Baseline Conditions Summary

Technical Document

USMCA Mitigation of Contaminated Tijuana Transboundary Flows Project

Prepared for:

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5	Final, revised	Updated with new information	PG	11/19/21

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

APTP	Advanced Primary Treatment Plant
BOD	biochemical oxygen demand
BOD_5	amount of oxygen consumed by microorganisms within five days
CEISA	Consorcio Especializado en Ingeniería
CESPT	Comisión Estatal de Servicios Públicos de Tijuana
EID	Environmental Information Document
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
ERG	Eastern Research Group, Inc.
FIB	fecal indicator bacteria
GIS	geographic information system
hp	horsepower
IBWC	International Boundary and Water Commission
ITP	South Bay International Wastewater Treatment Plant
L/s	liters per second
m^3	cubic meter
MCC	motor control center
MGD	million gallons per day
mg/L	milligrams per liter
NADB	North American Development Bank
NOAA	National Oceanic and Atmospheric Administration
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
RWQCB	Regional Water Quality Control Board
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
SCADA	supervisory control and data acquisition
SEPROA	Secretaría para el Manejo Saneamiento y Protección del Agua
TECP	technical expert consultation process
TSS	total suspended solids
USMCA	United States–Mexico–Canada Agreement
UV	ultraviolet
WWTP	wastewater treatment plant

1. INTRODUCTION

About three-quarters of the 1,750-square-mile Tijuana River watershed is in Mexico; the other quarter is in the U.S., in southern San Diego County. Pollution from untreated wastewater, sediment, and trash in transboundary flows from Mexico has created environmental, public health, and safety hazards in the U.S. for the better part of a century and has spawned a variety of binational agreements and engineering solutions. Most notably, the South Bay International Wastewater Treatment Plant (ITP) was constructed in the 1990s with capital investments from both countries. The ITP is designed to treat 25 MGD of wastewater from Tijuana, thereby reducing the burden on Mexico's wastewater infrastructure and preventing untreated wastewater from polluting transboundary flows in the Tijuana River and beaches in the U.S.

Under EPA Contract No. 68HERH19D0033, Task Order No. 53, PG Environmental conducted feasibility analyses of 10 proposed projects to mitigate impacts from transboundary flows from Mexico into the U.S. under the United States–Mexico–Canada Agreement (USMCA). Each project's feasibility analysis included an estimate of capital costs; an estimate of design, project, and construction management costs; an estimate of operation and maintenance (O&M) costs; a rough project implementation schedule; a summary of regulatory, engineering, and potential implementation issues; and a preliminary summary of social and environmental impacts. Each feasibility analysis also identified additional data and information that would enhance the analysis.

This document is a companion to the 10 individual *Feasibility Analysis Technical Memoranda*, and the Environmental Information Document (EID) under development by ERG, presenting information on background data analyzed, U.S. and Mexico entities, existing infrastructure and its operating conditions, water bodies, affected areas, other studies and reports, and dry- and wet-weather flow conditions referenced in the feasibility analyses.

Consistent with the task order scope, PG has worked with EPA to develop and analyze water infrastructure alternatives to mitigate the transboundary wastewater and stormwater flows. The alternatives include groupings of the projects evaluated in the feasibility analyses, scaled as necessary, and have been presented to EPA in the *Water Infrastructure Alternatives Analysis* report.

1.1 Document Organization

As noted above, this document is intended to serve as a companion to the individual *Feasibility Analysis Technical Memoranda*. Sections 1.2, 1.3, and 1.4 provide context on pertinent geographic features in the watershed, key organizations, and related infrastructure, respectively. The other sections present content and background information used to develop the *Feasibility Analysis Technical Memoranda*:

- **Section 2** presents an overview of the feasibility analysis process and a summary of the projects and sub-projects, including their most significant benefit(s) and capital and life cycle costs.
- **Section 3** is an inventory of reports and data used to develop the various *Feasibility Analysis Technical Memoranda*.
- **Section 4** summarizes the areas of focus and infrastructure analyzed in the individual *Feasibility Analysis Technical Memoranda.* The technical information is provided to facilitate brevity in the *Feasibility Analysis Technical Memoranda* and to justify and document assumptions, when necessary.

- **Section 5** lists the references used in this document.

1.2 Study Area Overview

Several areas of the Tijuana River watershed are discussed throughout this report and the individual *Feasibility Analysis Technical Memoranda*. These areas are summarized below to provide geographic context for the discussions. Overview maps of project locations, areas of impact, and existing critical project infrastructure in both the U.S. and Mexico are shown in Figure 1-1, Figure 1-2, and Figure 1-3 below.

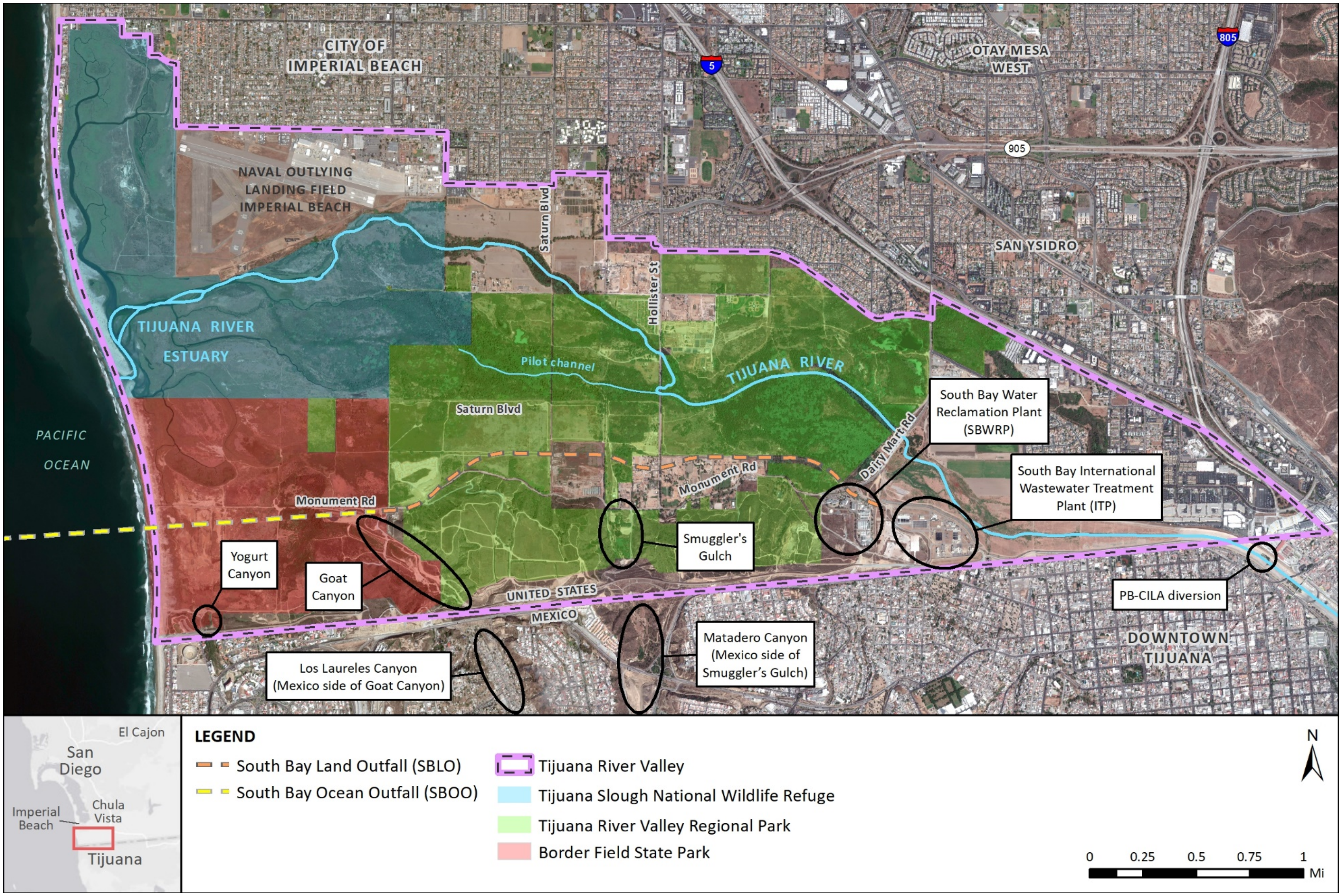

Figure 1-1. Overview of Tijuana River Valley

Figure 1-2. South Bay Ocean Outfall and San Diego Bay Areas of Impact

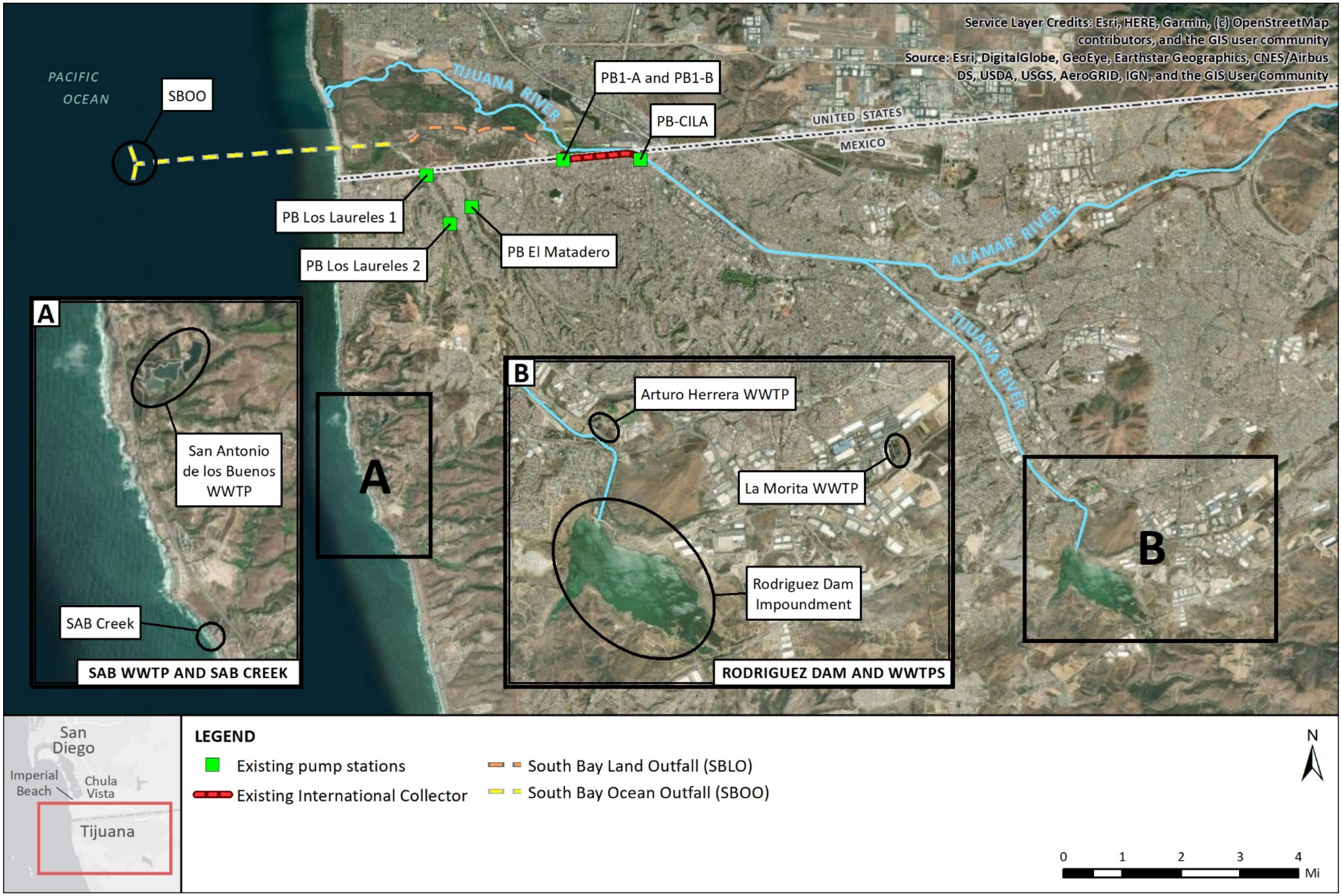

Figure 1-3. Overview of Existing Diversion and Treatment Infrastructure in Tijuana

1.2.1 Tijuana River Main Channel

The Tijuana River flows from Mexico into the U.S. about 5 miles upstream of its outlet into the Pacific Ocean. Shortly after entering the U.S., the river flows into the Tijuana River Estuary near the Dairy Mart Road bridge. Precipitation in the watershed and the operation of the PB-CILA river diversion system in Tijuana dictate how often flows from Mexico reach the U.S. These flows contribute to a range of environmental, public health, and safety hazards in the U.S.

PG defines transboundary flows in the Tijuana River main channel as flows that cross into the U.S. from Mexico and are not captured by a U.S.-side diversion. PG evaluated transboundary flows in the main channel using data from International Boundary and Water Commission (IBWC) flow gauge located downstream of the border.

1.2.2 Tijuana River Estuary

The Tijuana National Estuarine Research Reserve (which encompasses the estuary, on both sides of the border) is considered a wetland of international importance by the United Nations and provides habitat to nearly 400 species of birds.

1.2.3 Smuggler's Gulch (Matadero Canyon)

Smuggler's Gulch (Matadero Canyon) is a 5.9-square-mile watershed draining from Tijuana, Mexico, to the U.S. It is the largest and easternmost of three canyons in the Tijuana area. Flows from this canyon drain into the U.S. via the Smuggler's Gulch canyon flow diversion structure.[1] Flows entering the U.S. from Mexico at Smuggler's Gulch often exceed the capacity of the existing culvert under Monument Road. Under these conditions, Monument Road may be impassable, which cuts off access to the homes and properties along Monument Road and to the west of Smuggler's Gulch.

1.2.4 Goat Canyon (Los Laureles Canyon)

Goat Canyon (Los Laureles Canyon) is a 4.6-square-mile watershed draining from Tijuana, Mexico, to the U.S. Its flows are controlled by the Goat Canyon flow diversion structure and sediment basins. These structures are designed to keep excess sediment from reaching the Model Marsh and Tijuana River Estuary.

1.2.5 Yogurt Canyon

Yogurt Canyon is a relatively small watershed (415 acres) compared to other watersheds in the Tijuana River Valley. Yogurt Canyon is the westernmost canyon, and it drains north from Mexico into the U.S. It is the only canyon without a canyon flow diversion structure. Wet weather flows from Yogurt Canyon flood Monument Road, which cuts off vehicle access to the International Friendship Park.

[1] The canyon flow diversion structures along the U.S.-Mexico border consist of culverts, concrete approach pads, and grated intakes that drain to the ITP headworks via subsurface gravity piping. These are also referred to as "canyon collectors" in HDR (2020) and the *Feasibility Analysis Technical Memoranda*. Refer to Section 4.7.1 for additional details.

1.2.6 Pacific Ocean

The Tijuana River Estuary discharges into the Pacific Ocean just north of the U.S.-Mexico border. In addition, Pacific Ocean waters flow across the maritime boundary during northward "south swell" conditions, when polluted waters can affect the U.S. Navy SEALs training facility in Coronado, California, and public beaches. The polluted ocean waters are known to originate from untreated or undertreated wastewater discharges from San Antonio de los Buenos (SAB) Creek in Mexico, including approximately 10 MGD of effluent from the SAB Wastewater Treatment Plant (SABTP), as discussed in Section 4.5. Treated effluent from the ITP is discharged from the South Bay Ocean Outfall (SBOO) into the Pacific Ocean. More information on the SBOO can be found in Section 4.4.3.

1.3 Key Organizations

1.3.1 IBWC and CILA

> *"In 1944, a treaty between the U.S. and Mexico created a joint commission with federal agencies on both sides of the border to provide binational solutions to issues that arise in the border region related to national ownership of waters, sanitation, water quality, and flood control. In the U.S., the responsible federal agency is the United States International Boundary and Water Commission [IBWC]; in Mexico, the responsible federal agency is the Comisión International de Limites y Aguas, Sección Mexicana (CILA)"* (HDR 2020).

1.3.2 CESPT

The Comisión Estatal de Servicios Públicos de Tijuana (State Public Service Commission of Tijuana, or CESPT) is the Mexican public utility in Tijuana responsible for supplying drinking water and sewage services to Tijuana.

1.3.3 SEPROA

The Secretaría para el Manejo Saneamiento y Protección del Agua (Secretariat for Water Management, Sanitation, and Protection, or SEPROA) was created in May 2020 "to act as the state agency responsible for designing and coordinating public policy on the management of state water resources, as well as promoting the rational use of water," and oversees CESPT. Additionally, SEPROA is "in charge of planning, managing, regulating, validating, supervising, constructing and coordinating the potable water, sewerage, sanitation and reuse services that correspond to the State, as well as their systems, through the parastatal entities of the sector . . ." (https://www.facebook.com/bc.seproa/, accessed 2/17/21).

1.3.4 NADB

> *"The North American Development Bank (NADB) is a binational financial institution established by the Governments of the United States and Mexico to provide financing to support the development and implementation of infrastructure projects, as well as to provide technical and other assistance for projects and actions that preserve, protect or enhance the environment in order to advance the well-being of the people of the United States and Mexico*" (https://www.nadb.org/about/overview, accessed 1/13/21).

1.4 Overview of Existing infrastructure

The 10 projects analyzed in the individual *Feasibility Analysis Technical Memoranda* propose modification, rehabilitation, and/or expansion of existing wastewater infrastructure in both the U.S. and Mexico. This infrastructure is listed below by country and the data and information to support the analyses are described in Section 4.4 (also shown in Figure 1-1 and Figure 1-2).

- U.S.
  - ITP
  - South Bay Water Reclamation Plant (SBWRP)
  - SBOO
- Mexico
  - International Collector
  - CILA Pump Station (PB-CILA) and river diversion
  - Pump stations and conveyance lines
  - SABTP and SAB Creek
  - La Morita Wastewater Treatment Plant (WWTP)
  - Arturo Herrera WWTP

2. FEASIBILITY ANALYSIS SUMMARY

PG Environmental was tasked by EPA to conduct feasibility analyses of 10 proposed projects to mitigate impacts from transboundary flows from Mexico into the U.S. These projects, many of which include multiple sub-projects, include a range of treatment approaches in both the U.S. and Mexico as well as a source control project. Sections 2.1 to 2.3 below describe the overall process, possible alternative project delivery methods, and costing approach; Table 2-1 summarizes the 10 projects, including sub-projects, project purpose, and estimated capital and life cycle costs. Table 2-2 summarizes the 10 projects' significant benefits, challenges, and interdependencies.

Table 2-1. Summary of USMCA Projects Purpose and Cost

Project	Project Title	Sub-Project Title	Project Purpose	Estimated Project Capital Cost	Estimated 40-Year Life Cycle Cost
1	New Tijuana River Diversion and Treatment System in the U.S.	U.S.-side river diversion system to pump a peak daily flow rate of 35 MGD, 60 MGD, 100 MGD, or 163 MGD	Divert and treat river water during wet-weather flow conditions in order to protect the estuary and coastal communities; divert and treat dry-weather transboundary flows if the PB-CILA diversion fails	$17.2 million, $26.7 million, $37.8 million, $41.2 million	$28.0 million, $41.0 million, $57.0 million, $63.0 million
		82-million-gallon storage basin designed for a peak daily flow rate of 35 MGD, 60 MGD, 100 MGD, or 163 MGD		$71.8 million, $73.7 million, $75.0 million, $77.3 million	$97 million, $111 million, $116 million, $130 million
		Advanced Primary Treatment Plant (APTP) designed for a peak daily flow rate of 35 MGD, 60 MGD, 100 MGD, or 163 MGD		$72.9 million, $92.4 million, $160.4 million, $202.9 million	$280 million, $390 million, $496 million, $640 million
2	Expand and Upgrade Tijuana River Diversion System in Mexico and Provide Treatment	Rehabilitation and extension of the conveyance line from PB-CILA to the headworks of a new APTP in the U.S.	Eliminate the need for Pump Station 1-A (PB1-A), improve water quality in the Tijuana River, reduce flows discharged to the Pacific Ocean via SAB Creek, and make PB-CILA more reliable	$11.5 million	$12.3 million
		Upgrading the existing Mexico-side river diversion, PB-CILA, and the conveyance to divert river flows up to 60 MGD to a new APTP in the U.S.		$45.5 million	$49.9 million
		APTP designed to treat 35 MGD or 60 MGD of diverted river water from PB-CILA		$72.9 million, $92.4 million	$373 million, $440 million
3	Treat Wastewater from the International Collector at the South Bay International Wastewater Treatment Plant	Increasing ITP average daily design flow rate to 40 MGD, 50 MGD, 55 MGD, or 60 MGD	Reduce impacts to the U.S. coast by capturing and treating wastewater from the International Collector (and potentially flows from the canyon pump stations) that otherwise would be discharged to the Pacific Ocean via SAB Creek without adequate treatment	$227 million, $299 million, $353 million, $372 million	$510 million, $700 million, $860 million, $940 million

Project	Project Title	Sub-Project Title	Project Purpose	Estimated Project Capital Cost	Estimated 40-Year Life Cycle Cost
		Construct a pump station and pipeline to convey treated effluent from the expanded ITP to Mexico	Provide a source of water to be beneficially reused in Mexico while also lessening the volume of effluent discharged from the SBOO	$12.4 million	$26.0 million
		Construct a new pipeline in the U.S. to replace the International Collector	Reduce spillage from the International Collector while also enabling easier pipeline maintenance	$14.1 million	$28.9 million
4	Shift Wastewater Treatment of Canyon Flows to U.S. (via Expanded ITP or SBWRP) to Reduce Flows to SAB Creek	Decommissioning the Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations in Mexico and constructing a new conveyance system	Protect coastal communities and reduce beach impacts in the U.S. due to untreated or undertreated wastewater discharged to the Pacific Ocean via SAB Creek that originate in Matadero and Los Laureles Canyons	$30.8 million	$35.9 million
		Upgrading the U.S.-side wastewater collection structures at Smuggler's Gulch and Goat Canyon	Reduce U.S. Customs and Border Protection agents' exposure to untreated wastewater at the canyon flow diversion structures	$435,000	$600,000
5	Enhance Mexico Wastewater Collection System to Reduce Flows into the Tijuana River	Rehabilitating targeted collector pipelines as identified by CESPT	Provide the facilities necessary to collect sanitary wastewater from the Tijuana metropolitan area and treat it in Mexico, thereby minimizing the flow of untreated wastewater into the Tijuana River and the Pacific Ocean	$149 million	Not evaluated
		Extending wastewater collection facilities into developed but unsewered areas		$756 million	Not evaluated
		Rehabilitating or replacing the existing local pump stations		$84 million	Not evaluated
		Rehabilitating or replacing the existing local sanitary sewer system		Up to billions of dollars depending on extent of work; precise costs not evaluated	Not evaluated
		Expanding the Tijuana sanitary sewer system to account for future growth			
		Expanding the treatment capacity in Tijuana to treat the additional			

Project	Project Title	Sub-Project Title	Project Purpose	Estimated Project Capital Cost	Estimated 40-Year Life Cycle Cost
		wastewater captured by the sanitary system			
6	Construct New Infrastructure to Address Trash and Sediment	Restoration of the Tijuana River Main Channel sediment basin between the U.S./Mexico border and Dairy Mart Road to its original configuration by removing accumulated sediment	Reduce sediment loads in transboundary flows	$49.6 million	$380 million
		Sediment basin located on the U.S. side of the border at Smuggler's Gulch (in channel)		$2.4 million	$32.2 million
		Sediment basin located on the U.S. side of the border at Smuggler's Gulch (in and off channel combined)		$7.6 million	$38.5 million
		In-channel sediment basin on the Mexico side of the border at Smuggler's Gulch		$1.1 million	$8.5 million
		U.S.-side pilot channel in Yogurt Canyon	Reduce wet-weather flooding over Monument Road—ineffective	$3.3 million	$3.5 million
		U.S.-side modification to Monument Road just east of International Friendship Park	Reduce wet-weather flooding over Monument Road	$2.9 million	$3.2 million
		Installation of trash booms in the Tijuana River Main Channel (U.S. side)	Potential to reduce trash, waste tires, and associated pollutants in transboundary flows	$3.6 million	$33.1million
		Installation of trash booms in Smuggler's Gulch (Mexico side)	Potential to reduce trash, waste tires, and associated pollutants in transboundary flows	$420,000	$1.4 million

Project	Project Title	Sub-Project Title	Project Purpose	Estimated Project Capital Cost	Estimated 40-Year Life Cycle Cost
7	Divert or Reuse Treated Wastewater from Existing Wastewater Treatment Plants in Mexico to Reduce Flows into the Tijuana River	Discharge to Rodriguez Dam impoundment for potential indirect potable reuse, all new infrastructure	Reduce the need to divert and treat as much river water at the border, and ultimately reduce the quantity and frequency of transboundary flows	$36.9 million	$50.2 million
		Discharge to Rodriguez Dam impoundment for potential indirect potable reuse, reuse of some existing infrastructure		$20.7 million	$34.0 million
		Piping of treated wastewater from La Morita and Arturo Herrera WWTPs directly to the SBOO		$77.9 million	$79.0 million
8	Upgrade San Antonio de los Buenos Wastewater Treatment Plant to Reduce Untreated Wastewater to Coast	Upgrading the SABTP to properly treat reduced flows coming from Playas and direct vicinity of the SABTP (10 MGD)	Reduce untreated wastewater discharged to the Pacific Ocean via SAB Creek to reduce impacts of wastewater along the coastline	$65.8 million	$195 million
		Upgrading the SABTP to properly treat reduced flows coming from Playas and direct vicinity of the SABTP (5 MGD)		$43.3 million	$121.0 million
9	Treat Wastewater from the International Collector at the South Bay Water Reclamation Plant	Using the SBWRP at its current design capacity (15 MGD) and layout with solids pumped to Point Loma for processing	Reduce impacts to southern San Diego County beaches from untreated or undertreated wastewater discharged to the Pacific Ocean via SAB Creek	$51.6 million	$681 million
		Using the SBWRP at its current design capacity (15 MGD) but constructing a new onsite solids processing chain		$105 million	$759 million
		Expanding the SBRWP to a design capacity of 30 MGD (average daily flow), including a new onsite solids processing train		$274 million	$1.2 billion

<table>
<tr><th>Project</th><th>Project Title</th><th>Sub-Project Title</th><th>Project Purpose</th><th>Estimated Project Capital Cost</th><th>Estimated 40-Year Life Cycle Cost</th></tr>
<tr><td rowspan="5">10</td><td rowspan="5">Sediment and Trash Source Control</td><td>Road paving</td><td>Reduce sediment loads in transboundary flows</td><td rowspan="5" colspan="2">Unlike the cost impact analysis for the other nine projects, Project 10 does not provide estimates for the construction, operation, and maintenance of specific infrastructure or BMPs; see the Project 10 feasibility analysis for details</td></tr>
<tr><td>Trash and tire collection, processing, and disposal</td><td>Potential to reduce trash, waste tires, and associated pollutants in transboundary flows</td></tr>
<tr><td>Public education, outreach, and participation programs</td><td>Potential to facilitate public acceptance of investment in higher-cost trash and sediment source control projects</td></tr>
<tr><td>Land stabilization</td><td>Reduce sediment loads in transboundary flows</td></tr>
<tr><td>Green infrastructure</td><td>Potential sediment load reductions in transboundary flows</td></tr>
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Table 2-2. Summary of USMCA Projects Benefits, Challenges, and Interdependencies

Project	Sub-Project Title	Significant Benefits	Significant Challenges	Interdependencies
1	U.S.-side river diversion system to pump a peak daily flow rate of 35 MGD, 60 MGD, 100 MGD, or 163 MGD	Expected to increase the amount of river water diverted and treated during wet-weather flow conditions and divert and treat dry-weather transboundary flows if the dry-weather diversion system in Mexico fails	Protecting diversion structure from high flows; sediment management and disposal; scouring concerns; lack of sufficient data (both trash and sediment) to begin design	Linked to APTP treatment system
	82-million-gallon storage basin designed for a peak daily flow rate of 35 MGD, 60 MGD, 100 MGD, or 163 MGD	None	Sediment management and disposal and odors	Linked to U.S.-side diversion system
	APTP designed for a peak daily flow rate of 35 MGD, 60 MGD, 100 MGD, or 163 MGD	Expected to produce high-quality effluent that consistently satisfies the anticipated NPDES effluent limits for the proposed treatment process		Linked to U.S.-side diversion system and/or Mexico-side diversion
2	Rehabilitation and extension of the conveyance line from PB-CILA to the headworks of a new APTP in the U.S.	Effectively conveys wastewater flows diverted from PB-CILA to the new treatment facility on the U.S. side of the border	Requires reliable operation of PB-CILA	Linked to APTP treatment system. Enhances Project 3 and/or Project 9 performance.
	Upgrading the existing Mexico-side river diversion, PB-CILA, and the conveyance to divert river flows up to 60 MGD to a new APTP in the U.S.			
	APTP designed to treat 35 MGD or 60 MGD of diverted river water from PB-CILA	Expected to effectively treat diverted river water		Linked to Mexico-side diversion system
3	Increasing ITP average daily design flow rate to 40 MGD, 50 MGD, 55 MGD, or 60 MGD	Reduces the discharge of untreated or undertreated wastewater from the SABTP	Challenges around air permitting and regulations for anaerobic digestion; additional solids disposal	Serves same purpose as Project 9
	Construct a pump station and pipeline to convey treated effluent from the expanded ITP to Mexico	Creates a future opportunity for Mexico to implement a project to harvest the treated effluent for beneficial water reuse	Using PB1-B and parallel conveyance pipelines to carry treated effluent instead of untreated wastewater	Enhances ITP expansion
	Construct a new pipeline in the U.S. to replace the International Collector	Reduces spillage from the existing pipe, which has reached the end of its useful service life and is known to have structural defects that result in	Constructing infrastructure in and adjacent to the Tijuana River	Enhances ITP expansion

Project	Sub-Project Title	Significant Benefits	Significant Challenges	Interdependencies
		untreated wastewater leaking from the pipeline into the watershed		
4	Decommissioning the Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations in Mexico and constructing a new conveyance system	Reduces annual BOD_5 (oxygen consumption by microorganisms in five days) load to SAB Creek by 25%	None	Enhances Project 3 and/or 9 performance
	Upgrading the U.S.-side wastewater collection structures at Smuggler's Gulch and Goat Canyon	Reduces Customs and Border Protection agents' exposure to untreated wastewater that currently pools at the collectors	None	Enhances Project 3 and/or 9 performance
5	Rehabilitating targeted collector pipelines as identified by CESPT	Minimizes the flow of untreated wastewater into the Tijuana River and the Pacific Ocean	Long implementation timeline(s); construction in highly developed urban areas	Enhances Project 3 and/or 9 performance
	Extending wastewater collection facilities into developed but unsewered areas			
	Rehabilitating or replacing existing local pump stations			
	Rehabilitating or replacing the existing local sanitary sewer system			
	Expanding the Tijuana sanitary sewer system to account for future growth			
	Expanding the treatment capacity in Tijuana to treat the additional wastewater captured by the sanitary system			

Project	Sub-Project Title	Significant Benefits	Significant Challenges	Interdependencies
6	Restoration of the Tijuana River Main Channel sediment basin between the U.S./Mexico border and Dairy Mart Road to its original configuration by removing accumulated sediment	Reduces sediment loads in transboundary flows	Sediment management and disposal; lack of sufficient data (both trash and sediment) to begin design	None
	Sediment basin located on the U.S. side of the border at Smuggler's Gulch (in channel)			
	Sediment basin located on the U.S. side of the border at Smuggler's Gulch (in and off channel combined)			
	In-channel sediment basin on the Mexico side of the border at Smuggler's Gulch	None—ineffective		
	U.S.-side pilot channel in Yogurt Canyon	Reduces wet-weather flooding over Monument Road		
	U.S.-side modification to Monument Road just east of International Friendship Park	Potential to reduce trash, waste tires, and associated pollutants in transboundary flows		
7	Discharge to Rodriguez Dam impoundment for potential indirect potable reuse, all new infrastructure	Reduces the need to divert and treat as much river water at the border, and ultimately reduces the quantity and frequency of transboundary flows	Requires Rodriguez Dam integrity assessment	Enhances Projects 1, 2, 3, 8, and 9
	Discharge to Rodriguez Dam impoundment for potential indirect potable reuse, reuse some existing infrastructure			
	Piping of treated wastewater from La Morita and Arturo Herrera WWTPs directly to the SBOO		Raises NPDES compliance issues; large trenching project in main channel	

Project	Sub-Project Title	Significant Benefits	Significant Challenges	Interdependencies
8	Upgrading the SABTP to properly treat flow received from Tijuana and surrounding area	Improves wastewater discharge quality and reduce impacts of wastewater along the Pacific coastline near the international border	Requires revised design and costs and may create siting problems	Augments Projects 3 and 9
	Upgrading the SABTP to properly treat reduced flows coming from Playas and direct vicinity of the SABTP			
9	Using the SBWRP at its current design capacity and layout with solids pumped to Point Loma for processing	Reduces 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	Requires City of San Diego to sell SBWRP; challenges around air permitting and regulations for anaerobic digestion; additional solids disposal	Serves same purpose as Project 3
	Using the SBWRP at its current design capacity but constructing a new onsite solids processing chain			
	Expanding the SBRWP to a design capacity of 30 MGD (average daily flow), including a new onsite solids processing train	Reduces 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		
10	Road paving	Reduces sediment loads in transboundary flows	Some roads likely cannot be paved due to terrain and/or remote location prohibiting access with paving equipment	Complements all projects
	Trash and tire collection, processing, and disposal	Potential to reduce trash, waste tires, and associated pollutants in transboundary flows	Improper maintenance; public outreach	
	Public education, outreach, and participation programs	Potential to facilitate public acceptance of investment in higher-cost trash and sediment source control projects	Requires further analysis to understand funding and effectiveness	
	Land stabilization	Reduces sediment loads in transboundary flows	Coordination among agencies and stakeholders	
	Green infrastructure	Potential sediment load reductions in transboundary flows	New training; changes to local codes; and outreach to local community members	

2.1 Overview of Methodology

To inform the feasibility analyses, PG facilitated a technical expert consultation process (TECP) consisting of numerous meetings with individual stakeholders, government agencies, and organizations. The TECP enabled PG to gather current data and information about conditions in the watershed as well as important perspectives on the relevant environmental issues and proposed mitigation projects.

The 10 projects were divided into a logical series of sub-projects for more thorough evaluation. Data and information obtained from the TECP and through further research were used to evaluate the sub-projects' technical feasibility, limitations, and environmental impacts. These findings are presented in the individual *Feasibility Analysis Technical Memoranda*.

2.2 Alternative Project Delivery Methods

PG considered a design-build approach as an alternative means of project delivery in lieu of the conventional design-bid-build approach. The main benefits of design-build delivery are:

- The flexibility afforded to the contractor/engineer team to use their unique knowledge and experience to develop a technologically innovative, cost-efficient, and constructible project design.
- The ability to perform design and construction work simultaneously to reduce the overall implementation schedule.

The primary disadvantage of the design-build process is that the project owner must surrender some control over the quality of the work provided, particularly mechanical systems, electrical systems, control systems, and the fits and finishes of project components. The projects evaluated are relatively simple technically, without elements that can be designed and constructed simultaneously to reduce construction time. Therefore, the benefits of the design-build project delivery approach are minimal for these projects: they do not appear to warrant the loss of owner control over project quality. For these reasons, the design-bid-build approach is recommended.

2.3 Feasibility Analysis Opinions of Probable Costs

PG's cost estimates in all feasibility analyses were developed to a Class V level of accuracy in accordance with the AACE International Recommended Practice No. 17R-97 (AACE International 2020). Class V estimate accuracy can range from +40%/-20% to +200%/-100%. Based on the information that PG has reviewed thus far, PG's estimate accuracy goal for construction in the U.S. is +50%/-25%, meaning actual construction costs may range from 50% higher than PG estimates to 25% lower. Because there are fewer sources of cost data for construction in Mexico, PG's estimate accuracy goal for construction in Mexico is +100%/-50%, meaning actual construction costs may range from 100% higher than PG estimates to 50% lower.

For project construction cost data, PG used manufacturers' cost information, bid tabulations from similar projects in the U.S. and Mexico in recent years, R.S. Means Heavy Construction Cost Data 2020, EPA cost databases (cost curves for various treatment technologies), Hydromantis CapdetWorks™ cost data, and adjustments for a 2020 *Engineering News-Record* value of 11,455. 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 project construction cost × 1.4 × 1.5, which is equivalent to project construction cost × 2.1.

3. INVENTORY OF DATA AND INFORMATION

PG was provided or obtained an array of technical reports, literature, and data from EPA and other engaged stakeholders. PG developed a complete inventory of this material and below presents the information used in the development of the 10 *Feasibility Analysis Technical Memoranda*. This inventory is intended to provide benefits for future analysis and users.

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3.2 Data and Information Needs

Throughout the development of the 10 *Feasibility Analysis Technical Memoranda*, PG identified additional data needs. The most critical data of these are listed below, categorized as either data needs or other information needs. For some needs, PG has identified (in parentheses) the entity that PG believes would be the most likely to provide the needed information.

Data needs:

- Monitoring data for pollutants that can serve as surrogates for untreated wastewater (such as BOD_5 and tryptophan) in the Tijuana River during both wet and dry conditions, along with associated flow estimates from the same location(s). A better understanding of the flow rate of untreated wastewater could affect the estimated impacts of infrastructure projects.
- Monitoring data for sediment in the Tijuana River during both wet and dry conditions, along with associated flow estimates from the same location(s). A better understanding of water quality in the Tijuana River depends on more reliable data, particularly related to sediment loadings. This information could affect the cost and feasibility of implementing several projects.
- Wet-weather trash loading data for the Tijuana River.
- Upgraded PB-CILA performance data (CESPT).

- Better data on the source volumes and peak flow rates of untreated wastewater discharges into the Tijuana River (CESPT).
- Additional flow data from the Los Laureles 1 and Los Laureles 2 Pump Stations (CESPT).
- Water quality data from the canyon flow diversion structures (CESPT).
- More data on unit costs for source control best management practices currently implemented in the Tijuana River watershed.
- Street- and parcel-level GIS data for existing infrastructure in Tijuana.

Other information:

- Verification of the ITP processes to ensure facilities and operations are consistent with all feasibility analysis assumptions (IBWC).
- Finalized effluent limitations from the Regional Water Quality Control Board (RWQCB); this information could affect the feasibility and/or cost of projects 1, 2, 3, and 9 (RWQCB).
- Assessment of the condition of the Arturo Herrera and La Morita WWTPs (CESPT).
- Structural assessment of the Rodriguez Dam.
- Discussion with Arcadis to further understand their design for piping effluent to the SBOO (Arcadis).

4. DATA AND INFORMATION SUMMARY

Data and information were obtained from the reports and resources identified in Section 3. These were evaluated and incorporated into multiple or individual *Feasibility Analysis Technical Memoranda*, where applicable. The technical information below is provided to facilitate brevity in the *Feasibility Analysis Technical Memoranda* and to justify and document assumptions, when necessary.

4.1 Population

PG analyzed the feasibility of projects that involve constructing new treatment and/or conveyance infrastructure in terms of how well these systems will accommodate Tijuana's growing population. PG relied on population projections by NADB, EPA, and CESPT, summarized in Table 4-1.

Table 4-1. Tijuana Population Projections Through 2050

Year	Projected Population
2015	1,237,963
2020	1,376,271
2025	1,467,955
2030	1,559,140
2035	1,648,810
2040	1,736,081
2045	1,820,269
2050	1,900,898

Source: NADB et al. 2020

The population projections in Table 4-1 are based on data collected by the National Population Council, Mexico, and were generated using an average of multiple statistical projection methods (e.g., linear, exponential, logarithmic, potential, arithmetic, geometric).

4.2 Precipitation

Precipitation data are important to understand the temporal pattern and frequency of rainfall events and how these may influence transboundary flows. No suitable data sources for precipitation in Mexico were identified; PG's analysis relies on an assumption that precipitation recorded at the Brown Field Municipal Airport is representative of rainfall totals throughout the watershed. PG compared the Brown Field data to data from two other National Oceanic and Atmospheric Administration (NOAA) weather stations in the region: Imperial Beach Ream Field (Weather Station ID 92-1260) and Chula Vista (Weather Station ID 04-1758). The error in daily totals between Brown Field and these two locations was shown to be reasonably small and normally distributed. Additionally, PG's analysis only applies to flows in the Tijuana River immediately north of the international border, which is downstream from where PB-CILA diverts flow from the river.

Table 4-2 shows the precipitation totals for each year analyzed, as well as the approximate total gallons of transboundary flow in the Tijuana River main channel for each year.

Table 4-2. Annual Precipitation and Estimated Transboundary Flows

Year	Total Precipitation Recorded at Brown Field (Inches)	Total Transboundary Flow (Billion Gallons)
2016	11.2	9.8
2017	10.1	22.7
2018	7.0	6.5
2019	18.5	30.9

For reference, Table 4-3 below (from NOAA Atlas 14) shows the frequency of different magnitude storm events in the Tijuana River Watershed.

Table 4-3. NOAA Atlas 14 Data for the Tijuana River Watershed

Precipitation Frequency Estimates (Inches)										
Duration	Average Recurrence Interval (Years)									
	1	2	5	10	25	50	100	200	500	1,000
5-min	0.102	0.128	0.163	0.194	0.237	0.272	0.31	0.35	0.407	0.454
10-min	0.147	0.183	0.234	0.278	0.34	0.39	0.444	0.501	0.583	0.65
15-min	0.177	0.222	0.283	0.336	0.411	0.472	0.537	0.606	0.705	0.787
30-min	0.249	0.312	0.398	0.472	0.578	0.664	0.755	0.853	0.992	1.11
60-min	0.344	0.431	0.55	0.652	0.798	0.916	1.04	1.18	1.37	1.53
2-hr	0.479	0.601	0.766	0.903	1.1	1.25	1.4	1.57	1.8	1.99
3-hr	0.59	0.741	0.943	1.11	1.34	1.52	1.71	1.9	2.17	2.39
6-hr	0.77	0.97	1.24	1.45	1.75	1.98	2.22	2.46	2.8	3.06
12-hr	0.986	1.24	1.58	1.86	2.25	2.54	2.85	3.17	3.6	3.94
24-hr	1.25	1.59	2.03	2.39	2.89	3.28	3.68	4.1	4.67	5.12
2-day	1.56	2.01	2.59	3.07	3.73	4.23	4.75	5.28	6.01	6.58
3-day	1.74	2.26	2.94	3.49	4.25	4.83	5.42	6.02	6.85	7.49
4-day	1.89	2.47	3.22	3.83	4.66	5.3	5.95	6.61	7.52	8.22
7-day	2.19	2.86	3.74	4.45	5.43	6.18	6.94	7.73	8.8	9.63
10-day	2.39	3.12	4.08	4.86	5.93	6.75	7.58	8.44	9.61	10.5
20-day	2.89	3.8	4.98	5.93	7.22	8.19	9.17	10.2	11.5	12.6
30-day	3.48	4.59	6.01	7.15	8.67	9.8	10.9	12.1	13.6	14.8
45-day	4.08	5.39	7.05	8.35	10.1	11.3	12.6	13.8	15.5	16.7
60-day	4.77	6.28	8.18	9.66	11.6	13	14.3	15.7	17.4	18.7

Source: https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html (accessed February 19, 2021); station name: Brown Field Municipal Airport; Site ID: 92-0405

In general, PG observed that flow at the border following a rain event begins with a surge of peak flow followed by a period of days with sustained and subsiding flow. PG generated the correlations shown in Table 4-4 relating rainfall at Brown Field Municipal Airport to flow in the Tijuana River main channel.

Table 4-4. Precipitation and Flow Correlation for the Tijuana River

Precipitation (Inches)	Days of Flow	Total Flow (Million Gallons)	Peak Instantaneous Flow (MGD)
0.1	1.5	33	191
0.25	2.7	107	483
0.33	3.3	159	642
0.5	4.7	298	986
0.66	6.0	465	1,319

Precipitation (Inches)	Days of Flow	Total Flow (Million Gallons)	Peak Instantaneous Flow (MGD)
0.75	6.7	574	1,510
1	8.7	933	2,053
1.25	10.7	1,376	2,616
1.33	11.3	1,535	2,800
1.5	12.7	1,902	3,199
1.75	14.6	2,513	3,802
2	16.6	3,208	4,426
2.25	18.6	3,986	5,069
2.5	20.6	4,849	5,732
2.75	22.6	5,795	6,415
3	24.6	6,826	7,118
3.25	26.6	7,940	7,841
3.5	28.6	9,138	8,585
3.75	30.5	10,420	9,348
4	32.5	11,786	10,131

4.3 Tijuana River Main Channel—Flow Characteristics

4.3.1 Flow Characteristics

PG evaluated the frequency and magnitude of transboundary flows using data from IBWC's main channel flow gauge between January 1, 2016, and December 31, 2019. During that period, PG determined that an average of 153 days with transboundary flow occurred annually and the average annual volume of transboundary flows was 17,500 million gallons. Figure 4-1 displays the distribution of average daily flow rates for transboundary flows over the four-year period.

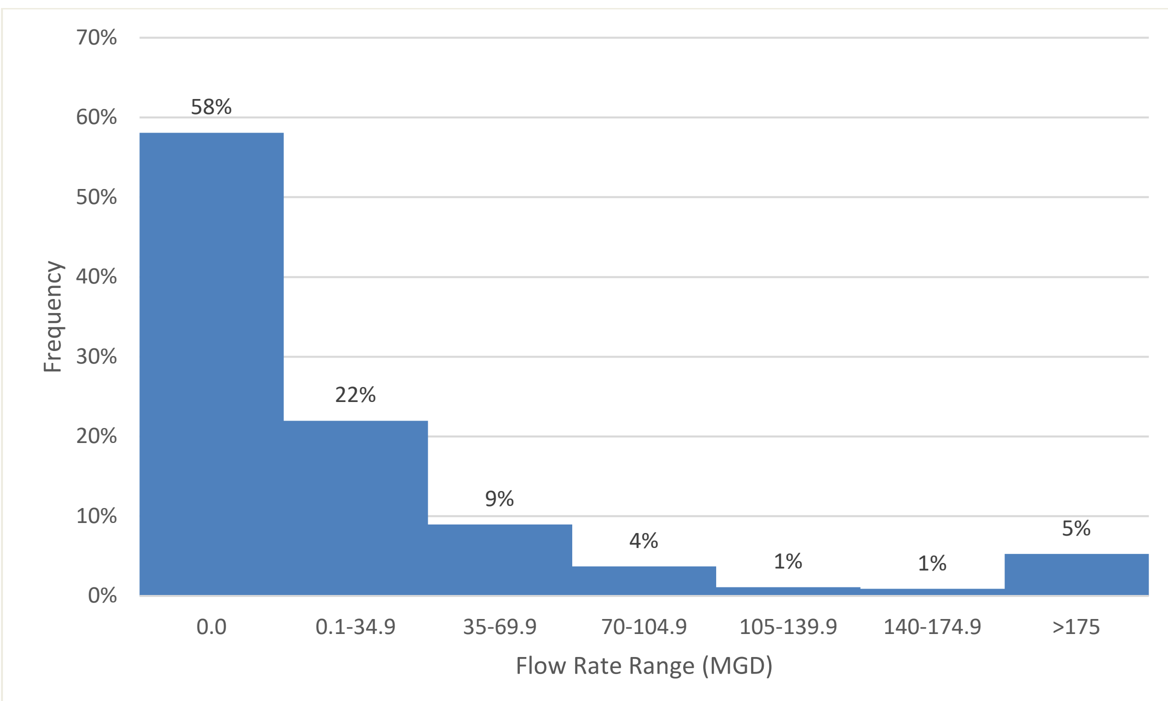

Figure 4-1. Tijuana River Transboundary Flows (2016–2019)

Although Figure 4-1 shows that most transboundary flows are below 35 MGD, most of the total volume of transboundary flows comes from infrequent, large wet weather flow events. The distribution of the total volume of flow based on the magnitude of transboundary flows in the Tijuana River is shown in Figure 4-2.

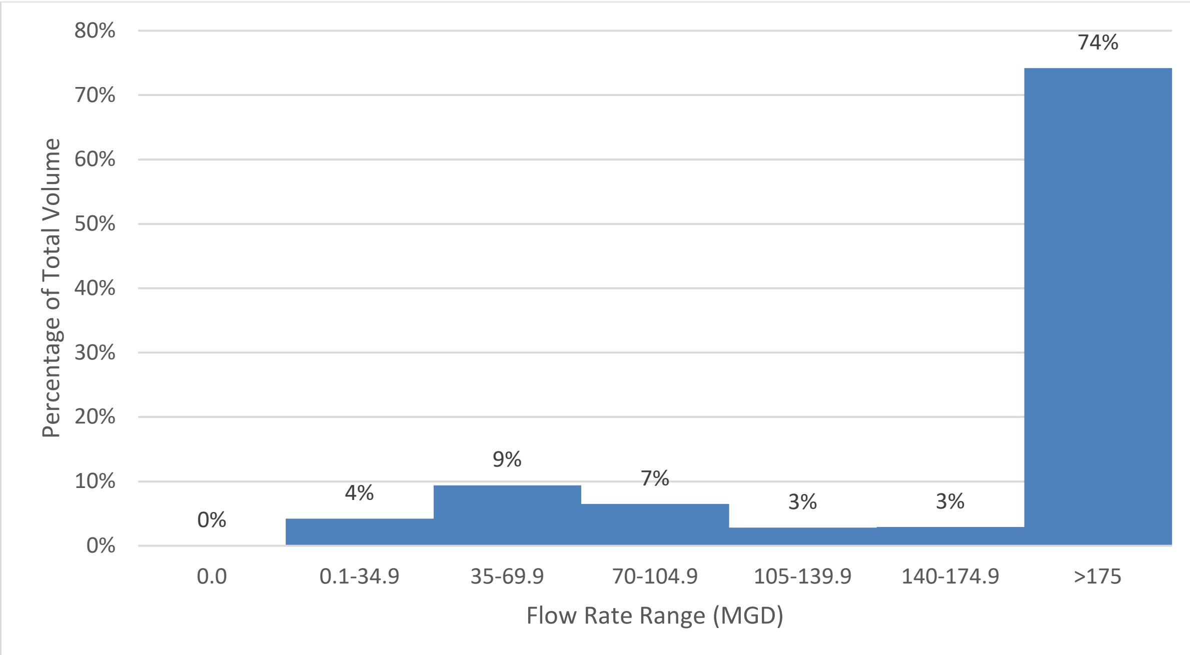

Figure 4-2. Distribution of the Total Transboundary Flow Volume by River Flow Rates

4.3.1.1 Dry Weather

During dry weather, flow in the Tijuana River upstream of the U.S.-Mexico border consists of untreated wastewater that escapes the City of Tijuana's sanitary collection system, treated effluent from the Arturo Herrera and La Morita WWTPs, and flows from the tributary Alamar River, which consist of mostly treated effluent from Tecate. Under normal conditions, all dry-weather flows in the river are diverted by PB-CILA about 1,000 feet upstream of the U.S.-Mexico border. When operating properly, the PB-CILA diversion prevents river flows up to 1,000 L/s (about 23 MGD) from flowing into the U.S. Historically, dry weather transboundary flows have occurred when PB-CILA was shut down due to malfunctioning equipment or other operational issues at PB-CILA, PB1-A, PB1-B, or pipelines downstream.

4.3.1.2 Wet-Weather

In wet weather, large volumes of stormwater runoff can cause the flow rate in the river to reach several thousand MGD. PB-CILA shuts off when the flow rate in the river exceeds 23 MGD to protect the pumping equipment (Arcadis 2019). The flows in the river then cross the border and flow into the Tijuana River Valley. PG analyzed the data for a four-year period from January 1, 2016, to December 31, 2019. PG excluded 2020 data because PB-CILA was offline for much of the year while new pumping equipment was installed. As a result, less flow was diverted from the river in 2020 than during the prior four years.

During 2016–2019, the operational protocol was to shut off PB-CILA when flows in the river exceeded 1,000 L/s (about 23 MGD). PB-CILA would not be reactivated until the flow subsided to less than 1,300 L/s (29.7 MGD), typically resulting in a multi-day period during which no flow was diverted from the river. PG estimates that the improvements made to PB-CILA in 2020 will enable more wet-weather flows to be diverted, thereby reducing the amount of transboundary flow resulting from precipitation events of a given magnitude as well as the number of days per year with transboundary flows.

4.3.2 Untreated Wastewater in Tijuana River Transboundary Flows

PG used BOD_5 as the surrogate parameter to evaluate the presence of untreated wastewater in the in Tijuana River transboundary flows. PG used BOD_5 because it is readily measurable and BOD_5 data are already available for untreated wastewater in Tijuana. Additionally, the non-wastewater flows in the river, composed primarily of stormwater and treated effluent from the Alamar River and the Arturo Herrera and La Morita WWTPs, generally have very low BOD_5 concentrations. PG estimates that untreated wastewater in Tijuana has a BOD_5 concentration of 400 mg/L based on the IBWC Water Quality Study and ITP influent data from 2016 through 2019 (IBWC 2020).

The BOD_5 concentration in transboundary flows is dependent on the flow rate of untreated wastewater entering the river relative to the total flow in the river. PG estimated the flow rate of untreated wastewater into the river using available flow source data from August 2020 through January 2021 collected by CESPT and provided by NADB (see Appendix E of the *Water Infrastructure Alternatives Analysis* report). CESPT collected these data by visually monitoring the points where untreated wastewater is discharged to the Tijuana River channel. CESPT used these data to estimate that the average flow rate of untreated wastewater was 13 MGD over this period. However, EPA and NADB stated, based on their observations, that untreated wastewater discharges into the river throughout 2020 were abnormally high compared to 2016 through 2019. Actual flow source data in the Tijuana River were not available for 2016 through 2019. Therefore, PG adjusted the 2020 average daily flow rate of untreated wastewater into the river (13 MGD) using flow balances between the river and the International Collector from 2016 through 2019. Based on the flow balances, PG estimated that the average daily flow rate of untreated wastewater into the river for 2016 through 2019 was 10 MGD.

During dry weather, the estimated average daily flow rate of 10 MGD of untreated wastewater that enters the river is diluted by effluent from the Arturo Herrera WWTP, effluent from the La Morita WWTP, and flows from the Alamar River. PG used the average daily effluent flow rate data presented in a CESPT (2020b) report to estimate the average daily effluent flow rates from the Arturo Herrera WWTP and the La Morita WWTP. PG estimated the average daily flow rate from the Alamar River using 2020 flow data collected by CESPT and provided by NADB. The sources of flow in the Tijuana River are summarized in Table 4-5.

Table 4-5. Summary of Dry Weather Flow Sources in the Tijuana River from 2016-2019

Source	Average Daily Flow (MGD)
Effluent from the Arturo Herrera WWTP (CESPT 2020b)	5.0
Effluent from the La Morita WWTP (CESPT 2020b)	5.3
River flows from Alamar River	4.1
Untreated wastewater from Tijuana	10
Average daily dry weather flows 2016–2019	**24.4**

PG used the dry weather and wet weather sediment concentrations in the river to calculate the average suspended sediment concentration and the sediment load at the average daily flow rates measured at the IBWC flow gauge from January 1, 2016, through December 31, 2019. PG used the daily BOD_5 loadings to estimate that the average annual sediment load over that four-year period was 1,670 tons.

Refer to Appendix B: Methods of Analysis of the *Water Infrastructure Alternatives Analysis* report for details on the methods PG used to evaluate BOD_5 loadings in the river.

4.3.3 Sediment Transport in Tijuana River Transboundary Flows

During wet-weather events, stormwater runoff from the City of Tijuana collects large amounts of sediment. The runoff flows into the Tijuana River, which transports large sediment loads across the border. Ultimately, the larger grains of sediment are deposited in the estuary while the finer grains of sediment are transported out into the Pacific Ocean. According to the HDR report, the sediment that settles in the estuary is known to cause environmental and public health issues (HDR 2020).

PG estimated the sediment transport characteristics in the river using existing literature for the main channel flow data, sediment characteristics, and water quality characteristics, as identified below:

- **Flow data.** PG used Tijuana flow data from the U.S. IBWC flow gauge at the international border.
- **Sediment characteristics.** In the main river channel, sediment characteristics came from the following sources:
  - The hydrology and sediment transport study outlined in Appendix F of the Stantec report (Stantec 2020).
  - Sediment monitoring data from storm events from December 2019 to February 2020 by Dr. Taniguchi-Quan of the Southern California Coastal Water Research Project.
  - Storm event monitoring data and correlations from a preliminary report by Dr. Trent Biggs of the San Diego State University.
  - Sediment loadings during frequency storm events from the U.S. Army Corps of Engineers Phase II Hydraulics, Hydrology, and Sediment Transport Study (USACE 2020).

During dry weather, untreated wastewater that is not captured in the sanitary sewer system is the primary source of total suspended solids (TSS) loads into the river. PG estimated the TSS loading in dry weather flows by multiplying the TSS concentration of the untreated wastewater by the average proportion of the total flows that is untreated wastewater (shown in Table 4-5). PG used the Minute 320 Water Quality Study (IBWC 2020) and ITP influent monitoring data to estimate that untreated wastewater in Tijuana has a TSS concentration of 400 mg/L. PG estimates that an average of 10 MGD out of the 24.4 MGD of the average dry weather flows in the Tijuana River are untreated wastewater, which alone would mean the TSS concentration in the river is 165 mg/L. PG assumed that other minor sediment sources (e.g., scouring) bring the TSS concentration in the river during dry weather to 200 mg/L.

During wet-weather events, the main source of sediment in the river is stormwater runoff that enters the river. The TSS concentration in wet weather flows increases as flows increase. PG assumed that smaller wet weather flow events have a TSS concentration of 200 mg/L, similar to dry weather flows. As flow rates increased, PG used a preliminary correlation relating suspended sediment concentrations to the flow rate in the Tijuana River at the IBWC gauge, developed by San Diego State University and Southern California Coastal Water Research Project on sediment samples for river flow rates over 5 m^3/s (114 MGD) to estimate TSS concentrations in the river during wet weather.

PG used the dry weather and wet weather sediment concentrations in the river to calculate the average TSS concentration and the sediment load in the average daily flow rates measured at the IBWC flow gauge January 1, 2016, through December 31, 2019. PG used the daily sediment loadings to estimate that the average annual sediment load over that four-year period was 125,000 tons of sediment.

The estimated average annual sediment load between 2016 and 2019 does not account for very large storm events that occur infrequently but are a significant source of sediment loading in the Tijuana River. The maximum 24-hour precipitation accumulation measured at the NOAA gauge at Brown Field in San Diego (the closest NOAA gauge to the City of Tijuana) between 2016 and 2019 was 2.21 inches. According to the NOAA Atlas 14 Precipitation Frequency Estimates, this event is between the size of a five-year, 24-hour storm (2.04 inches) and a 10-year, 24-hour storm (2.40 inches). PG used the *Phase 2 Hydrology, Floodplain, and Sediment Transport Report* developed by the U.S. Army Corps of Engineers (USACE 2020) to account for the sediment load from storms larger than those that occurred between 2016 through 2019. The USACE Phase 2 study described modeling used to estimate the sediment loads that are transported to the estuary during storm events with recurrence intervals ranging from two years to 500 years. USACE calculated the average sediment load in main channel flows that each storm contributes annually by multiplying the total sediment yield by the probability for a storm of that size to occur in an average year. The estimated sediment yields for the Tijuana River main channel is shown in Table 4-6 (USACE 2020).

Table 4-6. Estimated Sediment Loads from Storm Events in the Main Channel

Storm Recurrence Interval	Main Channel Estimated Sediment Load (at U.S./Mexico Border) (Tons)	Main Channel Average Annual Sediment Load (Tons/Year)
500 years	2,211,000	4,422
200 years	1,075,000	5,375
100 years	696,000	6,960
50 years	644,000	12,880
25 years	399,000	15,960
10 years	169,000	16,900
5 years	89,000	17,800
2 years	19,000	9,500
Annual average	**N/A**	**90,000**

Source: USACE 2020

PG used the annualized sediment load averages at the U.S.-Mexico border shown in Table 4-6 to estimate that storm events with a recurrence interval of 10 years or more have an annualized sediment load of 62,500 tons. PG combined this estimate with the estimated sediment load from 2016 through 2019 to estimate that the annual sediment load in transboundary flows in the river is 187,000 tons.

The USACE Phase 2 study also evaluated the sediment load that is discharged into the ocean for each frequency storm event. PG compared the amount of sediment crossing the border to the sediment load discharged into the ocean to estimate how much sediment is deposited in the estuary annually from both the Tijuana River main channel and Smuggler's Gulch. Table 4-7 shows the results.

Table 4-7. Estimated Sediment Load That Crosses the Border and Enters the Ocean

Storm Recurrence Interval	Total Sediment Load Crossing the Border in the Main Channel and Smuggler's Gulch (Tons)	Total Sediment Discharged to the Ocean (Tons)	Total Sediment Estimated to Be Deposited into the Estuary (Tons)	Annualized Amount of Sediment Deposited into the Estuary (Tons/Year)
500 years	2,290,000	1,420,000	870,000	1,740
200 years	1,138,000	1,242,000	-104,000	-520
100 years	756,000	894,000	-138,000	-1,380
50 years	695,000	376,000	319,000	6,380
25 years	440,000	213,000	227,000	9,080
10 years	200,000	153,000	47,000	4,700
5 years	113,000	75,000	38,000	7,600
2 years	63,000	20,000	43,000	21,500
Estimated annual average sediment deposited into the estuary by storms				**49,000**

Source: USACE 2020

The USACE study noted that the depositional trends for the frequency storm events show that sediment is primarily deposited upstream of Hollister Street on the U.S. side of the border. The study found that the beach areas near the mouth of the ocean showed significant scour during large storm events. The study also found that most sediment discharges into the river were classified as fines (that is, their particle diameter was less than 0.0625 millimeters).

Data on sediment transport in the river are currently limited. PG's estimated annual sediment loading in the river is largely based on limited information and should be considered preliminary. More data on sediment should be collected during wet weather to better understand sediment transport during wet weather.

4.3.4 Impacts of the Proposed Projects to Tijuana River Transboundary Flows

PG evaluated how each of the 10 projects analyzed in the *Feasibility Analysis Technical Memoranda* would affect the flow characteristics and pollutant loadings in Tijuana River transboundary flows. These impacts are summarized in Table 4-8 below. Some of the sub-projects are not expected to significantly affect parameters that PG evaluated. These instances are marked as "N/A." In some cases, a project is expected to significantly affect some or all of the parameters that PG evaluated, but not enough data were available to quantify their impact. These instances are marked as "Unquantifiable."

Table 4-8. Project Impacts on Transboundary Flows

Project	Notes	Change in Transboundary Flow Days (Days/year)	Change in Transboundary Flow Days (%)	Change in Transboundary Flows (Million Gallons/Year)	Change in Transboundary Flows (%)	Change in Annual Transboundary River BOD Load (Tons/Year)	Change in Annual Transboundary River BOD Load (%)	Change in Annual Transboundary River Sediment Load (Tons/Year)*	Change in Annual Transboundary River Sediment Load (%)*
1	35 MGD, shuts off at 60 MGD	-80	-53%	-1,700	-10%	-799	-55%	-1,000	<-1%
	60 MGD, shuts off at 120 MGD	-107	-70%	-3,300	-19%	-1,168	-70%	-3,000	-2%
	100 MGD, shuts off at 100 MGD	-126	-82%	-3,500	-20%	-1,257	-79%	-3,000	-2%
	163 MGD, shuts off at 163 MGD	-133	-87%	-4,400	-25%	-1,351	-85%	-4,000	-2%
2	35 MGD diversion shuts off over 35 MGD	-80	-53%	-800	-4%	-460	-27%	-1,000	<-1%
	35 MGD diversion shuts off over 60 MGD	-80	-53%	-1,700	-10%	-799	-48%	-1,000	<-1%
	60 MGD diversion shuts off over 60 MGD	-107	-70%	-2,000	-12%	-920	-54	-2,000	1%
3	40 MGD expansion	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	50 MGD expansion	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	55 MGD expansion	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	60 MGD expansion	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	All projects	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	All projects	Unquantifiable	Unquantifiable	Unquantifiable	Unquantifiable	Unquantifiable	Unquantifiable	Unquantifiable	Unquantifiable

Project	Notes	Change in Transboundary Flow Days (Days/year)	Change in Transboundary Flow Days (%)	Change in Transboundary Flows (Million Gallons/Year)	Change in Transboundary Flows (%)	Change in Annual Transboundary River BOD Load (Tons/Year)	Change in Annual Transboundary River BOD Load (%)	Change in Annual Transboundary River Sediment Load (Tons/Year)*	Change in Annual Transboundary River Sediment Load (%)*
6	Main channel sediment basin	N/A	N/A	N/A	N/A	N/A	N/A	142,000	-76%
7	10.3 MGD removed	-79	-52%	-700	-4%	-440	-26%	-1,000	-1%
	16.2 MGD removed	-84	-55%	-900	-5%	-520	-31%	-1,000	-1%
8	5 MGD operation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	10 MGD operation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9	15 MGD treatment	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	30 MGD treatment	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10	All projects	Unquantifiable	Unquantifiable	Unquantifiable	Unquantifiable	Unquantifiable	Unquantifiable	Unquantifiable	Unquantifiable

* Data on wet-weather sediment loading are limited, and these estimates are based on preliminary results. More wet-weather sediment data are needed to enhance the accuracy of impact estimates.

4.3.5 Trash in Tijuana River Transboundary Flows

Wet-weather flows in the Tijuana River also convey large loadings of trash into the Tijuana River Valley, the Tijuana River Estuary, and the Pacific Ocean. Trash in the Tijuana River Valley tends to accumulate along channels and in areas with vegetation or other physical barricades, where it can diminish aesthetics and contribute to human health concerns (e.g., exposure to bacteria, viruses, and toxic substances; risk of puncture and laceration injuries; and exposure to disease vectors from ponded water). PG estimated the average annual trash load consistent with the methodology used in HDR's *Tijuana River Valley Needs and Opportunities Assessment*, which assumes that the annual trash load is 10% of the annual sediment load by volume (HDR 2020). This approach yielded an average annual trash load in main channel transboundary flows of 15,000 cubic yards. More monitoring should be conducted to better characterize the loadings and types of trash that are carried by the Tijuana River.

4.4 Current Wastewater Infrastructure

A system of pumps and pipelines in Tijuana collects untreated wastewater and diverted river water and conveys it to an outfall into SAB Creek, near the coast southwest of the city. SAB Creek then flows into the Pacific Ocean. The existing system is shown in Figure 4-3.

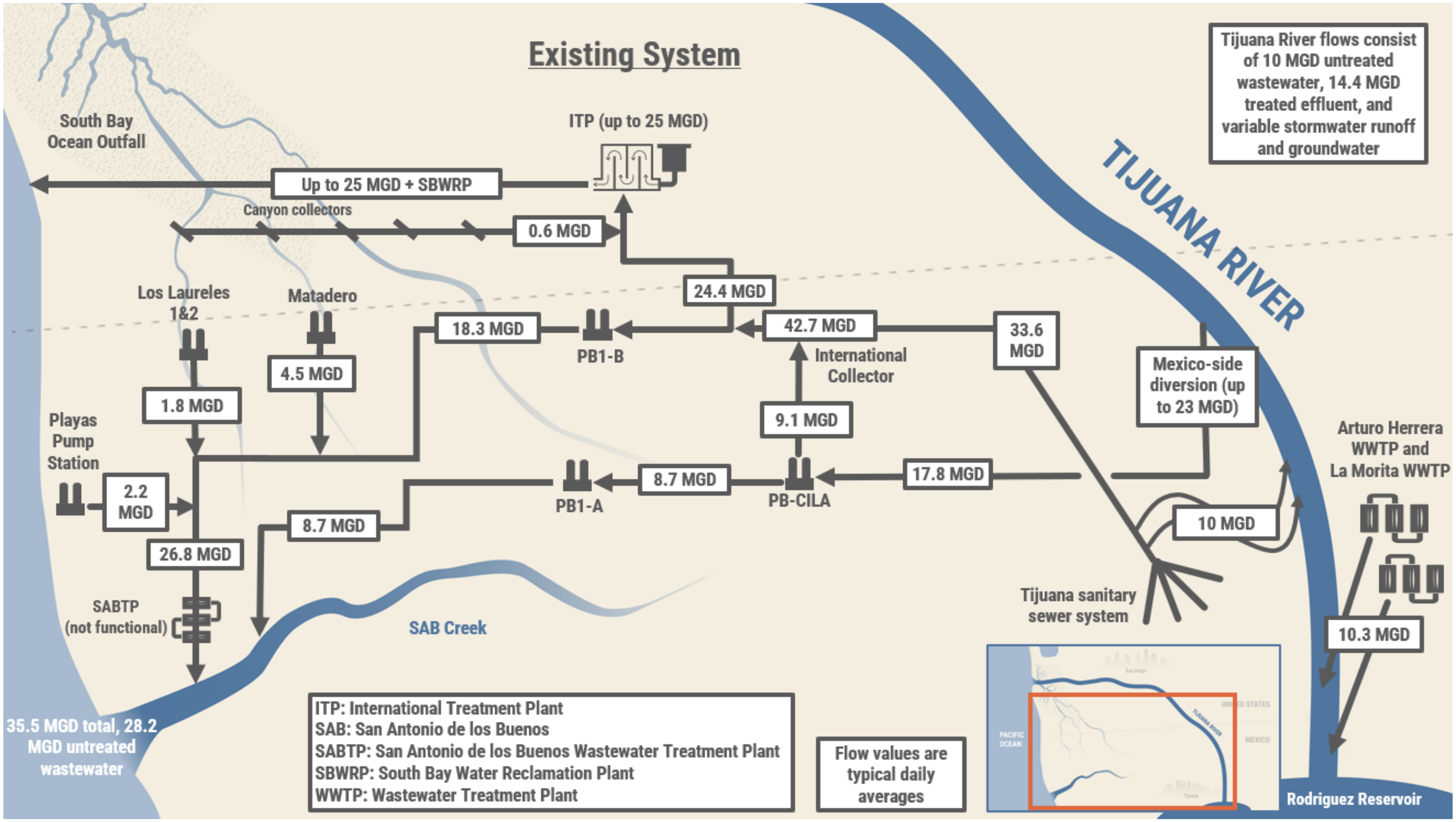

Figure 4-3. Flow Diagram of the Existing System of Pumps and Pipelines in the Lower Tijuana River Watershed

Infrastructure operations data and information used in the *Feasibility Analysis Technical Memoranda* are summarized below. In some cases, the individual reports offer further detail pertinent to specific projects.

4.4.1 South Bay International Wastewater Treatment Plant

The ITP is about 1.3 miles west of where the Tijuana River enters the U.S., and about one-half mile south of where Dairy Mart Road crosses over the Tijuana River. The existing plant is a primary and secondary treatment system designed to treat a daily average flow of 25 MGD of wastewater from the International Collector in Mexico, as well as dry-weather flows from the five canyon flow diversion structure systems (Goat Canyon, Smuggler's Gulch, Cañon del Sol, Silva Drain, and Stewart's Drain). The plant is owned by IBWC and operated under contract by Veolia. 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. Unused land area at the ITP property is sufficient to accommodate an expansion of the existing treatment systems as well as installation of a new APTP for treating diverted river water.

4.4.2 South Bay Water Reclamation Plant

The SBWRP was constructed in 2002 by the City of San Diego and operates in accordance with NPDES Permit CA01090445 (Order R9 2017 0023). It is on a 22-acre site adjacent to the ITP and currently treats wastewater collected from U.S. communities only. The existing SBWRP is designed to treat an average daily flow rate of 15 MGD and a peak daily flow rate of 35 MGD. The treatment process consists of preliminary treatment (screening and grit removal), primary treatment, secondary treatment (activated sludge with an anoxic selector ahead of aerobic zones), tertiary treatment (deep bed mono-media filtration), and disinfection (UV light using high-intensity, medium-pressure lamps). The City of San Diego pumps primary and secondary sludge from the treatment process to the Point Loma WWTP for processing and disposal via a dedicated force main. The SBWRP has an additional adjacent area of about 29 acres to the southwest for future expansion or new facilities.

4.4.3 South Bay Ocean Outfall

The SBOO discharges treated wastewater into the Pacific Ocean. HDR (2020) summarized its location and functionality as follows:

> *"The SBOO and the South Bay Land Outfall, located just north of the border, were completed in 1998 and are owned and operated by the City of San Diego. The SBOO is an 11-foot diameter tunnel extending 3.5 miles offshore to a depth of 93 feet below sea level. Treated flows from both the SBWRP and the SBIWTP are mixed at an effluent distribution vault before entering South Bay Land Outfall. The South Bay Land Outfall is a tunnel that extends from the effluent distribution vault to the coastline, after which it discharges into the Pacific Ocean via the SBOO. The SBOO extends beneath the seabed 3.5 miles offshore. From there, the outfall pipe connects to a vertical riser assembly that conveys effluent to a pipeline buried just beneath the surface of the sea floor. This subsurface pipeline then splits into a Y shaped multiport diffuser system, with the two diffuser legs each extending an additional 1,980 feet to the north and south. The SBOO is designed to handle an average flow of 174 mgd with a peak flow of 233 mgd."*

4.4.4 Pump Stations and Conveyances in Mexico

Tijuana has a complex network of piping and pump stations to transfer wastewater and diverted river water from a series of sources for treatment in the U.S. at the ITP or treatment at SABTP, or to be directly discharged to the Pacific Ocean via SAB Creek. This infrastructure includes the International Collector, PB-CILA, PB1-A, PB1-B, the canyon pump stations, and the parallel conveyance pipelines, which are described below. PG evaluated the flow rates for each stream in the system using monthly flow data from the pump stations and influent flow monitoring data from the ITP. A map showing the general layout and connections of this infrastructure is provided in Figure 4-3 above.

4.4.4.1 PB-CILA River Diversion

The PB-CILA river diversion is located along the Tijuana River channel just south of the U.S.-Mexico border. The diversion structure and pump station were originally designed to divert up to 23 MGD of river water in order to prevent transboundary flows during dry weather. PB-CILA was recently upgraded to increase the capacity to divert and pump up to 35 MGD of river water from the main channel. PB-CILA frequently experienced reliability issues prior to the upgrades. These issues cause the diversion and pump station to shut down and transboundary flows to occur. Under proper operation, PB-CILA pumps river water that is diverted from the main river channel at the Mexico-side diversion to PB1-A. If PB1-A cannot pump some or all of the flows, PB-CILA pumps the river water that PB1-A cannot handle to the International Collector.

The properties of the pumps at PB-CILA before the recent upgrades are shown in Table 4-9.

Table 4-9. PB-CILA Pumping Equipment (Pre-2020 Upgrades)

Pump Capacity (L/s)	Pump Type	Quantity of Pumps	Pump Power (hp)
550 L/s (12.6 MGD)	Horizontal	2	175
400 L/s (9.1 MGD)	Horizontal	1	75
300 L/S (6.8 MGD)	Vertical	3	40

PG's analysis of flow data from January 1, 2016, through December 31, 2019 (pre-2020 upgrade) showed that PB1-CILA pumped an average of 17.8 MGD of river water over that period. During wet weather, the flow rate of the river can greatly exceed PB-CILA's operational capacity, and PB-CILA is shut down to protect the pumps from high trash and sediment loads. According to its operating procedure, PB-CILA remains shut off after a wet-weather event until the flow rate of the river falls below 29 MGD (Arcadis 2019):

> *"**1.3.2 PBCILA Operational Protocol.** The operational protocol for the PBCILA intake and lift station is presented in Appendix B and summarized as follows:*
>
> - ***Phase 1. Dry-weather flow, normal operation:** This protocol is followed when flows are within the Tijuana Riverbanks and below the PBCILA intake capacity of 23 MGD or 1,000 lps [liters per second]. During the dry season, i.e. between May and October, normal operating procedures include stationing a two-person crew at the PBCILA intake and lift station for monitoring at 2 to 3 hours intervals and manual intake clearing as needed. A log of hourly pumping is maintained for determination of total daily station influent.*
> - ***Phase 2. Dry-weather flow, atypical operation:** This protocol is followed when Tijuana River flows are within banks but exceed intake capacity. The PBCILA lift station remains in operation during high river flows surpassing the PBCILA intake diversion capacity of 29*

MGD or 1,300 lps, which may occur from pipeline breaks within the city of Tijuana. CILA-MEX is to report higher flow levels to USIBWC when they surpass the intake capacity.

- *Manual intake cleanup and monitoring at 2-hour intervals*
- *Depth measurements at the Tijuana River Channel upstream of the PBCILA intake*
- *Manual activation of up to three pumps; pumping data are used to record daily inflows; pump run times and daily inflows are transmitted to CESPT for diagnosis and resolution of lift station problems.*

- ***Phase 3. Wet-weather flow operational protocol 1:*** *This protocol applies to small and intermittent rain events. The pumping rate is increased while sediment deposition levels are monitored at the wet well, with manual intake monitoring and cleaning as necessary every 1 to 2 hours. There is a possibility for transboundary flows to occur while operating under this protocol.*

- ***Phase 4. Wet-Weather Flow Operations Protocol 2:*** *This protocol is followed during higher-intensity rain events, typically when flows in the Tijuana River at the intake exceed 1,000 lps, accompanied by buildup of trash and sediment. When this occurs, CESPT closes the PBCILA intake and shuts down the lift station and informs CILA-MEX accordingly, which then informs USIBWC. The lift station is brought back into operation once Tijuana River flows fall below 1,300 (29 MGD) when no rain is forecast during the next 3 days. CESPT informs CILA-MEX of resumption of operation at PBCILA and basis of decision, which subsequently informs USIBWC of the resumption in operation."*

The Mexico-side river diversion system and PB-CILA were recently upgraded to increase the capacity of the diversion structure, install new pretreatment equipment, and improve the resilience and capacity of the pumping system. According to information obtained through email correspondence with NADB, the upgraded diversion has a capacity of 1,500 L/s (about 35 MGD). The new pretreatment equipment consists of new mechanically cleaned bar screens with a capacity of 45 MGD to remove trash from the diverted river water, and a new 20-foot-tall vortex desander to remove sediment. The upgrades to the pumping system included replacing the two 550 L/s pumps and the 400 L/s pump with four 500 L/s, 125 hp, chopper-type pumps. The upgraded PB-CILA has the pumps shown in Table 4-10.

Table 4-10. PB-CILA Pumping Equipment (Post-2020 Upgrades)

Pump Capacity (L/s)	Pump Type	Quantity of Pumps	Pump Power (hp)
500 L/s (11.4 MGD)	Chopper	4	125
300 L/S (6.8 MGD)	Vertical	3	40

The upgrades to PB-CILA are expected to allow the diversion and pump station to operate more reliably. The reliability issues at PB-CILA are reportedly often caused by trash and sediment loads in the diverted river water clogging the pumps. The new pretreatment system is designed to reduce the sediment and trash load in the diverted river water, which caused reliability issues with the pumps at the station prior to the 2020 upgrades. Additionally, the new chopper-type pumps are more resilient to trash and sediment. Pump station data from PB-CILA and river flow data from the ITP should be used to determine how reliably the upgraded PB-CILA is able to operate.

The upgrades are also expected to give PB-CILA the technical capability to operate at flows up to 35 MGD. This is due to the capacity of the diversion being increased to 35 MGD, and the pretreatment system and pumps being equipped to handle higher flow rates. The new pretreatment system is expected to have a capacity of 45 MGD (the capacity of the bar screens) and the new pump system is expected to have a firm capacity (the capacity of the pump station with the largest pump not operating) of 55 MGD. The operational protocol of PB-CILA would have to be modified to allow the pump station to operate at higher river flow rates.

4.4.4.2 International Collector

The International Collector was built in the 1990s and is in the northern area of Tijuana, near the Tijuana River and the international border. It consists of about 1.5 miles of 72-inch reinforced concrete pipe with a design flow capacity of about 103 MGD. Flows in the International Collector are conveyed by gravity from east to west. Untreated wastewater from the majority of the Tijuana metropolitan area is directed into the International Collector. Additionally, diverted river water from PB-CILA that is not sent to PB1-A is mixed with the untreated wastewater from Tijuana. PG applied flow balances to the pump station and ITP influent data from January 1, 2016, through December 31, 2019, to estimate that the average flow rate of untreated wastewater that flows into the International Collector is 33.6 MGD and the average flow rate of diverted river that enters the International Collector is 9.1 MGD.

At the west end of the International Collector, a diversion box directs about 25 MGD to the ITP. The remaining flow, about 18.3 MGD, is directed to the SABTP and SAB Creek via PB1-B. In 2020, the ITP was accepting an average of about 30 MGD of flow from the International Collector due to reduced capacity in the parallel conveyance pipelines (southward to SAB Creek) caused by damaged piping. The International Collector is known to be in need of rehabilitation to prevent untreated wastewater from spilling into the Tijuana River. A study by NADB et al. (2020) estimated that the highest-ranking alternative for rehabilitating the International Collector would cost $13.1 million.

Table 4-11 provides flow projections for the International Collector through the year 2040 from the NADB et al. (2020) study. PG used a linear regression (R^2 = 0.99) to project flows for the years 2045 and 2050, indicated with italics.

Table 4-11. 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

PG estimates that an average of 33.6 MGD of untreated wastewater flowed through the International Collector from 2016 through 2019. Therefore, PG adjusted the results of the 2020 NADB study to reflect the current flow rate of untreated wastewater in the collector, as shown in Table 4-12. PG used a linear regression (R^2 = 0.99) to project flows for the years 2045 and 2050, indicated with italics.

Table 4-12. Future Flow Projections for the International Collector—Adjusted

Year	Projected International Collector Flow	
2015	1,319 L/s	30.1 MGD
2020	1,472 L/s	33.6 MGD
2025	1,573 L/s	35.9 MGD
2030	1,674 L/s	38.2 MGD
2035	1,773 L/s	40.5 MGD
2040	1,870 L/s	42.7 MGD
2045	*1,968 L/s*	*44.9 MGD*
2050	*2,099 L/s*	*47.9 MGD*

4.4.4.3 PB1-A

PB1-A is a sanitary sewer pump station in Tijuana that receives diverted river water from PB-CILA and pumps it southward to the SABTP and SAB Creek via the parallel conveyance pipelines. The pump station currently consists of two parallel pump trains—a primary pump train and a backup. Each pump train consists of two centrifugal pumps operating in series, and each pump has a capacity of 500 L/s (about 11.5 MGD) and a pumping power of 700 hp. Overall, the firm capacity of the pump station is 500 L/s (about 11.5 MGD). PG's analysis of flow data from January 1, 2016, through December 31, 2019, estimated that PB1-A pumped an average of 9 MGD of river water over that period.

PB1-A's current firm capacity (about 11.5 MGD) is considered to be the limiting factor that prevents PB-CILA from diverting more flow from the Tijuana River. Arcadis (2019) notes a variety of O&M deficiencies at PB1-A:

> *"Preventive maintenance of PB1A is also deficient, with only one pump train in service during our visit and a second backup train not operational due to the inability to isolate it for maintenance. Significant health and safety concerns are apparent in moving trash by wheelbarrows on single sheets of plywood placed over wastewater influent channels. Trash is dumped at the side of the station and left for days before removal. Equipment showed significant deterioration and signs of internal and substrate corrosion and some MCC controls were inoperable. Mechanical racks show corrosion and were not in working order. Influent channel concrete lining conditions show clear signs of deterioration. Evidence of water intrusion through cracks in walls and floors of the building was observed, and leakage has accelerated corrosion and structural deterioration of the building. The PB1A lift station raises the temperature of a control room; the single desktop computer intended to monitor operations at PBCILA was not functional."*

4.4.4.4 PB1-B

PB1-B is a sanitary sewer pump station in Tijuana that pumps a mixture of untreated wastewater and river water from the International Collector toward the SABTP and SAB Creek via the parallel conveyance pipelines. PB1-B has three parallel pump trains, two serving as the primary pump trains and the other serving as a backup. Each pump train consists of two 500 L/s, 700 hp centrifugal pumps that are configured in series. Overall, the firm capacity of the pump station is 23 MGD (1,000 L/s). PG's analysis of flow data from January 1, 2016, through December 31, 2019, estimated that PB1-A pumped average of 9 MGD of river water over that period. Arcadis (2019) notes a variety of O&M deficiencies at PB1-B:

> *"PB1B shows effects of limited preventive maintenance practices. Similar to PB1A, trash is moved by wheelbarrows on single sheets of plywood placed over wastewater influent channels, dumped at the side of the station and left for days until removed. Equipment showed some deterioration and signs of substrate corrosion, and MCCs had some inoperable controls. Influent channel concrete lining showed clear signs of deterioration. Evidence of water intrusion through cracks in walls and floors of the building was observed, and leakage has accelerated corrosion and structural deterioration of the building. No SCADA systems were found."*

4.4.4.5 Matadero Pump Station

The Matadero Pump Station is about 1,700 feet south of the International Highway in Matadero Canyon and pumps wastewater generated in the canyon to the SABTP via the parallel conveyance pipelines. The station consists of four pumps and has a firm capacity of 10.2 MGD. Monthly flow data for January 1, 2016, through December 31, 2019, indicate that the station pumped an average of 4.5 MGD during that period. Information on the dynamic head of the pumps at the Matadero Pump Station was not available; therefore, PG used elevation data from Google Earth to estimate that the pump station provides about 250 feet of dynamic head.

4.4.4.6 Laureles Pump Stations

The wastewater generated in Los Laureles Canyon is currently collected by one of two pump stations, Los Laureles 1 and Los Laureles 2. Flow data for the two pump stations from January 1, 2016, through December 31, 2019, were not available; therefore, PG used data from September through November 2020 to estimate that the average monthly flow rate of both pump stations combined is 80 L/s (about 1.8 MGD). Wastewater pumped from Los Laureles 1 and Los Laureles 2 is conveyed to the SABTP.

Los Laureles 1 is the northernmost pump station, about 400 feet south of the border. It currently consists of two primary pumps operating in parallel, each with a capacity of 70 L/s (about 1.6 MGD). Therefore, its firm capacity is 70 L/s. Information on the dynamic head of its pumps was not available, so PG used elevation data from Google Earth to estimate that the station provides about 150 feet of dynamic head.

Los Laureles 2 is farther south, about 5,000 feet upstream (southward) in the canyon from Los Laureles 1. Los Laureles 2 currently consists of three primary pump trains. Each pump train consists of two 66 L/s (about 1.5 MGD) pumps that are configured in series. Therefore, the firm capacity of the pump station is 134 L/s (about 3.0 MGD). Information on the dynamic head of the pumps at Los Laureles 2 was not available; therefore, PG used elevation data from Google Earth to estimate that the pump station provides about 100 feet of dynamic head.

4.4.4.7 Parallel Conveyance Pipelines to SAB Creek

Flows from PB1-A and PB1-B sent to SAB Creek are conveyed via one of two 10-mile pipelines (the "parallel conveyance pipelines") over a 100-meter grade. The older of the two lines conveys flows from PB1-A to SAB Creek. The newer one conveys flows from PB1-B to the SABTP, then to SAB Creek. Each line consists of a force main section and a gravity pipe section. The lines have several junction boxes along their routes, allowing flows from the two pipes to be mixed. According to the Arcadis report, the older line needs to be rehabilitated and the newer line would need to be rehabilitated if flows were increased (Arcadis 2019).

4.4.5 SABTP

Wastewater and Tijuana River water are currently diverted and pumped from the Tijuana River basin to the SABTP, which discharges into the Pacific Ocean via SAB Creek. The plant began operation in 1987 as an aerated lagoon system with a design flow rate of 750 L/s (17 MGD). It was expanded in 2003 with surface aerators to treat a flow rate of 1,100 L/s (25 MGD). By the original design, wastewater is pumped from PB1-B, which receives wastewater from the International Collector, to the SABTP. However, the SABTP is currently operating at a severely reduced capacity, if not inoperable, due to poor O&M (Arcadis 2019).

4.4.6 La Morita WWTP

The La Morita WWTP is the easternmost WWTP in Tijuana and was designed for a capacity of 5.8 MGD. The plant's effluent is currently discharged into the Tijuana River upstream of the Mexico-side diversion. The effluent from La Morita is reportedly of high quality (BOD_5 concentration under 10 mg/L) (IBWC 2020).

4.4.7 Arturo Herrera WWTP

Like La Morita, the Arturo Herrera WWTP resides in eastern Tijuana, about 2 miles downstream from the La Morita WWTP. The plant is designed for a capacity of 10.5 MGD; its effluent is also discharged to the Tijuana River upstream of the diversion. The effluent from La Morita is also reportedly of high quality (IBWC 2020).

4.5 Discharges to the Pacific Ocean via SAB Creek

The flows from PB1-B are currently mixed with the diverted river flows from PB1-A, and the mixed Tijuana River water and untreated wastewater is conveyed through the parallel conveyance pipelines to the Pacific Ocean via SAB Creek. Using the flow and mass balances discussed in Appendix B of the *Water Infrastructure Alternatives Analysis* report, PG estimates that an average of 35.5 MGD of water is discharged from the parallel conveyance pipelines to SAB Creek. PG estimates that the discharges to SAB Creek have an average annual BOD_5 loading of 17,200 tons/year and an average TSS loading of 17,900 mg/L. PG used the estimated BOD_5 load to estimate that the discharges to the Pacific Ocean via SAB Creek consist of an average of 28.2 MGD of untreated wastewater, plus a combined total of 7.3 MGD of the Arturo Herrera WWTP effluent, the La Morita WWTP effluent, and river water from the Alamar River (which are diverted at PB-CILA). PG's evaluation of discharges at SAB Creek indicate that high loadings of organic matter, suspended solids, nutrients, and pathogenic microorganisms enter the Pacific Ocean via SAB Creek. When ocean currents carry this contaminated water northward, significant water quality problems occur in the San Diego area.

PG evaluated how each of the 10 projects would affect the flow rate and pollutant loadings in discharges to the Pacific Ocean via SAB Creek. These impacts are summarized in Table 4-13 below. Some of the sub-projects are not expected to significantly affect parameters that PG evaluated. These instances are marked as "N/A." In some cases, projects are expected to significantly affect some or all of the parameters that PG evaluated, but not enough data were available to quantify their impact. These instances are marked as "Unquantifiable."

Table 4-13. Project Impacts on Flows to SAB Creek

Project	Notes	Change in Flows Discharged to the Pacific Ocean via SAB Creek (Million Gallons/Year)	Change in Flows Discharged to the Pacific Ocean via SAB Creek (%)	Change in Annual BOD Load Discharged to the Pacific Ocean via SAB Creek (Tons/Year)	Change in Annual BOD Load Discharged to the Pacific Ocean via SAB Creek (%)	Change in Annual TSS (Sediment) Load Discharged to the Pacific Ocean via SAB Creek (Tons/Year)	Change in Annual TSS (Sediment) Load Discharged to the Pacific Ocean via SAB Creek (%)
1	35 MGD, shuts off at 60 MGD	N/A	N/A	N/A	N/A	N/A	N/A
	100 MGD	N/A	N/A	N/A	N/A	N/A	N/A
	163 MGD	N/A	N/A	N/A	N/A	N/A	N/A
2	35 MGD diversion shuts off over 35 MGD	-6,500	-50%	-6,200	-36%	-6,900	-39%
	35 MGD diversion shuts off over 60 MGD	-6,500	-50%	-6,200	-36%	-6,900	-39%
	60 MGD diversion shuts off over 60 MGD	-6,500	-50%	-6,200	-36%	-6,900	-39%
3	40 MGD	-3,400	-26%	-7,400	-43%	-7,100	-40%
	50 MGD	-3,400	-26%	-7,400	-43%	-7,200	-40%
	55 MGD	-5,700	-56%	-11,300	-66%	-11,000	-62%
	60 MGD	-5,700	-56%	-11,300	-66%	-11,000	-62%
4	New conveyance line	-2,400	-18%	-3,900	-25%	-3,900	-24%
5	All projects	Unquantifiable	Unquantifiable	Unquantifiable	Unquantifiable	Unquantifiable	Unquantifiable
6	All projects	N/A	N/A	N/A	N/A	N/A	N/A
7	10.3 MGD removed	-1,500	-11%	+400	+2%	+1,000	+6%
	16.2 MGD removed	-2,600	-20%	+500	+3%	+1,000	+6%
8	5 MGD operation	N/A	N/A	-2,900	-17%	-2,900	-16%
	10 MGD operation	N/A	N/A	-5,800	-34%	-5,800	-32%
9	15 MGD	-3,400	-26%	-7,400	-43%	-7,100	-40%
	30 MGD	-5,700	-56%	-11,300	-66%	-11,000	-62%
10	All projects	N/A	N/A	N/A	N/A	N/A	N/A

4.6 Modeling of Ocean Currents

Beaches in the County of San Diego must regularly close due to untreated wastewater discharges to the Pacific Ocean via SAB Creek and the Tijuana River. The County monitors the ocean water for fecal indicator bacteria (FIB), and beaches are closed if the concentration of FIB exceeds EPA's limit for the estimated illness rate of 32 primary contact recreators per 1,000 primary contact recreators, known as the beach action value (USEPA 2012).

In 2020, Scripps Institution of Oceanography examined the frequency and sources of FIB concentrations above EPA's beach action value (referred to hereafter as "FIB exceedances") at beaches along the U.S. and Mexican coasts. The Scripps model showed that these concentrations are mostly caused by untreated wastewater discharges to the Pacific Ocean via SAB Creek that are transported to the U.S. beaches by northward ocean currents, referred to as "south swells." For this analysis, PG focused on frequency of FIB exceedances at Imperial Beach. The Scripps model showed that similar improvements can be expected at other beaches along the Pacific Coast as well (Feddersen et al. 2020).

The Scripps model estimated that FIB exceedances at Imperial Beach occur an average of 14% of the year (1,210 hours/year) and 70% of the exceedances are caused by discharges from SAB Creek (Feddersen et al. 2020). The Scripps study found that, during the dry tourist season (May 22–September 8), FIB exceedances at Imperial Beach occur 24% of the time (636 hours/year) and are almost exclusively caused by untreated wastewater discharges at SAB Creek. The modeling also evaluated the effects to U.S. beaches from reducing the untreated wastewater discharges from SAB Creek to the Pacific Ocean and diverting more flow from the Tijuana River. The model estimated that these changes to the Pacific Ocean discharges would reduce the frequency of FIB exceedances at Imperial Beach—particularly during the tourist season, when the majority of south swells occur.

The study provided three scenarios to show the impacts of reducing flows in the Tijuana River and those discharged at SAB Creek. These three scenarios, with graphical representations, including the estimated reduction in number of days with impacts predicted to result in beach closures, can be found at https://docs.google.com/document/d/1SlpqsXZbwTl_c5NXW1IXIZtNrDjQVACqckl-QiUhgys/edit#.

4.7 Tijuana Canyons

4.7.1 U.S.-Side Canyon Collector System

Transboundary flows occur at a series of canyons and low spots along the border and are collected by five U.S.-side canyon flow diversion structures and conveyed to the ITP. The canyon flow diversion structures and their flow capacities are shown in Table 5-14.

Table 4-14. Canyon Collector System Capacities

Canyon Collector Name	Flow Capacity
Stewarts Drain	1.7 MGD
Silva Drain	0.33 MGD
Canyon Del Sol	0.67 MGD
Smuggler's Gulch	4.7 MGD
Goat Canyon	2.3 MGD

Source: Arcadis 2019

The actual average flow rate from the canyons is less than the capacities of the canyon flow diversion system. PG estimates that the average combined flow rate from the canyons is 0.6 MGD, based on data provided by IBWC. HDR (2020) provides the following details on the canyon flow diversion structures in Smuggler's Gulch and Goat Canyon:

> *"Canyon collectors are concrete channels and basins designed to capture transboundary dry weather flows from Mexico in canyons and ravines draining north across the border to the Tijuana River. The five canyon collector systems are located at Goat Canyon, Smuggler's Gulch, Cañon del Sol, Silva Drain, and Stewart's Drain.*
>
> *"Each canyon collector system includes a low-flow basin designed to capture dry weather flows, a screened drain/inlet, and infrastructure that allows flows to be sent to the SBIWTP. Captured flows are diverted to the SBIWTP for treatment and are disposed through the SBOO.*
>
> *"Dry or wet weather flows in the canyon collectors that exceed the maximum design capacity of the existing diversion infrastructure are not diverted to SBIWTP for treatment, and instead flow untreated north toward the Tijuana River Valley. These excess flows ultimately discharge into the Tijuana River and potentially get routed to the Tijuana River Estuary and the Pacific Ocean."*

Figure 4-4. Photograph of the Smuggler's Gulch canyon flow diversion structure, taken by PG Environmental on May 27, 2021.

Figure 4-5. Photograph of the Goat Canyon flow diversion structure, taken by PG Environmental on May 27, 2021.

The canyon flow diversion structures, in particular at Smuggler's Gulch and Goat Canyon, present hazards to U.S. Customs and Border Protection operations at the border, where untreated wastewater, sediment, and trash all affect daily operations. Currently, wastewater pools at the collectors before draining to the ITP, causing agents to be exposed to wastewater when working in the area. The accumulation of trash and sediment creates further obstructions and exposure to hazardous waste for agents.

HDR (2020) provides the following details for the Smuggler's Gulch and Goat Canyon flow diversion structures:

> <u>Smuggler's Gulch (Matadero Canyon)</u>
>
> *"Constructed in 2009 as part of the Secondary Border Fence Project, the Smuggler's Gulch diversion structure is located downstream of a double box culvert under a 145-foot high earthen berm topped with a road and border fence. The diversion structure has an average design capacity of 4.67 mgd (14.0 mgd peak). Dry weather flow from this canyon diversion structure is collected in a low area directly downstream of the culvert, conveyed to the Hollister Pump Station in a 30-inch polyvinyl chloride pipe, and pumped to the SBIWTP."*
>
> <u>Goat Canyon (Los Laureles Canyon)</u>
>
> *"The Goat Canyon diversion structure was also constructed in 2009 as part of the Secondary Border Fence Project. Downstream of a triple box culvert, the average design capacity of the Goat Canyon collector is 2.3 mgd (7.0 mgd peak). Dry weather flow from the diversion structure is conveyed in a 24-inchpolyvinyl chloride pipe to the Goat Canyon pump station, which is then pumped to the SBIWTP via the Hollister pump station."*

4.7.2 Wet-Weather Canyon Flows

Wet-weather canyon flows transport sediment and trash into the U.S. from Mexico. In addition to evaluating the sediment transport characteristics in the Tijuana River main channel, the USACE Phase II study evaluated the sediment transport characteristics in Smuggler's Gulch, Goat Canyon, and Yogurt Canyon for each of the frequency storms evaluated in the main channel. The USACE results for Smuggler's Gulch are shown in Table 4-15.

Table 4-15. Estimated Sediment Load That Crosses the Border and Enters the Ocean

Storm Recurrence Interval	Smuggler's Gulch Estimated Sediment Load (at U.S./Mexico Border) (Tons)	Smuggler's Gulch Average Annual Sediment Load (Tons/Year)
500 years	74,500	149
200 years	62,900	315
100 years	60,000	600
50 years	50,600	1,010
25 years	41,200	1,650
10 years	31,100	3,110
5 years	24,400	4,800
2 years	12,600	6,300
Annual average	**N/A**	**17,900**

Source: USACE 2020

Additionally, HDR developed a preliminary hydrology and sediment transport model for Smuggler's Gulch. The estimated sediment loads from of two-year, 25-year and 100-year frequency storm events from HDR are shown in Table 4-16.

Table 4-16. Estimated Sediment Load That Crosses the Border and Enters the Ocean

Storm Recurrence Interval	Sediment Load in Smuggler's Gulch Transboundary Flows (Tons)	Annualized Sediment Load in Smuggler's Gulch Transboundary Flows (Tons/Year)
5 years	25,728	5,150
25 years	48,313	1,930
100 years	114,311	1,140

Source: HDR 2020

The HDR report estimated that the average annual sediment load in transboundary flows is 18,000 cubic yards (about 21,600 tons). This estimate was based on sediment concentrations of observed sediment concentrations in other steep-sloped arroyos that are similar to Smuggler's Gulch. As shown in Table 4-15 and Table 4-16, the HDR report estimated higher sediment loads for all three frequency storm events than the USACE Phase 2 storm events. In particular, the HDR report's estimate for the sediment load for the 100-year storm (114,311 tons) is significantly higher than the USACE Phase 2 study's estimate (60,000 tons).

Recently, sediment and trash control infrastructure was installed in Smuggler's Gulch on the Mexico side of the border south of the International Highway. Monitoring should be conducted to determine how effective the sediment control infrastructure is at reducing sediment loads in wet weather flows. Additionally, proper maintenance of the basin is key to the new, Mexico-side infrastructure to reduce the sediment load in Smuggler's Gulch transboundary flows during wet weather over the long term.

Prior to 2018, trash loads in Smuggler's Gulch were conveyed across the border in wet weather and were transported into Tijuana River Valley without any capture devices. However, trash booms were installed in Smuggler's Gulch in 2018 on the U.S. side of the border, and a new sediment and trash control structure was constructed on the Mexico side of the border in 2020. California State Parks has recently observed a trash capture efficiency of at least 75% in the trash booms located in Goat Canyon, and PG expects that the trash booms in Smuggler's Gulch to have a similar trapping efficiency.

The USACE Phase 2 study determined that Goat Canyon was not a significant source of sediment loading in the Tijuana River Valley, the Tijuana River Estuary, or the Pacific Ocean (USACE 2020). This can primarily be attributed to two sediment basins that were constructed in 2003, which are effective at trapping sediment in wet weather transboundary flows from Goat Canyon. Both basins include trash booms that are effective at trapping trash loads in wet weather flows (HDR 2020). Discussions with California State Parks (currently responsible for maintaining the sediment basins and trash booms in Goat Canyon) during a site visit in May 2021 indicated that securing funding for long-term O&M costs for the existing Goat Canyon basins remains a challenge.

Yogurt Canyon is the smallest of the three canyons and the closest to the coast. The 2020 HDR report estimated that the drainage area of Yogurt Canyon is about 11% the size of the Smuggler's Gulch drainage area, and transboundary flows are not a major water quality concern to the Tijuana River Estuary or the Pacific Ocean (HDR 2020). The primary concern with transboundary flows from Yogurt Canyon is flooding on Monument Road during wet weather events. Discussions with California State Parks indicated that the section of Monument Road that runs across Yogurt Canyon is generally flooded for the duration of the wet-weather season. This section of road provides access to the International Friendship Park, meaning that visitors to the park would wade across the flooded section of road and be exposed to potentially contaminated stormwater runoff.

4.8 SBOO Outfall Modeling

PG performed dilution modeling of the SBOO to evaluate the impacts of an increase in permitted flows, changes to the quality of wastewater from the ITP, or new permitted wastewater sources in the region. PG used the UM3 model (from EPA's Visual Plumes modeling suite), with currently available temperature and salinity receiving water data in the vicinity of the outfall, currently available wastewater data, and reasonable and conservative assumptions consistent with engineering best practices.

The modeling informed the feasibility analyses for Projects 1 and 2 by indicating that the advanced primary level of treatment proposed in those projects would be sufficient to treat flows from the Tijuana River. PG evaluated multiple flow scenarios and outfall operation scenarios, assuming zero current flow consistent with NPDES permitting requirements. Limited pathogen transport modeling was performed to evaluate discharge impacts on local beaches. PG used these results to evaluate potential NPDES permitting outcomes for both the feasibility analyses and the EID.

PG will perform additional modeling of the SBOO to support the development of the forthcoming Environmental Impact Statement (EIS), including evaluating multiple flow scenarios, outfall scenarios, and current action scenarios to evaluate nearfield pollutant impacts of concern to NOAA Fisheries. In addition to nearfield modeling, reasonable worst-case fate and transport modeling in the farfield will be performed using the Brooks farfield diffusion approximation. The nearfield dilution and pollutant fate and transport estimates will be used in the EIS.

4.9 Potential Opportunities for Water Reuse in Tijuana

Due to the arid climate of Baja California and an increasing population, water scarcity is a growing concern in the Tijuana metropolitan area. This has made water reuse an attractive option to potentially alleviate the stress on the region's dwindling water resources.

As a sub-project to Project 3, PG evaluated constructing a new pump station and force main to convey treated effluent from the expanded ITP back to Mexico, where it could potentially be reused. The new pump station and force main would connect to PB1-B; the water could be harvested and rerouted for beneficial reuse.

The Rodriguez Reservoir, along the south-central edge of Tijuana, has mainly been used as an agricultural irrigation source throughout its nearly century-long history. Based on conversations with NADB and Suez during the TECP process, there are concerns about the quality of water behind the dam due to wastewater discharges. Therefore, direct potable reuse of water in the Rodriguez Reservoir is not an option. Additionally, based on information obtained during the TECP process, both the dam's available storage capacity and its current structural condition remain unclear.

Based on conversations with NADB, Mexican authorities are considering a project to reuse treated effluent from the Arturo Herrera WWTP. This project would involve piping the effluent into the Rodriguez Dam impoundment, then building one or more wells outside the dam to extract water for indirect potable treatment. At the time that this technical document was written, this project was only in the conceptual phase and its feasibility was unclear. PG reviewed two water reuse proposals (for details, see the Project 7 feasibility analysis):

- One, developed by CESPT (2020a), proposes to divert the effluent of both WWTPs 16.3 miles from a common location between Arturo Herrera and La Morita to the Valle de las Palmas for aquifer recharge.
- The other, by SEPROA (2020), proposes to divert the effluent just from the La Morita WWTP to Rodriguez Dam for indirect potable reuse.

PG also learned during a TECP meeting with Suez that the effluent from three WWTPs in Tijuana—La Morita, Arturo Herrera, and Natura—are currently being reused in experimental vineyards and olive orchards at an estimated rate of 11.8 million gallons per month. Table 4-17 below, from Suez's presentation during the meeting, summarizes the reuse of effluent from these three WWTPs.

Table 4-17. Summary of Tijuana WWTPs Effluent Reuse

	La Morita	Arturo Herrera	Natura
Design capacity (m^3/month)	664,952	1,204,243	157,075
Real treated flow (m^3/month)	667,570	562,853	86,391
Percent treated	100%	47%	55%
Reuse water m^3/month	18,042	22,345	4,241
Percent reused	3%	4%	5%

Source: 2020 presentation from Suez

PG received another presentation, WinWerks' 2020 *Turnkey Wastewater Treatment to Valuable Reclaimed Water Program,* that considers several reuse scenarios using electrocoagulation technology to clean contaminated wastewater. PG did not review this presentation or technology in detail.

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