VOLUME IV
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Appendix A: Metro System Facilities and Operations
Appendix B: Proposed Future Facilities

City of San Diego
Public Utilities Department

March 2022

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APPENDIX A

EXISTING METRO SYSTEM FACILITIES AND OPERATIONS

City of San Diego
Public Utilities Department

March 2022

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Acronyms and Abbreviations

AADF	annual average daily flow
ADC	alternative daily cover
AWPF	Advanced Water Purification Facility
BOD	biochemical oxygen demand
CEPT	chemically enhanced primary treatment
City	City of San Diego
COMC	City of San Diego Central Operations and Management Center
COMNET	City of San Diego Control Operations and Management Network
ft	feet
ft^2	square feet
ft^3	cubic feet
GAPS	Grove Avenue Pump Station
gpm	gallons per minute
gpd	gallons per day
gpd/ft^2	gallons per day per square foot
H_2O_2	hydrogen peroxide
H_2S	hydrogen sulfide
HGL	hydraulic grade line
HP	horsepower
IAP	Independent Advisory Panel
IBWC	International Boundary and Water Commission
IWTP	International Wastewater Treatment Plant
lbs	pounds
lbs/day	pounds per day
LED	light emitting diode
MBC	Metropolitan Biosolids Center
m^3/sec	cubic meters per second
Metro System	San Diego Metropolitan Sewerage System
MLLW	mean low low water
MSL	mean sea level
MLSS	mixed liquor suspended solids (aeration basin suspended solids)
MLVSS	mixed liquor volatile suspended solids
mgd	million gallons per day
mg/L	milligrams per liter

NCWRP	North City Water Reclamation Plant
NMI	North Metro Interceptor
NMVI	North Mission Valley Interceptor
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
O&M	operations and maintenance
Ocean Plan	Water Quality Control Plan, Ocean Waters of California
ORP	oxidation reduction potential
ORPS	Otay River Pump Station
PLOO	Point Loma Ocean Outfall
PLWTP	Point Loma Wastewater Treatment Plant
PRI-SC	Peroxide Regenerated Iron Sulfide Control
PUD	City of San Diego Public Utilities Department
Pure Water	Pure Water San Diego Program
PVC	polyvinyl chloride
RAS	return activated sludge
SBOO	South Bay Ocean Outfall
SMI	South Metro Interceptor
SEOC	South Effluent Outfall Connection
SBWRP	South Bay Water Reclamation Plant
TSS	total suspended solids
UV	ultraviolet
VSS	volatile suspended solids
WAS	waste activated sludge

A.1 INTRODUCTION

This appendix describes existing San Diego Metropolitan Sewerage System (Metro System) facilities and operations. Projected future Metro System flows and planned facility upgrades and improvements are provided in Appendix B.

A.1.1 Metro System Overview and Participating Agencies

The Metro System provides for the conveyance, treatment, reuse, and disposal of wastewater within a 450-square-mile service area for the City of San Diego (City) and regional participating agencies. Metro System facilities include wastewater collection interceptors and pump stations, wastewater treatment and water recycling plants, sludge pipelines and solids handling facilities, and two ocean outfall systems.

Metro System facilities are owned by the City and are managed and operated by the City's Public Utilities Department (PUD). The City administers and executes contracts with each participating agency, monitors flows to the Metro System, bills and collects payments from participating agencies, and disburses all monies spent in connection with the Metro System.

Wastewater collection systems that discharge to the Metro System are owned and operated by either PUD or the respective participating agencies. Currently, wastewater flows from the City comprise approximately 66% of the total Metro System flows. Remaining Metro System wastewater flows are contributed by Metro System participating agencies. Table A-1 presents the Metro System participating agencies. Participating agency input to Metro System planning and operation is provided through the Metropolitan Wastewater Commission Joint Powers Authority.

Table A-1:
Metro System Participating Agencies[1]

Municipalities	Water/Wastewater Districts
City of Chula Vista	Lemon Grove Sanitation District
City of Coronado	Otay Water District
City of Del Mar	Padre Dam Municipal Water District
City of El Cajon	San Diego County Sanitation District[2]
City of Imperial Beach	
City of La Mesa	
City of National City	
City of Poway	

Notes:
1. See Figure 1 for the location of the Participating Agency service areas.
2. Includes the East Otay Mesa, Lakeside, Alpine, Spring Valley, and Wintergardens Service Areas. See Figure 1 on page A-3.

Figure A-1 presents the Metro System service area, the boundaries of the participating agencies, and the location of key Metro System facilities.

Figure A-1:
Overview of Metro System Facilities

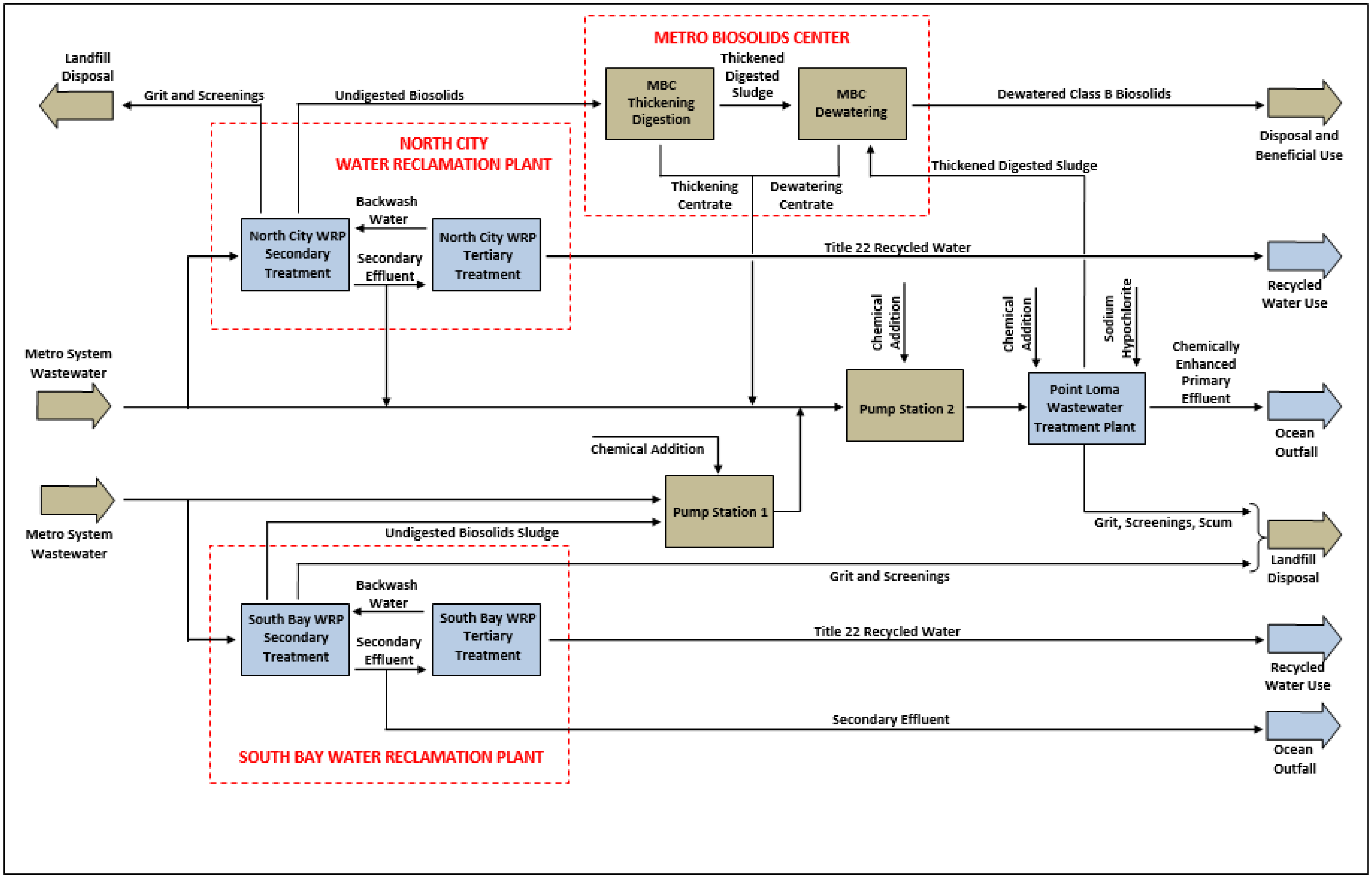
A.1.2 Facilities Overview

The Metro System is composed of the following five groups of facilities:

- wastewater conveyance facilities,
- the Point Loma Wastewater Treatment Plant (PLWTP) and Point Loma Ocean Outfall (PLOO),
- the North City Water Reclamation Plant (NCWRP),
- the Metropolitan Biosolids Center (MBC) and sludge conveyance facilities, and
- the South Bay Water Reclamation Plant (SBWRP) and Ocean Outfall.

Figure A-2 presents a schematic of current Metro System facilities. Additional information is provided in Sections A-2 and A-3.

Figure A-2:
Overview of Metro System Processes



A.2 WASTEWATER CONVEYANCE FACILITIES

A.2.1 Collection System Overview

As shown in Figure A-1, key wastewater collection facilities within the northern portion of the Metro System service area include the Peñasquitos Pump Station, Pump Station 65, Pump Station 64, the Rose Canyon Trunk Sewer, and the North Metro Interceptor (NMI). Wastewater collected from this northern portion is conveyed to Pump Station 2 and the PLWTP.

Wastewater from the eastern portion of the Metro System service area is conveyed to Pump Station 2 and the PLWTP via the East Mission Gorge Pump Station, the Mission Gorge Trunk Sewer, and the North Mission Valley Interceptor (NMVI). Wastewater from the central portions of the City of San Diego is conveyed to Pump Station 2 and the PLWTP via the NMVI.

Wastewater from the majority of the southern region of the Metro System is directed to the PLWTP via the South Metro Interceptor (SMI) and Pump Stations 1 and 2. A portion of the wastewater generated within the southern portion of the Metro System is directed to the SBWRP via the Otay River Pump Station (ORPS) and Grove Avenue Pump Station (GAPS). The NMI and SMI converge at Pump Station 2, which pumps the combined wastewater through two force mains to the Point Loma Tunnel and Interceptor Sewer, which in turn conveys the flow to the PLWTP for treatment and ocean disposal.

A.2.2 Peñasquitos Pump Station

The Peñasquitos Pump Station (see Figure A-1) was constructed in 1999 and began operations in 2000. The pump station consists of:

- four 400 horsepower variable frequency drive pumps, with an additional slot for a fifth future pump,
- an odor control facility housed in a separate building, and
- a screening facility.

Ferrous chloride, sodium hydroxide and sodium hypochlorite are used for odor and sulfide control. The Peñasquitos Pump Station is designed to handle an average daily flow of 20 million gallons per day (mgd) and has a maximum capacity of 24 mgd.

A.2.3 Pump Station 65

Pump Station 65 was constructed in 1998 and began operations in 1999. The pump station serves the northeast portion of the Metro System area (Sorrento Valley/Carmel Valley/) and currently features two 150 horsepower and two 400 horsepower constant speed pumps with a maximum capacity of 17.2 mgd. The pump station also includes an odor control facility.

The Pump Station 65 facility was upgraded in 2017 and features three 500 horsepower variable frequency drive pumps (two duty and one standby). Pump Station 65 also includes two 500 horsepower bypass pumps, manually controlled, and one backup generator capable of powering the entire facility at peak flow. Ferrous chloride, sodium hydroxide and sodium hypochlorite are used for odor and sulfide control.

A.2.4 Pump Station 64

Pump Station 64 (see Figure A-1) serves the northernmost 87 square miles of the north region of the Metro Service area, including the cities of Poway and Del Mar. The pumping facility, constructed in 1970 and upgraded in 1988, consists of:

- eight sets of two pumps connected in series and housed in two separate buildings (the East and the West Stations),
- a separate screening structure housing two mechanically-cleaned bar screens and one manually-cleaned bar screen, and
- an odor control facility housed in a separate building and chemical addition (ferrous chloride, sodium hydroxide and sodium hypochlorite) for odor and sulfide control.

Capacities of individual pumps range from 3,400 gallons per minute (gpm) to 8,700 gpm, and motor horsepower ranges from 200 to 500. The total capacity of Pump Station 64 is 73 mgd. Pump Station 64 discharges to the City of San Diego's Rose Canyon Trunk Sewer. The pump station also includes backup generators capable of powering the facility at peak flow in the event of power outage.

Rose Canyon Trunk Sewer. The Rose Canyon Trunk Sewer (see Figure A-1) conveys wastewater approximately 5 miles from the northern portion of the City of San Diego to the NMI. On January 26, 2021, the City completed work to parallel the original 72-inch-diameter Rose Canyon Trunk Sewer with a 24,000-foot-long interceptor that ranges from 48 inches to 60 inches in diameter. Wastewater from the Rose Canyon Trunk Sewer discharges to the Morena Boulevard and East Mission Bay Interceptors, which in turn discharge to the NMI.

In addition to conveying untreated wastewater, excess treated effluent from the NCWRP is discharged to the Rose Canyon Trunk Sewer for transport to the PLWTP for retreatment and ocean discharge.

A.2.5 North Metro Interceptor

The NMI conveys wastewater flows from the northern region and a portion of the central region of the Metro System service area to Pump Station 2. The NMI consists of two semi-parallel pipelines. The original 96-inch-diameter NMI ("West NMI") is 2.4 miles in length and begins at the San Diego River channel on the east side of Interstate Highway 5 and traverses north-to-south along several local streets and across the site of the U.S. Marine Corps Recruit Depot until it reaches Pump Station 2.

The 2.8-mile-long semi-parallel NMI ("East NMI") was constructed in 1996. The East NMI relief interceptor begins as a 108-inch sewer on the north side of the San Diego River, where it collects the flow from the new 78-inch NMVI. The 108-inch NMI crosses the San Diego River and picks up flow from the 30-inch South Mission Valley Interceptor. It then crosses under Interstate Highways 8 and 5, and traverses in a southerly direction approximately a half-mile east of the 96-inch West NMI. At Barnett Avenue, it turns to the west and reaches the alignment of the original 96-inch NMI, where it increases in size from 108 to 114 inches. The 114-inch East NMI then parallels the 96-inch West NMI in a southerly direction for approximately 1 mile to Pump Station 2.

A.2.6 East Mission Gorge Pump Station

The East Mission Gorge Pump Station was constructed in 1993 and began operations in 1994. The pump station features:

- four 500 horsepower constant speed pumps,
- an odor control facility housed in a separate building, and
- a screening facility.

Ferrous chloride and sodium hypochlorite are used for odor and sulfide control. The East Mission Gorge Pump Station has a maximum capacity of 34.6 mgd. While the City owns and operates this pump station, the City currently runs this station once a week for odor control purposes only. The City is in the process of transferring this asset to a Participating Agency to further reuse opportunities in the region. This transfer is anticipated to occur during the upcoming permit cycle.

A.2.7 North Mission Valley Interceptor

The NMVI conveys wastewater flows from the central and eastern portion of the Metro System service area to the NMI for conveyance to Pump Station 2 and the PLWTP. The NMVI extends the length of Mission Valley and consists of reinforced concrete pipe ranging from a diameter of 78 inches to 96 inches. The NMVI flows into the East NMI near the San Diego River and Interstate Highway 5.

A.2.8 South Metro Interceptor

The SMI conveys wastewater flows to Pump Station 2 from the southern region and portions of the central region of the Metro System service area. The upstream reach of the SMI extends from the City of Imperial Beach to Pump Station 1. This 7.6-mile SMI interceptor ranges from 42 to 96 inches in diameter. The downstream reach of the SMI runs between Pump Station 1 and Pump Station 2, and includes 1.6 miles of 72-inch force main, 1.0 mile of 78-inch sewer, 2.1 miles of 84-inch cross-town tunnel sewer, 0.3 miles of 102-inch sewer, and 1.7 miles of 108-inch sewer.

A.2.9 Pump Station 1

Pump Station 1 was initially placed in operation in 1963 with three pumps, and a fourth unit was added in 1974. Two additional pumps were added in 1993. Pump Station 1 conveys flows from the SMI and trucked waste that is introduced to the system at Pump Station 1 to Pump Station 2. Pump Station 1 is a conventional reinforced concrete structure equipped with:

- six vertical dry pit pumping units, each driven by a 600-horsepower electric motor,
- a screening facility consisting of two traveling screens, and
- an odor removal system consisting of an atomizer vessel.

Ferrous chloride, sodium hydroxide, and sodium hypochlorite are used for odor and sulfide control. With one unit as standby, the Pump Station 1 pumping capacity is approximately 160 mgd.

A.2.10 Pump Station 2

Pump Station 2 is the terminus of the NMI and SMI. Virtually all inflow to the PLWTP is conveyed via Pump Station 2. Pump Station 2 is a reinforced concrete structure equipped with:

- eight dry pit pumping units, each rated at 50,000 gpm (six pumps are driven by 2,250-horsepower electric motors and the other two by 2,400-horsepower natural gas fueled engines),
- a screening facility consisting of four traveling screens, and
- an odor removal system consisting of an atomizer vessel and five carbon towers.

Hydrogen peroxide, sodium hydroxide and sodium hypochlorite are used for odor and sulfide control and to assist in coagulation/sedimentation at the PLWTP.

With one main pump serving as a standby unit, Pump Station 2 has a maximum pumping capacity of 432 mgd. Pump Station 2 discharges wastewater to the east portal of the Point Loma Tunnel through two 87-inch diameter force mains, respectively 2.9 and 2.7 miles long. One force main, installed in 1963, follows a land route while the second force main, installed in 1975, is routed underneath San Diego Bay. The Point Loma Tunnel conveys wastewater under the Point Loma peninsula. It is 108 inches in diameter and 0.8 miles long. The Point Loma Interceptor Sewer begins at the tunnel's west portal, is 114 inches in diameter and 1.5 miles long, and terminates at the PLWTP headworks.

A.2.11 Grove Avenue Pump Station

The GAPS is located 3 miles north of the SBWRP and conveys wastewater from a portion of the southern region of the Metro System to the SBWRP. The pump station diverts wastewater from the San Ysidro Trunk Sewer and the Otay Valley Pump Station to the SBWRP via a 30-inch diameter force main. This station is capable of providing up to 15 mgd of wastewater to the SBWRP.

The pump station features a below-grade, trench-type, self-cleaning wet well. The pump room is a below-grade structure that houses the pumps, discharge piping and valves, and pump control valves. The motor room houses the pump motors with the pump motors connected to the pumps through extended shafting. The motor room and motor control rooms are situated at-grade and above the 100-year flood level to protect the electrical equipment and motors from damage and failure from flooding. The pump station includes:

- four 300 horsepower pumps (vertical, mixed-flow, non-clog, centrifugal with variable speed drives), and
- a bio-filter unit and two (2) carbon towers for odor control.

The design capacity of the GAPS is 15 mgd (average flow) and 18 mgd (peak flow).

A.2.12 Otay River Pump Station

The ORPS conveys wastewater from the Otay River portion of the Metro System service area to the GAPS via a conveyance system that includes:

- a 9,300 foot-long 24-inch force main and 3,400-foot-long gravity main to divert flows from the Otay and Chula Vista Trunk Sewers, and
- a 700-foot-long, 36-inch gravity line between Hollister Street and the GAPS.

Wet Well No. 1 of the ORPS typically handles an average daily flow of 3.5 mgd, but provides a 15.7 mgd capacity. Wet Well No. 1 is served by three 200 horsepower chopper pumps. Wet Well No. 2 of the pump station handles an average daily flow of 2.3 mgd, and has a maximum capacity of 6.8 mgd. Wet Well No. 2 is served by two 40 horsepower chopper pumps. The City is in the process of incorporating ferrous chloride addition into the pump station for sulfide control.

A.2.13 Chemical Addition Improvements Project

The City implemented a proprietary technology called Peroxide Regenerated Iron Sulfide Control (PRI-SC) in January 2008 which is now part of standard plant operations. The PRI-SC system involves coordinated chemical addition at key points within the Metro System to achieve for following goals:

- improved solids removal at the PLWTP,
- more effective odor control,
- reduced iron and solids emissions to PLOO, and
- reduced system-wide chemical costs.

The conceptual basis of the PRI-SC system was to utilize ferrous chloride at upstream locations within the Metro System for sulfide control, and to utilize hydrogen peroxide (H_2O_2) at downstream locations to regenerate ferrous or ferric iron for use in sulfide control and to enhance settling and solids removal at the PLWTP. Ferrous chloride is currently utilized at Pump Station 1, East Mission Gorge Pump Station, Penasquitos Pump Station, and Pump Station 65. An additional site will also be added at either ORPS or the GAPS, likely during the upcoming permit cycle. Hydrogen peroxide is currently utilized at NCWRP, SBWRP, PLWTP, and Pump Station 2. The Del Mar Pump Station uses Bioxide when or if flows are diverted to the City's system; however, this station typically sends their flow to the San Elijo Joint Powers Authority's system.

A.3 POINT LOMA WASTEWATER TREATMENT PLANT

The PLWTP is an advanced chemically enhanced primary treatment (CEPT) plant. The plant's rated treatment capacities are 240 mgd dry weather flow and 432 mgd peak wet weather flow. PLWTP processes include:

- mechanical self-cleaning climber screens to remove rags, paper, and other large material for disposal,
- chemical addition to enhance settling and achieve at least 80% removal of suspended solids (monthly average) and 58% removal of biological oxygen demand (annual average),
- aerated grit removal including grit tanks, pumps, and separators,
- primary sedimentation, where flocculated solids (sludge) settle to the bottom of the sedimentation tanks and fats, oils, and grease (scum) floats to the surface,
- sludge pumping and scum removal facilities,
- odor control systems to remove hydrogen sulfide (H_2S),
- anaerobic digestion of sludge,
- bio-gas gas powered co-generation facility,
- bio-gas gas collection system and waste gas flares, and
- effluent disinfection.

Onsite solids treatment at the PLWTP consists of anaerobic sludge digestion. Digested sludge is pumped via pipeline to the MBC for dewatering and disposal. Screenings, grit, and scum are hauled offsite to a landfill for disposal. The City is currently working on a project to pump scum to the digesters at PLWTP. Additional information is available in Appendix B.

The general plant layout is presented in Figure A-3. Figure A-4 presents a schematic of wastewater treatment processes at the PLWTP.

Table A-2 presents design criteria for PLWTP unit processes. Individual processes are also summarized in Sections A.3.1 to A.3.10 below.

Figure A-3:
PLWTP Plant Layout

Figure A-4:
PLWTP Treatment Process

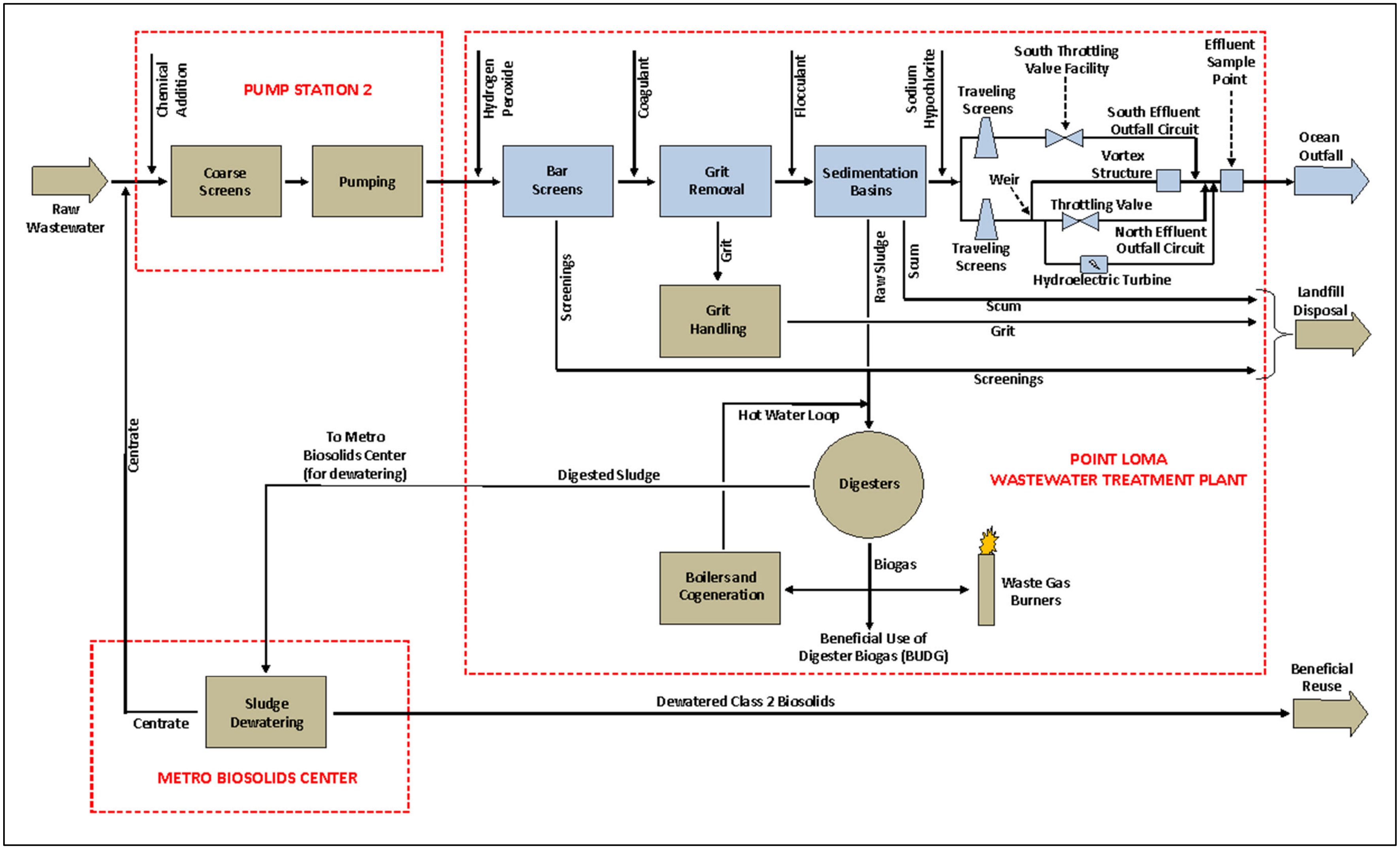


**Table A-2:
Design Criteria and Loadings at PLWTP[1]**

Process			Units[2]	Value
Influent Flow	Design Peak Dry Weather Flow		mgd	240
	Design Peak Wet Weather Flow		mgd	432
	Annual Average Flow		mgd	140
Preliminary Treatment	At Pump Station 2:	Number of screens	--	4
		Channel Width	ft	9.5
		Clear Opening between Bars	millimeters	30
	At Treatment Plant:	Number of screens	--	5
		Peak Capacity (each)	mgd	100
		Channel Width	ft	7
		Clear Opening between Bars	inches	3/8
Grit Removal	Number of Tanks		--	6
	Detention Time @ Peak Wet Weather Flow		minutes	2.8
	Tanks C1 and C2	Width	ft	20
		Length	ft	60
		Capacity, each	mgd	62
	Tanks N1 and N2	Width	ft	24
		Length	ft	88
		Capacity, each	mgd	91
	Tanks S1 and S2	Width	ft	22
		Length	ft	64
		Capacity, each	mgd	73
Sedimentation	Number of Tanks		-	12
	Total Width		ft	60
	Length		ft	224
	Average Liquid Depth:	Tanks 1 through 6	ft	16.5
		Tanks 7 through 12	ft	16.5
	Overflow Rate at annual average daily flow (AADF)		gpd/ft^2	1,530
	Maximum Hydraulic Capacity, each tank		mgd	21.9
Sludge Digestion	Number of Digesters		--	8
	Diameter, Digesters 1-6 and 8		ft	125
	Diameter, Digester 7		ft	110
	Side Water Depth		ft	35
	Volume, Digesters 1-6 and 8 (7 used as hold tank)		ft^3	430,000
	Average Detention Time (7 tanks)		days	23
	Suspended Solids Loading per Million Gallons		lbs dry solids	2,300
	Volatile Solids Loading (7 tanks)		lbs solids/ft/day	0.08
	Biogas Production (7 tanks)		million ft^3/day	3.0 - 3.3

Table A-2 Notes:
1. From PLWTP Master Plan - August 1994. Updated in 2000. These plans were prior to the addition of effluent disinfection.
2. ft = feet; gpd/ft^2 = gallons per day per square foot; ft^3 = cubic feet; lbs = pounds

A.3.1 Plant Inflow

In addition to receiving raw wastewater from both the northern and southern portions of the Metro System service area, the PLWTP may also receive treated effluent from the NCWRP. Excess NCWRP secondary effluent is discharged to the PLWTP via the NMI for treatment and disposal. Additionally, during times when NCWRP reclaimed water production exceeds demand, excess North City reclaimed water may also be conveyed to the PLWTP for treatment and disposal. The PLWTP also receives centrate from the dewatering process at MBC and waste solids from the SBWRP.

A.3.2 Preliminary Treatment

Raw wastewater from Pump Station 2 flows into the PLWTP through five mechanically cleaned bar screens fitted with 3/8 inch spacing. Screened raw wastewater then enters a common channel from which it flows through six parallel Parshall flumes where plant influent flow is measured. Preliminary treatment is also performed at Pump Station 2 where the coarse bar screens are provided, along with chemical addition for sulfide control.

A.3.3 Chemical Coagulation

Chemical coagulants are added to the screened raw wastewater to enhance settling of suspended solids. All process chemicals including effluent disinfection are flow-paced. Section A.9 summarizes chemical use, application points, typical dose rates, and purposes of chemical addition at the PLWTP. Hydrogen peroxide is used to regenerate iron salts for coagulation.

A.3.4 Grit Removal

The Parshall flumes apportion flow between six aerated grit removal tanks. Settled grit is pumped from the tanks, separated and conveyed to a hopper for truck loading and disposal. The grit removal tanks are covered to contain odors. Foul air is drawn from under the covers and treated in odor control scrubbers.

A.3.5 PLWTP Grit Improvements Project

The City completed a comprehensive renovation/upgrade of the PLWTP grit removal facilities during the current permit cycle. Grit improvements included:

- replacing the grit agitation air blowers and supply air piping and raising the height of the influent screening channel slide gates.,
- demolishing and reconstructing the south grit tanks,
- constructing a pump gallery for the south grit tanks,
- demolishing the original headworks building, grit processing equipment and agitation air blowers,
- constructing a new grit building that features drive-through, load-out grit disposal,
- providing Teacups™, Snails™ and new grit storage hoppers in the new processing facility, and

- expanding the ferric chloride feed facility to serve the flume channels to the south grit tanks.

A.3.6 Onsite Solids Handling

The influent screenings are removed by bar screens and dumped onto a shaftless screw conveyor for transport to a screenings compactor. After the compaction process, the screenings are deposited into a storage bin via a discharge chute. After it is determined that the screenings bin is full, the material is analyzed for solids concentrations to meet the 20% minimum solids disposal requirement. Once the disposal requirement is met, the screenings are hauled offsite and transported directly to a sanitary landfill for disposal.

Grit removed in the aerated grit tanks is currently pumped to SlurryCup separators where it separates grit from the wastewater. From the SlurryCup separators, grit is discharged to a snail type conveyor belt for washing.

Washed grit is deposited into a hopper from where it is loaded onto a bin and analyzed for solids concentration to meet a 40% minimum solids concentration disposal requirement. Once the targeted 40% solids concentration is achieved, the material is hauled offsite to sanitary landfill for disposal.

A.3.7 Flocculant

Ferric chloride mixing occurs in the Parshall flumes, and anionic polymer (for flocculation) is added in the individual flumes to the sedimentation tanks. Caustic soda, sodium hypochlorite, salt, and ferrous chloride are added (see Section A.9) to assist in odor control.

A.3.8 Sedimentation

The partially treated wastewater is discharged into a tunnel/distribution channel for diversion into the twelve sedimentation tanks. Anionic polymer is added at the cutthroat flumes to each bay of the sedimentation basins. Each sedimentation tank consists of three 20-foot wide bays provided with chain and flight sludge and scum collectors. Sludge is scraped along the bottom to a common hopper (at the tank influent end) provided with a cross collector. Scum is skimmed from the tank surface at the opposite end.

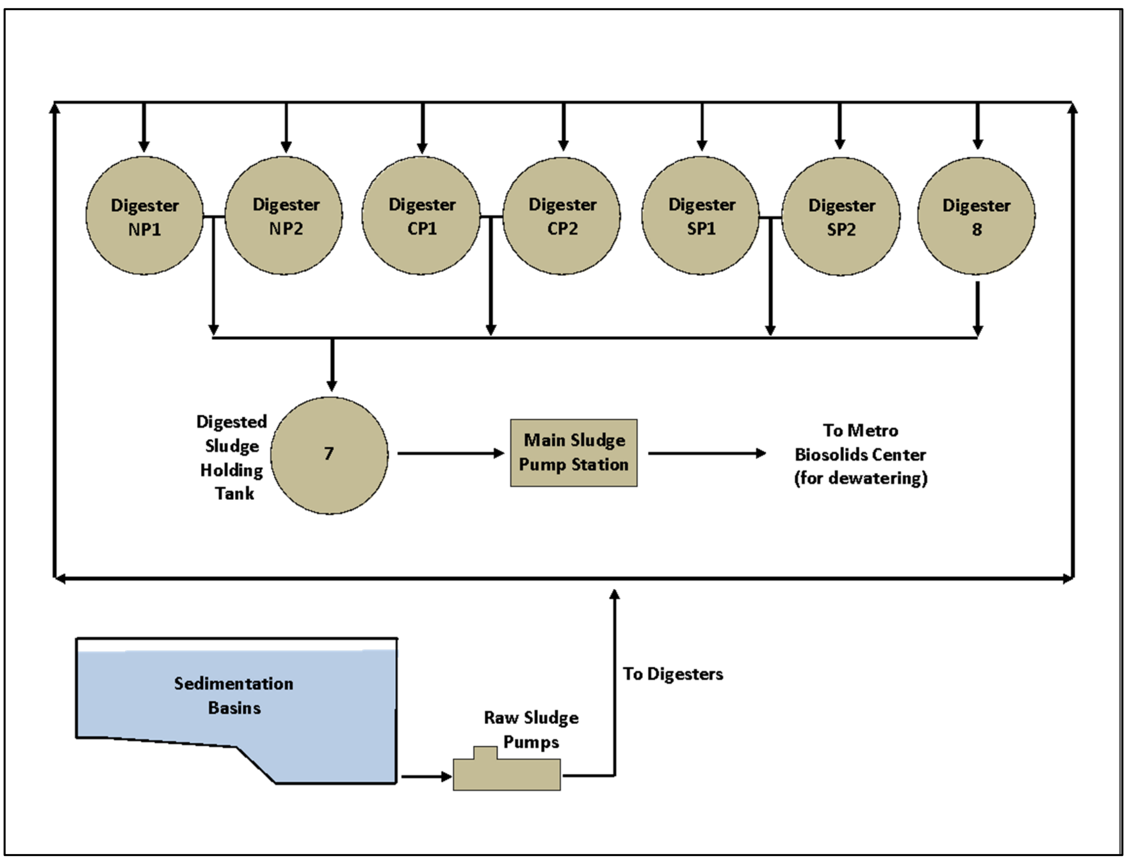
To control odors, each primary sedimentation tank is covered. Foul air from the sedimentation basins (as well as air from all other plant processes) is exhausted to an odor control system. The odor control system includes two-stage scrubbers that incorporate both caustic soda and sodium hypochlorite scrubbing. Scrubbed air is treated through activated carbon adsorption.

A.3.7 Sludge Digestion

Raw sludge is pumped from the sedimentation tanks to up to seven anaerobic digesters: Digesters 1 through 6 (N1P, N2P, C1P, C2P, S1P, S2P), and Digester 8. Digester 7 is used as a digested sludge holding tank. All the digesters are heated by hot water using external heating units. Mixing is performed by gas circulation, with the exception of Digester 7 which exclusively uses a pump mixing system.

Approximately 3 to 3.3 million cubic feet per day of biogas are produced during the digestion process. Of this total, approximately 1.8 million cubic feet is used as fuel for the plant's cogeneration facility, which consists of two engine/generator sets that together produce about 4570 kilowatts of power, over one half of which is used on site in the operation of the treatment plant. Excess power is exported to the power grid for which the PUD receives a credit on its energy bills from SDG&E, Sempra Energy. The remaining digester gas generated at the plant is either used to fuel boilers for digester heating, flared off, or delivered to a private customer. The private customer further cleans the gas to conform with Sempra Energy standards and exports the gas through the onsite natural gas line. Figure A-5 below presents a schematic of the sludge digestion system.

Figure A-5:
PLWTP Sludge Digestion Schematic



A.3.8 Sludge Pumping and Screening

Digested sludge is pumped to MBC for processing and dewatering. The sludge pump station at the PLWTP features multiple levels. The lower level houses four large positive displacement diaphragm pumps, each rated at 750 gpm. The pumps discharge the sludge via an 18-mile-long pipeline to the MBC for dewatering.

The top level contains five in-line sludge screens. The original and ultimate intent is to screen raw sludge, although they have also been used in the past to screen digested sludge prior to pumping. Each screen can process 450 gpm and has a screen opening of 5 millimeters and 2 millimeters. Screenings are conveyed to loading hoppers in the building. The sludge screenings are analyzed to ensure a 20% minimum solids content and transported to a sanitary landfill for disposal.

A.3.9 Effluent Disinfection

Receiving Water Limitation V.A.1.a of Order No. R9-2017-0007 (National Pollutant Discharge Elimination System (NPDES) CA0107409) requires the PLOO discharge to comply with recreational body-contact (REC-1) standards within state-regulated waters used for water contact sports. While the PLOO discharges beyond the 3-mile state-regulated coastal zone, in 2008 the City implemented effluent disinfection of PLWTP effluent after sedimentation to ensure compliance with receiving water bacteriological standards. PLWTP disinfection facilities consist of:

- an onsite sodium hypochlorite bulk storage facility,
- sodium hypochlorite feed pumps and controls to regulate sodium hypochlorite dose rates into the PLWTP effluent, and
- a conveyance and injection system (small diameter double wall pipe) that delivers sodium hypochlorite to the PLWTP effluent channel and distributes the disinfectant into the channel flow.

Sodium hypochlorite feed rates are regulated by the Distributed Control System to match effluent flows based on target dose. The disinfection operation is designed to reduce regulated pathogen indicator organisms (e.g., total coliform, fecal coliform, and enterococcus), while ensuring that the sodium hypochlorite dose rate is consumed by effluent chlorine demand at the NPDES sample point upstream from the outfall pipe. In this manner, the PLOO discharge maintains zero chlorine residual as the effluent enters the outfall. PLWTP effluent data previously collected by the City demonstrate that sodium hypochlorite dose rates do not lead to the formation of chlorination byproducts that exceed allowable California Ocean Plan receiving water concentrations. Additionally, toxicity analyses of the disinfected PLWTP effluent demonstrate that the PLOO discharge remains in compliance with applicable acute and chronic toxicity standards.

A.3.10 Chlorine Residual Monitoring

To achieve compliance with *California Ocean Plan* chlorine residual receiving water standards, Order No. Order No. R9-2017-0007 requires the City to monitor for chlorine residual at monitoring station EFF-001. Table E-4 of Order No. R9-2017-0007 requires the City to implement continuous chlorine residual monitoring, with footnote 4 stating:

> *For total chlorine residual, until a reliable method for continuous monitoring is available, the Discharger may meet this requirement with at least four grab samples per day, representative of the daily discharge, that is collected immediately prior to entering the PLOO and analyzed for total chlorine residual.*

In accordance with the requirements of this provision and provisions in the prior Order No. R9-2009-0001, the City coordinated with vendors to install continuous chlorine monitoring equipment at Monitoring Station EFF-001. The City considered a variety of analyzers and worked with a vendor to develop a custom probe; however, to date none of the solutions have met the requirements for accurate and continuous monitoring and all installed equipment continuously experienced failures. As a result, the City staff have continued to collect four grab samples per day to meet the permit monitoring requirements.

A.3.11 Effluent Discharge System

Treated effluent from the sedimentation tanks discharges to an effluent channel. Plant effluent in the effluent channel can be diverted to the North Effluent Outfall Connection through four 30-mm Parkson traveling screens and then either through an 84-inch sleeve valve or over a weir and into a vortex structure. Plant effluent can also be diverted to the South Effluent Outfall Connection (SEOC) through four 30-mm Parkson traveling screens and then, based on flow and equipment configuration, a combination of three 54-inch sleeve valves and a 54-inch ball valve.

A.3.12 Staffing and Operations

Consistent with its size and pivotal role within the Metro System, the PLWTP is staffed 24 hours per day, 7 days a week. PLWTP staffing is summarized in Table A-3.

Table A-3:
PLWTP Operations and Maintenance Staffing

Point Loma Operations Staff	Number of Staff[1]
Operations	23
Maintenance	29
Engineering/Gas Utilization Facility	16
Clerical	1

Table A-3 Note:
1. Represents budgeted positions. Staff vacancies may exist.

The PLWTP operations staff is supported by administration and maintenance support staff. The day shift (Monday through Friday) consists of the Plant Superintendent, the Senior Operations Supervisor, a shift supervisor, a Process Control Supervisor, and five operators. Support engineering staff, which are also assigned to assist with the SBWRP and all large pump stations, consists of a Senior Civil Engineer, three Associate Civil Engineers, one Associate Electrical Engineer, and one drafter.

The Point Loma Energy Production group (1) operates and maintains the onsite generation facilities at the PLWTP and the NCWRP and (2) maintains engine driven pumps and generators throughout the Wastewater Treatment and Disposal Division. This group consists of a Senior Power Plant Supervisor, two Power Plant Supervisors, and six Power Plant Operators.

A Process Control Group, consisting of one supervisor and one operator, supports the day-shift staff. The Process Control Group performs non-routine functions such as developing operating procedures, developing and implementing testing programs, purchasing chemicals, monitoring and assessing process trends, and process trouble-shooting. Operating data is also collected by the Process Control Group. The night shift consists of one shift supervisor and two operators. The maintenance staff is divided into the following two crews:

- mechanical maintenance crew, and
- electrical and instrumentation maintenance crew.

Laboratory analysis for process control and regulatory compliance is performed both on-site by City personnel and off-site at certified laboratories run by PUD's Environmental Monitoring and Technical Services Division.

A.3.13 Operator Training and Certifications

Operator training is an ongoing activity at the PLWTP. All plant personnel receive training in plant safety procedures. All PLWTP operators are required to hold a Certificate of Competence issued by the California Water Resources Control Board (available in Grades of I through V). Certified operators must have a Grade II certificate or higher. Entry level Operator-In-Training positions are utilized for "time in the field" experience to fulfill Grade 2 requirements. Table A-4 summarizes the current breakdown by grade among the plant's staff.

Table A-4:
PLWTP Operator Certification

Operator Grade	Number of Certified Staff[1]
Grade I or Operator-in-Training	2
Grade II	12
Grade III	6
Grade IV	1
Grade V	2

Table A-4 Note:
1. Accurate as of December 2021. Subject to Change as staff obtain new certifications.

A.3.14 Operations and Maintenance

The PLWTP Operations and Maintenance (O&M) Manual includes start-up and shutdown instructions for the plant process units. These instructions are complemented by established procedures (written in memo format) for operating plant function. Lock-out/tag-out procedures exist for each piece of electrically driven equipment. A number of the existing operating instructions have been converted into detailed standard operating procedures. The plant employs a computerized maintenance management system to schedule preventative and corrective maintenance tasks.

A.4 POINT LOMA OCEAN OUTFALL

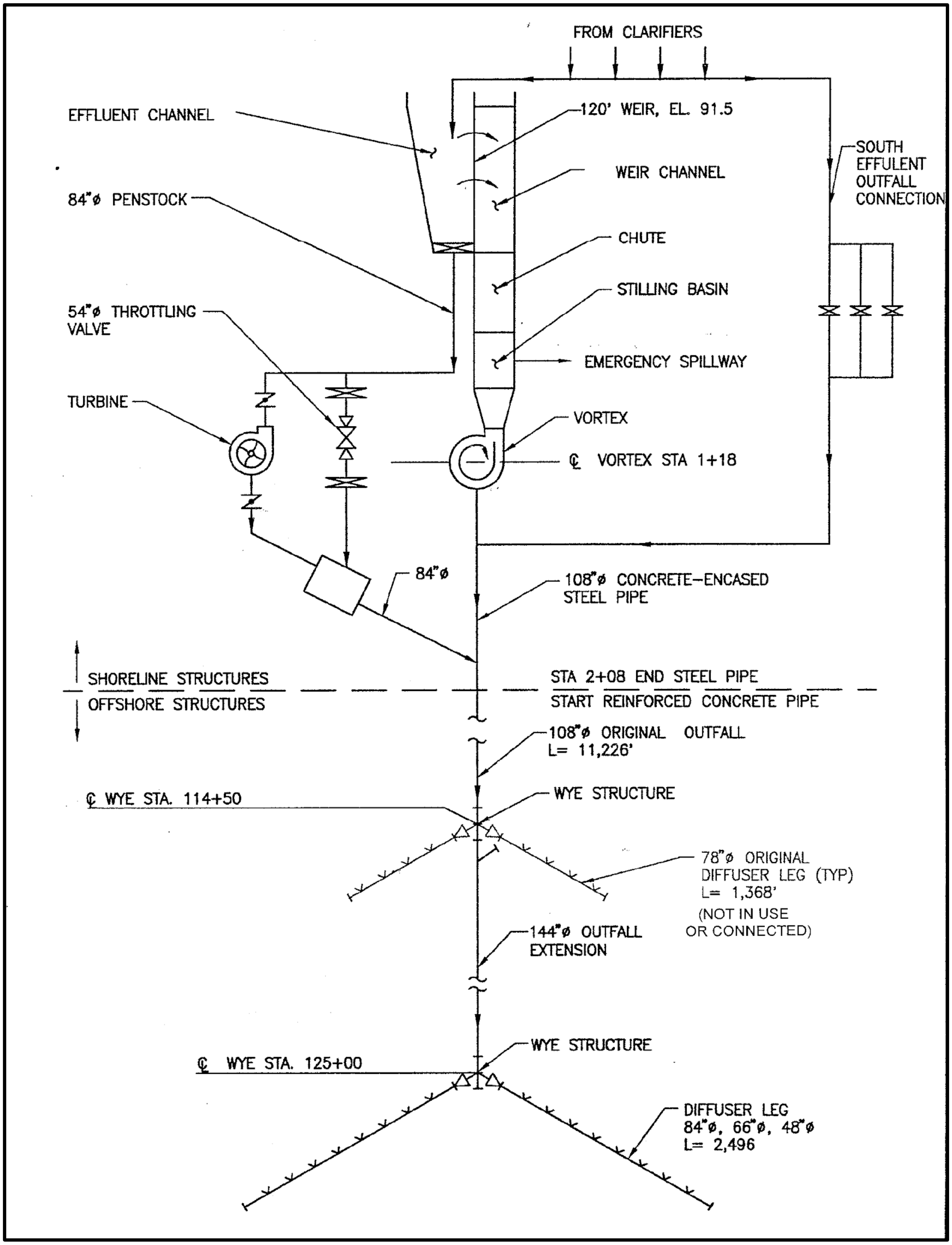
Treated effluent from PLWTP is discharged to the Pacific Ocean though the PLOO. The PLOO discharges treated effluent at a depth of approximately 310 feet approximately 4.5 miles offshore. The PLOO consists of an original 11,226-foot-long outfall section that was constructed in 1963 and a 12,246-foot-long extension that was added in 1993. The total length of the outfall system is 23,472 feet.

A.4.1 Shore Facilities

The principal function of the shore structure is to safely dissipate excess head. The hydroelectric unit generates electricity and is intended to operate in parallel with the throttling valve. The SEOC provides an additional parallel path to the outfall and is intended to avoid problems of air entrainment that have affected the performance of the vortex structure. Peak flows will be routed through the SEOC circuit and low flow could be routed through the throttling valve. For the foreseeable future, the SEOC will provide the main pathway to the ocean outfall, with the vortex working only as a standpipe.

A Figure A-6 presents a schematic of how the PLOO is connected to the PLWTP. The shore structures consist of the vortex, the throttling valve, the hydroelectric turbine, and the SEOC.

Figure A-6:
PLOO Shoreline and Offshore Structure Schematic



A.4.2 Original Outfall Section, including the Wye and Diffusers

The main barrel of the original PLOO consists of 11,226 feet of 9-foot-diameter, reinforced concrete pipe with a wall thickness of 10 inches. The offshore portion of the main barrel (original section of the outfall) starts at Station 2+08 at the connection to the 9-foot-diameter, concrete-encased, steel pipe leading from the Vortex Structure. Station 2+08 is approximately 20 feet downstream from the connection with the 7-foot-diameter conduit from the throttling valve and turbine. At Station 114+34, the main barrel of the original outfall ends at the connection to the diffuser wye structure. (Note: Each outfall station represents 100 feet of length. Station 114+34, for example, represents a distance of 11,434 feet from the beginning of the structure.)

The original outfall was constructed using bell and spigot pipe with double gaskets at each joint. The bell end of the pipe is of the raised type to provide additional strength at the joint. The original section of the outfall is not internally lined. This arrangement was used at the time of construction to facilitate hydrostatic testing of the joint for leakage. The test tube is connected to a coupling imbedded in the wall of the pipe. After testing, the coupling was sealed with a threaded plug.

In the construction of the original main barrel, three typical sections were used. Between Station 2+08 and Station 26+50, the main barrel was constructed in a trench with the entire pipe below seabed. The pipe was placed in the trench with a minimum bedding thickness up to the spring line of 1 foot. Above the spring line, the trench was backfilled with concrete and a minimum concrete thickness of two feet was maintained over the top of the pipe.

Between Station 26+50 and Station 30+40, a transition zone occurs where the pipe emerges from the rock trench and is laid on the ocean floor. The spring line of the main barrel was constructed roughly at the seabed. Between Station 30+40 and Station 114+34, the main barrel was placed on bedding with a minimum clearance of 1 foot from the seabed to the bottom of the pipe. The bedding ballast extends up to the spring line. Side slopes for the bedding ballast were set at 1.5:1 (horizontal to vertical). In the months immediately following construction of the original outfall, additional rip rap consisting of one ton boulders was placed on top of the existing ballast rock from Station 26+50 to Station 62+50.

The original diffusers and wye structure incorporate provisions for isolation and flushing. Slots were provided for the insertion of reinforced concrete bulkheads (gates) at the following locations: (1) at the inlet to each diffuser leg at the wye structure, and (2) on the main barrel of the wye structure, immediately downstream of the diffuser leg connections.

At the end-structure of each diffuser leg, a bolted bulkhead was provided. Flow into the original diffusers is presently blocked by bulkheads which were inserted at the time of inauguration of the outfall extension.

The original PLOO diffuser is no longer in service. The diffuser ports remain open, but outfall flow to the diffuser legs is blocked.

On February 2, 1992, a major failure of the original PLOO main barrel occurred between Station 33+28 and Station 37+61. Repair work was designed and completed within 60 days of the failure and involved:

- replacing 433 feet of the main barrel using 9-foot-diameter reinforced concrete pipe with a 360-degree polyvinyl chloride (PVC) lining,
- installing bedding, intermediate rock, and armor rock for the 433-foot-long section,
- providing cover that included 1.5 ton (median) armor rock with a minimum thickness of 4.5 feet above the top of the pipe from Station 27+90 to Station 60+00,
- providing armor rock flush with the top of the pipe from Station 60+00 to Station 67+15, and
- installing a manhole and air relief valve assembly at Station 3+52.50.

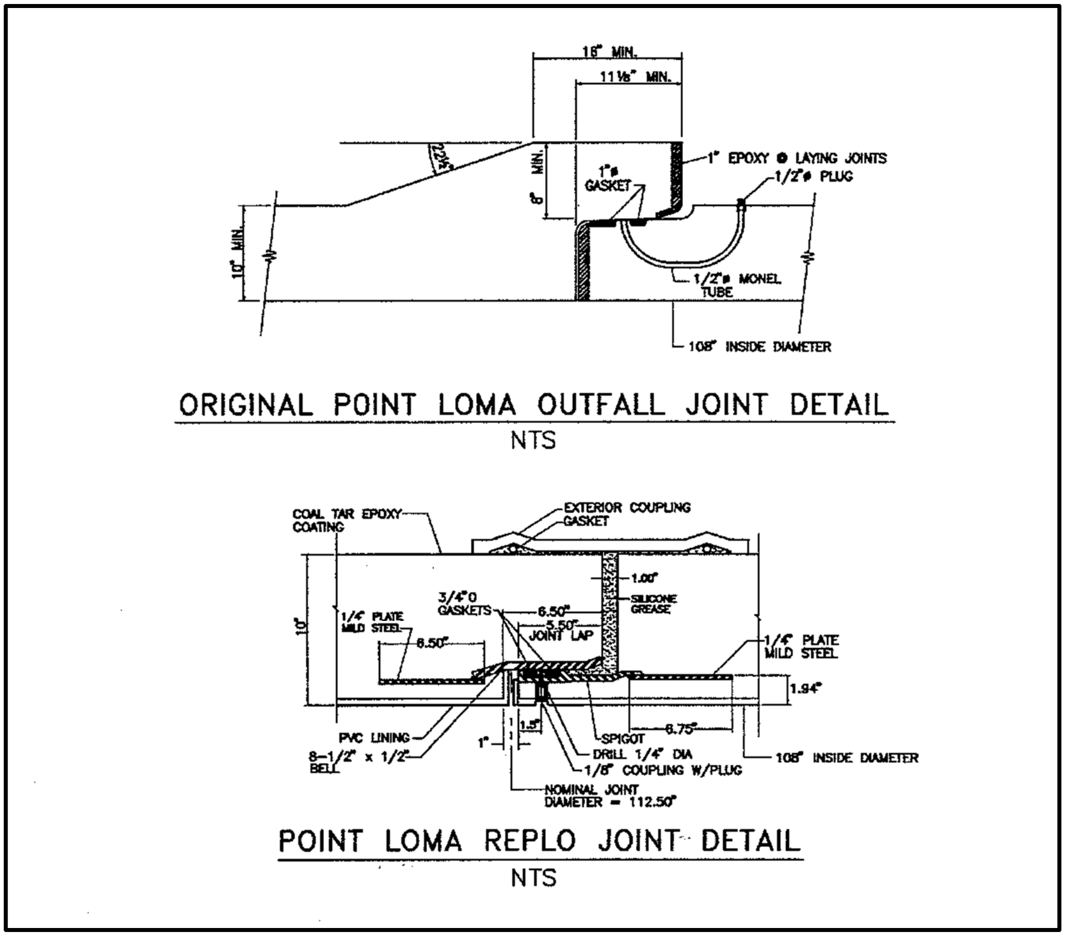
Details of the typical pipe joint used for the repair work are shown in Figure A-7. The joint is formed by steel rings on the pipe bell and spigot. Pipe is of the double gasket, flush bell type. Each pipe joint has a ¼-inch-diameter tube between the interior of the pipe at the spigot and the space between the two gasket grooves. This arrangement was used at the time of construction for hydrostatic testing of the joints for leakage.

A ¾-inch thick, 18-inch wide external steel split sleeve surrounds each joint and incorporates two ring gaskets to provide a tight seal. Silicone grease was injected into the annular space between the sleeve and the outside wall of the pipe through 1-inch-diameter fittings on the coupling.

A special closure piece was fabricated for completion of repair work. The closure piece incorporated a 25-foot-long, internal steel cylinder which provided support for two 13.625-foot-long, reinforced concrete, telescoping pipe sections. Double gaskets on each of the telescoping pipe sections provide a seal between the internal steel cylinder and the pipe. A reinforced, tremie concrete collar joins the telescoping pipe sections. The integrity of joints on each of the two telescoping pipe sections was tested by means of ½-inch-diameter, PVC test tubes between the exterior of the closure piece and the middle of the gasket grooves.

Figure A-7 presents typical details for joints within the original portion of the outfall. Joints within the original section of the outfall include a monel tube that connects the outside of the spigot to the space between the two gasket grooves.

Figure A-7:
Original Outfall and Outfall Repair Joint Details



A.4.3 PLOO Extension

The PLOO was extended in 1993 to discharge wastewater approximately 4.5 miles offshore (beyond the 3-mile limit of state-regulated ocean waters) and was designed to achieve a 75-year service life. The main barrel of the PLOO extension is connected to the original wye structure immediately downstream from the original diffuser legs. A slot for a reinforced concrete bulkhead is located in the original wye structure between the diffuser legs and the connection for the outfall extension. The bulkhead has been removed to allow flow to pass through the outfall extension, and a lid has been secured to the top of the slot.

Between the start of the outfall extension at Station 0+08 and Station 1+97, the diameter of the reinforced concrete pipe conduit is 108 inches and the wall thickness is 10 inches. Pipe in this section of the outfall extension is of the extended bell type. The main barrel of the outfall extension has double-gasket bell and spigot joints. The joint has a tube between the outside of the spigot and the space between the two gasket grooves. This arrangement was used at the time of construction to test each joint for leakage. A special self closing male fitting was provided at the test port on each pipe spigot for use in pressure testing of the pipe joint. The integrity of each joint may be retested in the future with the use of the special male fitting and mating test equipment.

The top 90 degrees of the inside circumference of the main barrel, centered on the crown of the pipe, is provided with a PVC liner that is permanently imbedded in the concrete with integral locking extensions. Vertical surfaces at pipe joints are lined with PVC that is bonded to the pipe with a (T Lock) specialized adhesive.

A maintenance access hatch is provided in the outfall extension at Station 0+20 on the 9-foot section of the outfall extension. The cover of the 42-inch opening is made of cast hi-resist alloy that has a low rise (almost flush with the exterior of the pipe). A 2-inch threaded opening, presently plugged, will allow piezometric testing of the outfall at future times. The main barrel was laid on a leveled course of bedding material. Following placement of the main barrel, bedding was completed and then ballast rock was placed up to the spring line.

Figure A-8 presents a typical joint detail of the outfall extension and Figure A-9 presents the profile of the original and extended sections of the PLOO.

Figure A-8:
Point Loma Extension Typical Joint Detail

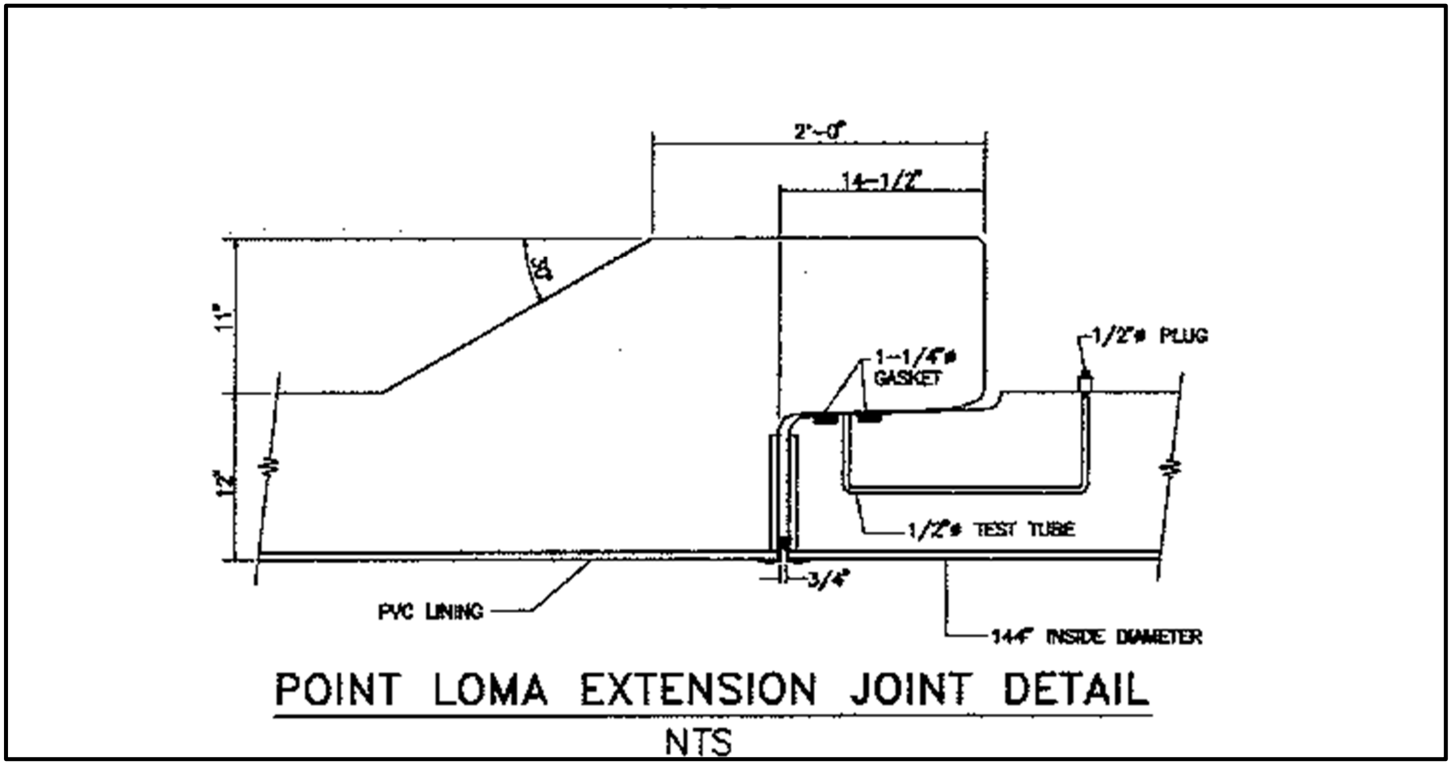
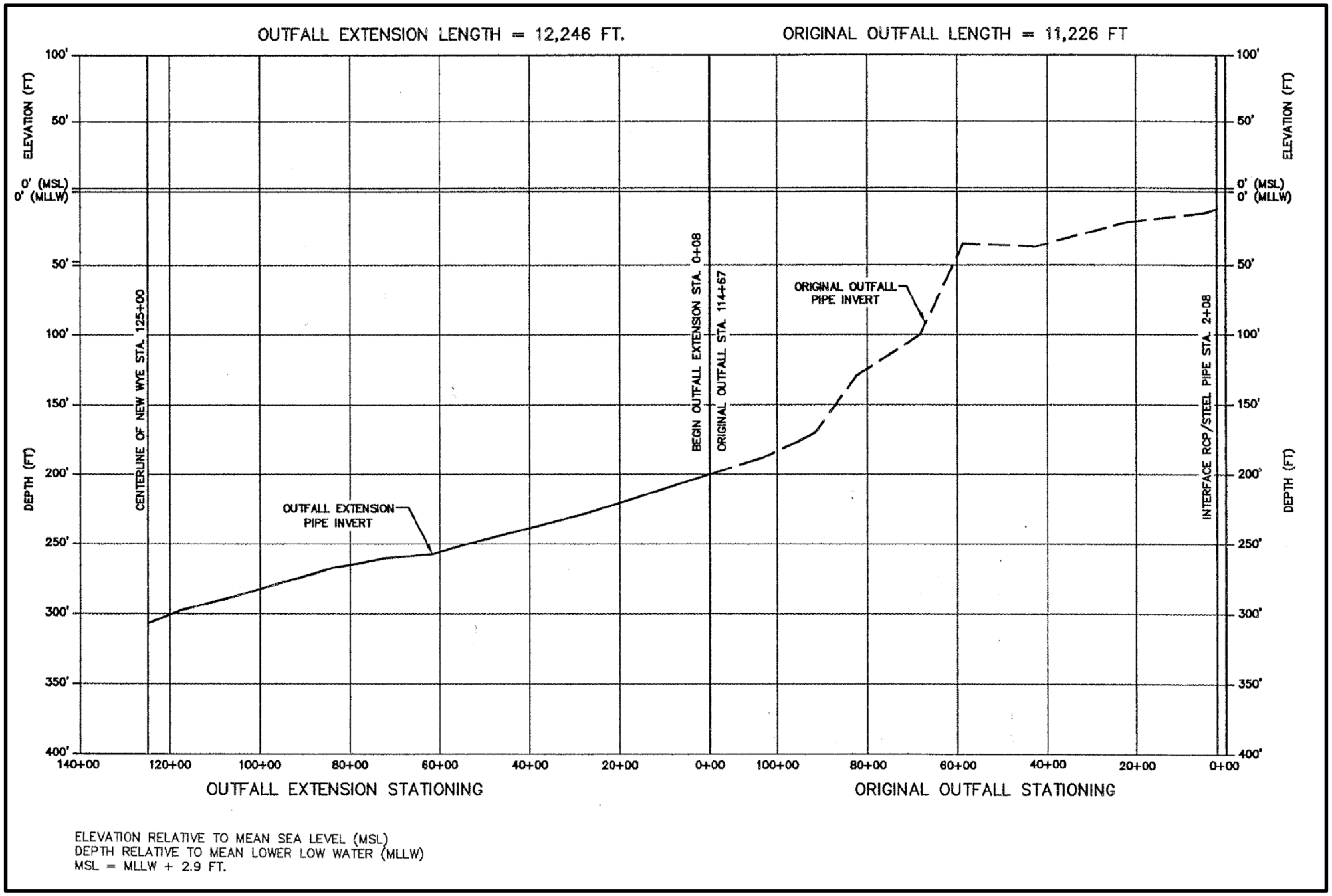


Figure A-9:
PLOO Depth Profile



A.4.4 Intermediate Wye Structure

A special transition pipe is provided at Station 1+97 which increases the outfall extension diameter from 108 to 144 inches. The intermediate wye structure starts at the downstream end of the transition pipe (Station 2+21). The purpose of the intermediate wye structure is to allow for the future connection of a 12-foot-diameter outfall that will parallel and replace the original outfall. The wye branch is oriented at 45 degrees to the main barrel and intersects the main barrel at Station 2+50. A reinforced concrete bulkhead is currently set in a special slot on the wye and will be removed upon connection of the parallel outfall conduit. Two monel lifting hooks are provided for retrieval of the bulkhead.

Constructed of a combination of ¾-inch steel plate and 2-inch reinforced concrete liner, the intermediate wye is set within a 19-foot high, 48-foot diameter, circular steel plate crib. The space between the wye and the steel ring is backfilled with rock to provide thrust restraint.

Cathodic protection for the steel plate ring at the intermediate wye is provided by a total of 14 active and 14 passive sacrificial anodes arranged in two rows around the periphery of the ring. All anodes are aluminum alloy ingots that contain 3% zinc by weight and are joined to the steel plate ring by bonding cables. Each ingot weighs approximately 90 pounds. The passive anodes are completely encapsulated in a wax-tape coating to reduce or eliminate current output.

The anodes on the intermediate wye will be consumed (sacrificed) for the protection of the structure as current is discharged from them into the surrounding soil or seawater. It is estimated the active sacrificial anodes will be consumed in about 50 years. At that time or earlier, it will be necessary to remove the wax-tape coating from the passive anode surfaces using a brush. Upon activation, the life of the passive anodes should exceed the service life of the original outfall. Because it is difficult to estimate the rate of consumption of an anode, the condition of the anodes are monitored to determine when activation of the passive anodes is required.

Between the downstream end of the intermediate wye at Station 2+79 and the upstream end of the diffuser wye structure at Station 127+74, the diameter of the conduit is 144 inches and the wall thickness is 12 inches. Pipe joints, lining, bedding, ballast, and exterior marking are identical to those described for the 9-foot-diameter portion of the outfall extension.

Maintenance access hatches (identical to the one located in the area between the original and intermediate wye) are provided at an interval of roughly 1,000 feet on the 12-foot diameter portion of the main barrel. Twelve access hatches are provided between the intermediate wye and the diffuser wye structures.

A.4.5 Outfall Diffuser Wye

The diffusers branch from the main outfall at the diffuser wye structure (Station 125+00) at a bottom depth of approximately 310 feet below mean low low water (MLLW). The diffuser wye, similar to the intermediate wye, is also constructed of combined fabricated steel plate and reinforced concrete liner, and is set within a 19-foot high, 42-foot- diameter, circular steel plate crib. The space between the wye and the steel ring is backfilled with gravel and provides thrust restraint.

Cathodic protection for the steel plate ring at the intermediate wye is provided by a total of 12 active and 12 passive sacrificial anodes arranged in two rows around the periphery of the ring. All anodes are aluminum alloy ingots that contain 3% zinc by weight and are joined to the steel plate ring by bonding cables. Each ingot weighs approximately 90 pounds. The passive anodes are completely encapsulated in a wax-tape coating to reduce or eliminate current output.

The anodes on the diffuser wye will be consumed (sacrificed) for the protection of the structure as current is discharged from them into the surrounding soil or seawater. As per the intermediate wye, the estimated anode life for the diffuser wye is also estimated to be over 50 years. At the time of depletion of the active anodes, it will be necessary to remove the wax-tape coating from the passive anode surfaces using a brush. Upon activation, the life of the passive anodes for the diffuser wye is estimated to be over 50 years.

Slots for three reinforced concrete bulkheads (gates) are provided at the diffuser wye structure inside the steel plate crib. Two of the bulkheads can be used to shut off flow to the two diffuser legs and can be used during outfall maintenance. As part of routine maintenance, a bulkhead would be inserted at one diffuser leg to enable flow to be routed to the other leg. Isolation of each leg allows for cleaning, inspection, or repair of the blocked diffuser leg with a minimum interruption of flow. Under normal operation, the diffuser slide gates are not in place and the gate slot is covered by a reinforced concrete lid. The reinforced concrete lids are rectangular in shape and are secured in place by ten 1.25-inch-diameter monel bolts and rest on collars that are integrally cast into the diffuser wye. A 1.5-inch thick, 3-inch wide gasket is in a rectangular pattern on the collar to ensure a watertight seal. Two lifting hooks are provided on each lid.

A third slot is provided on the 12-foot diameter main barrel, immediately downstream from the diffuser branches. This slot, which normally has the bulkhead in place, allows full diameter access to the main barrel of the outfall and could be used for mainline cleaning or for a future outfall extension.

A 2-inch-diameter port is located in the crown of the pipe at Station 124+71, immediately upstream of the wye. The purpose of the port is to prevent the accumulation of air, oil, grease, and floatable materials that could otherwise impair the function of the diffusers. A maintenance access hatch is provided in the diffuser wye structure at Station 124+89.50.

A.4.6 Outfall Diffuser Legs

The two diffuser legs for the outfall extension are built on the seabed at a depth between 306 and 313 feet below MLLW. The diffuser legs are oriented N 17° 13' W, and S 11° 16' W, with an internal angle of roughly 151.5 degrees. Each diffuser leg is 2,496 feet long and consists of 7-foot, 5.5-foot, and 4-foot internal diameter pipe. Pipe lengths, port spacings, and numbers of ports on each diffuser leg are summarized in Table A-5. Diffuser ports are set in the middle of each pipe on opposite sides, 6 inches above the springline of the pipe.

Table A-5:
Extended Point Loma Outfall Diffuser Configuration[1]

Section Length Per Leg (ft)	Internal Diameter (ft)	Pipe Thickness (inches)	Port Spacing[2] (ft)	Port Diameter (inches)	Number of Ports per Leg	Approx. Range of Depth[3] MLLW (ft)	Max Port Design Flow Rate (mgd)
1008	7.0	9	24	3.75	84	306-309	1.09
840	5.5	9	24	4.25	70	309-311	1.15
648	4.0	9	24	4.75	54	311-313	1.13

Table A-5 Notes:
1. Data from Engineering Science (1991) and City of San Diego (1995).
2. Port spacing shown is for ports on the same side of diffuser leg. Ports are located on both sides on the diffuser leg.
3. Distance from the centerline of the ports to the ocean surface.

The diffusers, excluding the final 160-foot-long section of the 4-foot-diameter diffuser, are constructed of PVC-lined, reinforced concrete pipe similar to the pipe used for construction of the main barrel. Unlike the main barrel of the outfall extension, all pipe joints on the diffuser have a single gasket. The final 160-foot section of each diffuser leg is constructed of a single piece of steel pipe which serves as a restraining block. Steel plate used in fabrication of the pipe has a thickness of $^5/_8$ inches and is lined internally with 5 inches of reinforced concrete. Externally, the steel is coated with a 180-mil thick layer of carboline.

Cathodic protection for the steel diffuser section is provided by two active and two passive sacrificial anode bands arranged on the top of the pipe. All anodes are aluminum alloy ingots that contain 3% zinc by weight and are joined to the steel plate ring by welded straps. Each ingot weighs approximately 45 pounds. The passive anodes are completely encapsulated in a 30-mil thick PVC shield to reduce or eliminate current output. The PVC shield on the passive anodes will be removed at a future date to replace depleted active anodes. The estimated life of the active anodes is in excess of 50 years.

The internal lining and bedding of the diffusers are identical to main barrel of the outfall extension. Bedding for the diffusers is similar to that for the main barrel, however, the ballast is depressed at the ports to avoid blockage of the flow. Likewise, the stripe painted along the springline of the diffuser to indicate the height of the ballast rock, is depressed in a "V" shape at the ports. A line is also painted along the circumference of the diffuser from the top of the pipe to each individual diffuser port.

A.4.7 Design Flows

The outfall extension was designed based on a maximum allowable hydraulic grade line (HGL) elevation of 81.5 feet above mean sea level (MSL) at the interconnection between the steel and concrete sections of the original outfall (Station 2+08). Station 2+08 is located roughly 60 feet downstream from the SEOC. Table A-6 presents design flows for the PLOO.

Table A-6:
PLOO Design Flows[1]

Flow Condition	Flow Rate	
	cubic meters per second (m^3/sec)	(mgd)
Minimum flow	3.15	72
Peak dry weather flow	10.51	240
Peak wet weather flow	18.92	432

Table A-6 Note:
1. Outfall design data from Engineering Science (1991).

A.4.8 Outfall Hydraulics

The HGL at the shore structure of the PLOO varies with the tide level and the headlosses through the outfall. Headlosses in the main outfall barrel and diffuser legs are a function of the flow rate through the system. Table A-7 presents projected maximum hydraulic gradelines for the outfall.

Table A-7:
PLOO Total Head Requirement Maximum Hydraulic Gradeline[1]

Flow (mgd)	Tide Level (ft, MSL)	Headlosses					Maximum Hydraulic Gradeline (ft, MSL)
		Original Outfall (ft)	Outfall Extension (ft)	Diffusers (ft)	Density Head (ft)	Minor Losses (ft)	
72	5.3	1.1	0.3	0.2	8.7	0.00	15.6
100	5.3	2.2	0.5	0.4	8.7	0.1	17.1
150	5.3	4.8	1.2	0.9	8.7	0.1	21.1
200	5.3	8.6	2.1	1.6	8.7	0.3	26.6
250	5.3	13.4	3.3	2.5	8.7	0.4	33.6
300	5.3	19.4	4.7	3.7	8.7	0.6	42.3
350	5.3	26.3	6.4	5.0	8.7	0.8	52.5
400	5.3	34.4	8.3	6.5	8.7	1.0	64.3
432	5.3	40.1	9.7	7.6	8.7	1.2	72.7

Table A-7 Note:
1. Outfall performance data from Point Loma Outfall Extension Report (Engineering Science, 1991).

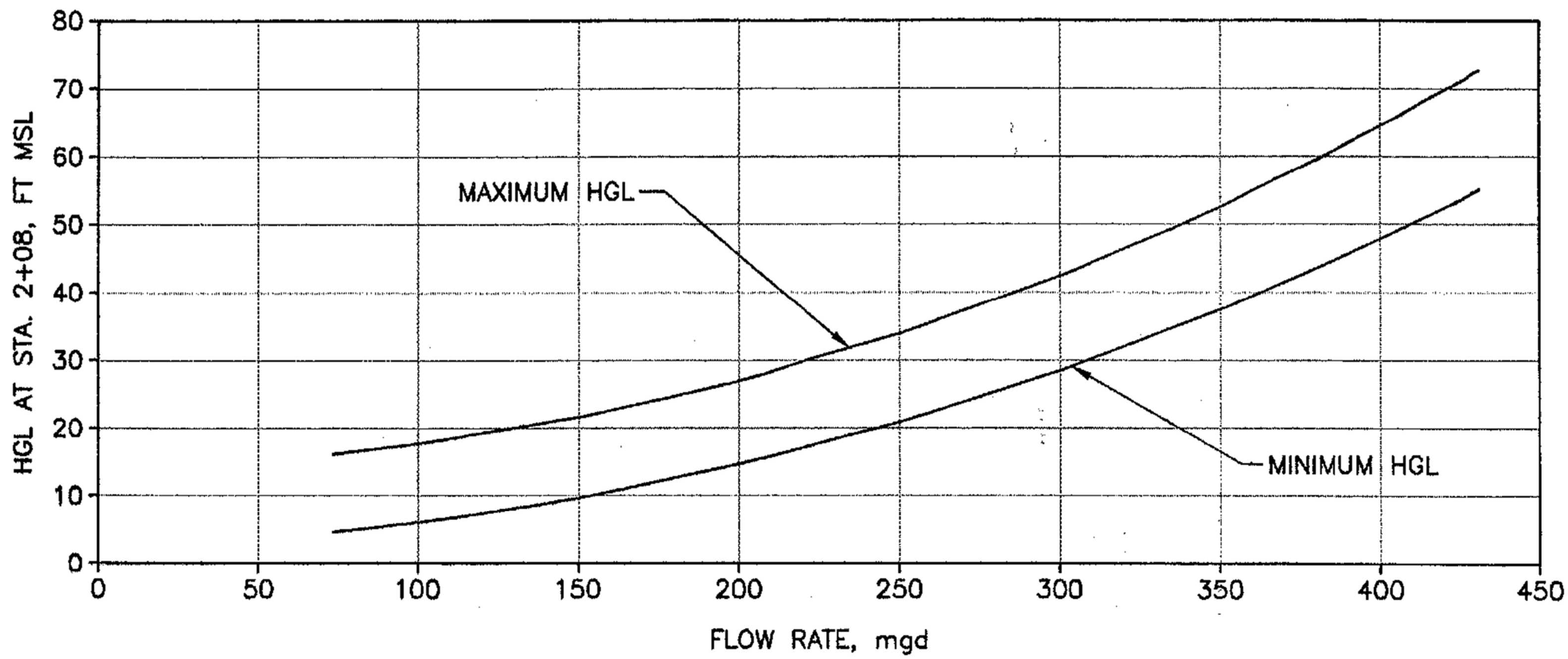
Table A-8 presents projected minimum hydraulic gradeline elevations and Figure A-10 graphically depicts the range of outfall hydraulic gradeline at the shore facilities.

Table A-8:
PLOO Total Head Requirement Minimum Hydraulic Gradeline[1]

Flow (mgd)	Tide Level (ft, MSL)	Headlosses					Maximum Hydraulic Gradeline (ft , MSL)
		Original Outfall (ft)	Outfall Extension (ft)	Diffusers (ft)	Density Head (ft)	Minor Losses (ft)	
72	-5.1	1.0	0.2	0.2	7.9	0.00	4.3
100	-5.1	2.0	0.4	0.4	7.9	0.1	5.6
150	-5.1	4.4	0.8	0.9	7.9	0.1	9.1
200	-5.1	7.9	1.4	1.6	7.9	0.3	14.0
250	-5.1	12.4	2.2	2.5	7.9	0.4	20.3
300	-5.1	17.8	3.2	3.7	7.9	0.6	28.0
350	-5.1	24.2	4.3	5.0	7.9	0.8	37.1
400	-5.1	31.6	5.6	6.5	7.9	1.0	47.6
432	-5.1	36.9	6.6	7.6	7.9	1.2	55.1

A-8 Note:
1. Outfall performance data from Point Loma Outfall Extension Report (Engineering Science, 1991).

**Figure A-10:
Estimated Hydraulic Gradeline Elevation at Shore Facilities**



ESTIMATED HYDRAULIC GRADELINE ELEVATION
AT SHORE FACILITIES

FIGURE B-4

The outfall extension was designed on the basis of a 432 mgd (18.93 m^3/sec) peak flow concurrent with a 50-year high tide of 8.2 feet above MLLW (5.3 feet above MSL). The minimum tide level is estimated to be 2.2 feet below MLLW (5.1 feet below MSL). The elevation of the ocean surface varies with the tide stage. For effluent to be discharged through the diffuser ports, the head in the diffuser must overcome the existing tide level. In addition, the head associated with the density difference between seawater and the plant effluent must be overcome.

This latter term, called the "density head", is equivalent to the product of the height of the water column above the diffuser ports and the difference between the specific gravity of seawater (1.026) and the plant effluent (0.9967). The outfall extension diffusers have been designed to avoid seawater intrusion into the diffuser ports at the minimum design flow of 72 mgd (3.15 m^3/sec). Seawater intrusion is a problem that occurs in some outfalls during periods of low flow when there are excessive differences in depth over the length of a diffuser. When the head available at the deeper diffuser ports is less than the differential density head between the beginning and end of the diffuser, seawater is able to enter the lower reaches of the diffuser. Sediments carried by the seawater can settle in the diffuser and may not be resuspended when the flow is increased.

A.4.9 Headlosses in the Main Outfall Barrel

Headlosses in the main outfall barrel were estimated using Manning's equation on the basis of the results of hydraulic testing conducted in 1989 and 1990, as reported by Engineering Science in the 1991 Point Loma Outfall Extension Report. Table A-9 presents assigned Manning's equation coefficients. Headlosses were computed assuming no air in the system.

Table A-9:
PLOO Headlosses in the Main Barrel

Condition	Main Barrel Section	Manning's coefficient ("n")
Maximum headloss:	Original outfall Outfall extension	0.0146 0.0146
Minimum headloss:	Original outfall Outfall extension	0.0140 0.0120

A.5 NORTH CITY WATER RECLAMATION PLANT

The NCWRP is an advanced wastewater treatment facility capable of producing recycled water that complies with requirements of Title 22, Division 4 of the California Code of Regulations for unrestricted body contact. The NCWRP provides a capacity to treat 32 mgd (average flow) and is operated under a separate permit (Order No. R9-2015-0091). Tertiary treated recycled water produced at the NCWRP is discharged to a regional conveyance system for transport to qualified recycled water users.

The NCWRP may also receive inflow from the Peñasquitos Pump Station via a pressure/gravity pipeline (Peñasquitos Trunk Sewer Relief Pipeline) which discharges directly into the plant's headworks. As shown in Figure A-1, the Peñasquitos Trunk Sewer Relief Pipeline diverts wastewater directly to the NCWRP that would otherwise be discharged into the Old Peñasquitos Trunk Sewer and Pump Station 64.

Excess secondary treated effluent is discharged to the Rose Canyon Trunk Sewer for conveyance to the NMI and PLWTP. Sludge from the NCWRP is pumped to the MBC for processing.

The main liquid treatment train consists of:

- influent pumping,
- screening,
- aerated grit removal,
- primary sedimentation with sludge and scum removal,
- sideline flow equalization,
- anoxic-aerobic activated sludge consisting of anoxic mixing with mixed liquor recycle and fine bubble aeration,
- secondary clarification with scum removal,
- mixed liquor and excess sludge wasting,
- chemical addition for coagulation,
- flocculation,
- tertiary filtration through anthracite coal media,
- electrodialysis reversal,
- advanced water purification demonstration facilities, and
- effluent chlorination.

Table A-10 presents NCWRP design criteria for each unit treatment process.

**Table A-10:
Design Criteria and Loadings for the NCWRP**

Process		Units	Average	Peak
Plant Influent	Influent Flow	mgd	30	60
	Total Suspended Solids (TSS) Concentration	mg/L	250	--
	TSS Loading	lbs/day	62,588	--
	Biochemical Oxygen Demand (BOD) Concentration	mg/L	250	--
	BOD Loading	lbs/day	62,588	--
Influent Pump Station (with in-Plant Return Flow)	Influent Flow	mgd	33.82	60
	TSS Concentration	mg/L	253	--
	TSS Loading	lbs/day	71,500	--
	BOD Concentration	mg/L	238	--
	BOD Loading	lbs/day	67,100	--
Screening	Type: Mechanically Cleaned "Climber Type"	--	--	--
	Number of Mechanical Screens	--	1	1
	Number of Bypass Mechanical Screens	--	1	1
	Total Mechanical Screens Installed	--	2	2
Grit Removal	Type: Aerated Grit Removal	--	--	--
	Total Number of Units	--	2	2
	Unit Width	ft	20	20
	Unit Length	ft	60	60
	Average Water Depth	ft	14	14
	Total Volume	ft^3	33,600	33,600
	Detention Time (all units in service)	minutes	10.70	6.03
	Detention Time (one unit out of service)	minutes	5.35	3.02
Primary Sedimentation	Type: Rectangular - Conventional	--	--	--
	Influent Flow	mgd	33.82	60
	Influent TSS Load	lbs/day	74,010	--
	Influent BOD Load	lbs/day	67,100	--
	Total Number of Units	--	6	6
	Unit Width	ft	20	20
	Unit Length	ft	208	208
	Average Depth	ft	11	11
	Total Area	ft^2	24,960	24,960
	Total Volume	ft^3	274,560	274,560
	Surface Overflow Rate (all units in service)	gpd/ft^2	1,355	2,404
	Surface Overflow Rate (one unit out of service)	gpd/ft^2	1,626	2,885
	Detention Time (all units in service)	minutes	87	49

Process		Units	Average	Peak
Primary Sedimentation (cont.)	Detention Time (one unit out of service)	minutes	73	41
	Weir Loading (all units in service)	gpd/ft	22,190	39,370
	Weir Loading (one unit out of service)	gpd/ft	26,630	47,240
	Percent BOD Removal	%	26	25
	Percent TSS Removal	%	60	60
Flow Equalization Basins	Type: Circular Prestressed Tank			
	Number of Units	--	2	2
	Diameter, each	ft	140	140
	Maximum Nominal Depth	ft	29	29
	Maximum Storage Volume, All Basins	ft^3	858,000	858,000
	Percent of Average Primary Effluent Flow	%	19	19
Primary Effluent/ RAS[1] Mix Basin	Volume	ft^3	11,060	11,060
	Detention Time (Based on plant effluent plus RAS)	minutes	3.6	2.5
	Mixing Power Input	HP/1,000 ft^3	1.2	1.2
Aeration Basins	Type: Single Pass-Plug Flow Anoxic/Aerobic Air Activated Sludge	--	--	--
	Influent Flow (Equalized Primary Effluent)	mgd	32.75	48
	Influent Design BOD_5 load	lbs/day	49,950	97,260
	Influent Design TSS load	lbs/day	29,600	55,640
	Total Number of Basins	--	7	7
	Basin Width	ft	20	20
	Basin Depth	ft	20	20
	Number of Anoxic Cells per Basin	--	3	3
	Anoxic Cells w/Standby Aeration	--	2	2
	Anoxic Cell Length	ft	27	27
	Number of Aerobic Zones per Basin	--	1	1
	Number of Aeration Grids per Basin	--	4	4
	Length of Aeration Grid	ft	78	78
	Total Aerobic Zone Length Per Basin	ft	312	312
	Total Basin Length (Anoxic and Aerobic)	ft	392	392
	Total Anoxic Volume	ft^3	224,000	224,000
	Total Aerobic Volume	ft^3	873,600	873,600
	Total Basin Volume	ft^3	1,097,600	1,097,600
	Anoxic Volume as Percent of Total Basin	%	20	20
	Maximum Anoxic Detention Time (all units in service)	hours	1.2	0.8

Process		Units	Average	Peak
Aeration Basins (cont.)	Maximum Anoxic Detention Time (one unit out of service)	hours	1.1	0.7
	Minimum Aerobic Detention Time (all units in service)	hours	4.8	3.3
	Minimum Aerobic Detention Time (one unit out of service)	hours	4.1	2.8
	Anoxic + Aerobic Detention Time (all units in service)	hours	6.0	4.1
	Anoxic + Aerobic Detention Time (one unit out of service)	hours	5.2	3.5
	Mixed Liquor Suspended Solids (MLSS)	mg/L	2,470	3,000
	Mixed Liquor Volatile Suspended Solids (MLVSS)	mg/L	1,930	2,370
	Mean Cell Residence Time (all units in service)	days	5.0	3.0
	Mean Cell Residence Time (one unit out of service)	days	4.3	2.6
	Food:Microorganism (FM) Ratio (all units in service)	--	0.30	0.45
	FM Ratio (one unit out of service)	--	0.35	0.53
	Waste Activated Sludge (WAS) Mass Rate	lbs/day	40,270	79,270
	WAS TSS Flow	mgd	1.95	1.95
	WAS TSS Concentration	mg/L	2,470	3,000
	WAS lbs TSS per lbs BOD_5 Removed	--	0.85	0.85
	Net Actual Oxygen Demand	lbs/day	62,580	103,430
Secondary Clarification	Type: Rectangular - Conventional Influent Flow	--	--	--
	Influent Flow (plant effluent only)	mgd	30.8	44.83
	Return Activated Sludge (RAS) Flow	mgd	20.45	29.79
	RAS TSS Concentration	mg/L	6,180	7,500
	Mixed Liquor Flow (less WAS)	mgd	51.25	74.62
	Mixed Liquor TSS Concentration	mg/L	2,470	3,000
	Total Number of Units	--	14	14
	Clarifier Width, per Unit	ft	20	20
	Clarifier Unit Length		180	180
	Unit Depth	ft	15	15
	Total Area	ft^2	50,400	50,400
	Total Volume	ft^3	756,000	756,000
	Surface Overflow Rate (all units in service)	gpd/ft^2	611	890
	Surface Overflow Rate (one unit out of service)	gpd/ft^2	658	958
	Solids Loading Rate w/MLSS waste (all units in service)	$lbs/ft^2/day$	21	37

Process		Units	Average	Peak
Secondary Clarification (cont.)	Solids Loading Rate (one unit out of service)	lbs/ft²/day	23	40
	Weir Loading (all units in service)	gpd/ft	15,350	22,340
	Weir Loading (one unit out of service)	gpd/ft	16,530	24,060
Secondary Effluent Bypass to PLOO	Minimum Flow	mgd	0	12.83
	Maximum Flow	mgd	30.8	44.83
Tertiary Filtration	Type: Monomedia	--	--	--
	Total Influent Flow	mgd	30.73	32
	Number of Units	--	6	6
	Unit Width	ft	21	21
	Unit Length	ft	53	53
	Total Area	ft²	6,678	6,678
	Filtration Rate (one unit out of service)	gpm/ft²	3.8	4.0
	Filtration Rate (two units out of service)	gpm/ft²	4.8	5.0
Demineralization	Type: Ionics electro dialysis reversal	--	--	--
	Number of Trains	--	4	4
	Capacity, Each Train	mgd	1.1	1.1
Waste Backwash Tank	Type: Rectangular w/Influent Pump Station Structure	--	--	--
	Maximum Instantaneous Inflow	gpm	22,220	22,220
	Number o Units	--	1	1
	Volume per Backwash Event	gallons	260,000	260,000
	Backwash Water per Day	mgd	2.3	3.6
	Outflow Rate	gpm	1,610	2,520
	Maximum Depth	ft	30	30
	Volume	million gallons	0.66	0.66
		ft³	87,690	87,690
	Volume as Percent of Daily Backwash Volume	%	28	18
Chlorine Contact	Total Influent Flow	mgd	30.73	32
	Total Number of Contact Tanks	--	3	3
	Width, Each Tank	ft	14.5	14.5
	Length, Each Pass	ft	290	290
	Length, Each Tank	ft	580	580
	Tank Depth	ft	14.5	14.5
	Total Volume, All Tanks	ft³	365,835	365,835
	Detention Time	minutes	128	123

Table A-10 Note:
1. mg/L = milligrams per liter; lbs/day = pounds per day; HP = horsepower

A.5.1 Advanced Water Purification Demonstration Project

The City of San Diego (City) operates an Advanced Water Purification Facility (AWPF) at the NCWRP site as part of an Advanced Water Purification Demonstration Project that has evaluated the feasibility of using advanced treated purified water as a source of supply to augment local and imported water supplies in a raw water storage reservoir. Reservoir augmentation with purified water was an integral component of the Integrated Reuse Alternatives assessed as part of the 2012 Recycled Water Study. Concurrent with completing the 2012 Recycled Water Study, the City initiated this multi-year project, which evaluated the feasibility of augmenting water supplies with purified water produced by an AWPF.

An Independent Advisory Panel (IAP) provided oversight and expert peer review of the technical, scientific, and regulatory aspects of the project. The IAP, organized by the National Water Research Institute, consisted of 10 academics and professionals with extensive expertise in the science of water reuse, chemistry, microbiology, advanced treatment, engineering, water and wastewater operations, regulatory requirements, limnology, toxicology, and public and environmental health. Additionally, regulatory staff from the California State Water Resources Control Board's Division of Drinking Water and the California Regional Water Quality Control Board, San Diego Region participated in IAP meetings and technical workshops. The effort continues to demonstrate the overall feasibility of the purified water treatment and reservoir augmentation concepts addressed in the 2012 Recycled Water Study and has provided the City of San Diego, Metro System Participating Agencies, and regional stakeholders with information on which to frame the Pure Water San Diego Program (Pure Water) water and wastewater facilities planning approach.

The demonstration facility became operational in June 2011. The project treats 1 mgd of tertiary effluent using membrane filtration, reverse osmosis and ultraviolet (UV)/advanced oxidation to purify tertiary treated recycled water. Purified water from the advanced treatment facility is currently blended with NCWRP tertiary effluent and used to augment non-potable recycled water supplies. The project's operational testing and monitoring program, however, has demonstrated that the advanced treatment facility can produce purified water that is comparable or superior in quality to the City's existing imported raw water supply. Data from the demonstration facility are used to inform treatment processes for Pure Water and the design of Pure Water's North City Pure Water Facility that is anticipated to be constructed and operational during the upcoming permit cycle and is regulated under a separate NPDES permit, San Diego Regional Water Quality Control Board Order No. R9-2020-0001.

A.5.2 Cogeneration

Electrical supply for the NCWRP is provided by a cogeneration facility that features five engine/generator units. Four engines and their corresponding generators are operated by a private contractor and one engine and its corresponding generator is operated by City personnel. The cogeneration plant engines are powered by methane gas extracted from the nearby Miramar Landfill.

A.6 METROPOLITAN BIOSOLIDS CENTER

MBC is located at Marine Corps Air Station Miramar. MBC provides dewatering for sludge from the PLWTP and thickening, anaerobic digestion, and dewatering of sludge form the NCWRP. Screened digested sludge from PLWTP is pumped to biosolids holding tanks at MBC where it is mixed with sludge from the onsite digesters. The mixed sludge is pumped to the Centrifuge Dewatering Biosolids Storage Building where dewatering is provided by high-solids type centrifuges. The dewatered biosolids cake is then pumped to storage silos which provide approximately three days of capacity. Biosolids are disposed of by a contracted hauler. Prior to 2020, biosolids were disposed of in the Otay Landfill, used as alternative daily cover (ADC), or were transported off-site for beneficial reuse. Disposal method is a at the sole discretion of the contracted hauler.

Table A-11:
Design Criteria for MBC

Process		Units	Value	
			Average	Peak
Raw Solids Receiving	Type: Circular, Covered, Pre-Stressed Concrete Tanks	--	--	--
	Flow	mgd gpm	1.76 1,223	2.81 1,957
	Solids Loading	lbs/day dry tons/day	79,357 39.7	178,554 89.3
	Solids Concentration	%	0.54	0.76
	Emergency Duration	hours	--	12
	Difference between Peak & Average Flows	gpd	--	1,050,000
	Required Tank Storage	gallons	--	525,000
	Number of Receiving Tanks Provided		2	2
	Receiving Tank Volume (each)	gallons ft^3	528,303 70,629	528,303 70,629
	Total Volume (both tanks)	gallons ft^3	-- --	1,056,606 141,258
	Detention time: w/o Thickening @ Peak Flow w/Thickening @ Peak Flow w/o Thickening	 hours days hours	 -- -- --	 7.20 0.50 4.50
	Influent Flow	mgd gpm	1.76 1,223	2.82 1,957
	Influent Sludge Loading	lbs/day dry tons/day	79,357 40	178,554 89
	Feed Solids Concentration	%	0.54	0.76
Centrifuge Thickening	Operating Schedule	hours/day days/week	24 7	24 7
	Unit Capacity	gpm	600	750
	Number of Centrifuge Units Required	--	2.0	2.6
	Number of Centrifuge Units Provided	--	5	5
	Number of In-Service Centrifuge Units	--	3	3
	Unit Capacity (each unit)	gpm	600	750
	Total Capacity (all units)	gpm	1,800	2,250

Process		Units	Value	
			Average	Peak
Centrifuge Thickening (cont.)	Percent Capture	%	95	95
	Thickened Sludge Solids	lbs/day dry tons/day	73,390 37.7	169,626 84.8
	Thickened Sludge Concentration	%	5	5
	Thickened Sludge Flow	mgd	0.18	0.41
	Centrate Flow	mgd	1.58	2.41
	Centrate Solids	lbs/day dry tons/day	3,968 2.0	8,928 4.5
	Centrate Solids Concentration	mg/L %	301.1 0.03	444.0 0.04
Anaerobic Digestion	Thickened Sludge Feed Flow (peaking factor = 1.5)	mgd	0.18	0.27
	Thickened Sludge Concentration	%	5	5
	Total Solids at peaking factor = 2.25	lbs/day dry tons/day	75,390 38	169,626 85
	Volatile Suspended Solids (VSS)	% lbs/day dry tons/day	69 52,215 26	69 78,323 39
	Minimum Detention time (design criteria)	days	20	15
	Total Volume Required	gallons ft^3	3,615,805 483,396	4,067,780 543,821
	Total Volume Required (0.1 lb VSS/ ft^3)	gallons ft^3	3,905,706 522,153	3,905,706 522,153
	Unit Volume Required	gallons ft^3	1,301,902 174,051	1,355,930 181,274
	Number of Digesters Provided	--	3	3
	Digester Volume (each)	gallons ft^3	2,913,147 389,458	2,913,147 389,458
	Total Digestion Volume (3 tanks)	gallons ft^3	8,739,440 1,168,374	8,739,440 1,168,374
	Hydraulic Resident Time All Units in Service One Unit Out-of-Service	 days days	 48 32	 32 21
	Volatile Suspended Solids Loading All Units in Service One Unit Out-of-Service	lbs ft^3 lbs/ ft^3	 0.04 0.07	 0.07 0.10
	Volatile Suspended Solids Reduction	%	50	50
	Volatile Suspended Solids Destroyed	lbs/day dry tons/day	26,108 13	39,161 20
	Biogas Production @15 ft^3/lb VSS	ft^3/day	391,615	587,422
Digested Biosolids Storage	Digested Biosolids Overflow to Storage	lbs/day dry tons/day mgd	49,282 24.6 0.18	73,923 37.0 0.27
	PLWTP Biosolids to Storage: Flow @ 3% Concentration	mgd gpm	1.14 794.2	1.66 1,150.6
	Solids Loading at peaking factor = 1.38	lbs/day dry tons/day	300,401 150	414,553 207
	Solids Concentration	mg/L %	31,497 3.15	30,000 3.00

Process		Units	Value	
			Average	Peak
Digested Biosolids Storage (cont.)	Number of Tanks Provided	--	2	2
	Tank Volume (each)	gallons ft^3	1,296,000 173,262	1,296,000 173,262
	Total Volume Provided	gallons	2,590,777	2,590,777
	Detention Time (one tank, combined digested flow, no dewatering)	days	0.98	0.67
Centrifuge Dewatering (Combined Flows)	Total Digested Flow (combined)	mgd gpm	1.32 919.7	1.93 1,339.4
	Solids Loading	lbs/day dry tons/day	349,683 175	482,562 241
	Digested Solids Concentration	%	3.17	3.00
	Operating Schedule	hours/day days/wk	24 7	24 7
	Centrifuge Capacity (each)	gpm	250	325
	Number of Centrifuges Required	-	4.0	5.0
	Number of Centrifuges Provided Number of In-Service Centrifuges	- -	8 4	8 5
	Flow Rate Per Unit	gpm	184	223
	Solids Load per Unit (including polymer)	gpm	70,636	117,727
	Percent Capture	%	95	92
	Centrate Flow	mgd	1.19	1.74
	Centrate Solids	lbs/day dry tons/day	14,162 7.1	34,165 17.1
	Centrate Concentration	mg/L %	1,427 0.14	2,359 0.24
Dewatered Sludge Production	Dewatered Sludge Cake Solids Production	lbs/day dry tons/day	335,521 168	448,397 224
	Dewatered Sludge Cake Concentration	%	30	28
	Dewatered Sludge Cake Flow	mgd	0.13	0.19
	Dewatered Sludge Cake Volume	ft^3/day	17,928	25,671
Dewatered Sludge Storage	Type: Cylindrical Live Bottom Silo	--	--	--
	Silo Volume (each)	ft^3	7,122	7,122
	Number of Silos	-	10	10
	Storage Available (10 silos)	ft^3 days	71,220 3.97	71,220 2.77
	Storage Available (9 silos)	ft^3 days	49,154 2.74	49,154 1.91

A.6.1 Cogeneration

A privatized cogeneration facility constructed and operated by the Fortistar Methane Group, LLC is located adjacent to the Energy Building. This facility houses four tandem Caterpillar 3516 reciprocating piston engines linked to one generator each. The engines burn landfill gas collected from the adjacent Miramar Landfill as well as digester gas generated in the MBC digesters. The combined output of these four generators is 6.4 megawatts of electricity. MBC uses approximately 2.4 megawatts and the rest is exported to the utility power grid via the MBC switchgear. Waste heat from the engine jacket water cooling system provides most of the energy necessary to heat the digesters and to provide comfort heating for the buildings.

A.7 SOUTH BAY WATER RECLAMATION PLANT AND OCEAN OUTFALL

The SBWRP was brought online in 2001 to treat wastewater from portions of the southern region of the Metro System service area. The SBWRP is an advanced wastewater treatment facility that produces recycled water that complies with requirements of Title 22, Division 4 of the California Code of Regulations for unrestricted body contact (e.g. disinfected tertiary recycled water). Solids generated by the SBWRP treatment processes are discharged back into the SMI via an 8-inch diameter pipeline for conveyance to and removal at the PLWTP.

The hydraulic capacity of the SBWRP is 18 mgd, and the plant can produce up to 15 mgd of tertiary treated recycled water. The main liquid treatment train consists of:

- influent pumping,
- screening,
- grit removal,
- primary sedimentation,
- sideline flow equalization,
- air activated sludge process with an anoxic selector zone,
- secondary clarification,
- chemical addition for coagulation,
- tertiary filtration through deep bed mono-media filters, and
- electrodialysis reversal, and
- UV disinfection.

SBWRP tertiary treated effluent is directed to a regional recycled water conveyance system for reuse. Use of SBWRP recycled water totaled approximately 2,634 acre-ft per year (an average of 2.35 mgd) during 2020. Recycled water production at the SBWRP averaged 3.97 mgd during 2020. SBWRP flows in excess of recycled water demands receive secondary treatment and are discharged through the South Bay Ocean Outfall (SBOO), which is jointly-owned by the International Boundary and Water Commission (U.S. Section IBWC) and the City. The SBOO discharges wastewater from both the SBWRP and from the IBWC International Wastewater Treatment Plant (IWTP). At times when recycled water production is more than demand, tertiary-treated effluent may be discharged through the SBOO.

The outfall has an average daily flow capacity of 174 mgd and a peak flow capacity of 333 mgd. The City of San Diego has purchased use of up to 40% of the outfall capacity (up to 74 mgd average daily flow capacity and 133 mgd of peak flow capacity). The remaining outfall capacity will be used by the IWTP. The SBOO includes an underground tunnel from the western terminus of the SBLO to roughly 13,500 ft offshore, where it surfaces and continues along the sea floor ending in a Y-shaped structure and two diffuser legs approximately 3.5 miles offshore at a depth of about 95 ft.

Table A-12:
Design Criteria and Loadings for the SBWRP

Process		Units	Parameter Value	
			Average	Peak
Plant Influent	Flow	mgd	15	18
	TSS	mg/L	270	--
		lbs/day	33,800	--
	BOD	mg/L	300	--
		lbs/day	37,555	--
Screening	Number of Mechanical Screens	--	2	2
	Channel Width	ft	3.0	3.0
	Channel Depth	ft	4.42	4.42
Grit Removal	Type: Aerated Grit Removal	--	--	--
	Total Number of Units	--	2	2
	Unit Width	ft	15	15
	Unit Length	ft	30	30
	Average Water Depth	ft	10	10
	Total Volume per Unit	ft^3	120,000	120,000
	Surface overflow rate (all units in service)	gpd/ft^2	1,646	1,947
	Surface overflow rate (one unit out of service)	gpd/ft^2	2,058	2,438
Primary Sedimentation	Type: Rectangular - Conventional	--	--	--
	Design Influent Flow	mgd	16.46	19.47
	Design Load: TSS	lbs/day	70,990	--
	Design Load: BOD	lbs/day	76,960	--
	Total Number of Units	--	5	5
	Unit Width	ft	20	20
	Unit Length	ft	100	100
	Average Unit Depth	ft	12	12
	Surface Overflow Rate (all units in service)	gpd/ft^2	1,646	1,947
	Surface Overflow Rate (one unit out of service)	gpd/ft^2	2,058	2,438
	Detention Time - All units in service	minutes	79	66
	Detention Time (one unit out of service)	minutes	63	53
	Design Percent Removal: BOD	%	30	--
	Design Percent Removal: TSS	%	60	--
Flow Equalization Basins	Number of Units	--	2	2
	Diameter, each	ft	80	80
	Maximum Nominal Depth	ft	19	19
	Maximum Storage Volume, All Basins	ft^3	191,000	191,000
	Percent of Average Primary Effluent Flow	%	19	--

Process		Units	Parameter Value	
			Average	Peak
Primary Effluent RAS Mix Basin	Volume	ft^3	11,060	11,060
	Detention Time (Based on plant effluent plus RAS)	minutes	2.5	2.5
	Mixing Power Input	HP/1,000 ft^3	1.2	1.2
Aeration Basins	Reactor Type: Air Activated w/Anoxic Selectors	--	--	--
	Design Influent Flow (Equalized primary influent)	mgd	15.34	18.0
	Design Load: TSS	lbs/day	53,870	--
	Design Load: BOD	lbs/day	28,400	--
	Total Number of Basins	--	8	8
	Basin Width	ft	25	25
	Basin Depth	ft	15	15
	Number of Anoxic Cells per Basin	--	3	3
	Anoxic Cells w/Standby Aeration	--	2	2
	Anoxic Cell Length	ft	16.7	16.7
	Number of Aerobic Zones per Basin	--	1	1
	Number of Aeration Grids per Basin	--	4	4
	Length of Aeration Grid	ft	30	30
	Total Aerobic Zone Length Per Basin	ft	140	140
	Total Basin Length (Anoxic and Aerobic)	ft	190	190
	Total Anoxic Volume	ft^3	180,000	180,000
	Total Aerobic Volume	ft^3	504,000	504,000
	Total Basin Volume	ft^3	684,000	684,000
	Anoxic Volume as Percent of Total Basin	%	26	20
	Anoxic Detention Time	hours	2.1	1.8
	Aerobic Detention Time	hours	5.9	5.0
	Anoxic + Aerobic Detention Time	hours	8.0	6.8
	MLSS	mg/L	2,800	--
	MLVSS	mg/L	2,240	--
	Mean Cell Residence Time	days	5.3	2.8
	WAS mass rate	lbs/day	41,050	--
	WAS Concentration (based on wasting MLSS)	mg/L	7,000	--
	WAS Flow	mgd	0.7	--
	WAS Ratio: TSS/BOD_5 Removed	--	0.8	--
	Net Actual Oxygen Demand	lbs/day	64,500	--
Secondary Clarification	Type: Rectangular - Conventional	--	--	--
	Influent Flow (plant effluent only)	mgd	30.9	44.8
	RAS Flow	mgd	20.5	29.8
	RAS Concentration	mg/L	6,180	7,500
	Mixed Liquor Flow (less WAS)	mgd	24.76	29.21
	Mixed Liquor TSS Concentration	mg/L	2,800	--
	Total Number of Units	--	9	9

Process		Units	Parameter Value	
			Average	Peak
Secondary Clarification (cont.)	Unit Width	ft	20	20
	Unit Depth	ft	130	130
	Nominal Unit Depth	ft	15	15
	Total Area	ft^2	23,400	23,400
	Total Volume	ft^3	351,000	351,000
	Surface Overflow Rate (all units in service)	gpd/ft^2	656	--
	Surface Overflow Rate (one unit out of service)	gpd/ft^2	--	856
	Solids Loading Rate w/MLSS waste (all units in service)	lbs/ft^2/day	24.7	--
	Solids Loading Rate (one unit out of service)	lbs/ft^2/day	--	32.8
Tertiary Filtration	Type: Monomedia	--	--	--
	Design Influent Flow	mgd	15	--
	Total Number of Units	--	7	7
	Unit Width	ft	15	15
	Unit Length	ft	30	30
	Unit Depth	ft	19	19
	Total Area	ft^2	3,150	3,150
	Filtration Rate (one unit out of service)	gpm/ft^2	3.31	--
	Filtration Rate (two units out of service)	gpm/ft^2	3.86	--
Waste Backwash Tank	Type: Rectangular & Concrete	--	--	--
	Maximum Instantaneous Flow	gpm	22,220	22,220
	Number of Units	--	1	1
	Volume per Backwash Event	million gallons	0.1	0.26
	Backwash Water per Day	mgd		3.6
	Overflow Rate	gpm	1,610	2,520
	Maximum Depth	ft	30	30
	Volume	million gallons	0.66	0.66
		ft^3	87,690	87,690
	Volume as % Daily Backwash Volume	%	28	18
	Desalinization			
	Type: Electrodialysis Reversal	--	--	--
	Total Number of Units	--	2	2
	Design Flow per Unit	mgd	1	1

Process		Units	Parameter Value	
			Average	Peak
Tertiary Disinfection	Type: UV Disinfection	--	--	--
	Design Flow	mgd	15	15
	Influent Turbidity	NTU	2	2
	Total Number of Disinfection Channels	--	1	1
	Width	ft	82	82
	Depth	ft	140	140
	Length	ft	68	68
	Volume	ft^3	5,420	5,420
	Residence Time (theoretical)	hours	3.9	3.9
	Residence Time (estimated)	hours	3.5	3.5
	UV Lamps: Low Pressure High Output Amalgam	--	--	--
	Wavelength	nanometers	253.7	253.7
	Number of Banks	--	8	8
	Rows per Bank	--	2	2
	Lamps per Rows	--	2	2
	Lamps per Bank	--	24	24
	Total Number of Lamps	--	192	192
	Lamp Life	hours	15,000	15,000
	Lamp Input Power	watts	1,000	1,000
	Minimum Exposure Time	seconds	3.4	3.4
	UV Channel Unobstructed Approach Length	ft	8	8
	UV Channel Unobstructed Downstream Length	ft	8	8
	UV Intensity Probes	--	48	48
	Fluid Transmittance Probes	--	1	1

Table A-12 Note:

1. NTU = nephelometric turbidity units

A.8 CENTRALIZED WASTEWATER OPERATIONS CONTROL

The City's centralized communications center, City of San Diego Central Operations and Management Center (COMC), features a distributed instrumentation, control, and data communications system that integrates monitoring and control of the treatment, storage, metering, and pumping facilities in the Metro System and the City's wastewater system. Ultimately, more than 200 facilities can be monitored and controlled either from the Distributed Control System at each facility or from the COMC control room. COMC is located at MBC. A Department Information Network, using a City-owned fiber optic cable network, provides remote monitoring, control and communications of all remote facilities from COMC. Although each facility also has a control room, COMC has full control capability for each facility, and has an operator on duty 24-hours a day to provide either back-up for the facility operators, or full remote control without a local operator.

COMC has two custom-designed operations consoles, with 10 Microsoft Windows-based computer workstations, printers, and telephone and radio communications. Four 72-inch light-emitting diode (LED) displays on the front wall of the control room provide additional monitoring. The operator workstations provide graphical representations of the treatment process at each facility. Real-time information is continuously displayed and updated every second.

To aid in operator training, and to provide quick identification of process areas, many of the screen graphics use realistic isometric (three-dimensional) drawings of the buildings, with cutaway views of the equipment inside. Altogether, more than 1,200 graphics are available, organized with links between graphics to make retrieval and access easy.

The City of San Diego Control Operations and Management Network (COMNET) system integrates all facility support automation systems such as fire alarm, management information systems, electronic O&M manuals, card access systems, process control training simulators, and energy management systems. Presently, Metro System facilities that are monitored and controlled from COMC include:

- NCWRP,
- SBWRP,
- GAPS,
- ORPS, and
- Peñasquitos Pump Station.

Additionally, COMC has the capability to monitor and control the following facilities on an as-needed basis:

- Pump Stations 1, 2, 64, 65,
- MBC, and
- PLWTP.

A supervisory control and data acquisition system is integrated within the monitoring and control system.

A.9 METRO SYSTEM FACILTIES CHEMICAL USE

The City has implemented a proprietary technology called PRI-SC. The PRI-SC system involves coordinated chemical addition at key points within the Metro System to achieve the following goals:

- improved solids removal at the PLWTP,
- more effective odor control,
- reduced iron and solids emissions to PLOO, and
- reduced system-wide chemical costs.

The conceptual basis of the PRI-SC system is to utilize iron for sulfide control, and to utilize hydrogen peroxide (H_2O_2) to regenerate ferrous or ferric iron from the spent iron salts. Figure A-18 schematically presents this process. To initiate the cycle, ferrous chloride is added at upstream Metro System pumping stations for sulfide control. Currently, ferrous chloride addition has been implemented within the City of Del Mar and at Pump Station 65, the Peñasquitos Pump Station, the East Mission Gorge Pump Station, and Pump Station 1.

The second part of the process involves adding hydrogen peroxide at downstream points to regenerate the iron for use in sulfide control and to enhance settling and solids removal at the PLWTP. In this way, iron added at upstream pump stations for odor control is regenerated and becomes available for odor control in the downstream portion of the collection system and to enhance flocculation in the PLWTP primary treatment clarifiers. Hydrogen peroxide is currently added at NCWRP, Pump Station 2, and PLWTP.

Table A-13 summarizes current chemical application at the Metro System pump stations. Table A-14 summarizes chemicals used at Metro System treatment and solids handling facilities. Chemical application rates shown in Tables A-13 and A-14 reflect experience gained during the past few years as the City has fine-tuned the PRI-SC chemical addition process to maximize odor control, maximize solids removal rates, minimize chemical costs, and minimize ocean discharges of iron salts.

Table A-13:
Summary of Chemical Use at Metro System Pump Stations

Chemical	Application Point	Purpose	Typical Dosage
PUMP STATION 1			
Ferrous Chloride	Influent wet well	Sulfide control in wastewater	4,900 gpd
Sodium Hydroxide	Odor scrubber(s)	Odor control	5-10 gpd
Sodium Hypochlorite	Odor scrubber(s)	Odor control	1,00 gpd
PUMP STATION 2			
Hydrogen Peroxide	Influent wet well	Iron salt regeneration to enhance PLWTP coagulation	500 - 600 gpd
Sodium Hydroxide	Odor scrubber(s)	Odor control	5 gpd
Sodium Hypochlorite	Odor scrubber(s)	Odor control	50 - 60 gpd
PUMP STATION 64			
Sodium Hypochlorite	Odor scrubber(s)	Odor control	25 gpd
Sodium Hydroxide	Odor scrubber(s)	Odor control	5 gpd
PUMP STATION 65			
Ferrous Chloride	Influent wet well	Sulfide control	400 gpd
Sodium Hypochlorite	Odor scrubber(s)	Odor control	30 gpd
Sodium Hydroxide	Odor scrubber(s)	Odor control	5 gpd
EAST MISSION GORGE PUMP STATION			
Ferrous chloride	Influent wet well	Odor control force main	1000 gal/week
Sodium Hypochlorite	Odor scrubber(s)	Odor control	3-5 gpd
PENASQUITOS PUMP STATION			
Ferrous Chloride	Influent wet well	Odor control force main	500 gpd
Sodium Hydroxide	Odor scrubber(s)	Odor control	1 gpd
Sodium Hypochlorite	Odor scrubber(s)	Odor control	3-5 gpd

Table A-14:
Chemical Use at Metro System Treatment and Solids Handling Facilities

Chemical	Application Point	Purpose	Typical Dosage
MBC			
Ferrous Chloride	Digester in service	Control of hydrogen sulfide gas	500 gpd
Mannich Polymer	Feed flow/centrifuges	Flocculation	4,500 gpd
Sodium Hydroxide	Wet scrubbers	Odor control, adjust ORP2	200 gpd
Sodium Hypochlorite	Wet scrubbers	Odor control, adjust pH	120 gpd
NCWRP[1]			
Hydrogen Peroxide	Influent wet well	Iron salt regeneration for coagulation	400 gpd
Anionic Polymer	Aeration Effluent Channel	Turbidity control	60 lbs/day
Sodium Hydroxide	Influent PS/headworks/primary	Odor control	30 gpd
Ferric Chloride	Sludge pump station	Odor control	500 gpd
Hydrochloric Acid 31%	Influent PS /headworks/primary	Odor control	7.8 gpd
Sodium Hypochlorite	Influent PS/headworks/primary	Odor control	300 gpd
Sodium Hypochlorite	Filter effluent	NC disinfection	1,500 gpd
PLWTP			
Hydrogen Peroxide	Y structure upstream	Iron salt regeneration for coagulation	500 - 600 gpd
Anionic Polymer	Flumes to sedimentation basins	Flocculation	4,500 gpd
Caustic Soda	Odor tower wet scrubber	Odor control, adjust ORP[2]	ORP2 > 575 (150 gpd)
Ferric Chloride	Parshall flumes	Coagulation	3,000 gpd
Ferrous Chloride	Sludge blending tank	Hydrogen sulfide control at digesters	4,000 gpd
Salt	Water softener	Odor control	500 lbs/day
Sodium Hypochlorite	Odor tower wet scrubber	Odor control, adjust ORP2	ORP2 > 575 (1,300 gpd)
Sodium Hypochlorite	Effluent channel	Effluent disinfection	5,500 gpd

Chemical	Application Point	Purpose	Typical Dosage
SBWRP			
Alum (poly-alum)	Tertiary filters main influent line	Coagulant aid/turbidity control	0 - 5 gpm
Sodium Hydroxide	Odor control wet scrubbers	Odor control	> 9.0 pH units
Sodium Hypochlorite	Odor control wet scrubbers	Odor control, adjust ORP2	ORP2 > 575
Sodium Hypochlorite	UV influent channel	Algae control	500 gpd
Sodium Hypochlorite	Header lines	Odor control	100 gpd
Cationic Polymer	RAS header lines	Flocculation	0 - 30 gpd
Sodium Hypochlorite	RAS header lines	Filament control	1 - 2 gpd

Table A-14 Notes:
ORP = oxidation reduction potential
1. Does not include chemicals used as part of advanced water treatment facilities for the Water Purification Demonstration Project. ORP indicates oxygen reduction potential.

APPENDIX B

PLANNED METRO SYSTEM FACILITIES IMPROVEMENTS

City of San Diego
Public Utilities Department

March 2022

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Acronyms and Abbreviations

BAC	biological activated carbon
BOD	biochemical oxygen demand
CCAP	Climate Change Action Plan
CEC	contaminant of emerging concern
City	City of San Diego
DCS	Distributed Control System
EPA	United States Environmental Protection Agency
gpcd	gallons per capita per day
MBC	Metropolitan Biosolids Center
MER	mass emissions rate
Metro System	San Diego Metropolitan Sewerage System
mg/L	milligrams per liter
mgd	million gallons per day
NCPWF	North City Pure Water Facility
NCWRP	North City Water Reclamation Plant
NPDES	National Pollutant Discharge Elimination System
PLOO	Point Loma Ocean Outfall
PLWTP	Point Loma Wastewater Treatment Plant
PUD	City of San Diego Public Utilities Department
Pure Water	Pure Water San Diego Program
R/O	reverse osmosis
RWQCB	California Regional Water Quality Control Board, San Diego
SANDAG	San Diego Association of Governments
SBWRP	South Bay Water Reclamation Plant
TSS	total suspended solids

B.1 INTRODUCTION

This appendix summarizes planned facilities improvements to the San Diego Metropolitan Sewerage System (Metro System). In submitting this application for renewal of 301(h) modified secondary treatment standards for the Point Loma Wastewater Treatment Plant (PLWTP), the City of San Diego (City) is committing to reducing both flows and solids discharged to the ocean through implementing a joint water/wastewater facilities plan called Pure Water San Diego Program (Pure Water). Pure Water establishes the goal of producing potable water for the San Diego Region while offloading flows and loads from the PLWTP. The Pure Water plan envisions implementing 83 million gallons per day (mgd) of potable reuse water by the December 31, 2035. To demonstrate the City's commitment to advance the State's water recycling goals, this National Pollutant Discharge Elimination System (NPDES) permit application proposes an initial schedule of Pure Water implementation tasks for inclusion within the renewed PLWTP NPDES permit. Proposed tasks for the next 5 years would focus on the initial 30 mgd potable reuse component of Pure Water; but includes actions necessary to ultimately achieve 83 mgd by December 31, 2035. In addition to the Pure Water Program, other planned near-term Metro System facilities improvements include upgrading grit removal facilities at the PLWTP, upgrading equipment at Pump Station 2, and implementing refinements to the system-wide chemical addition program.

B.2 FACILITIES PLANNING OVERVIEW

As described in Appendix A, the Metro System provides for the conveyance, treatment, reuse, and disposal of wastewater within a 450-square-mile service area. The City of San Diego Public Utilities Department (PUD) serves as owner and operator of the Metro System and as the planning agency for assessing Metro System facility's needs. Participating agency input to Metro System planning and operation is provided through the Metropolitan Wastewater Commission/Joint Powers Authority (see Appendix A for Metro System participating agencies).

As planning and operating agency of the Metro System, the PUD regularly prepares, and updates plans for Metro System facilities. Three key planning efforts have been completed since 2012 which led to the development of the proposed Pure Water Program. These planning efforts include:

- the 2012 *Metropolitan Wastewater Plan*[1]
- the Pure Water Phase 1 North City Project

PUD is anticipating creation of a Department-wide master plan that includes both water and wastewater during the upcoming permit cycle. While the City's Pure Water Program represents a different wastewater planning direction than that described within the 2012 Metropolitan Wastewater Plan, the 2012 Metropolitan Wastewater Plan provides value in (1) forecasting future Metro System flows and loads, and (2) assessing backbone Metro System facilities improvements that can be implemented to support facilities proposed as part of Pure Water.

1 City of San Diego Public Utilities Department. *Metropolitan Wastewater Plan.* 2012.

Update of the 2012 Metropolitan Wastewater Plan is anticipated to begin within the next NPDES 5-year permit cycle as part of a larger Departmental master plan.

B.3 PURE WATER SAN DIEGO PROGRAM

During the effective period of the renewed permit the City will be implementing significant changes to its wastewater treatment and disposal system. In a prior permit renewal application, the City introduced its goal of implementing a comprehensive water reuse program called Pure Water. Pure Water is a long-term program that would provide a safe, reliable and cost-effective potable water supply for San Diego through the application of advanced treatment technology to purify recycled water. As such it is a joint water and wastewater facilities plan with the goal of producing water suitable for potable reuse, while significantly reducing and improving the discharge to the ocean from the PLWTP. Initially, wastewater traditionally intended for treatment at the PLWTP will be diverted to upstream treatment facilities at the North City Water Reclamation Plant (NCWRP) and North City Pure Water Facility (NCPWF) where purified water will be produced by highly advanced treatment processes.

Ultimately, by December 31, 2035, it is anticipated that approximately 50% of San Diego's potable water demand will be met by a system of purifying wastewater. The upstream diversion to the NCPWF is expected to reduce flows and pollutant loads to the PLWTP which in turn is expected to reduce the flows and loads being discharged to the ocean. Pure Water is reflected in Order No. R9-2017-0007[2] with a schedule of tasks anticipated to be accomplished during the current permit period that will facilitate implementation of the program and is currently regulated under a separate permit, California Regional Water Quality Control Board, San Diego (RWQCB) Order No. R9-2020-0001. Pure Water is being implemented in two phases:

- Phase 1, the North City Pure Water Project
- Phase 2, the Central Area Project

This document will focus on the facilities that will be added for completion of the Phase 1 (North City Pure Water Project) and their interface with the PLWTP since those facilities will commence operation during the upcoming renewed permit period.

B.3.1 Phase 1: North City Pure Water Project

The Phase 1 NCPWF will be co-located with the NCWRP. Construction of Phase 1 facilities, including pipelines, pump stations, and treatment processes, has begun. Advanced purified water will eventually be delivered to the Miramar potable water reservoir. When full operating capacity is achieved, anticipated by December 31, 2027, it will remove 52 mgd of wastewater from the influent to PLWTP and produce at least 30 mgd of advanced purified water suitable

2 United States Environmental Protection Agency (EPA) and California Regional Water Quality Control Board, San Diego Region (RWQCB). Order No. R9-2017-0007 (NPDES CA0107409), Waste Discharge Requirements and National Pollutant Discharge Elimination System Permit for the E.W. Blom Point Loma Wastewater Treatment Plant Discharge to the Pacific Ocean through the Point Loma Ocean Outfall, San Diego County. 2017.

for potable reuse, as well as much as 12 mgd of recycled water for irrigation and other approved uses.

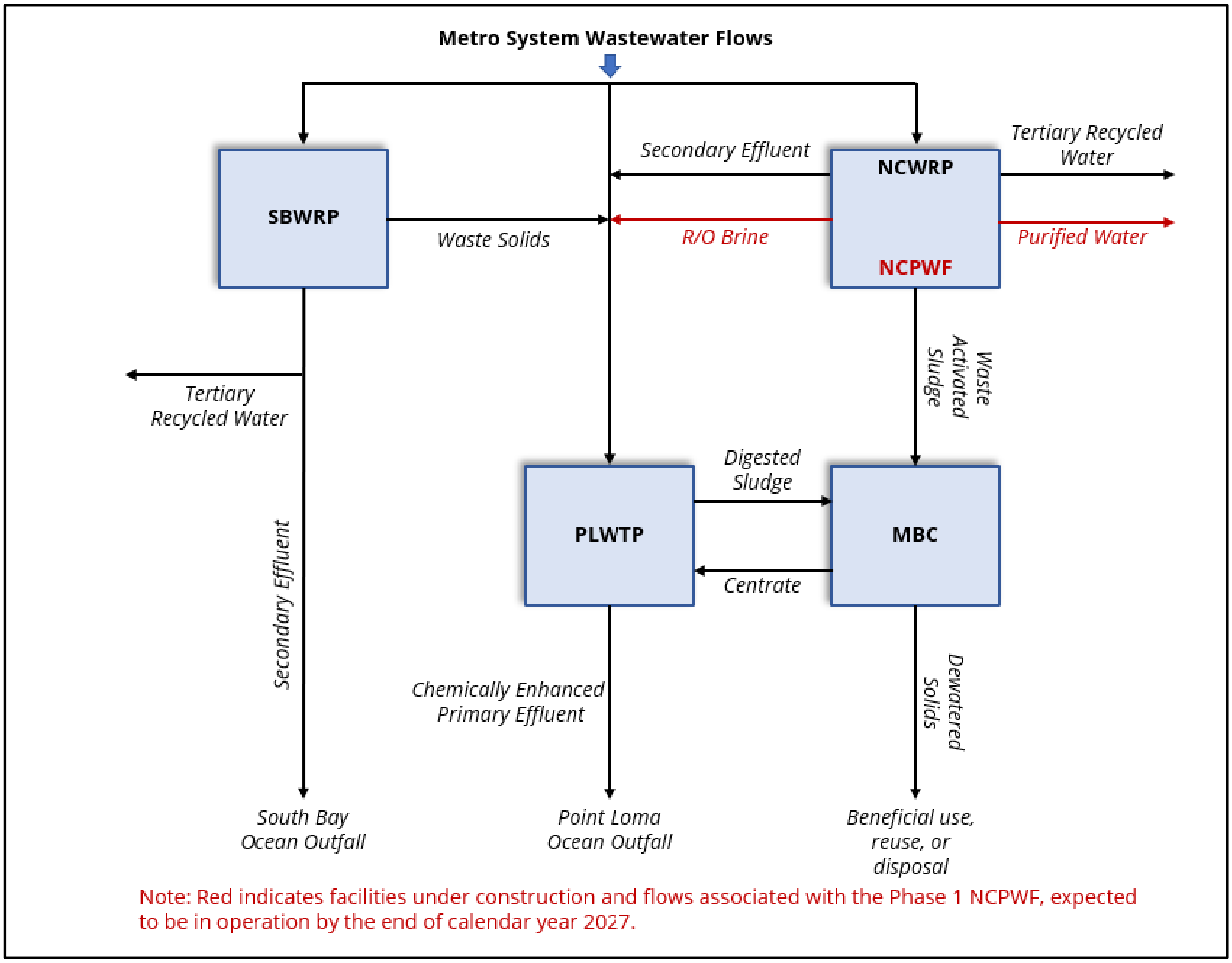
The NCWRP is permitted to distribute recycled water by Waste Discharge Requirements under Order No. R9-2015-0091 adopted by the RWQCB in December 2015. Discharge of advanced purified water from the NCPWF to the Miramar potable water reservoir has been permitted by NPDES permit Order No. R9-2020-0001 that was adopted by the RWQCB on May 13, 2020. Although each facility is permitted independently from the PLWTP, these facilities are discussed here because of their interrelationship with the Point Loma facility. Through the upstream diversion and treatment, the discharge through the Point Loma Ocean Outfall (PLOO) is significantly improved.

The Phase 1 North City Pure Water Project is currently under construction with full capacity operation anticipated by the end of Calendar Year 2027. The specific facilities to be completed include:

- NCWRP expansion of existing facilities (NCWRP Expansion): nearly doubles the amount of recycled water produced to meet the needs of the NCPWF and the Recycled Water system
- Morena Pump Station: to pump additional wastewater to the NCWRP Expansion
- Two 10.5-mile pipelines from the Morena Pump Station to the NCWRP Expansion
    - A 48-inch pipeline to convey wastewater to the NCWRP
    - A 36-inch pipeline to convey residuals from the NCWRP to the sewer
- Improvements to the Metropolitan Biosolids Center (MBC) to handle the increased biosolids that will be produced by the expanded NCWRP
- NCPWF: Advanced treatment processes to produce purified water:
    - Ozonation
    - Biological Activated Carbon (BAC) Filtration
    - Membrane Filtration
    - Reverse Osmosis (R/O)
    - Ultraviolet Disinfection and Advanced Oxidation
- Pure Water pipeline, 8 miles, to convey purified water to Miramar Reservoir
- De-chlorination facilities at Miramar Reservoir
- Underwater discharge pipe within Miramar Reservoir
- Miramar Reservoir pump station upgrades

Figure B-1 presents an overall general flow schematic of the existing and future Metro System.

Figure B-1:
Flow Schematic of Metro System Operations



B.3.2 Phase 2: Central Area Project

Phase 2 (Central Area Project) is in the planning stages that includes environmental review, siting of facilities, selection of discharge location, assessment of regulatory requirements, and the construction and operation of a pilot facility. The Central Area Project is expected to produce 53 mgd of purified water, for a cumulative total of 83 mgd by December 31, 2035.

B.4 PROJECTED WASTEWATER FLOWS AND LOADS

Metro System facilities planning and the scheduling for implementing Pure Water phases will, in part, be driven by wastewater flow and solids loading. Metro System wastewater flows and solids loading projections are developed using a comprehensive hydraulic model of the Metro System service area.

B.4.1 Metro System Hydraulic Model

The City of San Diego regularly updates projected future Metro System flows and loads through a comprehensive geographic information system-based hydraulic model of Metro System and City of San Diego wastewater collection facilities[3]. The model superimposes the latest San Diego Association of Governments (SANDAG) population and employment projections on grid levels as small as a city block to generate projected flows. Wastewater loads are based on a projected residential unit wastewater generation rate of 57 gallons per capita per day (gpcd) and gradually decreasing to 53 gpcd by 2050, and an employment unit wastewater generation rate of 18 gpcd. The model also computes system-wide total suspended solids (TSS) and biochemical oxygen demand (BOD) loads and PLWTP effluent discharges based on recorded historical influent data and treatment facilities performance.

B.4.2 Pure Water Interface with PLWTP

The City has operated a Pure Water Demonstration Facility for nearly 10 years, helping to collect data for the design of the Phase 1 facilities and to define regulatory requirements. It has also provided an understanding of the potential characteristics of the treatment process efficiencies, return stream characteristics and how this upstream advanced treatment will improve the PLWTP discharge.

The northern area water reclamation activities associated with the Pure Water Program remove flows that are normally influent to the PLWTP, as demonstrated in Figure B-1 and Figure B-2. Historically, a small return stream of dewatering and thickening centrate from biosolids processing at MBC, as well as excess secondary effluent from the NCWRP have been returned to the sewer and co-mingled with wastewater influent to the PLWTP. With the implementation of Pure Water Phase 1 these return streams will also include R/O brine generated at the NCPWF.

In conjunction with the flow projections a comprehensive model was utilized to estimate the TSS and flow reductions that will occur in the PLWTP discharge. This modeling also accounts for the return stream contributions. The initial results indicate that no significant concentration effects will occur because flow, TSS, and associated pollutants are proportionally reduced. The off-loading effect of the upstream Phase 1 Pure Water facilities and significant improvement in the PLOO discharge can be seen beginning in 2026.

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3 City of San Diego Public Utilities Department. Unpublished update of the Metro System hydraulic flow and load model. 2021.

Table B-1 presents the flow and loads projections for a future facility planning period of 20 years (2021 – 2041). The table presents both facilities planning projections as well as most probable projections. Facilities planning projections are very conservative and generally overstate what actual values are realized. However, this conservative methodology ensures that adequate facilities are always in place. The Pure Water planning was predicated on the facilities planning projections. Recent actual values are included to put the projections into perspective with each other.

Table B-1
Flow and Load Projections for the Point Loma Outfall Discharge[1, 2, 3]

Actual Measured Values[4]					
Year	**Total Metro System[5]**	**PLOO Discharge[6]**			
	Flow[3] (mgd)	Flow[3] (mgd)	Annual TSS Mass Emissions Rate (MER)[3] (mt/yr)	TSS Concentration[3] (milligrams per liter (mg/L))	Biochemical Oxygen Demand – 5 day (BOD_5) Concentration[3] (mg/L)
2017	163.3	139.3	7,112	37	124
2018	163.1	139.0	7,293	38	133
2019	168.1	143.9	8,155	41	131
2020	168.6	144.3	6,744	34	132
2021[3]	163.7	139.7	6,371	33	137

Projected Values[4,7]										
Year	**Total Metro System[5]**	**PLOO Discharge[6]**								
	Flow[3] (mgd)	Flow[3] (mgd)		Annual TSS MER[3] (mt/yr)		TSS Concentration[3] (mg/L)		BOD_5 Concentration[3] (mg/L)		
		Facilities Planning Based[7]	Most Probable[8]	Facilities Planning Based[7]	Most Probable[8]	Facilities Planning Based[7]	Most Probable[8]	Facilities Planning Based[7]	Most Probable[8]	
2021	178.4	154.0	140.0	9,853	7,159	46	37	142	132	
2022	179.2	154.7	140.6	9,944	7,192	46	37	143	133	
2023	180.0	155.4	144.2	10,035	7,415	47	38	144	134	
2024	180.8	156.1	141.8	10,126	7,447	47	38	145	135	
2025	181.7	156.8	142.4	10,217	7,664	47	38	145	135	
2026	182.5	157.7	143.3	10,308	7,691	47	38	145	135	
2027	183.5	158.5	144	10399	7,761	48	39	146	137	
2028[9]	184.5	**128.8[9]**	**114.3[9]**	**8,668[9]**	**6,161[9]**	49	39	149	140	
2029	185.5	129.7	115.1	8,754	6,204	49	39	149	140	
2030	186.4	130.6	115.8	8,841	6,241	49	39	150	141	

Table B-1:
Flow and Load Projections for the Point Loma Outfall Discharge[1,2,3] (contd.)

Year	Total Metro System[5]	PLOO Discharge[6]							
	Flow[3] (mgd)	Flow[3] (mgd)		Annual TSS MER[3] (mt/yr)		TSS Concentration[3] (mg/L)		BOD_5 Concentration[3] (mg/L)	
		Facilities Planning Based[7]	Most Probable[8]	Facilities Planning Based[7]	Most Probable[8]	Facilities Planning Based[7]	Most Probable[8]	Facilities Planning Based[7]	Most Probable[8]
2031	187.3	131.4	116.6	8,927	6,285	49	39	150	141
2032	188.3	132.3	117.4	9,014	6,490	50	40	151	142
2033	189.3	133.0	118.4	9,100	6,545	50	40	151	141
2034	190.3	134.0	119.0	9,187	6,578	50	40	152	142
2035	191.3	134.9	119.8	9,273	6,623	50	40	152	142
2036[10]	191.8	**81.8[10]**	**66.8[10]**	**5,151[10]**	**3,323[10]**	46	36	130	120
2037	192.4	82.3	67.2	5,199	3,343	46	36	130	120
2038	193.0	82.9	67.7	5,247	3,368	46	36	131	121
2039	193.6	83.4	68.1	5,295	3,383	46	36	131	121
2040	194.3	84.0	68.6	5,343	3,413	46	36	132	122
2041	194.9	84.5	69.0	5,391	3,433	46	36	132	122

Table B-1 notes:

1 These projections cover a 20-year planning period that extends to 2041.

2 Projections based on the SANDAG Series 13 population projections.

3 All flows reported as annual average daily flows; TSS & BOD_5 concentrations as annual daily averages. Actual 2021 data were preliminary at the time this application was compiled and may be subject to change.

4 Actual values are presented for several years preceding the projected values in order to put them into context with the projections. This illustrates the necessity for expressing both planning projections, as well as flows and loads most probable to be realized.

5 Total Metro System flows are all wastewater generated within the Metropolitan Wastewater System Service area.

6 Flows discharged through the PLOO are the remaining total Metro System flows treated at the PLWTP after having been reduced by (1) upstream recycled water production and use, (2) diversion of flows to the SBWRP, City of Del Mar, Otay Water District, Padre Dam Municipal Water District, and (3) upstream production and use of purified water. Projected PLOO flows include reverse osmosis reject (brine) from upstream advanced water purification facilities constructed as part of the Pure Water San Diego Program and centrate from the MBC facilities, and sludge from the SBWRP that are comingled with influent flow to the PLWTP.

7 -Planning flow and load projections are conservative and although overstating what the actual flows and loads will be, this method is used to insure that planning for future system improvements are initiated such that adequate facilities are always in place to meet the wastewater system needs and regulatory requirements.
- Planning flow and load projections are expressed as annual average daily flows and include wet weather impacts expressed as an I & I component reflective of 10-year storm events.
- Planning flow projections were determined by the same modeling procedure that has been used for future facilities planning and the Pure Water Program.
- Planning load projections are conservatively based on the highest waste strengths observed during the last 5 years. TSS and BOD_5 concentrations are projected to increase in future years as ongoing conservation reduces per capita flow; but per capita TSS and BOD_5 contributions remain unchanged.

8 Most probable flow projections are derived from the average of recent actual flow and load values and propagated using the same incremental adjustments as the facilities planning flow and load projections.

9 PLOO discharge flows and loads reduced by the implementation of 30 mgd of upstream potable reuse.

10 PLOO discharge flows and loads reduced by the implementation of an additional 53 mgd of upstream potable reuse (for a total of 83 mgd of potable reuse).

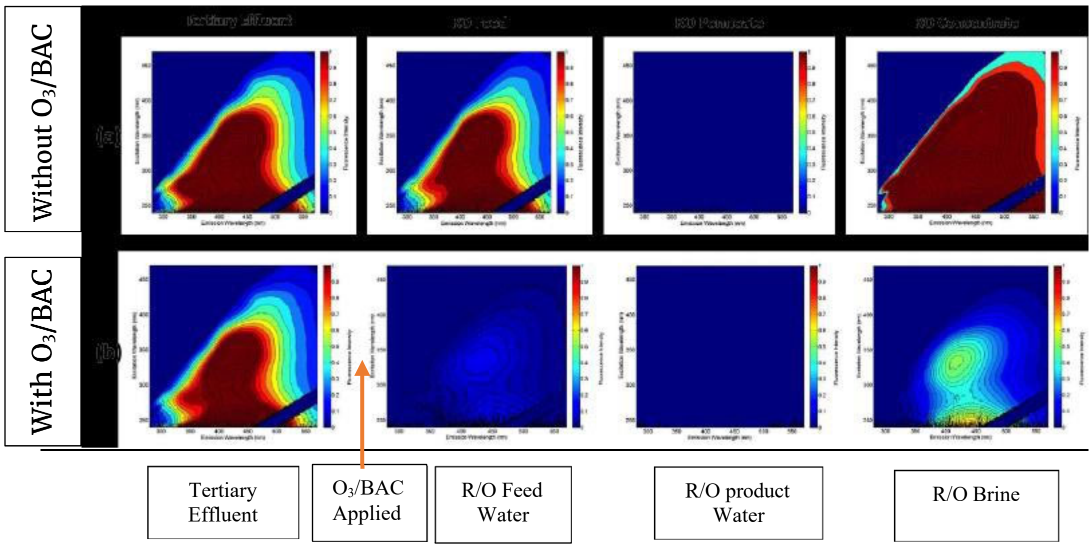
Besides a reduction in conventional pollutants in the PLWTP discharge, it is estimated that the diversion to the advanced treatment processes at the NCWRP and NCPWF will result in reduction in contaminants of emerging concern (CECs), such as toxic organics and pharmaceuticals and personal care products, greater than would normally be removed by typical wastewater treatment.

Although the R/O brine will be highly concentrated, it will be mostly salt water. This is because prior to the R/O process, the diverted wastewater will undergo primary, secondary, and tertiary treatment, as well as advanced processes consisting of ozone, BAC and membrane filtration. These advanced processes will significantly reduce many of the toxic organic molecules in the waste stream prior to the R/O process leaving mainly dissolved salts for the R/O to remove. Work done by the U.S. Department of the Interior, Bureau of Reclamation, informs us that the multiple barrier approach using several processes, including ozone and BAC, can result in a high removal efficiency for CECs prior to the R/O process. The overall result is a significant reduction for these constituents, both concentration and mass levels, in the Pt. Loma discharge, beyond what would normally be achieved by conventional treatment processes. The effectiveness of this system will be verified by testing upon the implementation of Pure Water Phase 1, which will occur during the renewed permit period.

Supporting this is work performed at San Diego’s potable reuse Demonstration Facility that tested the waste streams by means of measuring Fluorescence Intensity to assess the organic fraction. This work, although qualitative in nature, demonstrates that the Ozone/BAC has eliminated organic materials (that include CECs etc.) ahead of the R/O process so that they are not concentrated in the R/O brine. Rather they have been permanently removed from the system and eliminated from the PLWTP discharge. This work was presented to the California Division of Drinking Water and the RWQCB staff on July 21, 2020.

Figure B-2 presents the results of the Fluorescence Intensity work demonstrating the elimination of organic materials in the R/O brine.

Figure B-2: Fluorescence Intensity Measurements

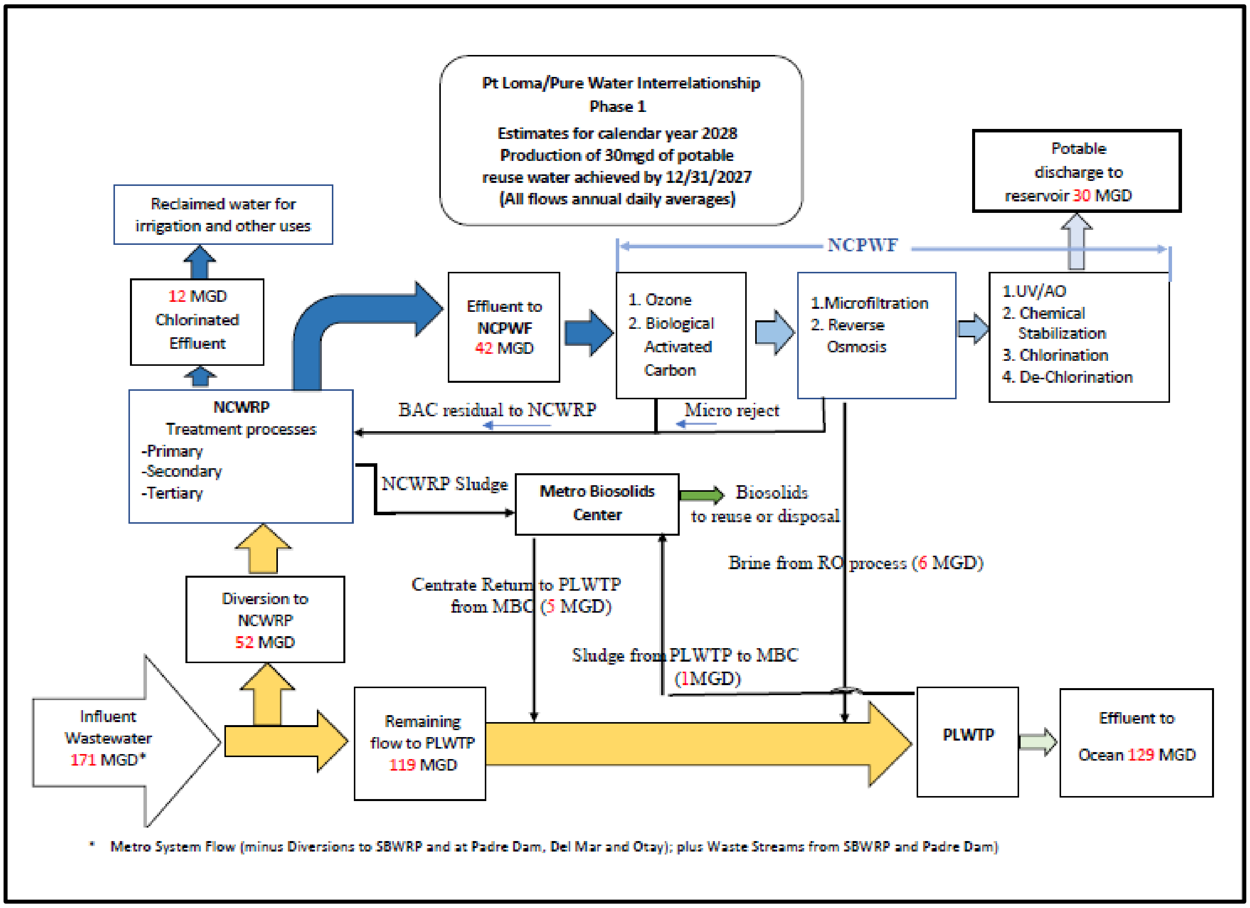


Note: Fluorescence Intensity measurements of waste streams through the advanced treatment process including tertiary effluent, post ozone/BAC (Ultrafilter-R/O feed), R/O product water and R/O brine. Performed at the City of San Diego pilot facility and presented to the CA Division of Drinking Water and the RWQCB on July 21, 2020. The Fluorescence Intensity is proportional to the organic material concentration Source: Shane Trussell, PhD

The brine discharge will result in an increase in salinity (total dissolved solids) in the PLOO discharge from its current average levels of about 1550 mg/L to an annual average around 3200 mg/L upon full implementation of Phase 2. The effect of this increase in salinity on the PLWTP and PLOO performance was studied using the daily average salinity that would result after Phase 2 implementation. Stantec Inc. and Consortium engineers determined: 1) That there would be no impacts to treatment plant performance and 2) that the outfall performance will actually be enhanced with initial dilution, per State of California Ocean Plan provisions/methods, estimated to increase by as much as 40%. These two studies, City of San Diego Task Orders 53 and 11, respectively, are available for review upon request.

Figure B-3 presents a detailed schematic of the interface between the PLWTP and NCWRP and NCPWF upon implementation of Pure Water Phase 1 in 2027. The schematic includes all diversions and return streams and flow estimates.

Figure B-3:
PLWTP Interface with Upstream NCWRP and NCPWF
(Flows and loads annual average daily values based on facilities planning criteria)



In conclusion, the implementation of Pure Water during this upcoming permit period will improve the discharge through the PLOO as well as produce a local source of potable water.

B.5 OTHER NEAR-TERM METRO SYSTEM IMPROVEMENTS

In addition to the long-term facilities planning associated with the Pure Water potable reuse program, the City will continue its ongoing Capital Improvements Program of maintaining and upgrading wastewater pump stations, conveyance facilities, and treatment facilities. Several key Metro System near-term improvements are summarized below.

B.5.1 Pump Station 2 Reliability Improvements

Improvements are scheduled to be completed at Pump Station 2 to comply with EPA Class I reliability requirements and improve surge control protection. Proposed improvements are scheduled for completion by the end of 2023 and include:

- a new generator building
- replacing two natural gas engines and associated pumps with two 2,250 horsepower motors, variable frequency drives and pumps
- installing two 3-megawatt natural gas generators providing the flexibility to allow either generator to run any of the eight main Pump Station 2 pumps
- installing supporting mechanical, electrical, and control components, including pump controls designed to prevent surges
- installing two 4-megawatt diesel generators for backup purposes

B.5.2 Chemical Addition Improvements

The system-wide peroxide regenerated iron sulfide control chemical addition program has resulted in noticeable improvement in solids removal at the PLWTP. Building on the success of the existing program, the City is proceeding with plans to implement ferrous chloride addition at the Grove Avenue Pump Station in the future. The City continues to look for chemical addition improvements. Two recent Chemicals the City has been piloting are SulFeLox and SULFeND. Both SULFeND is a and SulFeLox are ferrous/ferric blends. SulFeLox which could be used when the Ferrous availability in the market is low, and the second part of the trial is to evaluate for consideration in use where the use of a hazardous chemical may otherwise not be approved. Additional alternatives may also be piloted for use during the current and upcoming permit cycles.

B.5.3 PLWTP and Other Plant Storm Drain Diversions

The City is in the process of designing for the diversion of PLWTP's industrial storm water discharges from its storm drain system to PLWTP's influent headworks and/or influent channel. The diverted storm water flows will be treated to advanced primary standards with the plant's wastewater flows prior to being discharged to the Pacific Ocean through the PLOO. The design is intended to prevent industrial areas from discharging storm water up to the 85th percentile 24-hour storm event. Thus far, the planning phase has been completed, including but not limited to storm water capture concepts, topographic surveys, hydrology and hydromodification analyses, and preliminary design considerations. The City is in the process of completing the preliminary design by identifying the preferred project alternative and proceeding with the final design. The targeted time frame for completion of this diversion project at PLWTP is November 2023, but may be extended based on unforeseen circumstances, such as delays with permitting and construction.

South Bay Water Reclamation Plant (SBWRP), MBC, and NCWRP also have similar concurrent projects to divert on-site storm water runoff from industrial areas up to the 85th percentile 24-hour storm to the respective plant for treatment, with MBC's storm water flows returning to PLWTP. SBWRP's target completion date is December 2022. MBC's target completion date is November 2023. NCWRP's target completion date is currently anticipated for February 2025 due to unanticipated delays relating to the Pure Water Program.

B.5.4 PLWTP Scum Injection Project

Currently at PLWTP, scum is collected from the Primary Sedimentation Tanks, concentrated, pumped to storage containers, and hauled offsite to a landfill. In the future, it is anticipated that hauling scum to the landfill will not be allowed. This new project involves screening, dewatering and concentrating the collected scum before redirecting the scum flows to the sludge blending tank and onto the digesters, removing the need for landfill disposal. This project is not anticipated to negatively impact the water quality of the effluent and will increase renewable energy opportunities at PLWTP because it will produce more gas for the gas engines that helps to power. This project also supports the City's Climate Change Action Plan (CCAP).

B.5.5 PLWTP Replacement of Main Sludge Pumps

As part of the ongoing maintenance at the PLWTP, the main sludge pumps are slated for replacement. PLWTP's main sludge Pumps are over 20 years old and near the end of their service life. Additionally, procurement of parts for the current pipes has become increasingly difficult because there is only on manufacturer of parts for this equipment. These pumps deliver approximately 1 mgd of digested sludge 13 miles to the MBC for dewatering. Two of the four pumps are targeted for replacement in 2022. The final two pumps will be replaced once the first two are installed and testing is complete; and thus, will likely occur during the next permit cycle. The replacement of this equipment will help to ensure the future reliability of the City's treatment system and the ability of PLWTP to continue to pump sludge to MBC for processing.

B.5.6 PLWTP Erosion Monitoring

The City is currently implementing a coastal erosion monitoring program using various technologies and monitoring methods to assess and determine possible movement of the oceanside bluffs and safety of the vehicular access road to the PLWTP property by studying seismic activity, ground vibration, geology, groundwater, weather, tide action, etc. The results of the data collected may identify additional facility improvements needed to secure the facility against potential erosional impacts. This project supports climate change resiliency, including the CCAP, and emergency preparedness to make sure the facility and access to it remains secure in the face of possible erosional events.

B.5.7 PLWTP Vivianite Mitigation Project

With the addition ferric and ferrous chloride as part of the chemically enhanced primary treatment process, these iron salts can precipitate with sulfides and phosphate already present in the sludge to form vivianite on the inside of the digester feed piping. Over time, this build-up of vivianite will restrict flow and lead to piping and/or equipment failure. The method currently used to remove the vivianite is through manual jetting of the feed piping. This is costly, time consuming and causes interruptions to normal operations. To date, there have been two proposals to mitigate the formation of vivianite in plant piping, thus negating the need to manually clean the lines. The first proposal will test the introduction of a chemical into the digester feed sludge that will inhibit vivianite formation. The second proposal will test an electrical device attached to the outside of the piping that will inhibit vivianite formation.

B.5.8 PLWTP On-Site Chlorine Generation Project

Within the next few years, the facility will be testing the use of a salt chlorine generator to generate chlorine from salt through a process known as electrolysis. If found to be effective, this would lower the cost of treatment by decreasing the amount of chemical deliveries needed. It would also reduce the City's reliance on chemical suppliers and mitigate any future impacts that may arise from supply chain issues.

B.5.9 PLWTP Digester Cleanings

The primary digesters at the PLWTP accumulate inorganic material over time (sand, hair, rags) that do not breakdown as part of the biological digestion process. This build-up of inorganic material can occupy enough volume to prevent the digester from efficiently operating and requires the inorganic material to be removed from the digester to bring it back into full working order and maximize digestion efficiency. The digesters are typically cleaned every 7 to 10 years. The last cleaning of Digester 8 was in 2010 and Digesters N1 and N2 were last cleaned in 2014. Digester 8 will be cleaned in Fiscal Year 2023 and Digesters N1 and N2 will be cleaned in Fiscal Year 2024.

B.5.10 PLWTP Distributed Control System Upgrade Project

Plant processes and operating parameters are monitored and controlled via an internal computer operating system called the Distributed Control System (DCS). This computer system can be used to monitor plant operations, change operating parameters, record operating data, and control equipment. The current DCS version is outdated, the Ovation equipment is no longer supported, and replacement hardware parts are no longer manufactured. As a result, the City is undergoing a project to upgrade the current DCS to a newer one that does not have these limitations.

B.5.11 NCWRP Flow Equalization Basin and Process Equipment Improvements

NCWRP currently provides sideline flow equalization by diverting peak flows into two 140-foot diameter, 29-foot-deep circular flow equalization basins. Diverted flow is pumped to the equalization basins and returned by gravity back to the treatment process when the influent drops below average. A third basin will be added in the future. Additionally, improvements will be made to the process equipment to ensure the facility is capable of operating at its 30 mgd design capacity.

B.5.12 MBC Equipment Upgrades

Aging equipment at MBC will be replaced to ensure the plant operates reliably. Improvements include installation of new raw solids feed pumps, replacement of existing thickening centrifuges, upgrades to anaerobic digesters, improvements to the sludge dewatering system, and other upgrades. The following upgrades are expected to be completed at MBC over approximately the next 3 to 5 years:

- Replacement of all five Thickening Centrifuges along with associated feed and chemical pumps;
- Replacement of two Dewatering Centrifuges with and associated feed and chemical pumps;
- Installation of an additional flare;
- Upsizing of the biogas gas collection header; and
- Replacement of a total of 29 pumps (mix, recirculation and axial pumps) in the digester complex and addition of an additional degritting system.

B.5.13 Metropolitan Interceptor Repairs

The City has two Metropolitan Sewer Interceptors that convey wastewater flows from the North and South to PLWTP via Pump Station 2. The South Metro Interceptor's pipelines and a portion of the North Metro Interceptor's pipelines lack redundancy for backup if the primary pipelines are not able to function. A project to repair and rehabilitate the North and South Metropolitan Interceptors and Access structures is anticipated to begin in Fiscal Year 2023 and continue for at least the next 5 years. During this time, several pipeline segments, access structures, and siphon access structures will be repaired and rehabilitated.