except for about 1,000 feet passing beneath the U.S.-Mexico border infrastructure, which would be installed by micro-tunneling.

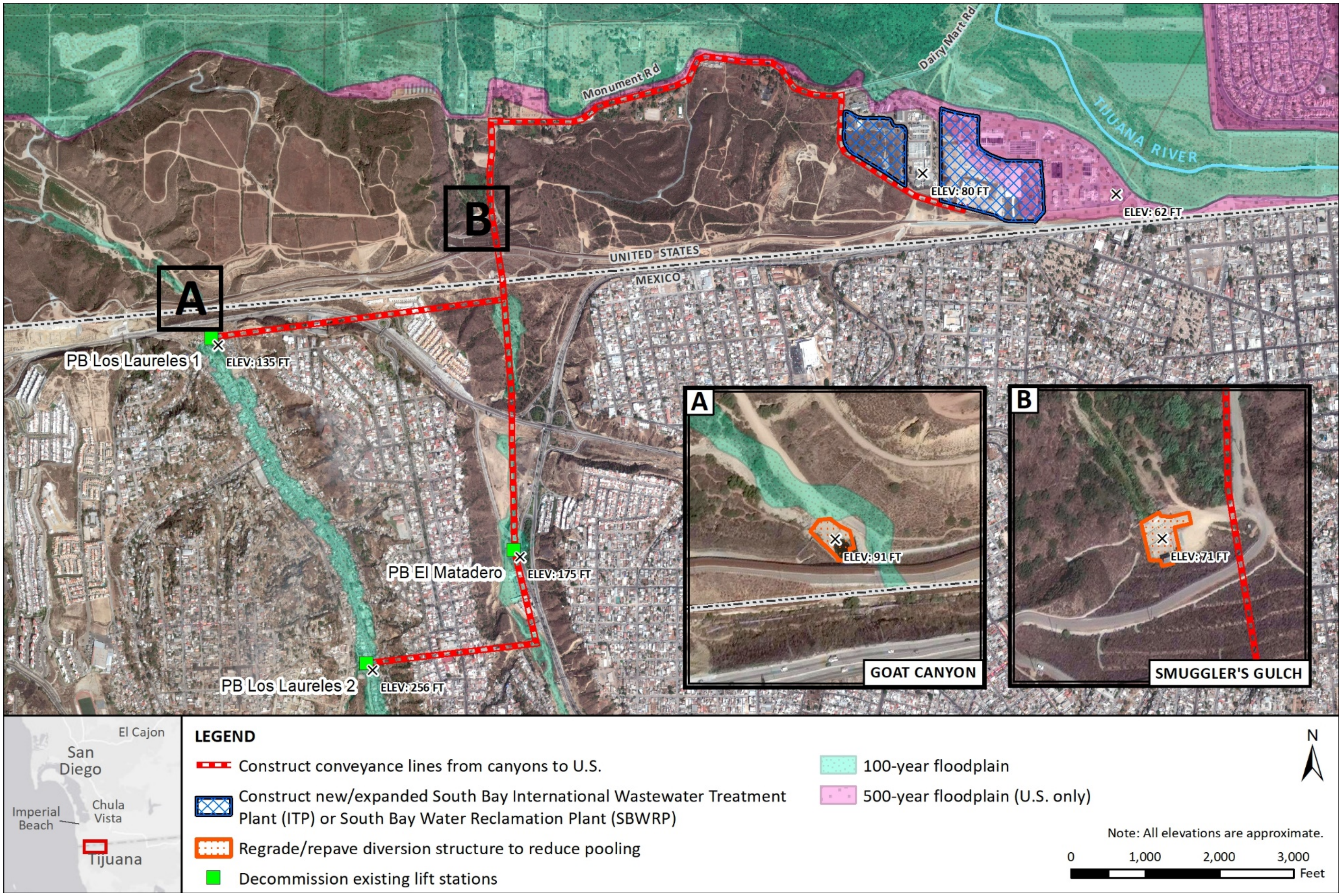

Figure 2-1. Locations of Both Sub-Projects

Table 2-1 below summarizes the design parameters for each section of pipe, and Appendix B provides more detailed specifications.

Table 2-1. Conveyance Line Features for Sub-Project 1

Pipe Reach	Pipe Size/Type	Pipe Length (Feet)	Starting Elevation (Feet)	Final Elevation (Feet)	Estimated Range of Flow Rates (MGD)
1	15-inch, HDPE	2,000	256	226	0.6–2.7
2	15-inch, HDPE	1,700	226	175	0.6–2.7
3	21-inch, PVC	3,500	175	100	3.6–10.7
4	15-inch, HDPE	4,000	135	100	0.6–2.0
5	24-inch, PVC	14,900	100	90	4.2–12.7

2.1.2 Engineering Issues

The primary engineering issues associated with constructing pipelines from the Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations to the SBWRP are the limitations that area topography, level of development, and environmental impacts during construction place on potential routes for the new pipelines. For Los Laureles 1 and 2, directional drilling can resolve the challenges associated with topography and level of development. This low-cost, well-proven construction technique would allow these pipelines to be installed beneath the plateau area between Matadero Canyon and Los Laureles Canyon rather than running around this plateau area. Using directional drilling eliminates the need to install 5,000 feet of pipeline using open cut trenching in Los Laureles Canyon, where dense urban development would mean a higher project cost, and 3,000 feet of open-cut pipeline construction in the environmentally sensitive Tijuana estuary area north of the border. Overall, installing pipe under the mesa using directional drilling reduces the required length of pipe by 8,000 feet. Directional drilling will also minimize construction disturbance to residents and the environment, since the only areas affected would be about 100 feet square at each end of the drilling operation.

The pipeline serving the Matadero Pump Station site is proposed to be placed along the thalweg of Matadero Canyon on the Mexico side of the border and along the thalweg of Smuggler's Gulch on the U.S. side of the border as far north as Monument Road. The continual flow of stormwater runoff has already heavily disturbed these areas. Finally, the sewer will be installed immediately adjacent to Monument Road to the SBWRP to avoid disruption to surrounding environmentally sensitive areas and to provide easy access for construction crews. Disturbance to the International Highway and U.S.-Mexico border facilities along this route would be minimized through use of micro-tunneling to install the new sewers beneath them.

The proposed conveyance system is designed to allow flows up to the peak firm capacity (the maximum capacity of the station with the largest set of pumps offline) of each pump station and to maintain linear velocities between 2 and 8 feet per second in the conveyance pipelines. Pipe reaches 1, 2, and 4 are primarily gravity sewers. PG sized these reaches using the Manning equation. PG used a Manning roughness coefficient $n = 0.11$. Pipe sections 3 and 5 are primarily pressure sewers—in essence, gravity-powered force mains. PG sized these pipe reaches using the Bernoulli equation to validate that the potential energy from the height difference between the starting point and ending point of each pipe provided enough energy to overcome pipe frictional and minor losses. PG estimated the frictional losses by establishing a Moody friction factor coefficient from the fluids flow properties and the diameter and roughness of the pipe. The frictional losses were related to the ratio of the total pipe length to pipe diameter and the Moody friction factor using the Darcy-Weisbach equation. PG multiplied the frictional losses by 1.1 to account for minor losses from fittings. PG used a conservative estimated hydraulic grade line elevation of 90 feet for the headworks of each treatment plant.

2.1.3 Implementation and Regulatory Issues

PG evaluated the implementation timeline for construction of the new conveyance line including design, regulatory approvals, contract bidding/awarding, and construction. The overall timeline of the new conveyance line is likely three to five years. The pipeline itself has minimal future O&M funding requirements, but will result in a substantial life cycle cost reduction for the decommissioned facilities in Mexico, which PG estimates to be up to $4 million.

The project requires tunneling underneath the border fence in Smuggler's Gulch, which will likely need prior approval from the U.S. Customs and Border Protection. Micro-tunneling under the border will also require a Presidential permit. Additionally, the construction of the new U.S.-side line from Smuggler's Gulch to the treatment facilities will have to comply with all zoning requirements. However, sub-project 1 is not expected to require extraordinary environmental regulatory approvals by U.S. federal, state, or local agencies since virtually all construction would occur in the right-of-ways of existing roadways or on SBWRP/ITP property. PG does not have information on construction permitting and other regulatory requirements in Mexico, but the various construction techniques proposed are common in the utility construction industry. It will be necessary to evaluate the permitting and regulatory requirements before advancing to the next stage of design.

2.2 Sub-Project 2: Upgrading the U.S.-Side Collectors to Reduce Pooling

PG evaluated upgrading the wastewater collection facilities on the U.S. side of the border at Smuggler's Gulch and Goat Canyon to reduce pooling of wastewater that interferes with U.S. Customs and Border Protection's operations. PG proposes installing improved wastewater intake piping as shown in Figure 2-1 and regrading the areas immediately upstream to eliminate low points in areas ahead of the collector intakes that allow pooling. Additionally, PG proposes constructing a low flow diversion trench to direct flows from the culverts that run underneath the border to the intake that leads to the U.S.-side canyon pump stations. The low flow diversion in each canyon collector would be U-shaped and about 2 feet wide and 2 feet deep. The diversion would be covered with a cast iron grate to prevent it from interfering with border patrol operation. The area to be regraded at Smuggler's Gulch is about 11,000 square feet and the area to be regraded at Goat Canyon is about 9,000 square feet. PG anticipates that construction of the project would be simple, with no significant engineering, implementation, or regulatory issues. Sub-Project 2 is not expected to require any burdensome environmental regulatory approvals by U.S. federal, state, or local agencies.

3. PROJECT IMPACT

3.1 Water Quality Impacts

Redirecting canyon flows to a U.S.-side secondary treatment facility will improve the water quality in the Pacific Ocean by reducing the total amount of untreated or partially treated flow presently being discharged from the SABTP to the Ocean via SAB Creek, as discussed in Section 1.2.

PG used current monthly pump data, as well as flow and mass balances, to estimate the effects of Project 4 on total annual flow, BOD_5, and sediment loads in ocean discharges via SAB Creek (Table 3-1). PG's estimates are based on operating data from Pump Station 1-A (PB1-A), Pump Station 1-B (PB1-B), Matadero Pump Station, and Playas Pump Station from January 1, 2016, through December 31, 2019; Los Laureles 1 and Los Laureles 2 data from September 1, 2020, through November 30, 2020; and flow balances (see the current flow diagram in Figure 1-1).

PG evaluated the reduction in untreated wastewater by estimating the annual BOD_5 and TSS loads conveyed to SAB Creek with the canyon flows diverted to the U.S. and comparing the estimated loads to current conditions. PG used BOD_5 load to estimate the untreated water that is present in discharges, assuming that the untreated wastewater has a BOD_5 concentration of 400 mg/L. PG estimated the BOD_5 and TSS loads using mass balances and the flow rates that were calculated for the total discharge. More details on this methodology, including assumptions on transboundary flows, PB-CILA's operation, BOD_5 and TSS level, can be found in *Baseline Conditions Summary: Technical Document.*

Table 3-1. Impact of Project 4 on Flows and Loads to SAB Creek

Parameter	Current Conditions	Canyon Flows Are Redirected to the U.S. for Treatment
Total annual flow (million gallons)	13,100	10,700
Percent change in total flow	N/A	-18%
Annual BOD_5 load (tons)	15,900	12,000
Percent change in BOD_5 load	N/A	-25%
TSS load (tons)	16,300	12,400
Percent change in TSS load	N/A	-24%

As shown in Table 3-1, implementing Project 4 reduces the total flow discharges to the Pacific Ocean via SAB Creek by 18% and the total annual BOD_5 load by about 25%. PG estimates that the project would reduce the untreated wastewater discharges to SAB Creek from an average flow rate of 24 MGD to an average flow rate of 18 MGD. Scripps Institute of Oceanography (Fedderson et al. 2020) estimated that reducing the untreated wastewater discharges from SAB Creek to an average of 10 MGD would reduce the number of days with impacts predicted to result in beach closures from an average of 50 days per year to an average 25 days per year. The Scripps report also estimated that reducing the untreated wastewater discharges from SAB Creek to an average of 10 MGD would reduce regional beach impacts predicted to result in beach closures during the dry tourist season (May 22 through September 8) from an average of 26 days annually to an average of 10 days annually. Although Project 4 alone does not reduce untreated wastewater discharges to less than 10 MGD, the results from the Scripps report indicate that the reduction in untreated wastewater discharges to SAB Creek caused by the implementation of Project 4 is likely to have a positive impact on the water quality at the beaches and Naval facilities in southern San Diego County, including the SEALs training facility in Coronado, California.

3.2 Sediment Impacts

PG does not anticipate that the conveyance system proposed for Project 4 will substantially affect sediment deposition in the estuary or sediment discharges to the Pacific Ocean from the river channel. Conveying the flows from the Mexico-side canyon pump stations to a U.S.-side treatment facility does reduce TSS loads from SAB Creek by about 3,400 tons annually.

3.3 Trash Impacts

PG does not anticipate that Project 4 will significantly reduce the amount of trash that is deposited into the estuary or the ocean.

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 4), focusing on impacts in the U.S.[2] Specifically, open trenching in Smuggler's Gulch and along Monument Road to install the new conveyance line could have adverse impacts on federally listed species and their habitat; the ability to avoid adverse effects through mitigation is not yet determined. The EID will include a more thorough evaluation of potential non-water-quality impacts in the U.S.

3.5 Social Impacts

Under Project 4, long-term positive socioeconomic impacts to affected populations (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). The EID will include a more thorough evaluation of potential socioeconomic impacts in the U.S.

Project 4 would reduce the amount of contaminated transboundary flows near border infrastructure in Goat Canyon and Smuggler's Gulch (by improving the collection reliability of dry-weather flows in Mexico) and the pooling of untreated wastewater near border infrastructure in these areas. Project 4 would therefore reduce existing impacts to U.S. Customs and Border Protection operations and workforce resulting from exposure to contaminated transboundary flows in these areas. It would also reduce contaminated transboundary flows in the ocean in Mexico that migrate north to the U.S. However, it would not reduce potential exposure to contaminated transboundary flows near border infrastructure in the Tijuana River.

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

4. COST IMPACT ANALYSIS

PG's construction cost estimates are developed to a Class V level of accuracy in accordance with AACE International's recommended practice 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 PG reviewed, the estimated accuracy goal for construction in the U.S. is +50%/ -25%: that is, actual construction costs may range from 50% higher than 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% (that is, actual construction costs may range from 100% higher than the estimated value to 50% lower).

Project capital cost was based on project construction cost multiplied by 1.4 to account for project engineering and owner administration costs. PG then multiplied that total by a general contingency factor of 1.5 to account for unanticipated construction, unknown subsoils, and other factors. PG applied an interest rate of 3% and an inflation factor of 2% annually to calculate the life cycle cost for each sub-project over a 40-year lifespan.

Tables 4-1 and 4-2, below, summarize the capital and life cycle costs for the conveyance system and the improvements at the Smuggler's Gulch and Goat Canyon collectors. Appendix A provides an itemized cost impact analysis for each sub-project.

4.1 Sub-Project 1: Pump Station Decommissioning and Construction of a New Conveyance System from the Canyon Collectors to the ITP/SBWRP

PG's project construction cost estimates for the proposed conveyance system from the Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations are based on unit price information from RSMeans' 2020 *Heavy Construction Costs* (RSMeans 2019), on adjustments for a 2020 *Engineering News-Record* (ENR) value of 11455, and on public bid information for similar construction. O&M cost information sources included CAPDET Works preliminary design and cost estimation software; manufacturers' information; O&M cost data from other publicly owned treatment works; and other similar sources (Turton et al. 2012).

PG estimated a net O&M cost savings of implementing Project 4 by estimating the O&M costs of the new conveyance system and comparing them to the estimated O&M costs of the pump stations under current conditions. PG included the savings of not having to replace the pumps at each pump station after 20 years in the evaluation of the life cycle cost of the new conveyance line. PG estimated that Mexico currently spends $133,000 annually on energy, which would be reduced to zero with the new gravity pipeline, and $159,000 on maintenance for the current pump stations. As shown in Table 4-1, PG estimates that the new conveyance line would have an O&M cost of $158,000. Therefore, the new gravity conveyance line is expected to save $134,000 in annual O&M. Additionally, decommissioning the pump stations eliminates the need to replace the pumps after approximately 20 years of service. PG estimates that not having to replace the pumps saves $1.08 million at present value. PG estimates that the combined savings in annual O&M and the elimination of the need to replace the pumps would reduce the 40-year life cycle cost by $5.1 million in present value.

Table 4-1. Cost of a New Conveyance System from Canyon Collectors to the ITP/SBWRP

Category	Item	Estimated Cost
Capital costs	Equipment/material	$2,800,000
	Construction costs	$11,900,000
	Indirect costs (engineering, project administration, general contingency)	$16,100,000
	Total capital cost	**$30,800,000**
O&M	Maintenance	$158,300
	Energy costs	$0
	Annual O&M costs	**$158,300**
Life cycle factors	Interest rate	3%
	Inflation rate	2%
	Total life cycle used	40 years
Total cost		**$35,900,000**

4.2 Sub-Project 2: Upgrading the U.S.-Side Collectors to Reduce Pooling

PG's project construction cost estimates for site improvements to reduce wastewater pooling at Goat Canyon and Smuggler's Gulch were based on unit price information from RSMeans' 2020 *Heavy Construction Costs* (RSMeans 2019), on adjustments for a 2020 ENR value of 11455, and on public bid information for similar construction. PG estimates the O&M costs for the site improvements will be minimal, about $5,000 annually for minor maintenance.

Table 4-2. Cost of Upgrading U.S.-Side Collectors to Reduce Pooling

Category	Item	Estimated Cost
Capital costs	Equipment/material	$100,000
	Construction costs	$82,300
	Indirect costs (engineering, project administration, general contingency)	$201,000
	Total capital cost	**$435,000**
O&M	Maintenance	$5,000
	Annual O&M costs	**$5,000**
Life cycle factors	Interest rate	3%
	Inflation rate	2%
	Total life cycle used	40 years
Total cost		**$600,000**

5. DISCUSSION

5.1 Feasibility

5.1.1 Sub-Project 1: Pump Station Decommissioning and Construction of a New Conveyance System

PG has determined that building the new conveyance system to convey sanitary wastewater flows from the canyons to the ITP or SBWRP for treatment is technically feasible. The new system will be capable of conveying the anticipated flow rates from all canyons. Gravitational forces will provide sufficient hydraulic head to convey flows from the Matadero, Los Laureles 1, and Los Laureles 2 Pump Station sites to the ITP or SBWRP for treatment, which will allow these pump stations to be decommissioned.

The directional drilling approach proposed for construction of the 4,000-foot sewer line from Los Laureles 1 and the 2,000-foot sewer line from Los Laureles 2 is well within the technical limitations of the directional drilling process. Directional drilling to install underground utilities is common across the U.S. and worldwide to avoid surface disturbance. As an example, in 2017, a new parallel set of pipes was installed underneath the Hong Kong harbor; directional drilling was used to create a tunnel over 17,000 feet long at a depth of 350 feet (Yan et al. 2019).

Two sections of pipe along the sewer line from the Matadero Pump Station to the SBWRP that require micro-tunneling are underneath the International Highway (700 feet long) and underneath the U.S.-Mexico border facilities (1,000 feet long). According to a report by the Virginia Center for Transportation Innovation and Research, micro-tunneling can be used to reach lengths up to 1,000 feet (Burden and Hoppe 2015). However, the maximum tunnel length between micro-tunnel construction work shafts is controlled by pipe material selection, geotechnical conditions, site access, and other factors that will need to be assessed as part of the project design process.

5.1.2 Upgrading the U.S.-Side Collectors to Reduce Pooling

PG has determined that improving the intake pipes and regrading the U.S.-side collectors to reduce untreated wastewater pooling is technically feasible and does not require extensive ongoing maintenance. The upgrades to the U.S.-side collectors would have a positive social impact on U.S. Customs and Border Protection agents by reducing contact with pools of untreated wastewater.

5.2 Other Stakeholder Information

PG did not identify other stakeholder impacts from implementation of Project 4.

6. CONCLUSION

The purpose of this project is to protect coastal communities and reduce beach impacts in the U.S. due to untreated or undertreated sewage discharged from SAB Creek that originates in Matadero Canyon (Smuggler's Gulch on the U.S. side of the border) and Los Laureles Canyon (the upper reach of Goat Canyon on the U.S. side of the border). This project will also reduce the pooling of untreated wastewater that escapes from the wastewater collection system in Mexico and flows overland to capture facilities in the U.S., thus reducing potential health threats to U.S. Customs and Border Protection agents.

This project is split into two sub-projects with varying purposes: sub-project 1 reduces beach impacts and sub-project 2 reduces pooling of untreated wastewater at U.S. capture facilities. PG evaluated the technical feasibility, impacts, and cost of the two sub-projects and made the following conclusions:

1. **Decommissioning the Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations in Mexico and constructing a new conveyance system** would transport the wastewater flows collected at the current pump stations to the ITP or SBWRP. Building the new conveyance system and decommissioning the existing pump stations was found to be technically feasible and is expected to reduce BOD_5 discharges from SAB Creek to the Pacific Ocean by 25%. The estimated capital cost of the sub-project is $30.8 million, and the estimated 40-year life cycle cost is $35.9 million. Decommissioning the pump stations is estimated to save $133,000 in annual O&M and save $5.1 million over the 40-year life cycle. The analysis could be refined with additional flow data for the existing pump stations to better characterize the flow rates.

2. **Upgrading the U.S.-side wastewater collection structures at Smuggler's Gulch and Goat Canyon** would decrease pooling during dry weather. Improving the intake pipes and regrading the U.S.-side collectors to reduce untreated wastewater pooling was found to be technically feasible and will reduce the exposure of U.S. Customs and Border Protection agents to untreated sewage that currently pools at the collectors. The estimated capital cost of the sub-project is $435,000, and the estimated 40-year life cycle cost is $600,000.

7. SUGGESTED NEXT STEPS

1. Obtain additional flow data from Matadero, Los Laureles 1, and Los Laureles 2 pump stations to better characterize the flows from these pump stations.
2. Conduct geotechnical analyses on the areas where the directional drilling and micro-tunneling is proposed to verify the necessary tunnel lengths can be achieved.
3. Obtain water quality data from the canyon collectors to confirm PG's assumptions and/or refine estimated water quality impacts of Project 4.

8. REFERENCES

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APPENDIX A: Itemized Cost Impact Analysis

Project 4: Conveyance Line Reach 1 - Opinion of Probable Cost

Cost	Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Capital Costs	Equipment/Materials Costs	15 inch HDPE Pipe	2000	LF	$33.50	$67,000	RS-Means 33-01-30.74 line 0350
		Allowance for Unquantified Line Items			5%	$96,331	
		Total Equipment/Materials Cost				**$163,000**	
	Construction Costs	Directional Drilling Hole (18 inch diameter)	2000	LF	$710.00	$1,420,000	RS-Means 33.05.07.13 Line 0344
		Mob/Demod Drill Pits	2	Each	$5,235.00	$10,470	RS-Means 33.05.07.13 Line 0310
		General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit			30%	$429,141	
		Total Contruction Costs				**$1,860,000**	
	Indirect Costs	Subtotal				$2,023,000	
		Engineer and Administrative Contingency, 40% of subtotal			40%	$809,200	
		Subtotal (With Engineering)				$2,832,200	
		Contigency 50%			50%	$1,416,100	
		Total Indirect Costs				**$2,230,000**	
		Total Capital Costs				**$4,250,000**	
Operations and Maintenance	O&M Costs	General Maintainence and Inspection Cost	1	Each	$16,300.00	$16,300	$10,000 vehicle expenses, $6,300 Misc expenses.
		Total O&M Costs				**$16,300**	
Life Cycle Costs	Life Cycle Costs	Sevice Life				40 years	
		Interest Rate				3%	
		Inflation Rate				2%	
		Major Upgrade(s) Cost				$0	
		Present Value of Major Upgrade(s)				$0	
		Location Adjustment Factor				1.0	
		Total Life Cycle Cost				**$4,640,000**	

Project 4: Conveyance Line Reach 2 - Opinion of Probable Cost

Cost	Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Capital Costs	Equipment/Material Cost	15 inch PVC	1300	LF	$33.50	$43,550	Means 33 31 11.25 line 2200
		Roadway Aggregate Subbase - granular material, placement, compaction (curb/gutter - if any - rests on undisturbed soil)	827.7777778	Sq Yd	$9.48	$7,847	Means 32.11.23.23 line 0200 (pg 320)
		4-Ft Diameter Precast Concrete Manholes	4	Each	2800	$11,200	Means 33.05.61.10 line 1130 (pg 364): 4-ft precast MHx 8 ft deep = ($2082*1.1) for gasketed precast sections + Means line 1140 (pg 364): (244.2/ft*1.1) for depth > 8-ft + Means line 4230 (pg 365): rubber boots @ $248.50 X 2 (boots on sanitary and combined sewer MHs only)
		Bituminous Roadway Paving - Assume trench width plus 2-Ft outside of trench lines each side	134.1	Ton	$85.36	$11,447	Means 32.12.16.13 line 0851 (pg 322)
		Allowance for Unquantified Line Items			5%	$16,444	
		Total Equipment/Materials Cost				**$90,500**	
	Construction Costs	Demolish Existing Bituminous Pavement & Parkway Areas	1509.444444	Sq Yd	$7.49	$11,306	Means 02.41.13.17 line 5050 (pg 27)
		Disposal of 100% of Existing Pavement Material - Assume 16.5 CuYd Truck, 15 Min Wait, 20MPH Haul Speed, 5 Miles to Disposal Site, 1.25 Expansion Factor	628.9351852	Cu Yd	$7.74	$4,868	Means 31.23.23.20 line 3038 (pg 265)*1.25 (Expansion Factor)
		Excavation - Assume trapazoidal shape 5:1 side slopes - trench box - excavate to bottom of bedding	1868.148148	Cu Yd	$4.59	$8,575	Means 31.23.16.13 line 1370 (pg 241) - 1 yd excavator w/trench box
		Disposal of 100% of Excavated Soil - Assume 16.5 CuYd truck, 15 Min Wait, 20MPH Haul Speed, 5 Miles to Disposal Site, 1.25 Expansion Factor	2335.185185	Cu Yd	$7.74	$18,074	Means 31.23.23.20 line 3038 (pg 265)*1.25 (Expansion Factor)
		Replace 100% of Removed Backfill Material with Select Granular Backfill (including bedding, but not including granular roadway subbase. Assume 110% of excavation volume MINUS pipe cross-sectional area to account for spillage)	1995.90625	Cu Yd	$26.68	$53,251	Means 31.23.23.15 line 5000 (pg 257) - 1 Yd Excavator (unit price changes with excavator size)
		Bedding & Backfill Compaction (not including granular roadway subbase)	1995.90625	Cu Yd	$2.81	$5,608	Means 31.23.23.23 line 7520 (pg 280)
		Deliver select granular bedding & backfill material to site - Assume 16.5 Cu Yd Truck, 15 min Wait, 20 MPH Avg Haul Speed, 5 Miles to Quarry.	1995.90625	Cu Yd	$7.74	$15,448	Means 31.23.23.20 line 3038 (pg 265)*1.25 (Expansion Factor)
		Deliver aggregate subbase material to site - Assume 16.5 Yd Truck, 15 min Wait, 20 MPH Avg Haul Speed, 5 Miles to Quarry, 1.10 spillage factor	227.6388889	Cu Yd	$7.74	$1,762	Means 31.23.23.20 line 3038 (pg 265)*1.25 (Expansion Factor)
		Deliver bituminous pavement material to site - Assume 16.5 Cu Yd Truck, 15 min Wait, 20 MPH Avg Haul Speed, 5 Miles to Plant. (1.10 spillage factor)	75.87962963	Cu Yd	$7.74	$587	Means 31.23.23.20 line 3038 (pg 265)*1.25 (Expansion Factor)
		Curb/Gutter Replacement - 6-In X 18-In	2600	LF	$23.90	$62,140	Means 32.16.13.13 line 0430 (pg 331)
		Sidewalk Replacement	2600	SqFt	$4.99	$12,974	Means 32.06.10.10 line 0350 (pg 319)
		Restoration of Roadside Grassed Areas Disturbed by Sewer Construction (minimum 5-Feet from back-of-curb or edge-of-pavement if no curbs)	6.5	MSF	$220.00	$1,430	Means 32.92.19.14 Line 5200 (pg 352) @ $54.45/MSF X 4 to account for fertilizer, mulch and periodic watering ≈ $220/MSF
		General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit			30%	$58,807	
		Total Contruction Costs				**$255,000**	
	Indirect Costs	Subtotal				$345,500	
		Engineer and Administrative Contingency, 40% of subtotal			40%	$138,200	
		Subtotal (With Engineering)				$483,700	160 hours of Labor @ $50/hr, $10,000 vehicle expenses, $7,000 Misc expenses.
		Contigency 50%			50%	$241,850	
		Total Indirect Costs				**$380,000**	
		Total Capital Costs				**$730,000**	
O&M Costs	Maintenance	General Maintainence and Inspection Cost				$19,400	
		Total O&M Costs				**$19,400**	
Life Cycle Cost		Sevice Life				40	
		Interest Rate				3%	
		Inflation Rate				2%	
		Major Upgrade(s) Cost				$0.00	
		Present Value of Major Upgrade(s)				$0.00	
		Location Adjustment Factor				1.0	
		Total Life Cycle Cost				**$1,430,000**	

Project 4: Conveyance Line Reach 3 - Opinion of Probable Cost

Cost	Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Capital Costs	Equipment/Material Cost	21 Inch PVC	3500	LF	$65.50	$229,250	Means 33 31 11.25 line 2400
		5-Ft Diameter Precast Concrete Manholes	11	Each	$4,400.00	$48,400	Means 33.05.61.10 line 1170 (pg 364): 5-ft precast MHx 8 ft deep = ($3498*1.1) for gasketed precast sections + Means line 1180 (pg 364): (434.3/ft*1.1) for depth > 8-ft + Means line 4235 (pg 365): rubber boots @ $284.5 X 2 (boots on sanitary and combined sewer MHs only)
		Allowance for Unquantified Line Items			5%	$82,893	
		Total Equipment/Materials Costs				**$361,000**	
	Construction Costs	Install Microtunnelled Section of Pipe Underneath the International Highway	1	Each	$1,160,000.00	$1,160,000	Bid estimates from Previous Projects
		Clear and Grub Trees/Shrubs/Brush along Sewer Route	1.7	Acres	$11,100.00	$18,870	Means G10.120 line 1100 (pg 514)
		Remove Top Soil, Sidewalks and Driveways In Sewer Trench Area	900.9259259	Cu Yd	$131.00	$118,021	Means 02.41.13.17 line 5500 (pg 27) @ $131/CuYd if sidewalks/drives, Means 31.23.16.13 line 1362 (pg 241) 7.65 CuYd - no sidewalks/drives
		Disposal of 100% of Existing Top Soil, and Sidewalk/Driveway Materials - Assume 16.5 CuYd Truck, 15 Min Wait, 20MPH Haul Speed, 5 Miles to Disposal Site, 1.25 Expansion Factor	1126.865741	Cu Yd	$7.74	$8,722	Means 31.23.23.20 line 3038 (pg 265)*1.25 (Expansion Factor)
		Excavation - Assume trapazoidal shape 5:1 side slopes - trench box - excavate to bottom of bedding	5548.148148	Cu Yd	$2.87	$15,923	Means 31.23.16.13 line 1372 (pg 241) - 2-1/2 yd excavator w/trench box
		Disposal of 20% of Excavated Material to account for Soil Displaced by Pipe, Pipe Bedding and Soil Expansion due to Excavation - Assume 16.5 CuYd truck, 15 Min Wait, 20MPH Haul Speed, 5 Miles to Disposal Site, 1.10 Expansion Factor	1109.62963	Cu Yd	$7.74	$8,589	Means 31.23.23.20 line 3038 (pg 265)*1.25 (Expansion Factor)
		Replacement of 10% of Excavated Material with Select Granular Backfill to acount for for pipe bedding.	554.8148148	Cu Yd	$26.68	$14,802	Means 31.23.23.15 line 5000 (pg 257) - 1 Yd Excavator (unit price changes with excavator size)
		Bedding & Backfill Compaction	5548.148148	Cu Yd	$2.81	$15,590	Means 31.23.23.23 line 7520 (pg 280)
		Deliver select granular bedding material to site - Assume 16.5 Cu Yd Truck, 15 min Wait, 20 MPH Avg Haul Speed, 5 Miles to Quarry.	554.8148148	Cu Yd	$7.74	$4,294	Means 31.23.23.20 line 3038 (pg 265)*1.25 (Expansion Factor)
		Restoration of Roadside Grassed Areas Disturbed by Sewer Construction (minimum 5-Feet from back-of-curb or edge-of-roadway if no curbs)	70	MSF	$220.00	$15,400	Means 32.92.19.14 Line 5200 (pg 352) @ $54.45/MSF X 4 to account for fertilizer, mulch and periodic watering ≈ $220/MSF
		General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit			30%	$414,064	
		Total Contruction Costs				**$1,790,000**	
	Indirect Costs	Subtotal				$2,151,000	
		Engineer and Administrative Contingency, 40% of subtotal			40%	$860,400	
		Total Contruction Costs (With Engineering)				$3,011,400	
		Contigency 50%			50%	$1,505,700	
		Total Indirect Costs				**$2,370,000**	
		Total Capital Costs				**$4,520,000**	
O&M Costs	Maintenance	General Maintainence and Inspection Cost				$29,600	224 hours of Labor @ $50/hr, $10,000 vehicle expenses, $20000 Misc expenses.
		Total O&M Costs				**$29,600**	
Life Cycle Cost		Sevice Life				40	
		Interest Rate				3%	
		Inflation Rate				2%	
		Major Upgrade(s) Cost				$0	
		Present Value of Major Upgrade(s)				$0	
		Location Adjustment Factor				1.0	
		Total Life Cycle Cost				**$5,500,000**	

Project 4: Conveyance Line Reach 4 - Opinion of Probable Cost

Cost Type	Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Capital Costs	Equipment/Materials Costs	15 inch HDPE Pipe	4000	LF	$33.50	$134,000	RS-Means 33-01-30.74 line 0350
		Allowance for Unquantified Line Items			5%	$142,524	
		Total Equipment/Materials Cost				**$277,000**	
	Construction Costs	Directional Drilling Hole (18 inch diameter)	4000	LF	$710.00	$2,840,000	RS-Means 33.05.07.13 Line 0344
		Mob/Demod Drill Pits	2	Each	$5,235.00	$10,470	RS-Means 33.05.07.13 Line 0310
		General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit			30%	$855,141	
		Total Contruction Costs				**$3,710,000**	
	Indirect Costs	Subtotal				$3,987,000	
		Engineer and Administrative Contingency, 40% of subtotal			40%	$1,594,800	
		Subtotal (With Engineering)				$5,581,800	
		Contigency 50%			50%	$2,790,900	
		Total Indirect Costs				**$4,390,000**	
		Total Capital Costs				**$8,380,000**	
O&M Costs	Maintenance	General Maintainence and Inspection Cost				$19,000	$10,000 vehicle expenses, $6,300 Misc expenses.
		Total O&M Costs				**$19,000**	
Life Cycle Cost		Service Life				40	
		Interest Rate				3%	
		Inflation Rate				2%	
		Major Upgrade(s) Cost				$0	
		Present Value of Major Upgrade(s)				$0	
		Location Adjustment Factor				1.0	
		Total Life Cycle Cost				**$9,000,000**	

Project 4: Conveyance Line Reach 5 - Opinion of Probable Cost

Cost Type	Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Capital Costs	Equipment/Material Cost	24 inch PVC	13700	LF	$82.00	$1,123,400	Means 33 31 11.25 line 2500
		Roadway Aggregate Subbase - granular material, placement, compaction (curb/gutter - if any - rests on undisturbed soil)	13393.33333	Sq Yd	$9.48	$126,969	Means 32.11.23.23 line 0200 (pg 320)
		6-Ft Diameter Precast Concrete Manholes	42	Each	$4,400.00	$184,800	Means 33.05.61.10 line 1170 (pg 364): 5-ft precast MHx 8 ft deep = ($3498*1.1) for gasketed precast sections + Means line 1180 (pg 364): (434.3/ft*1.1) for depth > 8-ft + avg of Means lines 4235 & 4240 (pg 365): rubber boots @ $298 X 2 (boots on sanitary and combined sewer MHs only)
		Bituminous Roadway Paving - Assume trench width plus 2-Ft outside of trench lines each side	2066	Ton	$85.36	$176,388	Means 32.12.16.13 line 0851 (pg 322)
		Allowance for Unquantified Line Items			5%	$258,899	
		Total Equipment/Materials Cost				**$1,870,000**	
	Construction Costs	Microtunnelled Section of Pipe Underneath Border	1	Each	$1,330,769	$1,330,769	Bid estimates from Previous Projects
		Demolish Existing Bituminous Pavement & Parkway Areas	17422.22222	Sq Yd	$7.49	$130,492	Means 02.41.13.17 line 5050 (pg 27)
		Disposal of 100% of Existing Pavement Material - Assume 16.5 CuYd Truck, 15 Min Wait, 20MPH Haul Speed, 5 Miles to Disposal Site, 1.25 Expansion Factor	7259.259259	Cu Yd	$7.74	$56,187	Means 31.23.23.20 line 3038 (pg 265)*1.25 (Expansion Factor)
		Excavation - Assume trapazoidal shape 5:1 side slopes - trench box - excavate to bottom of bedding	23229.62963	Cu Yd	$4.59	$106,624	Means 31.23.16.13 line 1370 (pg 241) - 1 yd excavator w/trench box
		Disposal of 100% of Excavated Soil - Assume 16.5 CuYd truck, 15 Min Wait, 20MPH Haul Speed, 5 Miles to Disposal Site, 1.25 Expansion Factor	29037.03704	Cu Yd	$7.74	$224,747	Means 31.23.23.20 line 3038 (pg 265)*1.25 (Expansion Factor)
		Replace 100% of Removed Backfill Material with Select Granular Backfill (including bedding, but not including granular roadway subbase. Assume 110% of excavation volume MINUS pipe cross-sectional area to account for spillage)	23924.44444	Cu Yd	$26.68	$638,304	Means 31.23.23.15 line 5000 (pg 257) - 1 Yd Excavator (unit price changes with excavator size)
		Bedding & Backfill Compaction (not including granular roadway subbase)	23924.44444	Cu Yd	$2.81	$67,228	Means 31.23.23.23 line 7520 (pg 280)
		Deliver select granular bedding & backfill material to site - Assume 16.5 Cu Yd Truck, 15 min Wait, 20 MPH Avg Haul Speed, 5 Miles to Quarry.	23924.44444	Cu Yd	$7.74	$185,175	Means 31.23.23.20 line 3038 (pg 265)*1.25 (Expansion Factor)
		Deliver aggregate subbase material to site - Assume 16.5 Yd Truck, 15 min Wait, 20 MPH Avg Haul Speed, 5 Miles to Quarry, 1.10 spillage factor	250.5555556	Cu Yd	$7.74	$1,939	Means 31.23.23.20 line 3038 (pg 265)*1.25 (Expansion Factor)
		Deliver bituminous pavement material to site - Assume 16.5 Cu Yd Truck, 15 min Wait, 20 MPH Avg Haul Speed, 5 Miles to Plant. (1.10 spillage factor)	83.51851852	Cu Yd	$7.74	$646	Means 31.23.23.20 line 3038 (pg 265)*1.25 (Expansion Factor)
		Curb/Gutter Replacement - 6-In X 18-In	28000	LF	$23.90	$669,200	Means 32.16.13.13 line 0430 (pg 331)
		Sidewalk Replacement	28000	SqFt	$4.99	$139,720	Means 32.06.10.10 line 0350 (pg 319)
		Restoration of Roadside Grassed Areas Disturbed by Sewer Construction (minimum 5-Feet from back-of-curb or edge-of-pavement if no curbs)	70	MSF	$220.00	$15,400	Means 32.92.19.14 Line 5200 (pg 352) @ $54.45/MSF X 4 to account for fertilizer, mulch and periodic watering ≈ $220/MSF
		General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit			30%	$670,699	
		Total Contruction Costs				**$4,240,000**	
	Indirect Costs	Subtotal				$6,110,000	
		Engineer and Administrative Contingency, 40% of subtotal			40%	$2,444,000	
		Total Contruction Costs (With Engineering)				$8,554,000	
		Contigency 50%			50%	$4,277,000	
		Total Indirect Costs				**$6,720,000**	
		Total Capital Costs				**$12,800,000**	
O&M Costs	Maintenance	General Maintainence and Inspection Cost				$74,000	880 hours of Labor @ $50/hr, $10,000 vehicle expenses, $20000 Misc expenses.
		Total O&M Costs				**$74,000**	
Life Cycle Cost		Sevice Life				40	
		Interest Rate				3%	
		Inflation Rate				2%	
		Major Upgrade(s) Cost				$0	
		Present Value of Major Upgrade(s)				$0	
		Location Adjustment Factor				1.0	
		Total Life Cycle Cost				**$15,300,000**	

Project 4: Upgrades to US Side Collectors - Opinion of Probable Cost

Cost Type	Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Capital Costs	Equipment/Material Cost	PCC Concrete Paving - 8 inches thick	2200	Sq Yd	$40.50	$89,100	Means 32 13 13.05 line 0100
		^ ^ Weld wire fabric	2200	Sq Yd	$5.10	$2,300	Means 32 13 13.05 line 0100
		Allowance for Unquantified Line Items			5%	$8,685	
		Total Equipment/Material Costs				**$100,000**	
	Construction Costs	Demolish Existing Pavement	2200	Sq Yd	$7.49	$16,478	Means 02.41.13.17 line 5050 (pg 27)
		Disposal of 100% of Existing Pavement Material - Assume 16.5 CuYd Truck, 15 Min Wait, 20MPH Haul Speed, 5 Miles to Disposal Site, 1.25 Expansion Factor	7500	Cu Yd	$7.74	$58,050	Means 02.41.13.17 line 5500 (pg 27)
		Deliver aggregate subbase material to site - Assume 16.5 Yd Truck, 15 min Wait, 20 MPH Avg Haul Speed, 5 Miles to Quarry, 1.10 spillage factor	403.3333333	Cu Yd	$7.74	$3,122	Means 02.41.13.17 line 5500 (pg 27)
		Deliver bituminous pavement material to site - Assume 16.5 Cu Yd Truck, 15 min Wait, 20 MPH Avg Haul Speed, 5 Miles to Plant. (1.10 spillage factor)	600	Cu Yd	$7.74	$4,644	Means 02.41.13.17 line 5500 (pg 27)
		General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit			30%	$24,688	
		Total Construction Costs				**$107,000**	
	Indirect Costs	Subtotal				$207,000	
		Engineer and Administrative Contingency, 40% of subtotal			40%	$82,800	
		Total Contruction Costs (With Engineering)				$289,800	
		Contigency 50%			50%	$144,900	
		Total Indirect Costs				**$228,000**	
		Total Capital Cost				**$435,000**	
O&M Costs	Maintenance	Allowance for Annual Maintainence				$5,000	
		Total O&M Costs				**$5,000**	
Life Cycle Cost		Sevice Life				40	
		Interest Rate				3%	
		Inflation Rate				2%	
		Major Upgrade(s) Cost				0.00	
		Present Value of Major Upgrade(s)				0.00	
		Location Adjustment Factor				1.0	
		Total Life Cycle Cost				**$600,000**	